PLAINTIFF'S
EXHIBIT
CRA-45

CRANE

VALVES

CATALOG NO. 60

CRTX 0815

CRANE

CRTX 0816

CRANE®

VALVES

CRANE CO.
300 PARK AVENUE
NEW YORK, N. Y. 10022

003767

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CRTX 0817

TERMS AND CONDITIONS

WARRANTY

If, within one year following date of delivery, any material manufactured by or trade-marked for Crane Co. proves defective, Buyer shall not return it unless requested to do so but shall immediately notify Crane Co. stating full particulars in support of his claim and, if faulty workmanship or material is involved, Crane Co. will adjust the matter fairly and promptly. Under no circumstances shall Crane Co. be obligated to allow claims for consequential damages or for any labor or other expenses incurred by reason of the use or sale of any defective material, the sole measure of damages being the price received therefor by Crane Co.

ILLUSTRATIONS

Catalog illustrations are actual representations of a certain size of each line of products but do not necessarily represent all sizes in all details. The designs shown are subject to change without notice.

WEIGHTS

Weights shown in catalogs, price schedules, quotations, acknowledgements or orders are approximate and are in no sense guaranteed. They represent the average weight of Crane Co. products as made from patterns in use at time weights were compiled.

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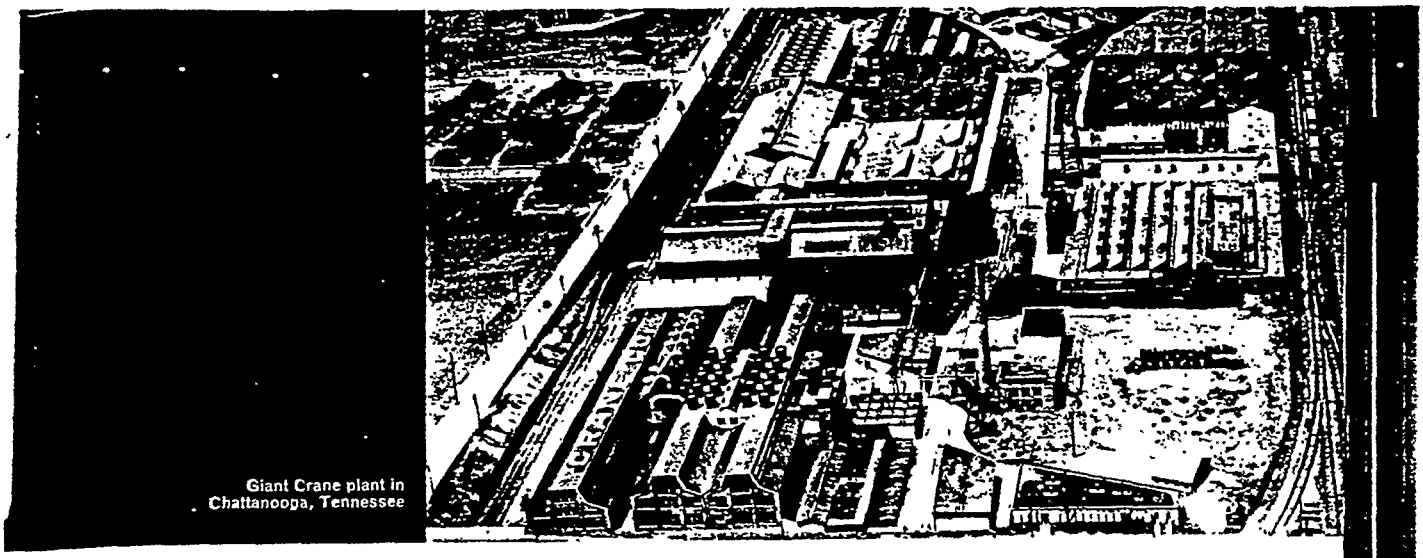

Giant Crane plant in Chattanooga, Tennessee

FROM THESE MODERN CRANE PLANTS COME THE FINEST PRODUCTS FOR INDUSTRY

Crane Co. has embarked on a dramatic new program of planned expansion, product development, and streamlined distribution, designed to help its customers meet the competitive challenges of the Sixties.

A powerful supporting factor for this great endeavor is the giant Crane Chicago Works, the world's largest factory of its kind, producing many thousands of individual piping products. Its modern, completely integrated operation produces valves, fittings, and piping specialties from raw materials to finished products. Another Crane Plant located in Chattanooga, Tennessee is steadily being expanded to increase Crane's productive capacity.

The finest product quality and the highest product value to the customer is the inflexible policy of Crane Co. Continuing emphasis is placed on engineering research, new product design, manufacturing techniques . . . and every facet of marketing, to assure products of recognized quality and superior performance that will satisfy the most discriminating customers.

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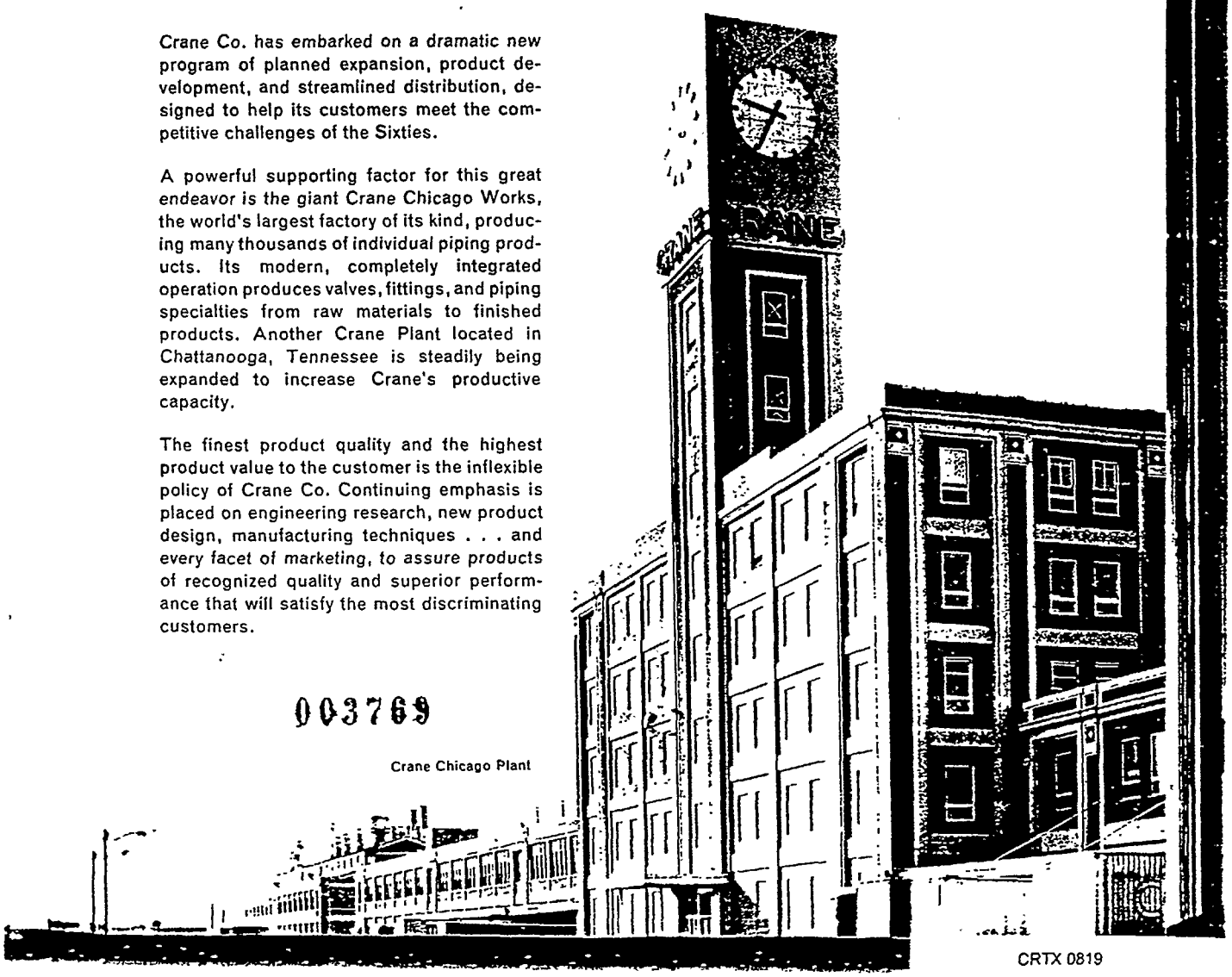
Crane Chicago Plant



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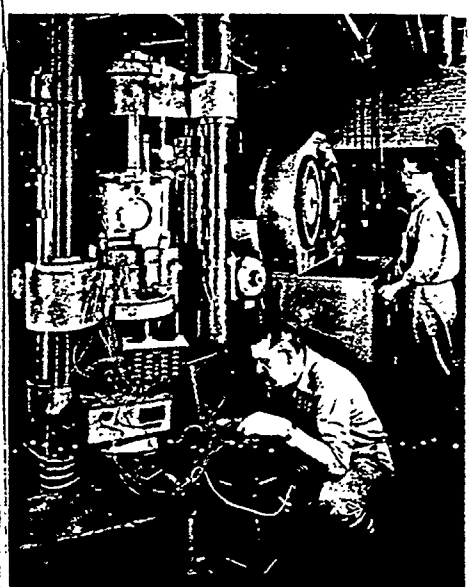
CRANE

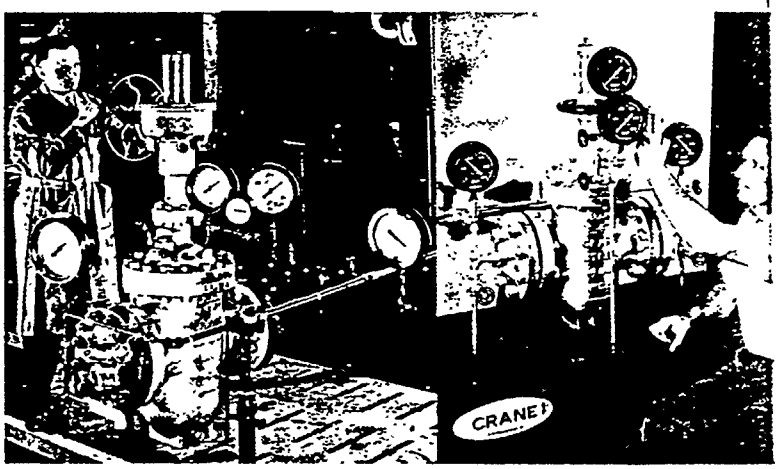
RESEARCH AND ENGINEERING KEY TO PRODUCT DEVELOPMENT

Carefully engineered and tested products have always been a hallmark of the Crane Co., and research and development by Crane Engineers continues to be a vital part of company philosophy. Useful new products, the result of planned engineering development, are being produced regularly. And existing products are continually being improved to assure long life, reliable performance, and minimum maintenance requirements.

Crane engineers are hard at work on solutions to the problems engendered by the super-high temperatures and pressures of modern processing systems. In all industries, Crane engineers are meeting challenges with new, sometimes radical, but always carefully engineered products. For example: valves for operation in a pure helium atmosphere . . . a universal valve trim material for use with oil or steam . . . flexible steel discs that seat tighter with lower operating torques . . . these are but a few of the exciting new ideas produced by Crane engineering . . . ideas that can help you in your job.



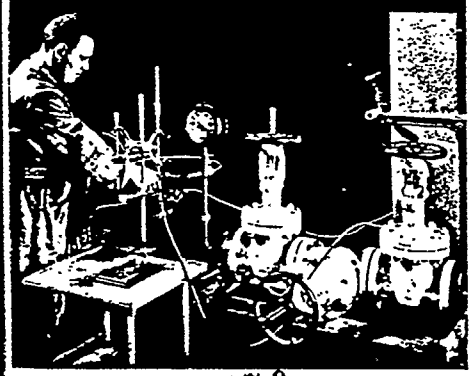
Measuring stress by means of electric strain gages in a valve component undergoing tensile and compressive loads similar to service.



Arrangements used for extreme tightness tests at both inlet and outlet of Conduit Valves with Teflon seats help determine valve suitability for any given application.

The effect of thousands of operations on seat tightness is determined, as well as the ability of all valve parts to withstand the wear and tear of simulated service conditions.

Laboratory set-up of three 6"—300 lb. Crane Steel Flex Gate valves verifies both inlet and outlet seat tightness under actual service conditions.



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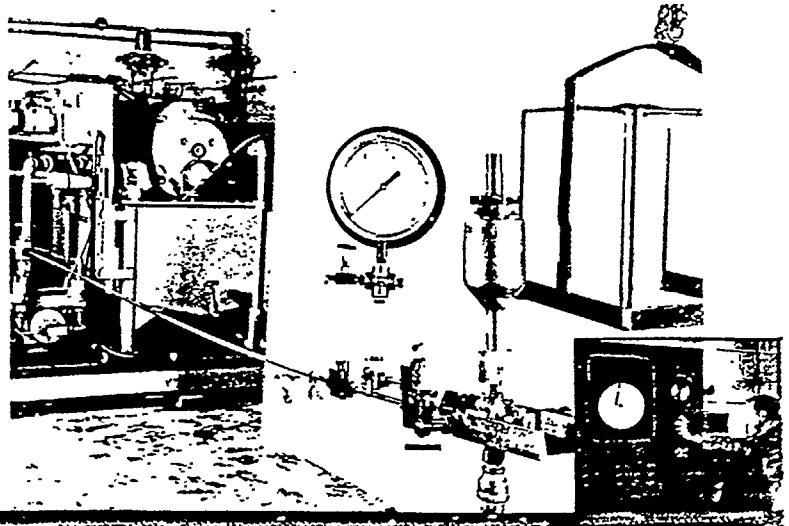
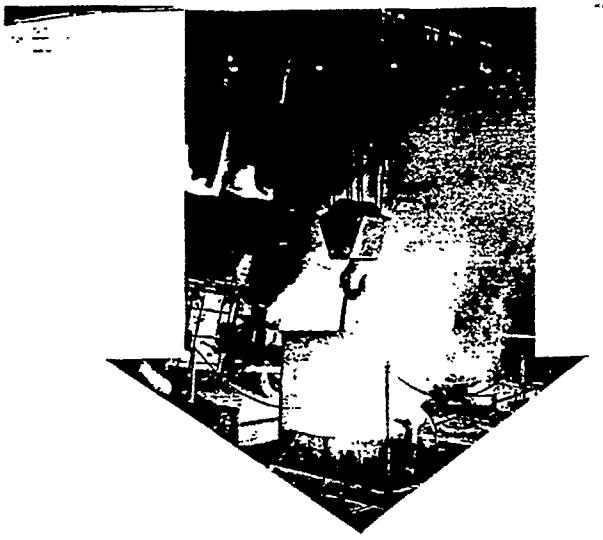
Tests at pressures up to 75,000 pounds per square inch assure valves and components that will function perfectly in actual service.







CRANE FOUNDRY AND FABRICATION FACILITIES HELP GUARANTEE GREATER PRODUCT PERFORMANCE

An integral part of Crane operations is a full complement of modern foundry and fabrication facilities designed to supply every customer requirement.

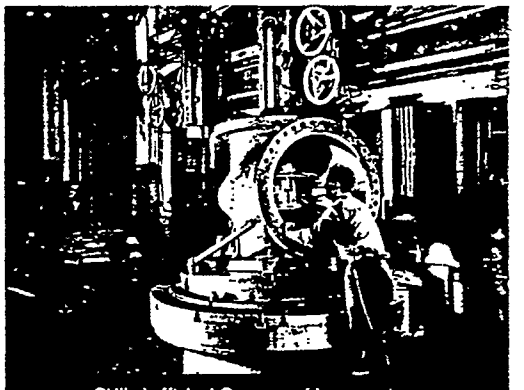
Electric furnaces with capacities ranging from 1000 to 20,000 pounds, with an average melting rate of 24,000 pounds of steel per hour, give Crane a capacity among the largest steel foundries in industry. For melting alloy steels, irons, and bronzes, Crane operates additional furnace units of the most modern design and function, capable of meeting the special quality requirements of the valve industry.

Moulding, pouring, and shakeout operations are fully mechanized, utilizing modern roller, belt, or over-head conveyor systems for continuous movement of castings and equipment.

In the fabrication and bending of piping, Crane supplies years of experience by engineers skilled in piping system design. Fabrication by full-time, skilled specialists . . . members of the United Association of Pipe Fitters, A. F. of L.

CRANE MAINTAINS MODERN METHODS IN MACHINE AND ASSEMBLING OPERATIONS

Basic operations in any manufacturing plant, both machining and assembly are an art at Crane, geared to match the exacting standards established for Crane products. Hundreds of the finest machines, many designed by Crane Engineers for special needs, occupy thousands of square feet in the Chicago Works and at Chattanooga. They insure the exceptional high quality of Crane Valves.



Skilled efficient Crane machine operators

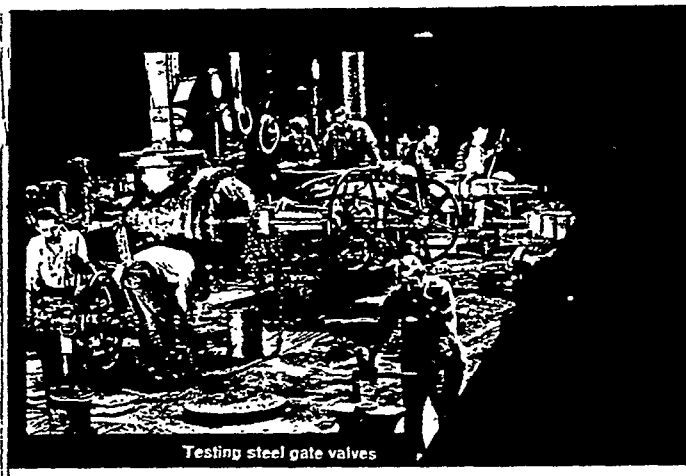
Smooth operating valve assembly line



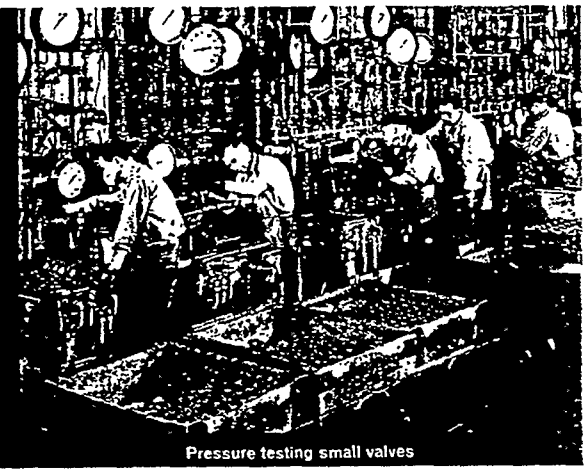
063771

RIGID INSPECTION AND TESTING INSURE PRECISE QUALITY CONTROL

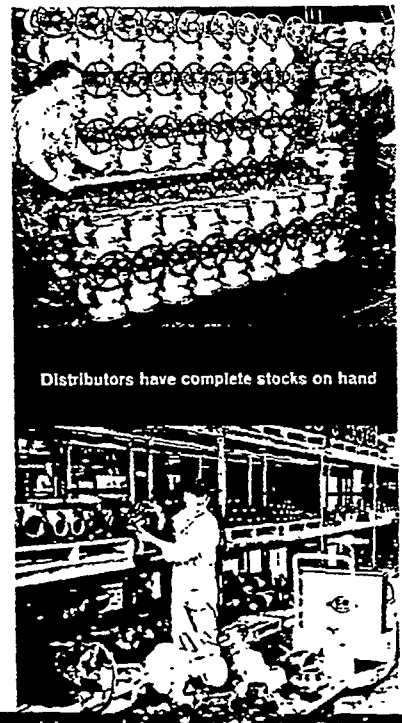
Quality control is absolute at Crane. By insisting on the most uncompromising methods of thorough inspection and rigorous testing, Crane guarantees product performance second to none. At Crane there is no substitute for quality, no short cut to insure it.



Testing steel gate valves



Pressure testing small valves



Distributors have complete stocks on hand

STREAMLINED PRODUCT DISTRIBUTION

Crane is steadily expanding its channels of product distribution through addition of vigorous, aggressive, independent distributors. Geared particularly to serve the industries in their local areas, these independent distributors can give you reliable recommendations for any of your valve applications.

Crane distributors across the country carry a sufficient supply of staple items to permit filling many orders from stock. Further assurance of fast action on your orders is the large factory inventory at both Crane Plants.

CRTX 0821

SECTION 1

Alphabetical Index

All items shown in this catalog are cross-indexed alphabetically. References under broad classifications are covered by page numbers showing the entire range of products. For example, under the very general heading of "Bronze Valves", group page numbers are shown for each of the various types, but under the specific heading of "Angle Valves, Bronze", etc., will be found a detailed listing of the many available types.

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Crane Bronzes

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CRANE STEAM BRONZE — ASTM B 62

Crane Steam Bronze, widely used for valves, fittings, and other products, is recommended for temperatures up to 450 F. The metal is classified as "Leaded Red Brass" in ASTM B 119 (Standard Classification of Cast Copper-Base Alloys). It is commonly known as *Eighty-Five and Three Fives* (85-5-5-5).

Chemical Requirements	Minimum	Maximum
Copper, %	84.0	86.0
Tin, %	4.0	6.0
Lead, %	4.0	6.0
Zinc, %	4.0	6.0
Nickel, %	....	1.0
Tensile Requirements		
Tensile strength, psi	30,000	....
Yield strength, psi	14,000	....
Elongation in 2 inches, %	20	....

CRANE SPECIAL BRONZE — ASTM B 61

Crane Special Bronze is a high grade alloy used in valves and other products recommended for the higher pressures and for temperatures up to 550 F. It is classified as "Leaded Tin Bronze" in ASTM B119 (Standard Classification of Cast Copper-Base Alloys).

Chemical Requirements	Minimum	Maximum
Copper, %	86.0	90.0
Tin, %	5.5	6.5
Lead, %	1.0	2.0
Zinc, %	3.0	5.0
Nickel, %	....	1.0
Tensile Requirements		
Tensile strength, psi	34,000	....
Yield strength, psi	16,000	....
Elongation in 2 inches, %	22	....

CRANE NAVAL BRONZE ROD — ASTM B 21, Alloy B, Hard Temper

Crane Naval Bronze Rod is used for stem material and other valve parts which require unusually good bearing qualities and resistance to wear. These properties, plus the strength and corrosion resistance of copper-base alloys, make this material ideally suitable for stems.

Chemical Requirements	Minimum	Maximum
Copper, %	59.0	62.0
Tin, %	0.5	1.0
Lead, %	0.4	1.0
Iron, %		0.10
Zinc, %	(remainder)	
Elements other than above, %		0.10

Tensile Requirements	Minimum 1-inch diameter and less	Minimum Over 1-inch diameter to 2½-inch
Tensile strength, psi	67,000	62,000
Yield strength, psi	45,000	37,000
Elongation in 2 inches, %	11	15

CRANE CAST SILICON BRONZE — ASTM B 198, Alloy 13B

Crane Cast Silicon Bronze has good strength and ductility and offers excellent resistance to corrosion. This metal is used as a valve trim material.

Chemical Requirements	Minimum	Maximum
Copper, %	78.0	84.5
Lead, %	....	0.5
Zinc, %	12.0	16.0
Silicon, %	3.0	5.0
Tensile Requirements		
Tensile strength, psi	60,000	....
Yield strength, psi	24,000	....
Elongation in 2 inches, %	16	....

CRANE NO. 9 and NO. 11 CAST MANGANESE BRONZES — ASTM B 132, Alloys A and B

Crane No. 9 (Alloy A) and No. 11 (Alloy B) Cast Manganese Bronzes were developed in order to provide stem metals that would withstand the great torsional and tensile strains to which this valve part is subjected.

The unusually good bearing qualities of these metals offer excellent resistance to wear; this, combined with strength and the good corrosion resistance typical of copper-base alloys, has extended the use of Crane No. 9 and No. 11 Cast Manganese Bronzes to yoke sleeves and yoke bushings of iron and steel valves for a wide variety of services.

Crane No. 9 Cast Manganese Bronze has chemical and tensile requirements as follows:

Chemical Requirements	Minimum	Maximum
Copper, %	56.0	62.0
Lead, %	0.5	1.5
Tin, %	....	1.5
Manganese, %	....	1.5
Aluminum, %	....	1.5
Iron, %	....	2.0
Zinc, %	(remainder)	
Tensile Requirements		
Tensile strength, psi	60,000	
Yield strength, psi	20,000	
Elongation in 2 inches, %	15	

Crane No. 11 Cast Manganese Bronze has chemical and tensile requirements as follows:

Chemical Requirements	Minimum	Maximum
Copper, %	55.0	60.0
Lead, %	0.5	1.5
Tin, %	....	1.5
Manganese, %	....	3.5
Aluminum, %	....	3.0
Iron, %	....	3.0
Zinc, %	(remainder)	
Tensile Requirements		
Tensile strength, psi	80,000	
Yield strength, psi	32,000	
Elongation in 2 inches, %	15	

Crane Cast and Malleable Irons

CRANE CAST IRON, FERROSTEEL, and HIGH TENSILE STRENGTH IRON

ASTM A 126
Classes A, B, and C

Crane Cast Iron is regularly produced in three grades . . . Cast Iron, Ferrosteel, and High Tensile Strength Iron. These metals are recommended for temperatures up to 450 F.

Each grade is particularly suited to provide uniform density, soundness, and close grain within a specific range of thicknesses of sections employed in the production of Crane cast iron valves.

Cast Iron is used for valves having light metal sections, Ferrosteel is used for sections of medium metal thicknesses, and High Tensile Strength Iron is used for the heavier metal sections.

Crane Cast Iron
ASTM A 126, Class A

Chemical Requirements	Minimum	Maximum
Sulfur, %	....	0.12
Phosphorus, %	....	0.75
Tensile Requirements		
Tensile strength, psi	21,000	....
Transverse strength, pounds	2,200	....
Deflection at center, inches	0.10	....

Crane Ferrosteel
ASTM A 126, Class B

Chemical Requirements	Minimum	Maximum
Sulfur, %	....	0.12
Phosphorus, %	....	0.75
Tensile Requirements		
Tensile strength, psi	31,000	....
Transverse strength, pounds	3,300	....
Deflection at center, inches	0.12	....

Crane High Tensile Strength Iron
ASTM A 126, Class C

Chemical Requirements	Minimum	Maximum
Sulfur, %	....	0.12
Phosphorus, %	....	0.75
Alloying elements, %	....	2.0
Tensile Requirements		
Tensile strength, psi	41,000	....
Transverse strength, pounds	4,000	....
Deflection at center, inches	0.12	....

CRANE 3% NICKEL CAST IRON

Crane 3% Nickel Cast Iron has tensile requirements comparable to ASTM A 126, Class B, and is used for corrosive services where ordinary gray iron is not adequate. The metal is used in valves for the pulp, paper, and petroleum industries. All pressure-containing castings of this iron are identified with the symbol "3NI".

Chemical Requirements	Minimum	Maximum
Nickel, %	2.75	3.25
Sulfur, %	...	0.12
Phosphorus, %	...	0.40
Tensile Requirements		
Tensile strength, psi	31,000	
Transverse strength, pounds	3,300	
Deflection at center, inches	0.12	

CRANE NODULAR CAST IRON

ASTM A 395

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Crane Nodular Cast Iron, also known as ductile or spheroidal iron, is cast iron with the graphite substantially in spherical shape and reasonably free of flake graphite. This results in a cast iron having high strength and good ductility. The corrosion resistance of nodular iron is approximately the same as that of gray iron. All pressure-containing castings of this iron are identified with the symbol "NCI".

Chemical Requirements	Minimum	Maximum
Total Carbon, %	3.0	....
Silicon, %	....	2.75
Phosphorus, %	....	0.08
Tensile Requirements		
Tensile strength, psi	60,000	....
Yield strength, psi	45,000	....
Elongation in 2 inches, %	15	....

NI-RESIST CAST IRON

Type II, Copper-Free

Ni-Resist Cast Iron is used where the physical properties of cast iron suffice but where greater resistance to corrosion is required. This copper-free alloy is generally selected for applications where copper contamination cannot be tolerated. All pressure-containing castings of this iron are identified with the symbol "NR2". *Ni-Resist* is the registered trade-mark of the International Nickel Company, Inc.

Chemical Requirements	Minimum	Maximum
Carbon, %	....	3.00
Manganese, %	1.00	1.50
Phosphorus, %	....	0.30
Sulfur, %	....	0.12
Silicon, %	1.00	2.80
Chromium, %	1.75	2.50
Nickel, %	18.00	22.00
Copper, %	....	0.50
Iron, %	(remainder)	
Tensile Requirements		
Tensile strength, psi	25,000	....

NI-RESIST NODULAR CAST IRON

Ni-Resist Nodular Cast Iron has excellent bearing qualities, high melting point, strength, ductility, and good resistance to atmospheric corrosion. It is especially suitable for use in yoke sleeves, yoke bushings, and similar applications. *Ni-Resist* is the registered trade-mark of the International Nickel Company, Inc.

CRANE MALLEABLE IRON

ASTM A 338

Crane Malleable Iron used in valves is characterized by pressure tightness, stiffness, and toughness, the latter property being an especially valuable one for piping materials subjected to expansion and contraction stresses and shock.

Tensile Requirements	Minimum
Tensile strength, psi	50,000
Yield point, psi	32,500
Elongation in 2 inches, %	10

Crane Nickel, Aluminum, and Chromium Alloys

CRANE NO. 49 CAST NICKEL ALLOY

Crane No. 49 Cast Nickel Alloy possesses excellent bearing qualities and corrosion resistance. With hardness up to 235 BHN, it withstands wear and erosion at steam temperatures up to 850 F unusually well.

The seating combination of Crane No. 49 Alloy and Crane Exelloy used in steel valves (known as XR trim) is particularly satisfactory for steam, water, air, oil, gas, and other non-lubricating and relatively non-corrosive gases and liquids like gasoline, fuel oil, etc. Valves with XR trim are also well suited for low viscosity oils such as are used in hydraulic systems, especially where seating loads are extremely high.

Chemical Requirements	Minimum	Maximum
Nickel....%	52.00	56.00
Tin....%	10.50	13.00
Copper....%	30.50	34.00
Silicon....%	....	0.40
Manganese....%	0.30	0.75
Phosphorus....%	0.40	1.00
Iron....%	1.00	2.00
Tensile Requirements		
Tensile strength....psi	60,000	....

CRANE CAST ALUMINUM ALLOY

Crane Cast Aluminum Alloy is light in weight, has good corrosion resistance for many services, and its impact strength is retained at extremely low temperatures. All pressure-containing castings of this alloy are identified with the symbol "AL".

Chemical Requirements	Minimum	Maximum
Copper....%	....	0.25
Iron....%	....	0.6
Silicon....%	6.5	7.5
Manganese....%	....	0.35
Magnesium....%	0.20	0.40
Zinc....%	....	0.35
Titanium....%	....	0.25
Other elements ..each—%	....	0 05
Other elements.. total—%	....	0.15
Aluminum....%	(remainder)	
Tensile Requirements		
Tensile strength....psi	21,000	....
Elongation in 2 inches...%	3.0	....

Designation of Seating Metals

Catalog numbers of Crane Steel Valves have a letter suffix which indicates the material of the disc and body seat ring, as follows:

"A" . . Monel
"L" . . 18-8 SMo or Type 316 Stainless Steel
"U" . . Stellite
"X" . . Exelloy
"XR" Exelloy to No. 49 Nickel Alloy
"XU" Exelloy to Stellite
"XW" Exelloy to "300 Brinell" Stainless Steel

CAST MONEL

Cast Monel is a high strength nickel-copper alloy containing approximately two-thirds nickel and one-third copper. It has excellent resistance to corrosion by many acids, alkalies, salt solutions, food products, organic substances, and many other miscellaneous fluids. Among non-ferrous alloys, Monel is outstanding for handling solutions of the alkalies and it is widely used wherever the avoidance of copper contamination is not imperative.

All pressure-containing castings of this alloy are identified with the symbol "NI-CU". *Monel* is the registered trade-mark of the International Nickel Company, Inc.

Chemical Requirements	Minimum	Maximum
Nickel....%	62 00	68 00
Copper....%	26.00	33 00
Iron....%	....	2.50
Manganese....%	....	1.50
Aluminum....%	....	0.50
Silicon....%	....	2.00
Carbon....%	....	0 35
Tensile Requirements		
Tensile strength....psi	65,000	....
Yield strength....psi	32,500	....
Elongation in 2 inches...%	25	....

HASTELLOY* ALLOY C

Hastelloy Alloy C is a nickel-molybdenum-chromium-iron alloy. Its tensile strength and hardness are comparable to that of alloy steel. It withstands strong oxidizing conditions such as those encountered with free chlorine and aqueous solutions containing chlorine. All parts made of this alloy are identified with the symbol "HC".

CRANE STELLITE* TRIM

Stellite, a cobalt-chromium-tungsten alloy, is a hard facing material deposited on steel discs or body rings of high pressure-temperature steel valves. It is known as U trim.

Stellite is recommended where service conditions are especially severe, particularly in modern steam power plants operating at elevated temperatures. Its extreme hardness when cold (Brinell number 375 minimum) is maintained almost unimpaired at red heat. Stellite withstands corrosion and erosion unusually well, and it displays excellent resistance to wear, seizure, galling, and abrasion

**Hastelloy and Stellite are registered trade-marks of the Union Carbide Corporation*

Crane Siliconized Steel

(Crane Patent No. 2,897,093)

Crane Siliconized Steel is resistant to wear and corrosion, and has good bearing qualities. A typical application of this material is its use for packing glands in some iron and steel valves. The surface of Siliconized Steel is impregnated with silicon (approximately 12%, Si

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Crane Exelloy

ASTM A 182, Grade F6, and AISI Type 410

Crane Exelloy is a specially processed corrosion and heat resisting AISI Type 410 chromium steel. It is heat-treated to various hardness ranges depending upon its application for use in a valve part.

As a stem material, it is heat-treated to obtain high strength and good wearing properties. It also possesses good resistance to corrosion by atmosphere; and by steam, gas, air, oil and hot oil vapors.

As a seating material, it is heat-treated to secure greater hardness depending upon the valve part, the hardness of some parts being in excess of 350 BHN. With this high hardness . . . which effectively resists scratching, scoring, or indentation by hard particles . . . is combined adequate strength and ductility, and excellent resistance to wear, seizure, galling, erosion, oxidation, and corrosion.

Crane Exelloy has been more universally suitable for valve seats in oil service than any other material. Crane Exelloy used in steel valves is known as X trim. All parts made of Exelloy are marked with the symbol "X".

Chemical Requirements	Minimum	Maximum
Carbon, %	....	0.12
Manganese, %	....	1.00
Phosphorus, %	....	0.040
Sulfur, %	....	0.030
Silicon, %	....	1.00
Nickel, %	....	0.50
Chromium, %	11.5	13.5
Tensile Requirements (for Stem Material)		
Tensile strength, psi	100,000	..
Yield point, psi	80,000	....
Elongation in 2 inches, %	20	.. .
Reduction of area, %	60	.. .
Brinell hardness number	225	255

Crane Hardened Stainless Steel

"500 Brinell"

AISI Type 420

Crane "500 Brinell" Stainless Steel is heat-treated to an unusually high hardness for services where foreign materials in the fluids handled could have adverse effects on the seating surfaces. Because of high hardness through heat treatment, this material is used for seats and discs in plug type bronze and iron globe and angle valves, and also for discs in small steel globe and angle valves. It possesses corrosion resistance comparable to that of Crane Exelloy.

Chemical Requirements	Minimum	Maximum
Carbon, %	0.20	0.24
Manganese, %	....	0 75
Phosphorus, %	....	0 03
Sulfur, %	....	0 03
Silicon, %	.	0 50
Nickel, %		0.50
Chromium, %	12.00	14 00

Crane Stainless Steels

CRANE 18-8 S ALLOY CAST STEEL — ASTM A 296 and A 351 Grade CF-8

Crane 18-8 S, an austenitic stainless steel, has excellent corrosion resistance to many fluids and is especially suitable for use on some nitric acid services. Castings are heat-treated for maximum corrosion resistance. It is comparable in composition to AISI Type 304 wrought stainless steel. All pressure-containing castings are marked "18-8 S".

Chemical Requirements	Minimum	Maximum
Carbon, %	....	0.08
Manganese, %	....	1.50
Phosphorus, %	....	0.040
Sulfur, %	....	0.040
Silicon, %	....	2.00
Chromium, %	18.0	21.0
Nickel, %	8.0	11.0
Tensile Requirements		
Tensile strength, psi	70,000	....
Yield point, psi	28,000	....
Elongation in 2 inches, %	35	....

CRANE 18-8 SMo ALLOY CAST STEEL — ASTM A 296 and A 351 Grade CF-8M

Crane 18-8 SMo is an austenitic stainless steel containing molybdenum which imparts greater resistance to pitting type of corrosion and higher resistance to general corrosion than the 18-8 S type. Castings are heat-treated for maximum corrosion resistance. This metal is comparable in composition to AISI Type 316 wrought stainless steel. All pressure-containing castings are marked "18-8 SMo".

Chemical Requirements	Minimum	Maximum
Carbon, %	....	0.08
Manganese, %	....	1.50
Phosphorus, %	....	0.040
Sulfur, %	....	0.040
Silicon, %	....	1.50
Chromium, %	18.0	21.0
Nickel, %	9.0	12.0
Molybdenum, %	2.0	3.0
Tensile Requirements		
Tensile strength, psi	70,000	....
Yield point, psi	30,000	....
Elongation in 2 inches, %	30	....

CRANELOY 20 ALLOY CAST STEEL

Craneloy 20, developed primarily for sulfuric acid service, has good corrosion resistance over a wide range of concentrations. Its use is being expanded into other services both under oxidizing and reducing conditions where its corrosion resistance is superior to that of austenitic steels. Castings are heat-treated for maximum corrosion resistance. All pressure-containing castings are marked "C 20".

In the absence of standard requirements for alloy of this type, the Crane properties for this material are established as follows:

Chemical Requirements	Minimum	Maximum
Carbon, %	..	0 07
Silicon, %	1 00	
Chromium, %	19 00	
Nickel, %	28.00	
Copper, %	3.50	....
Molybdenum, %	2 00	
Tensile Requirements		
Tensile strength, psi	65,000	
Yield point, psi	30 000	
Elongation in 2 inches, %	35	

Crane Cast Steels

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GENERAL

Cast Steel is ideally suited for the multitude of services that are beyond the scope of bronze and iron. Its superior strength and toughness, and its resistance to piping strains, vibration, shock, and damage by fire, afford reliable protection when safety and utility are desired.

To provide for the widely varied services to which steel valves and fittings are subjected, Crane regularly produces a number of different types of quality cast steels. The tensile requirements listed are the minima required by standard specifications, whenever they are applicable.

All steel castings are heat-treated, proper to their design and composition, to obtain the optimum properties for the service for which they are recommended. All pressure-containing castings are marked with the standard ASTM symbol to indicate the type of steel from which they are made.

CRANE CARBON CAST STEEL — ASTM A 216 Grade WCB

Crane Carbon Cast Steel is suitable for use on saturated or superheated steam, cold or hot water, cold or hot non-corrosive oil, gas, air, and other fluids. It has a carbon content not exceeding 0.30 per cent, which assures good welding qualities.

All pressure-containing castings of this steel are identified with the ASTM symbol "WCB".

Chemical Requirements	Minimum	Maximum
Carbon, %	....	0.30
Manganese, %	....	1.00
Phosphorus, %	....	0.05
Sulfur, %	....	0.06
Silicon, %	....	0.60
Tensile Requirements		
Tensile strength, psi	70,000	....
Yield point, psi	36,000	....
Elongation in 2 inches, %	22	....
Reduction of area, %	35	....

CRANE NO. 4 CARBON-MOLYBDENUM ALLOY CAST STEEL — ASTM A 217 Grade WC1

Crane No. 4 Carbon-Molybdenum Alloy Cast Steel has high temperature properties which make it suitable for service conditions that fall between those for carbon steel and chromium-molybdenum steel. The demand for this metal is diminishing and it is generally being replaced by Crane No. 7, a much superior and more highly alloyed steel.

All pressure-containing castings of this steel are identified with the ASTM symbol "WC1".

Chemical Requirements	Minimum	Maximum
Carbon, %	....	0.25
Manganese, %	0.50	0.80
Phosphorus, %	....	0.05
Sulfur, %	....	0.06
Silicon, %	....	0.60
Molybdenum, %	0.45	0.65
Tensile Requirements		
Tensile strength, psi	65,000	
Yield point, psi	35,000	
Elongation in 2 inches, %	24	
Reduction of area, %	35	

CRANE NO. 7 CHROMIUM-MOLYBDENUM ALLOY CAST STEEL — ASTM A 217 Grade WC6

Crane No. 7 Chromium-Molybdenum Alloy Cast Steel was introduced when it became apparent that steels need a substantial chromium content to stabilize them against graphitization under the operating conditions of welded power piping systems.

For the purposes of welded piping systems, Crane No. 7 Steel has been found highly satisfactory for its weldability and, when operating at high temperatures, for its stability and high strength. The use of 1.00 to 1.50 per cent chromium and of 0.45 to 0.65 per cent molybdenum as the principal alloying elements establishes the stability of the steel against graphitization and, at the same time, assures excellent strength retention at elevated temperatures. Combined with these qualities is ready weldability, not usually associated with chromium-bearing steels, but made possible by the low carbon content comparable to that of the pipe.

Crane No. 7 Steel is regularly used in Crane Pressure-Seal Bonnet Valves and Lip-Seal Bonnet Valves. All pressure-containing castings are identified with the ASTM symbol "WC6".

Chemical Requirements	Minimum	Maximum
Carbon, %	....	0.20
Manganese, %	0.50	0.80
Phosphorus, %	....	0.05
Sulfur, %	....	0.06
Silicon, %	....	0.60
Chromium, %	1.00	1.50
Molybdenum, %	0.45	0.65
Tensile Requirements		
Tensile strength, psi	70,000	
Yield point, psi	40,000	
Elongation in 2 inches, %	20	
Reduction of area, %	35	

CRANE NO. 9 CHROMIUM-MOLYBDENUM ALLOY CAST STEEL — ASTM A 217 Grade WC9

Crane No. 9 Chromium-Molybdenum Alloy Cast Steel was developed for high temperature service, where it possesses strength and creep resistance somewhat greater than Crane No. 7 Steel. It is a weldable steel recommended for the extreme temperature conditions encountered in modern power plants and refineries.

All pressure-containing castings of this steel are identified with the ASTM symbol "WC9".

Chemical Requirements	Minimum	Maximum
Carbon, %	....	0.18
Manganese, %	0.40	0.70
Phosphorus, %	....	0.05
Sulfur, %	....	0.06
Silicon, %	....	0.60
Chromium, %	2.00	2.75
Molybdenum, %	0.90	1.20
Tensile Requirements		
Tensile strength, psi	70,000	
Yield point, psi	40,000	
Elongation in 2 inches, %	20	
Reduction of area, %	35	

Crane Cast Steels

CRANE NO. 5 CHROMIUM-MOLYBDENUM ALLOY CAST STEEL

ASTM A 217 Grade C5

Crane No. 5 Chromium-Molybdenum Alloy Cast Steel is unusually strong at normal temperatures and, at high temperatures, possesses exceptional strength and offers excellent resistance to creep, erosion, and scaling.

Crane No. 5 Steel is ideal for severe service, particularly in high temperature oil refinery service where corrosion resistance is essential. Since heat-treatment after welding is desirable, this steel is best adapted to products having flanged or threaded ends. All pressure-containing castings are identified with the ASTM symbol "C5".

Chemical Requirements	Minimum	Maximum
Carbon, %	....	0.20
Manganese, %	0.40	0.70
Phosphorus, %	....	0.05
Sulfur, %	....	0.06
Silicon, %	....	0.75
Chromium, %	4.00	6.50
Molybdenum, %	0.45	0.65
Tensile Requirements		
Tensile strength, psi	90,000	....
Yield point, psi	60,000	....
Elongation in 2 inches, %	18	....
Reduction of area, %	35	....

CRANE NO. 15 ALLOY CAST STEEL

Crane No. 15 Alloy Cast Steel possesses high strength and is recommended particularly for normal atmospheric temperature service where the high strength is required. Castings are used for discs in steel pipe-line gate valves.

Chemical Requirements	Minimum	Maximum
Carbon, %	0.30	0.40
Manganese, %	....	1.00
Phosphorus, %	....	0.05
Sulfur, %	....	0.06
Silicon, %	....	0.60
Chromium, % / Nickel, % / Molybdenum, %	....	1.75
Tensile Requirements		
Tensile strength, psi	90,000	....
Yield point, psi	60,000	....
Elongation in 2 inches, %	18	....
Reduction of area, %	35	....

CRANE CARBON CAST STEEL

For Low Temperature Service — ASTM A 352 Grade LCB

Crane Carbon Cast Steel can be heat-treated to retain impact resistance at temperatures as low as minus 50 F. All pressure-containing castings that are heat-treated are identified with the ASTM symbol "LCB". Chemical requirements are the same as those for regular Carbon Cast Steel (ASTM A 216; see facing page).

Tensile Requirements		Minimum
Tensile strength	psi	65,000
Yield point	psi	35,000
Elongation in 2 inches	%	24
Reduction of area	%	35
Impact Strength		
Charpy keyhole notch at −50 F	foot pounds	15

CRANE CARBON-MOLYBDENUM ALLOY CAST STEEL

For Low Temperature Service — ASTM A 352 Grade LC1

Crane Carbon-Molybdenum Alloy Cast Steel can be heat-treated to retain its toughness at temperatures as low as minus 75 F. All pressure-containing castings that are heat-treated are identified with the ASTM symbol "LC1". Impact strength (Charpy keyhole notch at minus 75 F) is 15 foot pounds minimum. Chemical and tensile requirements are the same as those for Crane No. 4 Carbon-Molybdenum Cast Steel; see facing page.

CRANE NO. 3 NICKEL ALLOY CAST STEEL

ASTM A 352 Grade LC2

Crane No. 3 Nickel Alloy Cast Steel provides excellent tensile and impact strength at sub-zero temperatures and is especially recommended for use at temperatures down to minus 100 F. All pressure-containing castings are identified with the ASTM symbol "LC2" and the test temperature.

Chemical Requirements	Minimum	Maximum
Carbon, %	....	0.25
Manganese, %	0.50	0.80
Phosphorus, %	....	0.050
Sulfur, %	....	0.050
Silicon, %	....	0.60
Nickel, %	2.0	3.0
Tensile Requirements		
Tensile strength, psi	65,000	....
Yield point, psi	40,000	....
Elongation in 2 inches, %	24	....
Reduction of area, %	35	....
Impact Strength		
Charpy keyhole notch at −100 F, foot pounds	15	....

CRANE "ARCTIC" NICKEL ALLOY CAST STEEL

ASTM A 352 Grade LC3

For sub-zero temperatures substantially lower than those for which Crane No. 3 Nickel Alloy Cast Steel is recommended, Crane Metallurgists developed Crane "Arctic" Nickel Alloy Cast Steel. All castings are heat-treated to develop the required physical properties. Inquiries should include specifications of the intended service.

All pressure-containing castings are identified with the ASTM symbol "LC3" and the test temperature. The trademark "ARCTIC" is registered in the U.S. Patent Office.

Chemical Requirements	Minimum	Maximum
Carbon, %	....	0.15
Manganese, %	0.50	0.80
Phosphorus, %	....	0.050
Sulfur, %	....	0.050
Silicon, %	....	0.60
Nickel, %	3.0	4.0
Tensile Requirements		
Tensile strength, psi	65,000	....
Yield point, psi	40,000	....
Elongation in 2 inches, %	24	....
Reduction of area, %	35	....
Impact Strength		
Charpy keyhole notch at −150 F, foot pounds	15	

2

Crane Forged Steels

Paralleling the variety of Cast Steels produced by Crane to provide for widely varied services, is a corresponding group of Crane Forged Steels. While chemical composition and physical properties of the forged and cast steels are not exactly the same, in general characteristics and ultimate utility, the forged material is the full equivalent of the cast. Steel forgings are carefully heat-treated to develop the optimum properties for the services for which they are recommended.

The recommendations for Crane Cast Steels and the comparisons thereof are, therefore, equally applicable to Crane Forged Steels; see pages 6 and 7. From the standpoint of life and service there is no difference; both metals are component parts of a complete line. Forgings have a highly refined grain, with physical properties well in excess of recognized minimum requirements.

CRANE CARBON FORGED STEELS

ASTM A 105, Grade II
ASTM A 234, Grade B

Crane Carbon Forged Steels, like the cast material, are ideally suited for a multitude of services that are beyond the scope of bronze or iron.

Crane forged steel products such as valve bodies and bonnets, flanges of the 400-pound pressure class and higher, and fittings are heat-treated to meet the requirements of ASTM A 105, Grade II and ASTM A 234, Grade B.

Chemical Requirements	Minimum	Maximum
Carbon, %	0.22	0.35
Manganese, %	....	0.90
Phosphorus, %	....	0.04
Sulfur, %	....	0.05
Silicon, %	0.15	0.30
Tensile Requirements		
Tensile strength, psi	70,000	....
Yield point, psi	36,000	....
Elongation in 2 inches, %	22	....
Reduction of area, %	30	....

ASTM A 181, Grade II

Crane forged steel products which are not regularly heat-treated, such as 150 and 300-pound flanges, are made of steel conforming to ASTM A 181, Grade II. This steel meets the same chemical and tensile requirements as the carbon steels described above except that elongation in 2 inches is 18 per cent and reduction of area is 24 per cent.

CRANE NO. 7 CHROMIUM-MOLYBDENUM ALLOY FORGED STEEL

ASTM A 182
Grade F11

Crane No. 7 Chromium-Molybdenum Alloy Forged Steel, like the cast material, combines ready weldability with excellent strength retention and is not subject to graphitization at elevated temperatures. All pressure-containing forgings of this steel are identified with the ASTM symbol "F11".

Chemical Requirements	Minimum	Maximum
Carbon, %	0.10	0.20
Manganese, %	0.30	0.80
Phosphorus, %	....	0.040
Sulfur, %	....	0.040
Silicon, %	0.50	1.00
Chromium, %	1.00	1.50
Molybdenum, %	0.45	0.65
Tensile Requirements		
Tensile strength, psi	70,000	
Yield point, psi	40,000	
Elongation in 2 inches, %	20	
Reduction of area, %	30	

CRANE NO. 9 CHROMIUM-MOLYBDENUM ALLOY FORGED STEEL

ASTM A 182
Grade F22

Crane No. 9 Chromium-Molybdenum Alloy Forged Steel possesses somewhat greater strength and creep resistance than Crane No. 7 Steel.

Crane No. 9 is a weldable steel developed for the extreme temperature conditions encountered in modern power plants and refineries.

All pressure-containing forgings of this steel are identified with the ASTM symbol "F22".

Chemical Requirements	Minimum	Maximum
Carbon, %	....	0.15
Manganese, %	0.30	0.60
Phosphorus, %	....	0.040
Sulfur, %	....	0.040
Silicon, %	....	0.50
Chromium, %	2.00	2.50
Molybdenum, %	0.90	1.10
Tensile Requirements		
Tensile strength, psi	70,000	
Yield point, psi	40,000	
Elongation in 2 inches, %	20	
Reduction of area, %	30	

CRANE NO. 5 CHROMIUM-MOLYBDENUM ALLOY FORGED STEEL

ASTM A 182
Grade F5a

Crane No. 5 Chromium-Molybdenum Forged Steel like the cast material, offers unusually high retention of strength and creep resistance plus excellent resistance to erosion and scaling at high temperatures.

It is ideal for severe service, particularly in high temperature oil refinery service where corrosion resistance is essential.

All pressure-containing forgings of this steel are identified with the ASTM symbol "F5a"

Chemical Requirements	Minimum	Maximum
Carbon, %		0.25
Manganese, %		0.60
Phosphorus, %		0.040
Sulfur, %		0.030
Silicon, %		0.50
Nickel, %		0.50
Chromium, %	4.0	6.0
Molybdenum, %	0.45	0.65
Tensile Requirements		
Tensile strength, psi	60,000	
Yield point, psi	30,000	
Elongation in 2 inches, %	22	
Reduction of area, %	50	

Crane Bolting Materials

In the manufacture of Crane Valves and in bolting flanged valves, fittings, and flanges together to form a complete piping system, the following bolting materials are regularly used:

Machine Bolts, Studs, Stud Bolts, and Nuts

Bolts for temperatures up to 500 F are made from steel complying with ASTM Specification A 307, Grade B.

This steel has a minimum tensile strength of 55,000 pounds per square inch.

Nuts regularly used with machine bolts are hot pressed steel conforming to ASTM Specification A 307.

Studs and stud bolts for temperatures up to 500 F, used primarily for high pressure hydraulic service, are made from cold rolled steel complying with ASTM Specification A 108, Open Hearth free-cutting grade.

Nuts regularly used with cold rolled steel studs and stud bolts are cold formed steel conforming to ASTM Specification A 307.

Alloy Steel Studs and Stud Bolts

Crane pioneered in the development of alloy steel bolting. For many years, Crane Triplex Steel has been recognized as the highest quality bolting material for services at temperatures beyond the range of carbon steel.

Crane Templex Steel resulted from much study and experience with high temperature composition and stands as the highest quality bolting material for services at temperatures beyond the range of other ferritic alloy steels.

Crane Triplex Steel is a chromium-molybdenum alloy of marked stability. It retains its strength unusually well at elevated temperatures and offers better resistance to creep than most high grade alloy steel bolting materials. Special heat-treatment, by quenching and drawing, produces a dense, uniform, and fine grain with superior physical properties.

The uniformly satisfactory results secured with Triplex Steel stud bolts in thousands of steel valve and fitting installations, many of which — particularly in oil refineries — have been operating under extreme pressures and temperatures, is a fitting testimonial of their excellence.

This steel is regularly used in the bonnet bolting of Crane bolted bonnet carbon steel valves and all Pressure-Seal Bonnet valves.

Crane Triplex Steel substantially exceeds minimum requirements of ASTM Specification A 193, Grade B7.

Crane Templex Steel is a chromium-molybdenum-vanadium alloy developed by Crane. Its unusual strength and remarkable stability at elevated temperatures is the result of the molybdenum and vanadium combined with special heat-treatment.

The exacting heat-treatment developed by Crane Laboratories is the secret of the superiority of Crane Templex Steel. In addition to uniform grain and excellent physical properties, it produces a definite carbide size in the microstructure of the material, resulting in maximum creep resistance—this resistance is much greater than offered in other bolting steels on the market today.

This steel, ideal for exceptionally high temperatures, is regularly used in the bonnet bolting of Crane "U" trimmed bolted bonnet alloy steel valves.

Crane Templex Steel substantially exceeds minimum requirements of ASTM Specification A 193, Grade B14.

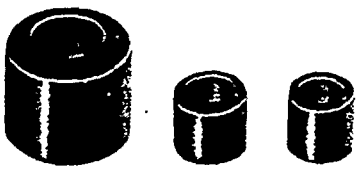
Physical Properties	ASTM Minimum	Crane Triplex average	Crane Templex average
Tensile strength.....psi	125,000	134,000	145,000
Yield point.....psi	105,000	116,000	118,000
Elongation in 2 inches.. per cent	16	20	20
Reduction of area.....per cent	50	57	57
Brinell hardness number...range	260-320	270-300	285-320

Nuts for Alloy Steel Studs and Stud Bolts

Crane Triplex and Templex Steel studs and stud bolts use hot forged, medium carbon steel, oil-quenched nuts conforming to ASTM Specification A 194, Grade 2H Having a Brinell hardness number of 250 minimum, the nuts are capable of developing the full strength of the stud.

Crane Valve Packings

2



Packing for Small Size
Bronze and Iron Body Valves

The homogenous type of endless molded ring packing is used in small size bronze and iron body valves. They are made in various shapes to fit each size stuffing box.



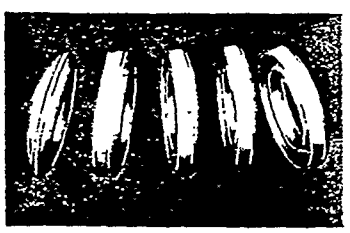
Packing for Large Size
Bronze and Iron Body Valves

The large size bronze and iron body valves use a plastic core packing similar to the type used in the smaller size valves, but with an asbestos jacket and a corrosion inhibitor added.



Packing for Steel Valves

Steel valves for use in high pressure, high temperature service require an extremely tough, yet pliable, construction. Crane valves use plastic cores encased in a jacket of Inconel wire and yarn. The cutaway of a straight section of the packing shows how the Inconel wire supports the core.



Packing for Valves
For Corrosive Services

Teflon, a proven material in corrosive services, is used in Crane stainless steel valves and in valves for chlorine service.

Just as there are many types of valves designed for specific purposes, so there are many types of valve packings to handle various liquids and gases. However, since the common lines of valves can be divided into three general classes . . . . and since these three classes handle the bulk of service conditions encountered today . . . . Crane, by careful selection of packing, particularly in regard to quality and adaptability in the intended service, has been able to standardize on relatively few types. These packing types are used in the following valves.

1. Bronze and iron body valves for moderate pressures and for temperatures up to 550 F.
2. Steel valves for high pressure service at temperatures up to 1200 F.
3. Corrosion-resistant valves and valves with special trim for chemical and corrosive services.

Packings for Bronze and Iron Body Valves

Crane bronze and iron body valves in the smaller sizes (usually 2-inch and smaller) use packing made of endless molded rings; larger sizes have plastic cores encased in woven asbestos. The packings are suitable for steam, water, oil, gas, liquefied petroleum gases, gasoline, and air. Although the packings generally are suitable for temperatures up to 550 F, the pressure-temperature ratings specified for the individual valves apply. All rings are accurately die-formed to fit into stuffing boxes with minimum effort.

Endless molded rings (illustrated at upper left) are formed from a homogenous mass consisting principally of asbestos filler, graphite, and binder. The fiber length is carefully determined and the percentage of asbestos and graphite accurately apportioned to maintain deformable qualities in each ring.

Core packing (see second illustration at left) consists of a plastic core encased in an asbestos jacket. The core material is essentially the same as that used in the molded ring packing; the length of asbestos fiber is carefully determined, and a corrosion inhibitor is added. Jackets are generally comprised of a commercial grade yarn or braid. After the braid is applied to the core, the packing is drawn through a light binder and graphite to provide adequate external lubrication. The rings are the split-type so that they are easily slipped on the stem. The diagonally cut ends provide a bevel joint for good sealing when the gland is pulled up.

Packing for Steel Valves

Steel valves intended for high pressure-temperature service demand the utmost in well-constructed packing. In Crane valves, the core materials are asbestos and graphite with a minimum of binder which will not harden in service. The cores are soft enough so that the packing, under fluid and gland pressure, will conform to the shape of the stuffing box with no detrimental effect. Suitable agents are included to inhibit stem corrosion.

Jackets, made by using Inconel wire inserts in each strand of triple-A asbestos yarn (see third illustration), support the cores and provide the strength needed to withstand high pressure and temperature.

Packing for Valves for Corrosive Service

Valves used in chemical and corrosive services present the greatest packing problems. Teflon (DuPont tetrafluoroethylene), when used within its temperature range, has proven very effective against almost all chemicals, liquids, and gases. Because of the flexibility and general efficiency offered by the "V" ring construction (see bottom illustration), Teflon "V" Rings of that design have been selected for regular use in Crane 18-8 SMo and Crancloy 20 stainless steel valves for corrosive services and in steel valves for chlorine service.

Crane Sheet Packings and Gaskets

C.C. Rubber Sheet Packing

C.C. Rubber Sheet Packing is a high grade rubber composition packing compounded to a special formula and manufactured solely for Crane. It is exceptionally tough, durable, and resilient. Frequent, careful tests throughout the manufacturing process assure high, uniform quality.

This packing is recommended for all pressures in services such as saturated steam, hot and cold water, air, and gas.

C.C. Rubber is available in rolled sheets (page 320) or in finished cut gasket shapes (pages 321 and 322).

Cranite Sheet Packing

Cranite is a superior gasket material prepared from selected long fiber asbestos, cross-laminated to secure exceptional strength and durability. It has a high and uniform compressive strength, does not deteriorate with age, and is ideally suited for use with water, air, gas, gasoline, ammonia, steam, oil, acids, alkalies, etc. It is used for temperatures up to 750 F.

Cranite is approved by the Underwriters' Laboratories, Inc. (National Board of Fire Underwriters), for use on hazardous liquids.

Cranite is available in flat sheets (page 320), in finished cut gasket shapes (pages 321 to 323), or for tongue and groove flange unions (page 292).

Spiral Wound Gaskets

Spiral wound gaskets consist of plies of preformed metal with asbestos or some other material as the filler strip. Corrugations in the continuous metal strip impart tension and resiliency when the gasket is under compression; the edges of the strip create multiple barriers against leakage; the soft filler strip seals minute imperfections in the flange faces.

The gaskets are self-adjusting to compensate for shock, vibration, and temperature change. They are recommended for use against steam, oil, gases, and liquids including most chemicals, in high pressure, high temperature installations.

Compressibility is made to vary by changing the number of plies to accommodate the pressure requirements and bolt load; it is therefore necessary, when ordering, to specify the nominal pipe size, ASA pressure class, and type of facing.

Styles are available for application to all pressure classes and to all types of end flanges. For large male to male face product, supplemental centering rings or guides may be obtained to position the gasket in relation to the bolts; these contain markings to indicate the nominal pipe size, the ASA pressure rating, the metal, and the manufacturer.

Teflon Gaskets

Teflon flat ring gaskets (or Cranite full face gaskets; see adjacent column) are recommended for use with 18-8 and Craneloy 20 stainless steel end flanges. Solid Teflon (Du Pont tetrafluoroethylene resin) is tough and is particularly characterized by chemical inertness, making it ideal for such use. In fact, these qualities have led to the regular use of Teflon for bonnet gaskets in Crane corrosion-resistant valves.

Normally, for end flange use, gasket dimensions conforming to ASA B16.21 are satisfactory. If crevice corrosion is a factor in handling a particular solution, consideration should be given to a change in the inside diameter.

Corrugated Metallic Gaskets

Corrugated metallic gaskets must have proper strength, ductility, and toughness. They are recommended for service where temperatures exceed 750 F and are generally made of copper or soft iron.

To secure a smaller bearing surface with the resulting increase in unit compressive load, the inside diameter of these gaskets is made larger than the port diameter of the joint. For dimensional information, see page 323.

Rings for Ring Joints

Ring joints can be utilized as connections for all pressure classes of Crane steel valves and flanges. They are particularly recommended for high pressure hydraulic installations and for high pressure-temperature steam and hot oil lines.

Ring joints require the use of a metal ring which seats in a specially prepared groove in each flange face, thus sealing the joint. The rings are generally made of soft steel or of 4 to 6 per cent chromium steel with ½ per cent molybdenum. Oval and octagonal shapes are available. For ring joint dimensions, see pages 334 and 335.

Composition Discs

The dependability of the Crane line of renewable type composition discs for use in globe, angle, and check valves is the result of years of constant research. Crane composition discs are made from high quality materials . . . . compounded, cured, and tested for specific services such as steam, hot and cold water, oil, air, gases, including liquid petroleum gases, and gasoline services. Users are urged to choose the type and material best suited to the service requirements. For complete details and recommendations, see page 281.

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Identification of Crane Products



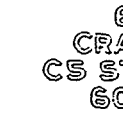
Bronze and cast iron valves are marked with the size, the name "CRANE", and the basic working pressure (steam). Some valve markings will include the cold rating.



Ferrosteel, High Tensile, and alloy iron valves include a material symbol marking. In this case, the metal is Ferrosteel (FS) and the valve bears both the steam (S) and the non-shock cold water, oil, and gas (WOG) rating.



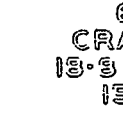
Typical marking for a carbon cast steel valve. Forged steel valves will include the marking "FORGED STEEL."



Alloy cast steel valves include a material symbol marking; in this case "C5" for ASTM A217, Grade C5 steel (Crane No. 5 Cast Steel).



Alloy forged steel valves also include a material symbol marking; in this case, "F5a" for ASTM A182, Grade F5a steel (Crane No. 5 Forged Steel).



Stainless steel valves have a material symbol marking such as 18-8 SMo, C-20 (Craneloy 20), etc.

MSS STANDARD

Marking and identification of Crane products conform to the Manufacturers Standardization Society Standard Marking System for Valves, Fittings, Flanges, and Unions (MSS SP-25).

GENERAL

All Crane products are marked for identification with the name "CRANE", the letter "C", or the letters "CC", depending on the type and size of product as well as the method of manufacture.

In addition, valves made in accordance with the specifications adopted by the American Association of Railroads are marked "AAR" or "ARA" . . . . valves listed by the Underwriters' Laboratories, Inc., are marked "CU" or "UL" . . . . and valves listed by the Factory Mutual Laboratories are marked "FM".

MATERIAL

Bronze products, readily distinguished by the color, bear no material marking.

Cast iron products conforming to ASTM A126, Class A, bear no material marking. Crane Ferrosteel, High Tensile Strength Iron, and alloy irons are marked with appropriate material symbols; see table on facing page. Malleable iron products bear the marking "MI" or "MALL".

Corrosion-resistant alloy products such as 18-8 SMo, Craneloy 20, etc., are marked with appropriate material symbols; see table on facing page.

Steel products are marked "STEEL" (for cast steel) or "FORGED STEEL". Alloy steels are further identified by appropriate material symbols; see table on facing page. Alloy steel castings for pressure-containing parts also have the heat number stamped on a raised pad which is an integral part of the casting.

SERVICE PRESSURE RATINGS

Nearly all Crane products are designated by the general or primary pressure class such as "25-Pound", "100-Pound", "125-Pound", etc. These should not be construed as a recommendation for use of the product at those pressures. The designations are descriptive of a general product class and do not necessarily imply that all items within a given class . . . . or that all sizes of a given product . . . . are rated for the same primary service pressure.

Recommended pressure ratings for Crane products are included on the catalog page or pages pertaining to those products and, practically all products except gas stops are marked with the recommended basic working pressure.

If the product is marked with numerals not followed by a letter suffix, the marking denotes the basic steam pressure rating at the maximum temperature indicated on the page describing the product. If the marking consists of numerals followed by the letters G, L, O, S, or W, either individually or collectively, it denotes the gas, liquid, oil, steam, or water service pressure rating, respectively, at the maximum temperature indicated on the page describing the product.

Valves with leather or composition faced discs are exceptions to the foregoing. These valves use bodies which are regularly marked with a basic steam rating . . . . but the valves should be used only for services for which the type of disc facing is recommended.

Test pressure markings, where used, are followed by the word "TEST".

Identification of Crane Valve Trims

Trim Material	Crane Designation For Material	Catalog No. Suffix (when used)	Marking on Identification Plate
Bronze	Bronze	H	B
Buna N (Synthetic Rubber)	Buna N	SB	. .
Carbon Steel	Carbon Steel	. . .	CS
Cobalt-Chromium-Tungsten	Stellite	U	HF
Composition (Disc)	Composition	C	No of Disc
Integral Seats (Steel)	Integral Seats		INT
Kel-F	Kel-F	KF	. .
Monel	Monel	A	NICU
Neoprene	Neoprene	.	.
Nickel Copper Alloy	No. 49 Nickel Alloy	R	NICU
Rubber (Natural)	Natural Rubber	RN	.
Surface Hardened Steel	"500 Brinell"	W	CR13H
Teflon	Teflon	TF	Teflon
13% Chromium Steel	Exelloy	X	CR13
18-8 Steel with Molybdenum	18-8 SMo (AISI Type 316)	L	18-8 SMo

The Catalog No. suffix for steel valves having a disc and seat of different materials is a combination of letters, such as "XU" for Exelloy to Stellite

Identification of Crane Products

IDENTIFICATION PLATES

For further product identification, body markings may be supplemented by identification plates, as shown at the right. The plates, depending on type and size of product, are mounted in the most practicable position . . . under the wheel nut, on the yoke, etc.

Bronze valves except checks, and all iron, Ferrosteel, and High Tensile Iron valves including checks, have plates bearing the valve catalog number and the number of the composition disc if so equipped. Bronze checks have no plates and are generally identifiable by body markings or by comparison with catalog illustrations. Check valves having a composition disc, in most cases, have the disc number stamped on the valve cap.

Steel valves and bronze specialties have plates bearing some or all of the following data: catalog number and size . . . material of body, disc, stem, and seat (trim) . . . fluid recommendation . . . and the pressure-temperature rating.

Symbols for trim materials are shown in the table on the facing page.

IMPORTANCE OF PROPER IDENTIFICATION FOR ORDERING OF PARTS, FOR INQUIRIES, ETC.

Proper identification of Crane products in service . . . for ordering of replacement parts, to replace an old valve, for inquiries concerning operation, etc. . . . is extremely important. To expedite handling of such matters, it is imperative that the customer furnish all pertinent data.

Generally, for bronze and iron valves, the catalog number and size will suffice; if these are not available, specify the complete body markings, type of valve, and the size of the pipe line.

In the case of steel valves, specify the catalog number and size, or the assembly part number; if these are not available, furnish all body markings and all information shown on the identification plate.

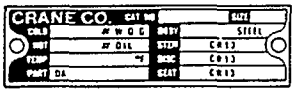
When valves have a composition disc, be sure to include the number of the disc or the service. In all cases where records permit, furnish the approximate purchase date of the product under consideration.



Bronze valves, except checks, have a plate bearing the catalog number of the valve.



Iron valves, including valves made of Crane Ferrosteel and High Tensile Iron, have a plate bearing the catalog number of the valve.



Steel valves have a plate bearing the catalog number, size, rating and fluid, and in some cases, the body, stem, disc, and seat or seat facing material.

Material Symbol Markings on Crane Pressure-Containing Iron and Steel Castings or Forgings

Classification of Material		ASTM Material Designation: Specification	ASTM Material Designation: Class or Grade	AISI Material Type (*)	Crane Material Designation	Symbol on Casting or Forging	For description of material, see:
Cast Irons		A 126	A	. .	Cast Iron	. . .	page 3
		A 126	B	. . .	Ferrosteel	FS	
		A 126	C	. .	High Tensile Iron	HT	
Alloy Cast Irons		. . .	. . .	. . .	3% Nickel Cast Iron	3NI	page 3
		. . .	. . .	. . .	Nodular Cast Iron	NCI	
		. . .	. .	. .	Ni-Resist Cast Iron	NR2	
Malleable Iron		A 338	. .	. . .	Malleable Iron	MI or MALL	page 3
Cast Steels	Carbon	A 216	WCB	. . .	Carbon Cast Steel	. . .	pages 6 and 7
	Carbon-Molybdenum	A 217	WC1	. . .	No. 4 Cast Steel	WC1	
	1¼% Chromium — ½% Moly.	A 217	WC6	. . .	No. 7 Cast Steel	WC6	
	2¼% Chromium — 1% Moly.	A 217	WC9	. . .	No. 9 Cast Steel	WC9	
	5% Chromium — ½% Moly.	A 217	C5	. . .	No. 5 Cast Steel	C5	
Low Temperature Cast Steels	Carbon	A 352	LCB	. . .	"LCB" Cast Steel	. . .	page 7
	Carbon-Molybdenum	A 352	LC1		"LC1" Cast Steel	LC1	
	2½% Nickel Steel	A 352	LC2	. . .	No. 3 Cast Steel	LC2	
	3½% Nickel Steel	A 352	LC3		"Arctic" Cast Steel	LC3	
Forged Steels	Carbon	A 105	II	. . .	Carbon Forged Steel	. .	page 8
	Carbon	A 181	II	. .	Carbon Forged Steel	. . .	
	Carbon	A 234	B	. . .	Carbon Forged Steel	. .	
	1¼% Chromium — ½% Moly.	A 182	F11	. . .	No. 7 Forged Steel	F11	page 8
	2¼% Chromium — 1% Moly.	A 182	F22	. . .	No. 9 Forged Steel	F22	
	5% Chromium — ½% Moly.	A 182	F5a	. .	No. 5 Forged Steel	F5a	
Stainless Steels	11-13% Chromium Steel	A 182	F6	Type 410	Exelloy	F6	page 5
	18-21% Cr—8-11% Ni	A 351*	CF-8	Type 304*	18-8 S Alloy*	18-8S	
	18-21% Cr—9-12% Ni—2-3% Mo	A 351*	CF-8M	Type 316*	18-8 SMo Alloy*	18-8 SMo	
	19% Cr—28% Ni—2% Mo				Craneloy 20 Alloy	C-20	

*Crane 18-8 S and 18-8 SMo are equivalent to AISI Types 304 and 316 wrought stainless steels, respectively, and conform also to ASTM A296.

Crane Tests and Working Pressures

AIR TESTING

The fact that many Crane products are recommended for water, oil, gas, and air does not necessarily indicate that all are air tested. It has been found commercially that our regular stock valves have proven quite satisfactory for air or gas service without an air test; therefore, if an air test is required, it must be definitely specified.

In addition, any valve intended for air, gas, or very volatile fluids, where absolute tightness is essential, should be ordered air tested unless the catalog specifically states it is regularly air tested. Air tested valves are provided with end protectors.

When iron or steel gate valves are to be used in pipe lines on natural dry gas service, orders should so specify, so that they can be suitably packed.

NON-DESTRUCTIVE TESTING

All Crane steel foundry practice is developed with the aid of radiography, magnetic particle, or fluid penetrant testing . . . . and these inspections provide continuous control of production. X-Ray and Betatron equipment, radio isotopes, and modern magnetic particle machines are used.

Crane steel pressure castings are qualified by special inspections as required by service application or demands. MSS Standards SP-53 and SP-54 are the basis for examination by pressure classes and requirement for acceptance.

The 900-pound and higher pressure classes of castings are inspected by the magnetic particle method and by radiography. In addition, the lower pressure class castings are monitored by these inspection methods and, for some alloy grades, the examination is regularly extended to lower pressure classes.

HYDROSTATIC AND SHOCK WORKING PRESSURES

Crane valves are suitable for liquid working pressures specified on catalog pages only when used in hydraulic installations in which shock is absent or negligible. Sudden closure of a valve in a hydraulic system causes the body of liquid, which may be moving at a rate generally in excess of one foot per second, to stop instantaneously. As liquids are relatively incompressible, the sudden cessation of flow effects a rise in pressure considerably greater than the static working pressure; this pressure increase is termed "SHOCK" and may, in some cases, be sufficient to cause valves or piping to fail.

Pressure increase due to shock is not dependent upon the working pressure in the system but upon the velocity at which the liquid is flowing. This pressure surge, or shock, severely limits design velocities . . . . a fact readily understandable if it is remembered that pressure rise resulting from arrest of flow may be as high as 60 psi for each foot per second initial velocity. For example, installations of 100 psi and 1000 psi working pressures, with the same initial velocity of 10 feet per second, will be subject to the same increase in pressure (approximately 600 psi) due to instantaneous closure of a valve.

Shock generally prevails in lines equipped with check or quick-closing valves, or in lines supplied by reciprocating pumps. It may also be produced, to a lesser degree, by rapid closure of gate and globe valves. Therefore, care should be exercised when closing valves installed in liquid lines.

Where shock is likely to occur, the maximum shock pressure should be added to the working pressure of the line to determine working pressure of products in the line . . . also, hydraulic installations should be equipped with air chambers or other types of shock absorbers to eliminate, as much as possible, increase in pressure due to shock.

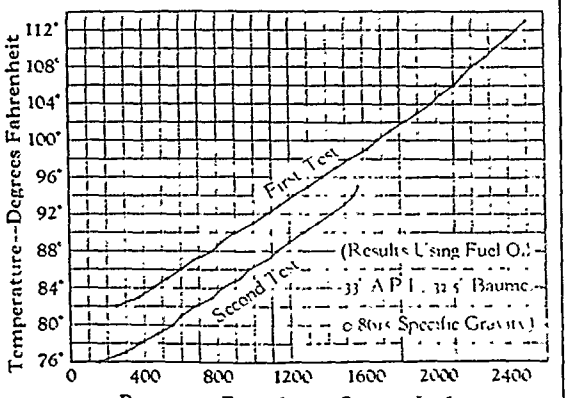
Increase in Pressure Due to Expansion of Liquids

If a vessel is filled with liquid so that no space remains for volumetric expansion, any rise in temperature of the liquid will cause an increase in internal pressure; this is due to the tendency of liquids to change in volume and, as liquids are relatively incompressible, the pressure builds up rapidly with only a slight temperature rise. The increase may be due to the sun's rays or to atmospheric conditions.

Crane tests indicate that when vessels are completely filled with 33° API fuel oil, a rise of 1° F causes an increase in internal pressure of about 75 psi; see chart at right.

In the first test, the 31° increase (from 82° to 113°) caused a total pressure increase of 2250 psi (from 250 to 2500 psi) or about a 73 psi per degree average. In the second test, the 19° increase (from 76° to 95°) caused a total pressure increase of 1425 psi (from 150 to 1575 psi) or about a 75 psi per degree average. While results may vary slightly under actual service conditions, depending upon the kind of oil, its cubical coefficient of expansion, the flexibility, if any, of the vessel, the presence of air in the oil, and other variables, the tests prove conclusively that dangerously high pressures can build up in an oil-containing vessel with only moderate temperature increase.

Thermo-Piezo Effects of Oil at Constant Volume



It is recommended, therefore, on valves installed in liquid lines (particularly oil), that some means be taken to prevent entrapment of liquid in the valve bonnet so as to eliminate possible pressure build-up due to rising temperature.

SECTION 3

Crane Bronze Gate Valves

Names of Parts.....page 16

Screwed Ends
100-Pound.....page 17
125-Pound, Screwed Bonnet.....pages 18 and 19
125-Pound, Union Bonnet.....page 20
150-Pound, Screwed Bonnet.....page 22
150-Pound, Union Bonnet.....page 23
200-Pound, Union and Bolted Bonnet.....page 24
200-Pound, Outside Screw and Yoke.....page 26
300-Pound.....page 25

Solder-Joint Ends
125-Pound.....page 17

Flanged Ends
125-Pound.....page 21
150-Pound.....page 22
300-Pound.....page 26

With Lock Shield.....pages 18 and 19

For Liquefied Petroleum Gases.....page 24

3

For other bronze products, supplementing those indexed above, refer to:

Bronze globe and angle valves.....Section 4
Bronze check and foot valves.....Section 5
Bronze diaphragm valves.....Section 16
Bronze safety and relief valves.....Section 18
Bronze valves for marine service.....Section 20

Bronze lever-operated quick-opening valves.....pages 56 to 58
Bronze radiator valves.....page 59
Bronze hose valves.....pages 60 and 61
Bronze cocks and stops.....pages 64 and 65
Bronze pressure regulators.....pages 246 to 249

Use Crane steel valves for high pressure-temperature service

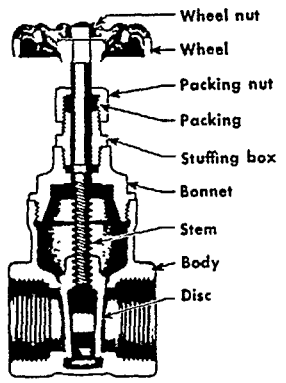
For pressures and temperatures that are beyond the scope of bronze or iron valves, and for unusually severe services, Crane manufactures a complete line of steel wedge gate valves. Of outstanding quality, the valves are made in a wide range of sizes and with screwed, flanged, butt-welding, or socket-welding ends.

For steel gate valves of the conventional bolted bonnet type, including Crane's new Flex-Gate, see Section 12; for valves of the Pressure-Seal and Lip-Seal Bonnet types, see Section 15.

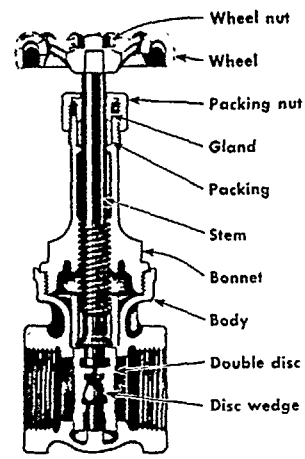
Bronze Gate Valves

Names of Parts

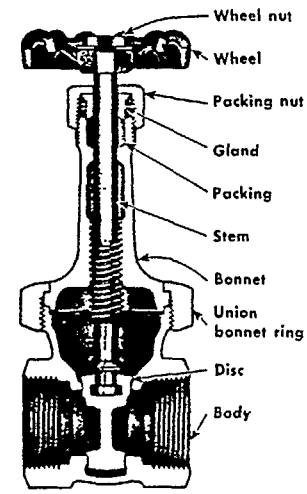
3



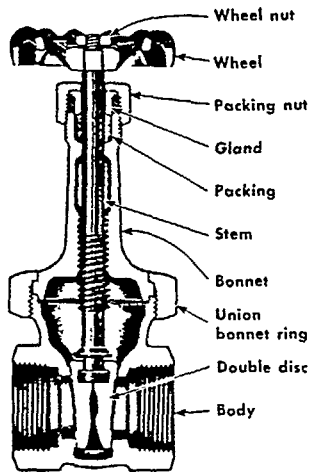
No. 410
Non-Rising Stem
Screwed Bonnet
Wedge Disc
(see page 17)



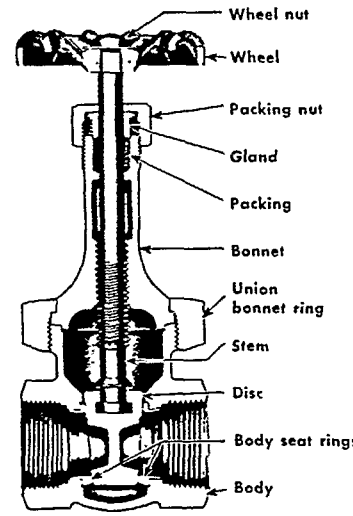
No. 440
Rising Stem
Screwed Bonnet
Double Disc
(see pages 18 and 19)



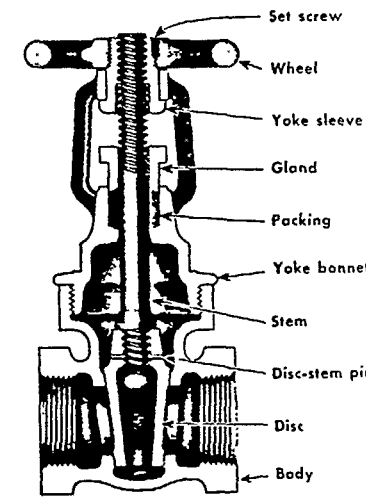
No. 428-UB
Rising Stem
Union Bonnet
Wedge Disc
(see page 20)



No. 435-UB
Rising Stem
Union Bonnet
Double Disc
(see page 23)



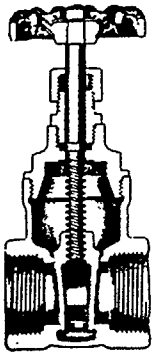
No. 424
Rising Stem
Union Bonnet, Wedge Disc
Expanded Seats
(see page 24)



No. 459
Underwriters' Pattern
Outside Screw & Yoke
Wedge Disc
(see page 26)

Bronze Gate Valves
Wedge Disc — Non-Rising Stem

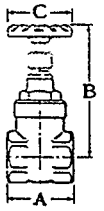
100-Pound Screwed



Cross Section No. 410



No. 410 Screwed



Working Pressures

Valve	Saturated Steam	Cold Water*	Cold Oil or Gas
		Non-Shock	Non-Shock
No. 410	100 psi	150 psi	150 psi
No. 1320	125 psi	200 psi	....

*No. 1320 Valves, for water service, are suitable for temperatures up to 200 F.

Screwed valves: Crane No. 410 are versatile valves, featuring many advancements in design. They are excellently suited for low pressure service, such as city water lines, domestic hot and cold water lines, domestic gas and fuel oil lines, heating systems, exhaust steam, low pressure condensate or steam process piping, and similar services.

The valves feature wide-faced hexagons at the pipe ends, accurately cut threads, ample metal sections, and long disc guides for correct seating. The upper portion of the body, cylindrical in shape, combines strength with light weight and reinforces the seats against the wedging action of the disc.

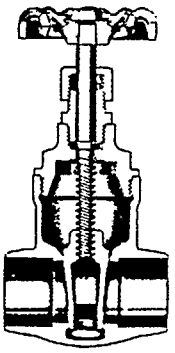
The body is bronze (ASTM B 62). The bonnet, disc, stem, stuffing box, and packing nut are also bronze. The valves, when wide open, can be repacked while under pressure.

Solder-joint valves: Crane No. 1320 Valves, like the No. 410, are non-rising stem gate valves with a one-piece wedge disc. They are recommended for general shut-off valve service on steam lines and on hot and cold water lines, and are widely used in plumbing and heating systems, on low pressure condensation return lines, and similar services.

The valves are sturdily constructed and amply reinforced at points subject to greatest stress to withstand piping and operating strains. All parts are made of good quality materials. The body is bronze (ASTM B 62); ends comply with American Standard, B16.18-1950, for Cast Brass Solder-Joint Fittings. The valves, when wide open, can be repacked while under pressure.

Important: When solder-joint valves are installed on steam lines, the solder used to make the joints must have a melting point high enough to withstand the temperature of the steam. Instructions for soldering accompany each valve.

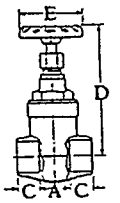
125-Pound Solder-Joint



Cross Section No. 1320



No. 1320 Solder-Joint



Weights and Dimensions — Prices on Request

Size	No. 410 Screwed Ends				No. 1320 Solder-Joint Ends				
	Weight	Dimensions, in Inches			Weight	Dimensions, in Inches			
Inches	Pounds Each	A	B	C	Pounds Each	A	C	D	E
1/4	0.55	1 3/4	3 1/4	1 1/2	...	...	...	...	...
3/8	0.6	1 13/16	3 1/4	1 1/2	0.66	13/16	13/32	3 1/4	1 1/2
1/2	0.9	1 15/16	3 3/4	1 3/4	0.7	13/16	17/32	3 3/4	1 3/4
3/4	1.3	2 1/16	4 3/8	2 1/16	1.2	7/8	25/32	4 3/8	2 1/16
1	2.0	2 7/16	5 1/8	2 9/16	1.7	1 1/16	29/32	5 1/8	2 9/16
1 1/4	2.9	2 7/8	5 3/4	2 3/4	2.3	1 5/16	31/32	5 3/4	2 3/4
1 1/2	4.0	3	6 3/8	3 1/16	3.3	1 7/16	1 3/32	6 3/8	3 1/16
2	5.9	3 1/4	7 3/8	3 5/8	5.0	1 9/16	1 11/32	7 3/8	3 5/8

Solder-Joint Valves in Larger Sizes or for Higher Pressures

When valves with solder-joint ends are wanted in larger sizes, or for use at higher pressures than recommended for the No. 132c, Crane screwed end valves with solder-joint adapters can be used.

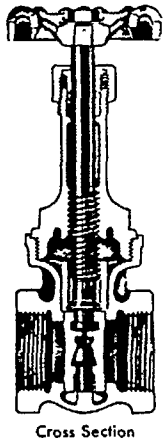
Solder-joint globe and angle valves....page 30

Solder-joint swing check valves.....page 46

125-Pound Bronze Gate Valves

3

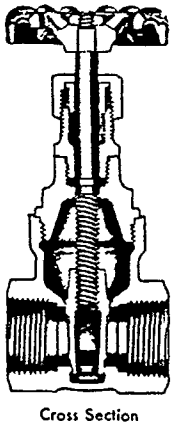
Rising Stem
Double Disc
Parallel Seats



Cross Section
No. 440, with Wheel
No. 441, with Lock Shield

Dependability at low cost with this rugged double disc valve. Ample metal sections assure a high safety factor. Available with wheel, as illustrated, or with lock shield.

Non-Rising Stem
Wedge Disc



Cross Section
No. 438, with Wheel
No. 439, with Lock Shield

An extremely reliable non-rising stem valve featuring a cylindrical-shaped body and a screwed-in type stuffing box. Available with wheel, as illustrated, or with lock shield.

For weights and dimensions see the opposite page.

For 125-pound bronze union bonnet valves, see page 20.

Working Pressures
125 psi saturated steam
200 psi non-shock
cold water, oil, or gas

Screwed bonnet valves . . . . designed to suit every service requirement

The 125-Pound Bronze Gate Valves described on this and the opposite page are recommended for general service on steam, water, oil, or gas lines. Ruggedly constructed throughout, each type offers distinctive advancements in design.

Rising stem valves feature three disc types . . . . the double disc and parallel seats of the Nos. 440 and 441 . . . . the solid wedge disc of the No. 428 . . . . and the double wedge disc of the No. 430. Each meets Crane's high standards for top performance in hard service. The rising stem clearly indicates whether the disc is in the open or closed position.

For use in confined installations, the No. 438 and No. 439 are a logical selection. They have a wedge disc and a non-rising stem.

Cylindrical-shaped body: The body on all wedge disc valves has a cylindrical-shaped neck terminating in a round opening for the bonnet. The design, generally associated with high pressure steel valves, combines strength with light weight. Wide-faced hexagon ends provide added reinforcement and an easy wrench grip. Full diameter seat openings assure straight-through flow.

No. 440 or 441: The No. 440 and No. 441 are rising stem valves. Low cost, dependability in continuous use, and infrequent need for maintenance make them ideal for a variety of services.

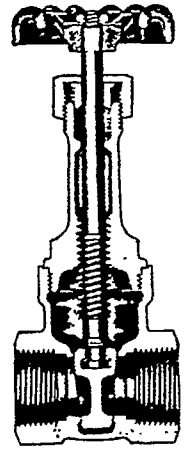
The valves have a double disc, carefully guided in the body, and parallel seats. When closing, the last turn of the wheel forces the discs against the seats; when opening, the first turn releases the discs from their seats.

No. 438 or 439: The No. 438 and No. 439 are non-rising stem valves. Their wedge disc provides tight, positive seating and trouble-free operation. The disc travel is accurately controlled by long guides in the body.

The valves have a cylindrical-shaped body. Their stuffing box, screwed into the bonnet, provides good stem support and assures true alignment and easy operation; in addition, wear on the packing is minimized

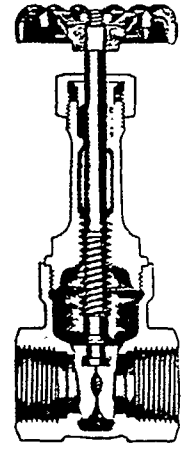
Rising Stem

Solid Wedge Disc



Cross Section
No. 428

Double Wedge Disc



Cross Section
No. 430

Compact rising stem valves with either a solid or a double wedge disc. The slip-on type disc-stem connection provides smooth, positive performance.

The cylindrical-shaped body combines strength with light weight . . . . reinforces the seats against wedging action of the discs. Wide-faced body ends are easy to grip . . . . assure quick installation of valves.

No. 428: The No. 428 have a rising stem and a solid wedge disc, reversible in the body. The disc slips onto a strong head on the stem end. Accurate guiding prevents contact at the seating surfaces until the valve is almost closed.

The No. 428, like the other wedge disc valves shown on this page, features a cylindrical-shaped body which provides added strength without added weight and serves to reinforce the seats against the wedging action of the disc.

No. 430: The No. 430 are rising stem valves equipped with a double wedge disc, reversible in the body (see section and inset illustrations); the discs are well guided and carefully machined to assure positive, easy operation. When closing, the last turn of the wheel presses the discs against the seats; when opening, the first turn of the wheel releases the discs from the seats. The disc-stem connection is the slip-on type



The No. 430 Valves, except for the double wedge disc, are similar to the No. 428. Both feature the full flow, cylindrical-shaped body.

125-Pound Bronze Gate Valves



No. 440
Screwed
With Wheel



No. 441
Screwed
With Lock Shield

Rising Stem
Double Disc, Parallel Seats



No. 428
Screwed
With Wheel

Rising Stem
Solid Wedge Disc



No. 430
Screwed
With Wheel

Rising Stem
Double Wedge Disc



No. 438
Screwed
With Wheel



No. 439
Screwed
With Lock Shield

Non-Rising Stem
Wedge Disc

Materials: The valves are made of quality materials throughout. Except for the wheel and packing, all parts are high grade bronze; the body is made of bronze conforming to ASTM B 62. Each part is carefully designed and liberally proportioned to assure a high factor of safety over recommended working pressures.

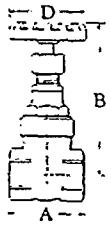
Stuffing box: The stuffing box, amply deep and filled with a long-lasting packing, provides a tight stem seal. All valves are equipped with a gland.

On non-rising stem valves, the stuffing box screws into the bonnet; its long contact with the stem, supports and keeps the stem in true alignment.

Repacking: The valves, when wide open, can be repacked while under pressure.

Federal Specification: These valves, in all sizes, comply with Federal Specification WW-V-54 for Class "A", 125-Pound Bronze Screwed Valves (for land use), as follows:

Type I, Non-Rising Stem, Wedge Disc . No. 438
Type II, Rising Stem, Wedge Disc . . . No. 428
Type III, Rising Stem, Double Disc . . No. 430
Type III, Rising Stem, Double Disc . . . No. 440



Valves
With Wheel



Valves With
Lock Shield

Solder-joint gate valves . . . . . page 17
Keys for lock shield valves . . . . page 283
Thread engagement . . . . . page 352

Weights and Dimensions — Prices on Request

Valve Type	Size	With Wheel				With Lock Shield		
		Weight	Dimensions, in inches			Weight	Dimensions, in inches	
	Inches	Pounds Each	A	B* open	D	Pounds Each	A	C* open
		No. 440				No. 441		
Rising Stem Double Disc	¼	.7	1⅝	4¼	1¾	...	...	...
	⅜	.7	1¾	4¼	1¾	...	...	...
	½	1.1	1⅞	4¾	2 1/16	1.0	1⅞	5
	¾	1.5	2⅛	6	2 9/16	1.4	2⅛	5¾
	1	2.5	2½	7	2¾	2.4	2½	6¾
	1¼	3.6	2 13/16	8¼	3 1/16	3.4	2 13/16	8
	1½	5.5	3 1/16	9½	3⅜	5.2	3 1/16	9¼
	2	8.5	3½	11¾	4 1/16	8.0	3½	11½
	2½	14.5	4 1/16	14	4¾	...	...	...
	3	20.0	4 9/16	16¼	5⅜	...	...	...
		No. 428 or †430				—		
Rising Stem Solid or Double Wedge Disc	¼†	.9	1 13/16	4½	1¾	...	...	...
	⅜†	.9	1 13/16	4½	1¾	...	...	...
	½	1.2	2⅛	5¼	2 1/16	...	...	...
	¾	1.9	2¼	6½	2 9/16	...	...	...
	1	2.6	2 13/16	7¾	2¾	...	...	...
	1¼	4.0	3	9¼	3 1/16	...	...	...
	1½	5.5	3¼	10½	3⅝	...	...	...
	2	9.0	3 11/16	12¾	4¾	...	...	...
	2½	16.5	4½	15¼	5⅜	...	...	...
	3	26.0	5⅛	18	7	...	...	...
		No. 438				No. 439		
Non-Rising Stem Wedge Disc	¼	.7	1 13/16	3¾	1¾	...	...	...
	⅜	.7	1 13/16	3¾	1¾	...	...	...
	½	1.0	2⅛	4¼	2 1/16	.9	2⅛	4
	¾	1.6	2¼	5	2 9/16	1.4	2¼	4¾
	1	2.5	2 13/16	5¾	2¾	2.4	2 13/16	5½
	1¼	4.0	3	6¼	3 1/16	3.6	3	6¼
	1½	5.4	3¼	7¼	3⅝	5.0	3¼	7
	2	8.5	3 11/16	8¾	4 1/16	8.0	3 11/16	8½
	2½	14.5	4½	10¼	4¾			
	3	22.0	5⅛	11¾	5⅜			

*Center to top: Dimensions B and C apply to rising stem valves in the open position and to non-rising stem valves either open or closed

†No. 430 Valves are not made in ¼ and ⅜-inch sizes, use the No. 428

125-Pound Bronze Gate Valves

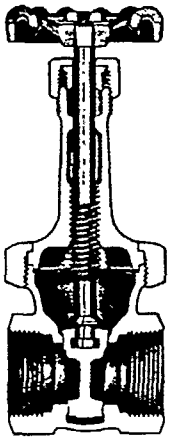
Rising Stem — Union Bonnet

Working Pressures
125 psi saturated steam
200 psi non-shock cold water, oil, or gas

New, compact 125-pound union bonnet valves designed for dependable performance in general service

3

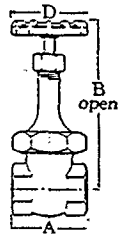
Solid Wedge Disc



Cross Section
No. 428-UB



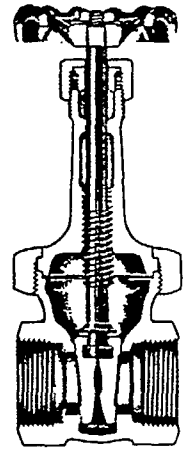
No. 428-UB
Screwed
Solid Wedge Disc



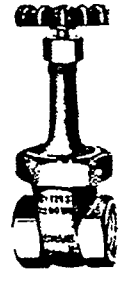
Repacking: No. 428-UB Valves, when wide open, can be repacked while under pressure.

For valves for marine service, see page 230

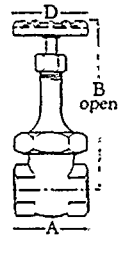
Double Wedge Disc



Cross Section
No. 430-UB



No. 430-UB
Screwed
Double Wedge Disc



Repacking: No 430-UB Valves when wide open, can be repacked while under pressure.

For normal thread engagement, see page 352

Materials: The body and discs are made of bronze conforming to requirements of ASTM Specification B 62. The bonnet, union bonnet ring, stem, packing nut, and gland are also bronze. Each part is carefully designed and liberally proportioned to assure a high factor of safety over recommended working pressures.

Cylindrical-shaped body: The valve body has a cylindrical-shaped neck terminating in a round opening for the bonnet. The design is generally associated with high pressure steel valves and combines strength with light weight. Wide-faced hexagons at the body ends provide added reinforcement and an easy wrench grip; full diameter seat openings assure straight-through flow.

Union bonnet: All sizes have a union bonnet. The union bonnet ring reinforces the bonnet joint and facilitates dismantling and reassembly of the valve.

Discs: The No. 428-UB have a rising stem and a solid wedge disc which is reversible in the body. The disc slips onto a strong head on the stem end. Accurate guiding prevents contact at the seating surfaces until the valve is almost closed.

The No. 430-UB are similar to the No. 428-UB except for their double wedge disc. The discs are reversible in the body; they are well guided and carefully machined to assure positive, easy operation. When closing, the last turn of the wheel presses the discs against the seats; when opening, the first turn of the wheel releases the discs from the seats. The disc-stem connection is the slip-on type.

Stuffing box: The ample stuffing box is filled with a durable packing, provides a tight stem seal, and is equipped with a gland.

Federal Specification: The No. 428-UB and No. 430-UB comply with Federal Specification WW-V-54 for Class "A" 125-Pound Bronze Screwed Valves . . . . Types II and III respectively.

Weights and Dimensions — Prices on Request

Size	Pounds, Each		Dimensions, in Inches					
			No. 428-UB			No. 430-UB		
Inches	No. 428-UB Solid Disc, Screwed	No. 430-UB Double Disc, Screwed	A	B open	D	A	B open	D
¼	1.0	Use No. 428-UB	1 13/16	4½	1¾			
⅜	1.0		1 13/16	4½	1¾			
½	1.3	1.3	2⅛	5¼	2 1/16	2⅛	5¼	2 1/16
¾	2.0	2.0	2¼	6½	2 9/16	2¼	6½	2 9/16
1	2.8	2.8	2 13/16	7¾	2¾	2 13/16	7¾	2¾
1¼	4.2	4.2	3	8¾	3 1/16	3	8¾	3 1/16
1½	6.0	6.0	3¼	10	3⅝	3¼	10	3⅝
2	9.0	9.0	3 11/16	11¾	4¾	3 11/16	11¾	4¾

125-pound bronze gate valves with screwed bonnet . . . . pages 18 and 19

125-Pound Bronze Gate Valves

Wedge Disc — Non-Rising Stem — Bolted Bonnet

Sizes	Working Pressures		Hydrostatic Test Pressures
	Saturated Steam	Cold Water, Oil, or Gas Non-Shock	
4-inch and smaller	125 psi	200 psi	400 psi
5-inch and larger	125 psi	150 psi	300 psi

Indicator-equipped wedge gate valves . . . for dependable performance on large size pipe lines

Recommendations: These flanged end, bolted bonnet wedge gate valves are recommended for general shut-off service on large size steam, water, oil, and gas lines. In addition, they offer excellent service in brewery applications for water and beer transfer lines.

Materials and construction: The body, bonnet, disc, and renewable body seat rings are made of bronze conforming to ASTM Specification B 62. The stem, stuffing box, and gland are also bronze. The valve wheel is malleable iron. All parts are liberally proportioned to assure a high factor of safety.

The bolted bonnet is unusually compact. Equipped with steel studs, bronze nuts, and a Cranite gasket, it maintains a strong, tight joint, yet can easily be dismantled and reassembled with no damage to the valve.

Long, clean-cut threads engage the disc and stem assuring accurate, easy operation. The disc is thoroughly guided throughout its travel and the seating surfaces do not come into contact until the valve is practically closed.

Indicator: The valves are regularly equipped with an all-bronze indicator to show whether the disc is in the open or closed position. When specified, they can be furnished without an indicator.

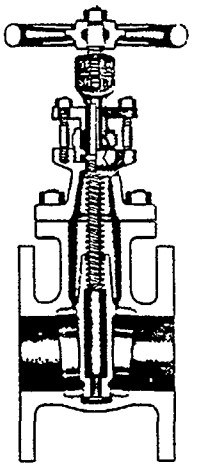
Stuffing box: The stuffing box is deep and is filled with high grade packing to assure a tight seal.

Sizes 2½-inch and larger have a bolted gland as shown in the illustrations; the 2-inch size has a screwed type stuffing box equipped with a gland and a packing nut (not illustrated).

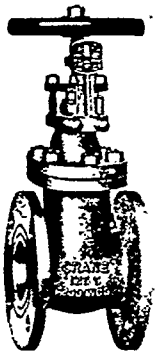
Repacking: The valves, when wide open, can be repacked while under pressure.

End flanges: The dimensions and drilling of end flanges conform to American Standard (B16.24-1953) for 150-Pound Bronze Flanges. Flanges are plain faced, with two V-shaped concentric grooves between the port and the bolt holes.

The valves are regularly furnished faced and drilled; faced only valves can be furnished when specified. Full face gaskets should be used; see page 321.



Cross Section
No. 4437

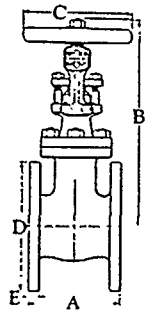


No. 4437
Flanged
With Indicator

Non-rising stem, one-piece wedge disc, bolted bonnet, and renewable seats.

Weights and Dimensions — Prices on Request

No. 4437	Size Inches	Weight Pounds Each	Dimensions, in Inches A	B	C	End Flanges D	E	No. and diameter of bolts
Flanged F & D With Indicator	2	20	4⅝	9¾	4½	6	½	4-⅝
	2½	30	5	11½	6	7	9/16	4-⅝
	3	41	5½	13¾	7	7½	⅝	4-⅝
	4	66	6½	16	8	9	11/16	8-⅝
	5	84	7	18¼	9	10	¾	8-¾
	6	110	7½	20	9	11	13/16	8-¾
	8	185	8½	25	10	13½	15/16	8-¾



No. 4437

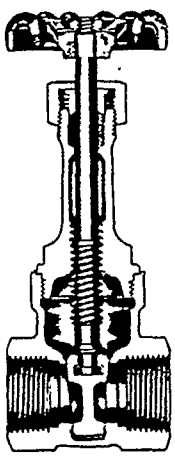
Templates for drilling . . . . page 326

Valves can be furnished without indicator when so ordered.

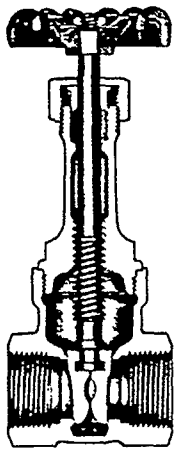
150-Pound Bronze Gate Valves

Wedge Disc—Screwed Bonnet

Rising Stem



Cross Section
Solid Wedge Disc
No. 431



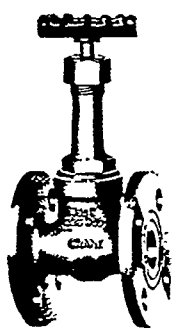
Cross Section
Double Wedge Disc
No. 435



No. 431, Screwed
Solid Wedge Disc



No. 435, Screwed
Double Wedge Disc



No. 429, Flanged
Solid Wedge Disc

For drilling templates, see page 326.

For thread engagement, see page 352.

Working Pressures

Valve Ends	Saturated Steam	Cold Water, Oil, or Gas Non-Shock
Screwed	150 psi	300 psi
Flanged	150 psi	225 psi

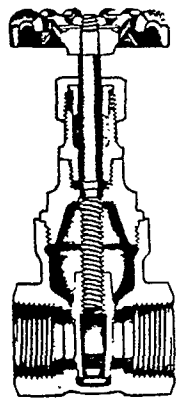
These valves offer a construction considerably heavier than that found in "Standard" or 125-Pound Valves. The body is designed to reinforce the seats against the wedging action of the disc. Full diameter seat openings assure straight-through flow. Screwed valves feature wide faced hexagons at the pipe ends, assuring an easy wrench grip.

Except for the wheel and packing, all parts are high grade bronze with the body conforming to ASTM B 62. The deep stuffing box has a gland and is filled with quality packing. The valves, when wide open, can be repacked while under pressure.

Rising stem: Rising stem valves include the No. 431 and No. 429 with a solid wedge disc, and the No. 435 with a double wedge disc. In all valves, the discs are reversible in the body and are carefully machined to provide easy, positive operation. The disc-stem connection is the slip-on type. Accurate guiding prevents contact at the seating surfaces until the valve is almost closed. The position of the stem indicates whether the valve is open or closed.

Non-rising stem: The No. 437, a non-rising stem valve with wedge disc, provides tight seating and long, trouble-free operation. The stuffing box screws into the bonnet; its long contact with the stem adds to the support and alignment of the stem.

Non-Rising Stem



Cross Section
No. 437



No. 437, Screwed
Wedge Disc

Federal Specification: These valves comply with Federal Specification WW-V-54 for Class "B", 150-Pound Bronze Gate Valves, as follows: No. 437 (Type I), No. 431 or No. 429 (Type II), and No. 435 (Type III).

Flanged valves: End flanges conform to American Standard (B16.24-1953) for 150-Pound Bronze Flanges and are plain faced, with two V-shaped concentric grooves between the port and the bolt holes. Flanged valves, regularly faced and drilled, can be furnished faced only, when specified. Full face gaskets should be used; see page 321.

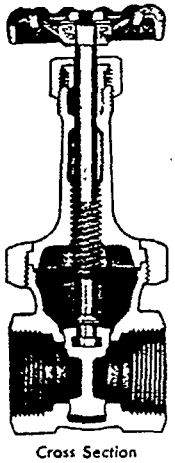
Weights and Dimensions — Prices on Request

Size	Pounds, Each				Dimensions, in Inches								
	Rising Stem			No. 437	Rising Stem						Non-Rising Stem		
	No. 431 Solid Disc,	No. 429 Solid Disc,	No. 435 Double Disc,	Non-Rising Stem	End to end	Face to face	Center to top, open	Diameter of wheel	End Flanges Diameter	End Flanges Thickness	End to end	Center to top	Diameter of wheel
Inches	Screwed	Flanged	Screwed	Screwed									
1/4	1.1	...	See No 431	.9	1 13/16	...	4 1/2	1 3/4	...	...	1 13/16	3 3/4	1 3/4
3/8	1.2	...		.9	1 13/16	...	4 1/2	1 3/4	...	...	1 13/16	3 3/4	1 3/4
1/2	1.5	...	1.5	1.3	2 1/8	...	5 1/4	2 1/16	...	...	2 1/8	4 1/4	2 1/16
3/4	2.3	...	2.3	1.8	2 1/4	...	6 1/2	2 9/16	...	...	2 1/4	5	2 9/16
1	3.2	6.0	3.2	2.8	2 13/16	3 1/2	7 3/4	2 3/4	4 1/4	3/8	2 13/16	5 3/4	2 3/4
1 1/4	5.0	8.0	5.0	4.2	3 1/8	4	9 1/4	3 1/16	4 5/8	13/32	3 1/8	6 1/4	3 1/16
1 1/2	6.6	11.0	6.6	6.0	3 7/16	4 1/2	10 1/2	3 5/8	5	7/16	3 7/16	7 1/4	3 5/8
2	10.0	18.0	10.0	9.0	3 7/8	5 1/2	12 3/4	4 3/4	6	1/2	3 7/8	8 3/4	4 1/16
2 1/2	19.0	30.0	19.0	16.0	4 5/8	6 1/2	15 1/4	5 3/8	7	9/16	4 5/8	10 1/4	4 3/4
3	26.0	39.0	26.0	23.0	5 3/8	7 1/2	18	7	7 1/2	5/8	5 3/8	11 3/4	5 3/8

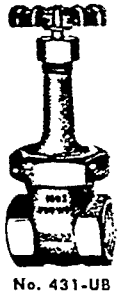
150-Pound Bronze Gate Valves

Rising Stem — Union Bonnet

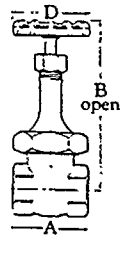
Solid Wedge Disc



Cross Section
No. 431-UB



No. 431-UB
Screwed
Solid Wedge Disc



Working Pressures
150 psi saturated steam
300 psi non-shock cold water, oil, or gas

New, rugged 150-pound union bonnet valves for top performance in general service

These new 150-pound bronze gate valves feature rugged union bonnet construction and a choice of discs . . . . the solid wedge disc of the No. 431-UB or the double wedge disc of the No. 435-UB. The valves are recommended for steam, water, oil, or gas service where conditions require a heavier, more massive construction than that found in "Standard" or 125-pound valves.

Materials: The body and discs are made of bronze conforming to requirements of ASTM Specification B 62; the bonnet, union bonnet ring, stem, packing nut, and gland are also bronze. All parts are of liberal proportions, assuring a high factor of safety.

Body and bonnet: The valves are streamlined throughout. The body is designed to withstand high internal pressures and line strains and to reinforce the seats against the wedging action of the disc. The wide-faced, flat hexagons at the body ends provide an easy wrench grip. Full diameter seat openings assure straight-through flow. The union bonnet ring reinforces the body-bonnet joint and facilitates dismantling and reassembly of the valve.

Construction: The No. 431-UB have a rising stem and a solid wedge disc which is reversible in the body. The disc slips onto a strong head on the stem end, and is accurately guided throughout its travel so that there is no contact between the seating surfaces until the valve is almost closed.

The No. 435-UB are also rising stem valves. Their double wedge disc, reversible in the body, is carefully machined to assure easy operation. In closing, the last turn of the wheel presses the discs against the seats; when opening, the first turn releases the discs from the seats. The disc-stem connection is the slip-on type.

Stuffing box: The valves have a deep stuffing box filled with high grade packing and equipped with a gland.

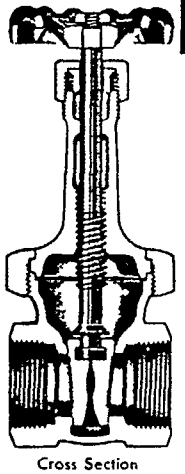
Federal Specification: The No. 431-UB and No. 435-UB comply with Federal Specification WW-V-54 for Class "B" 150 Pound Bronze Screwed Gate Valves . . . . Types II and III respectively.

Weights and Dimensions — Prices on Request

Size	Pounds, Each		Dimensions, in Inches					
	No. 431-UB	No. 435-UB	No. 431-UB			No. 435-UB		
Inches	Solid Disc, Screwed	Double Disc, Screwed	A	B open	D	A	B open	D
¼	1.2	Use No. 431-UB	1 13/16	4½	1¾			
⅜	1.2		1 13/16	4½	1¾			
½	1.6	1.6	2⅛	5¼	2 1/16	2⅛	5¼	2 1/16
¾	2.5	2.5	2¼	6½	2 9/16	2¼	6½	2 9/16
1	3.4	3.4	2 13/16	7¾	2¾	2 13/16	7¾	2¾
1¼	5.5	5.5	3⅛	8¾	3 1/16	3⅛	8¾	3 1/16
1½	7.0	7.0	3 7/16	10	3⅝	3 7/16	10	3⅝
2	10.5	10.5	3⅞	11¾	4¾	3⅞	11¾	4¾

150-pound bronze gate valves with screwed bonnet . . . . page 22

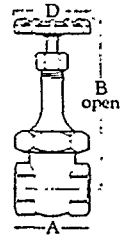
Double Wedge Disc



Cross Section
No. 435-UB



No. 435-UB
Screwed
Double Wedge Disc



Repacking: No. 431-UB Valves, when wide open, can be repacked while under pressure

For valves for marine service, see page 230

Repacking: No. 435-UB Valves, when wide open, can be repacked while under pressure.

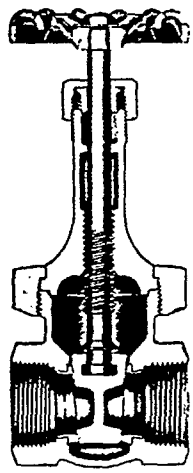
For normal thread engagement, see page 352

200-Pound Bronze Gate Valves

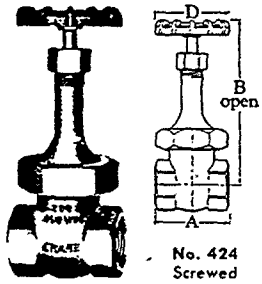
Wedge Disc — Exelloy Seats

3

Rising Stem



Cross Section
No. 424



No. 424
Screwed

Efficient cylindrical body design, easy-to-replace slip-on type solid wedge disc, and Exelloy seats.

Working Pressures, Non-Shock		Hydrostatic Test Pressures
Steam 550 F	Cold Water, Oil, Gas, Air, or Volatile Fluids	
200 psi	400 psi	600 psi

Air Tested

New, multi-service gate valves featuring long-lasting Exelloy seats. . . . *No. 424 is Underwriters' Approved for LP-Gases

All-new design, externally and internally, plus high quality materials and expert workmanship make these rugged bronze gate valves outstanding values.

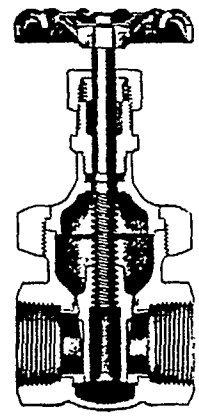
Recommendations: Both valves are excellent for use on steam, water, air, oil, gas, gasoline, light oils, volatile fluids, etc., at pressures up to 400 psi.

*No. 424 Rising Stem Valves are approved by the Underwriters' Laboratories, Inc., for the safe handling of all liquefied petroleum gases such as butane, propane, propylene, etc., provided they are installed in branch or by-pass lines where a positive shut-off is not essential and where pressures do not exceed 250 psi; their identification plate is marked "Butane-UL-Propane".

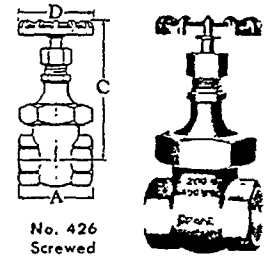
Features: The valves feature a streamlined body, cylindrically designed to withstand high internal pressures and line strains and to reinforce the seats against the wedging action of the disc. Wide-faced hexagons at the pipe ends provide an easy wrench grip.

Wear-resistant Exelloy body seat rings, securely expanded into the body under hydraulic pressure, assure trouble-free service. Normal seating wear is absorbed by the bronze disc which can easily be replaced.

Non-Rising Stem



Cross Section
No. 426



No. 426
Screwed

Efficient cylindrical body design, easy-to-replace one-piece wedge disc, and Exelloy seats.

Construction and materials: The No. 424 are inside screw, rising stem valves; their solid wedge disc slips onto a strong head on the stem end. The No. 426 are inside screw, non-rising stem valves equipped with a one-piece wedge disc; long clean-cut threads engage the disc and stem.

The body, bonnet, bonnet ring, and disc are Crane Special Bronze conforming to ASTM Specification B 61. Crane Exelloy, used for the seat rings, is an AISI Type 410 stainless steel, specially heat-treated for high resistance to wear, temperature, galling, and scoring.

Bonnets: Sizes 2-inch and smaller have a union bonnet, as shown in the full illustrations; 2½ and 3-inch sizes have a compact, inside screw bolted bonnet, equipped with a gasket, as shown in the partial section of the rising stem valve at the left.



2½ and 3-inch sizes have a bolted bonnet.

Both bonnets provide a strong, tight joint, yet they are easily dismantled and reassembled without danger of damaging the valve.

Stuffing box; repacking: The stuffing box is large and deep, is equipped with a gland, and is filled with high grade packing to assure a tight stem seal. The valves, when wide open, can be repacked while under pressure.

Weights and Dimensions — Prices on Request

Size	Pounds, Each		Dimensions, in Inches			
Inches	No. 424 Rising Stem	No. 426 Non-Rising Stem	A	B open	C	D
¼	1.2	1.1	2 1/16	4½	4	2 1/16
⅜	1.5	1.4	2 3/16	4½	4	2 1/16
½	1.9	1.6	2 9/16	5½	4½	2 9/16
¾	3.0	2.6	2¾	7	5¼	2¾
1	4.0	3.8	3 3/16	8	6	3 1/16
1¼	6.4	6.0	3 9/16	9¼	6¾	3⅝
1½	8.5	8.0	3 13/16	10½	7½	4 1/16
2	13.0	12.0	4 5/16	12¾	8¾	4¾
2½	23.0	18.0	5	15¼	10¾	5⅜
3	36.0	28.0	5⅝	18	12¼	7

Other Bronze Valves for LP Gases:
Globe and Angle.....page 37
Check.....page 49

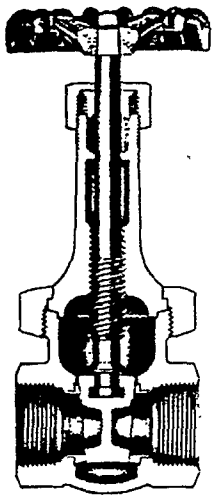
For Valves for Marine Service, see page 230.

200-Pound Bronze Outside Screw and Yoke Gate Valves....page 26

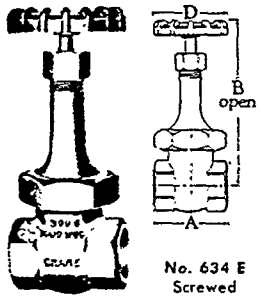
300-Pound Bronze Gate Valves

Wedge Disc — Exelloy Seats

Rising Stem



Cross Section
No. 634 E



No. 634 E
Screwed

Efficient cylindrical body design, easy-to-replace slip-on type solid wedge disc, and Exelloy seats.

Sizes	Working Pressures (Non-Shock)		Hydrostatic Test Pressures
	Steam	Cold Water, Oil, Gas, or Air	
Inches	550 F		
¼ to 2	300 psi	1000 psi	1500 psi
2½ and 3	300 psi	600 psi	900 psi

Air Tested

New, rugged 300-pound bronze valves designed for hard, tough service and easy maintenance

All-new design, externally and internally, plus high quality materials and expert workmanship make these unusually rugged 300-pound bronze gate valves an ideal choice for high pressure services and for use where operating conditions are particularly severe.

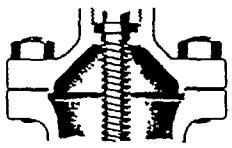
Features: The body, streamlined throughout, has a cylindrical-shaped neck terminating in a round opening for the bonnet. The design withstands high internal pressures and line strains and also serves to reinforce the seats against the wedging action of the disc. Wide-faced hexagons provide an easy wrench grip.

The use of wear-resistant Exelloy body seat rings, securely expanded into the body under hydraulic pressure, assures long maintenance-free service. Normal seating wear is absorbed by the disc which can easily be replaced when necessary.

Construction and materials: The No. 634 E are inside screw, rising stem valves; they have a solid wedge disc which slips onto a strong head on the stem end. The No. 636 E are inside screw, non-rising stem valves equipped with a one-piece wedge disc; long clean-cut threads engage the disc and stem.

The body, bonnet, bonnet ring, and disc are Crane Special Bronze, a hard, leaded tin bronze conforming to ASTM Specification B 61. Crane Exelloy, used for the seat rings, is a specially heat-treated AISI Type 410 stainless steel having excellent resistance to wear, temperature, galling, and scoring.

Bonnets: Sizes 2-inch and smaller have a union bonnet, as shown in the full illustrations; 2½ and 3-inch sizes have a compact, inside screw bolted bonnet, equipped with a gasket, as shown in the partial section of the non-rising stem valve at the left.

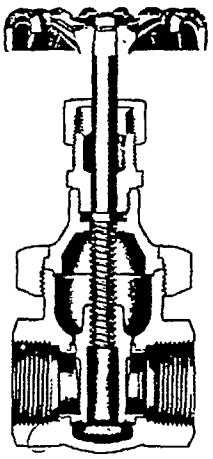


2½ and 3-inch valves have a bolted bonnet.

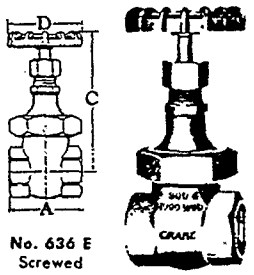
Both bonnet types provide a strong, tight joint, yet they are easily dismantled and reassembled without danger of damaging the valve.

Stuffing box; repacking: The stuffing box is large and deep, has a gland, and is filled with high grade packing to assure a tight stem seal. The valves, when wide open, can be repacked while under pressure.

Non-Rising Stem



Cross Section
No. 636 E



No. 636 E
Screwed

Efficient cylindrical body design, easy-to-replace one-piece wedge disc, and Exelloy seats.

Weights and Dimensions — Prices on Request

Size	Pounds, Each		Dimensions, in Inches			
	No. 634 E Rising Stem	No. 636 E Non-Rising Stem	A	B open	C	D
Inches						
¼	1.3	1.2	2⅛	4½	4	2 1/16
⅜	1.8	1.6	2¼	5⅜	4½	2 9/16
½	2.2	1.8	2⅝	6	5	2¾
¾	3.5	3.0	2⅞	7⅜	5⅝	3 1/16
1	4.5	4.4	3 5/16	8⅜	6½	3⅜
1¼	7.5	7.0	3⅝	9⅞	7⅜	4 1/16
1½	10.0	9.5	3 15/16	11⅛	8⅛	4¾
2	15.0	14.0	4⅜	13¾	9⅝	5⅜
2½	28.0	26.5	5⅛	15¼	10⅝	5⅜
3	46.0	42.0	5¾	18	12¼	7

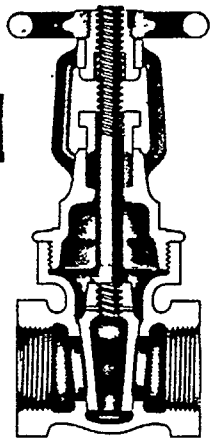
Valves for Marine Service....page 230
Thread engagement.....page 352

300-Pound Bronze Flanged Gate Valves....page 26

CRANE 003812

200-Pound Bronze Gate Valves

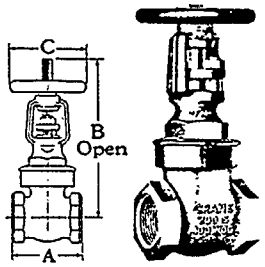
Outside Screw and Yoke — Wedge Disc



No. 459, Cross Section

Working Pressures
200 psi steam, 550 F
400 psi non-shock cold water, oil, or gas

Test Pressure
600 psi hydrostatic



No. 459, Screwed
Underwriters' Pattern in sizes ¾ to 2-inch.

No. 459 are ruggedly constructed valves recommended for service on steam, water, oil, or gas lines. They have been carefully designed to give long service under severe operating conditions. All parts are liberally proportioned to assure a high factor of safety against pressure, operating strains, and expansion and contraction of piping.

Materials and construction: The valves are the outside screw and yoke type. Their body, bonnet, and wedge disc are Crane Special Bronze, a high grade material conforming to ASTM B61 requirements.

The valves are ideally used where action of the fluid in the line might affect inside stem threads; in addition, stem threads can be easily lubricated when necessary, thereby minimizing wear. The valve stuffing box is equipped with a gland and is filled with high grade packing. When wide open, the valves can be repacked while under pressure.

Underwriters' Specifications: The No. 459 in sizes ¾-inch to 2-inch have been approved by the Underwriters' Laboratories, Inc., and Factory Mutual Laboratories. The valve markings include the "CU" and "FM" designations.

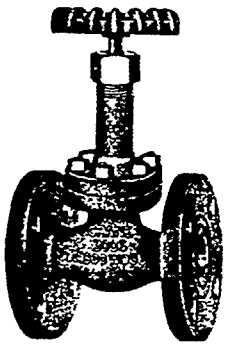
Weights and Dimensions — Prices on Request

Size	No. 459 Screwed	Dimensions, in Inches		
Inches	Pounds Each	A	B	C
½	3.5	2⅝	6⅜	3 5/16
¾	3.5	2⅝	6⅜	3 5/16
1	4.4	3	7⅜	3⅝
1¼	6.8	3½	8¾	3⅞
1½	10.0	4	9¾	4⅜
2	15.5	4¾	11⅝	4 13/16
2½	21.0	5⅜	13⅞	5¾
3	34.0	6	16⅛	6 11/16

Other 200-pound bronze gate valves . . . . page 24

300-Pound Bronze Gate Valves

Rising Stem — Wedge Disc — Monel Seats



No. 623½ E, Flanged
The 1-inch size has a union bonnet (not illustrated).

Working Pressures
300 psi steam, 550 F
500 psi non-shock cold water, oil, gas, or air

Test Pressure
900 psi hydrostatic
Air Tested

The No. 623½ E are exceptionally durable, flanged end gate valves recommended for high pressure service. The body, bonnet, and disc are Crane Special Bronze (ASTM B61); the disc, slipped onto a strong head on the stem end, is accurately guided in the body to prevent contact between the seating surfaces until the valve is almost closed. The renewable type, screwed-in body seat rings are made of wear-resistant, corrosion-resistant Monel. The large, deep stuffing box is equipped with a gland; the valves, when wide open, can be repacked while under pressure.

The 1-inch valves have a union bonnet; larger sizes have an inside screw, bolted bonnet with steel studs, bronze nuts, and Cranite gasket.

End flanges: End flanges conform to the American Standard (B16.24-1953) for 300-Pound Bronze Flanges; they are plain faced, with two V-shaped concentric grooves between the port and the bolt holes. The valves are regularly furnished faced and drilled (F & D); they can be furnished faced only, if specified. Full face gaskets should be used, see page 321.

Weights and Dimensions — Prices on Request

No. 623½ E	Size	Weight	Dimensions, in Inches			
	Inches	Pounds Each	Face to Face	Center to top, open	Dia of wheel	Flange diameter	Flange thickness
Flanged F & D	1	11.0	4¾	8⅜	3⅝	4⅞	19/32
	1¼	16.0	5¼	9¾	4 1/16	5¼	⅝
	1½	27.0	6	11	4¾	6⅛	11/16
	2	30.0	6½	13½	5⅜	6½	¾
	2½	44.0	7½	15½	5⅜	7½	13/16
	3	62.0	8	18⅛	7	8¼	29/32

Other 300-pound bronze gate valves..page 25
Templates for drilling.....page 326

SECTION 4

Crane Bronze Globe and Angle Valves

(Including AAR Valves)

Names of Parts.....pages 28 and 42

Globe Valves

100-Pound.....page 29
125-Pound.....pages 30 and 31
150-Pound.....pages 32 to 34
200-Pound.....pages 38 and 39
300-Pound.....pages 40 to 43
2500-Pound Hydraulic.....page 44

Needle Point and Needle Air.....page 36
For Liquefied Petroleum Gases.....page 37

Angle Valves

100-Pound.....page 29
125-Pound.....pages 30 and 31
150-Pound.....pages 32 to 34
200-Pound.....pages 38 and 39
300-Pound.....pages 40, 42, and 43

Needle Point.....page 36
For Liquefied Petroleum Gases.....page 37

AAR Globe and Angle Valves

Types.....page 42
Names of Parts and Ordering Information.....page 42

Diaphragm Valves.....page 35

For other bronze products, supplementing those indexed above, refer to:

Bronze gate valves.....Section 3
Bronze check and foot valves.....Section 5
Bronze safety and relief valves.....Section 18
Bronze valves for marine service.....Section 20

Bronze lever-operated quick-opening valves.....pages 56 to 58
Bronze radiator valves.....page 59
Bronze hose valves.....pages 60 and 61
Bronze cocks and stops.....pages 64 and 65
Bronze pressure regulators.....pages 246 to 249

Use Crane steel valves for high pressure-temperature service

For pressures and temperatures that are beyond the scope of bronze or iron valves, and for unusually severe services, Crane manufactures a complete line of steel globe and angle valves. Made to Crane's high standards, these valves are available in a wide range of sizes and with screwed, flanged, butt-welding, or socket-welding ends.

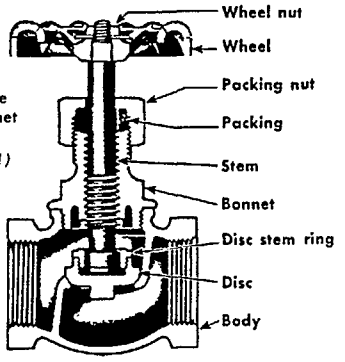
For steel globe and angle valves of the conventional types, see Section 13; for valves of the Pressure-Seal and Lip-Seal Bonnet types, see Section 15.

Bronze Globe and Angle Valves

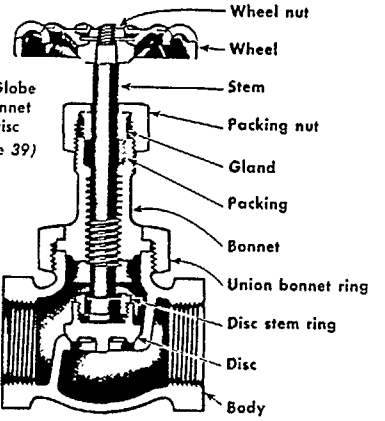
Names of Parts

4

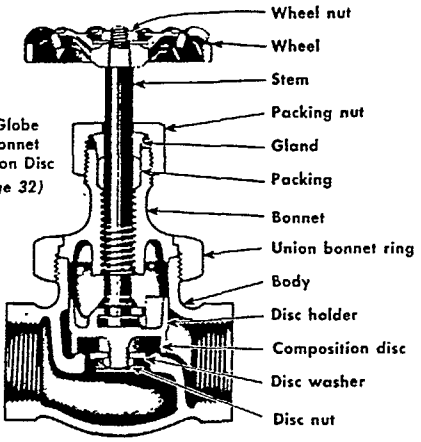
No. 1, Globe
Screwed Bonnet
Metal Disc
(see page 31)



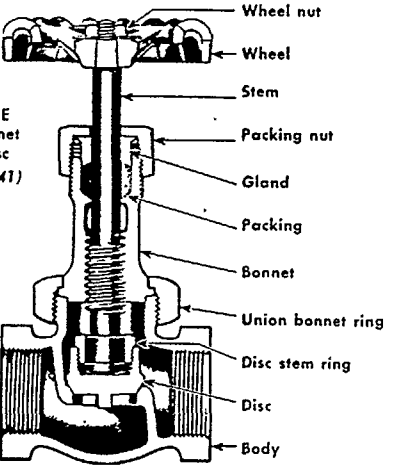
No. 70, Globe
Union Bonnet
Metal Disc
(see page 39)



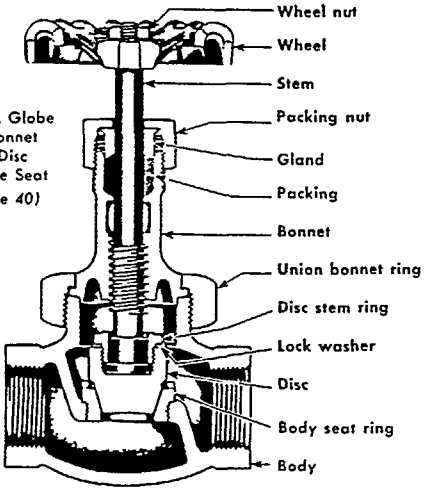
No. 7, Globe
Union Bonnet
Composition Disc
(see page 32)



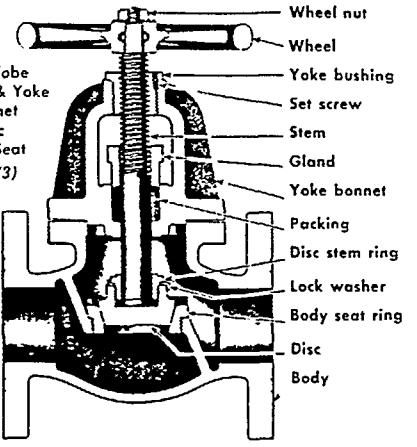
No. 362 E
Union Bonnet
Metal Disc
(see page 41)



No. 382 P, Globe
Union Bonnet
Metal Disc
Renewable Seat
(see page 40)

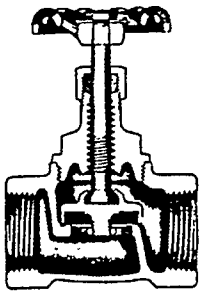


No. 87 P, Globe
Outside Screw & Yoke
Bolted Bonnet
Metal Disc
Renewable Seat
(see page 43)

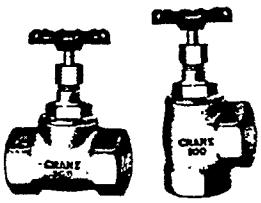


100-Pound Bronze Globe and Angle Valves

Composition Disc



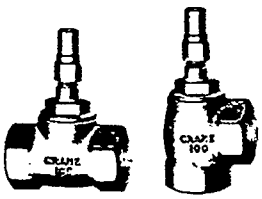
Cross Section
No. 1240



With Wheel

No. 1240 Globe Screwed

No. 1241 Angle Screwed



With Lock Shield

No. 1260 Globe Screwed

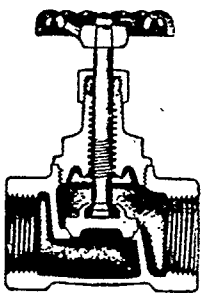
No. 1261 Angle Screwed

Working Pressures, Non-Shock

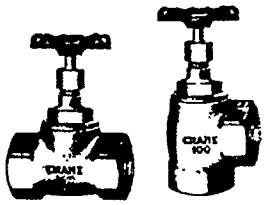
Fluid	Composition Disc Valves		Bronze Disc Valves
	Globe or Angle with No. 12 Disc (regular)	Globe Only with No. 10 Disc (optional)	
Cold Water, Oil, or Gas	150 psi	...	150 psi
Saturated Steam	...	100 psi	100 psi

Composition disc valves are recommended for domestic gas service.

Bronze Disc



Cross Section
No. 1250



No. 1250 Globe Screwed

No. 1251 Angle Screwed

This diversified line of sturdy, well proportioned valves combines wide utility with moderate cost. The valves offer ample strength and durability for any low pressure installation . . . . such as domestic water and gas lines, steam heating systems, for piping on equipment operated at low pressures, and similar services.

Body: The body is made of bronze (ASTM B 62) and is designed with long, flat hexagons which reinforce the openings and afford a positive wrench grip.

Construction: Except for their discs, the composition and bronze disc valves are similar. The bonnet screws into the body and has liberal thread engagement with the stem. An amply deep stuffing box provides a tight stem seal. The seat is integral with the body.

Composition disc: Composition disc valves have a bronze disc holder which is spun onto the end of the stem. The valves are regularly furnished with a No. 12 Disc suitable for water (up to 200 F), oil, and gas (including domestic gas) service. The globe valves only, when specified, can be furnished with a No. 10 Disc making them suitable for saturated steam service. Angle valves may be converted to saturated steam service by the user; simply replace the original disc with a No. 10 disc. For description and service recommendations of composition discs, see page 281.

Bronze disc: Bronze disc valves have a ball-to-angle seat. The disc is spun onto the stem end on sizes ¾-inch and larger and, in smaller sizes, is integral with the stem (not illustrated). The valves are suitable for steam, water, oil, or gas; however, composition disc valves are recommended for domestic gas.

Other low pressure bronze valves: For screwed end gate and lift check valves, see pages 17 and 47 respectively. For solder-joint valves, see page 17 for gates, page 30 for globe and angles, and page 46 for swing checks.

Weights and Dimensions — Prices on Request

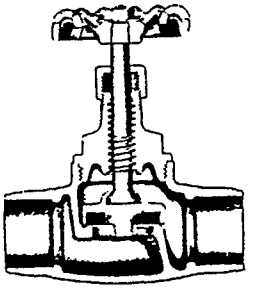
Size	Pounds, Each						Dimensions, in Inches								
	Composition Disc				Bronze Disc		End to end	Center to end	Center to Top, Open						Diameter of wheel
	With Wheel		With Lock Shield		With Wheel				No. 1240	No. 1241	No. 1260	No. 1261	No. 1250	No. 1251	
Inches	No. 1240 Globe	No. 1241 Angle	No. 1260 Globe	No. 1261 Angle	No. 1250 Globe	No. 1251 Angle	All Globe	All Angle							
⅛	0.43	...	...	...	...	...	1⅞	...	2¾	...	...	...	...	...	1½
¼	0.43	0.41	0.43	0.41	...	...	1⅞	⅞	2¾	2½	3¼	2⅝	...	...	1½
⅜	0.52	0.50	0.52	0.50	0.52	0.5	2	15/16	2⅞	2⅜	3¼	2⅞	3	2⅝	1½
½	0.8	0.8	0.8	0.8	0.8	0.8	2⅜	1⅛	3½	3⅛	3¾	3¼	3½	3¼	1¾
¾	1.2	1.1	1.2	1.1	1.2	1.1	2¾	15/16	4	3¾	4	3⅝	4⅛	3⅞	2 1/16
1	1.9	1.7	1.9	1.7	1.9	1.7	3¼	1½	4½	4¼	4¾	4⅝	4¾	4⅜	2 9/16
1¼	2.7	2.6	2.7	2.6	2.7	..	3⅞	1 13/16	4⅞	4⅝	5½	5¼	5	...	2¾
1½	4.0	3.8	...	..	4.0	...	4¼	2	5½	5¼	...	...	5⅝	..	3 1/16
2	6.3	5.8	..	..	6.3	.	5	2¼	6	5⅞	..	...	6¼	...	3⅝

Extra composition discs....page 281

Keys for lock shield valves....page 283

125-Pound Bronze Globe and Angle Valves

Solder-Joint Ends — Composition Disc



Cross Section, Globe



No. 1310
Globe, Solder-Joint



No. 1310½
Globe, Solder-Joint
With Right Hand Drain



No. 1311
Angle, Solder-Joint

Solder-joint gate and checks: The complete Crane line of solder-joint valves includes gate valves shown on page 17 and swing check valves shown on page 46

Working Pressures, Non-Shock

Fluid	With No. 12 Composition Disc (regular)	With No. 10 Composition Disc (optional)
Water	200 psi, 200 F	....
Saturated Steam	....	125 psi

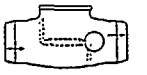
Recommendations: Crane globe and angle valves with solder-joint ends are recommended for use on steam or water lines. They are well suited for plumbing and heating systems, for low pressure steam and water piping in industrial plants, and for similar service.

Important —When the valves are installed on steam lines, the solder used to make the joints must have a melting point high enough to withstand the temperature of the steam.

Design: The valves combine the advantages of light weight with sturdy construction. All parts are made of good quality materials, the body being made of bronze conforming to ASTM Specification B62; body ends comply with American Standard, B16.18-1950, for Cast Brass Solder-Joint Fittings.

The disc holder is spun onto the stem end. The stuffing box is amply deep to prevent leakage around the stem.

Composition disc: The valves are regularly furnished with a No. 12 Composition Disc for water service. Valves ordered for saturated steam are equipped with a No. 10 Disc. For description, dimensions, and service recommendations of composition discs, refer to page 281.

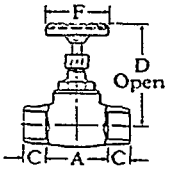


Drain on No. 1310½: The No. 1310½ Globe, available in ½ and ¾ inch sizes only, is furnished with a right hand drain. The inset illustration indicate the position of the drain.

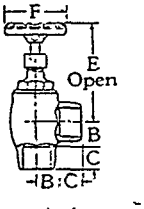
Repacking: Any of the valves, when wide open, can be repacked while under pressure.

Instruction tag: These valves are furnished with a tag giving special instructions for soldering.

Larger sizes and higher pressure valves: When larger sizes or valves suitable for higher pressures are wanted, Crane screwed end valves with solder-joint adaptors are recommended.



Globe



Angle

Weights and Dimensions — Prices on Request

Valve Type	Size Inches	Weight Pounds Each	Dimensions, in Inches A	B	C	D	E	F
No. 1310, Globe	⅜	.5	1½		7/16	2⅞		1½
	½	.8	1¾		9/16	3½		1¾
	¾	1.2	1 15/16		13/16	4		2 1/16
	1	1.8	2⅜		15/16	4½		2 9/16
	1¼	2.5	2¾		1	4⅞		2¾
	1½	3.6	3 3/16		1⅛	5½		3 1/16
	2	5.6	3⅞		1⅜	6		3⅝
No. 1310½, Globe With Drain	½	0.8	1¾		9/16	3½		1¾
	¾	1.2	1 15/16		13/16	4		2 1/16
No. 1311, Angle	⅜	.5		9/16	7/16		2⅝	1½
	½	.7		5/8	9/16		3⅛	1¾
	¾	1.0		¾	13/16		3¾	2 1/16
	1	1.6		7/8	15/16		4¼	2 9/16

Extra composition discs....page 281

125-Pound Bronze Globe and Angle Valves

Screwed Ends—Bronze Disc

Working Pressures
125 psi saturated steam
200 psi non-shock cold water, oil, or gas

Recommendations: These valves are recommended for general service on steam, water, oil, or gas lines.

Materials: Except for the wheel, metal parts are bronze, the body being made of bronze conforming to requirements of ASTM Specification B 62.

Construction: The valves are sturdy and unusually well constructed. They are heavier and more rugged than is usual with "Standard" or 125-Pound Valves.

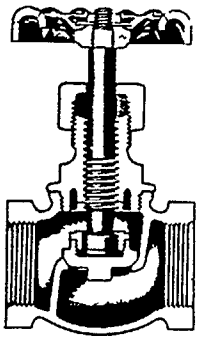
All parts are liberally proportioned to assure a high factor of safety against pressure, operating strains, and expansion and contraction of the piping.

The disc in sizes ⅛ to ½-inch is integral with the stem. In larger sizes, the disc swivels on the stem as shown at the right.

Repacking: These valves, when wide open, can be repacked while under pressure. The stuffing box is amply deep to prevent leakage at the stem

Federal Specification: These globe and angles comply respectively to requirements for Type I and Type II Valves, as covered in Federal Specification WW-V-51a for Class "A" 125-Pound Bronze Valves (for land use).

Flanged valves: When flanged valves are required, use the No. 71 Globe or No. 711 Angle Valves described on page 39.



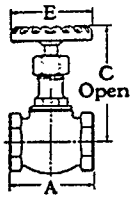
Cross Section



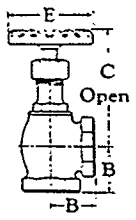
No. 1
Globe, Screwed



No. 2
Angle, Screwed



Globe



Angle

Weights and Dimensions — Prices on Request

Size	Pounds, Each		Dimensions, in Inches			
	No. 1 Globe	No. 2 Angle	A Globe	B Angle	C	E
Inches	Screwed	Screwed				
⅛	0.3	0.3	1 7/16	¾	2¾	1½
¼	0.5	0.4	1⅝	13/16	3	1¾
⅜	0.6	0.5	1⅞	15/16	3¼	2 1/16
½	1.0	0.9	2 3/16	1⅛	3¾	2 9/16
¾	1.5	1.5	2 11/16	1⅜	4¼	2¾
1	2.4	2.2	3 3/16	1⅝	5	3 1/16
1¼	3.5	3.3	3 11/16	1 13/16	5½	3⅝
1½	5.0	4.8	4 3/16	2 1/16	6¼	4 1/16
2	8.0	8.0	5⅛	2½	7½	4 3/4
2½	12.0	10.0	6 1/16	3 1/16	7½	5⅜
3	19.5	20.0	7 1/16	3 11/16	9¼	6

Hose Valves



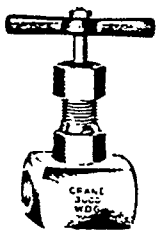
No. 117
Angle Hose Valve
with
Cap and Chain

See pages 60 and 61

Crane offers a variety of bronze hose valves in a wide range of sizes. Among these are Angle and Chicago Hose Valves, widely used on standpipes, hose racks, and similar services; Underwriters' Hose Gate, and Garden Hose Valves. A variety of hose threads are available

Steel Valves

No. 222 H
Globe Valve
Female
Steel Bar Stock

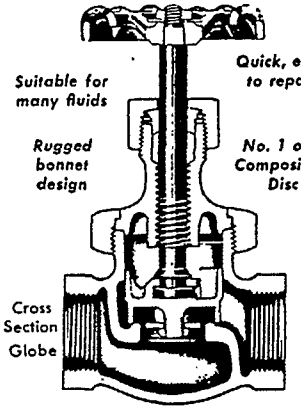


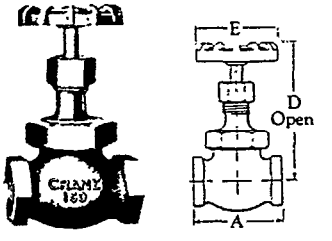
See pages 136 and 196

The Crane line of bar stock valves includes small, rugged steel, Exelloy, and 18-8 SMo globe and angle valves. They are used on orifice meters, regulator leads, by-passes, gauges and many similar services. Available with female or with male and female ends.

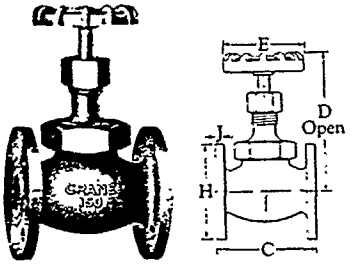
150-Pound Bronze Globe and Angle Valves

Composition Disc

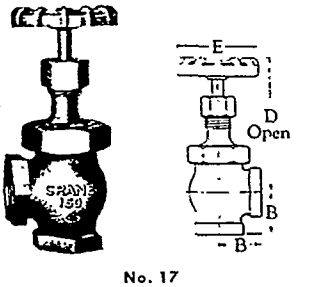




No. 7
Globe, Screwed



No. 9
Globe, Flanged

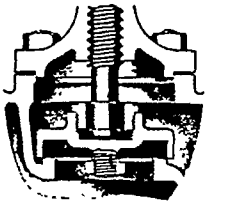


No. 17
Angle, Screwed

Extra composition discs....page 281
Templates for drilling.....page 326

Working Pressures, Non-Shock

Valve Ends	With No. 1 Cranite Disc (regular)		With No. 6 Disc (optional)
	Saturated Steam	Hot Water (200-300 F)	Water up to 200 F, Oil, Gas, or Air
Screwed	150 psi	300 psi	300 psi
Flanged	150 psi	225 psi	225 psi



2½ and 3-inch valves have a disc stem ring and are made with a bolted bonnet.

Recommendations: These rugged valves are unexcelled where quick disc replacement is necessary. When equipped with the proper disc, they will give excellent results on steam, water, oil, gas, gasoline, or air lines.

Quick repairs: A leak is easily repaired. Replace the disc holder with an extra complete holder and disc, or, insert a new disc into the original holder. Extra parts should be kept on hand for this purpose.

Materials: Except for the wheel, metal parts are bronze, the body being made of bronze conforming to ASTM B 62.

Construction: Valves 2-inch and smaller have a slip-on disc holder and union bonnet, as illustrated at the upper left. Larger sizes have the disc holder and stem fastened with a disc stem ring and are equipped with an inside screw, bolted bonnet, as illustrated at the upper right. Both bonnet types provide a strong, tight joint, yet either is easily dismantled and reassembled without danger of damaging the valve.

Discs: The valves will be furnished with a No. 1 Cranite Disc for saturated steam or for hot water (from 200 to 300 F), unless a No. 6 Disc for water (up to 200 F), oil, gas, gasoline, or air is specified. For service recommendations and description of discs, see page 281.

Stuffing box; repacking: The stuffing box is deep and has a gland. The valves, when wide open, can be repacked while under pressure.

Federal Specification: Globe and angle valves comply, respectively, to requirements for Type I and Type II Valves, as covered in Federal Specification WW-V-51a for Class "B" 150-Pound Bronze Valves (for land use).

Flanged valves: The dimensions and drilling of end flanges conform to the American Standard (B16.24-1953) for 150-Pound Bronze Flanges Flanges are plain faced, with two V-shaped concentric grooves between the port and the bolt holes. The valves are regularly furnished faced and drilled; they will be furnished faced only, when specified. Full face gaskets should be used; see page 321.

Weights and Dimensions — Prices on Request

Size	Pounds, Each			Dimensions, in Inches						
	No. 7 Globe	No. 9 Globe	No. 17 Angle	A	B	C	D open	E	End Flanges H	End Flanges J
Inches	Screwed	Flanged F & D	Screwed							
⅛	0.8		0.8	2	1 5/16		3 3/4	1 3/4		
¼	0.8		0.8	2	1 5/16		3 3/4	1 3/4		
⅜	1.2		1.1	2 5/16	1 1/16		4 3/8	2 1/16		
½	1.7		1.6	2 11/16	1 1/4		4 3/4	2 9/16		
¾	2.6		2.3	3 3/16	1 7/16		5 3/8	2 3/4		
1	3.8	6.9	3.6	3 3/4	1 11/16	4 3/8	6 1/8	3 1/16	4 1/4	3/8
1¼	5.7	8.8	5.4	4 1/4	2	4 13/16	6 3/4	3 5/8	4 5/8	13/32
1½	7.9	12.0	7.4	4 3/4	2 3/16	5 1/2	7 5/8	4 1/16	5	7/16
2	13.0	19.5	12.0	5 3/4	2 11/16	6 1/2	8 5/8	4 3/4	6	1/2
2½	22.5	32.0	22.0	6 3/4	3 1/4	7 1/2	10 1/2	7	7	9/16
3	36.0	45.0		8		8 7/8	12	8	7 1/2	5/8

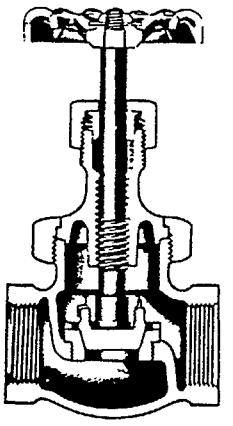
150-Pound Bronze Globe and Angle Valves

Plug Type Disc

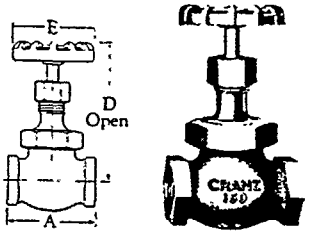
Working Pressures
150 psi saturated steam
300 psi non-shock cold water, oil, gas, or air

Air Tested

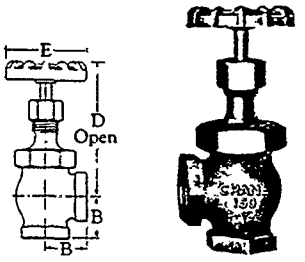
Crane "500 Brinell" Stainless Steel seating surfaces . . . . plug type disc and renewable body seat ring . . . . union bonnet on sizes 2-inch and smaller . . . . bolted bonnet on sizes 2½ and 3-inch



Cross Section, Globe



No. 14½ P
Globe, Screwed

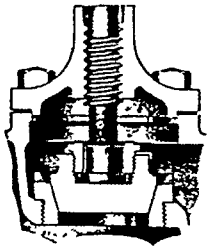


No. 16½ P
Angle, Screwed

Recommendations: These valves are recommended for throttling, for soot blower, blow-off, boiler feed, drip, and drain lines, and for other hard services. Having a disc and seat made of Crane "500 Brinell" Stainless Steel, they are well suited for use where operating conditions are severe.

Plug type disc valves for moderate pressures: High pressure valves are often used on much lower pressures in order to obtain the better seat construction usually associated with higher pressures. These valves are unique in that, although recommended for 150 psi saturated steam and 300 psi water, oil, gas, or air, they have a seat and disc that will withstand extremely hard operating conditions. For severe and exacting services on moderate pressures, such as throttling, blow-off, boiler feed, frequent operation, etc., they are ideal. They provide abundant seat life without the greater initial cost of a high pressure valve.

Disc and seat: The valves have a plug type disc and seat whose excellent design characteristics for rigorous service are well known. The wide seating surface is unusually resistant to foreign matter and to wiredrawing, and the tapered disc permits close regulation of flow when throttling.



2½ and 3-inch valves have a bolted bonnet.

The disc and seat ring are Crane "500 Brinell" Stainless Steel. This metal offers excellent resistance to wear, temperature, galling, and scoring; it is harder, tougher, and stronger than metals ordinarily used in bronze valves.

Sturdy construction: The valves are ruggedly constructed throughout. Their body, bonnet, and stem are proportioned to provide liberal strength and safety under the recommended working pressures. The body is made of bronze conforming to requirements of ASTM Specification B 62.

Bonnet construction: Sizes 2-inch and smaller have a union bonnet as shown on the illustrations at the right; 2½ and 3-inch sizes are equipped with a low-type, compact bolted bonnet, inside screw, as illustrated directly above.

Both types of bonnet construction provide a strong, tight joint, yet they can be easily dismantled and reassembled without danger of injuring the valve.

Stuffing box: The valves have a stuffing box which is large and deep; it is equipped with a gland and filled with high grade packing.

Repacking: These valves, when wide open, can be repacked while under pressure.

Valves for Marine Service....page 230

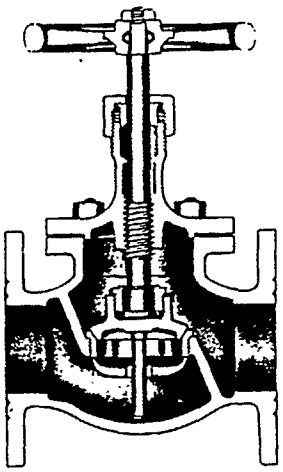
Weights and Dimensions — Prices on Request

Size	Pounds, Each		Dimensions, in Inches			
	No. 14½ P Globe	No. 16½ P Angle	A	B	D open	E
Inches	Screwed	Screwed				
⅛	.8	...	2	...	4	1¾
¼	.8	.8	2	15/16	4	1¾
⅜	1.1	1.1	2 5/16	1 1/16	4½	2 1/16
½	1.8	1.7	2 11/16	1¼	5	2 9/16
¾	2.5	2.4	3 3/16	1 7/16	5¾	2¾
1	4.0	3.7	3¾	1 11/16	6⅝	3 1/16
1¼	5.7	5.5	4¼	2	7	3⅝
1½	8.0	7.4	4¾	2 3/16	8	4 1/16
2	13.0	13.0	5¾	2 11/16	9⅛	4¾
2½	23.0		6¾		10½	7
3	36.0		8		11⅞	8

150-Pound Bronze Globe and Angle Valves

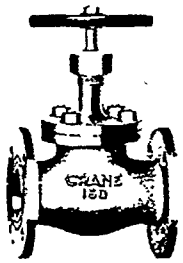
Bolted Bonnet

4

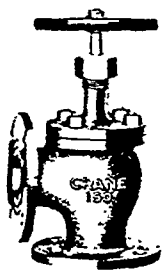


Cross Section, Globe

Construction above is typical of valves 3-inch and smaller. The 4-inch valves have outside stem threads and a bolted gland.



No. 4197
Globe, Flanged



No. 4199
Angle, Flanged

Working Pressures		Hydrostatic Test Pressure
Steam 550 F	Cold Water, Oil, or Gas Non-Shock	
150 psi	225 psi	450 psi

Rugged bolted bonnet flanged valves designed for large size pipe lines

Recommendations: These high quality 150-pound bronze valves are especially intended for use in large size pipe lines. They are recommended for general service on steam, water, oil, or gas.

Materials: All parts are made of high grade materials. The body, bonnet, body seat ring, and disc are made of Crane Special Bronze, a hard, leaded tin bronze conforming to ASTM Specification B 61 requirements.

Construction: The valves feature rugged, durable construction. Their bolted bonnet design assures a tight body-bonnet joint which can be easily dismantled and reassembled without danger of damaging the valve.

The disc is accurately guided by a guide stem which operates in a bridge cast integral with the body seat ring; the seat ring is renewable.

Valves 3-inch and smaller have inside stem threads, a screwed packing nut, and a gland, as illustrated in the cross section at the upper left.

In the 4-inch size (not illustrated), the valves have outside stem threads with a crosshead type yoke and one-piece bolted gland and flange.

Stuffing box: The stuffing box is unusually deep and is filled with high grade packing.

Repacking: The valves, when wide open, can be repacked while under pressure.

End flanges: The dimensions and drilling of end flanges conform to the American Standard (B16.24-1053) for 150-Pound Bronze Flanges. The flanges are plain faced, with two V-shaped concentric grooves between the port and the bolt holes.

Drilling: The valves are regularly furnished faced and drilled (F & D). Faced only valves can be furnished when specified. Full face gaskets should be used; see page 321.

Weights and Dimensions — Prices on Request

Valve Type	Size	Pounds	Dimensions, in Inches				
			Face to face	Center to face	Center to top, open	Diameter of wheel	End Flanges
Flanged F & D	Inches	Each					Diameter / Thickness
No. 4197 Globe	1½	14.0	5⅞	2 15/16	8	4 1/16	5 / 7/16
	2	23.0	6⅞	3 7/16	9¼	5⅜	6 / ½
	2½	36.0	8	4	11	7	7 / 9/16
	3	48.0	9⅛	4 9/16	12½	8	7½ / ⅝
	4	88.0	11	5½	13¾	10	9 / 11/16
No. 4199 Angle	1½	14.0		3⅛	7½	4 1/16	5 / 7/16
	2	21.5		3¾	9	5⅜	6 / ½
	2½	36.0		4¼	10½	7	7 / 9/16
	3	48.0		4 5/8	11¾	8	7½ / ⅝
	4	88.0		5½	12½	10	9 / 11/16

Valves for Marine Service . . . page 230
Templates for drilling . . . . . page 326

Bronze Packless Diaphragm Valves

(Patented and Patents Pending)

Tight-seating diaphragm valves . . . . unexcelled for a wide variety of general and corrosive services

Crane packless diaphragm valves, long a prime favorite, are built for hard usage and dependable performance in general and corrosive services.

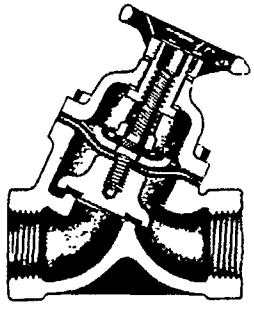
Included in Crane's extensive line of diaphragm valves are the bronze screwed end valves listed on this page. As shown in the illustration at the right, the flexible diaphragm mounted between the body and bonnet eliminates the need for a stuffing box and, coupled with the "tight-seating" disc facing, makes the valves ideal for conveying liquids, compressed air, gases, volatile fluids, etc.

Bronze diaphragm valves are regularly furnished in sizes ½ to 2-inch . . . . with a neoprene, Buna N, natural rubber, or Kel-F diaphragm and disc insert . . . . and for wheel or sliding stem operation.

A complete line: The bronze valves described briefly on this page are only a small portion of Crane's complete line. In addition to bronze, the Crane line includes both wheel-operated and sliding stem cast iron, aluminum, and 18-8 SMo valves with a choice of disc insert and diaphragm materials and with screwed or flanged ends, the latter being available in sizes up to 14-inch.

Cast iron flanged valves having the body internally lined, and the disc coated, with neoprene or natural rubber are also regular products.

For complete design and construction features, weights, dimensions, and recommendations for the entire Crane line, see Section 16, pages 181 to 188.



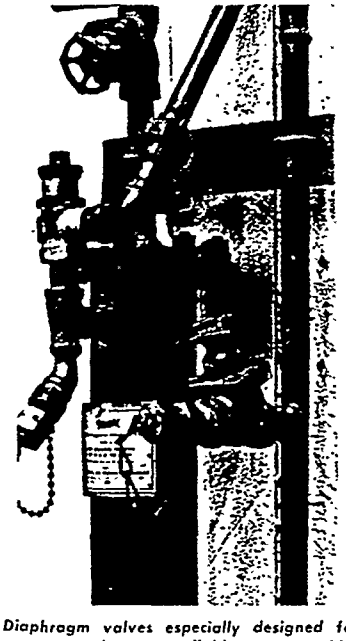
Sectional of a bronze packless diaphragm valve. The valves are described in greater detail in Section 16.

4

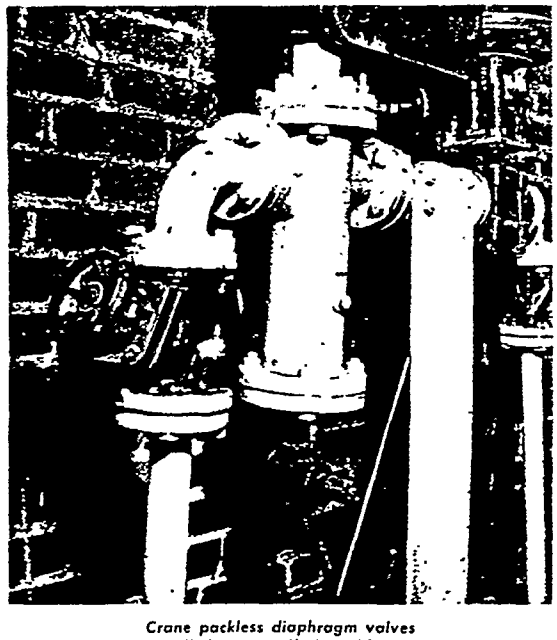
Types, Sizes, and Ratings

Bronze Screwed Diaphragm Valve Catalog Numbers		Sizes	Diaphragm and Disc Insert Materials	Pressure-Temperature Ratings
Wheel-Operated	Sliding Stem	Inches		Water, Oil, Air, or Gas
1600	5600	½ to 2	Neoprene	150 psi, 180 F
1600-SB	5600-SB	½ to 2	Buna N	150 psi, 180 F
1600-RN	5600-RN	½ to 2	Natural Rubber	150 psi, 180 F
1600-KF	5600-KF	½ to 2	Kel-F	150 psi, 200 F

For complete description, dimensions, recommendations, etc., for the above valves . . . as well as for cast iron, aluminum, 18-8 SMo, and neoprene or rubber-lined diaphragm valves . . . see Section 16.

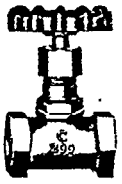


Diaphragm valves especially designed for oxygen service are available; see page 184.



Crane packless diaphragm valves installed in a sulfuric acid line.

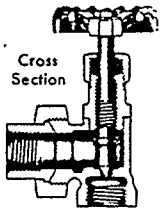
Bronze Globe and Angle Valves
Needle Point



No. 88
Globe, Screwed



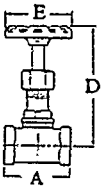
No. 89
Angle, Screwed



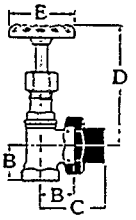
Cross Section

No. 85
Angle, Screwed with Female Union Outlet

Working Pressures
200 psi saturated steam
400 psi non-shock cold water, oil, or gas



Globe Valve



Angle Valves

Recommendations: Crane Globe and Angle Needle Point Valves are especially suitable where very close and delicate regulation of flow is desired.

They are recommended for steam, water, oil, gas, light liquid lines, fuel oil, and similar services.

Body: The body is made of bronze conforming to requirements of ASTM Specification B 62.

Construction: The valves are unusually rugged, compact, and well proportioned throughout. The stem is bronze. The stuffing box is large and, on the ¾-inch size, is equipped with a gland.

Repacking: The valves, when wide open, can be repacked while under pressure.

Seat opening: The diameter of the seat opening is listed in the table below. The ⅛-inch size has a nominal seat opening; larger sizes have a reduced seat opening.

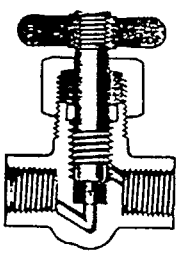
Weights and Dimensions — Prices on Request

Size	Pounds, Each			Dimensions, in Inches					
Inches	No. 88 Globe	No. 89 Angle	No. 85 Angle Union Outlet	A	B	C	D open	E	Diameter of seat opening
⅛	0.3	0.3	0.3	1 3/16	5/8	1 5/16	2 3/8	1 1/2	⅛
¼	0.4	0.4	0.5	1 9/16	13/16	1 9/16	2 3/8	1 1/2	3/16
⅜	0.5	0.5	0.7	1 13/16	7/8	1 3/4	2 3/4	1 3/4	¼
½	0.8	0.8	1.0	2 1/16	1 1/16	2	3 1/8	2 1/16	5/16
¾	1.1	1.1	1.8	2 5/16	1 1/4	2 3/16	4	2 9/16	7/16

Bronze Needle Air Valve

Working Pressure
300 psi non-shock cold water, oil, gas, or air

Recommendations: This is a heavy, rugged valve ideal for service on water lines to air drills, on air or water lines in garages, filling stations, and industrial plants, and for similar service.



Cross Section

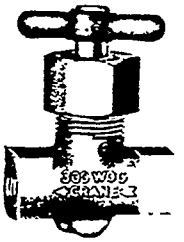
Installation: The valve should always be installed with the pressure above the seat.

Construction: The body and packing nut are made of bronze. The malleable iron tee handle is threaded onto a bronze stem which has the end spun over to lock the handle in place.

The valve has an extra thick fibre seat that can be easily renewed should it become worn.

Weight and Dimensions — Price on Request

No. 57 Needle Air Valve	Size	Pounds	Dimensions, in Inches		
			End to end	Center to top of stem open	Diameter of seat opening
	Inches	Each			
	3/8	0.9	2 5/16	2½	⅛



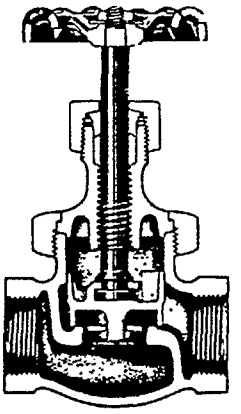
No. 57
Needle Air Valve

Bronze Globe and Angle Valves
For Liquefied Petroleum Gases

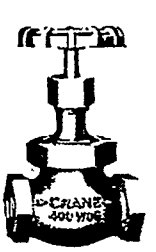
Working Pressure
400 psi non-shock, 150 F
LP-gases, light oils, volatile fluids, or air

Test Pressure
600 psi hydrostatic
Air Tested

Easy-Seating, Safety-Tight Valves
****Underwriters' Approved for Efficient Handling Of Liquefied Petroleum Gases***



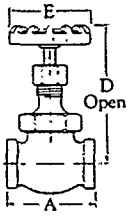
Cross Section, Globe

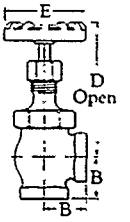


No. 130
Globe, Screwed



No. 131
Angle, Screwed





Recommendations: These valves are especially designed and recommended for safe handling of all common commercial forms of liquefied petroleum gases, such as butane, iso-butane, propane, propylene, butylenes, etc. The gases can be handled separately or mixed, and in either the liquid or gaseous state.

*The valves have been approved by the Underwriters' Laboratories, Inc. for use on all types of piping systems carrying liquefied petroleum gases, provided the system is subject to working pressures no greater than 250 psi. Their identification plate is marked "Butane-UL-Propane."

In addition, the valves are excellent for use on water (up to 200 F), compressed air, gasoline, light oils, volatile fluids, and similar services operating at pressures up to 400 psi.

Safety-tight: Precision design and high quality materials have produced a valve that is completely tight throughout, assuring safer, more efficient handling of LP-gases, even under rigorous service conditions.

With reasonable attention and occasional replacement of the disc, the valves will remain tight indefinitely.

Body and bonnet: The body is made of Crane Special Bronze, a high grade, leaded tin bronze conforming to ASTM Specification B 61.

The union bonnet provides a strong, tight joint, yet it can be easily dismantled and reassembled without danger of damaging the valve.

Durable composition disc: The valves have a Crane No. 6 Disc. Made of a specially formulated composition, the disc is particularly suited for use with petroleum products. It is soft enough to make a tight seat, and yet is sufficiently stiff and resilient to withstand hard wear

The disc holder slips on to the end of the stem and the disc, in turn, is secured to the underside of the holder by means of a washer and a self-locking nut. The washer and nut also serve to reinforce and protect the disc from strain and distortion ordinarily resulting from tight closure of a valve. As an added precaution against leakage, the disc is sealed into the disc holder.

Quick disc repairs: A leak is easy to repair. Simply replace the disc holder with an extra complete disc holder and disc, or insert a new disc into the original holder. For long, practically uninterrupted valve service, a supply of extra disc holders and discs should be kept on hand for replacement purposes.

Stuffing box; repacking: The stuffing box has a gland and is filled with one-piece molded asbestos packing to provide a long lasting, tight stem seal. The valves, when wide open, can be repacked while under pressure.

Installation: Wherever conditions permit, install the valves with the pressure under the disc. An arrow cast on the body indicates correct direction of flow.

Weights and Dimensions — Prices on Request

Size	Pounds, Each		Dimensions, in Inches			
Inches	No. 130 Globe Screwed	No. 131 Angle Screwed	A Globe	B Angle	D open	E
1/4	0.8	0.8	2	15/16	3 5/8	1 3/4
3/8	1.2	...	2 5/16	...	4 1/4	2 1/16
1/2	1.7	1.5	2 11/16	1 1/4	4 5/8	2 9/16
3/4	2.5	2.3	3 3/16	1 7/16	5 1/4	2 3/4
1	4.0	3.5	3 3/4	1 11/16	6	3 1/16
1 1/4	6.0	5.5	4 1/4	2	6 5/8	3 5/8
1 1/2	8.0	8.0	4 3/4	2 3/16	7 3/8	4 1/16
2	13.0	12.5	5 3/4	2 11/16	8 3/8	4 3/4

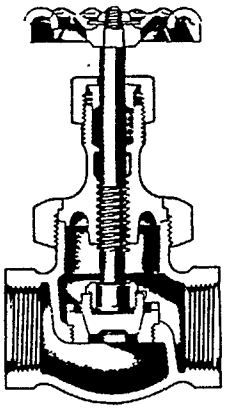
For extra composition discs, see page 281

Bronze valves for LP-gases.....Gate, see page 24.....Check, see page 49.

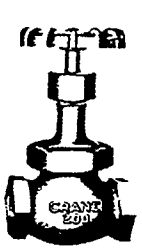
003824

200-Pound Bronze Globe and Angle Valves

Plug Type Disc



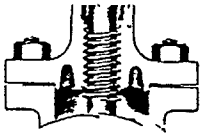
Cross Section, Globe



No. 212 P
Globe, Screwed



No. 214 P
Angle, Screwed



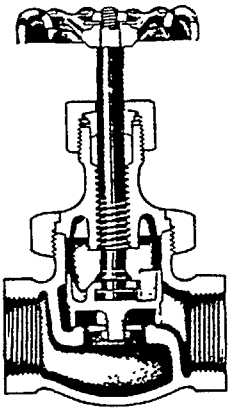
The 2½ and 3-inch globe valves have a bolted bonnet.

Valve		Working Pressures: Steam	Working Pressures: Cold Water, Oil, Gas, Air Non-Shock	Hydrostatic Test Pressures
No. 212 P or 214 P		200 psi, 550 F	400 psi	600 psi
No. 229 C	No. 4 Disc	200 psi, 450 F	*	600 psi
	No. 6 Disc	...	400 psi	600 psi

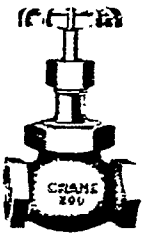
Nos. 212 P and 214 P are regularly air tested.

**No. 229 C Valves with a No. 4 Cranite Disc (furnished unless No. 6 Disc is specified) are also used for hot water up to 400 psi at temperatures over 200 F up to 420 F.*

Composition Disc



Cross Section, Globe



No. 229 C
Globe, Screwed

These valves are made of quality materials. Their body is Crane Special Bronze, a leaded tin bronze conforming to ASTM B 61. Plug type disc valves have a screwed-in body seat ring and a metal disc. In the composition disc valves, the seat is integral with the body.

Plug type disc valves: The No. 212 P and No. 214 P are recommended for severe services such as for throttling, and for blow-off, boiler feed, soot blower, drip, and drain lines. Their plug type disc and seat are designed for exacting use. The wide seating surface is not easily affected by foreign matter or wiredrawing and the tapered disc permits close regulation of flow when throttling.

Both the disc and seat, made of Crane "500 Brinell" Stainless Steel (AISI Type 420), offer fine resistance to wear, temperature, galling, scoring, and corrosion.

Composition disc valves: The No. 229 C is especially suitable where discs must be renewed quickly and easily. The valve is regularly furnished with a No. 4 Cranite Disc for steam up to 450 F (and for hot water from 200 to 420 F). When ordered for cold water, oil, gas, gasoline, or air, the valves will be equipped with a No. 6 Disc. On water under 200 F, especially for frequent operation or easy seating, the No. 6 Disc is preferred to the No. 4.

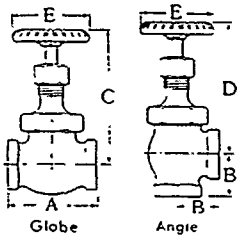
Bonnet: All valves 2-inch and smaller have a union bonnet; 2½ and 3-inch plug type globe valves have a bolted bonnet, inside screw as shown at the lower left. Both types provide a strong tight joint, yet they can be easily dismantled and reassembled without danger of injury to the valve.

Stuffing box: The unusually deep stuffing box is equipped with a gland and is filled with high grade packing.

Repacking: Any of the valves, when wide open, can be repacked while under pressure.

Weights and Dimensions — Prices on Request

Size	No. 212 P Globe, Screwed Plug Type Disc				No. 214 P Angle, Screwed Plug Type Disc				No. 229 C Globe, Screwed Composition Disc			
	Lbs.	Dimensions, In.			Lbs.	Dimensions, In.			Lbs.	Dimensions, In.		
		A	C open	E		B	D open	E		A	C open	E
Inches	Each				Each				Each			
¼	.8	2	4	1¾	.8	15/16	4	1¾	.8	2	3¾	1¾
⅜	1.2	2 5/16	4½	2 1/16	1.2	1 1/16	4⅜	2 1/16	1.2	2 5/16	4½	2 1/16
½	1.8	2 11/16	5⅛	2 9/16	1.8	1¼	5	2 9/16	1.6	2 11/16	4¾	2 9/16
¾	2.8	3 3/16	5¾	2¾	2.5	1 7/16	5⅝	2¾	2.5	3 3/16	5½	2¾
1	4.2	3¾	6⅜	3 1/16	4.0	1 11/16	6¼	3 1/16	3.5	3¾	6¼	3 1/16
1¼	6.2	4¼	7¼	3⅝	6.0	2	7⅛	3⅝	5.8	4¼	6¾	3⅝
1½	8.5	4¾	8⅜	4 1/16	8.5	2 3/16	8¼	4 1/16	7.4	4¾	7¾	4 1/16
2	14.0	5¾	9½	5⅜	14.0	2 11/16	9¼	5⅜	14.0	5¾	8¾	4¾
2½	27.0	7¼	10¾	7								
3	35.0	8¼	12⅜	8								



Extra composition discs.....page 281

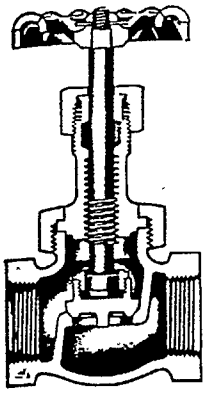
Valves for Marine Service....page 230

CRTX 0873

A2C90 003825

200-Pound Bronze Globe and Angle Valves

Regrinding

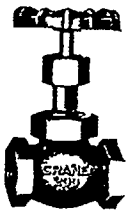


Cross Section, Globe

Valve Ends	Working Pressures		Hydrostatic Test Pressures
	Steam	Cold Water, Oil, or Gas	
	550 F	Non-Shock	
Screwed	200 psi	400 psi	600 psi
Flanged	150 psi	225 psi	450 psi

Recommendations: These valves are sturdily constructed and liberally proportioned. They are recommended for service on steam, water, oil, and gas lines.

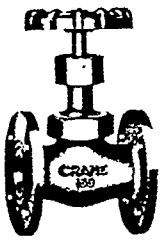
Regrinding: The valves can be reground without removing the body from the line; instructions are furnished with each valve.



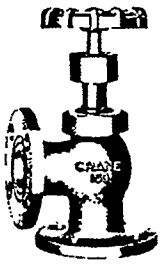
No. 70
Globe, Screwed



No. 701
Angle, Screwed



No. 71
Globe, Flanged



No. 711
Angle, Flanged

Materials: Quality materials are used throughout. Except for the packing and wheel, all parts are bronze, the body being made of Crane Special Bronze conforming to ASTM Specification B 61.

Construction: The valves have a union bonnet. The bonnet ring reinforces the bonnet joint, facilitates dismantling and reassembly, and, when valves are being reground, centers and guides the valve trimmings.

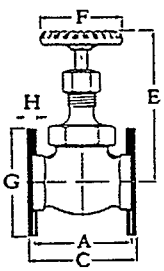
The disc in sizes ½-inch and smaller is integral with the stem; in larger sizes, it swivels on the stem as shown in the sectional view.

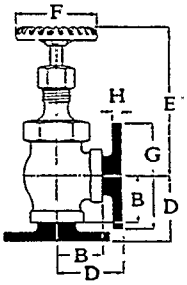
Stuffing box; repacking: The stuffing box is deep and is filled with high grade packing; sizes ½-inch and larger have a gland. The valves, when wide open, can be repacked while under pressure.

Flanged valves: Dimensions and drilling of end flanges conform to American Standard (B16.24-1953) for 150-Pound Bronze Flanges. Flanges are plain faced, with two V-shaped concentric grooves between the port and the bolt holes. Full face gaskets should be used; see page 321.

Flanged valves are regularly furnished faced and drilled (F & D). Faced only valves can be furnished when orders so specify.

Union end valves available: Globe and angle valves having a male union connection are shown on page 59 (No. 4270 line). They are heavy duty radiator valves similar in design and proportions to the valves on this page. Sizes ½ and ¾-inch with wheel or lock shield are available.





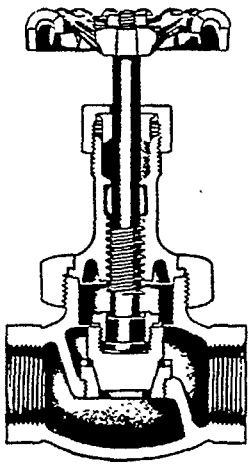
Weights and Dimensions — Prices on Request

Size	Pounds, Each				Dimensions, in Inches									
	Screwed		Flanged F & D		Screwed				Flanged					
Inches	No. 70 Globe	No. 701 Angle	No. 71 Globe	No. 711 Angle	A Globe	B Angle	E open	F	C Globe	D Angle	E open	F	G	H
⅛	0.6				1 11/16		3½	1¾						
¼	0.6	0.5			1 11/16	13/16	3½	1¾						
⅜	0.8	0.8			1 15/16	1	3⅞	2 1/16						
½	1.2	1.1			2¼	13/16	4¼	2 9/16						
¾	2.0	1.9			2¾	1⅜	5	2¾						
1	3.0	3.0	6.0	5.9	3 5/16	1 11/16	5¾	3 1/16	4 3/16	2⅝	5¾	3 1/16	4¼	⅜
1¼	5.0	5.0	8.3	9.0	3⅞	1 15/16	6⅝	3⅝	4 9/16	2⅞	6⅝	3⅝	4⅝	13/32
1½	7.0	7.0	10.7	11.6	4½	2¼	7⅝	4 1/16	5 5/16	3 3/16	7⅝	4 1/16	5	7/16
2	11.0	11.0	16.8	20.0	5¼	2⅝	8⅜	4¾	6	3¾	8⅜	4¾	6	½
2½	19.0		25.6	32.0	6 5/16		9¼	6	6¾	4 5/16	9¼	6	7	9/16
3	29.0		39.0	38.0	7¼		11	7	7 15/16	4⅝	11	7	7½	⅝

Heavy Duty Bronze Union End Valves....page 59 *Valves for Marine Service....page 230* *Templates for drilling....page 326*

300-Pound Bronze Globe and Angle Valves

Plug Type Disc



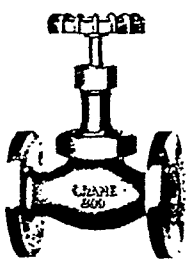
Cross Section, Globe

Valve Ends	Sizes	Working Pressures		Hydrostatic Test Pressures
		Steam	Cold Water, Oil, Gas, or Air	
	Inches	550 F	Non-Shock	
Screwed	¼ to 2	300 psi	1000 psi	1500 psi
	2½ and 3	300 psi	600 psi	900 psi
Flanged	All sizes	300 psi	500 psi	900 psi

Air tested



No. 382 P
Globe, Screwed



No. 383 P
Globe, Flanged



No. 384 P
Angle, Screwed

Recommendations: These valves are recommended for exceptionally severe service, such as for throttling and for use on soot blower, blow-off, boiler feed, drip and drain lines, etc.

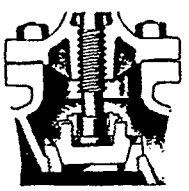
Body: The strong, durable body is made of Crane Special Bronze, a high grade, leaded tin bronze conforming to requirements of ASTM Specification B 61.

Disc and seat: The valves have a plug type disc and seat especially designed for rigorous service. The wide seating surface is not easily damaged by foreign matter or by wiredrawing, and the tapered disc permits close regulation of flow when throttling.

Both the disc and seat are Crane "500 Brinell" Stainless Steel, a specially heat-treated material. The design of the disc and seat plus the excellent resistance offered by this stainless steel to wear, temperature, galling, and scoring produce a superior seat.

Stuffing box; repacking: The stuffing box is unusually deep and has a gland. The valves, when wide open can be repacked while under pressure.

Bonnet construction: Sizes 2-inch and smaller have a union bonnet as shown in the marginal illustrations; sizes 2½ and 3-inch are equipped with a compact bolted bonnet of the inside screw type, as shown in the partial section at the left.



2½ and 3-inch valves have a bolted bonnet

Both bonnet types provide a strong, tight joint, yet either can be easily dismantled and reassembled without danger of damaging the valve.

Flanged valves: The dimensions and drilling of end flanges conform to the American Standard (B16.24-1953) for 300-Pound Bronze Flanges. The end flanges are plain faced, with two V-shaped concentric grooves between the port and the bolt holes.

Flanged valves are regularly furnished faced and drilled (F & D); they can be furnished faced only, when specified.

Full face gaskets should be used; see page 321.

Weights and Dimensions — Prices on Request

Size	Pounds, Each			Dimensions, in Inches						
	No. 382 P Globe	No. 383 P Globe	No. 384 P Angle	End to end, globe	Center to end, angle	Face to face, globe	Center to top, open		Diameter of wheel	End Flanges
							Globe	Angle		Diameter / Thickness
Inches	Screwed	Flanged F & D	Screwed							
¼	1.1	...	1.5	2¼	1⅛	..	4¼	4⅛	2 1/16	. .
⅜	1.6	.	1.5	2½	1¼	..	4⅞	4½	2 9/16	. . .
½	2.4	.	2.2	2 15/16	1½	.	5¼	5	2¾	..
¾	3.6	...	3.5	3½	1¾	...	6⅜	6⅛	3 1/16	.
1	5.2	11.0	5.2	4⅛	2 1/16	5⅜	7	6¾	3⅝	4⅞ 19/32
1¼	8.4	16.0	8.0	4¾	2⅜	6¼	8	7¾	4 1/16	5¼ 5/8
1½	11.3	22.5	11.3	5¼	2⅝	7¼	9⅛	8¾	4¾	6⅛ 11/16
2	19.0	32.0	18.0	6⅜	3 3/16	8	10 3/8	10	6	6½ ¾
2½	36.0	49.0	.	7½	.	9	11½		7	7½ 13/16
3	53.0	69.0	.	8½		10 5/16	13 3/8	.	8	8¼ 29/32

Valves for Marine Service....page 230

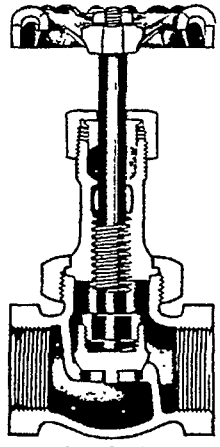
Templates for drilling....page 326

300-Pound Bronze Globe Valves

Regrinding

Working Pressures
300 psi steam, 550 F
600 psi non-shock cold water, oil, or gas

Test Pressure
900 psi hydrostatic



Cross Section

4

Recommendations: No. 362 E Globe Valves are recommended for severe operating conditions at high pressures. Combining serviceability with moderate cost, they offer dependable performance on steam, water, oil, and gas lines.

Body and disc: The valves feature high quality materials throughout. The body and disc are Crane Special Bronze, a strong, hard, leaded tin bronze conforming to requirements of ASTM Specification B 61.

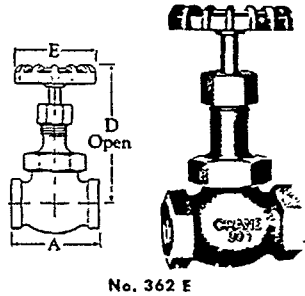
Union bonnet: The bonnet is made of a special bronze. Its unusually good wear-resisting properties, combined with the long, accurately machined threads on the stem, materially lengthen the life of both the stem and bonnet.

In addition to making a sturdy, tight joint, the union bonnet facilitates dismantling and reassembling the valve. The union ring reinforces the bonnet joint, and when the valve is being reground, it centers and guides the valve trimmings.

Regrinding: The valves can be reground without removing the body from the line. Instructions for regrinding are furnished with each valve.

Stuffing box: The stuffing box is unusually deep and is filled with high grade packing; it is equipped with a gland.

Repacking: The valves, when wide open, can be repacked while under pressure.



No. 362 E
Globe, Screwed

Weights and Dimensions—Prices on Request

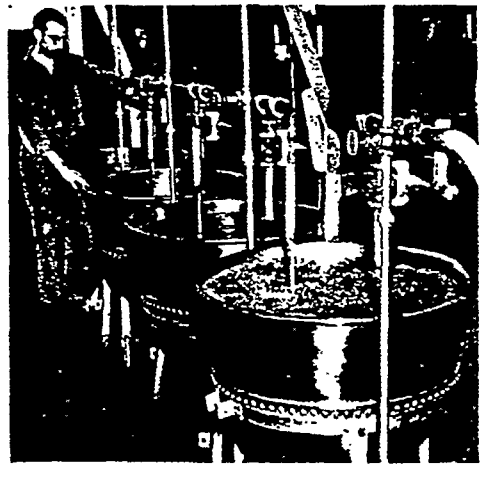
	Size Inches	Weight Pounds Each	Dimensions, Inches A	D	E
No. 362 E Screwed	¼	0.8	2	4	1¾
	⅜	1.2	2 5/16	4½	2 1/16
	½	1.8	2 11/16	5	2 9/16
	¾	2.8	2 15/16	6⅛	3 1/16
	1	4.0	3½	6⅝	3⅝
	1¼	6.0	4 1/16	7⅝	4 1/16
	1½	8.3	4⅝	8½	4¾
	2	15.0	5¾	10⅛	6

Valves for Marine Service..page 230

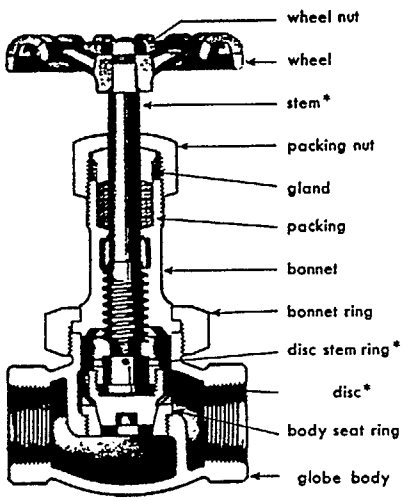
Severe steam throttling problem?
. . . Crane has the solution!

With many users of valves, Crane has always been the standard of quality . . . and with good reason. The case of an eastern food packer is an example. At least once a week, the valves in the steam lines to juice heaters and cooking kettles were acting up . . . the disc and seat would cut out, resulting in uncontrolled steam to kettles and, consequently, a costly loss in product batches.

New valves were tried. None could stand up until Crane No. 212 P plug type globes were installed. After four years of no maintenance cost, the No. 212 P were still in like-new condition . . . with no erosion, no leakage . . . even though used to provide close regulation of steam flow, a service for which these valves are outstanding. If yours is a steam throttling problem, Crane bronze plug type globe and angle valves can help you, too. See pages 33, 38, and 40.



AAR 300-Pound Bronze Globe and Angle Valves

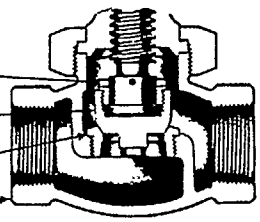


Cross Section of Globe
With Plug Type Disc
(No. 376 P)

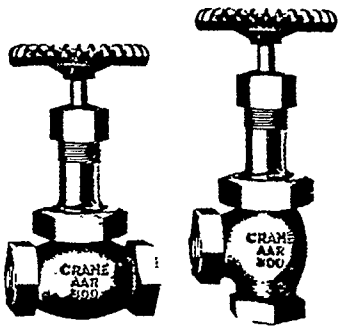
Inside screw, rising stem valves designed especially for severe locomotive service

Working Pressure
300 psi steam

Test Pressure
800 psi hydrostatic



Partial Section of Globe
With Ball Type Disc
(No. 376 E)



Globe, Screwed — Angle, Screwed

No. 376 P...Plug Type Disc...No. 377 P
No. 376 E...Ball Type Disc.....

These heavy, rugged, rising stem globe and angle valves are designed especially for locomotive service. The globe valves are available with either a plug type or ball type disc and seat.

Association of American Railroads: The dimensions and materials of the valves conform to the recommended practice of the Association of American Railroads (AAR) for 300-Pound Globe and Angle Valves for Steam Locomotives.

Body: The body is made of Crane Special Bronze, a leaded tin bronze having high strength and hardness and offering liberal resistance to wear. This metal conforms to ASTM Specification B 61.

Union bonnet: The bonnet is made of a special bronze. Its unusually good wear-resisting properties, combined with the long and accurately machined threads on the stem, materially lengthen the life of both the stem and bonnet.

Union bonnet ring: The bonnet ring is made of Crane Special Bronze. Valves 1½-inch and smaller have a hexagon shaped ring, as shown in the illustrations; the 2-inch size has a round spanner-type ring.

Disc and seat: In valves ½-inch and smaller, the disc is Monel and is spun onto the stem; in larger sizes, the disc is made of Crane No. 49 Nickel Alloy and is held to the stem by a disc stem ring, as shown in the cross sections. The disc in the 2-inch ball type valves has a bottom pin guide which operates through a bridge in the body seat ring.

Plug type valves have an Exelloy body seat ring. In the ball type valves, the seat ring is Exelloy on sizes ½-inch and smaller and Crane No. 49 Nickel Alloy on sizes ¾-inch and larger.

Crane Exelloy is an AISI Type 410 stainless steel, specially heat-treated for high resistance to wear, temperature, galling, and scoring.

Ordering parts: Except for the disc and seat, corresponding parts for the plug type and ball type valves are identical, size for size. When ordering spare parts, use the cross sections above as a guide.

Weights and Dimensions — Prices on Request

Size	Pounds, Each		Dimensions, in Inches			
	Nos. 376 P 376 E Globe	No. 377 P Angle	End to end Globe	Center to end Angle	Center to top, open	Diameter of wheel
Inches						
¼	1.4	1.3	2 5/16	1 5/32	4⅞	2¾
⅜	1.5	1.6	2½	1¼	4⅞	2¾
½	2.3	2.2	2⅞	1 7/16	5⅝	3 1/16
¾	3.8	3.1	3 9/16	1 25/32	6½	3⅝
1	5.7	5.9	4⅛	2 1/16	7⅝	4 1/16
1¼	8.5	8.9	4¾	2⅜	8⅜	4¾
1½	11.0	11.0	5¼	2⅝	9¼	5⅜
2	19.0	19.0	6⅜	3 3/16	10⅝	6

*Note—In sizes ½-inch and smaller, the disc and stem are furnished as a unit (not illustrated); a disc stem ring is not used in these sizes.



Stem end for Universal Joint: When specified, any of these valves can be furnished with the stem end machined for a Universal Joint connection as shown at the right; dimensions conform to the recommended practice of the AAR.

Military Specification: The No. 376 P and 377 P comply with Military Specification MIL-V-1187-B (1956) for 300-Pound WSP Screwed End Bronze Globe and Angle Valves. For other valves complying with military specifications, see page 230

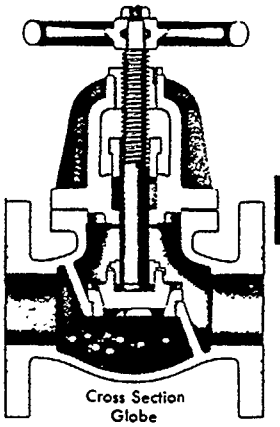
300-Pound Bronze Globe and Angle Valves

Outside Screw and Yoke — Bolted Bonnet

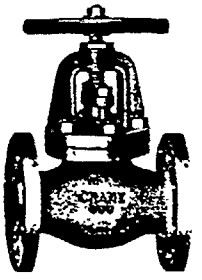
Working Pressures
300 psi steam, 550 F
500 psi non-shock
cold water, oil, gas, or air

Hydrostatic Test Pressure
900 psi
Air tested

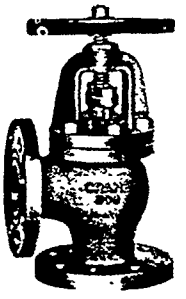
Crane Special Bronze body and bolted bonnet
Crane "500 Brinell" Stainless Steel plug type disc and renewable seat



Cross Section Globe



No. 87 P Globe, Flanged



No. 87½ P Angle, Flanged

Recommendations: These outside screw and yoke valves are recommended for throttling, soot blower lines, and for exceptionally severe services.

Body and bonnet: The valves are unusually heavy and rugged. Their body and bonnet are made of Crane Special Bronze, a high grade leaded tin bronze conforming to requirements of ASTM Specification B 61. The bolted type bonnet provides liberal strength at the bonnet joint.

Disc and seat: The plug type disc and seat are designed for rigorous service. The wide seating surface is not easily ruined by foreign matter or wiredrawing. The tapered disc permits close regulation of flow when throttling.

The disc and body seat ring are made of Crane "500 Brinell" Stainless Steel. This metal offers excellent resistance to wear, temperature, galling, scoring, and corrosion; it is harder, tougher, and stronger than materials ordinarily used in bronze valves.

Outside stem threads: The outside stem threads are particularly well suited for services where action of the fluid might affect inside threads. The stem is liberal in diameter and strong.

Stuffing box: The stuffing box is deep and is filled with a high grade packing. It is equipped with a bolted gland.

Repacking: The valves, when wide open, can be repacked while under pressure.

End flanges: The dimensions and drilling of end flanges conform to American Standard (B16.24-1953) for 300-Pound Bronze Flanges. The flanges are plain faced, with two V-shaped concentric grooves between the port and the bolt holes.

Drilling: The valves are regularly furnished faced and drilled (F & D); they can be furnished faced only, when specified. Full face gaskets should be used; see page 321.

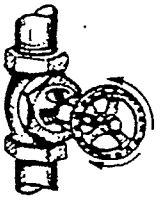
Weights and Dimensions — Prices on Request

Size	Pounds, Each		Dimensions, in Inches						
			Globe		Angle		Both Valves		
Inches	No. 87 P Globe Flanged F & D	No. 87½ P Angle Flanged F & D	Face to face	Center to top of stem, open	Center to face	Center to top of stem, open	Diameter of wheel	Diameter of flanges	Thickness of flanges
1½	28	28	7	9⅛	3⅞	8⅜	6	6⅛	11/16
2	38	41	8	10¼	4¼	9½	7	6½	¾
2½	53	55	9	11⅝	4¾	10⅝	8	7½	13/16
3	78	80	10 5/16	13	5 7/16	12	9	8¼	29/32

Valves for Marine Service....page 230

Templates for drilling....page 326

Closing a Valve!



When a valve starts to leak, don't try to make it tight by brute force. And never put a wrench on the wheel for extra leverage; the chances are that won't stop the leak, and you may break the wheel or the stem.

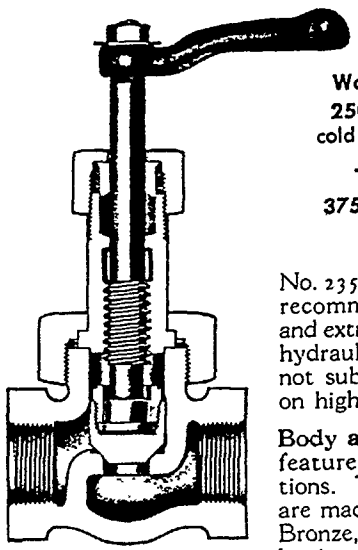
Instead, bring the disc to its seat gently, back it off a turn, and repeat this operation two or three times. A piece of dirt or scale has probably lodged on the seat, and this action may flush it away. If the leak persists, take the valve apart and clean and inspect it.

If the seat and disc are cut, they will have to be refinished or replaced. Valve reseating tools are available, and new parts can be obtained from Crane.

003630

2500-Pound Hydraulic Bronze Globe Valves

45° Seat



Cross section showing construction typical of sizes 1¼-inch and smaller; larger sizes have a bolted bonnet and are wheel-operated.

Working Pressure
2500 psi non-shock
cold water, oil, or gas

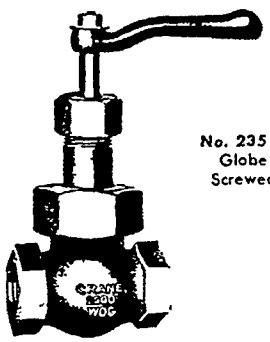
Test Pressure
3750 psi hydrostatic

No. 235 H Globe Valves are recommended for severe and extremely high pressure hydraulic service on lines not subject to shock, and on high pressure gas lines.

Body and disc: All sizes feature heavy metal sections. The body and disc are made of Crane Special Bronze, a leaded tin bronze having high strength and hardness and offering liberal resistance to wear. It conforms to requirements of ASTM B 61.

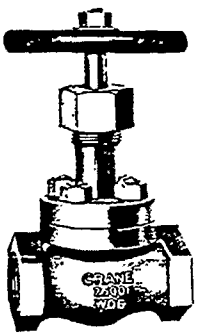
Union and bolted bonnet: Sizes 1¼-inch and smaller have a compact union bonnet. Sizes 1½ and 2-inch are equipped with a rugged inside screw, bolted bonnet and an O-ring rubber gasket set into a depression in the body joint. Both bonnet types provide a strong tight joint, yet are easy to dismantle and reassemble without danger of damaging the valve.

Disc-stem connection: In all sizes except the 1½-inch, the disc and stem are fastened together with a disc stem ring, as illustrated in the cross section. In 1½-inch valves, the disc and stem are fastened together with two disc pins.



No. 235 H Globe Screwed

Union bonnet and handle on sizes 1¼-inch and smaller.



Bolted bonnet and wheel on sizes 1½ and 2-inch.

Weights and Dimensions — Prices on Request

Size	No. 235 H	Dimensions, in Inches				
Inches	Pounds Each	End to end	Center to top, open	Center to end of handle	Diameter of wheel	Diameter of seat opening
⅜	3.0	2 13/16	6¼	3⅞	...	7/16
½	3.0	2 13/16	6¼	3⅞	...	7/16
¾	4.8	3 7/16	6¾	4¼	...	½
1	7.6	4	8¼	4⅝	...	11/16
1¼	12.0	4 11/16	10	5	...	15/16
1½	22.0	5½	10⅛	...	6	1⅛
2	32.0	6⅜	11½	...	7	1½

Lever handle or wheel: Sizes 1¼-inch and smaller have a lever handle; sizes 1½ and 2-inch have a Style D malleable iron wheel.

Stuffing box; repacking: The stuffing box is exceptionally deep and is filled with high grade packing. The valves, when wide open, can be repacked while under pressure.

For Higher Pressures and Temperatures—Use Crane Steel Valves

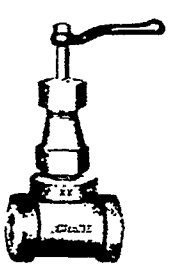
When globe and angle valves are required for hydraulic pressures higher than 2500 psi or for high pressure-high temperature lines, use dependable Crane Steel Valves. The complete line includes a wide range of sizes and types for all service conditions.



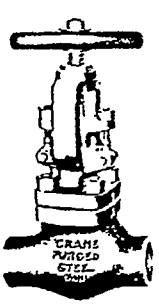
3000-Pound W.O.G. Steel No. 222 H Globe (page 136)

Especially desirable for the extremely high steam pressures and temperatures of modern industry are the Crane globe and angles featuring the Pressure-Seal or Lip-Seal type bonnet joint; refer to Section 15 for illustrations, dimensions, and complete description.

For detailed description of the full line of Crane Steel Globe and Angle valves of the conventional types, refer to Section 13.



6000-Pound Hydraulic Forged Steel No. 225 H, Globe (page 150)



600-Pound Forged Steel No. 3644 XW, Globe (page 139)

SECTION 5

Crane Bronze Check and Foot Valves

Names of Parts
Check Valves....page 46
Foot Valves....page 47

Lift Check Valves
100-Pound....page 47
125-Pound....page 48
150-Pound....pages 49 and 50
200-Pound....pages 51 and 52
300-Pound....page 53
2500-Pound Hydraulic....page 54
For Liquefied Petroleum Gases....page 49

Vertical Lift Check Valves
125-Pound....page 48

Swing Check Valves
125-Pound, Solder-Joint Ends....page 46
125-Pound, Screwed Ends....page 48
150-Pound....page 50
200-Pound....page 52
300-Pound....page 53

Foot Valves....page 47

5

For other bronze products, supplementing those indexed above, refer to:

Bronze gate valves....Section 3
Bronze globe and angle valves....Section 4
Bronze diaphragm valves....Section 16
Bronze safety and relief valves....Section 18
Bronze valves for marine service....Section 20

Bronze lever-operated quick-opening valves....pages 56 to 58
Bronze radiator valves....page 59
Bronze hose valves....pages 60 and 61
Bronze cocks and stops....pages 64 and 65
Bronze pressure regulators....pages 246 to 249

Use Crane steel valves for high pressure-temperature service

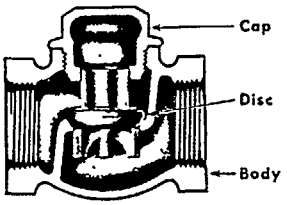
For pressures and temperatures that are beyond the scope of bronze or iron valves, and for unusually severe services, Crane manufactures a complete line of steel check valves. These valves offer top performance in tough service. They are available in a wide range of sizes and with screwed, flanged, butt-welding, or socket-welding ends.

For check valves of the conventional types, see Section 14; for Pressure-Seal and Lip-Seal Cap types, see Section 15.

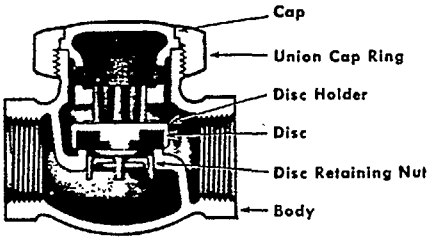
C&C06003832

Bronze Check Valves

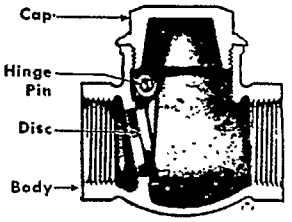
Names of Parts



No. 20
Horizontal Lift Check
With Bronze Disc
(see page 48)

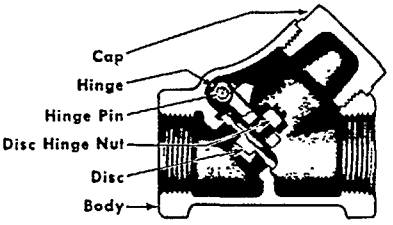


No. 27
Horizontal Lift Check
With Composition Disc
(see page 49)

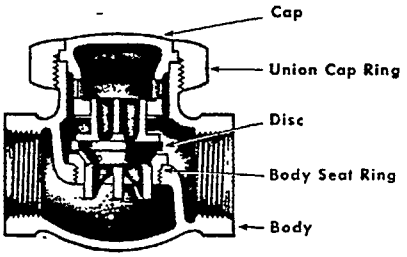


No. 34
Swing Check
With Bronze Disc
(see page 48)

5

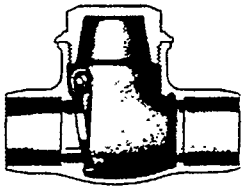


No. 36
Y-Pattern Swing Check
Regrinding Type
(see page 52)



No. 218
Horizontal Lift Check With
Metal Disc and Renewable Seat
(see page 51)

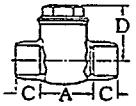
Bronze Solder-Joint Swing Check Valves



Cross Section



No. 1303
Swing Check
Solder-Joint Ends



Swing Check Valves may be used either in a horizontal position, or in a vertical position for upward flow.

Working Pressures

125 psi saturated steam
200 psi water, 200F

Recommendations: No. 1303 Valves are recommended for service on steam, hot water, and cold water lines. They are ideally suited for plumbing and heating systems and for low pressure service in industrial and process plants.

Important: When solder-joint valves are installed on steam lines, the solder used to make the joints must have a melting point high enough to withstand the temperature of the steam.

Weights and Dimensions

	Size Inches	Pounds Each	A Inches	C Inches	D Inches
No. 1303	½	.5	1⅜	13/16	1⅝
	¾	.9	111/16	1	1⅞
	1	1.4	21/16	1 1/16	2¼
	1¼	1.8	27/16	1⅛	2⅝
	1½	2.9	2⅞	13/16	2⅞
	2	4.6	3½	1⅜	3¼

Prices on Request

Body: The body is made of bronze conforming to requirements of ASTM Specification B62. Body ends comply with American Standard, B16.18-1950, for Cast Brass Solder-Joint Fittings.

Construction: The valves are strong and well proportioned; they will easily withstand normal operating strains. All parts are made of good quality materials, assuring dependable performance.

Larger sizes and higher pressure valves: When larger size valves or valves suitable for higher pressures are wanted, Crane screwed end valves with solder-joint adapters can be used.

Instruction tag: The valves are furnished with a tag giving special instructions for soldering.

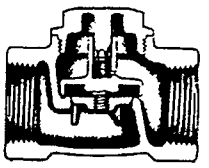
Solder-joint gate valves.....page 17
Solder-joint globe and angle valves.....page 30
Proper sizing of check valves.....page 427

100-Pound Bronze Lift Check Valves

Composition Disc

Working Pressure
150 psi non-shock cold water, oil, or gas
(including domestic gas service)

These valves may be converted to 100 psi saturated steam service by the user; simply replace the original disc with a No. 10 Disc; for discs, see page 281.



Cross Section
In sizes ¼ and ⅜-inch, the disc holder is guided at the top only (not shown).

Recommendations: These 100-pound bronze lift check valves combine wide utility with moderate cost. Sturdily constructed and well proportioned throughout, they are recommended for use on water, oil, and gas piping and equipment operating at pressures up to 150 psi. They are particularly suitable for domestic water and gas lines.

Construction: The valve body, made of bronze conforming to requirements of ASTM Specification B 62, features accurately cut threads and ample metal sections. Long, wide-faced hexagons at the pipe ends reinforce the openings and provide a good wrench grip.

Weights and Dimensions

	Size	Pounds	Dimensions, In.	
	Inches	Each	End to end	Center to top
No. 1246 Lift Check	¼	.3	1⅞	1⅛
	⅜	.5	2	1⅛
	½	.6	2⅜	1⅜
	¾	1.0	2¾	1½
	1	1.5	3¼	1¾
	1¼	2.2	3⅞	1⅞
	1½	3.2	4¼	2⅛
	2	5.5	5	2½

Prices on Request



No. 1246
Horizontal, Screwed

The seat is integral with the body. In sizes ½-inch and larger, the disc holder is guided at the top and bottom, as illustrated in the cross section at the upper right; in the ¼ and ⅜-inch sizes, the disc holder is guided at the top only.

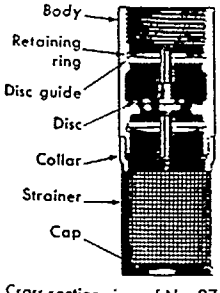
Composition disc: No. 1246 Valves are furnished with a No. 12 Disc, a high quality composition material well suited for the recommended services. For description and service recommendations of composition discs, see page 281.

Other low pressure bronze valves: Crane manufactures a complete assortment of bronze valves, with screwed and with solder-joint ends, suitable for a variety of low pressure services; for gate valves, see page 17; for globes and angles, see pages 29 and 30. For solder-joint swing checks, see page 46.

Extra composition discs.....page 281
Proper sizing of check valves....page 427

Bronze Foot Valves with Strainer

Working Pressure
200 psi non-shock cold water



Cross section view of No. 97 Foot Valve showing construction and names of parts.

No. 97 Foot Valves are recommended for use on water suction lines. They are entirely bronze, the body being made of bronze conforming to ASTM B 62. The disc is accurately guided at the top and bottom to assure square seating. The seat is integral with the body. The strainer is perforated sheet bronze with liberal area.

The valves are designed to slip through Standard Wrought Pipe, two sizes larger than the nominal valve size.

Proper sizing of foot valves....page 427

Weights and Dimensions

Size	No. 97	End to end	Valve passes through
Inches	Pounds Each	Inches	
½	.3	2⅝	1" pipe
¾	.4	3⅛	1¼" pipe
1	.6	4¼	1½" pipe
1¼	1.1	5¼	2" pipe
1½	1.6	6	2½" pipe
2	2.4	6⅝	3" pipe
2½	4.5	8⅜	3½" pipe
3	6.0	9⅝	4" pipe

Prices on Request



No. 97
Foot Valve
Screwed

603834

125-Pound Bronze Check Valves

Horizontal Lift Check

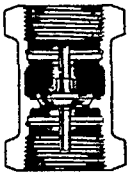


Cross Section



No. 20
Screwed

Vertical Lift Check



Cross Section



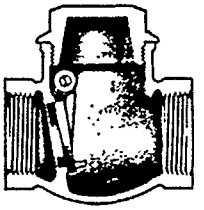
No. 29
Screwed

Federal Specification

The No. 20 and No. 34 Valves comply respectively to requirements for Type III and Type IV Valves, as covered in Federal Specification WW-V-51a for Class "A" 125-Pound Bronze Check Valves (for land use).

The No. 34½ also comply with WW-V-51a, Type IV requirements except the disc is composition.

Bronze Disc Swing Check

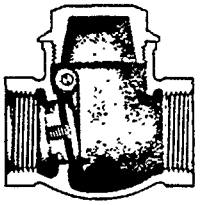


Cross Section



No. 34
Screwed

Composition Disc Swing Check



Cross Section



No. 34½
Screwed

Working Pressures (Non-Shock)

Type of Valve		Saturated Steam	Cold Water	Cold Oil or Gas
Lift Checks		125 psi	200 psi	200 psi
Swing Checks	No. 34	125 psi	200 psi	....
	No. 34½	....	200 psi	200 psi

Materials: Quality materials are used throughout. In all valves, the body is made of bronze conforming to ASTM Specification B 62.

Lift checks: Lift check valves are recommended for general service on steam, water, oil, and gas lines. In sizes ½-inch and larger, the valves have a bronze disc guided at the top and bottom, as illustrated in the cross sections; sizes ⅜-inch and smaller (No. 20 Valves only) have a stainless steel ball disc.

Installing the vertical check: The No. 29 Vertical Lift Check Valve is designed to operate on upward flow only. It should always be installed with the pressure below the seat and the inlet end down.

Swing checks: Except for their discs, the swing check valves illustrated above are identical.

The No. 34 has a bronze disc and is suitable for steam and water lines. The No. 34½ is furnished with a composition disc for use on water, oil, and gas lines.

Sizes 2-inch and smaller have an integral disc and hinge, as illustrated in the cross sections; in 2½ and 3-inch sizes (No. 34 Valves only), the disc swivels on the hinge. All sizes feature a disc stop which prevents the disc from sticking in the open position.

Installing swing checks: Swing check valves may be used in a horizontal position....or in a vertical position for upward flow.

Weights and Dimensions — Prices on Request

Size	Pounds, Each				Dimensions, in Inches					
	Lift Checks		Swing Checks		No. 20		No. 29		No. 34 or No. 34½	
Inches	No. 20 Horizontal	No. 29 Vertical	No. 34 Bronze Disc	No. 34½ Composition Disc	End to end	Center to top	End to end	Largest diameter	End to end	Center to top
⅛	.3	...	...	...	17/16	1	...	...	...	...
¼	.3	.3	...	...	1⅝	1⅛	2	1⅛	...	...
⅜	.4	.4	.4	.4	1⅞	1¼	2	1⅛	1⅞	1⅜
½	.6	.6	.6	.6	2¼	1⅜	2⅛	1¼	2¼	1⅝
¾	1.0	.8	1.0	.9	211/16	1⅝	2¼	1⅝	211/16	1⅞
1	1.7	1.4	1.7	1.5	33/16	1⅞	2⅞	1⅞	33/16	2¼
1¼	2.4	2.1	2.6	2.3	311/16	2¼	3¼	2⅜	311/16	2⅝
1½	3.2	2.8	3.6	3.0	4¼	2⅜	3⅝	2⅝	4¼	2⅞
2	6.0	4.8	6.0	5.0	5⅛	2⅞	3⅞	3¼	5⅛	3¼
2½	9.0	8.1	8.5	...	61/16	3⅜	4⅞	3⅞	61/16	4
3	14.0	12.0	14.0	...	71/16	3¾	53/16	4¾	73/16	4⅜

Bronze Solder-Joint Swing Check Valves....page 46

Proper sizing of check valves....page 427

150-Pound Bronze Lift Check Valves

(And 400-Pound W. O. G. Valves for LP-Gases)

Compact, dependable lift checks for saturated steam, water, oil, and gas .... including the Crane No. 132, Underwriters' Approved for liquefied petroleum gases

These valves offer top efficiency in the services for which they are recommended. The No. 27 and 132 have a composition disc and are ideal where discs must be renewed quickly. Their disc holder is guided above and below the seat in sizes ½-inch and larger; in smaller sizes, it is guided in the cap only (not illustrated). No. 31 Valves have a stainless steel ball disc.

Quick disc repairs: A leak is easily remedied in composition disc valves. Simply replace the disc holder with an extra complete holder and disc . . . or insert a new disc into the original holder. A supply should be kept on hand for this purpose.

No. 27: No. 27 Valves have a No. 1 Cranite Disc and are recommended for saturated steam service, or for hot water from 200 F to 300 F. The body and cap are bronze (ASTM B 62). Sizes 2-inch and smaller have a union cap, as shown at the upper right; sizes 2½ and 3-inch have a compact bolted cap, as shown at the left. Both types provide a strong, tight joint, easily dismantled for cleaning or disc replacement.

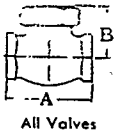


No. 27 Valves in sizes 2½ and 3-inch have a bolted cap

Federal Specification: No. 27 Valves comply with Federal Specification WW-V-51a for Class "B" 150-Pound Bronze Valves, Type III (for land use).

No. 31: No. 31 Valves have a stainless steel ball disc and are used on saturated steam, water, oil, or gas lines. The body and cap are bronze (ASTM B 62). The union cap provides a tight joint, easily dismantled when necessary. When sizes ⅜-inch and smaller are needed, use No. 20 Valves shown on the facing page.

No. 132: No. 132 Valves are equipped with a No. 6 Composition Disc. The body is made of Crane Special Bronze, a leaded tin bronze conforming to ASTM B 61. The union cap provides a tight joint, easily dismantled when necessary. The No. 6 Disc, a specially formulated composition ideal for petroleum usage, is secured to the disc holder by means of a disc retaining nut. To protect against leakage on light oils and gases, the disc is sealed into the holder.



All Valves

Service recommendations for the No. 132 are explained in detail at the lower right.

Weights and Dimensions — Prices on Request

Size	Pounds, Each			Dimensions	
	No. 27 With No. 1 Cranite Disc	No. 31 With Metal Ball Disc	No. 132 With No. 6 Composition Disc	A	B
Inches				Inches	Inches
¼	.5	Use No. 20 on page 48.	.6	2	1⅜
⅜	.8		.8	2 5/16	1½
½	1.1	1.1	1.3	2 11/16	1¾
¾	1.9	1.8	2.0	3 3/16	2
1	2.8	3.0	2.9	3¾	2¼
1¼	4.1	....	4.8	4¼	2⅝
1½	5.8	....	6.0	4¾	3
2	10.0	....	10.3	5¾	3½
2½	16.0	....	..	6¾	3½
3	22.5	....	..	8	3⅞

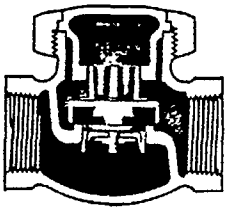
Other bronze valves for LP-gases.....Gate, page 24.....Globe and Angle, page 37
Composition discs....page 281 Proper sizing of check valves....page 427

150-Pound Valves With No. 1 Cranite Disc

150 psi saturated steam



No. 27
Horizontal, Screwed



Sizes ¼ to 2-inch have a union cap, as shown above; sizes 2½ and 3-inch have a bolted cap.

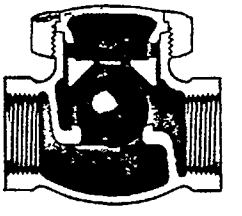
5

150-Pound Valves With Metal Ball Disc

150 psi saturated steam
300 psi non-shock cold water, oil, or gas



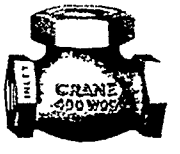
No. 31
Horizontal, Screwed

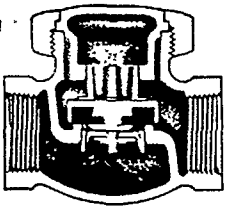


LP-Gas Valves With No. 6 Composition Disc

400 psi non-shock cold water, oil, gas, air, LP-gases, and volatile fluids

Underwriters' Approved for LP-Gases*





No. 132, Horizontal, Screwed

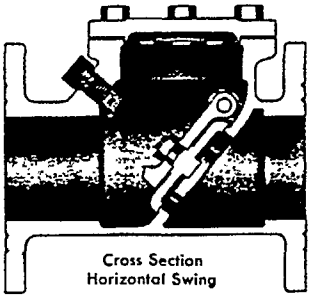
No. 132 Valves are given a hydrostatic test at 600 psi and are also air tested. The valves, within the limits of the ratings specified above, are designed for safe handling of liquefied petroleum gases and are excellent for use on cold water, oil, gas, compressed air, light oils, volatile fluids, etc.

*No. 132 Valves have been approved by the Underwriters' Laboratories, Inc. (and are so marked) for the handling of all LP-gases such as butane, propane, propylene, butylenes, etc., provided the piping system is subject to a pressure no greater than 250 psi. Gases can be handled separately or mixed, and in the liquid or gaseous state.

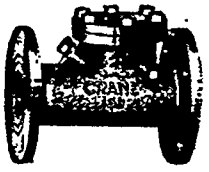
150-Pound Bronze Check Valves

Bolted Cap

Swing Check



Cross Section
Horizontal Swing



No. 4033
Horizontal Swing, Flanged

Swing Check Valves may also be used in a vertical position for upward flow. Whether used horizontally or vertically, the valves should be installed with the pressure under the disc; an arrow cast on the body indicates correct direction of flow.

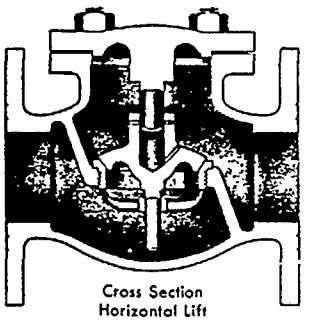
Working Pressures		Hydrostatic Test Pressure
Steam 550 F	Cold Water, Oil, or Gas Non-Shock	
150 psi	225 psi	450 psi

Recommendations: These high quality valves are recommended for use wherever rugged, bolted cap bronze checks are needed. They are particularly suitable for use on large pipe lines. The valves are liberally proportioned to withstand severe operating strains; their bolted cap construction makes an exceptionally tight, strong, and serviceable joint.

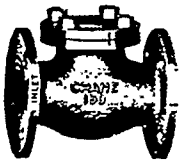
Swing check: The No. 4033 swing check valves have a body, cap, disc, and hinge made of Crane Special Bronze, a strong, hard, leaded tin bronze having good resistance to wear. Crane Special Bronze conforms to requirements of ASTM Specification B 61.

The valves can be reground without removing the body from the line. By removing the stop plug, a screw driver can be engaged with the slot in the disc spud, making it easy to rotate the disc when regrinding.

Lift Check



Cross Section
Horizontal Lift



No. 4063
Horizontal Lift, Flanged

For proper sizing of lift and swing check valves, see page 427.

Lift check: As in the swing check valve, the No. 4063 lift checks have a body, cap, and disc made of Crane Special Bronze conforming to ASTM Specification B 61. The body seat ring is also Crane Special Bronze.

End flanges: The dimensions and drilling of end flanges conform to the American Standard (B 16.24-1953) for 150-Pound Bronze Flanges. The flanges are plain faced, with two V-shaped concentric grooves between the port and the bolt holes. Flanged valves are regularly furnished faced and drilled (F & D); they can be furnished faced only, when specified. Full face gaskets should be used, see page 321.

Weights and Dimensions — Prices on Request

Valve Flanged F & D	Size Inches	Pounds Each	Face to face Inches	Center to top Inches	Diameter of flanges Inches	Thickness of flanges Inches
No. 4033, Swing	3	37	9⅛	5	7½	⅝
	4	68	11¼	6½	9	11/16
No. 4063, Lift	Information on request					

Valves for Marine Service....page 230 *Templates for drilling....page 326*

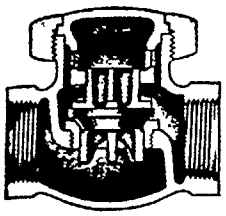
For better threaded and flanged joints . . . Crane Thread Lubricant

Crane Thread Lubricant is the "sure" way to make tighter and better threaded and flanged joints on steam, water, and gas piping. It's a versatile lubricant . . . . use it on Cranite or corrugated metal gaskets . . . . use it on bronze, copper, iron, or steel as well as on alloys such as stainless steel, Monel, nickel, etc. . . . use it at temperatures up to 500 F. The lubricant always spreads easily; it will not separate or harden, regardless of age. A high degree of lubrication is assured; joints are made up "tight" yet are easy to "break" when necessary. For complete details, see page 324.



200-Pound Bronze Lift Check Valves

With Monel Disc

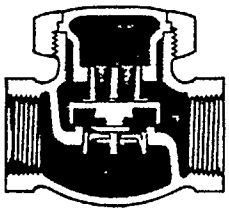


Cross Section
No. 218

Valve		Working Pressures, Non-Shock		Hydrostatic Test Pressure
		Steam	Cold Water, Oil, Gas, or Air	
No. 218		200 psi, 550 F	400 psi	600 psi
No. 239 C	No. 4 Disc—regular	200 psi, 450 F	*	600 psi
	No. 6 Disc—optional	...	400 psi	600 psi

*No. 239 C with a No. 4 Cranite Disc may also be used for hot water up to 400 psi at temperatures over 200 F up to 420 F.

With Composition Disc



Cross Section
No. 239 C

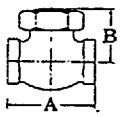
5



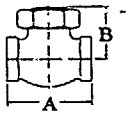
No. 218
Horizontal Lift
Screwed



No. 239 C
Horizontal Lift
Screwed



Monel
Seat and Disc
Union Cap
Construction



No. 4 Cranite
or, if specified,
No. 6 Composition Disc
Union Cap Construction

These are unusually strong and rugged valves. They are liberally proportioned and will withstand severe operating strains. Corresponding dimensions of the valves are the same.

Both valves have a body made of Crane Special Bronze, a strong, hard, leaded tin bronze conforming to requirements of ASTM Specification B61. The union cap construction facilitates dismantling and reassembling for cleaning and maintenance purposes.

Monel disc valves: The No. 218 are recommended where operating conditions require a high quality metal disc and seat. They are suitable for severe service on steam, water, oil, or gas lines.

The disc and seat are made of Monel, a seating material that resists wear and corrosion exceptionally well. The disc is guided from above and below the seat, assuring accurate seating at all times.

Composition disc valves: The No. 239 C are recommended for a wide range of fluids when equipped with the proper type of disc. They are especially suitable for installations where the discs must be renewed quickly and easily.

The valves are regularly equipped with a No. 4 Cranite Disc suitable for high pressure steam up to 450 F, and for hot water at 200 to 420 F.

Weights and Dimensions — Prices on Request

Size	Pounds, Each		Dimensions, in Inches			
	No. 218	No. 239 C	No. 218		No. 239 C	
Inches	Monel Disc	Composition Disc	A	B	A	B
¼	...	.5	...	...	2	1½
⅜	...	.8	...	...	2 5/16	1½
½	1.1	1.2	2 11/16	1¾	2 11/16	1¾
¾	2.0	2.0	3 3/16	2	3 3/16	2
1	3.0	3.0	3¾	2¼	3¾	2¼
1¼	4.0	4.4	4¼	2¾	4¼	2¾
1½	5.5	6.5	4¾	3	4¾	3
2	11.0	12.0	5¾	3½	5¾	3½

Extra composition discs.....page 281
Proper sizing of check valves....page 427

When ordered for water (up to 200 F), oil, gas, gasoline, or air, the valves are furnished with a No. 6 Disc. When ordered for air service, the valves are air tested.

For service recommendations, description, and dimensions of composition discs, see page 281

Composition disc valves have a bronze disc holder guided from above and below the seat on sizes ½-inch and larger, as illustrated in the cross section; in smaller sizes, the holder is guided in the cap only.

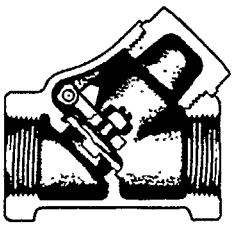
Quick repairs: A leak is quickly repaired on composition disc valves. Simply replace the disc holder with an extra complete disc holder and disc . . . . or insert a new disc into the original holder.

Extra disc holders and discs should be kept on hand for this purpose.

200-Pound Bronze Check Valves

Regrinding

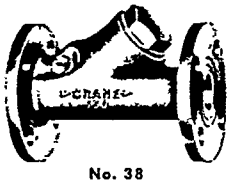
Y-Pattern Swing Check



Cross Section Swing Check



No. 36
Horizontal Swing
Screwed



No. 38
Horizontal Swing
Flanged

Valve Ends	Working Pressures		Hydrostatic Test Pressures
	Steam	Cold Water, Oil, or Gas	
	550 F	Non-Shock	
Screwed	200 psi	400 psi	600 psi
Flanged	150 psi	225 psi	450 psi

Swing check valves: The No. 36 and No. 38 are ruggedly constructed valves recommended for severe service on steam, water, oil, or gas lines. Their Y-pattern design is a marked improvement over conventional, regrinding type swing check valves. The body, made of Crane Special Bronze, a strong, hard, leaded tin bronze conforming to ASTM B61, features full area and smooth interior contours. Pressure drop and flow resistance are reduced to a minimum.

The cap and all internal parts are bronze. The pressure-tight, easy seating disc has a threaded spud which passes through a hole in the lower end of the hinge; a disc nut, screwed onto the spud, retains the parts. The hinge and disc swing freely out of the path of flow. A hinge bumper prevents the disc from sticking in the open position.

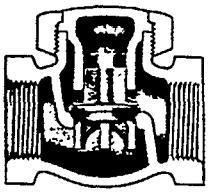
All parts are readily accessible and can be quickly replaced in the field. The valves may be reground without removing the body from the line. A slot in the end of the disc-spud enables rotating the disc with a screw driver.

Installation: Swing check valves may be used horizontally . . . . or in a vertical position for upward flow. In either position, they should be installed with the pressure under the disc. An arrow cast on the body indicates the correct direction of flow.

Flanged valves: The dimensions and drilling of end flanges conform to the American Standard (B16.24-1953) for 150-Pound Bronze Flanges. The flanges are plain faced, with two V-shaped concentric grooves between the port and the bolt holes.

Flanged valves are regularly furnished faced and drilled (F&D); Faced only valves can be furnished when specified. Full face gaskets should be used; see page 321.

Lift Check



Cross Section Lift Check



No. 72
Horizontal Lift
Screwed

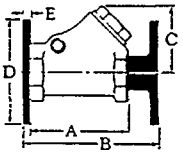
Lift check valves: The No. 72 are sturdily constructed horizontal lift check valves made of high grade materials and designed for long service. They are recommended for severe service on steam, water, oil, or gas lines.

All parts are bronze, the body being made of Crane Special Bronze (ASTM B61), a leaded tin bronze that resists wear exceptionally well. The union cap construction simplifies dismantling and reassembling the valves for cleaning or regrinding.

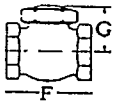
On sizes ½-inch and larger, the disc is guided at the top and bottom as illustrated at the upper right of the page; on the ¼ and ⅜-inch sizes, the disc is guided at the top only.

The valves can be reground without removing the body from the line.

Weights and Dimensions — Prices on Request



Swing Checks



Lift Check

Size	Pounds, Each			Dimensions, in Inches							
	No. 36 Swing	No. 38 Swing	No. 72 Lift	No. 36		No. 38				No. 72	
Inches	Screwed	Flanged F & D	Screwed	A	C	B	C	D	E	F	G
¼	.6	.	.3	2⅛	1½	.	.	...	...	1 11/16	1
⅜	.6	...	.5	2⅛	1½	.	.	...	...	1 15/16	1⅛
½	.9	...	.8	2½	1¾	...	.	...	.	2¼	1¼
¾	1.4	...	1.4	3	2⅛	...	.	...	..	2¾	1½
1	2.4	4.9	2.0	3¾	2½	5⅜	2½	4¼	⅜	3 5/16	1¾
1¼	3.6	7.0	3.1	4¼	3	6	3	4⅝	13/32	3⅞	2
1½	5.6	10.0	4.6	5	3½	6¾	3½	5	7/16	4½	2¼
2	11.3	14.3	8.0	6	4¼	8	4¼	6	½	5¼	3⅜
2½	14.5	23.0		6⅞	5	9¼	5	7	9/16		
3	23.0	29.0		8⅛	6	10⅜	6	7½	⅝		

Valves for Marine Service, see page 230.

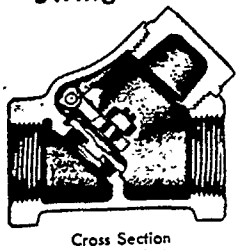
Templates for drilling . . . . page 326

Proper sizing of check valves . . . . page 427

300-Pound Bronze Check Valves

Regrinding

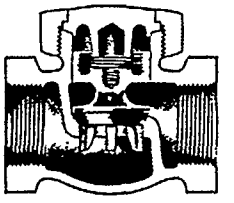
Y-Pattern Swing Check



Cross Section
Horizontal Swing

Sizes	Working Pressures		Hydrostatic Test Pressures
	Steam	Cold Water, Oil, or Gas	
Inches	550 F	Non-Shock	
¼ to 2	300 psi	1000 psi	1500 psi
2½ and 3	300 psi	600 psi	900 psi

Lift Check

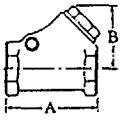


Cross Section
Horizontal Lift

Y-pattern swing check valves featuring full area body design. . . . rugged lift check valves with piston type disc for smooth operation



No. 76 E
Horizontal Swing
Screwed



Swing check valves: No. 76 E are heavy, ruggedly constructed swing check valves recommended for severe service on steam, water, oil, or gas lines. Their Y-pattern design is considerably superior to that of conventional regrinding type swing check valves.

The cap and all internal parts are made of bronze. The body is made of Crane Special Bronze, a hard, leaded tin bronze conforming to requirements of ASTM B61. The body design features full area and smooth interior contours; pressure drop and flow resistance are reduced to a minimum.

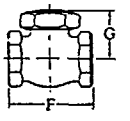
The pressure-tight, easy-seating disc has a threaded spud which passes through a hole in the lower end of the hinge; a disc nut, screwed onto the spud, retains the parts. A hinge bumper prevents the disc from sticking in the open position. All parts are readily accessible and can be quickly replaced in the field.

The valves may be reground without removing the body from the line. A slot in the end of the disc-spud enables rotating the disc with a screw driver.

Proper installation of swing checks: Swing check valves may be used in a horizontal position . . . . or in a vertical position for upward flow. Whether used horizontally or vertically, the valves should be installed with the pressure under the disc; an arrow cast on the valve body indicates the correct direction of flow.



No. 366 E
Horizontal Lift
Screwed



No. 366 E Valves feature a piston type disc and are excellently used in services where line pulsations may cause ordinary check valves to hammer. In the Crane design, the dashpot formed above the disc provides an effective cushion.

Weights and Dimensions — Prices on quest

Size	Pounds, Each		Dimensions in Inches			
	No. 76 E Swing Check	No. 366 E Lift Check	No. 76 E		No. 366 E	
Inches	Screwed	Screwed	A	B	F	G
¼	.6	.4	2¼	1½	1 13/16	1
⅜	.6	.6	2¼	1½	2	1⅛
½	1.0	.9	2⅝	1¾	2½	1⅜
¾	1.6	1.5	3⅛	2⅛	2 15/16	1⅞
1	2.7	2.6	3⅞	2½	3½	2
1¼	4.2	4.2	4½	3	4 1/16	2⅜
1½	6.0	5.4	5⅛	3½	4⅝	2⅝
2	10.0	10.8	6⅜	4¼	5¾	3¼
2½	16.3	15.6	7⅛	5	6⅞	3⅞
3	25.0	24.0	8⅜	6	8	4½

Valves for Marine Service.....page 230
Proper sizing of check valves....page 427

Lift check valves: No. 366 E Horizontal Lift Check Valves are recommended for steam, water, oil, or gas, and especially for service where pulsations in the line are apt to cause an ordinary check valve to hammer. The dashpot formed above the piston type disc effectively cushions the disc.

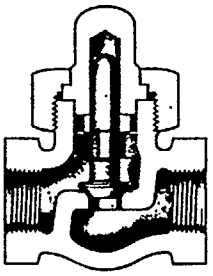
The body and disc are Crane Special Bronze, a leaded tin bronze (ASTM B61) that resists wear exceptionally well.

These valves can be reground without removing the body from the line. To facilitate regrinding, the top of the disc is tapped with pipe threads so that a nipple can be inserted.

On special order, the valves can be equipped with a spring above the disc to keep the valve normally closed when used on air or gas.

003840

2500-Pound Hydraulic
Bronze Lift Check Valves

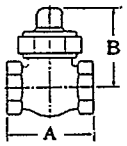


Cross Section

5



No. 237 H
Horizontal Lift
Screwed



Working Pressure
2500 psi non-shock cold water, oil, or gas

Test Pressure
3750 psi hydrostatic

Recommendations: Crane Hydraulic Bronze Lift Check Valves are recommended for severe high pressure hydraulic service on lines not subjected to shock, and for high pressure gas lines.

Materials: All parts are made of Crane Special Bronze, a strong, hard, leaded tin bronze having excellent resistance to wear. This metal conforms to requirements of ASTM Specification B 61.

Construction: The valves are exceptionally heavy and rugged. The top of the disc fits snugly in the valve cap, guiding the disc accurately and forming a dashpot that effectively cushions the action of the valve while in service.

The union cap construction provides a strong, tight joint, easily dismantled or reassembled when necessary for purposes of cleaning or repairing the valve.

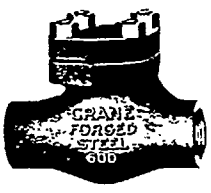
Seat opening: The diameter of the seat opening in the valves is slightly larger than the inside diameter of Double Extra Strong Pipe.

Weights and Dimensions — Prices on Request

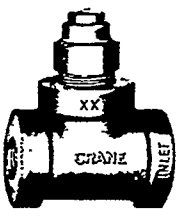
	Size	Pounds	Dimensions, in Inches		
	Inches	Each	A	B	Diameter of seat opening
No. 237 H Horizontal Lift Check Screwed	3/8	2.0	2 13/16	2 3/4	7/16
	1/2	2.0	2 13/16	2 3/4	7/16
	3/4	3.5	3 7/16	3 1/4	1/2
	1	6.0	4	4	11/16
	1 1/4	9.0	4 11/16	4 1/2	15/16

For Higher Pressures and Temperatures — Use Crane Steel Valves

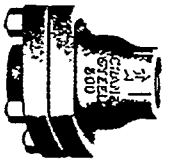
The Crane line of bronze check valves shown in this section is supplemented by a wide assortment of steel check valves designed for severe services and for pressures and temperatures beyond the scope of bronze valves. Steel check valves for industrial service are shown in Section 14 (conventional types) and Section 15 (Pressure-Seal and Lip-Seal types). Valves intended particularly for marine service are shown in Section 20.



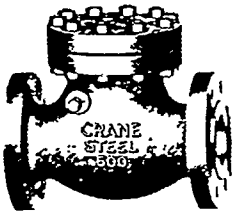
600-Pound Forged Steel
Horizontal Lift Check
No. 3674 X (Page 152)



6000-Pound Hydraulic Forged
Steel Horizontal Lift Check
No. 227 H (Page 160)



600-Pound Cast Steel
Ball Check
No. 3692 XS (Page 153)



600-Pound Cast Steel
Horizontal Swing Check
(Pages 154 and 158)

003841 55
81 2506

SECTION 6

Crane Bronze Quick-Opening, Butterfly, Radiator, and Hose Valves

Quick-Opening Valves
Globe, 125-Pound.....page 56
Globe, 150-Pound.....page 57
Gate, 125-Pound.....page 58

Butterfly Valves.....page 58

Radiator Valves
Angle, 150-Pound Government Pattern.....page 59
Angle, 200-Pound.....page 59
Globe, 200-Pound.....page 59

Hose Valves
Hose Gate, 200-Pound.....page 60
Hose Gate, 300-Pound.....page 60
Hose Gate, Underwriters' Pattern.....page 60
Garden Hose.....page 61
Chicago Hose.....page 61
Angle Hose.....page 61

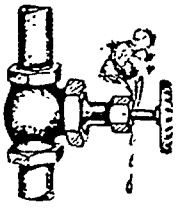
Hose Threads.....page 62

6

For quick-opening iron valves refer to:
Iron body quick-opening clamp gate valves.....pages 70 and 71
Ferrosteel quick-opening wedge gate valves.....page 78
Iron body quick-opening pulp stock valves.....page 85
Alloy iron quick-opening pulp stock valves.....page 85
Iron body butterfly valves.....page 99

Leaky valve stuffing boxes are easily remedied!

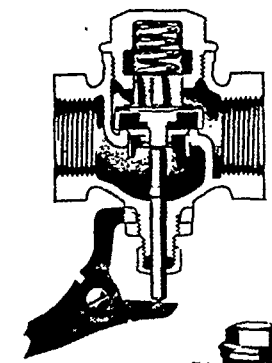
A slight stuffing box leak, if left unattended, gets larger and larger . . . . and eventually can cause serious damage to valve parts. More important, waste of fuel, power, or fluid is surprisingly great . . . . often, in a few months of leakage, many times the cost of the valve itself.



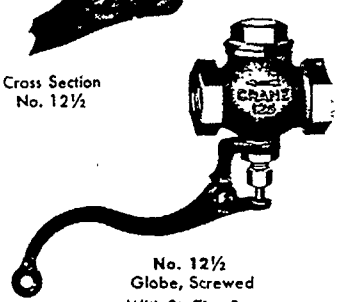
The remedy is generally simple. Since packing wears gradually as it is subjected to service, it is only necessary to slightly tighten the packing nut or gland the moment a leak becomes apparent. And when new packing is necessary, most Crane valves can be repacked when wide open and under pressure

125-Pound Bronze Globe Valves
Quick-Opening—Self-Closing

Composition Disc



Cross Section
No. 12½



No. 12½
Globe, Screwed
With Stuffing Box

Working Pressures

Composition Disc Valves
125 psi air or gas, **150** F
(Air Tested)

125 psi saturated steam
(when furnished with No. 1 Disc)

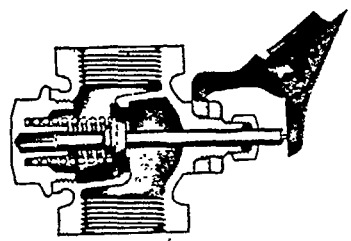
Bronze Disc Valves
125 psi saturated steam

Recommendations

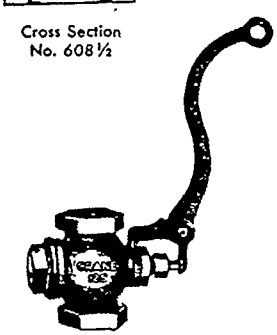
The No. 12½ Valves, as regularly furnished, are air tested and are recommended for air or gas up to 150 F. When equipped with a No. 1 Disc, they are suitable for saturated steam. The valves are ideally suited for cooking vats, soot blowers, can and bottle sterilizers, and similar services.

The No. 608½ Valves are recommended for general industrial service on steam lines only. They are used to control flow to small apparatus such as steam presses, laundry machinery, can and bottle sterilizers, etc.; they are often installed with whistles.

Bronze Disc



Cross Section
No. 608½



No. 608½
Globe, Screwed
With Stuffing Box

Materials and construction: The body of the No. 12½ Valve and the body, disc, and cap of the No. 608½ are made of bronze conforming to ASTM Specification B 62. The disc holder in the No. 12½ is also bronze. Both valves have a stainless steel spring.

The valves have a malleable iron lever which can be turned to any desired position by loosening the locknut which holds the bracket to the valve body. A steel pin, inserted into the end of the stem, provides a long wearing contact between the stem and the lever.

Stuffing box: A stuffing box around the stem, amply deep and filled with high grade packing, assures protection against leakage of fluid. This feature makes the valves well suited for use in confined spaces and in installations requiring valves that will not leak at the stem under constant service.

Easy, quick operation: The valves are easily operated. A short pull on the lever lifts the disc from its seat and opens the valve. When the lever is released, the spring above the disc automatically closes the valve.

Operation of larger size No. 608½ Valves used with whistles is facilitated when the pull of the lever is at right angles to the center line of the whistle.

Installation: Always install these valves with the pressure above the disc. An arrow cast on the body indicates the correct direction of flow.

Weights and Dimensions — Prices on Request

Valve Type	Size	Pounds	Dimensions, in Inches			
			End to end of body	Center of port to end of cap	Center of port to end of lever, open	Center of stem to end of lever, closed
	Inches	Each				
No. 12½ Composition Disc	¼	.9	2⅛	1½	3¾	3⅜
	⅜	1.0	2⅜	1⅝	3¾	3⅜
	½	1.4	2¾	1¾	5⅛	4¼
	¾	2.1	3¼	2	5⅛	5⅝
	1	3.2	3¾	2¼	6⅞	6⅜
	1¼	4.5	4¼	2½	8¾	8⅛
	1½	6.8	5	3	9½	8¼
No. 608½ Bronze Disc	⅜	.8	1⅞	1¼	3⅝	3¼
	½	1.1	2 3/16	1⅜	5¼	3⅞
	¾	1.8	2⅝	1¾	5⅜	5⅝
	1	2.8	3⅛	2	7¾	6⅜
	1¼	4.0	3⅝	2⅛	8¾	8⅛
	1½	5.0	4 1/16	2⅝	9½	8⅛
	2	8.3	4 15/16	2⅞	12⅝	9¾

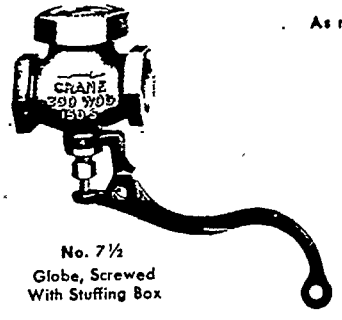
For extra composition discs for No. 12½ Valves, see page 281.

Composition discs: No. 12½ Valves are regularly furnished with a No. 6 Disc suitable for air or gas. When ordered for saturated steam, they will be furnished with a No. 1 Granite Disc.

For description, service recommendations, and dimensions of composition discs, see page 281

150-Pound Bronze Globe Valves

Quick-Opening — Self-Closing

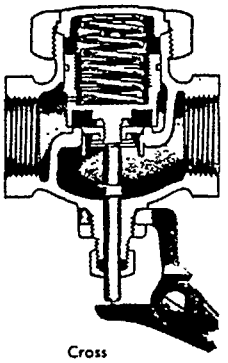


Working Pressures

As regularly furnished (with No. 6 Disc), valves are suitable for:
200 psi water.....200 F
200 psi light oils, gasoline, gas, or air....150 F
Air Tested

If ordered with No. 1 Disc, valves are suitable for:
150 psi.....saturated steam
200 psi water..200 to 300 F

Composition disc valves suitable for a variety of quick-opening services when equipped with the proper disc.


Cross Section

6

Recommendations: No. 7½ Quick-Opening Globe Valves, as regularly furnished, are air tested and are recommended for water up to 200 F, and for light oils, gasoline, air, and gas up to 150 F.

When so ordered, the valves can be furnished with a No. 1 Cranite Composition Disc suitable for saturated steam, and for hot water from 200 to 300 F.

The valves are widely used on gasoline and oil loading racks, public showers, and in other services where high quality quick-opening, self-closing globe valves are needed. Valves for heavy oil service can be furnished when desired; information will be furnished on request.

Materials: The body and disc holder are made of quality bronze conforming to ASTM B62. The cap, union cap ring, and the stem also are bronze. The bracket and opening lever are malleable iron. The spring is stainless steel.

Construction: The valves are ruggedly constructed throughout. They have a union cap ring which permits easy dismantling and reassembling for inspection, cleaning, or replacement of the disc.

The stuffing box around the stem is amply deep, is filled with non-friction packing, and is large enough to remain pressure-tight when the valve is open. A steel pin, inserted in the end of the stem, provides a long wearing contact between the stem and lever.

Weights and Dimensions — Prices on Request

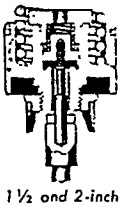
Size	No. 7½ Screwed	Dimensions, in Inches			
		End to end of body	Center of port to top of cap	Center of port to bottom of lever, open	Center of stem to end of lever, closed
Inches	Pounds Each				
½	1.6	2¾	1¾	5¼	4¼
¾	2.4	3¼	2	5½	5⅝
1	3.8	3¾	2¼	7⅜	6⅜
1½	8.0	4¾	3	10	8¼
2	13.3	5¾	3½	12⅝	9½

For extra composition discs, see page 281.

The top of the disc holder is piston shaped and is equipped with a piston ring. It fits snugly into the upper part of the valve body, forming a dashpot that effectively cushions the disc when closing, preventing hammering and destructive shock.

Operation: The valves are easily operated. A short pull on the lever lifts the disc off its seat, opening the valve. When the lever is released, the spring above the disc automatically closes the valve.

Pilot valve on 1½ and 2-inch: Sizes 1½ and 2-inch have a pilot valve in the main valve, as shown in the inset illustration. When the valve is operated, the pilot valve opens first, equalizing the pressure around the main disc, thereby assuring easy operation.


1½ and 2-inch sizes have a pilot valve.

The pilot valve disc is also a composition material, having the same characteristics as the main valve disc; it is loaded for closing with a stainless steel spring.

Orders for extra pilot valve discs should indicate the service.

Composition discs: Unless otherwise ordered, these valves are furnished with a No. 6 Disc suitable for 200 psi water at temperatures up to 200 F and for 200 psi light oils, gasoline, gas, or air at temperatures up to 150 F. Valves equipped with a No 6 disc are regularly air tested.

When ordered for saturated steam service, or for hot water at temperatures from 200 to 300 F, the valves are furnished with a No. 1 Cranite Disc.

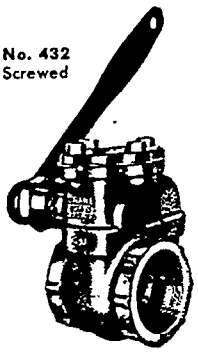
For description, service recommendations, and dimensions of composition discs, see page 281.

Installation: These valves always should be installed so that the pressure is above the disc. An arrow cast on the body indicates the correct direction of flow.

Shock: Quick-opening valves used on liquid lines may produce shock; for details, see page 14.

125-Pound Bronze Gate Valves

Quick-Opening — Cam Action



No. 432
Screwed

Underwriters' Approved for hazardous liquids*

The No. 432 are bronze quick-opening; cam action gate valves designed for dependable performance on saturated steam, water, oil, gas, or air lines.

*All sizes have been approved by the Underwriters' Laboratories, Inc., for hazardous liquid service at pressures not exceeding 50 psi; this is the maximum pressure prescribed by the Underwriters' for such hazardous liquid equipment.

Working Pressures

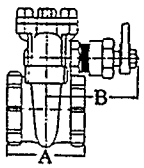
Size (Inches)	Saturated Steam	Cold Water, Oil, Gas, Air Non-Shock
½ to 2	125 psi	200 psi
2½ and 3	100 psi	100 psi

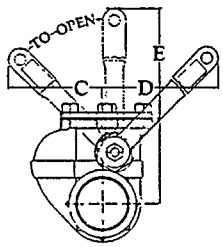
Air Tested

Body: The body is made of bronze conforming to requirements of ASTM Specification B 62.

Construction: The solid wedge disc is operated by means of a quick-opening lever through a specially designed cam arrangement. Fast, positive valve action is assured. Sizes 1-inch and smaller have a screwed cap (not illustrated); larger sizes have a bolted cap, as illustrated.

Operation: To insure proper seating in the closing phase, *operate the lever with a snappy action and plenty of force.* The disc will not jam; nor is there any danger of damage to the parts since the valve is designed to withstand vigorous operation.





Weights and Dimensions — Prices on Request

	Size (Inches)	Weight (Pounds Each)	Dimensions, in Inches A	B	C	D	E
No. 432 Gate	½	1.6	1⅞	2¾	3	2⅛	5⅜
	¾	2.3	2⅛	2⅞	3¼	3⅛	6¼
	1	3.3	2½	3⅛	3½	4	6¾
	1¼	4.4	2¾	3½	4⅝	5½	8⅝
	1½	5.8	2⅞	3⅞	5⅜	6⅜	9⅞
	2	9.4	3⅜	4¼	6⅜	7⅝	12
	2½	19.5	4	4⅞	7½	8¾	13⅞
	3	28.5	4¼	5⅜	8⅛	10	15⅝

Prevent water hammer: Sudden closure of valves used in liquid lines frequently can cause "water hammer".

When severe, water hammer must be eliminated by installing a suitable cushioning device in the line. Otherwise, resulting shock might damage both valves and piping; see page 14 for detailed explanation.

Bronze Butterfly Valves

Working Pressures
125 psi saturated steam
200 psi non-shock cold water, oil, or gas

These durably constructed bronze butterfly valves provide easy, smooth operation in approximately one-quarter turn from the wide-open to closed position. They are not designed to close pressure-tight and, therefore, should be used only to control or regulate flow.

The body and disc are made of good quality bronze which conforms to requirements of ASTM Specification B 62. The stem is of ample diameter; it is made of corrosion-resisting Exelloy (an AISI Type 416 stainless steel) in sizes 1½-inch and smaller and is steel, nickel-plated in the 2-inch size.



Cross section of No. 44 Valve with disc in a partly opened position

Weights and Dimensions — Prices on Request

	Size (Inches)	Weight (Pounds Each)	Dimensions, in Inches End to end	Center to top	Center to bottom	Over-all height	Diameter of stem
No. 44 Butterfly Valve	1	1.1	2 9/16	3¼	1⅜	4⅝	5/16
	1¼	1.6	2¾	3⅝	1⅝	5¼	⅜
	1½	2.1	2 15/16	3⅝	1¾	5⅜	⅜
	2	3.8	4 1/16	4⅞	1⅞	6¾	½

Iron Body Butterfly Valves....page 99



No. 44
Butterfly
Screwed

Bronze Radiator Valves

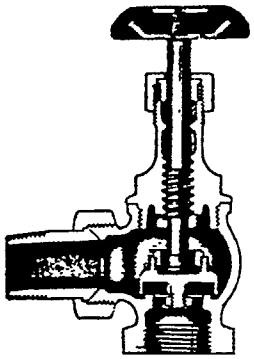
150-Pound Government Pattern Composition Disc

Working Pressures

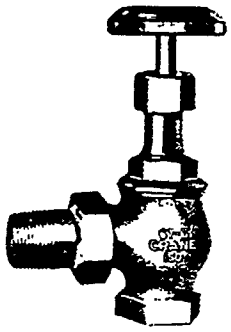
150-Pound Valves With No. 1 Cranite Disc	200-Pound Valves With Metal Disc
150 psi.....saturated steam.....200 psi	

When ordered for hot water service (up to 200 F), the 150-pound valves are furnished with a No. 6 Disc.

200-Pound Union Bonnet Metal Disc



Angle—Cross Section



Angle
No. 67 G, with Wheel
*No. 68 G, with Lock Shield

*Not illustrated

Recommendations: These heavy, unusually rugged bronze radiator valves are recommended for use on steam and hot water heating systems.

Important—gravity flow: When the intended use is gravity flow hot water, orders should so specify. Valves for such service will have a small hole drilled through the seat to provide slow circulation in the closed position.

Repacking: All valves listed on this page, when wide open, can be repacked while under pressure.

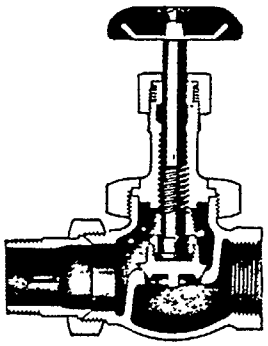
150-pound: The 150-pound valves have a rising stem, a composition disc, and a gland in the stuffing box. Their body and bonnet are made of bronze conforming to requirements of ASTM Specification B 62.

They are regularly furnished with a No. 1 Cranite Disc suitable for saturated steam and for hot water from 200 to 300 F. When ordered for water up to 200 F, they are furnished with a No. 6 Disc.

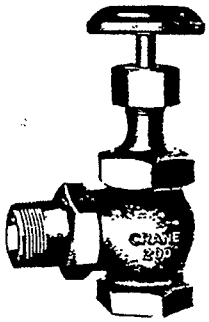
Both the No. 67 G and 68 G comply with Government Specifications issued by the General Supervising Architect's Office and the Quartermaster General's Office. They also comply with Navy Department (Bureau of Yards and Docks) Specification No. 66-P-1a (INT), dated September 1944, on Power Plant Heating and Ventilating Apparatus and Piping (Shore Use).

200-pound: The 200-pound valves have a rising stem, a metal disc, and rugged union bonnet construction. The body is Crane Special Bronze, a hard, leaded tin bronze conforming to ASTM Specification B 61.

The valves have a one-piece disc and stem in the ½-inch size; in the ¾-inch size, the disc swivels on the stem, as illustrated in the globe section. The stuffing box on both sizes is equipped with a gland. The valves can be reground without removing the body from the line.



Globe—Cross Section
No. 4270, with Wheel
*No. 4272, with Lock Shield



Angle
No. 4271, with Wheel
*No. 4273, with Lock Shield

*Not illustrated

6

Weights and Dimensions — Prices on Request

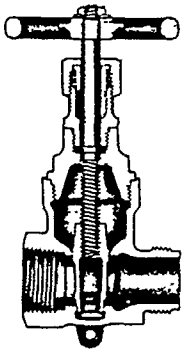
Valve Type	Size	Pounds, Each				Dimensions, in Inches				
		Globe		Angle		Center to male union end	Center to female end	Center to top, open		Diameter of wheel
	Inches	With Wheel	With Lock Shield	With Wheel	With Lock Shield			With wheel	With lock shield	
		—	—	No. 67 G	No. 68 G					
150-Pound Rough Nickel-Plated	½	...	...	1.5	1.5	2⅜	1¼	4½	5¼	2¼
	¾	...	...	2.5	2.4	3¼	1⅝	5¼	5¼	2½
	1	...	...	3.2	3.0	3½	1¾	6	7	2¾
	1¼	...	...	5.3	5.0	3⅞	2	7⅛	8⅜	3
	1½	...	...	6.6	6.4	4⅜	2¼	7½	7¼	3
200-Pound Rough Body		No. 4270	No. 4272	No. 4271	No. 4273					
	½	1.4	1.3	1.3	1.2	2 7/16	1 3/16	4⅛	4¼	2¼
	¾	2.3	2.2	2.1	2.0	3	1⅜	4¾	5	2½

Extra composition discs for No. 67 G or 68 G....page 281

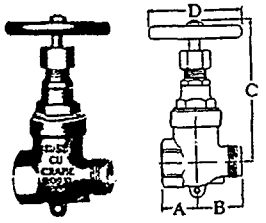
Keys for lock shield valves....page 283

Bronze Hose Gate Valves

Underwriters' Pattern — Wedge Disc — Non-Rising Stem

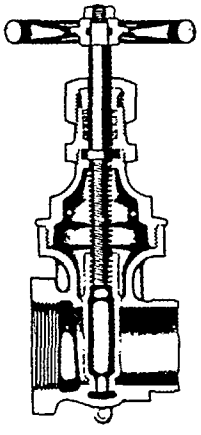


For cold water pressures up to *200 psi non-shock

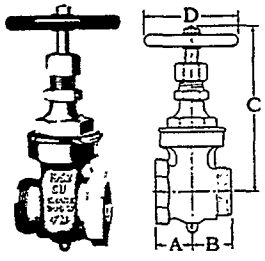


No. 451, Screwed
*Underwriters' Pattern

*No. 451 is approved by the Underwriters' and Factory Mutual Laboratories for pressures up to 175 psi. A bronze cap and chain and/or drain cock can be furnished when specified.



For cold water pressures up to 300 psi non-shock



No. 453, Screwed
Underwriters' Pattern

No 453 is approved by the Underwriters and Factory Mutual Laboratories at pressures up to 300 psi. A bronze cap and chain and/or drain cock can be furnished when specified.

Weights and Dimensions — Prices on Request

Valve Rough Body, Plain	Size Inches	Pounds, Each Without Cap & Chain	Pounds, Each With Cap and Chain	Dimensions, in Inches A	B	C	D
No. 451	1	2.3	2.7	1 7/16	1 3/4	5 1/4	3 1/2
	1 1/2	5.0	5.5	1 5/8	2 3/16	7 1/4	4 1/2
	2	7.5	8.5	1 13/16	2 7/16	9	5 1/2
	2 1/2	16.5	18.0	2 1/4	2 7/8	10 1/4	6
No. 453	1 1/2	5.7	7.0	1 5/8	2 1/4	7 1/2	4 1/2
	2 1/2	16.5	18.0	2 5/16	2 5/8	11	6

Unless otherwise ordered, these valves are furnished without a cap and chain and without a drain cock.

These compact Underwriters' Pattern Hose Gate Valves have a non-rising stem, a wedge disc, and a rugged Style D malleable iron wheel. The stuffing box, amply deep, is fitted with a gland. The body is made of bronze conforming to requirements of ASTM Specification B 62.

The No. 451 features wide-faced hexagons at the female end; the upper portion of the body is cylindrical in shape for maximum strength with light weight.

Underwriters' Specifications: The No. 451 and No. 453 are approved by the Underwriters' Laboratories, Inc., and the Factory Mutual Laboratories for water working pressures up to 175 and 300 psi, respectively. The body of each valve is marked "CU" and "FM."



Valves with cap and chain

Cap and chain: When specified, these valves can be equipped with a bronze cap and chain, as shown in the inset illustration at the upper right.



Valves with drain cock

Drain: When specified, the valves can be furnished with the boss on the outlet end tapped and fitted with a drain cock, as shown at the lower right.

Hose threads: The valves are furnished with an American Standard Taper Pipe Thread on the female end.

The male end is available with a variety of threads as indicated in the adjacent table.

Orders for hose threads other than listed in the table should be accompanied by a sample, preferably the male end of a hose coupling; see page 62.

Hose Threads Available on Male Outlet
(Female inlet is furnished with an American Standard Taper Pipe Thread)

Valve	Valve Sizes, in Inches				
	Threads Regularly Furnished		Optional Threads—Furnished if Specified		
	Chicago Standard Hose Thread	American (National) Standard Fire-Hose Coupling Screw Thread	Iron Pipe or California Standard Hose Thread	American (National) Standard Fire Protection Hose Thread	Chicago Fire Department Hose Thread
No. 451	1 to 2	2 1/2	1 to 2 1/2	1 1/2	2 1/2
No. 453	1 1/2	2 1/2	1 1/2 or 2 1/2	1 1/2	2 1/2

For complete hose thread information, see page 62.

Bronze Hose Valves

Garden Hose Valves

With Rubber Composition Disc



No. 58, Screwed

Garden Hose Valves are ideal for garden and lawn hose service for homes, estates, greenhouses, cemeteries, golf courses, and similar locations.

The body is bronze conforming to ASTM Specification B 62.

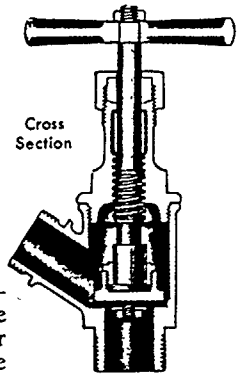
Chicago Hose Valves

With Rubber Composition Disc

For cold water pressures up to 200 psi, non-shock



No. 50, Screwed



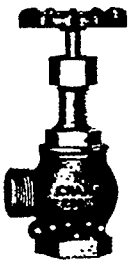
The No. 50 Chicago Hose Valve is excellent for use on outside standpipes.

The body, bonnet, stem, and disc holder are made of bronze conforming to ASTM Specification B 62.

Angle Hose Valves

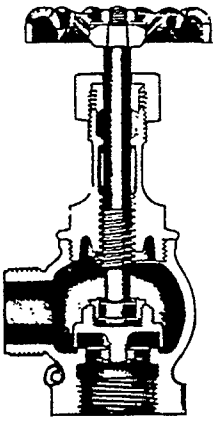
With Composition Disc

For cold water pressures up to 250 psi, non-shock



No. 117 Screwed

Regularly furnished without cap and chain.



Cross Section



When specified, No. 117 Valves are furnished with a bronze cap and chain.

Angle Hose Valves are recommended for dependable performance on standpipes, hose racks, and similar types of equipment.

Their body and bonnet are bronze conforming to ASTM B 62. They have a Crane No. 6 Composition Disc. For extra discs, and for description, dimensions, and service recommendations of discs, see page 281.

*The No. 117 Valves are furnished with a bronze cap and chain only when orders so specify.

6

Weights and Dimensions — Prices on Request

Valve	Size	Pounds, Each		Dimensions, in Inches			
		Without Cap & Chain	With Cap & Chain	Center to hose end	Over-all height, open	Diameter of wheel	Length of tee handle
Rough Body, Plain	Inches	Regular	Optional				
No. 58 Garden	½	.8	...	1⅜	4⅝	2 1/16	...
	¾	.8	...	1⅜	4¾	2 1/16	...
	1	1.3	...	1⅝	5⅞	2 9/16	...
No. 50 Hose	1	2.5	...	2½	8⅛	...	4⅛
	1½	5.0	...	3	10½	...	6
	2½	9.0	...	4⅛	13⅞	...	7
*No. 117 Angle	¾	1.7	2.0	1⅝	7 3/16	2¾	...
	1	3.0	3.4	1¾	7 13/16	3 1/16	...
	1½	6.3	7.0	2⅜	10	4 1/16	...
	2	10.0	11.0	2¾	12 5/16	5⅜	...
	2½	18.5	20.0	3¼	14 3/16	6	...

Hose threads: All valves shown on this page have an American Standard Taper Pipe Thread on the inlet.

The male outlet is available with a variety of threads as indicated in the adjacent table.

Orders for hose threads other than listed in the table should be accompanied by a sample, preferably the male end of a hose coupling.

Hose Threads Available on Male Outlet
(Inlet is furnished with an American Standard Taper Pipe Thread)

Valve	Valve Sizes, in Inches				
	Threads Regularly Furnished		Optional Threads — Furnished if Specified		
	Chicago Standard Hose Thread	American (National) Standard Fire-Hose Coupling Screw Thread	Iron Pipe or California Standard Hose Thread	American (National) Standard Fire Protection Hose Thread	Chicago Fire Department Hose Thread
No. 58	½ to 1	...	½ to 1	...	...
No. 50	1 and 1½	2½	1 to 2½	1½	2½
No. 117	¾ to 2	2½	¾ to 2½	1½	2½

For complete hose thread information, see page 62.

Hose Threads

Hose Thread Standards: The table shown below gives the basic dimensions of the American (National) Standard Hose Coupling Threads and of other hose coupling threads now in general use.

The upper portion of the table includes:

1. American Standard Hose Coupling Screw Threads (ASA B33.1-1947) sizes 2-inch and smaller for valves, hose couplings, nozzles, and other fittings used in direct connection with hose intended for fire protection or for domestic, industrial, and general service.

2. American (National) Standard Fire-Hose Coupling Screw Threads (ASA B26-1947) sizes 2½-inch and larger, for fire hose valves, couplings, hydrant outlets, stand-pipe connections, Siamese connections, and all other special fittings on fire lines.

The two ASA Standards mentioned above agree with the data in the Hose Thread section of the handbook of Screw-Thread Standards for Federal Services, No. H-28, Part II, 1957.

The lower portion of the table includes:

Other hose thread standards in general use: The Chicago Hose Thread, Chicago Fire Department Hose Thread, 2½ and 3-inch Iron Pipe Hose Threads, and the California Hose Thread.

Form of thread: The basic form of all Crane hose threads is the American (National) Standard, formerly known as the "U.S. Standard Form".

Ordering: Unless otherwise ordered, Crane Hose Valves are furnished with the threads specified on pages 60 and 61, their dimensions conforming to those shown in the table below.

Special hose threads: Other hose threads included in the table below but not mentioned on pages 60 and 61 can be furnished when so specified; prices on application. When orders are received for American Standard hose threads in sizes ½ or ¾-inch, the garden hose thread will be furnished, and in sizes 1 or 1½-inch the iron pipe hose thread will be furnished, unless otherwise specified. In addition, other types of special threads can be furnished at a special price; orders should be accompanied by a sample, preferably the male end of a hose coupling.

General Classification	Name of Hose Thread		Nominal Size of Hose, Inches	Number of Threads per Inch	Max. Major Dia. (O.D.) of Nipple Thread, Inches	Service Recommendations
American (National) Standard Hose Coupling and American (National) Standard Fire-Hose Coupling Screw Threads	Hose Coupling Screw Threads	Garden Hose Thread	½	11½	1.0625	Garden and similar service
			⅝			
			¾			
		Chemical Hose Thread	¾	8	1.3750	Chemical engine and booster hose
			1			
	American Standard (B33.1-1947) Sizes 2-inch and smaller	Fire Protection Hose Thread	1½	9	1.9900	Fire protection hose
		Iron Pipe Hose Thread	½	14	.8248	Steam, water, air, oil, and all other hose connections
			¾		1.0353	
			1	11½	1.2951	
			1¼		1.6399	
			1½		1.8788	
			2		2.3528	
	American (National) Standard Fire-Hose Coupling Screw Threads (B26-1947) Sizes 2½-inch and larger		2½	7½	3.0686	Fire hose
			3	6	3.6239	
			3½		4.2439	
			4½	4	5.7609	
Other Hose Threads in General Use	Chicago Standard Hose Thread		½ or ¾	11½	1.0682	†Note: Iron Pipe Hose Threads sizes 2-inch and smaller are included in the American Standard B33.1-1947 and are shown above. The 2½ and 3-inch sizes, shown here, are not included in the American Standard.
			1		1.2797	
			1¼		1.6880	
			1½		1.9272	
			2	8	2.5129	
			3	7	3.6365	
	Chicago Fire Department Hose Thread		2½	7½	2.9916	
	†Iron Pipe Hose Threads		2½	8	2.8434	
			3		3.4412	
	California Standard (Pacific Coast) Hose Thread		½	11	1.0504	
			¾			
			1		1.3141	
			1¼		1.8561	
			1½		2.0870	
			2	10	2.5416	
			2½	7½	2.9916	

Hose Valves . . . . pages 60 and 61

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SECTION 7

Crane Bronze and Iron Cocks

(and Gas Stops)

Bronze Cocks
Pet Cocks.....page 64
Cylinder Cocks.....page 64
Gauge Cocks.....page 64
Try Cocks.....page 64
Spring-Loaded Cocks.....page 64

Brine Cocks.....page 65
125-Pound Cocks.....page 65
250-Pound Cocks.....page 65

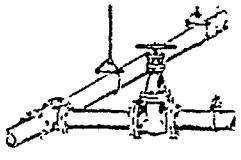
Bronze Stops
Gas Service Stops.....page 64

Iron Cocks
125-Pound W.O.G. Cocks.....page 66
Gas Line Cocks.....page 66
Spring-Loaded Mine Cocks.....page 67
Spring-Loaded Four-Way Cocks.....page 67

Wrenches
For Cocks and Stops.....page 68

7

Every pipe line needs support!

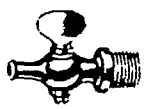


Piping won't stand up and work efficiently without adequate support. Its own weight plus the weight of the fluid will cause a break in the line or will strain joints to the point of leakage and distort or ruin valve seats.

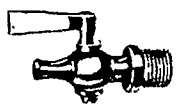
An amply strong pipe hanger or support at about 10-foot intervals is considered good practice for the average or ordinary installation, but the spacing will vary considerably with the size and type of system. Place the hangers close to valves and heavy pieces of equipment.

Bronze Cocks and Stops

Pet, Cylinder, and Gauge Cocks



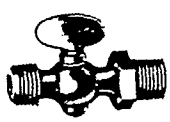
No. 700
Pet Cock
Tee Head



No. 702
Pet Cock
Lever Handle



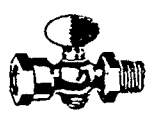
No. 724
Cylinder Cock
Lever Handle



No. 708
Gauge Cock
Male,
Tee Head



No. 712
Gauge Cock
Female,
Tee Head



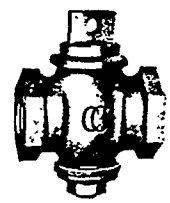
No. 744
Gauge Cock
Male and Female,
Tee Head

7

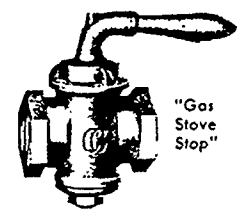
Weights — Prices on Request

Size	Pounds, Each					
	Pet		Cylinder	Gauge		
Inches	No. 700	No. 702	No. 724	No. 708	No. 712	No. 744
1/8	.13	.13	.16	.13	.16	
1/4	.13	.15	.23	.17	.23	.27
3/8	.16	..	...	...	.30	...
1/2	.2	.	.	.	.	...

Gas Service Stops



No. 270
Flat Head



No. 298
Lever Handle, with Check

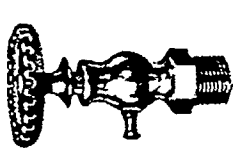
The No. 298, frequently called a "gas stove stop", is commonly used in the gas line to gas stoves (or other appliances) so that the gas can be shut off at the appliance without cutting off the main supply line.

Weights and Dimensions — Prices on Request

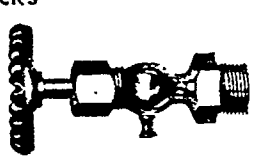
Size	No. 270		No. 298	
	Pounds	End to end	Pounds	End to end
Inches	Each	Inches	Each	Inches
1/4	.3	1 5/8	.4	1 5/8
3/8	.4	1 7/8	.5	1 7/8
1/2	.5	2 1/16	.7	2 1/16
3/4	.9	2 3/8	1.0	2 3/8
1	1.3	2 11/16	1.7	2 11/16
1 1/4	2.3	3 5/16	...	...
1 1/2	2.9	3 11/16	...	...
2	5.8	4 9/16	...	...

Wrenches....page 68

Try Cocks



No. 730, 125-Pound
Short Pattern
125 psi saturated steam working pressure



No. 734, 250-Pound
With Stuffing Box
250 psi saturated steam working pressure

Try cocks, except for their wheel, are furnished polished all over. The No. 734, recommended for saturated steam services up to 250 psi, has a Crane Special Bronze body and is equipped with a stuffing box

Weights and Dimensions — Prices on Request

Cock No.	Size Inches	Weight Pounds Each	Over-all height Inches	Dia. of wheel Inches
No. 730	3/8	.5	3 3/4	2 1/16
	1/2	.5	3 3/4	2 1/16
	3/8	.7	4 11/16	2 9/16
No. 734	1/2	.8	4 13/16	2 9/16
	3/4	.8	4 15/16	2 9/16

Spring-Loaded Cocks

Working Pressures
125 psi air *(air tested)*
175 psi non-shock cold water

These cocks feature a steel spring between the plug and cap which compensates for undue wear, assures a tight body-plug connection, and permits easy operation. Prices furnished on request.

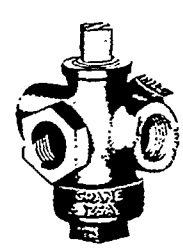


No. 306
Square Head
Three-Way

Weights and Dimensions

Cock No.	Size Inches	Pounds Each	Center to end Inches
No. 306	1/4	.6	31/32
	3/8	.8	1 1/16
	1/2	1.0	1 3/32
No. 307	1/4	1.0	1 3/32
	3/8	1.0	1 1/8
	1/2	1.6	1 9/32

Wrenches....page 68

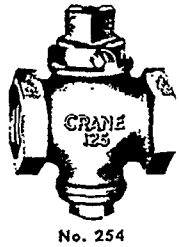


No. 307
Square Head
Four-Way

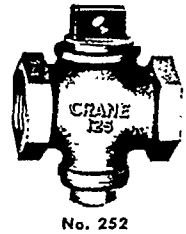
125-Pound Bronze Cocks



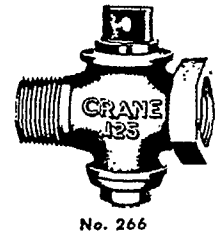
No. 250
Square Head



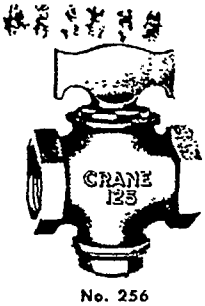
No. 254
Square Head
With Check



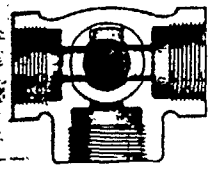
No. 252
Flat Head



No. 266
Flat Head
(Male and Female)



No. 256
Tee Head



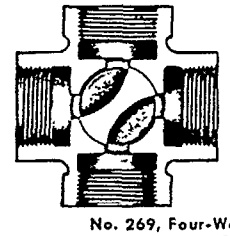


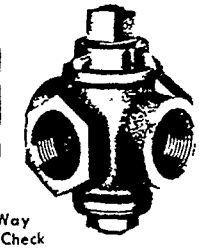
No. 268, Three-Way
Square Head with Check

125 psi
working pressure

Air Tested

These are dependable cocks made of quality bronze. For wrenches see page 68.





No. 269, Four-Way
Square Head with Check

7

Weights and Dimensions — Prices on Request

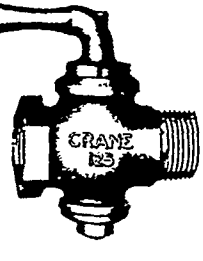
Size	Pounds, Each							Dimensions, Inches		
	Square Head				Flat Head		Tee Head	End to End		Center to End
Inches	No. 250 Without Check	No. 254 With Check	No. 268 3-Way with Check	No. 269 4-Way with Check	No. 252 Female Ends	No. 266 Male and Female Ends	No. 256	No. 250 No. 252 No. 254 No. 256	No. 266	No. 268 No. 269
1/8	...	...	...	...	...	...	.4	1 5/8	...	...
1/4	.3	...	.4	...	.4	.3	.4	1 5/8	1 15/16	7/8
3/8	.4	...	.6	...	.5	.4	.5	1 3/4	2 3/16	31/32
1/2	.6	.6	1.1	1.5	.7	.6	.6	2 1/16	2 1/2	1 1/4
3/4	1.1	1.1	2.2	2.6	1.0	.9	...	2 7/16	2 7/8	1 17/32
1	1.9	2.0	2.8	3.6	1.8	1.6	...	3	3 3/8	1 5/8
1 1/4	2.9	3.2	5.0	6.0	2.6	...	...	3 1/2	...	2
1 1/2	4.0	4.0	6.0	6.6	4.2	...	...	3 13/16	...	2 3/16
2	7.5	8.5	10.3	12.6	7.5	...	...	4 9/16	...	2 19/32

Bronze Brine Cocks

No. 814
Lever Handle

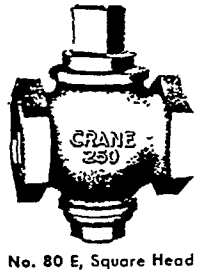
Weights and Dimensions

Size Inches	No. 814 Pounds Each	End to end Inches
3/8	.5	2 1/4
1/2	.7	2 1/2
3/4	1.2	2 7/8
1	1.7	3 3/8



The No. 814, designed especially for cold storage plant installations on lines handling brine, are equally effective on many other services requiring bronze cocks with male and female ends. Prices on request.

250-Pound Bronze Cocks



No. 80 E, Square Head

250 psi working pressure

Air Tested

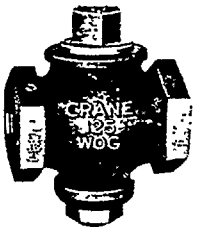
Weights and Dimensions

Size Inches	No. 80 E Pounds Each	End to end Inches
1/4	.4	1 3/4
3/8	.5	2
1/2	1.1	2 3/8
3/4	1.6	2 11/16
1	3.0	3 5/16
1 1/4	5.5	4
1 1/2	7.7	4 1/2
2	13.0	5 1/4

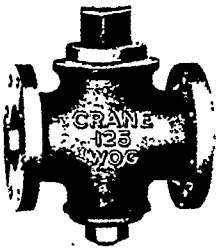
The No. 80E have a body and plug made of Crane Special Bronze, a hard, leaded tin bronze. Prices furnished on request.

Wrenches . . . page 68

125-Pound W.O.G. Iron Cocks

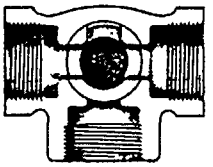


Square Head
Screwed
No. 320, All-Iron
No. 324, With Bronze
Plug and Washer

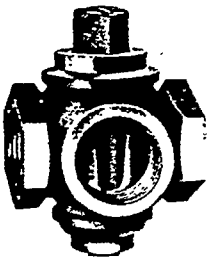


Square Head
Flanged
No. 325, All-Iron

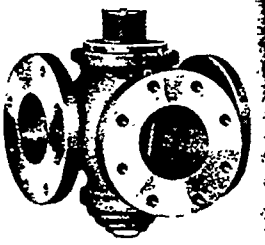
Working Pressure
125 psi non-shock cold water, oil, air, or gas
Air Tested



Cross-Section, Three-Way



Three-Way
Square Head, Screwed
No. 326, All-Iron



Three-Way
Square Head, Flanged
No. 331, All-Iron

These cocks are regularly fitted with an iron nut. End flanges of flanged cocks are plain faced, with a smooth finish and conform to the American Cast Iron Flange Standard, Class 125 (B16.1-1948). Unless otherwise ordered, flanged cocks are furnished faced and drilled (F & D); they can be furnished faced only, when specified.

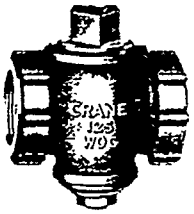
Weights and Dimensions — Prices on Request

Type and Finish	Size	Pounds, Each					Dimensions, in Inches					
		Screwed			Flanged, F & D		Screwed		Flanged			
		No. 320	No. 324	No. 326	No. 325	No. 331	End to end	Center to end of side outlet	Face to face	Center to face of side outlet	Flange diameter	Flange thickness
	Inches	All-Iron	Bronze Plug & Washer	3-Way, All-Iron	All-Iron	3-Way, All-Iron		3-Way		3-Way		
Square Head, Black	½	1.1	1.1	...	...	...	2¼	...	...	...	...	...
	¾	1.8	1.9	2.0	...	...	2¾	1 7/16	...	...	...	...
	1	3.0	3.2	3.3	...		3⅜	1 11/16	...	...	...	..
	1¼	4.9	5.0	5.6	...	..	4⅛	2 1/16	...	...	...	..
	1½	6.8	6.8	7.5	...	..	4⅝	2¼	...	...	...	..
	2	11.0	11.5	12.0	19.0	.	5¼	2⅝	6⅜	...	6	⅝
	2½	20.5	20.5	21.5	33.0	...	6⅜	3 3/16	8⅝	..	7	11/16
	3	32.0	30.0	34.0	48.0	55.0	7¾	3⅞	9⅝	4 13/16	7½	¾
	4	58.0	56.0	...	84.0	102.0	9⅞	...	12⅛	6 1/16	9	15/16

Wrenches....page 68

Templates for drilling....page 327

Iron Gas Line Cocks



No. 1228
Square Head
With Bronze Plug
and Washer

Working Pressure

125 psi non-shock cold water, oil, air, or gas

Air Tested

Full area cocks — Equipped with bronze plug and washer

No. 1228 are compact, sturdily constructed cocks especially recommended for dependable service on gas lines. The cocks have a cast iron body equipped with a bronze plug, a bronze washer, and an iron nut.

Finish: The cocks, regularly furnished black, will be furnished galvanized when so specified.

Available with check: When specified, the No. 1228 can be furnished with a check.

Weights and Dimensions — Prices on Request

	Size	Weight	End to end
	Inches	Pounds Each	Inches
No. 1228 Square Head	½	.9	2¼
Furnished black unless galvanized is specified	¾	1.4	2 5/8
	1	2.3	3 1/4
	1¼	3.6	3 3/4
	1½	5.1	4 1/4
	2	9.0	5 1/16

Wrenches....page 68

Iron Spring-Loaded Mine Cocks

With Bronze Plug or All-Iron

Working Pressures
125 psi air
175 psi non-shock cold water
Air Tested

Weights and Dimensions — Prices on Request

Size	Pounds, Each		Dimensions, in Inches		
	No. 319 With Bronze Plug	No. 332 All-Iron	End to end	Center to top	Center to bottom
Inches					
½	1.3	1.3	2¼	1½	2⅛
¾	2.0	2.0	2⅝	1⅞	2½
1	3.2	3.2	3⅛	2⅛	2¾

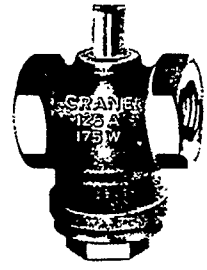
Wrenches....page 68

Spring-Loaded Mine Cocks are equipped with a steel spring between the plug and cap which compensates for wear, assures tightness between the body and plug, and permits easy operation.

The position of the ports in the plug is indicated on the head of the plug.

No. 319: The No. 319 has a cast iron body and cap and a bronze plug.

No. 332: The No. 332 is an all-iron cock.

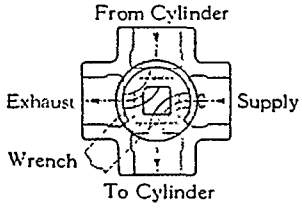


Spring-Loaded Mine Cock
No. 319 Square Head With Bronze Plug
No. 332 Square Head All-Iron

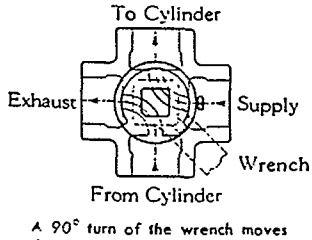
7

Iron Spring-Loaded Cocks

Four-Way



Supply fluid diverted to one end of cylinder. Fluid from opposite end passes into the exhaust line.



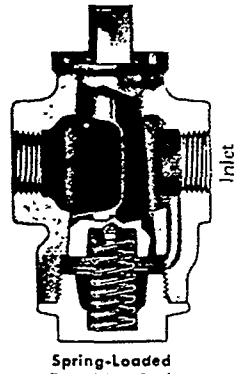
A 90° turn of the wrench moves the piston in the opposite direction and the action is reversed.

Working Pressures
250 psi air
350 psi non-shock cold water
Air Tested

The No. 339, a spring-loaded four-way cock, is extensively used on hydraulic or air cylinders, hydraulic presses, and similar equipment. The body is cast iron; the plug and cap are bronze.

The cocks have a steel spring between the cap and plug which compensates for wear, assures tightness between the body and plug, and permits easy operation. The body is equipped with an equalizing duct which leads from the inlet port to the chamber beneath the plug.

The position of the ports in the plug is indicated on the head of the plug.



Spring-Loaded Four-Way Cock
No. 339 Square Head With Bronze Plug

Operation and installation: The two diagrams at the left illustrate the operation of the No. 339. As shown in the upper diagram, the supply fluid is diverted to one end of the cylinder, while fluid from the opposite end passes into the exhaust line. When the wrench is turned 90°, the action is reversed, as shown in the lower diagram. Installation must be as indicated in the diagram.

Bronze spring-loaded cocks: Bronze spring-loaded cocks in both three-way and four-way types are listed and described on page 64.

Weights and Dimensions — Prices on Request

No. 339 Four-Way Cock	Size	Pounds	Dimensions, in Inches		
			Center to end	Center to top	Center to bottom
	Inches	Each			
	½	2.4	1 5/16	2⅛	2⅜
	¾	4.2	1 9/16	2½	2⅞
	1	9.6	1 15/16	3⅛	3½

Wrenches....page 68

Wrenches for Cocks and Stops

Made of tough malleable iron



Square Head—Series "S"
For all Crane Square Head Cocks except Nos. 319, 332, and 339



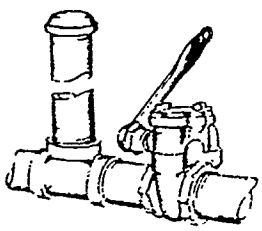
Square Head—Series "M"
For Crane Nos. 319, 332, and 339 Square Head Iron Cocks only



Flat Head—Series "F"
For all Crane Flat Head Cocks and Stops

Catalog Numbers, Weights, Lengths, and Application — Prices on Request

Wrenches				Sizes of Cocks and Stops (Inches) Wrenches Will Fit									
				Bronze Cocks and Stops						Iron Cocks			
Type and Catalog Number		Weight Pounds Each	Length from center of head to end Inches	No. 80 E	Nos. 250 254	Nos. 268 269	Nos. 252 266 270	No. 306	No. 307	Nos. 319 332	Nos. 320 324 325 326 331	No. 339	No. 1228
Square Head Series "S"	1-S	.11	3	1/4	1/4	1/4	..	..	..	..	..	..	..
	2-S	.15	3 1/2	3/8	3/8	..	..	1/4 to 1/2	1/4, 3/8	..	..	..	..
	3-S	.20	4	..	1/2	3/8	..	..	1/2	..	..	..	1/2
	4-S	.33	5	1/2	3/4	1/2	..	..	..	..	1/2	..	3/4
	5-S	.46	6 1/2	3/4	1	3/4	..	..	..	..	3/4	..	1
	6-S	.64	8	1	1 1/4	1	..	..	..	..	..	..	1 1/4
	6 1/2-S	.70	7 5/8	..	..	..	..	..	..	..	1	..	..
	7-S	.9	9 1/2	1 1/4	1 1/2	1 1/4, 1 1/2	..	..	..	..	..	..	1 1/2
	7 1/2-S	.8	8 1/2	..	..	..	..	..	..	..	1 1/4	..	..
	8-S	1.5	12	1 1/2	2	2	..	..	..	..	1 1/2	..	2
	9-S	2.7	14 1/2	2	..	..	..	..	..	..	2	..	..
	10-S	3.8	17	..	..	..	..	..	..	..	2 1/2	..	..
	11-S	5.8	22	..	..	..	..	..	..	..	3	..	..
	12-S	11.2	30	..	..	..	..	..	..	..	4	..	..
Square Head Series "M"	1-M	.27	5 1/2	..	..	..	..	..	..	1/2	..	..	..
	2-M	.5	8	..	..	..	..	..	..	3/4, 1	..	1/2, 3/4	..
	4-M	1.0	11	..	..	..	..	..	..	..	..	1	..
Flat Head Series "F"	1-F	.10	3	..	..	..	1/4	..	..	..	..	..	..
	2-F	.15	3 1/2	..	..	..	3/8	..	..	..	..	..	..
	3-F	.21	4	..	..	..	1/2	..	..	..	..	..	..
	4-F	.34	5	..	..	..	3/4	..	..	..	..	..	..
	5-F	.45	6 1/2	..	..	..	1	..	..	..	..	..	..
	6-F	.66	8	..	..	..	1 1/4	..	..	..	..	..	..
	7-F	.97	9 1/2	..	..	..	1 1/2	..	..	..	..	..	..
	8-F	1.5	12	..	..	..	2	..	..	..	..	..	..



Prevent Shock on Liquid Lines!

When a quick-opening valve in a liquid line is suddenly closed, thereby instantly stopping the flow, a momentary but very high pressure builds up in the line. This is called "water hammer" or "shock"—and it can do serious damage to piping.

To protect the system, install an air cushioning chamber—an assembly of a tee, a length of pipe, and a cap—just ahead of the quick-opening valve, or use a shock absorber which is especially designed for this purpose.

SECTION 8

Crane Iron Body Wedge Gate Valves

(Including Alloy Iron and Pulp Stock Valves)

Clamp Gate Valves.....pages 70 and 71

Ferrosteel Wedge Gate Valves
125-Pound, General Description.....pages 72 and 73
125-Pound, Non-Rising Stem.....pages 74 and 75
125-Pound, Outside Screw and Yoke.....pages 76 and 77
125-Pound, Quick-Opening.....page 78
250-Pound.....pages 80 and 81
Underwriters' Pattern.....page 79

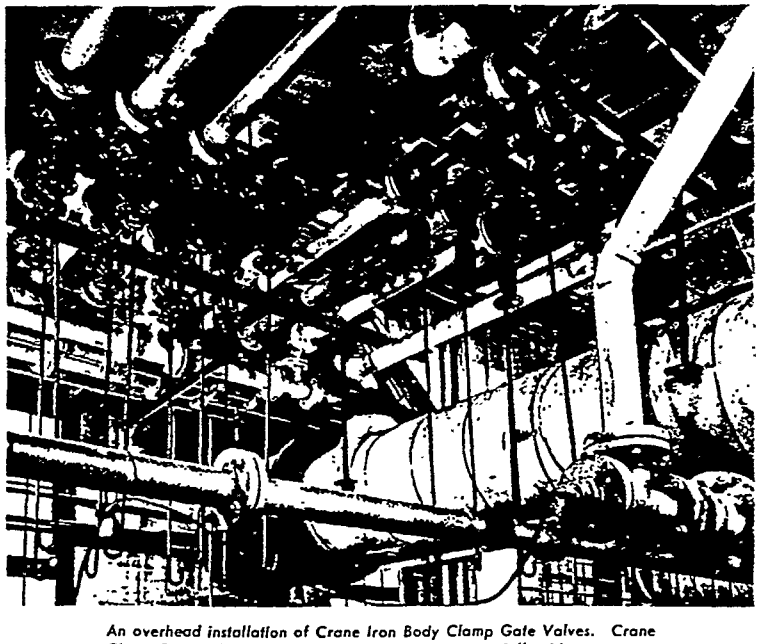
Alloy Iron Wedge Gate Valves
3% Nickel Cast Iron, for Process Industries.....page 82
Ni-Resist Cast Iron.....page 83
Nodular (Ductile) Cast Iron.....page 87

Pulp Stock Valves
Iron Body.....pages 84 and 85
3% Nickel Cast Iron Body.....pages 84 and 85
18-8 SMo Body.....page 86

For related data, refer to:

Cast steel pipe-line gate valves.....pages 131 to 133
Iron body gate valves for marine service.....pages 230 and 233
Gearing.....pages 271 to 274
By-passes.....page 282
Accessories for valves.....pages 259 to 283
Gaskets for iron flanged joints.....page 322
Templates for drilling.....pages 327 and 328

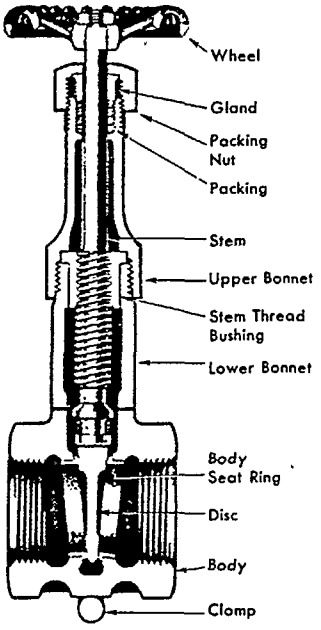
8



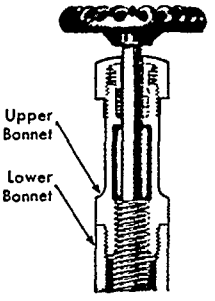
An overhead installation of Crane Iron Body Clamp Gate Valves. Crane Clamp Gate Valves, compact and sturdy, have an especially wide acceptance among process industries, and in oil field or oil refinery installations.

Clamp Gate Valves
Wedge Disc

Bronze Trimmed



Bronze Trimmed Inside Screw Type
Typical construction of 1¼ to 4-inch sizes



Bronze Trimmed Inside Screw Type
Typical construction of ¼ to 1-inch sizes (½-inch and smaller do not have a gland)

Working Pressures

Size, Inches	Saturated Steam	Cold Water, Oil, or Gas, Non-Shock
Screwed Valves		
¼ to 2	150 psi	225 psi
2½ to 4	125 psi	175 psi
Flanged Valves		
1 to 2	125 psi	200 psi
2½ to 4	125 psi	175 psi

Air Tested

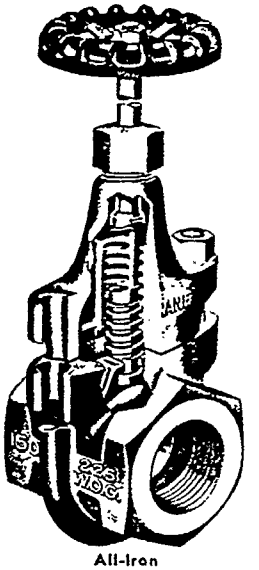
Recommendations

Crane Clamp Gate Valves are suited for a wide variety of service in process industries, in oil fields or refineries, and wherever compact, sturdy valves are needed.

The bronze trimmed valves are recommended for steam, water, air, or non-corrosive oil lines.

The all-iron valves are recommended for oil, gas, or gasoline, or for fluids that corrode bronze but not iron or steel. For special corrosive services, all-iron valves can be made with a malleable iron disc.

All-Iron



All-Iron Inside Screw Type
Illustration shows partially sectioned All-Iron Inside Screw Valve which features a free-draining bonnet. The bonnet has neither flats nor pockets to trap the fluid.

Body: The body is made of cast iron (ASTM A 126, Class A) in sizes 2½-inch and smaller; in sizes 3 and 4-inch, the body is Crane Ferrosteel (ASTM A 126, Class B).

Construction: All valves are made with lugs on both the body and bonnet. A U-shaped clamp passes through these lugs assuring a snug, accurately aligned bonnet joint. In addition, the clamp construction enables quick dismantling of the valve for inspection, cleaning, or repairs.

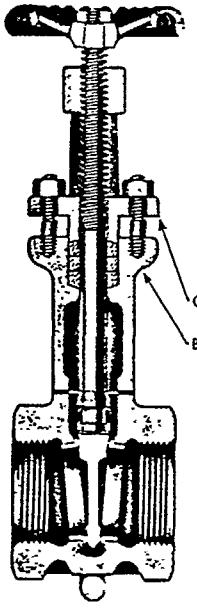
Bronze trimmed valves: Bronze trimmed valves have bronze body seat rings, disc, and stem.

In inside screw valves ¼ to 1-inch, the upper portion of the bonnet engages the stem threads; it is made of bronze and is renewable. Sizes 1¼-inch and larger have a bronze renewable stem thread bushing in the bonnet. This design provides full stem thread engagement, bronze-to-bronze, and assures long life of stem threads.

Outside screw and yoke valves have a cast iron bolted gland.

All-iron valves: All-iron valves have seats cast integral with the body. The disc is forged steel. The stem is steel; the portion coming in contact with the stuffing box packing is nickel-plated.

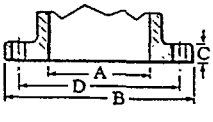
All-Iron Inside Screw Valves have a one-piece free-draining bonnet with an interrupted thread for engagement with the stem. This construction, shown at the upper right, permits free passage on either side of the stem from the upper part of the bonnet, preventing the entrapment of line fluids. The interrupted threads have a wiping action on the stem, preventing sticking in heavy fluid service.



Bronze Trimmed Outside Screw and Yoke Type
All Sizes

Shock: Quick-opening valves used in liquid lines should be installed with a suitable cushioning device to protect against water hammer; see page 14.

End flanges: The dimensions and drilling of end flanges conform to the American Cast Iron Flange Standard, Class 125 (B16.1-1948). The flanges are plain faced with a smooth finish.



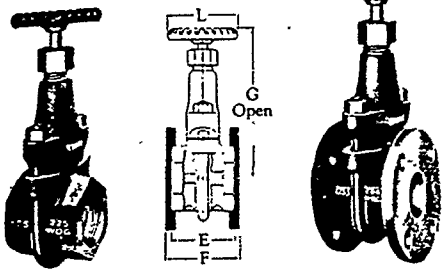
Dimensions of Flanges, in Inches

Size	A	B	C	D	No. of bolts	Dia. of bolts
1	1	4¼	7/16	3⅛	4	½
1¼	1¼	4⅝	½	3½	4	½
1½	1½	5	9/16	3⅞	4	½
2	2	6	⅝	4¾	4	⅝
2½	2½	7	11/16	5½	4	⅝
3	3	7½	¾	6	4	⅝
4	4	9	15/16	7½	8	⅝

For valve weights and dimensions, see page 71.

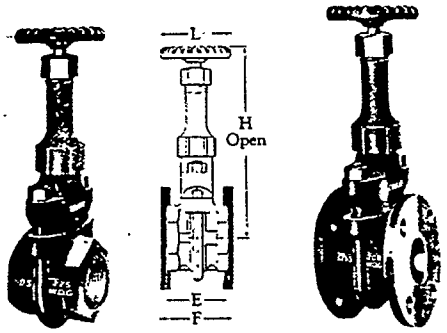
Clamp Gate Valves

Inside Screw, Rising Stem



All-Iron

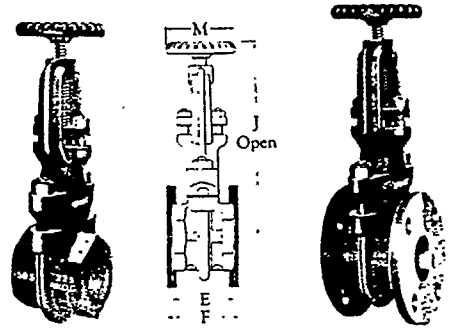
No. 488, Screwed — No. 488½, Flanged



Iron Body, Bronze Trimmed

No. 490, Screwed — No. 490½, Flanged

Outside Screw and Yoke



All-Iron

No. 484½, Screwed — No. 485½, Flanged

Iron Body, Bronze Trimmed

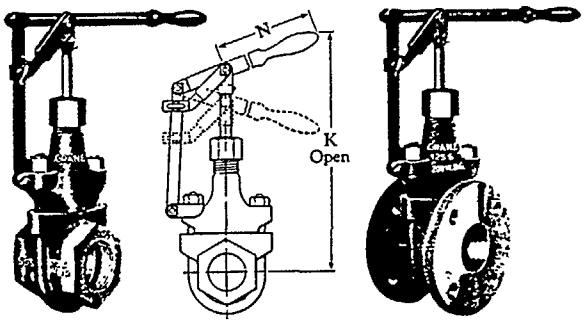
No. 486½, Screwed — No. 487½, Flanged

Flanged valves are furnished faced and drilled (F & D) to the American Cast Iron Flange Standard, Class 125; they can be furnished faced only when specified.

*Dimensions E (end to end) and F (face to face) apply also to Quick-Opening Valves.

Quick-Opening

For description, see page 70.



All-Iron

No. 492, Screwed — No. 492½, Flanged

Iron Body, Bronze Trimmed

No. 494, Screwed — No. 494½, Flanged

Weights in Pounds, Each — Prices on Request

Valve Ends	Size Inches	Inside Screw, Rising Stem: All-Iron	Inside Screw, Rising Stem: Bronze Trim	Outside Screw and Yoke: All-Iron	Outside Screw and Yoke: Bronze Trim	Quick-Opening: All-Iron	Quick-Opening: Bronze Trim
		No. 488	No. 490	No. 484½	No. 486½	No. 492	No. 494
Screwed	¼	1.2	1.2	...	...	...	...
	⅜	1.3	1.4	...	...	...	...
	½	1.6	1.8	2.3	2.4	2.2	..
	¾	2.6	2.9	3.1	3.1	3.4	...
	1	3.9	4.2	4.8	4.8	5.1	5.0
	1¼	5.5	6.1	6.1	6.1	6.7	..
	1½	7.3	8.0	9.3	9.3	9.3	9.0
	2	11.3	12.3	13.0	13.3	13.3	13.4
	2½	17.0	19.0	21.5	.	20.0	21.0
	3	25.0	26.0	30.0	..	27.0	27.0
	4	54.0	58.0	55.0	.	55.0	50.0
		No. 488½	No. 490½	No. 485½	No. 487½	No. 492½	No. 494½
Flanged F & D	1	6.6					
	1¼	9.0	...	..	.	...	..
	1½	11.7	12.2	13.8	13.5		
	2	18.0	19.0	19.0	20.0	19.5	20.0
	2½	28.0	28.0	29.0	29.0	30.0	30.0
	3	38.0	38.0	40.0	40.0	38.0	38.0
	4	70.0	70.0	72.0	72.0	76.0	76.0

Dimensions, in Inches

Size	E*	F*	G	H	J	K	L	M	N
¼	1⅞	..	4⅝	4⅞	.	...	1¾	...	.
⅜	2	.	4⅝	4⅞	.	.	1¾	...	.
½	2 1/16	...	5⅜	6¼	6⅝	7½	2 1/16	2 9/16	6
¾	2 5/16	..	6¼	7½	7½	8¾	2 9/16	2 9/16	7
1	2 9/16	3 3/16	7⅜	8½	9⅛	9⅛	2¾	2¾	7
1¼	2⅞	3½	9	10⅛	10⅛	12	3 1/16	3 1/16	7
1½	3⅛	3¾	9⅝	11¼	12¼	13¼	3⅝	3⅝	9
2	3⅝	4¼	11¾	13½	14¼	15¾	4 1/16	4 1/16	9
2½	4⅛	4 15/16	13	15¾	16¼	18	4¾	4¾	10⅞
3	4 9/16	5 1/16	15¼	18¼	19	21¾	6	6	10⅞
4	5 9/16	6¾	19¾	24¼	24	25	9	9	14¾

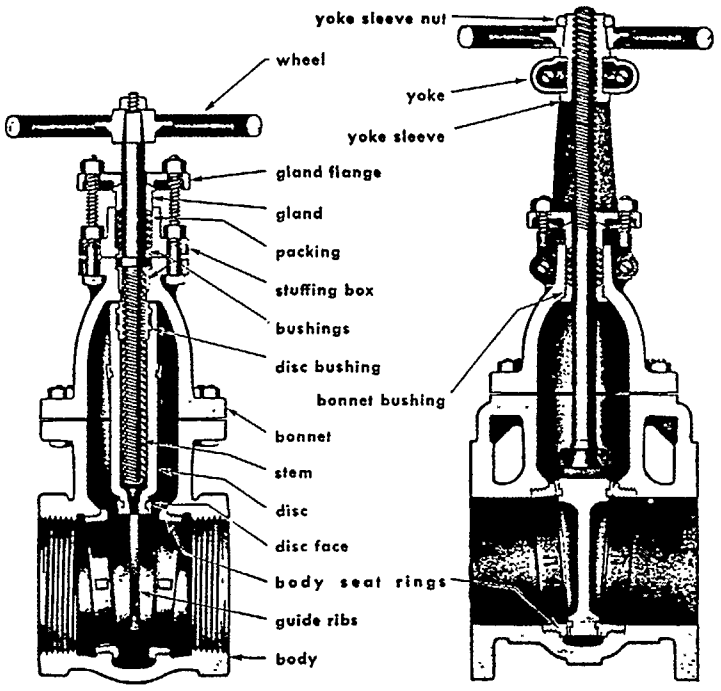
Templates for drilling....page 327 *Thread engagement.....page 352*

8

CRTX 906

125-Pound Ferrosteel Wedge Gate Valves

Names of Parts



Non-Rising Stem Valve
Bronze Trimmed — Open

Outside Screw and Yoke Valve
Bronze Trimmed — Closed

These illustrations are representative of sizes 12-inch and smaller only; larger sizes are made similar to the 250-Pound Wedge Gate Valves described on page 80.

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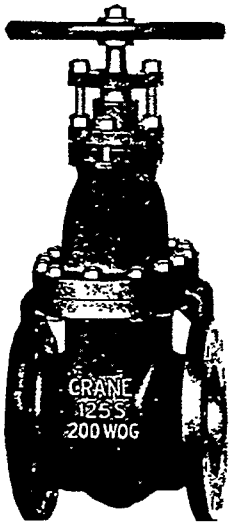


Non-Rising Stem Flanged
Bronze trimmed and all-iron valves with screwed, flanged, or hub ends are available.

Crane 125-Pound Ferrosteel Wedge Gate Valves are described in detail on this and the seven pages that follow.

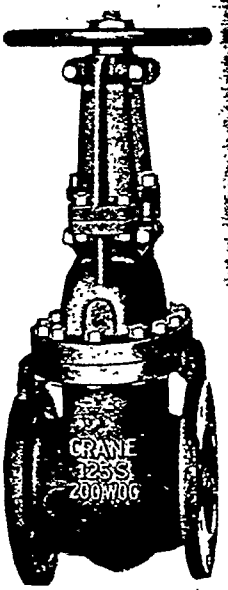
The valves have proved their versatility and dependability in practically every industry. Sizes 16-inch and smaller, particularly, with many features of unusual merit, set a new peak for quality in iron body wedge gate valves; unusual strength, long service life, and fine all-around adaptability in all types of installations are a few of the advantages of the Crane line.

Bronze trimmed and all-iron non-rising stem and outside screw and yoke valves are available; refer to the listings below:

General Description ..... page 73
Non-Rising Stem Valves ..... pages 74 and 75
Outside Screw and Yoke Valves... pages 76 and 77
Quick-Opening Valves..... ..... page 78
Underwriters' Pattern Valves..... page 79

The following alloy iron valves, made to the same high standard of quality and exacting design as the 125-pound valves, are also included in this section:

3½ Nickel Cast Iron Wedge Gate Valves . . page 82
Ni-Resist Cast Iron Wedge Gate Valves.... page 83
Nodular Cast Iron Wedge Gate Valves . . . page 87



Outside Screw and Yoke Flanged
Bronze trimmed screwed and flanged, or all-iron flanged valves, are available.

125-Pound Ferrosteel Wedge Gate Valves

General Description

Body and bonnet

The body and bonnet are oval-shaped; liberal metal sections combined with proper metal distribution assure maximum strength.

Flanged valves 24-inch and smaller have straight through ports, with tie ribs between the bonnet flange and the end flanges providing additional resistance to line strains.

Disc

The disc is made of cast iron, and in bronze trimmed valves has large bronze seating faces rolled securely into machined dovetails.

The disc is of the solid web type. All non-rising stem valves and 14-inch and larger outside screw and yoke valves have the disc built up at the center to accommodate the stem hole. In the non-rising stem bronze trimmed valves the portion of the disc that engages the stem threads is bronze-bushed.

All valves feature long disc guides consisting of ribs in the body and machined grooves in the disc. This minimizes the drag on the seating surfaces and thereby prolongs their life. In sizes 12-inch and smaller, where the disc guide is at least 50 per cent of the port diameter, the engaging surfaces are tapered to prevent a line bearing contact which would cause excessive wear of the guides.

Stem

The stem is of liberal diameter and amply strong. Stem threads have long engagement in the disc or yoke sleeve. In outside screw and yoke valves, sizes 12-inch and smaller have a tee-head disc-stem connection, and sizes 14-inch and larger have a threaded disc-stem connection locked together with a pin.

Gland and stuffing box

These valves have a two-piece ball-type gland, consisting of a gland and a gland flange. This construction maintains an even load on the packing and prevents binding on the stem even when gland bolt nuts are pulled up unevenly.

Non-rising stem valves 12-inch and smaller have through bolts holding the stuffing box to the bonnet and, in the bronze trimmed valves, the stem collar recess is bronze-bushed, top and bottom, to minimize friction and to prevent corrosion.

Outside screw and yoke valves 12-inch and smaller have swinging gland eye bolts which move out of the way when the stuffing box is being repacked but which will not become detached and lost.

All valves have an exceptionally deep stuffing box filled with high grade packing.

Repacking

The valves, when wide open, can be repacked while under pressure.

The outside screw and yoke bronze trimmed valves in sizes 12-inch and smaller have a bronze bonnet bushing which offers a better back seat for the stem and makes this point non-corrosive.

Yoke sleeve

The yoke sleeve used in outside screw and yoke valves is made of Cast Manganese Bronze.

Yoke

The yoke in outside screw and yoke valves 4-inch and smaller is cast integral with the bonnet; in larger sizes, the yoke consists of two halves which are bolted together at the top, and also to the bonnet.

Wheel

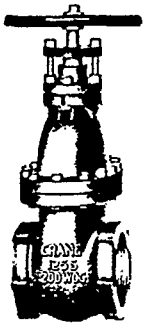
Valve wheels are made of malleable iron, assuring maximum strength; they have an oval-shaped rim, affording an easy grip.

For additional description, see the pages that follow.

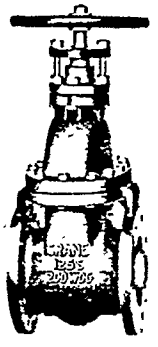
8

125-Pound Ferrosteel Wedge Gate Valves

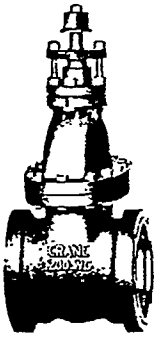
Non-Rising Stem—Bronze Trimmed or All-Iron



Non-Rising Stem
Screwed
No. 460
Bronze Trimmed
No. 472
All-Iron



Non-Rising Stem
Flanged
No. 461
Bronze Trimmed
No. 473
All-Iron



Non Rising Stem
Hub Ends
No. 462
Bronze Trimmed

For additional description, see the preceding two pages.

These are rugged non-rising stem valves. They have a wide application in nearly every kind of industry. Like other valves in the Crane 125-Pound Ferrosteel Wedge Gate line (see pages 76 to 79), they feature a solid web disc; flanged valves 24-inch and smaller have straight-through ports with tie ribs between the bonnet flange and the end flanges. For additional description and sectional illustration, see the preceding two pages; for dimensions, see the facing page.

Ratings—Pounds per Square Inch

Valve Type	Valve Size	Working Pressures (non-shock)			Hydrostatic Test Pressures	
		Saturated Steam	Cold Water or Gas	Cold Oil	Shell test	Seat test
	Inches					
Screwed or Flanged	2 to 12	125	200	200	350	225
	14 and 16	125	150	150	250	175
	18 to 24	*	150	150	250	175
	30 to 48	*	120	120	200	150
Hub Ends	2 to 12	...	200	...	350	225

*For steam lines larger than 16-inch, Crane 150-Pound Cast Steel Gate Valves are recommended; see page 125.

Body and bonnet: The body and bonnet in sizes 16-inch and smaller are Crane Ferrosteel, a high grade iron approximately 35 per cent stronger than regular gray iron. In larger sizes, they are made of Crane High Tensile Iron. These metals conform to ASTM Specification A 126, Classes B and C respectively.

Bronze trimmed valves: Bronze trimmed valves are recommended for steam, water, or oil lines.

The body seat rings are bronze, screwed into the body. The disc faces are bronze, rolled into the disc.

The stem is Cast Manganese Bronze and the disc is bronze-bushed where it engages the stem threads. In sizes 12-inch and smaller, bronze bushings are used above and below the stem collar to reduce friction and to prevent corrosion.

All-iron valves: All-iron valves are recommended for oil or gas, or for fluids that corrode bronze.

The seats are cast integral with the body and disc. The stem is steel; the portion contacting the packing is nickel-plated.

No. 472 Valves with screwed-in body seat rings can be made to order.

Stuffing box: The stuffing box is filled with high grade packing. The valves, when wide open, can be repacked while under pressure.

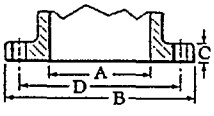
Gland: All valves have a two-piece gland consisting of a malleable iron gland flange and a siliconized steel gland.

In sizes 12-inch and smaller, the bronze trimmed valves have bronze gland bolt nuts; the all-iron valves have steel gland bolts and gland bolt nuts.

Disc rollers: Bronze trimmed valves 30-inch and larger, ordered for use in a horizontal line with the valve stem horizontal, will have a bronze track in the lower side of the body and bronze rollers in the lower side of the disc.

Federal Specification: No. 460 Valves 6-inch and smaller and No. 461 Valves 12-inch and smaller comply with Federal Specification WW-V-58 for Class "A" 125-Pound Iron Body Wedge Gate Valves, Type 1, Designations "NS" and "NF" respectively. However, the valves must be ordered with end protectors.

Flange dimensions and facing: The dimensions and drilling of end flanges conform to the American Cast Iron Flange Standard, Class 125 (B16.1-1948). The flanges are plain faced, with a smooth finish.



Dimensions of Flanges, in Inches

Size	A	B	C	D	No and diameter of bolts
2	2	6	5/8	4 3/4	4-5/8
2 1/2	2 1/2	7	11/16	5 1/2	4-5/8
3	3	7 1/2	3/4	6	4-5/8
3 1/2	3 1/2	8 1/2	13/16	7	8-5/8
4	4	9	15/16	7 1/2	8-5/8
5	5	10	15/16	8 1/2	8-3/4
6	6	11	1	9 1/2	8-3/4
8	8	13 1/2	1 1/8	11 3/4	8-3/4
10	10	16	1 3/16	14 1/4	12-7/8
12	12	19	1 1/4	17	12-7/8
14	14	21	1 3/8	18 3/4	12-1
16	16	23 1/2	1 7/16	21 1/4	16-1
18	18	25	1 9/16	22 3/4	16-1 1/8
20	20	27 1/2	1 11/16	25	20-1 1/8
24	24	32	1 7/8	29 1/2	20-1 1/4
30	30	38 3/4	2 1/8	36	28-1 1/4
36	36	46	2 3/8	42 3/4	32-1 1/2
42	42	53	2 5/8	49 1/2	36-1 1/2
48	48	59 1/2	2 3/4	56	44-1 1/2

(description continued on the opposite page)

125-Pound Ferrosteel Wedge Gate Valves

Non-Rising Stem—Bronze Trimmed or All-Iron

(For additional description and ratings, see pages 72 to 74)

Hub ends: Hub ends of the No. 462 fit Class A, B, C, or D cast iron pipe. The valves have a 2-inch square operating nut instead of a wheel. The following sizes are suitable for use with Transite or Century asbestos cement pipe for a poured joint (specify pipe size, type, and class):

For machined or rough end pipe:

3 to 8-inch valves for
Class 50, 100, or 150 Transite
Class 100 or 150 Century

10 and 12-inch valves for
Class 50 or 100 Transite
Class 100 or 150 Century
Class 100 Century (Big 10 and Big 12)

For machined end pipe only:

2-inch valves for Class 50 Transite
4-inch valves for Class 200 Transite or Century

Cleanout: For use on lines carrying an unusual amount of sediment, the 3, 4, 5, 6, 8, 10, and 12-inch flanged valves can be equipped with a cleanout on the side of the body to facilitate cleaning; see page 283.

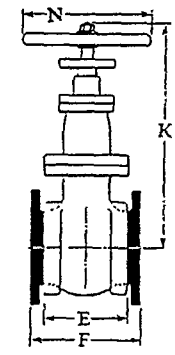
Indicator: Nos. 460 and 461 Valves 12-inch and smaller can be equipped with a "Universal" type indicator; see page 283.

Motor or cylinder operation: Valves installed in inaccessible locations can be equipped with some easy means of operation. An electric or air motor drive, or an operating cylinder, is ideal for this purpose; see pages 260 to 270.

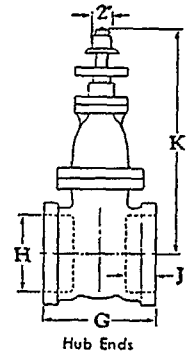
Face to face: Face to face dimensions (F) of flanged valves conform to the American Standard for Face-to-Face Dimensions (B16.10-1957) for Class 125 Cast Iron Flanged Wedge Gate Valves. The Standard includes sizes 2 to 24-inch inclusive.

Drilling: Flanged valves are regularly furnished faced and drilled (F & D) to the American Cast Iron Flange Standard, Class 125 (B16.1-1948); they can be furnished faced only when specified.

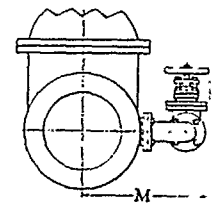
Smaller sizes: For sizes smaller than listed, use Clamp Gate Valves, page 70.



Screwed or Flanged



Hub Ends



By-pass for water service available for sizes 12-inch and larger

8

Weights and Dimensions — Prices on Request

Size	Pounds, Each					Dimensions, in Inches									
	Screwed		Flanged F & D		Hub Ends									By-Pass	
Inches	No. 460 Bronze Trim	No. 472 All-Iron	No. 461 Bronze Trim	No. 473 All-Iron	No. 462 Bronze Trim	E	F	G	H	J	K	N	Turns to open	By-pass size	M
2	34	34	41	39	42	6⅛	7	8¾	3.25	2.75	13	8	7	...	...
2½	41	41	50	40	...	6½	7½	...	..	...	13¾	8	8½	...	...
3	50	50	70	65	60	6¾	8	9¼	4.66	2.75	15½	9	10½	...	...
3½	...	...	80	...	...	...	8½	..	..	...	16½	9	12	...	..
4	90	80	100	100	100	7⅝	9	10⅜	5.70	3.00	18¾	10	9	...	...
5	120	...	140	140	...	8½	10	...	..	..	21½	12	11	...	..
6	160	...	170	180	170	8⅞	10½	11¼	7.80	3.00	23¼	12	13	...	...
8*	260	...	310	295	300	10¼	11½	13	10.00	3.50	27½	16	17	...	...
10*	...	...	460	460	445	...	13	13¾	12.10	3.50	33	20	21	...	...
12*	...	...	690	690	640	...	14	14½†	14.20	3.50	36½	20	25½	2	22
14*	..	..	520	...	.	...	15	...	...	...	39½	20	30	2	23½
16*	...	...	1330	...	..	..	16	...	..	...	48½	22	34	3	27½
18*	...	..	1380	.	...	.	17	...	..	.	49	24	38	3	28½
20*	..	...	1720		..	...	18	...	..	..	52½	24	42¼	3	29½
24*	.	..	2660	.	..	...	20	...	.	..	63½	30	50	4	35½
30*	...	...		...	..	...	24	...	...	...	76	36	95	4	39
36*	..	...	on	...	...	...	28†	..	..	...	92	42		6	45
42*	...	...	request	..	...	...	33	.	.	.	106	42	.	6	50
48*	..	...		.	..	..	36		...	.	114	42		8	58

*By-pass and gearing: To facilitate operation, by-passes are available for sizes 12-inch and larger, and gearing for sizes 8-inch and larger. The use of either, or both should be particularly considered for sizes 16-inch and larger. The by-pass serves to balance the pressure on both sides of the disc before the main valve is opened; see pages 271 to 274 for gearing and page 282 for by-passes.

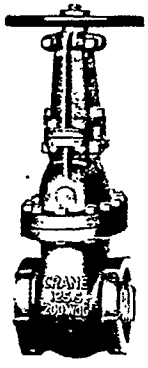
†When equipped with by-pass, 30-inch flanged valves have a face to face (F) of 32 inches and 12-inch hub end valves have an end to end (G) of 16 inches.

Outside Screw and Yoke Valves.....page 76
Quick-Opening Valves.....page 78
Underwriters' Pattern Valves.....page 79
Valves for Marine Service.....page 233
Indicator posts.....page 275
Templates for drilling.....page 327
Thread engagement.....page 352

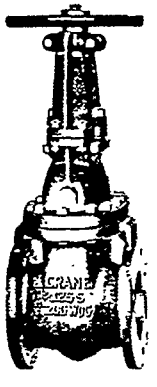
125-Pound Ferrosteel Wedge Gate Valves

Outside Screw and Yoke — Bronze Trimmed or All-Iron

603862



Outside Screw & Yoke
Screwed
No. 464½
Bronze Seats, Bronze Stem



Outside Screw & Yoke
Flanged
No. 465
Bronze Seats, Steel Stem
No. 465½
Bronze Seats, Bronze Stem
No. 475½
All-Iron

For sectional illustration, see page 72.

Ratings—Pounds per Square Inch

Valve Size, Inches	Working Pressures (non-shock) Saturated Steam	Cold Water or Gas	Cold Oil	Hydrostatic Test Pressures Shell test	Seat test
2 to 12	125	200	200	350	225
14 and 16	125	150	150	250	175
18 to 24	*	150	150	250	175
30 to 48	*	120	120	200	150

*For steam lines larger than 16-inch, Crane 150-Pound Cast Steel Gate valves are recommended; see page 125.

For additional description, see page 73.

8

These rugged outside screw and yoke valves are part of Crane's complete line of 125-Pound Ferrosteel Wedge Gate Valves. Like the other valves, they feature a solid web disc; flanged valves 24-inch and smaller have straight-through ports with tie ribs between the bonnet flange and the end flanges. See pages 72 and 73.

Body and Bonnet: The body and bonnet in sizes 16-inch and smaller are Crane Ferrosteel, a high grade iron approximately 35 per cent stronger than regular gray iron. In larger sizes, for even greater strength, the body and bonnet are Crane High Tensile Iron. These metals conform to ASTM Specification A 126, Classes B and C respectively.

Bronze trimmed valves: Bronze trimmed valves are recommended for steam, water, or oil lines.

The body seat rings are made of bronze and are screwed into the body. The disc faces are bronze, rolled into the disc. As indicated under the lower illustration at the left, the flanged valves are made with either a bronze or a steel stem; on steel stems, the portion in contact with the packing is nickel-plated.

Sizes 12-inch and smaller have a tee-head disc-stem connection with a renewable bronze stem hole bushing in the bonnet.

All-iron valves: The No. 475½ are all-iron valves recommended for oil or gas, or for fluids that corrode bronze.

The seats are cast integral with the body and disc. The stem is made of steel and the portion contacting the packing is nickel-plated. When specified, sizes 12-inch and smaller (except 5-inch) can be made to order with screwed-in body seat rings.

Stuffing box: The exceptionally deep stuffing box is filled with high grade packing. The valves, when wide open, can be repacked while under pressure.

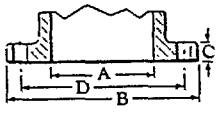
Gland: All valves have a two-piece gland consisting of a malleable iron gland flange and a siliconized steel gland.

Valves 12-inch and smaller have swinging type gland eye bolts. In these sizes, the bronze trimmed valves are equipped with bronze gland bolt nuts and the all-iron valves have steel gland eye bolts and gland bolt nuts.

Disc rollers: Bronze trimmed valves 30-inch and larger, ordered for use in a horizontal line with the valve stem horizontal, will have a bronze track in the lower side of the body and bronze rollers in the lower side of the disc.

Federal Specification: The No. 464½ in all sizes and the No. 465½ in sizes 12-inch and smaller comply with Federal Specification WW-V-58 for Class "A" 125-Pound Outside Screw and Yoke Wedge Gate Valves, Type I, Designations "OS" and "OF" respectively. However, the valves must be ordered with end protectors.

Flange dimensions and facing: The dimensions and drilling of end flanges conform to the American Cast Iron Flange Standard, Class 125 (B16.1-1948). The flanges are plain faced, with a smooth finish.



American Standard 125-pound templates for drilling are shown on page 327.

Dimensions of Flanges, in Inches

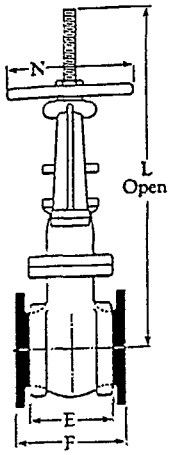
Size	A	B	C	D	No. & dia of bolts
2	2	6	5/8	4¾	4-5/8
2½	2½	7	11/16	5½	4-5/8
3	3	7½	¾	6	4-5/8
3½	3½	8½	13/16	7	8-5/8
4	4	9	15/16	7½	8-5/8
5	5	10	15/16	8½	8-¾
6	6	11	1	9½	8-¾
8	8	13½	1⅛	11¾	8-¾
10	10	16	1 3/16	14¼	12-⅞
12	12	19	1¼	17	12-⅞
14	14	21	1⅜	18¾	12-1
16	16	23½	1 7/16	21¼	16-1
18	18	25	1 9/16	22¾	16-1⅛
20	20	27½	1 11/16	25	20-1⅛
24	24	32	1⅞	29½	20-1¼
30	30	38¾	2⅛	36	28-1¼
36	36	46	2⅜	42¾	32-1½
42	42	53	2⅝	49½	36-1½
48	48	59½	2¾	56	44-1½

(description continued on the opposite page)

125-Pound Ferrosteel Wedge Gate Valves

Outside Screw and Yoke—Bronze Trimmed or All-Iron

(Continued from the preceding page; for general description, see pages 72 and 73)



Screwed or Flanged Valves

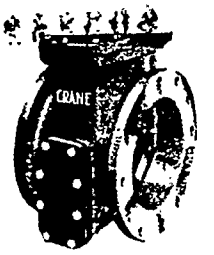
Cleanout: Flanged end valves (non-rising stem type as well as outside screw and yoke) in sizes 3, 4, 5, 6, 8, 10, and 12-inch, intended for use on lines carrying any unusual amount of sediment, tarry fluids, etc., can be equipped with a side cleanout; see illustration at upper right.

Motor or cylinder operation: Valves installed in inaccessible locations or used for emergency purposes should preferably be equipped with some easy means of operation. An electric or air motor drive, or an operating cylinder is ideal for this purpose. See pages 260 to 270.

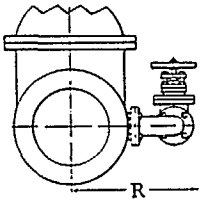
Face to face: Face to face dimensions (F) of flanged valves conform to those in the American Standard for Face-to-Face Dimensions (B16.10-1957) for Class 125 Cast Iron Flanged Wedge Gate Valves. This Standard includes sizes 2 to 24-inch inclusive.

Drilling: Flanged valves are regularly furnished faced and drilled (F & D) to the American Cast Iron Flange Standard, Class 125 (B16.1-1948); they can be furnished faced only, when specified.

Smaller sizes: When sizes smaller than 2-inch are required, use the Iron Body Clamp Gate Valves shown on pages 70 and 71.



Cleanout available for 3, 4, 5, 6, 8, 10 and 12-inch flanged valves



By-pass available for water service

8

Weights and Dimensions — Prices on Request

Size	Pounds, Each				Dimensions, in Inches						
	Screwed	Flanged, F & D								By-Pass*	
Inches	No. 464½ Bronze Seats, Bronze Stem	No. 465 Bronze Seats, Steel Stem	No. 465½ Bronze Seats, Bronze Stem	No. 475½ All-Iron	E	F	L	N	Turns to open	Size	R
2	35	40	43	44	6⅛	7	15	8	7	...	...
2½	43	50	53	50	6½	7½	17	8	8½	...	...
3	50	70	72	65	6¾	8	19½	9	10½	...	..
3½	...	...	90	...	...	8½	21¼	9	12	...	...
4	100	110	107	100	7⅝	9	23¾	10	9	...	...
5	...	155	155	150	...	10	28¾	12	11	...	...
6	...	190	197	190	...	10½	32¾	12	13	...	..
8*	...	330	320	325	...	11½	42¼	16	17	...	...
10*	...	520	520	520	...	13	50¾	20	21	...	...
12*	...	710	720	710	...	14	58	20	25½	2	22
14*	...	910	930	940	...	15	68	20	30	2	23½
16*	...	1400	1410	1400	...	16	75½	22	34	3	27½
18*	...	1600	1600	1520	...	17	83½	24	38	3	28½
20*	...	1950	1920	1900	...	18	91½	24	42¼	3	29½
24*	...	2980	2980	2960	...	20	109	30	50	4	35½
30*	...	5480	5480	5480	...	24	138	36	95	4	39
36*	...	9250	9250	9250	...	28†	160	42	...	6	45
42*	...	15000	15000	15000	...	33	191	42	...	6	50
48*	...	18000	18000	18000	...	36	209	42	...	8	58

*By-pass and gearing: To facilitate operation, by-passes are available for sizes 12-inch and larger, and gearing for sizes 8-inch and larger. The use of either, or both, should be particularly considered for sizes 12-inch and larger. The by-pass serves to balance the pressure on both sides of the disc before the main valve is opened. See pages 271 to 274 for gearing and page 282 for by-passes.

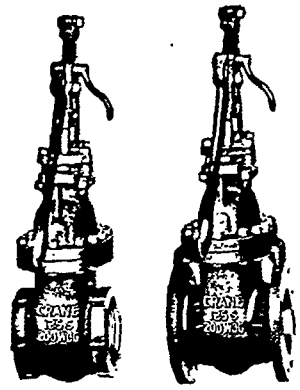
†30-inch flanged valves equipped with by-pass have a face to face (F) of 32 inches.

Non-Rising Stem Valves.....page 74
Quick-Opening Valves.....page 78
Underwriters' Pattern Valves....page 79
3% Nickel Cast Iron Valves....page 82
Ni-Resist Cast Iron Valves.....page 83
Templates for drilling.....page 327
Thread engagement.....page 352

125-Pound Ferrosteel Wedge Gate Valves

Quick-Opening—Bronze Trimmed

003864



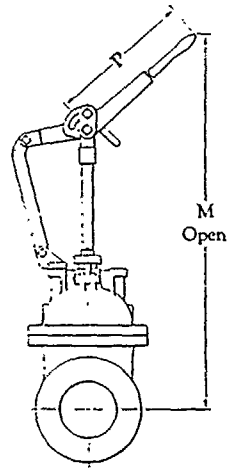
No. 470 Screwed — No. 471 Flanged

Bronze Trimmed

Working Pressures
125 psi saturated steam
200 psi non-shock cold water, oil, or gas

Hydrostatic Test Pressures
350 psi shell **225** psi seat

These valves are part of the Crane line of 125-Pound Ferrosteel Wedge Gate Valves. Except for their quick-opening mechanism and the disc-stem connection, they are the same as the outside screw and yoke valves described on the two preceding pages. For a general description of the entire line, see pages 72 and 73.



Screwed or Flanged

Complete dimensions are shown in the table below

Body and bonnet: The body and bonnet are oval-shaped; liberal metal sections combined with proper metal distribution assure maximum strength.

The body and bonnet are made of Crane Ferrosteel, a high grade iron approximately 35 per cent stronger than regular gray iron. This metal conforms to requirements of ASTM Specification A 126, Class B.

Flanged valves have straight through ports with tie ribs between the bonnet flange and the end flanges.

Bronze trimmed: The body seat rings are bronze, screwed into the body. The disc, of the solid web type, has large bronze seating faces rolled securely into machined dovetails.

The stem, liberal in diameter and amply strong, is made of bronze; *for the extra rigidity needed in this type of valve, the disc is threaded on the stem and pinned to it.* The upper part of the bonnet is fitted with a renewable bronze bonnet bushing.

Gland: The two-piece gland consists of a siliconized steel gland and a malleable iron gland flange.

Swinging type gland eye bolts are used; the gland nuts are bronze.

Stuffing box: The stuffing box, amply deep, is filled with high grade packing.

Lever handle: The lever handle is made of rugged malleable iron.

Shock: Closing one of these valves quickly on liquid lines may cause "water hammer". When severe, water hammer must be eliminated by installing a suitable cushioning device; for details, refer to page 14.

Face to face: Flanged valves conform to the American Standard for Face-to-Face Dimensions (B16.10-1957) for Class 125 Cast Iron Flanged Wedge Gate Valves.

Flange dimensions and facing: The dimensions and drilling of end flanges conform to the American Cast Iron Flange Standard, Class 125 (B16.1-1948). The flanges are plain faced, with a smooth finish.

Drilling: Flanged valves are furnished faced and drilled (F & D) to the American Cast Iron Flange Standard, Class 125; they can be furnished faced only, when specified.

Smaller sizes: When quick-opening valves are required in sizes smaller than 3-inch, use the Iron Body Clamp Gate Valves illustrated and described on pages 70 and 71.

Weights and Dimensions — Prices on Request

Size	Pounds, Each		Dimensions, in Inches							
							End Flanges			
Inches	No. 470 Screwed	No. 471 Flanged F & D	End to end	Face to face	M	P	Diameter	Thickness	Dia. of bolt circle	No & dia of bolts
3	50	60	6¾	8	27¾	12	7½	¾	6	4-⅝
4	75	100	7⅝	9	35¼	15½	9	15/16	7½	8-⅝
5		140		10	40	23	10	15/16	8½	8-¾
6	145	180	8⅞	10½	46	23	11	1	9½	8-¾
8		310		11½	59¼	29	13½	1⅛	11¾	8-¾
10		480		13	76¼	41	16	13/16	14¼	12-⅞
12		660		14	83¼	41	19	1¼	17	12-⅞

Additional description.....page 73
125-Pound Ferrosteel Wedge Gates....pages 74 to 77
Templates for drilling....page 327
Thread engagement.....page 352

Ferrosteel Wedge Gate Valves

Underwriters' Pattern

Working Pressure
175 psi non-shock cold water

Hydrostatic Test Pressures
350 psi shell 200 psi seat

These valves, designed for fire protection service, are similar to the valves described on pages 72 to 77.

These valves, companions to the 125-Pound Ferrosteel Wedge Gates described on pages 72 to 77, are designed especially for fire protection service. They are approved by the Underwriters' Laboratories, Inc., and the Factory Mutual Laboratories. The valves are marked "CU" and "FM."

Materials and design: The body and bonnet are Crane Ferrosteel, a high grade iron approximately 35 per cent stronger than regular gray iron. This metal conforms to requirements of ASTM Specification A 126, Class B.

The body seat rings are bronze, screwed into the body. The solid web type disc is cast iron with large bronze seating faces rolled securely into machined dovetails.

The stem is bronze; the bonnet and stuffing box are bronze-bushed where they contact the stem. In the non-rising stem valve, the disc is bronze-bushed where it engages the stem threads. The bronze-to-bronze contacts prevent corrosion and assure easy operation.

Outside screw and yoke valves generally are used indoors. Their rising stem indicates whether the valve is open or closed.

Stuffing box: The stuffing box is filled with high grade packing. The valves, when wide open, can be repacked while under pressure.

Gland: The two-piece, ball-type gland consists of a siliconized steel gland and a malleable iron gland flange. The gland nuts are bronze. The No. 467 has swinging type gland eye bolts.

Hub end valves: Hub end valves have a square flange cast integral with the bonnet. An indicator post can be bolted to the flange to simplify operation of valves installed in underground lines.

Hub ends fit Class D cast iron pipe. The following sizes are suitable for use with Transite or Century asbestos cement pipe for a poured joint (specify pipe size, type, and class):

For machined or rough end pipe:
4 to 8-inch valves for
Class 50, 100, or 150 Transite
Class 100 or 150 Century
10-inch valves for
Class 50 or 100 Transite
Class 100 or 150 Century
Class 100 Century (Big 10)

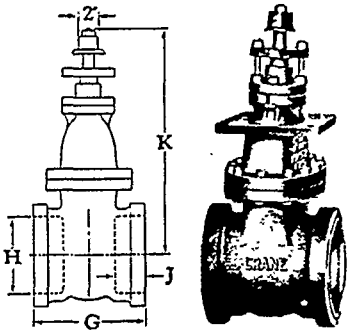
For machined end pipe only:
4-inch valves for
Class 200 Transite or Century

Flanged valves: Flanged valves conform to the American Standard for Face-to-Face Dimensions (B16.10-1957) for Class 125 Cast Iron Flanged Wedge Gate Valves.

The dimensions and drilling of end flanges conform to the American Cast Iron Flange Standard, Class 125 (B16.1-1948). The flanges are plain faced, with a smooth finish. End flange dimensions are the same as those for 125-pound valves; see page 74 or 76.

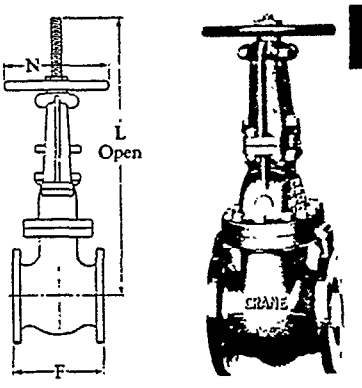
Flanged valves are regularly furnished faced and drilled (F & D) to the American Cast Iron Flange Standard, Class 125. They are furnished faced only when specified.

Non-Rising Stem



No. 462½
Underwriters' Pattern
Hub Ends

Outside Screw and Yoke



No. 467
Underwriters' Pattern
Flanged

8

Weights and Dimensions — Prices on Request

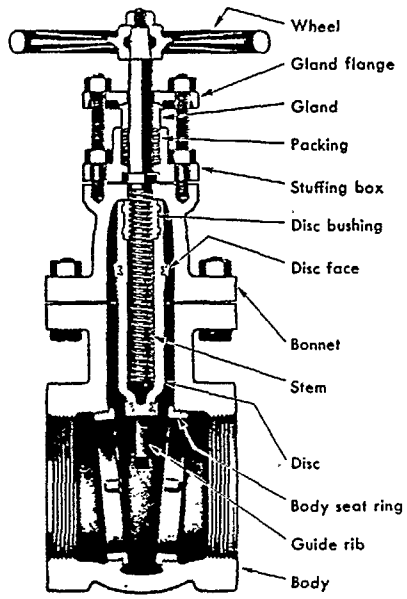
Size	Pounds, Each		Dimensions, in Inches							Turns to open
	No. 462½	No. 467	Hub Ends				Flanged			
Inches	Hub Ends	Flanged F & D	G	H	J	K	F	L	N	
2½	...	50	...	...	..	..	7½	17	8	8½
3	..	80	...	.	..	...	8	19½	9	10½
4	110	110	10⅜	5.70	3.00	19¼	9	23¾	10	9
5	..	160	...	.		. .	10	28¾	12	11
6	190	190	11¼	7.80	3.00	23¾	10½	32¾	12	13
8	305	320	13	10.00	3.50	27¾	11½	42¼	16	17
10	460	520	13¾	12.10	3.50	33	13	50¾	20	21
12		700					14	58	20	25½

Additional description.....page 73
End flange dimensions.....page 76
Indicator posts.....page 275
Templates for drilling....page 327

250-Pound Ferrosteel Wedge Gate Valves

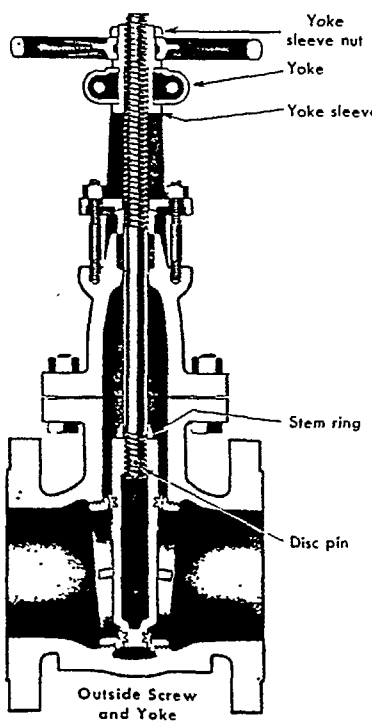
Bronze Trimmed or All-Iron

Non-Rising Stem



Non-Rising Stem
Bronze Trimmed Valve — Open

Outside Screw and Yoke



Bronze Trimmed Valve — Closed

Working Pressures
250 psi steam, 450 F
500 psi non-shock cold water, oil, or gas

Hydrostatic Test Pressures
1000 psi shell test 550 psi seat test

Crane 250-Pound Ferrosteel Wedge Gate Valves are admirably suited for a wide variety of service conditions requiring the use of rugged, substantially constructed valves. They will give excellent results on steam lines where the pressure and temperature do not require the use of steel valves, on high pressure cold water lines, on natural gas lines, oil pipe lines, and similar services.

Body and bonnet: The body and bonnet are made of Crane Ferrosteel, a high grade iron, approximately 35 per cent stronger than regular gray iron. This metal conforms to requirements of ASTM Specification A 126, Class B. Metal sections are more than ample, and the metal is distributed to provide maximum strength.

Wedge disc: The disc is a single casting with tapered faces. Two ribs cast in opposite sides of the body engage machined slots in the disc. They guide the disc and prevent contact between the seating surfaces until the valve is practically closed. In bronze trimmed valves, the faces are securely rolled into machined dovetails in the disc, assuring tightness under pressure.

Bronze trimmed valves: Bronze trimmed valves are recommended for steam, water, or oil, or for other fluids that do not corrode bronze or iron. The screwed-in body seat rings are made of Crane Special Bronze, a leaded tin bronze of high strength and hardness The disc is Crane Special Bronze in the 2-inch size and cast iron faced with Crane Special Bronze in larger sizes.

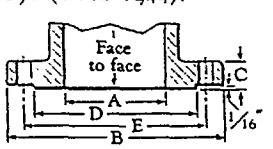
Non-rising stem valves have a Cast Manganese Bronze stem; the disc is bronze-bushed where it engages the stem threads, except on 2-inch valves which have a solid Crane Special Bronze disc.

Outside screw and yoke valves are available with a bronze or steel stem. The bronze stem serves as a safeguard against corrosion.

All-iron valves: All-iron valves are recommended for gas or oil service, or for fluids that corrode bronze but not iron. The seats are cast integral with the body and disc. The stem is steel, the portion in contact with the packing being nickel-plated.

Stuffing box: The stuffing box is filled with high grade packing. The valves, when wide open, can be repacked while under pressure

Flange dimensions and facing: Dimensions and drilling of end flanges conform to the American Cast Iron Flange Standard. Class 250 (B16b-1944).



End flanges have a 1/16-inch raised face. The raised face is finished with approximately 16 concentric grooves per inch, known as a "serrated" finish

Dimensions of Flanges, in Inches

Size	A	B	C	D	E	No. & dia. of bolts
2	2	6½	⅞	4 3/16	5	8-⅝
2½	2½	7½	1	4 15/16	5⅞	8-¾
3	3	8¼	1⅛	5 11/16	6⅝	8-¾
4	4	10	1¼	6 15/16	7⅞	8-¾
5	5	11	1⅜	8 5/16	9¼	8-¾
6	6	12½	1 7/16	9 11/16	10⅝	12-¾
8	8	15	1⅝	11 15/16	13	12-⅞
10	10	17½	1⅞	14 1/16	15¼	16-1
12	12	20½	2	16 7/16	17¾	16-1 1/8

For additional description, weights, and dimensions, see the next page.

250-Pound Ferrosteel Wedge Gate Valves

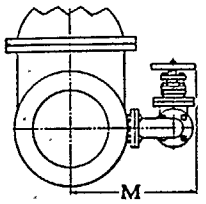
Bronze Trimmed or All-Iron

(continued from the preceding page)

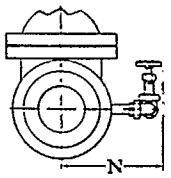
Gland: A two-piece gland, consisting of a gland flange and a gland, prevents binding on the valve stem and assures an even load on the packing. The gland flange is steel or malleable iron. The gland is made of siliconized steel.

Motor or cylinder operation: Valves used for emergency purposes or installed in inaccessible locations should preferably be equipped with some easy means of operation. An electric or air motor drive, or an operating cylinder, is ideal for this purpose. For description, see pages 260 to 270.

By-pass; gearing: To facilitate operation, by-passes are available for sizes 5-inch and larger, and gearing, for sizes 6-inch and larger. The use of either, or both, should be considered particularly for 10 and 12-inch non-rising stem valves and for 8-inch and larger outside screw and yoke valves. Also, a by-pass should be considered for any valve 5-inch and larger intended for steam service.



By-pass for water service available for valves 5-inch and larger



By-pass for steam service available for valves 5-inch and larger

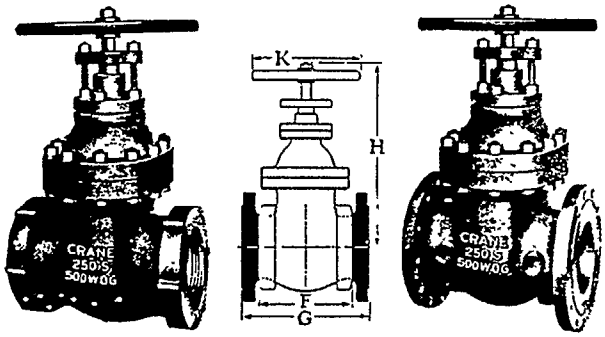
The by-pass serves to balance the pressure on both sides of the disc before the main valve is opened and, in steam service, also serves to preheat the line. See pages 271 to 274 for gearing and page 282 for by-passes.

Federal Specification: Nos. 2 E, 3 E, and 7½ E Valves comply with Federal Specification WW-V-58 for Class "B" 250-Pound Iron Body Wedge Gate Valves, Type I, Designations NS, NF, and OF, respectively. However, the valves must be ordered with end protectors.

Face to face: Flanged valves conform to the American Standard for Face-to-Face Dimensions (B16.10-1957) for Class 250 Cast Iron Flanged Wedge Gate Valves.

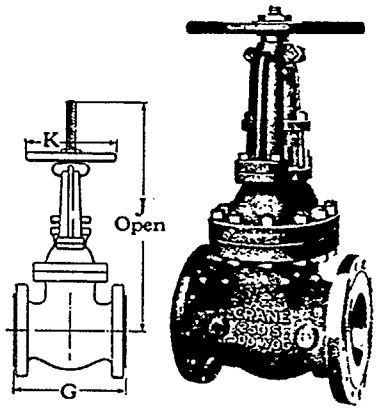
Drilling: Flanged valves are regularly furnished faced and drilled (F & D) to the American Cast Iron Flange Standard, Class 250. They can be furnished faced only when orders so specify.

Non-Rising Stem



No. 2 E, Screwed — No. 3 E, Flanged
Crane Special Bronze Seats and Bronze Stem

Outside Screw and Yoke



No. 7 E, Flanged
Crane Special Bronze Seats and Steel Stem

No. 7½ E, Flanged
Crane Special Bronze Seats and Bronze Stem

No. 14 E, Flanged
All-Iron

8

Weights and Dimensions — Prices on Request

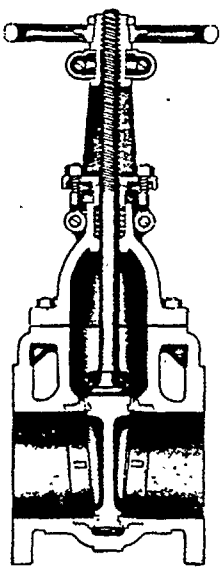
Size	Pounds, Each					Dimensions, in Inches									
	Non-Rising Stem		Outside Screw and Yoke									By-Pass For Water		By-Pass For Steam	
	No. 2E	No. 3 E	No. 7 E	No. 7½ E	No. 14 E	F	G	H	J	K	Turns to open	By-pass size	M	By-pass size	N
Inches	Screwed	Flanged F & D	Flanged F & D	Flanged F & D	Flanged F & D										
2	39	47	50	50	50	7	8½	11	14½	8	15				
2½	70	76	80	80	..	8	9½	13¼	17½	9	15½				
3	95	110	110	110	110	9	11⅛	14¾	20½	10	14				
4	140	170	180	180	180	11	12	17½	24¾	12	18½				
5*		250	280	280			15	20¼	29¾	14	23	1¼	16⅜	¾	11¾
6*		325	360	360	360		15⅞	23	34½	16	27	1¼	16¾	¾	12½
8*		540	590	590	..		16½	30¾	43	20	35	1½	21⅛	¾	13¼
10*		820	920	920			18	36	52¾	22	38	1½	21¼	1	16⅝
12*		1250	1400	1400			19¾	39¾	60	24	46	2	25⅝	1	17⅞

*See "By-pass and gearing" recommendations above

Templates for drilling....page 328 *Thread engagement....page 352*

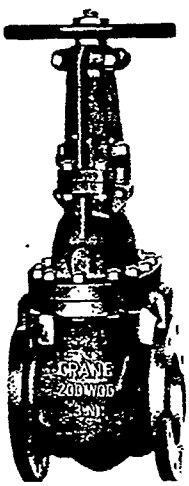
3% Nickel Cast Iron Wedge Gate Valves

For Process Industries



Cross Section

8



No. 14477
Flanged
Outside Screw and Yoke
18-8 SMo Trimmed

Valve Sizes	Working Pressures Cold water, oil, or gas, non-shock	Hydrostatic Test Pressures	
		Shell	Seat
2 to 12-inch	200 psi	350 psi	225 psi
14 to 18-inch	150 psi	250 psi	175 psi

Better Materials for Greater Resistance to Corrosion

3% Nickel Cast Iron Body and Disc — *Disc faced with 18-8 SMo Alloy*
18-8 SMo Alloy Body Seat Rings and Stem — *Siliconized Steel Gland*

Use Crane No. 14477 Valves wherever conventional "bronze trimmed" or "all-iron" gate valves fail due to corrosion of seating surfaces. In the petroleum industry, for handling of oils containing traces of mineral acids—in the wood treating industry for handling of creosote vapors and oils—in the pulp and paper industry for use with various kinds of alkaline liquors—wherever corrosion is a factor, a Crane No. 14477 assures better results.

3% Nickel Cast Iron: The valve body and disc are Crane 3% Nickel Cast Iron. This metal, developed especially for service in the process industries, extends the usefulness of cast iron valves.

Where ordinary cast iron is not adequate, and where higher physical properties and substantially better corrosion resistance are desired, Crane 3% Nickel Cast Iron Valves are an economical choice.

Rugged body and bonnet: Liberal metal sections in the body and bonnet assure maximum strength. Tie ribs between the bonnet flange and end flanges provide exceptional resistance to line strains. Straight-through ports in the body minimize turbulence and provide a more uniform flow through the valve.

Disc: The solid web disc has extra long disc guides to lessen drag on seating surfaces. Sizes 12-inch and smaller have a tee-head disc-stem connection; larger sizes have a threaded disc-stem connection locked together with a pin.

Stem: The stem is of liberal diameter with long engagement in the yoke sleeve. The position of the stem indicates whether the valve is open or closed.

Gland and stuffing box: A two-piece ball-type gland maintains an even load on the packing and prevents binding on the stem even when gland bolts are not pulled up evenly. Sizes 12-inch and smaller have swinging type gland eye bolts which move out of the way when the stuffing box is being repacked; they will not loosen in service.

Face to face: All sizes conform to the American Standard for Face-to-Face Dimensions (B16.10-1957), for Class 125 Cast Iron Wedge Gate Valves.

Flange dimensions and facing: Dimensions and drilling of end flanges conform to the American Cast Iron Flange Standard, Class 125 (B16.1-1948). Flanges are plain faced, with a smooth finish

Swing checks: For Crane 3% Nickel Cast Iron Swing Checks; see page 114.

Drilling: Valves are regularly faced and drilled to the American Cast Iron Flange Standard, Class 125. They can be furnished faced only, when specified

Drilling templates, page 327
Materials.....Section 2

Weights and Dimensions — Prices on Request

	Size	Weight	Dimensions, in Inches					Turns to open
			Face to face	Center to top, open	Diameter of wheel	End Flanges		
	Inches	Pounds Each				Diameter	Thickness	
No. 14477 Flanged F & D	2	43	7	15	8	6	5/8	7
	2½	50	7½	17	8	7	11/16	8½
	3	70	8	19½	9	7½	¾	10½
	4	100	9	24	10	9	15/16	9
	6	190	10½	33	12	11	1	13
	8	310	11½	42	16	13½	1 1/8	17
	10	560	13	50½	20	16	1 3/16	21
	12	730	14	58	20	19	1¼	25½
	14	920	15	68	20	21	1⅜	30
	16	1350	16	75½	22	23½	1 7/16	34
	18	1550	17	83½	24	25	1 9/16	38

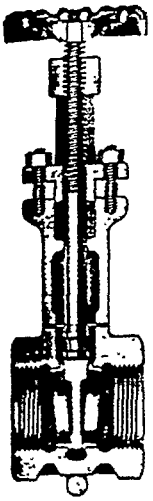
The No 14477 is similar in design to Crane 125-Pound Ferrosteel Wedge Gate Valves shown on page 76

Ni-Resist Cast Iron Wedge Gate Valves

Outside Screw and Yoke

Sizes 3-inch and smaller

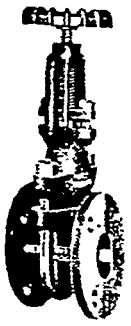
Working Pressures
Screwed valves — **225** psi non-shock cold water, oil, or gas
Flanged valves — **200** psi non-shock cold water, oil, or gas
Air Tested



Cross Section



No. 1670
Screwed



No. 1671
Flanged

Templates for drilling, page 327.

Recommendations: Crane Ni-Resist Valves are safely used where the strength of ordinary cast iron is adequate. They are especially suitable for soda and sulfate pulp mill service, for creosote used in wood preserving, for handling sour distillates and crudes in petroleum refineries, and for kindred services.

Materials: All valves have a body and bonnet made of Type II Ni-Resist Cast Iron. The body seat rings and stem are Crane 18-8 SMo Alloy Steel.

Sizes 3-inch and smaller have an 18-8 SMo Alloy Steel disc; larger sizes have a Ni-Resist Cast Iron Disc with 18-8 SMo seating faces.

Ni-Resist (Type II) is an alloy cast iron containing approximately 18 to 22% nickel, 1.75 to 2.5% chromium, and a maximum of 0.5% copper. Its strength and physical characteristics are similar to ordinary cast iron, but its resistance to corrosion, erosion, and wear is definitely superior.

It is generally selected for application where copper contamination cannot be tolerated; Ni-Resist parts are marked "NR2".

Crane 18-8 SMo Alloy Steel is a material equivalent to AISI Type 316 wrought stainless steel.

Construction: The valves are the outside screw and yoke type. Stem threads, on the outside of the valve, are readily lubricated and are not exposed to the corrosive action of fluid in the line. The yoke is integral with the bonnet on ½ to 4-inch sizes and is bolted to the bonnet on the 6 and 8-inch sizes.

Valves 3-inch and smaller have a clamp type bolted bonnet and a one-piece bolted gland. Larger sizes have a conventional bolted bonnet and a two-piece bolted gland; the latter consists of a malleable iron gland flange and a ball-type gland follower. Both types of bonnets are easily disassembled for cleaning or repairs.

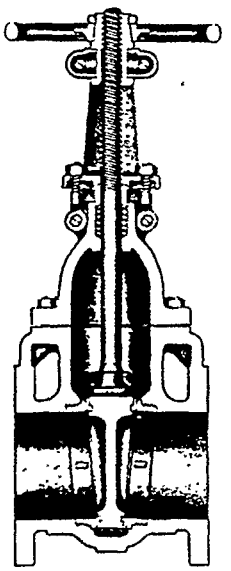
All valves have a solid wedge disc. The seating faces are integral with the disc in sizes 3-inch and smaller and rolled into the disc in sizes 4-inch and larger. The disc-stem connection is in the form of a T-head on the end of the stem which fits loosely into a matching slot in the disc, permitting the disc to be operated easily and safely.

Stuffing box: The deep stuffing box is filled with high grade packing. The valves when wide open can be repacked while under pressure.

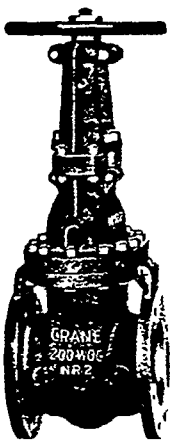
Weights and Dimensions — Prices on Request

Size	Pounds, Each		Dimensions, in Inches					
	No. 1670	No. 1671	End to end	Face to face	Center to top, open	Diameter of wheel	End Flanges	
Inches	Screwed	Flanged F & D					Diameter	Thickness
½	2.4	..	2 1/16	..	6 5/8	2 9/16	..	..
¾	3.1	..	2 5/16	..	7 5/8	2 9/16	..	..
1	4.8	7.5	2 9/16	3 3/16	9 1/8	2 3/4	4 1/4	7/16
1¼	6.3	8.8	2 7/8	3 1/2	10	3 1/16	4 5/8	½
1½	9.5	14.0	3 1/8	3 3/4	12 1/8	3 5/8	5	9/16
2	13.0	20.5	3 5/8	4 1/4	14 1/8	4 1/16	6	5/8
2½		32.0		4 15/16	16 1/4	4 3/4	7	11/16
3		40.0		5 1/16	19	6	7½	¾
4		110.0		9	24	10	9	15/16
6		205.0		10½	32 5/8	12	11	1
8		335.0		11½	41 7/8	16	13½	1 1/8

Sizes 4-inch and larger



Cross Section



No. 1671
Flanged

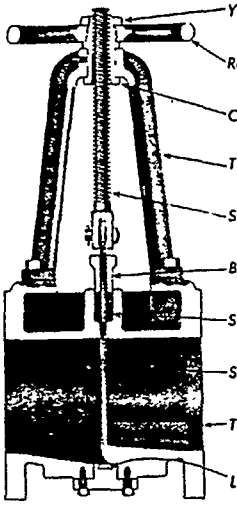
End flanges conform to the American Cast Iron Flange Standard, Class 125 (B16.1-1948), and are faced and drilled unless ordered faced only. They are plain faced, with a smooth finish.

Materials....Section 2

8

Pulp Stock Valves

Cast Iron or 3% Nickel Cast Iron Body



Cross section of wheel-operated valve. Quick-opening valves, except for their sliding stem mechanism, are similar.

Easy operating outside screw and quick-opening valves. Shearing-action disc for tight closure. Non-clogging . . . self-cleaning . . . full port area.

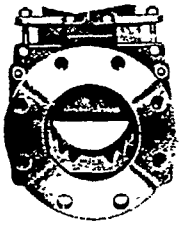
Choice of Types and Materials

Flanged ends only; faced and drilled unless otherwise ordered.

Valve Part	No. 1425 Wheel-Operated No. 1429 Quick-Opening	No. 1447 Wheel-Operated No. 1431 Quick-Opening
Body	*Cast Iron	3% Nickel Cast Iron
Stem	Cast Manganese Bronze	Exelloy
Disc	Bronze	18-8 SMo Alloy Steel
Disc-Stop Holder	Cast Iron holder with lead filler	3% Nickel Cast Iron holder with lead filler
Gland	Bronze	Malleable Iron

*Crane Ferrosteel on sizes 16-inch and larger

60 psi water working pressure



Outlet half of all valves has deep notches . . . incoming pulp fibers are separated into small bunches for clean, thorough shearing.

Recommendations: These are rugged valves especially designed to meet the requirements of modern pulp stock handling. As indicated in the table above, the valves are offered in wheel-operated and quick-opening types and in a choice of body and trim materials.

The valves are recommended for use on discharge lines, on filter, hydrofiner, and Jordan lines, on pulp stock beater lines, and in a host of other locations common to pulp and paper mill piping.

Shearing action; self-cleaning: All valves feature Crane's exclusive, shearing action disc for clog-proof closure and a positive, tight shut-off

In operation, as the knife-edged disc is lowered, deep specially designed notches in the outlet half of the body comb the pulp fibers into small bunches which are easily sheared by the disc. The fibers are cut cleanly; they cannot jam nor clog the underside of the disc

The thoroughness of the shearing operation permits the disc to close completely without leaving any accumulation of fibers to wash out later and cause leakage. Once the valve is in the closed position, the pulp packs around the disc assuring an absolutely tight shut-off

Body: The valves have a two-piece body divided on the vertical center line and bolted together; a special gasket in the joint prevents leakage. Circular end ports and a spacious, rectangular center passage assure full, uninterrupted flow. There are no sections where clogging can occur through pulp impaction or build-up.

Bodies are cast iron, Ferrosteel, or, for added resistance to corrosion, Crane 3% Nickel Cast Iron. Crane cast iron and Ferrosteel conform to requirements of ASTM A 126, Classes A and B respectively Crane 3% Nickel Cast Iron has tensile requirements comparable to Ferrosteel but offers substantially greater resistance to corrosion.

Disc: Discs are made in a rectangular shape and have a knife-like cutting edge at the bottom to assure complete shearing and a positive shut-off The disc is precision-guided through machined slots in the body.

Discs are bronze or Crane 18-8 SMo Alloy Steel Crane 18-8 SMo is a high grade alloy equivalent to AISI Type 316 wrought stainless steel; it offers excellent resistance to corrosion.

Stem: Valve stems are Crane Cast Manganese Bronze or Exelloy. The stem threads do not come in contact with the fluid in the line, and the rising stem effectively indicates the position of the disc. Quick-opening valves have a sliding stem and a non-slip locking device which permits the disc to be held in any desired position.

(continued on the next page)

Pulp Stock Valves

Cast Iron or 3% Nickel Cast Iron Body

(continued from the preceding page)

Disc protection: A lead filler dovetailed into the disc-stop holder located at the bottom of each valve acts as a seat and protects the cutting edge of the disc from dulling or damage at the point of closing.

Cleanout: All valves are easily cleaned out when necessary. Simply remove the disc-stop holder which is attached to the bottom of the valve by means of cap screws.

Stuffing box: A rectangular shaped stuffing box, equipped with a bolted gland, completely surrounds the disc. It is unusually deep and is filled with a special packing which minimizes friction.

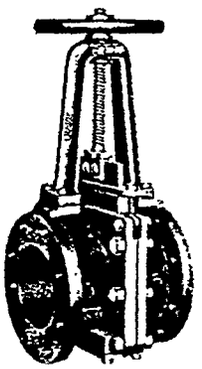
Bosses: Each valve body has six bosses, two on each side and two on the bottom. When specified, they are drilled, tapped, and plugged; openings are ½ inch on 4 and 6-inch valves and ¾ inch on larger sizes.

Special operating equipment: Special operating aids such as floor stands, extension stems, chain wheels, hydraulic or air cylinder operators, and electric motor operators are available; for description, refer to Section 23. Gearing to facilitate operation of larger sizes can also be furnished.

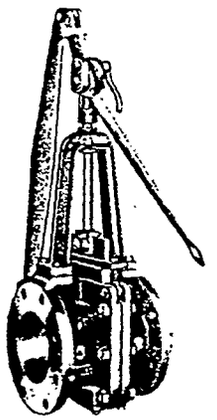
Face to face: These valves conform to the American Standard for Face-to-Face Dimensions (B16.10-1957) of Class 125 Cast Iron Flanged Wedge Gate Valves. They, therefore, will replace 125-pound iron body flanged wedge gate valves without necessitating piping changes.

End flanges: End flanges conform to the American Cast Iron Flange Standard, Class 125 (B16.1-1948). The flanges are plain faced, with a smooth finish.

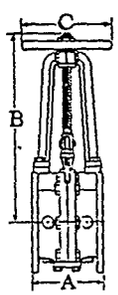
Drilling: The valves, regularly furnished faced and drilled (F & D), can be furnished faced only, when specified.



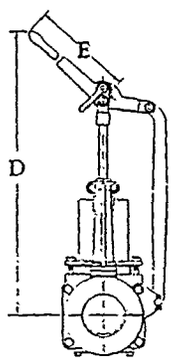
Outside Screw, Rising Stem, Flanged
No. 1425
Iron Body, Bronze Disc
No. 1447
3% Nickel Iron Body
With 18-8 SMo Disc



Quick-Opening Flanged
No. 1429
Iron Body, Bronze Disc
No. 1431
3% Nickel Iron Body
With 18-8 SMo Disc



Dimension "A" applies to Quick-Opening Valves also.



8

Weights and Dimensions — Prices on Request

Size	Pounds, Each				Dimensions, in Inches									
	With Cast Iron Body Flanged, F & D		With 3% Nickel Cast Iron Body Flanged, F & D		Wheel-Operated			Quick-Opening			End Flanges			
	No. 1425 With Wheel	No. 1429 Quick-Opening	No. 1447 With Wheel	No. 1431 Quick-Opening	A Face to face	B open	C	A Face to face	D open	E	Diameter	Thickness	Diameter of bolt circle	No and diameter of bolts
4	100	100	100	105	9	22½	10	9	33¼	12	9	15/16	7½	8-5/8
6	145	150	140	150	10½	28	10	10½	43¼	23	11	1	9½	8-¾
8	240	250	220	260	11½	35	12	11½	57	29	13½	1⅛	11¾	8-¾
10	310	340	310	340	13	41	14	13	68¾	41	16	13/16	14¼	12-⅞
12	440	460	430	475	14	48	16	14	80¾	41	19	1¼	17	12-⅞
14	510	560	520	590	15	53	16	15	90½	41	21	1⅜	18¾	12-1
16	690	700	690	700	16	58	18	16	95	41	23½	17/16	21¼	16-1
18	870		860		17	64	20				25	19/16	22¾	16-1⅛
20	1230		1250		18	72	20				27½	111/16	25	20-1⅛
24			1830		20	85	30				32	1⅞	29½	20-1¼

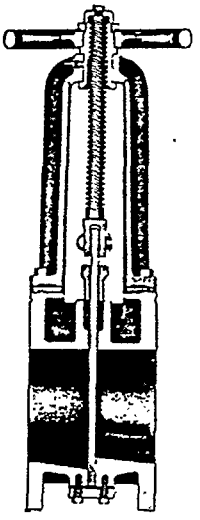
18-8 SMo Pulp Stock Valves with short face to face dimensions....page 86

Templates for drilling....page 327

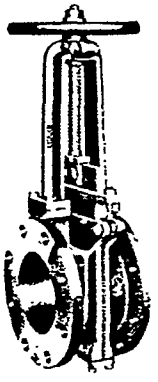
18-8 SMo Pulp Stock Valves

New stainless steel valves for maximum resistance to corrosion. Non-clogging . . . self-cleaning . . . with narrow face-to-face design for reduced weight

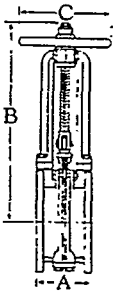
75 psi water working pressure



Cross Section



No. 1450
Outside Screw, Rising Stem
With 18-8 SMo Body and Disc



Features; recommendations: These new Crane 18-8 SMo Valves, a companion line to the pulp stock valves shown on the preceding two pages, are designed for use in stock lines where corrosion is a problem. Like the other valves, they feature Crane's time-proven shearing-action disc and notched body design to assure clean, tight closure with no clogging.

The narrow face-to-face design of the body makes possible reduced bulk and weight . . . as much as 35% lighter than conventional valves of the same size . . . with resultant lower cost. The valves are ideal for use on light wall, stainless steel stock lines and are extremely effective in the handling of sulphite stock, sulphate unwashed stock, and stock which must be kept free of contamination; they are used on caustic extraction lines, for soaking sections in bleach plants, and for many other applications.

Body: The body consists of two halves divided on the vertical center line and welded together. The body halves are made of Crane Cast 18-8 SMo Alloy Steel, a high grade material conforming to requirements of ASTM A 351, Grade CF-8M, and comparable to AISI Type 316 stainless steel.

Circular end ports and a spacious rectangular center passage assure full area flow. There are no sections where clogging can occur through pulp impaction or build-up. The outlet body half features deep notches which comb the pulp fibers into small bunches, easily sheared by the disc.

Shearing-action disc: The valve disc, also made of 18-8 SMo, is rectangular in shape with a knife-like cutting edge at the bottom which cuts the pulp fibers cleanly. The thoroughness of the shearing operation permits the disc to close completely without leaving any accumulation of fibers to wash out later and cause leakage. Once the disc is closed, the pulp packs around it, assuring a tight shut-off. The disc is precision-guided through machined slots in the body.

Disc protection: A stem stop, located at the upper part of the stem, limits the downward travel of the disc preventing possible damage to the cutting edge.

Stem: The stem is Crane Exelloy. Stem threads, fast acting for speedy operation, are on the outside of the valve free from corrosive effects of fluid in the line.

Cleanout: To clean the valve, simply remove the bottom plate attached to the underside of the valve body by means of cap screws. The plate is equipped with a full face rubber gasket.

Stuffing box: A rectangular-shaped stuffing box, equipped with a bolted gland, completely surrounds the valve disc. It is unusually deep and is filled with a special packing which minimizes friction.

End flanges: The diameter, thickness, and drilling of end flanges of valves 12-inch and smaller conform to the MSS 150-Pound Corrosion Resistant Cast Flanged Valve Standard, No. SP-42-1957 (see page 326). On 14 and 16-inch sizes, dimensions except for thickness, conform to the 150-Pound American Steel Flange Standard (B16.5-1957).

The flanges are plain faced, with a serrated finish.

The valves are regularly furnished faced and drilled to the foregoing Standards. They can be furnished faced only, when orders so specify. Full face gaskets should be used; see page 321.

Weights and Dimensions — Prices on Request

	Size	Weight	Dimensions, in Inches						
						End Flanges			
	Inches	Pounds Each	A	B open	C	Diameter	Thickness	Dia of bolt circle	No & dia of bolts
No. 1450 Flanged F & D	4	70	6¼	23	10	9	11/16	7½	8-5/8
	6	90	6¾	28½	10	11	13/16	9½	8-¾
	8	180	7	36	12	13½	15/16	11¾	8-¾
	10	220	7⅜	42	14	16	1	14¼	12-⅞
	12	320	8	49	16	19	1 1/16	17	12-⅞
	14	390	8½	54	16	21	1 3/16	18¾	12-1
	16	490	9	59	18	23½	1¼	21¼	16-1

Other pulp stock valves . . . . pages 84 and 85 *Special operating equipment . . . . Section 23* *Information on gearing furnished on request*

Nodular Cast Iron Wedge Gate Valves

Outside Screw and Yoke

New nodular (ductile) iron valves for low cost handling of oil and oil vapors at temperatures up to 650 F.

Crane nodular iron valves are satisfactory for oil and oil vapor services where high resistance to thermal shock, impact, bending stresses, and corrosion are essential. They are excellent for use on sour crude and other process lines in refinery and tank farm installations, are used extensively aboard tankers and at dockside transfer areas and, in general, can be used where strength and qualities approaching steel are desired, combined with the economy and corrosion resistance of iron.

Body and bonnet: The body and bonnet are nodular cast iron (ASTM A 395). This metal has corrosion resistance equal to that of regular gray iron, with strength approximating that of carbon steel and three times that of cast iron; see page 3.

The body features liberal sections with the metal properly distributed for maximum strength. Tie ribs between the bonnet flange and end flanges provide additional resistance to line strains. Two ribs, cast in opposite sides of the body, engage machined slots in the disc; they guide the disc and prevent contact with the seating surfaces until the valve is almost closed.

Exelloy trimmed: The solid wedge disc is Exelloy in sizes 4-inch and smaller and is carbon steel faced with Exelloy in larger sizes. The stem, and the shoulder type, screwed-in body seat rings are also Exelloy. The stem is finished with a tapered shoulder for back seating in the Exelloy bonnet bushing.

Yoke and yoke sleeve: The yoke is cast integral with the bonnet on sizes 4-inch and smaller; on larger sizes, it consists of two halves, bolted together at the top and also to the bonnet: The yoke sleeve is nickel alloy.

Pressure-Temperature Ratings
(For Oil or Oil Vapor)

Temperature Deg. Fahr.	Psi Non-Shock	Temperature Deg. Fahr.	Psi Non-Shock
-20 to +100	220	400	145
150	205	450	130
200	190	500	120
250	180	550	110
300	170	600	105
350	155	650	95

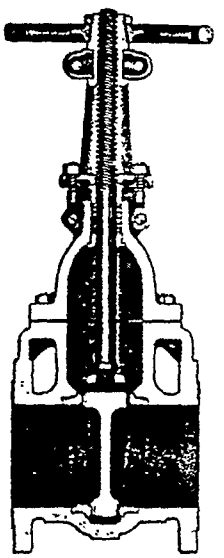
Hydrostatic Test Pressures
Shell . . . 425 psi Seat . . . 300 psi

Valve seat tested 100 psi air-under-water

Gland: The two-piece ball-type gland consists of a siliconized steel gland and a malleable iron gland flange. This construction maintains an even load on the packing and prevents binding on the stem even when the gland bolt nuts are not pulled up evenly. Swinging type gland eye bolts move out of the way to simplify repacking of the valve; they will not loosen in service. The gland eye bolts and bolt nuts are steel.

Stuffing box; repacking: The deep stuffing box is filled with high grade packing. The valves, when wide open, can be repacked while under pressure.

Standards: The valves conform to the American Standard for Face-to-Face Dimensions (B16.10-1957) for Ferrous Flanged Gate Valves. They also comply dimensionally to the American Petroleum Institute (API) Standard for Valves for Refinery Use, No. 600, Fourth Edition (1958). Ratings shown above are 80 per cent of those listed in API No. 600 for 150-pound carbon steel valves.



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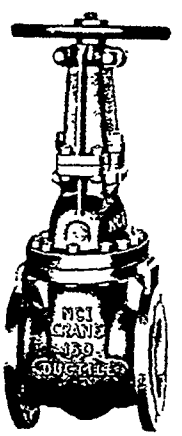

No. 6465 X
Nodular Iron Gate
Exelloy Trimmed
Flanged

8

Weights and Dimensions — Prices on Request

	Size	Weight	Dimensions, in Inches					Turns to open
			Face to face	Center to top, open	Diameter of wheel	End Flanges		
	Inches	Pounds Each				Diameter	Thickness	
No. 6465 X Flanged, F & D	2	44	7	15½	8	6	5/8	7
	2½	50	7½	17	8	7	11/16	8½
	3	65	8	19⅝	9	7½	¾	10½
	4	100	9	23¾	10	9	15/16	9
	6	190	10½	33	12	11	1	13
	8	325	11½	42¼	16	13½	1⅛	17
	10	520	13	50⅞	18	16	1 3/16	21
	12	710	14	58¼	18	19	1¼	25½

End flanges conform to the 150-Pound American Steel Flange Standard (B16.5-1957), and are faced and drilled unless ordered faced only. The flanges have a 1/16-inch raised face, with a serrated finish.

Face to face and thickness of flange dimensions include the 1/16-inch raised face; for drilling templates, see page 329.

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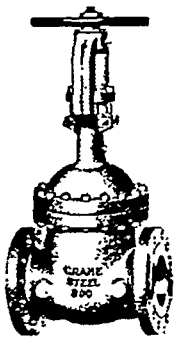
For pressures and temperatures beyond the range of bronze or cast iron . . . .



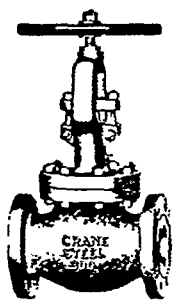
300-Pound
Cast Steel Gate Valve
With Flexible Wedge Disc
(see pages 124 and 125)

Use Crane steel gate valves

When gate valves are required for pressures above 300 psi or temperatures exceeding 550 F, the valve designed for the specific service is certain to be found among the extensive listing of steel gate valves shown elsewhere in this catalog.

For steel gate valves of the conventional type, refer to Section 12. Small size 600-pound valves with reduced and full port openings are available, as are 150 to 2500-pound cast steel wedge gate valves ranging, in some pressure classes, in sizes up to 24-inch. For extremely high temperature steam service, Crane Pressure-Seal Bonnet Gate Valves can be used; see Section 15.

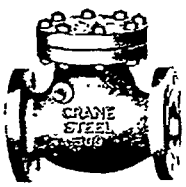
8



300-Pound
Cast Steel Globe Valve
(see pages 146 and 147)

Use Crane steel globe and angle valves

Crane cast and forged steel globe and angle valves offer dependable service in installations where pressures and temperatures are beyond the range of bronze or cast iron. For small size bar stock valves, 600-pound forged steel and 6000-pound hydraulic valves as well as a varied selection of bolted bonnet valves of the 150, 300, 400, 600, 900, 1500, and 2500-pound pressure classes, see Section 13. Also included in Section 13 are Monel trimmed globe valves as well as valves designed specifically for chlorine service. For Pressure-Seal and Lip-Seal Bonnet Globe and Angle Valves, see Section 15.



300-Pound
Cast Steel Swing Check Valve
(see pages 158 and 159)

Use Crane steel check valves

The Crane line of steel check valves includes 600-pound steel union and bolted cap lift checks and swing checks in sizes up to 2-inch, as well as bolted cap swing checks in larger sizes and in pressure classes ranging from 150 to 2500-pound; see Section 14. Steel Pressure-Seal Cap and Lip-Seal Cap Lift Checks are shown on pages 175 and 179, respectively, of Section 15.

SECTION 9

Crane Iron Body Double Disc Gate Valves

Names of Parts.....page 90

General Description.....pages 90 and 91

Iron Body Valves
25-Pound.....pages 92 and 93

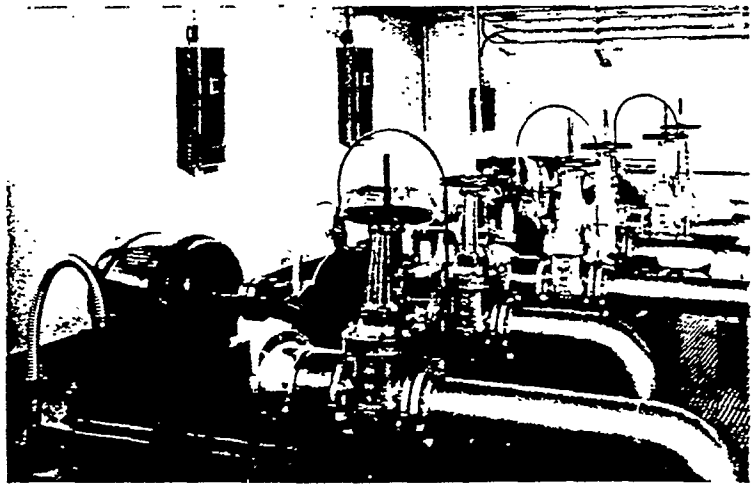
Ferrosteel Valves
200-Pound W.O.G.....pages 94 and 95
500-Pound W.O.G.....page 96

The Crane line of iron body double disc gate valves includes valves for water, oil, or gas pressures up to 500 psi, as well as valves for low pressure steam. Bronze trimmed and all-iron valves are available. The uniformly superior quality that distinguishes all Crane products has been maintained in this line. Excellence of design, high grade materials, and workmanship of the highest order assure dependability in service.

For related data, refer to:

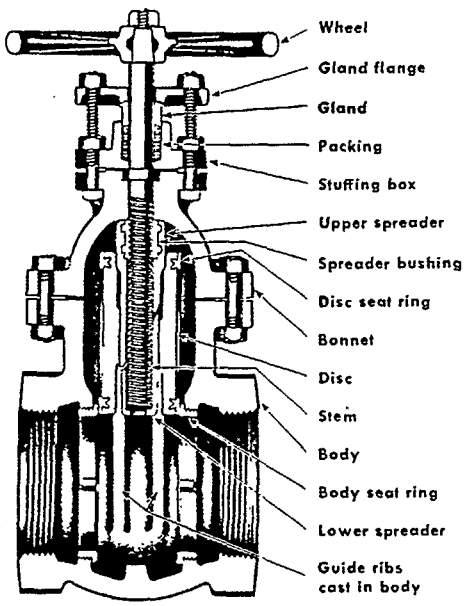
Gearing.....pages 271 to 274
By-passes.....page 282
Accessories for valves.....pages 259 to 283
Gaskets for iron flanged joints.....page 322
Templates for drilling.....pages 327 and 328
Cast steel pipe-line gate valves.....pages 131 to 133

9

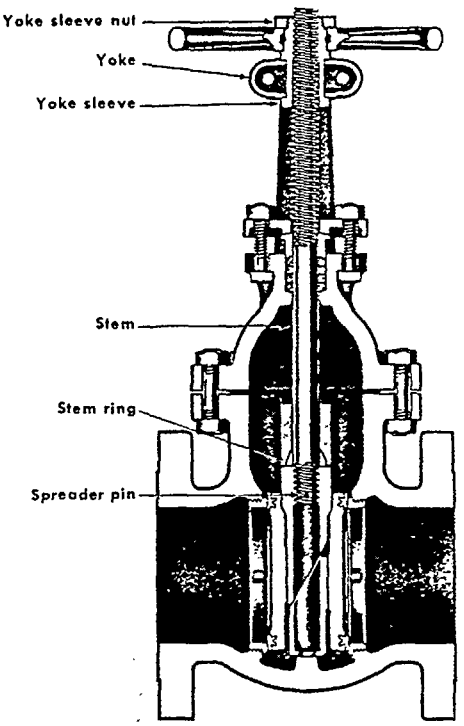


Crane iron body double disc gate valves installed in the pipe lines of a large pumping station

Iron Body Double Disc Gate Valves



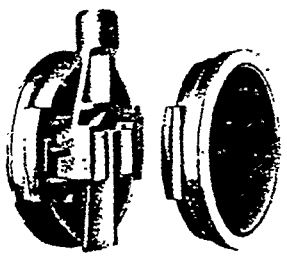
Non-Rising Stem Valve Open



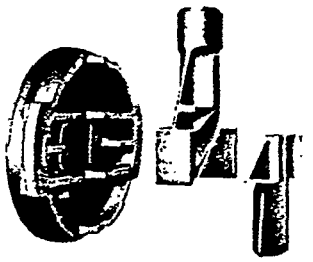
Outside Screw and Yoke Valve Closed

9

Flanged end bodies for 500-Pound W.O.G. Valves have straight through ports; see page 91.



Discs with Spreaders



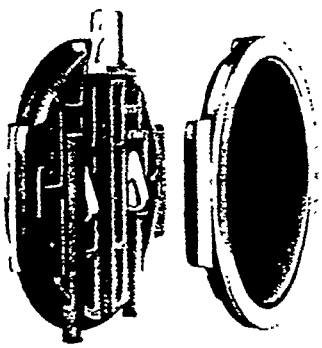
Discs with Spreaders

The discs . . . .

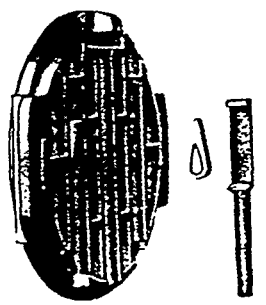
Depending upon the size of the valve and the pressure class, two types of disc construction are used in Crane Iron Body Double Disc Gate Valves.

Discs with spreaders: The upper spreader, engaging the valve stem, raises and lowers the discs. When the valve is being closed, the lower spreader strikes a stop in the bottom of the body; further rotation of the wheel brings the wedging surfaces of the spreaders into contact, and the spreaders force the discs outward against the seats.

Discs with wedges: A disc nut, engaging the valve stem, raises and lowers the discs. When the valve is being closed, two hooks, carrying Manganese Bronze wedges, strike a stop in the bottom of the body; further rotation of the wheel forces the wedges between the discs and the wedges force the discs outward against the seats.



Discs with Wedges



Discs with Wedges

Iron Body Double Disc Gate Valves

General Description

The general characteristics of Crane Iron Body and Ferrosteel Double Disc Gate Valves are illustrated on the preceding page. As the general description below implies, the various lines, quite similar in construction, differ principally in proportions and materials. For specific details on each line, refer to the pages that follow.

Double discs: The seats in the valves are parallel. The disc mechanism, illustrated and described on the preceding page, assures positive, tight seating and easy opening.

Except for certain small size valves having bronze or Crane Special Bronze discs, bronze trimmed valves have cast iron or Ferrosteel discs with bronze or Crane Special Bronze seating faces. The faces are securely rolled into machined dovetails in the discs, assuring tightness under pressure.

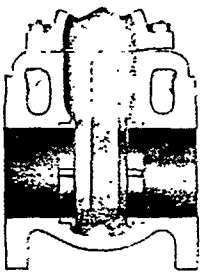
In all-iron valves, the seating faces are cast integral with the discs.

In non-rising stem bronze trimmed valves, the portion of the discs that engages the stem threads is bronze or bronze-bushed.

In bronze trimmed valves with spreader type discs, the lower spreader is bronze in the smaller sizes, and cast iron with bronze wedging faces in the larger sizes.

Body and bonnet: All lines of valves have oval-shaped bodies and bonnets. Metal sections are more than ample, and the metal is distributed to assure maximum strength.

Flanged end 500-Pound W.O.G. Valves have straight through ports, as shown in the illustration at the right. The metal sections adjacent to the bonnet and end flanges are heavily reinforced.



Straight Through Ports in Flanged End 500-Pound W.O.G. Valves

Body seat rings: In bronze trimmed valves, the body seat rings are bronze or Crane Special Bronze.

In 25-pound valves 14-inch and larger, the body seat rings are rolled into machined dovetails in the body.

In 10 and 12-inch 25-pound valves, and in all bronze trimmed valves for higher pressures, the body seat rings are screwed into the body.

All-iron valves are regularly furnished with the seats integral with the body.

Stem: The stem in non-rising stem bronze trimmed valves is made of Crane Cast Manganese Bronze. Outside screw and yoke bronze trimmed valves are made with a rolled bronze stem

All-iron valves have a steel stem; the portion coming in contact with the packing is nickel plated

Gland and stuffing box: All valves have a two-piece ball-type gland, consisting of a siliconized steel gland and a malleable iron gland flange.

This construction provides for even distribution of the compressive loading on the packing, the ball-type bearing between the gland and flange compensating for unequal adjustment of the bolts. Binding on the valve stem and frequent stuffing box maintenance are avoided.

Repacking: These valves, when wide open, can be repacked while under pressure.

In non-rising stem valves, jamming the disc in the wide open position forces the stem collar against the machined top of the bonnet, making a pressure-tight joint.

In outside screw and yoke valves, when the valve is jammed wide open, the tapered stem ring engages a tapered machined surface in the under side of the top of the bonnet, forming a tight joint.

Yoke: In smaller size outside screw and yoke valves, the yoke is cast integral with the bonnet. In larger sizes, the yoke is made in two halves, bolted to the bonnet and bolted together at the top.

Yoke sleeve: The yoke sleeve is made of Crane Cast Manganese Bronze.

Wheel: Wheels are made of malleable iron to assure maximum strength. They have an oval-shaped rim, affording an easy grip.

In non-rising stem valves, the wheel has a tapered square hole fitting the tapered square end of the stem, and is held in place by a steel nut.

In outside screw and yoke valves, the hole in the wheel is hexagonal and tapered, and fits the tapered hexagonal top of the yoke sleeve. The wheel is held in place by a malleable iron nut.

In both types of valves, the wheel is attached securely, yet can be removed easily.

Flange dimensions and facing: The dimensions and drilling of the end flanges on flanged valves conform to the American Cast Iron Flange Standard for their respective working pressures.

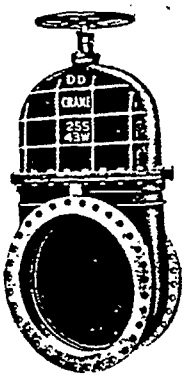
The flanges on 25-Pound and 200-Pound W.O.G. valves are plain faced, with a smooth finish.

The 500-Pound W.O.G. flanged valves are regularly furnished with a raised face 1/16-inch high on the end flanges

9

25-Pound
Iron Body Double Disc Gate Valves
Bronze Trimmed

Non-Rising Stem



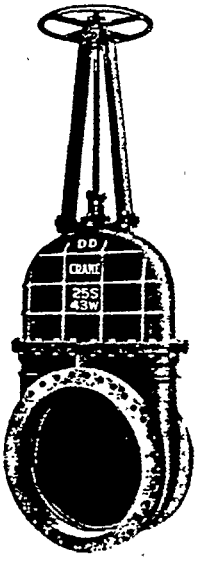
No. 791
Flanged
Non-Rising Stem
Bronze Trimmed

Size of Valve Inches	Working Pressures: Saturated Steam or Cold Gas	Working Pressures: Cold Water Non-Shock	Hydrostatic Test Pressures: Shell test	Hydrostatic Test Pressures: Seat test
10 to 24	25 psi	50 psi	75 psi	65 psi
30 and 36	25 psi	43 psi	75 psi	55 psi
42 and 48	25 psi	35 psi	50 psi	45 psi

For general data on Crane Iron Body Double Disc Gate Valves, see pages 90 and 91.

Outside Screw and Yoke

9



No. 793½
Flanged
Outside Screw and Yoke
Bronze Trimmed

For dimensions and additional description, see the facing page

Recommendations: Crane 25-Pound Iron Body Double Disc Gate Valves, illustrated and described on these facing pages, are admirably suited for a great variety of service conditions.

The valves will give excellent service in low pressure steam, water, or gas lines . . . . in exhaust or condenser piping . . . . in water works, irrigation, filtration, or sewage disposal systems . . . . in pumping engine suction lines . . . . in by-product coke installations . . . . and in similar services.

Vacuum or air service: Valves for vacuum exhaust lines or for air service should be air-tested. Such valves are given a special air test to assure absolute tightness. Unless an air test is specified, water-tested valves are furnished.

Body and bonnet: The body and bonnet are oval-shaped. Metal sections are more than ample and the metal is distributed to assure maximum strength.

The body and bonnet are made of cast iron in sizes 10 to 14-inch, of Crane Ferrosteel in sizes 16 to 24-inch, and of Crane High Tensile Iron in sizes 30-inch and larger. These metals conform to requirements of ASTM Specification A 126, Classes A, B, and C, respectively.

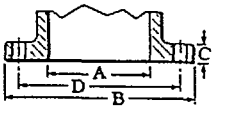
Materials and construction: The valves are short and compact and occupy minimum space in the pipe line. High quality materials are used throughout

The body seat rings, made of bronze, are screwed into the body on 10 and 12-inch sizes and are rolled into the body on sizes 14-inch and larger. The discs are cast iron with bronze seating faces. Non-rising stem valves have a Cast Manganese Bronze stem; the portion of the discs engaging the stem threads is bronze or bronze-bushed. Outside screw and yoke valves have a bronze stem

Stuffing box: The stuffing box is filled with high grade packing. The valves, when wide open, can be repacked while under pressure.

Gland: Both valves have a two-piece ball-type gland consisting of a silicon-ized steel gland and a malleable iron gland flange.

Flange dimensions and facing: The dimensions and drilling of end flanges conform to the 25-Pound American Tentative Cast Iron Flange Standard (B16b2-1931). The flanges are plain faced, with a smooth finish.



Dimensions of Flanges, in Inches

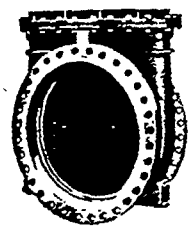
Size	A	B	C	D	No. & diam. of bolts
10	10	16	7/8	14¼	12-5/8
12	12	19	1	17	12-5/8
14	14	21	1⅛	18¾	12-¾
16	16	23½	1⅛	21¼	16-¾
18	18	25	1¼	22¾	16-¾
20	20	27½	1¼	25	20-¾
24	24	32	1⅜	29½	20-¾
30	30	38¾	1½	36	28-⅞
36	36	46	1⅝	42¾	32-⅞
42	42	53	1¾	49½	36-1
48	48	59½	2	56	44-1

25-Pound
Iron Body Double Disc Gate Valves
Bronze Trimmed

(continued from the preceding page)

Disc rollers: Valves 14-inch and larger, ordered for use in a horizontal line with the valve stem horizontal, will be equipped with a bronze track in the lower side of the body, and bronze rollers and bronze scrapers in the lower side of the discs.

Cleanouts: When so ordered, valves 14-inch and larger can be fitted with two side cleanouts, as shown at the left; prices on request.



Double Cleanout

Cleanouts are useful on valves installed in gas lines. They permit passing a rod through the valve between the seats to dislodge coke or other sediment.

Motor or cylinder operation: Valves installed in inaccessible locations or used for emergency purposes should be equipped with some easy means of operation, such as an electric or air motor drive, or an operating cylinder; see pages 260 to 270.

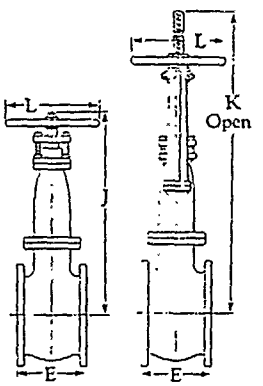
By-passes; gearing: To facilitate operation, by-passes and gearing are available for sizes 14-inch and larger. The use of either, or both, should receive particular consideration for 36-inch No. 791 Valves and for 24-inch and larger No. 793½ Valves. Valves ordered with a by-pass have a longer face to face dimension (E) than those without by-pass.

A by-pass serves to balance pressure on both sides of the discs before the main valve is opened.

For gearing description, see pages 271 to 274; for by-passes, see page 282.

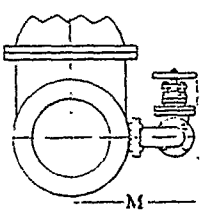
Drilling: Unless otherwise ordered, flanged valves are furnished faced and drilled (F & D) to the 25-Pound American Tentative Cast Iron Flange Standard (B16b2-1931); they can be furnished faced only, when specified.

Larger sizes: Valves in sizes larger than listed in the dimension table below (up to 72-inch) can be made to order; prices and dimensions will be furnished on request.



No. 791 Flanged Non-Rising Stem

No. 793½ Flanged Outside Screw and Yoke



By-pass available for sizes 14-inch and larger

9

Weights and Dimensions — Prices on Request

	Size	Pounds, Each		Dimensions, in Inches							
		No. 791	No. 793½	E*		J	K	L	Turns to open	By-Pass	
	Inches	Non-Rising Stem	Outside Screw & Yoke	Without By-Pass	With By-Pass					Size	M
Bronze Trimmed, Flanged, F & D	10	250	280	9½	. . .	27¾	47	12	22	. . .	. . .
	12	360	390	10	. . .	30¾	54¼	12	26	. . .	. . .
	14*	500	540	10½	16	34	65½	14	29	2	23½
	16*	610	680	11	18	37	72	14	33	3	27½
	18*	820	880	11½	18½	42½	81	18	38	3	28½
	20*	990	1090	12	18½	45½	89½	18	42	3	29½
	24*	1450	1570	13	20	52½	105	20	49	4	33
	30*	2500	2780	14½	20½	64	129	22	124	4	35½
	36*	3780	4070	16	24	75	148	27	147	6	42
	42*	. . .	6500	17½	25½		177	30	131	6	45
	48*	. . .	9200	19	29½		202	36	149	8	52

*By-pass and gearing are available for sizes 14-inch and larger. The use of either, or both, should receive particular consideration for 36-inch No. 791 Valves and for 24-inch and larger No. 793½ Valves. As indicated in the table, valves with by-pass have a longer face to face dimension (E) than the corresponding size furnished without a by-pass. For gearing, see pages 271 to 274; for by-passes, see page 282.

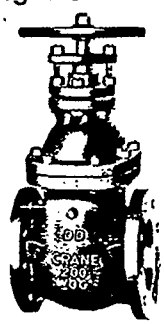
Motor or cylinder operation....pages 260 to 270 Templates for drilling....page 327

200-Pound W.O.G.
Ferrosteel Double Disc Gate Valves
Bronze Trimmed or All-Iron

Non-Rising Stem



Screwed
No. 480
Bronze Trimmed



Flanged
No. 481
Bronze Trimmed

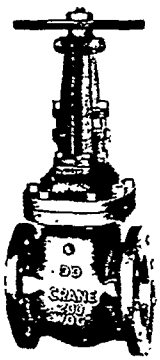
Size of Valve	Working Pressures	Hydrostatic Test Pressures	
	Cold Water, Oil, or Gas Non-Shock	Shell test	Seat test
2 to 12-inch	200 psi	350 psi	225 psi
14 to 24-inch	150 psi	250 psi	175 psi

Air Tested

For general data on Crane Iron Body Double Disc Gate Valves, see pages 90 and 91.

Crane 200-Pound W.O.G. Ferrosteel Double Disc Gate Valves, described on these facing pages, are especially recommended for use in the oil and gas industry and for water lines requiring rugged, substantially constructed valves.

Outside Screw and Yoke



Flanged
No. 483
Bronze Trimmed
No. 1083
All-Iron

9

The valves are excellent for general utility service in oil, gas, or water lines and as such, have a particularly varied application in oil and gas fields, oil refineries, stations for storing and dispensing gasoline or oil, etc.

Body and bonnet: The body and bonnet are made of Crane Ferrosteel in sizes up to 16-inch and of Crane High Tensile Iron in sizes 18-inch and larger. These metals conform to requirements of ASTM Specification A 126, Classes B and C, respectively; see page 3 for details.

Bronze trimmed: Bronze trimmed valves are recommended for water, oil, or gas lines. The body seat rings are bronze, screwed into the body. The discs in sizes 3-inch and smaller are bronze; in larger sizes, they are cast iron with a bronze face.

In non-rising stem valves, the stem is Cast Manganese Bronze and the portion of the discs engaging the stem threads is bronze or bronze-bushed. Outside screw and yoke valves have a bronze stem.

All-iron: The all-iron valves are recommended for oil or gas, or for fluids that corrode bronze. The seats are cast integral with the body and discs. The stem is steel and that portion which comes in contact with the packing is nickel-plated.

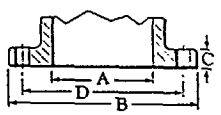
Stuffing box: The stuffing box is amply deep and is filled with high grade packing. The valves, when wide open, can be repacked while under pressure.

Gland: All valves have a two-piece ball-type gland consisting of a siliconized steel gland and a malleable iron gland flange.

Disc rollers: Bronze trimmed valves 16-inch and larger, ordered for use in a horizontal line with the valve stem horizontal will have a bronze track in the lower side of the body and bronze rollers and scrapers in the lower side of the discs

Federal Specification: Bronze trimmed No. 480 non-rising stem screwed, No. 481 non-rising stem flanged, and No. 483 outside screw and yoke flanged valves comply with Federal Specification WW-V-58 for Class "A" 125-Pound Iron Body Double Disc Gate Valves, Type II, Designations "NS", "NF", and "OF", respectively. However, the valves must be ordered with end protectors.

Flange dimensions and facing: Dimensions and drilling of end flanges conform to the American Cast Iron Flange Standard, Class 125 (B16.1-1948). The flanges are plain faced, with a smooth finish.



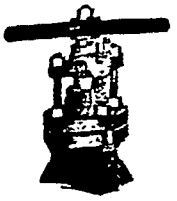
Dimensions of Flanges, in Inches

Size	A	B	C	D	No & dia of bolts
2	2	6	5/8	4 3/4	4-5/8
2 1/2	2 1/2	7	11/16	5 1/2	4-5/8
3	3	7 1/2	3/4	6	4-5/8
4	4	9	15/16	7 1/2	8-5/8
5	5	10	15/16	8 1/2	8-3/4
6	6	11	1	9 1/2	8-3/4
8	8	13 1/2	1 1/8	11 3/4	8-3/4
10	10	16	1 3/16	14 1/4	12-7/8
12	12	19	1 1/4	17	12-7/8
14	14	21	1 3/8	18 3/4	12-1
16	16	23 1/2	1 7/16	21 1/4	16-1
18	18	25	1 9/16	22 3/4	16-1 1/8
20	20	27 1/2	1 11/16	25	20-1 1/8
24	24	32	1 7/8	29 1/2	20-1 1/4

(description continued on the next page)

200-Pound W.O.G.
Ferrosteel Double Disc Gate Valves
Bronze Trimmed or All-Iron

(continued from the preceding page)



Non-Rising Stem Valves with Indicator

Indicator: The stem of outside screw and yoke valves indicates the position of the discs. Non-rising stem valves can be equipped with an all-bronze "Universal" type indicator; specify valve number and size.

Cleanout: Flanged valves 3 to 12-inch, intended for use on lines carrying an unusual amount of sediment, tarry fluids, etc., can be ordered with a cleanout to facilitate cleaning. The cleanout is installed on the side of the valve body, as shown at lower left.



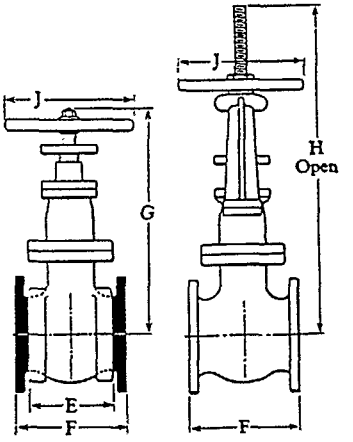
Single Side Cleanout

Motor or cylinder operation: Valves installed in inaccessible locations or used for emergency purposes should be equipped with some easy means of operation, such as an electric or air motor drive, or an operating cylinder; see pages 260 to 270.

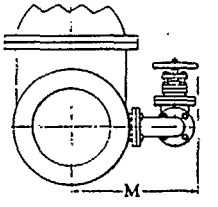
Face to face: Face to face dimensions of flanged valves without by-pass conform to the American Standard for Face-to-Face Dimensions (B16.10-1957) for Class 125 Cast Iron Flanged Double Disc Gate Valves. The Standard includes sizes up to 12-inch only.

Drilling: Flanged valves are regularly furnished faced and drilled (F & D) to the American Cast Iron Flange Standard (Class 125). The valves can be furnished faced only when specified.

Larger sizes: No. 481 and No. 483 flanged valves can be made to order in sizes up to 48-inch; dimensions furnished on request.



Non-Rising Stem Valves — Outside Screw and Yoke Valves



Valves 12-inch and larger are available with a by-pass

9

Weights and Dimensions — Prices on Request

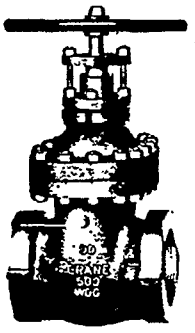
Size	Pounds, Each				Dimensions, in Inches								
	Non-Rising Stem		Outside Screw and Yoke		E	F		G	H	J	Turns to open	By-Pass	
	No. 480 Screwed	No. 481 Flanged F & D	No. 483 Flanged F & D	No. 1083 Flanged F & D		Without by-pass	With by-pass					By-pass size	M
Inches	Bronze Trim	Bronze Trim	Bronze Trim	All-Iron									
2	28	38	40	40	5½	7		12	15	8	7½	...	...
2½	36	40	48	48	6¼	7½	...	12½	16¼	8	9	...	...
3	50	60	60	60	7	8		14	19	9	10½	...	...
4	80	105	110	110	7½	9	..	17½	23½	10	9	...	...
5	...	150	...	...	..	10	..	19¾	...	12	11	...	..
6	.	200	210	210	..	10½	.	21¼	33	12	13	..	.
8*	..	300	330	320	..	11½	..	26	41¼	14	18	...	...
10*	...	470	510	510	..	13	.	30	50	16	22	...	..
12*	...	690	740	720	..	14	18	34½	57	18	26	2	22½
14*	.		1070	..	.	15¾	18½	..	67	20	31	2	23½
16*	..	..	1450	..	.	17	26½	...	75½	22	35	3	26
18*	...	...	1790	..	..	18½	27	..	83½	24	39	3	27½
20*	...	...	2370	...	..	20	28	...	92½	24	44	3	29
24*	.		4000	.	..	24	32		109½	30	52	4	33

*By-passes and gearing: To facilitate operation, by-passes are available for sizes 12-inch and larger and gearing, for sizes 8-inch and larger. The use of either, or both, should be particularly considered for outside screw and yoke valves 12-inch and larger. As indicated in the table, valves with by-pass have a longer face to face dimension (F) than the same size furnished without a by-pass. For description of gearing see pages 271 to 274, for by-passes see page 282.

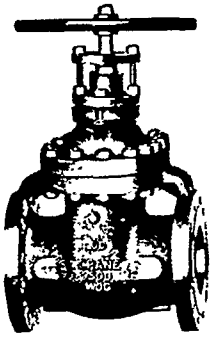
Ratings and description.....page 94
Gearing.....pages 271 to 274
By-passes.....page 282
Templates for drilling.....page 327
Normal thread engagement....page 352

500-Pound W.O.G.—Bronze Trimmed
Ferrosteel Double Disc Gate Valves

Non-Rising Stem



No. 340 E, Screwed



No. 341 E, Flanged

Working Pressure
500 psi non-shock
cold water, oil, or gas

Hydrostatic Test Pressures
1000 psi shell **550** psi seat

Air Tested

Additional description on pages 90 and 91.

Weight — Pounds, Each

Size In.	No. 340 E	No. 341 E	No. 343 E
2	53	63	...
3	90	120	120
4	...	200	210
6	...	350	380
8	...	610	660
10	...	920	...
12	...	1430	...

These valves are used in oil refineries, in pump houses, in pipe lines, in high pressure water lines, and for similar services requiring heavy, massive iron valves.

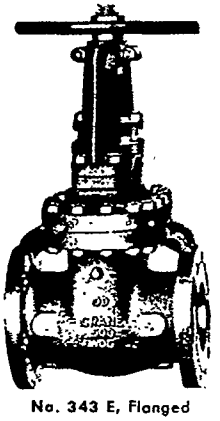
Nos. 340 E, 341 E, and 343 E comply with Federal Specification WW-V-58 for Class "B" 250-Pound Iron Body Double Disc Gate Valves, Type II, Designations "NS", "NF", and "OF", respectively.

Materials: The body and bonnet are Ferrosteel in sizes 2 and 3-inch and Crane High Tensile Iron in sizes 4-inch and larger; these metals conform to ASTM A 126, Classes B and C, respectively.

The body seat rings, screwed into the body, are made of Crane Special Bronze, a hard leaded tin bronze. Discs are Crane Special Bronze in sizes 4-inch and smaller and cast iron faced with Crane Special Bronze in sizes 6-inch and larger.

In non-rising stem valves, the stem is Cast Manganese Bronze and the portion of the discs engaging the stem threads is bronze or bronze-bushed. The outside screw and yoke valves have a bronze stem.

Outside Screw and Yoke



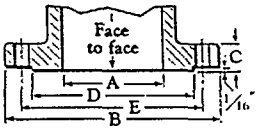
No. 343 E, Flanged

Stuffing box; gland: The stuffing box is filled with quality packing. The two-piece gland consists of a silicon-ized steel gland and malleable iron gland flange. When wide open, the valves can be repacked while under pressure

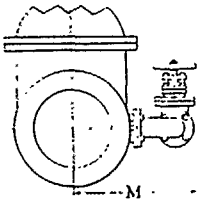
Face to face: Flanged valves without by-pass conform to the American Standard for Face-to-Face Dimensions (B16.10-1957) for Class 250 Cast Iron Flanged Double Disc Gate Valves.

Flange dimensions and facing: End flanges conform to the American Cast Iron Flange Standard, Class 250 (B16b-1944). Flanges have a 1/16-inch raised face. The raised face is finished with approximately 16 concentric grooves per inch, known as a "serrated" finish.

Drilling: Flanged valves are regularly furnished faced, drilled, and spot faced (FD & SF) to the American Cast Iron Flange Standard, Class 250. The valves can be furnished faced only when orders so specify.



End Flanges



By-passes available for sizes 6-inch and larger

Dimensions, in Inches — Prices on Request

Size	End to end	Face to face		Center to top, open		Diameter of wheel	Turns to open	End Flanges						By-Pass	
		W/o by-pass	With by-pass	Nos. 340 E 341 E	No. 343 E			A	B	C	D	E	No. & dia of bolts	By-pass size	M
2	8	8½	...	12½	..	9	15	2	6½	⅞	4 3/16	5	8-⅝		
3	9⅝	11⅛		15½	20¾	10	15	3	8¼	1⅛	5 11/16	6⅝	8-¾		
4		12		18	25	12	19	4	10	1¼	6 15/16	7⅞	8-¾		
6*		15⅞	16	22¾	34	16	28	6	12½	1 7/16	9 11/16	10⅝	12-¾	1¼	12¾
8*		16½	18	28¾	42¾	20	36	8	15	1⅝	11 5/16	13	12-⅞	1½	15⅛
10*		18	20	36		22	44	10	17½	1⅞	14 1/16	15¼	16-1	1½	16⅞
12*		19¾	22	40		24	52	12	20½	2	16 7/16	17¾	16-1⅛	2	24½

*For easier operation by-passes and gearing are available for sizes 6-inch and larger. Use of either or both should be particularly considered for 10 and 12-inch No. 341 E Valves and for 8-inch No. 343 E Valves. See pages 271 to 274 for gearing and page 282 for by-passes.

Drilling templates....page 328
For motor or cylinder operation, see pages 260 to 270.

SECTION 10

Crane Iron Body Globe and Angle Valves

(Including Butterfly Valves)

Globe Valves, Union Bonnet
150-Pound.....pages 98 and 99
1000-Pound W.O.G. (Malleable Iron).....page 103

Angle Valves, Union Bonnet
150-Pound.....page 98

Globe and Angle Valves, Yoke Bonnet
125-Pound.....pages 100 and 101
250-Pound.....page 102

Butterfly Valves.....page 99

Diaphragm Valves.....page 104

For related data, refer to:

Accessories for valves.....pages 259 to 283
Gaskets for iron flanged joints.....page 322
Templates for drilling.....pages 327 and 328
Crane's complete line of packless diaphragm valves (bronze, iron, aluminum, 18-8 SMo).....pages 181 to 188

Flow of Fluids Through Valves, Fittings, and Pipe

The more complex industry becomes, the more vital becomes the role played by fluids in the industrial machine. One hundred years ago, water was the only important fluid which was conveyed from one point to another in pipe. Today, almost every conceivable fluid is handled in pipe during its production, processing, transportation, or utilization. The age of atomic energy and rocket power has added fluids such as liquid metals . . . . i.e., sodium, potassium, and bismuth, as well as liquid oxygen, nitrogen, etc. . . . to the list of more common fluids such as oil, water, gases, acids, and liquors that are being transported in pipe.

Nor is the transportation of fluids the only phase of hydraulics which warrants attention. Hydraulic and pneumatic mechanisms are used extensively for the controls of modern aircraft, sea-going vessels, automotive equipment, machine tools, earth-moving and road-building machines, and even in scientific laboratory equipment where precise control of fluid flow is required. So extensive are the applications of hydraulics and fluid mechanics that almost every engineer has found it necessary to familiarize himself with at least the elementary laws of fluid flow. To this end, Crane has devoted a section of this catalog to a condensed presentation of data previously published in Crane's Technical Paper No. 410, "Flow of Fluids Through Valves, Fittings, and Pipe." See Section 32, pages 421 to 442

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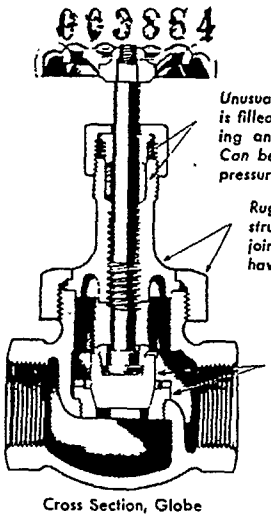
150-Pound Iron Body Globe and Angle Valves

Plug Type Disc



Cross Section, Globe

Working Pressures
150 psi saturated steam
250 psi non-shock cold water, oil, or gas

Renewable body seat ring and plug type disc with Crane "500 Brinell" Stainless Steel seating surfaces
Union bonnet on sizes 2-inch and smaller
Bolted bonnet on sizes 2½ and 3-inch

Recommendations: These globe and angle valves are ideal for installations operating under severe conditions. Strong, compact, and durable, they are recommended for throttling service and for soot blower, blow-off, boiler feed, drip, and drain lines. Except for their disc and seat, the valves are similar to the globe valves shown on the opposite page.

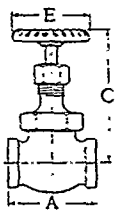


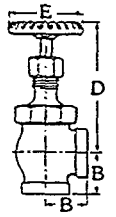
No. 314½ P
Globe, Screwed



No. 316½ P
Angle, Screwed

10





Materials: The body is cast iron conforming to ASTM A 126, Class A. Sizes 2-inch and smaller have a bronze bonnet and malleable iron union bonnet ring; 2½ and 3-inch sizes have a cast iron bonnet.

Disc and seat: The valves have a plug type disc and seat whose excellent design characteristics for rigorous service are well known. The wide seating surface is not easily harmed by foreign matter or by wiredrawing and the tapered disc permits close regulation of flow when throttling.

Both the disc and seat are Crane "500 Brinell" Stainless Steel, an AISI Type 420 stainless steel specially heat-treated for high hardness. The disc and seat design combined with the natural resistance of stainless steel to corrosion, and the excellent resistance offered by the high hardness to erosion, galling, and scoring, produce a truly superior seating combination.

Bonnet design: Sizes 2-inch and smaller have a union bonnet as shown in the illustrations at the left: 2½ and 3-inch valves have a bolted bonnet of the outside screw and yoke type as shown below.

Both bonnet types provide a strong, tight joint, yet they are easily dismantled and reassembled without danger of damaging the valve.

Stuffing box: The stuffing box is unusually deep and is equipped with a gland. It is filled with high grade packing.

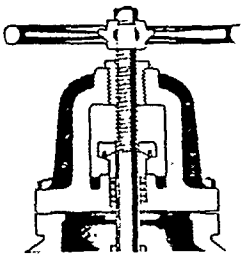
Repacking: The valves, when wide open, can be repacked while under pressure.

Interchangeability: Except for their plug type disc and seat and materials, these valves are the same as the No. 350½ and No. 355½ Globes on the opposite page. Corresponding parts are completely interchangeable, size for size.

Weights and Dimensions — Prices on Request

Size	Pounds, Each		Dimensions, in Inches				
	No. 314½ P Globe	No. 316½ P Angle	Globe		Angle		
Inches	Screwed	Screwed	A	C open	B	D open	E
½	2.1	2.0	3	5⅛	1⅜	5	2⁹⁄₁₆
¾	3.1	2.9	3½	5½	1⁹⁄₁₆	5⅜	2¾
1	4.5	4.3	4⅛	6⅝	1⅞	6½	3¹⁄₁₆
1¼	6.5	6.3	4⅝	7¼	2³⁄₁₆	7¼	3⅝
1½	9.3	8.8	5¼	8¼	2⅜	8⅛	4¹⁄₁₆
2	15.0	14.5	6⅜	9½	3	9¼	4¾
2½	32.0	25.0	7	11½	3½	11¾	8
3	48.0		8	14			9

A metal tag secured under the wheel nut, shows the catalog number of the valve



The 2½ and 3-inch valves have a bolted bonnet of the outside screw and yoke type and a Style D malleable iron wheel

Thread engagement....page 352

150-Pound Iron Body Globe Valves

Regrinding Disc — Bronze Trimmed or All-Iron

Working Pressures
150 psi saturated steam
250 psi non-shock cold water, oil, or gas

Renewable seat valves....bronze trimmed with Monel disc and seat....all-iron with steel or iron disc and seat

Recommendations: These compact valves are used on steam, water, oil, and gas lines. They have a wide application in oil and gas fields, mines, gas and chemical plants, sugar refineries, and similar locations.

Body: The valve body is cast iron conforming to ASTM A 126, Class A.

Disc-seat: The disc and renewable screwed-in seat ring are finished to a 35° taper and have wide contacting surfaces; they hold pressure easily and offer good resistance to wear.

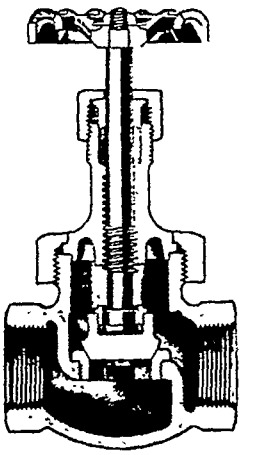
No. 350½: The No. 350½ are ideal for general non-corrosive service. The disc and seat are Monel. The bonnet, gland, and stem are bronze. The union bonnet ring and packing nut are tough malleable iron.

No. 355½: The No. 355½ are all-iron valves. Their bonnet, union bonnet ring, and packing nut are malleable iron. The stem and gland are steel. The disc and seat are steel in the smaller sizes and cast iron in the larger sizes.

Regrinding: These valves can be reground without removing the body from the line.

Stuffing box: The stuffing box is amply deep and filled with high grade packing. The valves, when wide open, can be repacked while under pressure.

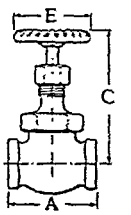
Interchangeability: These valves are a companion line to those on the facing page; parts are interchangeable, size for size.



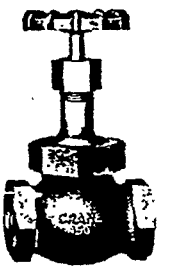
Cross Section

Weights and Dimensions — Prices on Request

Size	Pounds, Each Screwed		Dimensions, in Inches		
	No. 350½ Bronze Trim	No. 355½ All-Iron	A	C open	E
Inches					
¼	1.1	1.1	2⅜	4½	1¾
⅜	1.5	1.5	2⅝	4¾	2 1/16
½	2.1	2.0	3	5⅜	2 9/16
¾	3.1	3.1	3½	6	2¾
1	4.5	4.4	4⅛	7	3 1/16
1¼	6.7	6.4	4⅝	7¾	3⅝
1½	8.4	9.2	5¼	8¾	4 1/16
2	15.0	15.0	6⅜	10¼	4¾



Globe, Screwed



No. 350½, Bronze Trimmed With Monel Disc and Seat

No. 355½, All-Iron with Steel or Iron Disc and Seat

10

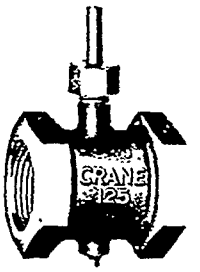
Iron Body Butterfly Valves

Working Pressures
125 psi saturated steam
200 psi non-shock cold water, oil, or gas

Butterfly valves provide easy operation in about one-quarter turn from the wide open to the closed position. They are not intended to close pressure-tight and should be used only to control or regulate flow. The valves have a bronze disc and a steel stem. A drilled hole in the upper part of the stem permits attaching an operating mechanism. The body is cast iron conforming to ASTM A 126, Class A.

Weights and Dimensions — Prices on Request

Size	Pounds Each		Dimensions, Inches		
	No. 380	No. 381	End to end or face to face	Center to top of stem	Diameter of stem
Inches	Screwed	Flanged F & D			
2	5.5		4¼	6⅛	½
2½	7.5		4¾	7	½
3	12.0	23.0	5¼	8	9/16
4		37.0	6	9¼	⅝
6		50.0	7½	11½	¾
8		100.0	9¼	12½	15/16



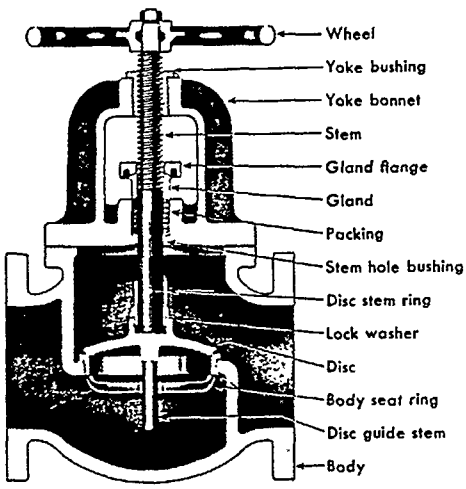
No. 380, Screwed
No. 381, Flanged

Flanged valves: End flanges conform to the American Cast Iron Flange Standard, Class 125 (B16.1-1953). The flanges are plain faced, with a smooth finish. Flanged valves are regularly furnished faced and drilled (F & D) to the aforementioned Standard. Faced only valves can be furnished when specified.

Bronze Butterfly Valves....page 58 *Templates for drilling....page 327* *Thread engagement....page 352*

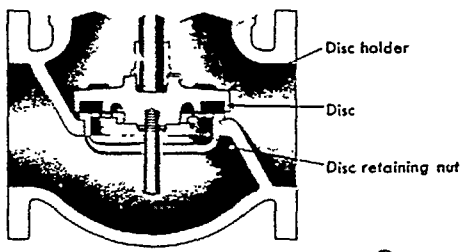
125-Pound Ferrosteel Globe and Angle Valves

With Yoke Bonnet



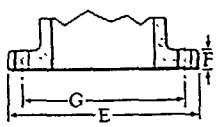
Bronze Trimmed or All-Iron

Except for materials and minor differences in construction, the bronze trimmed valves (illustrated) and the all-iron valves are similar.



Composition Disc

The partial section above shows the disc assembly of composition disc valves. Unless otherwise ordered, the valves have a No. 1 Cranite Disc.



Dimensions of Flanges, Inches

Size	E	F	G	No & dia. of bolts
2	6	5/8	4¾	4-5/8
2½	7	11/16	5½	4-5/8
3	7½	¾	6	4-5/8
3½	8½	13/16	7	8-5/8
4	9	15/16	7½	8-5/8
5	10	15/16	8½	8-¾
6	11	1	9½	8-¾
8	13½	1⅛	11¾	8-¾
10	16	13/16	14¼	12-⅞

Rugged valves for severe services . . . choice of bronze trimmed, all-iron, or composition disc types

Working Pressures, Non-Shock

Fluid	Bronze Trimmed or All-Iron Valves	Composition Disc Valves	
		With No. 1 Cranite Disc (regular)	With No. 6 Disc (optional)
Saturated Steam	125 psi	125 psi	...
Cold Water, Oil, Gas	200 psi	*	200 psi
Air	...	...	200 psi

*Valves with No. 1 Cranite Disc may be used for 200 psi hot water service at temperatures from 200 to 300 F.

Hydrostatic Test Pressures

350 psi shell test **225** psi seat test

The yoke bonnet globe and angle valves described on these facing pages comprise three distinct types . . . bronze trimmed . . . all-iron . . . and composition disc. Similar in design but differing principally in materials, each features rugged construction and quality materials. Thick metal sections and proper metal distribution assure maximum strength.

Bronze trimmed: Bronze trimmed globe and angle valves are recommended for steam and water or for fluids that do not corrode bronze or iron. They have a screwed-in bronze body seat ring and a Cast Manganese Bronze stem. Sizes 6-inch and smaller have a solid bronze disc; larger sizes have an iron disc with a heavy bronze seating face.

All-iron: All-iron globe valves are ideal for fluids corrosive to bronze but not iron. The disc and screwed-in body seat ring are iron. The stem is steel, nickel-plated.

Composition disc: The No. 359 have a composition disc, a bronze screwed-in body seat ring, and a Cast Manganese Bronze stem.

They are regularly furnished with a No. 1 Cranite Disc suitable for saturated steam or for hot water (200 to 300 F). When ordered for water (up to 200 F), oil, gas, gasoline, or air, they are equipped with a No. 6 Disc. For description and service recommendations of composition discs, see page 281.

Body: All valves have a body made of Crane Ferrosteel. This metal conforms to requirements of ASTM Specification A 126, Class B.

Yoke bonnet: The yoke bonnet is also made of Crane Ferrosteel. Stem threads engage the yoke on the outside where they are not affected by fluid in the line and are easily lubricated. The yoke bushing is Cast Manganese Bronze.

Guided disc: Except on 2-inch all-iron valves, the disc or disc holder is closely guided throughout its travel by a disc guide stem operating in a bridge cast integral with the seat ring. The design minimizes vibration of internal parts and assures true seating of the disc.

The disc guide stem in the smaller sizes is integral with the disc; in larger sizes, it is screwed into the disc or disc holder and pinned.

Disc-stem connection: The swivel disc or disc holder is securely fastened to the stem with a disc stem ring. The connection is locked with a special locking device.

Gland: The two-piece gland, consisting of a siliconized steel gland and malleable iron gland flange prevents binding on the stem and assures an even load on the packing. Gland studs and nuts are bronze on bronze trimmed valves and steel on all-iron and composition disc valves.

125-Pound Ferrosteel Globe and Angle Valves
With Yoke Bonnet

(continued from the preceding page)

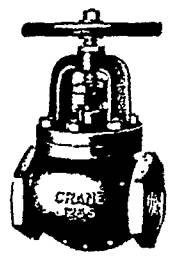
Stuffing box: All valves have an amply deep stuffing box filled with high grade packing. In bronze trimmed valves, the bottom of the stuffing box is fitted with a bronze stem hole bushing.

Repacking: The valves, when wide open, can be repacked while under pressure.

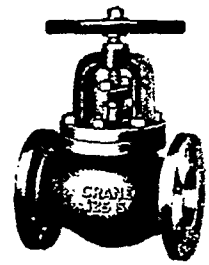
Wheel: The valve wheel, made of tough malleable iron, has a tapered square hole which fits snugly on the square stem end. The wheel is held in place with a wheel nut.

Flanged valves: Flanged valves conform to the American Standard for Face-to-Face and Center-to-Face Dimensions (B16.10-1957) for Class 125 Cast Iron Flanged Globe and Angle Valves.

Bronze Trimmed and All-Iron



Globe, Screwed
No. 350
Bronze Trimmed

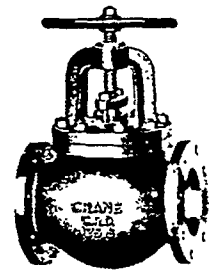


Globe, Flanged
No. 351
Bronze Trimmed
No. 351¼
All-Iron

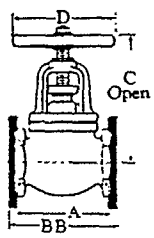


Angle, Flanged
No. 353
Bronze Trimmed
No. 353¼
All-Iron

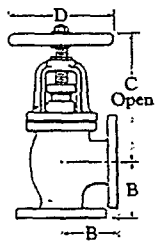
Composition Disc



Globe, Flanged
No. 359
Composition Disc



Globe
Screwed or Flanged



Angle
Flanged

End flanges: The dimensions and drilling of end flanges conform to the American Cast Iron Flange Standard, Class 125 (B16.1-1948). The flanges are plain faced, with a smooth finish. For dimensions of end flanges, see the facing page; for drilling templates, see page 327.

Drilling: Flanged valves are regularly furnished faced and drilled to the American Cast Iron Flange Standard, Class 125. They can be furnished faced only when specified.

250-pound valves: For 250-Pound Ferrosteel Globe and Angle Valves with yoke bonnet, see next page; the valves are bronze trimmed.

10

Weights and Dimensions — Prices on Request

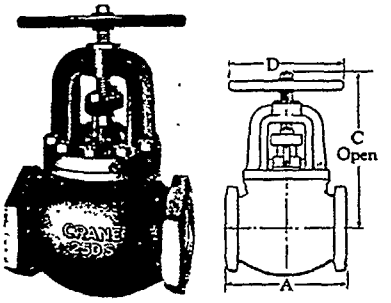
Size	Pounds, Each						Dimensions, in Inches					
	Bronze Trimmed			All-Iron		Composition Disc*	A	BB	B	C Globe		C Angle	D
	No. 350	No. 351	No. 353	No. 351¼	No. 353¼	No. 359				Bronze Trimmed or All-Iron	With Composition Disc		
Inches	Globe, Screwed	Globe, Flanged	Angle, Flanged	Globe, Flanged	Angle, Flanged	Globe, Flanged							
2	22	29	31	29	28		6½	8	4	11⅛	...	11	8
2½	30	41	30	30	37	49	7	8½	4¼	11½	10½	11½	8
3	40	50	40	40	50	65	8	9½	4¾	13¼	12¼	12¾	9
3½	..	70	..	..	..	..	..	10½	...	13½	...	...	9
4	60	90	90	90	70	90	10	11½	5¾	15½	14½	15	10
5	..	120	120	..	..	140	..	13	6½	17½	16¼	17½	10
6	..	180	150	170	140	180	..	14	7	19½	18¾	19½	12
8	..	340	280	330	280	..	..	19½	9¾	25	..	21½	16
10	..	520	470	..	..	..	..	24½	12¼	30	...	27	18

* 350 Valves are regularly furnished with a No. 1 Granite Disc for saturated steam, or for hot water from 200 to 300 F. When specified they can be furnished with a No. 6 Disc suitable for water up to 200 F, oil, gas, gasoline, or air

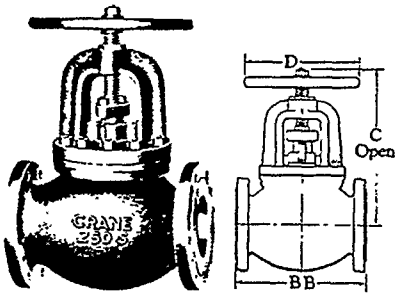
Extra composition discs.....page 281
Valves for marine service....pages 233 and 234
Templates for drilling....page 327
Thread engagement.....page 352

250-Pound Ferrosteel Globe and Angle Valves

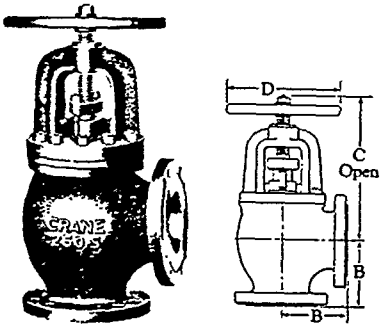
Yoke Bonnet — Bronze Trimmed



Globe, Screwed
No. 20 E



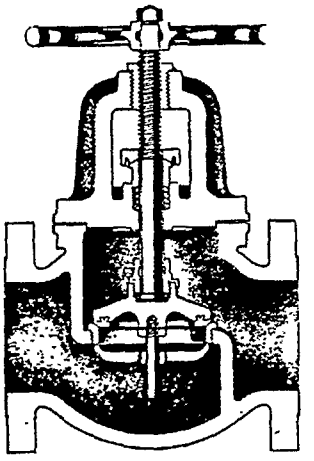
Globe, Flanged
No. 21 E



Angle, Flanged
No. 23 E

Working Pressures
250 psi steam, 450 F
500 psi non-shock cold water, oil, or gas

Hydrostatic Test Pressures
Shell test — 1000 psi
Seat test — 550 psi



Cross Section, Globe

These valves have unusually heavy metal sections and are suitable for severe and high pressure service on steam, water, oil, and gas lines.

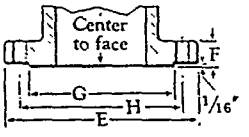
Materials: The body and yoke bonnet are Crane Ferrosteel conforming to ASTM A 126, Class B. The body seat ring is Crane Special Bronze, a strong, wear-resisting, leaded tin bronze.

The stem and yoke bushing are Cast Manganese Bronze. Sizes 3-inch and smaller have a solid Crane Special Bronze disc; larger sizes have an iron disc with a large Crane Special Bronze seating face rolled in. All valves have a two-piece, ball-type gland and gland flange. The gland is siliconized steel or bronze, and the gland flange is forged steel or malleable iron, depending on the valve size.

Construction: The disc is securely fastened to the stem with a disc stem ring; the connection is locked with a special lock washer on sizes up to 5-inch and with a set screw on larger sizes. A guide stem (integral with disc in sizes 3-inch and smaller; screwed into the disc and pinned on larger sizes) guides the disc closely throughout its travel, assuring true seating. Valves 6-inch and smaller have a 45° seat; 8-inch valves have a flat seat.

The deep stuffing box is filled with high grade packing. The valves, when wide open, can be repacked while under pressure.

Flanged valves: Flanged valves conform to the American Standard for Face-to-Face and Center-to-Face Dimensions (B16.10-1957) for Class 250 Cast Iron Flanged Globe and Angle Valves. End flanges conform to the American Cast Iron Flange Standard, Class 250 (B16b-1944); they have a 1/16-inch raised face with serrated finish (about 16 concentric grooves per inch).



Flanged valves are furnished faced and drilled unless faced only is specified.

10

Weights and Dimensions — Prices on Request

Size	Pounds, Each			Dimensions, in Inches										
											End Flanges			
Inches	No. 20 E Globe Screwed	No. 21 E Globe Flanged F & D	No. 23 E Angle Flanged F & D	A	BB	B	C Globe	C Angle	D	E	F	G	H	No & dia of bolts
2	48.5	58.5	54.0	9½	10½	5¼	13¾	13	9	6½	⅞	4 3/16	5	8-⅝
2½	74.5	70.0	80.0	10¾	11½	5¾	14¾	13¾	10	7½	1	4 15/16	5⅞	8-¾
3	90.0	110.0	90.0	11¾	12½	6¼	16½	15½	10	8¼	1⅛	5 11/16	6⅝	8-¾
4	130.0	160.0	160.0	13	14	7	18½	17¼	12	10	1¼	6 15/16	7⅞	8-¾
5		225.0	222.0		15¾	7⅞	21	19½	14	11	1⅜	8 5/16	9¼	8-¾
6		320.0	280.0		17½	8¾	23¼	21¾	16	12½	1 7/16	9 11/16	10⅝	12-¾
8		550.0	470.0		21	10½	28½	26	20	15	1⅝	11 15/16	13	12-⅞

Templates for drilling . . . . page 328

Malleable Iron Globe Valves

1000-Pound W.O.G. — Plug Type Disc

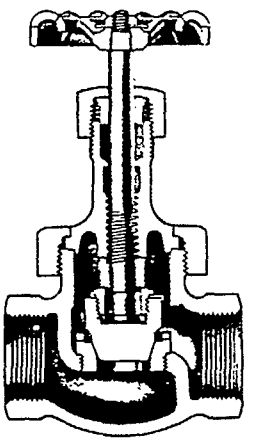
Working Pressures
300 psi steam or hot oil, 550 F
1000 psi non-shock cold water, oil, gas, or air

Test Pressure
1200 psi hydrostatic

Air Tested

Union Bonnet Valves with Crane "500 Brinell" Stainless Steel Seating Surfaces

Choice of Exelloy or Steel Stem



Cross Section
Globe Valve with
Exelloy or Steel Stem



Globe, Screwed
No. 254 P
With Exelloy Stem
No. 255 P
With Steel Stem

Recommendations: These 1000-Pound W.O.G. Malleable Iron Globe Valves are exceptionally strong and compact. They are ideal for oil lines where fire hazard legislates against the use of cast iron and for services where a material stronger than cast iron is desired. The valves hold pressure easily and, when throttled, permit accurate regulation of flow.

Materials: The body, bonnet, and union bonnet ring are made from high grade malleable iron conforming to ASTM Specification A 338.

Generous metal sections in all parts and the durability of the materials used contribute to the unusual ruggedness of the valves. They have a very liberal factor of safety at the maximum recommended working pressures.

No. 254 P Valves have an Exelloy stem. The No. 255 P have a steel stem, nickel-plated. A metal tag, secured under the wheel nut, shows the catalog number of the valve.

Plug type disc and seat: The valves have a plug type disc and seat whose excellent design characteristics for rigorous service are well known. The wide seating surface is not easily harmed by foreign matter or wire-drawing and the tapered disc permits close regulation of flow when throttling.

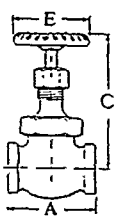
Both the disc and renewable seat are made of Crane "500 Brinell" Stainless Steel, an AISI Type 420 steel specially heat-treated for high hardness. Their design, combined with the natural resistance of stainless steel to corrosion and the excellent resistance offered by the high hardness to erosion, galling, and scoring, produce a truly superior seating combination.

Union bonnet: The union bonnet connection, joining the body and bonnet in a metal to metal contact, is made up with a heavy malleable iron union ring. The joint is strong, tight, simple, and practical; yet, when occasion demands, it can be easily dismantled and reassembled quickly. Gaskets are not required.

Stuffing box: The stuffing box, unusually deep, is fitted with a steel gland and a malleable iron packing nut; it is filled with a high grade packing.

Weights and Dimensions (Inches) — Prices on Request

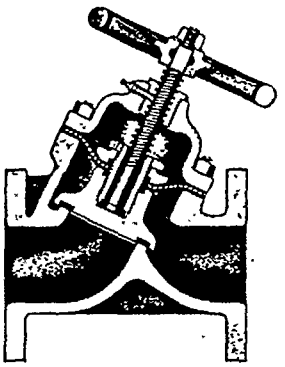
Size	No. 254 P Globe, Screwed — Exelloy Stem				No. 255 P Globe, Screwed — Steel Stem			
Inches	Pounds Each	A	C open	E	Pounds Each	A	C open	E
1/4	1.1	2 3/8	4 1/2	1 3/4	1.1	2 3/8	4 1/2	1 3/4
3/8	1.5	2 5/8	4 5/8	2 1/16	1.5	2 5/8	4 5/8	2 1/16
1/2	2.1	3	5 1/4	2 9/16	2.1	3	5 1/4	2 9/16
3/4	3.0	3 1/2	5 5/8	2 3/4	3.1	3 1/2	5 5/8	2 3/4
1	4.5	4 1/8	7	3 1/16	4.5	4 1/8	7	3 1/16
1 1/4	6.3	4 5/8	7 5/8	3 5/8	6.3	4 5/8	7 3/4	3 5/8
1 1/2	9.2	5 1/4	8 3/4	4 1/16	9.1	5 1/4	8 3/4	4 1/16
2	16.0	6 3/8	10	4 3/4	15.0	6 3/8	10	4 3/4



Repacking: These valves, when wide open, can be repacked while under pressure

Thread engagement..page 352

Iron Body Packless Diaphragm Valves



Sectional of an iron body unlined diaphragm valve. Also available with the body lined, and the disc coated, with neoprene or rubber.

Crane Diaphragm Valves are described in detail in Section 16

Lined and unlined valves with wheel or sliding stem . . . . for general and corrosive services

Crane diaphragm valves, available in a wide choice of body, diaphragm, and disc insert materials, are highly recommended for use in general and corrosive services.

The valves belong to that general class known as "packless" valves, so called because the customary stuffing box around the stem has been eliminated through the use of a flexible diaphragm mounted between the body and bonnet. The diaphragm coupled with the "tight-seating" disc facing make the valves ideal for conveying liquids, compressed air, gases, volatile fluids, etc. They are rated for pressures up to 150 psi and, depending on the diaphragm and disc insert material, for temperatures up to 200 F.

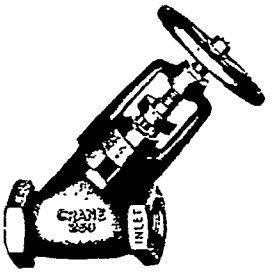
Iron body diaphragm valves are regularly made with screwed ends in sizes up to 2-inch and with flanged ends in sizes up to 14-inch . . . . with a neoprene, natural rubber, Buna N, or Kel-F diaphragm and disc insert . . . . and with wheel or sliding stem operation. Valves lined with neoprene or natural rubber also are available.

A complete line: The iron body unlined and lined valves described briefly on this page are only a small portion of Crane's extensive line. Also included are valves made of bronze, aluminum, and 18-8 SMo with the same choice of diaphragm and disc insert materials. For complete details, refer to Crane's Diaphragm Valve Section 16, pages 181 to 188.

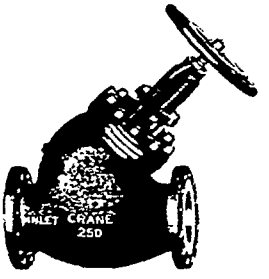
10

Crane Iron Body Valves

Specific types are available to suit practically any service requirement



250-Pound Ferrosteel Blow-Off Valve
(see page 218)



250-Pound Ferrosteel Stop-Check Valve
(see page 221)

Commonly used types of Crane iron body valves are described in Sections 8 to 11 of this catalog.

In addition to the foregoing, Crane regularly manufactures a wide assortment of iron body valves in designs that will automatically perform a specified duty in piping installations. For the convenience of the catalog user, such valves are described in other sections of the catalog along with related items.

For complete description of commonly used iron body valves as well as those for specific purposes, refer to the following listings:

Iron body wedge gate valves	Section 8
Iron body double disc gate valves	Section 9
Iron body globe and angle valves	Section 10
Iron body check and foot valves	Section 11
Iron body diaphragm valves	Section 16
Iron body valves for marine service	Section 20
Alloy iron wedge gate valves	pages 82, 83, and 87
Iron body and alloy iron pulp stock valves	page 84
Iron body butterfly valves	page 90
3½% nickel iron swing check valves	page 114
Iron body pop safety valves	page 200
All-iron relief valves	page 216
Ferrosteel blow-off valves	page 218
Ferrosteel stop-check valves	page 221

SECTION 11

Crane Iron Body Check and Foot Valves

(Including Alloy Iron Valves)

Iron Body Lift Check
125-Pound.....page 107
150-Pound.....page 106
Vertical Type.....page 107

Iron Body Swing Check
125-Pound.....pages 108 to 110
125-Pound, Outside Lever and Weight.....page 110
250-Pound.....page 113
1000-Pound W.O.G., Malleable Iron.....page 106
Clearway Type, Underwriters' Pattern.....page 112

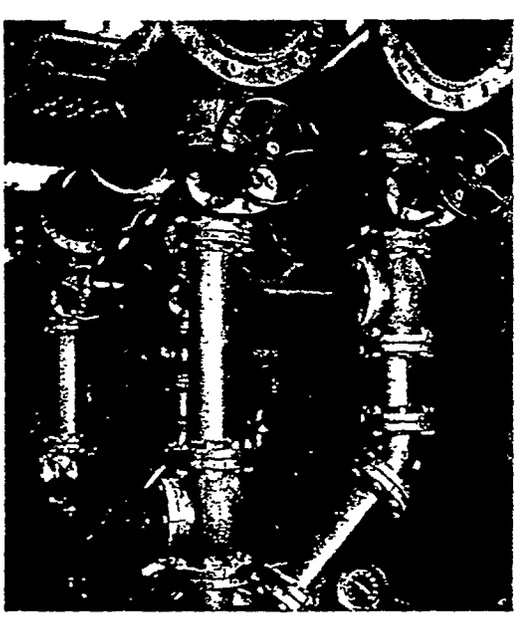
3% Nickel Cast Iron Swing Check
For Process Industries.....page 114

Foot Valves.....page 111

The liberal variety of sizes and types of Crane iron body check and foot valves described in this section assures an adequate selection for all ordinary service requirements. In addition, the stop-check valves shown on page 221 are frequently used to excellent advantage for regular check valve service in boiler feed lines, in the discharge lines from high pressure pumps, and in the discharge lines from air compressors.

For related data, refer to:

Stop-check valves.....pages 219 to 225
Gaskets for iron flanged joints.....page 322
Templates for drilling.....pages 327 and 328
Proper sizing of check and foot valves.....page 427



Crane iron body check and gate valves in an electric light and power plant.

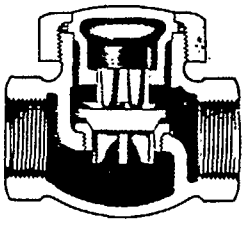
11

150-Pound Iron Body Lift Check Valves

Monel Disc and Seat

Working Pressures
150 psi saturated steam
250 psi non-shock cold water, oil, or gas

Compact valves for small size pipe lines



Cross Section
No. 366½



No. 366½
Horizontal Lift
Screwed

Recommendations: The No. 366½ Lift Check is an excellent valve for use on small lines carrying steam, water, oil, gas, and similar fluids.

Materials: High grade materials are used throughout. The body is made of cast iron conforming to requirements of ASTM Specification A 126, Class A.

The cap is made of bronze. The union cap ring is malleable iron. The valves feature a disc and body seat ring made of Monel, a high strength alloy offering excellent resistance to wear and corrosion.

Construction: The valves are compact and rugged. Their union cap provides a strong, tight joint; it can easily be dismantled or reassembled, when necessary. The disc is guided both at the top and bottom, assuring square seating

Weights and Dimensions

	Size	Weight	End to end	Center to top
	Inches	Pounds Each	Inches	Inches
No. 366½ Screwed	½	1.6	3	1¾
	¾	2.4	3½	2 1/16
	1	3.4	4⅛	2 5/16
	1¼	5.5	4⅝	2 11/16
	1½	7.7	5¼	3 3/16
	2	12.4	6⅜	3⅝

Prices on Request

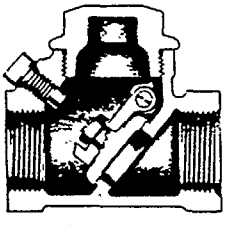
1000-Pound W.O.G.

Malleable Iron Swing Check Valves

Working Pressures
300 psi oil, 550 F
1000 psi non-shock cold water, oil, or gas

Test Pressure
1200 psi hydrostatic

11



Cross Section
No. 346½



No. 346½
Screwed

Recommendations: No. 346½ Swing Checks are compact, ruggedly constructed valves.

They are especially suitable for use on oil lines where fire hazard legislates against the use of cast iron, and for corrosive services where all-iron valves are satisfactory but where a material stronger than cast iron is desired.

Materials: The body, cap, disc, and hinge are made of tough, durable malleable iron conforming to ASTM Specification A 338. The hinge pin is Exelloy.

Regrinding: The valves can be reground without taking the body from the line. Simply remove the stop plug; a screw driver can then be engaged with the slot in the disc spud, making it easy to rotate the disc when regrinding.

Weights and Dimensions

	Size	Weight	End to end	Center to top
	Inches	Pounds Each	Inches	Inches
No. 346½ Screwed	½	.9	2¾	1 7/8
	¾	2.0	3 1/16	2 1/8
	1	2.2	3 5/8	2 1/2
	1¼	3.6	4⅛	2 7/8
	1½	5.4	4 13/16	3 3/8
	2	9.0	5 13/16	3 7/8

Prices on Request

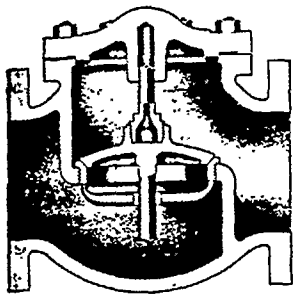
Normal thread engagement....page 352

Proper sizing of check valves....page 427

125-Pound Ferrosteel Lift Check Valves

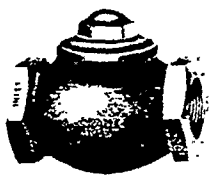
Bronze Trimmed

Horizontal

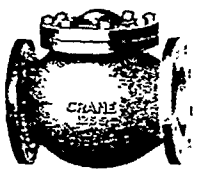


Cross Section

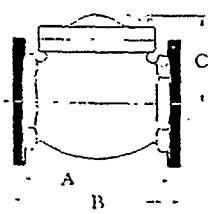
Flanged horizontal lift check valves have an iron bolted cap as shown above. Screwed end valves are furnished with a bronze screwed-in cap as illustrated directly below.



No. 366
Horizontal, Screwed



No. 367
Horizontal, Flanged



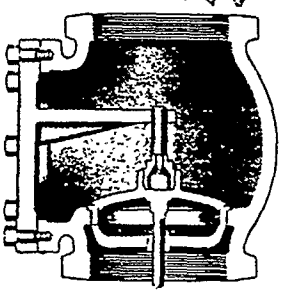
Horizontal Checks

Working Pressures
125 psi saturated steam
200 psi non-shock cold water, oil, or gas

Test Pressures
Shell — 350 psi hydrostatic
Seat — 225 psi hydrostatic

Horizontal and vertical lift checks for use in large size pipe lines

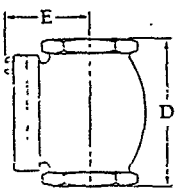
Vertical



Cross Section



No. 368
Vertical, Screwed



Vertical Check

Recommendations: These iron body horizontal and vertical lift check valves are designed for service in large size pipe lines carrying steam, water, oil, gas, and similar fluids.

Materials and construction: The valves are unusually rugged. Their body, well proportioned throughout, is made of Crane Ferrosteel conforming to ASTM Specification A 126, Class B.

All valves are bronze trimmed. The body seat ring is bronze, screwed into the body. The disc is solid bronze and is accurately guided both at the top and bottom to assure square seating.

No. 366 Valves are equipped with a bronze cap, screwed into the body. The No. 367 and No. 368 Valves have an iron cap bolted onto the body.

Proper sizing: In many cases, difficulties arising in the use of check valves are due to oversizing. For proper sizing of check valves, see page 427.

11

Flange dimensions and facing: The dimensions and drilling of the end flanges of No. 367 Valves conform to the American Cast Iron Flange Standard, Class 125 (B16.1-1948). The flanges are plain faced, with a smooth finish.

Drilling: Flanged valves are regularly furnished faced and drilled (F & D). Lines can be furnished faced only when specified

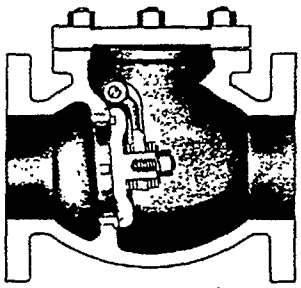
Weights and Dimensions — Prices on Request

Size	No. 366 Horizontal Lift Screwed			No. 367 Horizontal Lift Flanged, F & D			No. 368 Vertical Lift Screwed		
	Pounds	A	C	Pounds	B	C	Pounds	D	E
Inches	Each	End to end Inches	Center to top, Inches	Each	Face to face, Inches	Center to top, Inches	Each	End to end, Inches	Center to top, Inches
2	11.0	6½	3½						
2½	15.6	7	4¼						
3				40.0	9½	5	30.0	8	5
4				70.0	11½	6¼	55.0	10	6
5				90.0	13	7			
6				120.0	14	8¼			

Templates for drilling....page 327 *Thread engagement....page 352*

125-Pound Ferrosteel Swing Check Valves

Bronze Trimmed or All-Iron



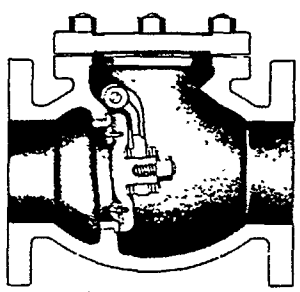
Bronze Trimmed
(8-inch and smaller illustrated)

All valves . . . bronze trimmed *and all-iron* . . . in sizes 8-inch and smaller feature the flexible disc-hinge connection illustrated above. The design provides true seating and reduces wear on the parts.

Valve Size, Inches	Working Pressures: Saturated Steam	Working Pressures: Cold Water, Oil, or Gas Non-Shock	Hydrostatic Test Pressures: Shell test	Hydrostatic Test Pressures: Seat test
2 to 12	125 psi	200 psi	350 psi	225 psi
14 and 16	125 psi	150 psi	250 psi	175 psi
18 to 24	.....	150 psi	250 psi	175 psi

Valves with a leather faced disc are recommended for cold water service only.

Sturdily constructed swing checks . . . with flexible disc-hinge connection on sizes 8-inch and smaller.



Bronze Trimmed
With Leather Faced Disc
(8-inch and smaller illustrated)

When specified, bronze trimmed valves in some sizes are available with a leather faced disc; such valves are suitable for cold water service only.

11

For additional description, weights, and dimensions, see the facing page.

Swing Check Valves Equipped with Outside Lever and Weight

For a complete description of iron body swing check valves equipped with an outside lever and weight, refer to page 110. The lever and weight can be mounted either to assist the disc in closing or to balance the disc so that the valve opens under minimum pressure

The Crane line of Ferrosteel Swing Check Valves, described on these facing pages, includes both bronze trimmed and all-iron types.

Bronze trimmed valves: The bronze trimmed valves are recommended for steam or water . . . or for fluids that do not corrode bronze.

The body seat ring is bronze and is screwed into the body. The hinge pin, also bronze, rides in bronze bushings, one on each side of the valve body, thus assuring a non-corrosive, wear-resistant bearing. The disc is made of bronze in sizes 3-inch and smaller and is iron faced with bronze in larger sizes.

All-iron valves: All-iron valves are recommended for gas . . . or for fluids that corrode bronze but not iron.

The seating surfaces are cast integral with the body and disc. The valves have an Exelloy hinge pin supported at each end by iron bushings in the valve body.

Body and cap metals: The body and cap are made of Crane Ferrosteel in sizes up to 16-inch and of Crane High Tensile Cast Iron in sizes 18-inch and larger.

These metals conform to requirements of ASTM Specification A 126 for Class B Higher Strength and Class C High-Test Castings respectively; for detailed description of these metals, see page 3.

Construction: These are well proportioned, sturdily constructed valves. The body, oval or globular in shape, provides ample flow area around the disc when the valve is wide open. All valves are designed so that the disc cannot stick in the open position.

The hinge is suspended in the body. A tapped and plugged opening in each of the two bosses on the body provides easy access to either end of the hinge and simplifies changing over to outside lever and weight construction.

Disc-hinge connection: Valves 8-inch and smaller (patented) feature a flexible disc-hinge connection. Two springs are used in the connection, one on each side of the hinge. When the disc nut is tightened upon assembly, these springs are compressed sufficiently to provide a flexible but semi-rigid connection which eliminates lost motion between the parts, reduces wear . . . and yet, permits the disc to make true, full contact with the seat. The cross sections at the left illustrate this construction.

Valves 10-inch and larger (not illustrated) have the conventional swing check valve disc-hinge connection; the spud on the disc fits into a hole in the hinge, the parts being held together by a large washer and a nut.

Leather faced disc: The bronze trimmed valves (Nos. 372 and 373) in certain sizes, can be furnished with a leather faced disc.

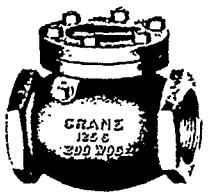
The No. 372 can be furnished with a leather faced disc in sizes 2½, 3, and 4-inch. The No. 373 can be similarly equipped in sizes 3, 3½, 4, 6, 8, and 10-inch.

Valves having a leather faced disc are recommended for cold water service only.

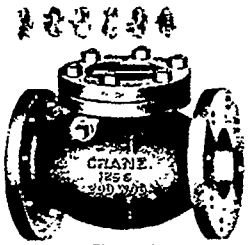
125-Pound Ferrosteel Swing Check Valves

Bronze Trimmed or All-Iron

For working pressures and additional description, see the preceding page.



Screwed
No. 372, Bronze Trimmed
No. 372½, All-Iron



Flanged
No. 373, Bronze Trimmed
No. 373½, All-Iron

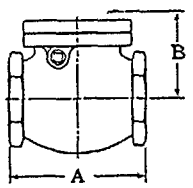
Installation: Crane Ferrosteel Swing Check Valves may be used in a horizontal position or, if desired, in a vertical position for upward flow.

By-passes: A by-pass can be furnished on flanged valves 12-inch and larger when specified; an added charge applies. The valve in the by-pass is a non-rising stem wedge gate valve. The table at the left lists the sizes of main valves and by-pass valves.

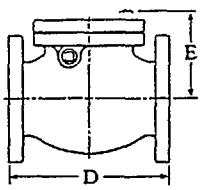
By-Pass Sizes For Main Valves

Main Valve Inches	By-Pass Valve Inches
12 and 14	2
16 to 20	3
24	4

Additional information, prices, and dimensions of valves equipped with by-pass will be furnished on request.



Screwed

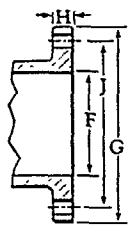


Flanged

Face to face dimensions: The face to face dimensions of flanged valves conform to the American Standard for Face-to-Face Dimensions (B16.10-1957), for 125-Pound Cast Iron Swing Check Valves. This Standard does not include a 3½-inch size, nor does it include sizes larger than 14-inch.

Flange dimensions and facing: The dimensions and drilling of the end flanges on flanged valves conform to the American Cast Iron Flange Standard, Class 125 (B16.1-1948). The flanges are plain faced, with a smooth finish.

Drilling: Flanged valves are regularly furnished faced and drilled to the American Cast Iron Flange Standard, Class 125. The valves can be furnished faced only but orders must so specify.



End Flanges

Weights and Dimensions — Prices on Request

Size	Pounds, Each						Dimensions, in Inches								
	*Bronze Trimmed				All-Iron		Screwed		Flanged						
	No. 372 Screwed		No. 373 Flanged		No. 372½ Screwed	No. 373½ Flanged					End Flanges				
In.	Metal Disc	Leather Faced Disc	Metal Disc	Leather Faced Disc	Metal Disc	Metal Disc	A	B	D	E	F	G	H	J	No & diameter of bolts
2	18	...	25	...	18	25	6½	4¼	8	4¼	2	6	5/8	4¾	4-5/8
2½	20	20	30	..	20	30	7	4 3/16	8½	4 3/16	2½	7	11/16	5½	4-5/8
3	32	30	40	40	32	40	8	5 1/16	9½	5 1/16	3	7½	¾	6	4-5/8
3½		...	56	55				..	10½	5 13/16	3½	8½	13/16	7	8-5/8
4	60	60	80	80	60	80	10	6 3/16	11½	6 3/16	4¼	9	15/16	7½	8-5/8
5	90	..	120	...	.	120	11¼	7 3/16	13	7 3/16	5¼	10	15/16	8½	8-¾
6	120	.	150	150		150	12½	7½	14	7½	6 5/16	11	1	9½	8-¾
8	.	..	290	290	.	290	...		19½	10 3/16	8	13½	1⅛	11¾	8-¾
10		...	450	450	.	450	...		24½	12⅛	10	16	13/16	14¼	12-⅞
12		.	670	...		670	.	.	27½	13¾	12	19	1¼	17	12-⅞
14			960	...	.	..	...	.	31	16⅛	14	21	1⅜	18¾	12-1
16			1430	.	.	. .	. .		36	17⅞	16	23½	17/16	21¼	16-1
18			1680			..	..	.	36	17½	18	25	1 9/16	22¾	16-1⅛
20			2030	...	.	.	..	..	40	20	20	27½	1 11/16	25	20-1⅛
24			3010	. .	.		..		48	21	24	32	1⅞	29½	20-1¼

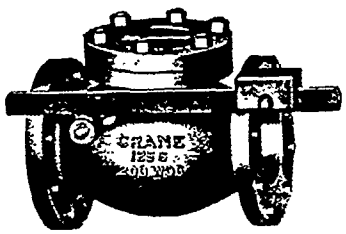
*Bronze trimmed valves are regularly furnished with a metal (bronze or bronze faced) disc. Sizes available with a leather faced disc will be so furnished only if specified

Templates for drilling.....page 327
Normal thread engagement.....page 352
Proper sizing of check valves....page 427

11

125-Pound Ferrosteel Swing Check Valves

With Outside Lever and Weight



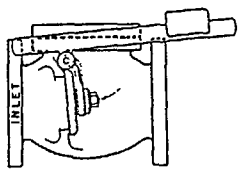
No. 383, Flanged
Bronze Trimmed

Working Pressures
125 psi saturated steam
200 psi non-shock cold water, oil, or gas

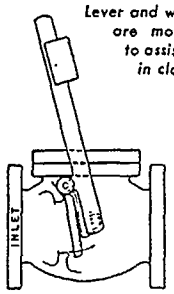
Hydrostatic Test Pressures
Shell: **350** psi Seat: **225** psi

These are swing check valves, similar, except for the lever and weight, to the No. 373 valves shown on page 109; they are not to be used as back pressure valves, unloading valves, etc.

For use in horizontal lines

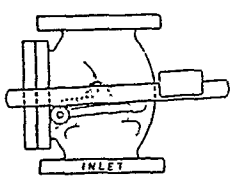


Above: Lever and weight are mounted to assist disc in closing.



Lever and weight mounted to balance the disc.

For use in vertical lines for upward flow



Lever and weight mounted to assist the disc in closing

Recommendations: Lever and Weight Swing Check Valves with the lever and weight positioned to assist the disc in closing are recommended for use in pipe lines where quick action is necessary to avoid a sudden reversal of flow.

Valves with the weight balancing the disc are used in installations requiring swing check valves that will open under a minimum of pressure.

Construction and materials: The hinge and outside lever are made of malleable iron and are keyed to a long Exelloy hinge pin which extends out of one side of the body through a special stuffing box. The stuffing box ensures a pressure-tight connection.

The lever is also locked to the end of the hinge pin and the weight is locked to the lever with setscrews. All moving parts operate together.

Other parts are the same as the No. 373 Swing Check Valves shown on page 109.

Leather faced disc available: These valves are regularly furnished with a bronze or bronze faced disc. Certain sizes (see table below) can be furnished with a leather faced disc, at added charge, when specified.

No. 383 Valves equipped with a leather faced disc are recommended for cold water service only.

Position of lever and weight: Commonly accepted positions of the lever and weight are illustrated at the right.

Valves can also be furnished for vertical lines with downward flow, or for lines on an angle, provided sound engineering practices are not violated.

Standards: The dimensions and drilling of the end flanges conform to the American Cast Iron Flange Standard, Class 125 (B16.1-1948). The flanges are plain faced, with a smooth finish.

The valves also conform to the American Standard For Face-to-Face Dimensions (B16.10-1957), for 125-Pound Cast Iron Flanged Swing Check Valves. The Standard does not include a 3½-inch size.

Drilling: Flanged valves regularly are furnished faced and drilled (F & D) to the American Cast Iron Flange Standard, Class 125. Faced only valves can be furnished when specified.

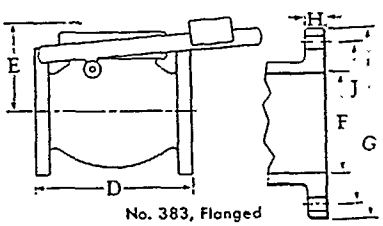
Ordering: State whether for horizontal or vertical installation and, if the latter, the direction of flow; also, whether lever and weight are to assist the disc in closing or to balance it. When not specified, the lever and weight are mounted on the right side of the valve when facing the inlet.

Other valves: Any iron body, Ferrosteel, or cast steel swing check valve can be made to order with lever and weight.

Weights and Dimensions — Prices on Request

	Size	Weight	Dimensions, in Inches						
					End Flanges				
	Inches	Pounds Each	D	E	F	G	H	J	No. & dia. of bolts
No. 383 Flanged F & D	2	30	8	4¼	2	6	⅝	4¾	4-⅝
	2½	36	8½	4 3/16	2½	7	11/16	5½	4-⅝
	3*	50	9½	5 1/16	3	7½	¾	6	4-⅝
	3½*	65	10½	5 13/16	3½	8½	13/16	7	8-⅝
	4*	83	11½	6 3/16	4¼	9	15/16	7½	8-⅝
	5	132	13	7 3/16	5¼	10	15/16	8½	8-¾
	6*	160	14	7½	6 5/16	11	1	9½	8-¾
	8*	300	19½	10 3/16	8	13½	1⅛	11¾	8-¾
	10*	475	24½	12⅛	10	16	1 3/16	14¼	12-⅞
	12	710	27½	13¾	12	19	1¼	17	12-⅞

**Asterisked sizes available with leather faced disc; orders must specify.*



No. 383, Flanged

Overall dimensions provided on request, for drilling templates, see page 327.

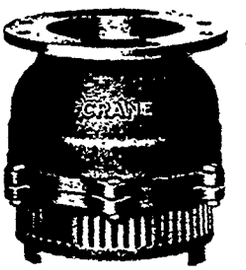
Iron Body Foot Valves

Leather or Bronze Disc

Rugged screwed and flanged foot valves . . . recommended for suction lines on shallow well pumps and similar services



Screwed
No. 394, Leather Disc
No. 394½, Bronze Disc



Flanged
No. 395, Leather Disc
No. 395½, Bronze Disc

Recommendations: Crane Iron Body Foot Valves are recommended for suction lines on shallow well pumps where the pressure does not exceed 34-foot head (approximately 15 psi). The valves, however, will safely withstand 25 psi pressure on priming pump service when not subjected to pulsations of the pump.

Leather disc valves are especially suitable for cold water. The bronze disc valves are recommended for hot water.

Materials and construction: All valves have a body and strainer made of cast iron (ASTM A 126, Class A).

Leather disc valves have a cast iron seat; sizes 6-inch and smaller have one disc and larger sizes have two discs.

Bronze disc valves have a bronze seat; sizes 6-inch and smaller have one disc and larger sizes have four discs.

Shape of strainer: Valves 6-inch and smaller have a semi-spherical strainer, as illustrated on the screwed valve; larger sizes have a flat bottom strainer, as illustrated on the flanged valve.

End flange: The dimensions and drilling of the end flange on flanged valves conform to the 25-Pound American Tentative Cast Iron Flange Standard (B16b2-1931). The flange is plain faced, with a smooth finish.

Drilling: Flanged valves regularly are furnished faced and drilled to the 25-pound American Standard; faced only valves can be furnished when specified.

When specified, the flange on flanged valves can be drilled to the American Standard, Class 125. Full face gaskets should then be used to avoid distorting the flange.

Weights and Dimensions — Prices on Request

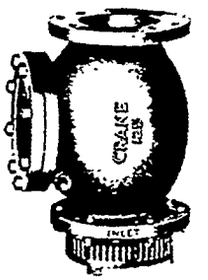
Size	Pounds, Each					Dimensions, in Inches									
	Screwed			Flanged, F & D		Screwed		Flanged							
	*No. 394		No. 394½	No. 395	No. 395½	Over-all width	Over-all height	No. 395		No. 395½		End Flange			
Inches	Leather Disc Black	Leather Disc Galv.	Bronze Disc Black	Leather Disc Black	Bronze Disc Black			Over-all width	Over-all height	Over-all width	Over-all height	Diam-eter	Thick-ness	Bolt circle dia.	No. & dia. of bolts
1½	3.9	3.9	...	...	...	4¾	4¾	...	...	...	...	...	...	...	...
2	5.7	5.7	6.0	...	...	5½	5¾	...	...	...	...	...	...	...	...
2½	7.8	7.8	...	...	...	6¼	6½	...	...	...	...	...	...	...	...
3	12.0	12.0	12.8	...	...	7	7¼	...	...	...	...	...	...	...	...
3½	...	21.0	...	...	...	8⅞	9¼	...	...	...	...	...	...	...	...
4	20.0	20.0	20.6	...	...	8⅞	9¼	...	...	...	...	...	...	...	...
5	...	...	32.0	...	...	10½	11	...	...	...	...	...	...	...	...
6	43.0	43.0	41.0	51.0	40.0	11¾	12½	11¾	13¼	11¾	13¼	11	¾	9½	8-⅝
8	...	...	...	90.0	90.0	...	...	15⅛	13½	15⅛	13½	13½	¾	11¾	8-⅝
10	...	...	...	170.0	210.0	...	...	18	15¾	20¼	16¼	16	⅞	14¼	12-⅝
12	...	...	...	250.0	330.0	...	...	20¼	18¼	24⅛	18¼	19	1	17	12-⅝

*No. 394 is furnished black unless galvanized is specified.

Bronze foot valves.....page 47
Selecting proper size.....page 427
Templates for drilling.....page 327
Thread engagement.....page 352

11

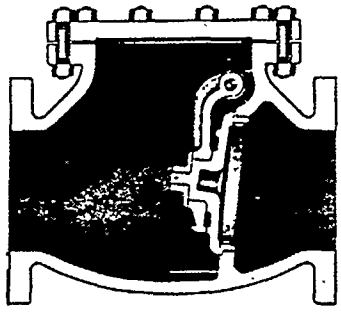
High Pressure Iron Body Foot Valves



When foot valves are wanted for high pressures or for severe service, Crane No. 373 Flanged 125-Pound Iron Body Swing Check Valves having a strainer bolted on the inlet end, as illustrated at the right, are recommended. These valves are furnished with either a leather faced or a solid bronze or bronze faced disc. Prices will be furnished on request

Ferrosteel Clearway Swing Check Valves

Underwriters' Pattern



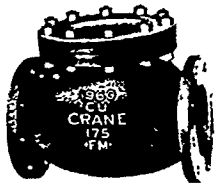
Cross Section

Working Pressure
175 psi non-shock cold water

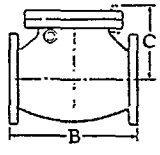
Test Pressures
Shell test — 350 psi hydrostatic
Seat test — 200 psi hydrostatic

Underwriters' approved for fire protection service

These valves are especially designed for fire protection service. They have been approved by the Underwriters' Laboratories, Inc., and the Factory Mutual Laboratories. The valve body bears the "CU" and "FM" markings.



No. 375
Flanged



These valves may be used either in a horizontal position....or in a vertical position for upward flow.

Materials: These valves have a body and cap made of Crane Ferrosteel, a high grade iron conforming to requirements of ASTM Specification A 126, for Class B higher strength Gray Iron Castings. The body seat ring, screwed into the body, and the hinge pin are bronze.

In sizes 6-inch and smaller, the disc and hinge are bronze.

In sizes 8 and 10-inch, the disc is iron with a heavy bronze seating face, and has a bronze collar where it engages the hinge. The hinge is malleable iron and is equipped with a bronze hinge-pin bushing and a bronze disc-hub bushing.

Construction: The valves are ruggedly constructed. They have a large body designed with liberal clearance around the disc. When the valve is opened, the disc swings entirely clear of the waterway; it can not stick in the open position.

Through stud bolts with a nut on each end are used in the cap joint. The hinge pin, retained by bronze plugs, is accessible from both sides of the body.

Bosses: Each valve has four bosses for a by-pass, two on each side of the body. An extra charge is made for drilling and tapping the bosses and for furnishing a by-pass.

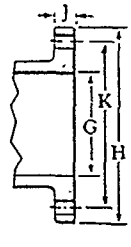
End flanges: The dimensions and drilling of end flanges conform to the American Cast Iron Flange Standard, Class 125 (B16.1-1948). The flanges are plain faced, with a smooth finish.

Drilling: The valves are regularly furnished faced and drilled (F & D) to the American Cast Iron Flange Standard, Class 125; they can be furnished faced only, when orders so specify.

Interconnection service: The No. 375 is not recommended for "interconnection service." For such service, reduced pressure backflow preventers can be used; information will be furnished on request.

Weights and Dimensions — Prices on Request

No. 375 Flanged F & D	Size Inches	Weight Pounds Each	Dimensions, in Inches						
			B	C	End Flanges G	H	J	K	No. & dia of bolts
	2½	60	10	6¼	2½	7	11/16	5½	4-5/8
	3	70	11	6¾	3	7½	¾	6	4-5/8
	4	110	13	7½	4	9	15/16	7½	8-5/8
	6	190	16	9¼	6	11	1	9½	8-¾
	8	310	18	11¼	8	13½	1⅛	11¾	8-¾
	10	480	22	13½	10	16	13/16	14¼	12-⅞



Templates for drilling....page 327

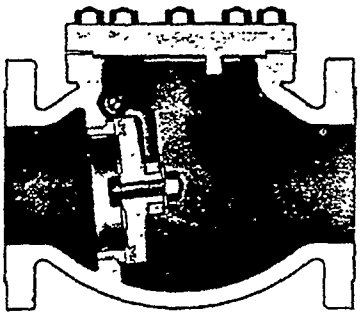
Proper sizing of check valves....page 427

250-Pound Ferrosteel Swing Check Valves

Bronze Trimmed

Working Pressures
250 psi steam, 450 F
500 psi non-shock cold water, oil, or gas

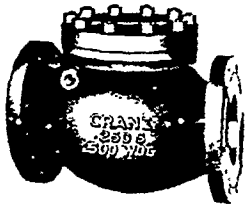
Test Pressures
Shell test — **1000** psi hydrostatic
Seat test — **550** psi hydrostatic



Cross Section



No. 38 E
Screwed



No. 39 E
Flanged

These valves may be used either in a horizontal position . . . . or in a vertical position for upward flow.

Recommendations: Crane 250-Pound Ferrosteel Swing Check Valves are excellent for a wide variety of services requiring rugged, sturdily constructed valves.

They will give unusually fine results on steam lines where pressure and temperature conditions do not require the use of steel valves and are highly recommended for use on high pressure water, oil, or gas lines, and for similar service.

Materials: The body and cap are Crane Ferrosteel, a high grade iron approximately 35 per cent stronger than regular gray iron; it conforms to requirements of ASTM Specification A 126 for Class B higher strength Gray Iron Castings.

The body seat ring, screwed into the body, is made of Crane Special Bronze, a hard leaded tin bronze conforming to ASTM B 61.

Sizes 3-inch and smaller are equipped with a solid Crane Special Bronze disc. Sizes 4-inch and larger have an iron disc with a Crane Special Bronze seating face.

Construction: The valves are heavily proportioned and unusually rugged. Their oval-shaped body provides ample flow area when the valve is open. A disc stop prevents the disc from sticking in the open position.

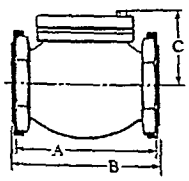
Face to face: The face to face dimensions of flanged valves conform to the American Standard for Face-to-Face Dimensions (B16.10-1957), for 250-Pound Cast Iron Flanged Swing Check Valves.

End flanges: The dimensions and drilling of end flanges conform to the American Cast Iron Flange Standard, Class 250 (B16b-1944).

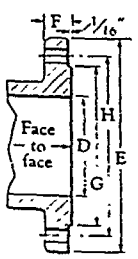
The flanges have a 1/16-inch raised face finished with concentric grooves, approximately 16 grooves per inch, known as a "serrated" finish.

Drilling: Flanged valves are regularly furnished faced and drilled (F & D) to the American Cast Iron Flange Standard, Class 250; they can be furnished faced only, when specified.

11



Screwed or Flanged



Weights and Dimensions — Prices on Request

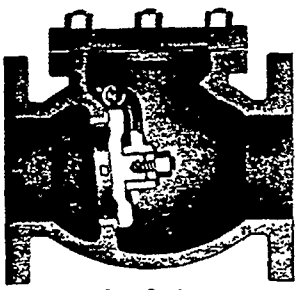
Size	Pounds, Each		Dimensions, in Inches									
			Screwed		Flanged							
							End Flanges					
Inches	No. 38E Screwed	No. 39E Flanged F & D	A	C	B*	C	D	E	F*	G	H	No & dia of bolts
2	36.0	46.0	9½	5¼	10½	5¼	2	6½	⅞	4 3/16	5	8-⅝
2½	55.0	64.0	10¾	5⅞	11½	5⅞	2½	7½	1	4 15/16	5⅞	8-¾
3	78.0	90.0	11¾	6¼	12½	6¼	3	8¼	1⅛	5 11/16	6⅝	8-¾
4	110.0	133.0	13	7¼	14	7¼	4	10	1¼	6 15/16	7⅞	8-¾
5	...	188.0	..	...	15¾	8¼	5	11	1⅜	8 5/16	9¼	8-¾
6	...	250.0	..	...	17½	9	6	12½	1 7/16	9 11/16	10⅝	12-¾
8	...	410.0	..	...	21	11	8	15	1⅝	11 15/16	13	12-⅞
10	. .	690.0	. .	...	24½	13	10	17½	1⅞	14 1/16	15¼	16-1
12	..	1000.0	. .	...	28	14¾	12	20½	2	16 7/16	17¾	16-1⅛

*The face to face (B) and thickness of flange (F) dimensions include the 1/16-inch raised face.

Templates for drilling . . . . page 328 *Thread engagement . . . . page 352* *Proper sizing . . . . page 427*

3% Nickel Cast Iron Swing Check Valves

For Process Industries

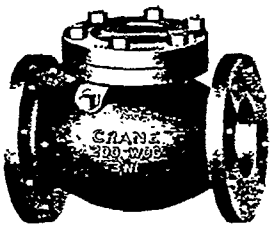


Cross Section

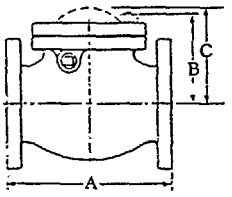
Valve Sizes	Working Pressures Cold water, oil, or gas, non-shock	Hydrostatic Test Pressures	
		Shell	Seat
2 to 12-inch	200 psi	350 psi	225 psi
14 to 18-inch	150 psi	250 psi	175 psi

Valve seat also tested hydrostatically at 40 psi.

Crane 3% nickel cast iron body and bolted cap
Stainless steel seating surface



No. 14493
Flanged, 18-8 SMo Trimmed



The No. 14493 may be used in a horizontal position . . . . or in a vertical position for upward flow.

Recommendations: These 3% nickel cast iron swing check valves, with stainless steel seating surfaces, are excellently used wherever conventional "all-iron" and "bronze trimmed" valves fail because of corrosion of seating surfaces.

The valves are used in the petroleum industry handling oils which contain traces of mineral acids, in the wood treating industry handling creosote vapors and oils, in the pulp and paper industry handling alkaline liquors of various kinds, and in other kindred types of installations. They are a companion line to the 3% nickel cast iron wedge gate valves shown on page 82.

Where substantially better corrosion resistance is desired in body as well as seating metals, Crane 3% Nickel Cast Iron Valves are an economical, logical choice.

Materials: The body and cap are Crane 3% Nickel Cast Iron. This metal, with tensile requirements similar to ASTM A 126, Class B higher strength gray iron, was developed especially for piping services in the process industries.

The body seat ring, hinge, and hinge pin in all sizes, and the disc in sizes 12-inch and smaller, are made of Crane 18-8 SMo, an alloy steel equivalent to AISI Type 316 stainless steel. In sizes 14-inch and larger, the disc is 3% nickel cast iron with 18-8 SMo facing.

Construction: These are rugged, well proportioned valves. The body, oval or globular in shape, provides ample flow area around the disc when the valve is wide open. The valves are designed so that the disc cannot stick in the open position.

The body seat ring is screwed into the body. The hinge is suspended in the body. Easy access to both ends of the hinge pin is provided by the tapped and plugged opening in each of the two bosses on the body.

Face to face: The valves conform to the American Standard for Face-to-Face Dimensions (B16.10-1957) for Class 125 Cast Iron Swing Check Valves. This Standard does not include a 16 or 18-inch size.

Flange dimensions and facing: The dimensions and drilling of end flanges conform to the American Cast Iron Flange Standard, Class 125 (B16.1-1948). The flanges are plain faced, with a smooth finish.

Drilling: The valves are regularly furnished faced and drilled to the American Cast Iron Flange Standard, Class 125; they can be furnished faced only, when specified.

Other 3% nickel iron valves: For wedge gates, see page 82. For pulp stock valves, see page 85.

Weights and Dimensions — Prices on Request

	Size	Weight	Dimensions, in Inches				
			A	B	C	End Flanges	
	Inches	Pounds Each				Diameter	Thickness
No. 14493 Flanged, F & D	2	24	8	4 1/4		6	5/8
	2 1/2	30	8 1/2	4 3/16		7	11/16
	3	43	9 1/2	5 1/16		7 1/2	3/4
	4	60	11 1/2	6 3/16		9	15/16
	5	125	13	7 3/16		10	15/16
	6	140	14	7 1/2		11	1
	8	280	19 1/2	10 3/16		13 1/2	1 1/8
	10	440	24 1/2	12 1/8		16	1 3/16
	12	660	27 1/2	13 3/4		19	1 1/4
	14	990	31	16 1/8		21	1 3/8
	16	1430	36	17 7/8		23 1/2	1 7/16
	18	1575	36	16	17 1/2	25	1 9/16

Description of materials . . . . Section 2
Templates for drilling . . . . page 327 *Proper sizing of check valves . . . . page 427*

SECTION 12

Crane Steel Wedge Gate Valves

(Including Pipe-Line Valves)

Forged Steel Valves — 2-inch and Smaller

600-Pound, Bolted Bonnet, Inside Screw.....page 116
600-Pound, Bolted Bonnet, Outside Screw and Yoke.....page 117

Cast Steel Valves — 2-inch and Smaller

600-Pound, Bolted Bonnet, Exelloy to Stellite Trimmed..pages 118 and 119
600-Pound, Bolted Bonnet, Monel Trimmed.....page 120

Cast Steel Valves — 150 to 2500-Pound

Pressure-Temperature Ratings and Service Recommendations.....page 121
Description and Specification of Materials.....page 122

150 and 300-Pound Valves:

Description, Sizes, and Weights.....pages 123 to 125
Dimensions.....page 128
By-Passes.....page 129

400, 600, 900, and 1500-Pound Valves:

Description, Sizes, and Weights.....pages 126 and 127
Dimensions.....page 128
By-Passes.....page 129

2500-Pound Valves, Description and Sizes.....page 130

Cast Steel Pipe-Line Valves

Class 400.....pages 131 to 133
Class 600.....pages 131 to 133

Crane forged and cast steel gate valves indicated above as being available in sizes 2-inch and smaller are frequently considered general utility valves. They are used in a variety of services, often at pressures and temperatures lower than the recommended maximum.

Crane cast steel gate valves indicated above as being available in 150 to 2500-pound pressure classes are made, in some of the classes, in sizes as large as 24-inch and as small as 1-inch. The 150 and 300-pound pressure classes in sizes 12-inch and smaller feature Crane's new flexible wedge disc design.

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For related data, and for complete description of other Crane steel products, refer to:

Cylinder and motor operation, gearing.....pages 260 to 274
Gaskets for steel flanged joints.....page 323
Templates for drilling.....pages 329 to 331
Fabricated piping.....pages 355 to 380

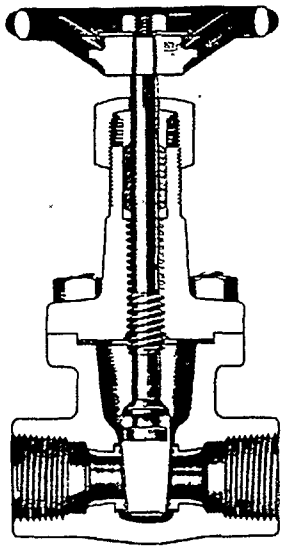
Steel stop-check valves, Pressure-Seal Bonnet.....pages 170 to 173
Steel stop-check valves, bolted bonnet.....pages 219 to 225
Steel sediment separators.....page 254

Steel globe and angle valves.....Section 13
Steel check valves.....Section 14
Steel Pressure-Seal and Lip-Seal Bonnet Valves.....Section 15
Corrosion-resistant alloy valves.....Section 17
Steel valves for special and extreme services.....Section 21

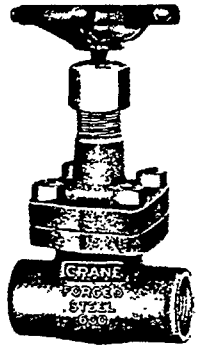
Steel screwed fittings, unions, and flange unions.....Section 24
Steel welding fittings.....Section 25
Steel flanges.....Section 26

600-Pound Forged Steel Wedge Gate Valves

Bolted Bonnet—Inside Screw



Cross Section
No. 3634 XU



No. 3634 XU
Gate, Screwed
Reduced Port

12

New 600-pound reduced port valves . . . . with "all-service" trim and stainless steel, spiral wound bonnet gasket . . . . fully equal to so-called "800-pound" and "Standard Port" Valves

Features: These neat, compact reduced port valves feature design refinements generally associated only with higher priced valves . . . . such as bolted bonnet, stainless steel spiral wound bonnet gasket, Exelloy to Stellite seating, shoulder-type body seat rings, tee-head disc-stem connection, and a spacious stuffing box area.

The valves offer the same service advantages . . . . and have the same pressure-temperature ratings . . . . as those sometimes termed "800-Pound", "standard port", or "conventional port" valves. In design and functional value, however, the No. 3634 XU offers considerably more.

Recommendations: The No. 3634 XU are ideally used wherever dependable inside screw valves are desired. They are furnished with an "all service" trim . . . "XU" . . . and are recommended for steam, water, air, gas, oil, and oil vapor at temperatures up to 800 F.

Body and bonnet: The body and bonnet are forged carbon steel conforming to ASTM A105, Grade II. The body interior is forged rather than bored and slotted, in order to obtain a smooth inside surface. Long disc guide channels provide full and accurate guidance of the disc throughout its travel.

Flow characteristics: Although the valves have "reduced" seat ports, flow characteristics approximate those of full port valves.

Working Pressures
Steam, Water, Air, Gas, Oil, or Oil Vapor

Temp. Deg. Fahr.	Psi Non-Shock	Temp. Deg. Fahr.	Psi Non-Shock
100°	2000	500°	1735
150	1970	550	1640
200	1940	600	1540
250	1915	650	1430
300	1895	700	1305
350	1875	750	1180
400	1850	800	1015
450	1810	...	...

Test Pressures
Shell—**2175** psi hydrostatic
Seat—**2100** psi hydrostatic
Seat tested 100 psi air-under-water

Bonnet joint and gasket: The valves have a male and female body-bonnet joint equipped with Triplex steel studs and an AISI Type 316 stainless steel, spiral wound gasket with asbestos filler. In the Crane design, the compression load placed upon the gasket . . . predetermined through careful machining of contact surfaces . . . . remains constant, thus assuring maximum joint tightness.

Disc, seats, and stem: The valves are furnished with Class "XU" trim. The disc is Crane Exelloy, a chromium steel, specially heat-treated for high hardness. The body seat rings are Exelloy, faced with Stellite. The seat rings are securely expanded into the body under hydraulic pressure and seat against a square shoulder; they will not loosen in service.

The stem, also Exelloy, is finished with a tapered shoulder for back-seating in the bonnet. The lower end has an integral tee-head which fits in a slot in the disc. The connection (see inset illustration on page 118) provides a rugged but flexible coupling between the stem and disc.

Stuffing box; repacking: The stuffing box, generously sized and filled with high quality, die formed ring packing, is equipped with a gland and a packing bearing ring. The valves when wide open, can be repacked while under pressure.

Weights and Dimensions — Prices on Request

	Size	Weights	Dimensions, in Inches		
	Inches	Pounds Each	End to end	Center to top, open	Dia. of wheel
No. 3634 XU Gate, Screwed	¼	4.0	3⅛	6 3/16	3
	⅜	4.0	3⅛	6 3/16	3
	½	4.0	3⅛	6 3/16	3
	¾	5.2	3½	7⅜	3½
	1	8.0	4⅛	8⅜	4
	1½	15.0	4¾	10⅞	5
	2	22.5	5¼	12⅜	6

600-Pound O S & Y Steel Gate Valves with Reduced Ports.....page 117
600-Pound O S & Y. Steel Gate Valves with Full Ports....pages 118 and 119

600-Pound Forged Steel Wedge Gate Valves

Bolted Bonnet—Outside Screw and Yoke

These forged steel valves are fully equal to . . . and have the same ratings as . . . those sometimes termed "800-Pound" or "Standard Port" Valves.

These all-new, high quality reduced port valves offer the same features as the inside screw valves shown on the facing page . . . plus rugged outside screw and yoke construction, two-piece, ball-type gland, and a choice of trims.

Recommendations: As indicated by their catalog numbers, the valves are made with two types of trim . . . . Class 'XU', an "all-service" trim suitable for steam, water, air, and gas up to 850 F, and for oil or oil vapor up to 1000 F . . . . and Class 'L' trim for use up to 750 F on liquids and gases (not steam) that may be corrosive to Exelloy or Stellite but not to 18-8 SMo.

Body and bonnet: The compact, streamlined body and one-piece bonnet and yoke are forged carbon steel (ASTM A105, Grade II). The body interior is also forged, rather than bored and slotted, to assure a smooth finish; long disc guide channels accurately guide the disc throughout its travel.

Bonnet joint and gasket: The close fitting male and female body-bonnet joint is equipped with Triplex steel studs and an AISI Type 316 stainless steel, spiral wound gasket with asbestos filler. The construction provides maximum tightness and eliminates any possibility of a gasket blowout.

Disc, seats, and stem: In the "XU" trimmed valves, the disc and stem are wear-resistant Exelloy; body seat rings are Exelloy, faced with Stellite. In "L" trimmed valves, the body seat rings, disc, and stem are Crane 18-8 SMo Alloy Cast Steel.

Working Pressures

For limitations, see "Recommendations" at left.

Temp. Fahr.	Psi Non-Shock	Temp. Fahr.	Psi Non-Shock
100°	2000	650°	1430
150	1970	700	1305
200	1940	750	1180
250	1915	800	1015
300	1895	850	800
350	1875	875	725
400	1850	900	600
450	1810	925	520
500	1735	950	425
550	1640	975	330
600	1540	1000	235

Hydrostatic Test Pressures

Shell: 2175 psi Seat: 2100 psi

Class "XU" seat tested 100 psi air-under-water.

The shoulder-type body seat rings are securely expanded into the body under hydraulic pressure and will not loosen in service.

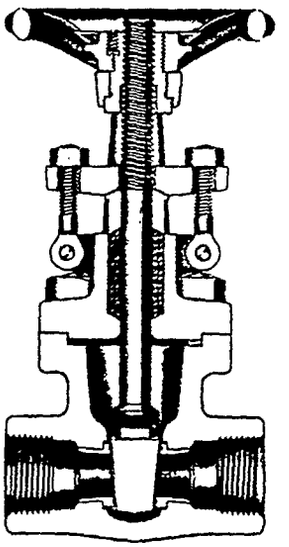
Although seat ports are "reduced", flow characteristics approximate those of full port valves.

The valves have a tee-head disc-stem connection (see inset illustration on page 118) for maximum dependability. The stem is finished with a tapered shoulder for back-seating in the bonnet.

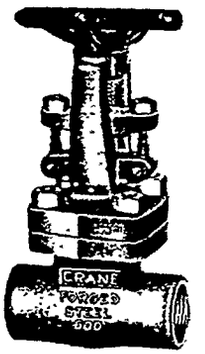
Yoke sleeve: The yoke sleeve is Nodular Ni-Resist Cast Iron . . . . high in bearing qualities, strength, melting point, and resistance to corrosion.

Gland: The two-piece, ball-type siliconized steel gland and steel gland flange exert an even pressure on the packing without binding on the stem. Stainless steel swinging eye bolts hold the gland flange securely in place.

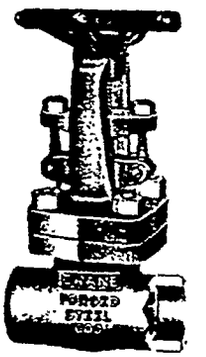
Stuffing box: The deep stuffing box is filled with high quality, die formed ring packing. When wide open, the valves can be repacked under pressure.



Cross Section—"XU" Trimmed



No. 3604 XU or 3604 L
Reduced Port Gate
Screwed



No. 3605 XU or 3605 L
Reduced Port Gate
Socket-Welding

Socket-welding valve ends comply with ASA B16.11.

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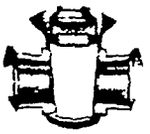
Weights and Dimensions — Prices on Request

Size	Pounds, Each		Dimensions, in Inches			
	Nos. 3604 XU 3604 L	Nos. 3605 XU 3605 L	End to end	Center to top, open	Diameter of wheel	Depth of socket
Inches	Screwed	Socket-Welding				
1/4	4.4	4.4	3 1/8	6 1/8	3	7/16
3/8	4.4	4.4	3 1/8	6 1/8	3	9/16
1/2	4.4	4.4	3 1/8	6 1/8	3	5/8
3/4	5.7	5.7	3 1/2	7	3 1/2	11/16
1	8.0	8.0	4 1/8	8 3/8	4	3/4
1 1/4	13.0	13.0	4 1/2	10 1/4	5	13/16
1 1/2	15.0	15.0	4 3/4	10 5/8	5	7/8
2	23.0	23.0	5 1/4	12 1/2	6	1

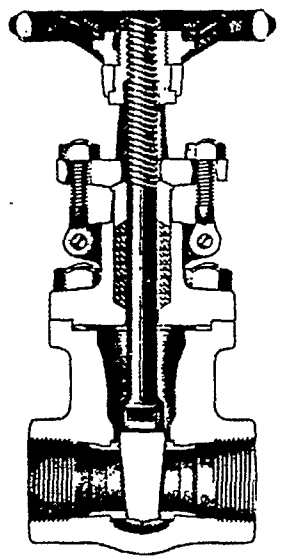


"L" trimmed valves except for disc, seat, and stem materials, are the same as "XU" trimmed valves.

All valves have a threaded hole malleable iron wheel. Style E on the 2-inch size and Style A on sizes 1 1/2-inch and smaller.

600-Pound Cast Steel Wedge Gate Valves

Bolted Bonnet—Outside Screw and Yoke



Typical cross section. For complete description, see these facing pages.

Rugged, small, full port steel valves for hydraulic lines and high pressure-temperature steam, oil, or oil vapor lines.

These bolted bonnet, outside screw and yoke, full port valves answer the need for high quality, compact, light but strong, small steel wedge gate valves. Their design includes modifications and features generally found only in larger size or more expensive valves.

Screwed, flanged, and socket-welding patterns are regularly furnished in sizes ½ to 2-inch, as indicated on the next page. The valves are a companion line to the reduced port bolted bonnet types shown on the preceding two pages.

Recommendations: The valves are ideal for a wide variety of services in oil refineries, oil and gas fields, central power stations, and industrial plants; they offer top performance on high pressure hydraulic lines and on high pressure-temperature steam or oil lines.

All valves have Class "XU" trim and are recommended for steam, water, air, gas, and general services at temperatures up to 850 F and for oil or oil vapor services at temperatures up to 1000 F.

Body and bonnet: The body is cast from high quality carbon steel conforming to requirements of ASTM Specification A 216, Grade WCB. The port openings are larger than is usual for valves of this type. The diameter of the seat opening is approximately the same as the nominal pipe size.

The one-piece bonnet and yoke, also made of carbon steel, is forged in sizes 1½-inch and smaller and cast in the 2-inch size.

Bonnet joint: The body-bonnet joint is fitted with a spiral-wound gasket made of AISI Type 316 stainless steel with asbestos filler. The gasket provides high resiliency with absolute tightness under all operating conditions. The male and female joint assures alignment and correct gasket compression . . . and eliminates any possibility of a gasket blowout.

The bolted bonnet construction provides generous strength and can be quickly and easily dismantled and reassembled. For greater compactness, the valves are fitted with high-strength Triplex Steel studs.

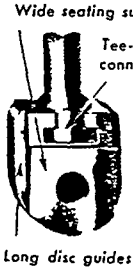
Disc and body seat rings: The disc is Crane Exelloy, a specially heat-treated chromium steel offering high resistance to wear, seizure, erosion, galling, and scoring.

The body seat rings are Exelloy faced with Stellite. The seat rings have heavy sections, are securely expanded into the body under hydraulic pressure, and seat against a square shoulder. There is no danger of leakage around the rings, nor will they loosen in service.

Disc guides: Full length machined guide ribs on each side of the disc operate in channels in the valve body. With the disc closely guided throughout its entire travel, seating surfaces are protected against unnecessary wear.

Stem: The stem is Exelloy. Of liberal diameter, the lower end has an integral tee-head and is finished with a tapered shoulder for backseating in the bonnet. Accurately cut threads on the upper end provide positive control with minimum friction; being outside of the valve, the threads are easily lubricated.

Disc-stem connection: As shown in the inset illustration, the valves feature a tee-head disc-stem connection which provides a safe and rugged, yet flexible, coupling between the stem and disc.



The tee-head on the stem end slips into a machined slot of corresponding shape in the disc. The connection is exceptionally strong and serviceable, yet it cannot distort the stem and binding of parts is avoided.

(continued on the next page)

Working Pressures

Fluid	Temp. Deg. Fahr.	Psi, Non-Shock: Screwed or Socket-Welding Valves	Psi, Non-Shock: Flanged Valves
Steam, Water, Air, Gas, Oil, or Oil Vapor	100°	2000	1440
	150	1970	1420
	200	1940	1400
	250	1915	1380
	300	1895	1365
	350	1875	1350
	400	1850	1330
	450	1810	1305
	500	1735	1250
	550	1640	1180
	600	1540	1110
	650	1430	1030
	700	1305	940
	750	1180	850
	800	1015	730
	850	800	600
Oil or Oil Vapor Only	875	725	525
	900	600	445
	925	520	375
	950	425	310
	975	330	240
	1000	235	170

Hydrostatic Test Pressures

Valve Ends	Psi: Shell	Psi: Seat
Screwed	2175	2100
Socket-Welding	2175	2100
Flanged	2175	1550

Seat tested 100 psi air-under-water.

600-Pound Cast Steel Wedge Gate Valves

Bolted Bonnet — Outside Screw and Yoke

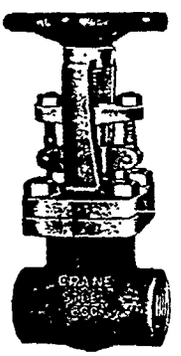
(continued from the preceding page)

Ball-type gland: All valves feature a two-piece ball-type siliconized steel gland and steel gland flange which exert an even pressure on the packing without binding on the stem.

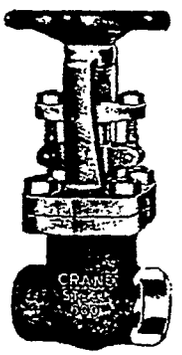
The gland flange is held in place by stainless steel swinging eye bolts which will not loosen in service. The packing load can be easily adjusted.

Stuffing box: The wide, deep stuffing box provides liberal space for a tight seal. It is filled with a high quality, die formed ring packing.

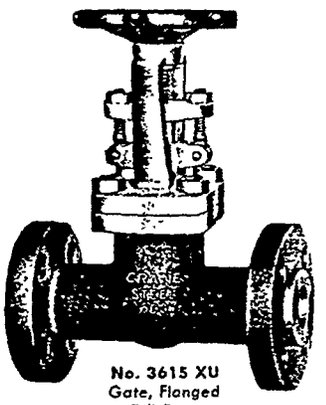
Repacking: The valves, when wide open, can be repacked while under pressure.



No. 3607 XU
Gate, Screwed
Full Port



No. 3611 XU
Gate, Socket-Welding
Full Port



No. 3615 XU
Gate, Flanged
Full Port

Wheels: Valve wheels are made of malleable iron, have a threaded hole, and are locked to the yoke sleeve by means of a set screw. Valves 1¼-inch and smaller have a Style "A" dished design wheel with small gripping knobs around the outer edge, as shown in the illustrations. The 1½ and 2-inch valves have a rugged Style "E" oval rim wheel.

Yoke sleeve: The yoke sleeve is made of Nodular Ni-Resist Cast Iron, a material with excellent bearing qualities, strength and a high melting point.

Socket-welding valves: Ends of socket-welding valves comply with American Standard B16.11.

Flanged valves: Flanged valves conform to the American Standard for Face-to-Face Dimensions (B16.10-1957) for 600-Pound Ferrous Flanged Gate Valves.

Flange dimensions, facing, and drilling: End flanges on flanged valves conform to the 600-Pound American Steel Flange Standard (B16.5-1957). They have a male face ¼-inch high (large male), with a serrated finish, consisting of approximately 32 concentric grooves per inch.

When so ordered, flanged valves can be furnished with ring joint, female, tongue, or groove facings; for dimensions, see pages 333 and 334.

The valves, as regularly furnished, include drilling to the 600-Pound American Standard (B16.5-1957) and are spot faced. They can be furnished faced only, when specified.

150-pound flanges: Flanged valves having end flanges conforming to the 150-Pound American Standard can be furnished on special order.

Weights and Dimensions — Prices on Request

Valve	Size	Weights	Dimensions, in Inches				End Flanges, Inches				
			End to end or *face to face	Center to top, open	Diameter of wheel	Depth of socket	Diameter	Thickness (*)	Dia. of male face	Dia. of bolt circle	No. & dia. of bolts
	Inches	Pounds Each									
No. 3607 XU Screwed	½	5.0	3⅛	7	3½	...					
	¾	7.0	3½	8⅜	4	...					
	1	11.0	4⅛	10¼	5	...					
	1¼	14.0	4½	10⅝	5	...					
	1½	21.0	4¾	12½	6	...					
	2	36.0	5¼	15	7	...					
No. 3611 XU Socket-Welding	½	5.0	3½	7	3½	⅝					
	¾	7.0	4	8⅜	4	11/16					
	1	11.0	4⅛	10¼	5	¾					
	1¼	14.0	4½	10⅝	5	13/16					
	1½	21.0	4¾	12½	6	⅞					
	2	36.0	5¼	15	7	1					
No. 3615 XU Flanged, FD & SF	½	9.0	6½	7	3½	...	3¾	9/16	1⅜	2⅝	4-½
	¾	15.0	7½	8⅜	4	...	4⅝	⅝	111/16	3¼	4-⅝
	1	21.0	8½	10¼	5	...	4⅞	11/16	2	3½	4-⅝
	1¼	27.0	9	10⅝	5	...	5¼	13/16	2½	3⅞	4-⅝
	1½	40.0	9½	12½	6	...	6⅛	⅞	2⅞	4½	4-¾
	2	60.0	11½	15	7	...	6½	1	3⅝	5	8-⅝

*Face to face dimensions include the ¼-inch male face; thickness of flange dimensions do not.

Valves with reduced port: Crane small size 600-pound forged steel valves with reduced port are shown on pages 116 and 117.

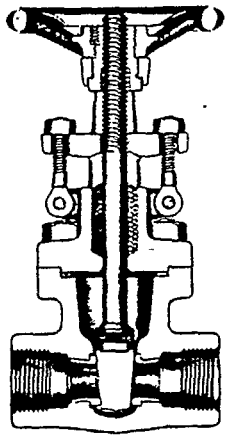
Valves with Monel trim: For Monel trimmed steel gates and globes designed for specific corrosive services, see pages 12c and 141, respectively.

For larger size 600-pound cast steel gate valves, see pages 126 and 127.

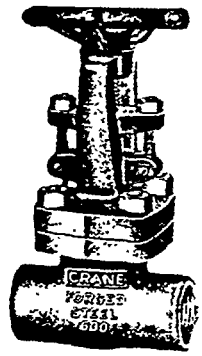
Description of materials....Section 2 *Templates for drilling....page 330*
Dimensions of ring joint and special facings.....pages 333 and 334

Steel Monel Trimmed Wedge Gate Valves

Reduced Port



Cross Section, No. 3604 A



No. 3604 A
Outside Screw & Yoke Gate
Reduced Port, Screwed

Shell is hydrostatically tested at 2175 psi; seat at 2100 psi. Seat also tested 100 psi air-under-water.

New outside screw and yoke valves . . . with Monel trim, spiral wound Monel gasket, and Teflon packing . . . for corrosive service

These compact valves are patterned after the reduced and full port 600-pound steel gate valves shown on pages 117 and 119 respectively. Like those valves, they feature bolted bonnet construction . . . tee-head disc-stem connection . . . shoulder-type seat rings . . . and one-piece bonnet and yoke.

Recommendations: The valves are used on refining units by the petroleum industry and for various processes in chemical plants where high quality steel valves with Monel trim are desired. They offer good service in hydrofluoric alkylation units handling anhydrous H.F., and where mixtures of the acid and hydrocarbons are found. They are not recommended for aqueous solutions of hydrofluoric acid where concentration drops below 80% H.F.

Body and bonnet: The No. 3604 A have a forged carbon steel (ASTM A105, Grade II) body and bonnet. On the No. 3615 A, the body is cast carbon steel (ASTM A216, Grade WCB).

Both valves have a rugged male and female bonnet joint equipped with Triplex steel studs and a spiral wound Monel gasket with Teflon filler, assuring tightness and dependability.

Monel trim: The disc, body seat rings, and stem are Monel. The shoulder-type seat rings, securely expanded into the body under hydraulic pressure, will not loosen in service. The lower end of the stem has an integral tee-head and is finished with a tapered shoulder for back-seating into the bonnet.

Yoke sleeve: The yoke sleeve is made of Nodular Ni-Resist Cast Iron, a material high in bearing qualities, strength, melting point, and resistance to corrosion.

Gland: The two-piece ball-type siliconized steel gland and steel gland flange exert even pressure on the packing without binding on the stem. Stainless steel swinging eye bolts hold the gland flange securely in place and permit easy adjustment of packing.

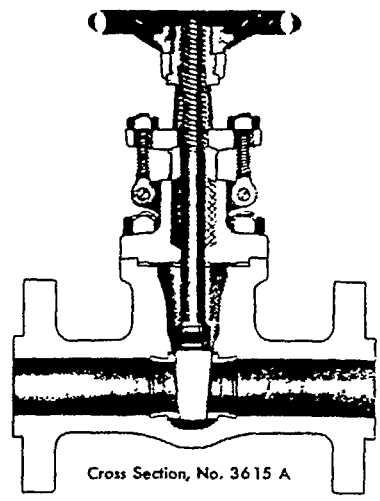
End flanges: End flanges have a large male face ¼-inch high with a serrated finish. The No. 3615 A are regularly furnished drilled to the 600-Pound American Standard and are spot faced. They can be furnished faced only, when specified.

Stuffing box: The stuffing box is deep and is filled with Teflon packing.

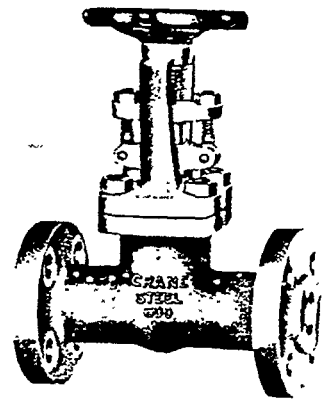
Wheels: Wheels up to 5-inch diameter inclusive are Style A; larger wheels are Style E. All have a threaded hole

For monel trimmed globe valves, see page 141

Full Port



Cross Section, No. 3615 A



No. 3615 A
Outside Screw & Yoke Gate
Full Port, Flanged

Shell is hydrostatically tested at 2175 psi and the seat at 1550 psi. The seat is also tested 100 psi air-under-water.

End flange and face to face dimensions conform, respectively, to ASA B16.5-1957 and B16.10-1957 for 600-pound valves. For drilling templates, see page 330.

12

Weights and Dimensions — Prices on Request

Sizes	Pounds, Each		Dimensions, in Inches							
			No. 3604 A			No. 3615 A				
	No. 3604 A	No. 3615 A	End to end	Center to top. open	Dia. of wheel	Face to face (*)	Center to top. open	Dia of wheel	End Flanges Diameter	End Flanges Thickness (*)
Inches	Screwed	Flanged FD & SF								
½	4.4	9.0	3⅛	6⅛	3	6½	7	3½	3¾	9/16
¾	5.7	15.0	3½	7	3½	7½	8⅜	4	4⅝	5/8
1	8.0	21.0	4⅛	8⅜	4	8½	10¼	5	4⅞	11/16
1½	15.0	40.0	4¾	10⅝	5	9½	12½	6	6⅛	⅞
2	23.0	60.0	5¼	12½	6	11½	15	7	6½	1

*Face to face dimensions include the ¼-inch male faces; thickness of flange dimensions do not

Cast Steel Wedge Gate Valves

Working Pressures

For Valves Described on Pages 122 to 130

Valves with "XR" trim.....for steam up to 850 F.....for water, air, gas, or oil up to 500 F
Valves with "X" trim.....for oil or oil vapor up to 1100 F
Valves with "XU" trim.....for steam up to 850 F.....for oil or oil vapor up to 1100 F
Valves with "U" trim.....for steam up to 1200 F.....for oil or oil vapor up to 1200 F

Temp. Deg. Fahr.	Working Pressures—Pounds per Square Inch, Non-Shock. For 150 and 300-Pound Screwed Valves and 150 to 2500-Pound Flanged or Butt-Welding End Valves												
	Carbon Steel[1] (ASTM A216, Grade WCB)							No. 5 Chromium-Molybdenum Alloy Steel (ASTM A217, Grade C5 — made to order)					
	150 Pound	300 Pound	400 Pound	600 Pound	900 Pound	1500 Pound	2500 Pound	300 Pound	400 Pound	600 Pound	900 Pound	1500 Pound	2500 Pound
100°	275	720	960	1440	2160	3600	6000						
150	255	710	945	1420	2130	3550	5915						
200	240	700	930	1400	2100	3500	5830						
250	225	690	920	1380	2070	3450	5750						
300	210	680	910	1365	2050	3415	5690						
350	195	675	900	1350	2025	3375	5625						
400	180	665	890	1330	2000	3330	5550						
450	165	650	870	1305	1955	3255	5430						
500	150	625	835	1250	1875	3125	5210						
550	140	590	790	1180	1775	2955	4925						
600	130	555	740	1110	1660	2770	4620						
650	120	515	690	1030	1550	2580	4300						
700	110	470	635	940	1410	2350	3920	485	645	965	1450	2415	4025
750	100	425	575	850	1275	2125	3550	450	600	900	1350	2250	3745
800	92	365	490	730	1100	1830	3050	415	555	835	1250	2080	3470
850	[2]82	[2]300	[2]400	[2]600	[2]900	[2]1500	[2]2500	385	510	765	1150	1915	3190
875	[2]75	[2]260	[2]350	[2]525	[2]785	[2]1305	[2]2180	365	490	735	1100	1830	3055
900	[2]70	[2]225	[2]295	[2]445	[2]670	[2]1115	[2]1855	350	465	700	1050	1750	2915
925	[2]60[3]	[2]190[3]	[2]250[3]	[2]375[3]	[2]565[3]	[2]945[3]	[2]1570[3]	335	445	665	1000	1665	2775
950	[2]55[3]	[2]155[3]	[2]205[3]	[2]310[3]	[2]465[3]	[2]770[3]	[2]1285[3]	315	420	635	950	1585	2640
975	[2]50[3]	[2]120[3]	[2]160[3]	[2]240[3]	[2]360[3]	[2]600[3]	[2]1000[3]	300	400	600	900	1500	2500
1000	[2]40[3]	[2]85[3]	[2]11[illegible][3]	[2]170[3]	[2]255[3]	[2]430[3]	[2]715[3]	250	335	500	750	1250	2085
1025	...	...	...	...	...	...	...	215	285	430	645	1070	1785
1050	...	...	...	...	...	...	...	180	240	355	535	890	1485
1075	...	...	...	...	...	...	...	145	195	290	435	730	1215
1100	...	...	...	...	...	...	...	115	150	225	340	565	945
1125[4]	...	...	...	...	...	...	...	95	125	190	285	470	785
1150[4]	...	...	...	...	...	...	...	75	100	150	225	375	630
1175[4]	...	...	...	...	...	...	...	65	85	125	190	315	530
1200[4]	...	...	...	...	...	...	...	50	70	105	155	255	430

At temperatures lower than 700 F, ratings for these valves are the same as those shown at the left for the Carbon Steel Valves.

[1]Where welded construction is used, consideration should be given to the possibility of graphite formation on Carbon Steel at temperatures above 775 F.

[2]Product used within the jurisdiction of Section 1, Power Boilers of the ASME Boiler and Pressure Vessel Code, is subject to the same maximum temperature limitations placed upon the material in Table P7, 1959 edition thereof.

[3]Product used within the jurisdiction of Section 1, Power Piping of the ASA Code for Pressure Piping, B31.1, is subject to the same maximum temperature limitations placed upon piping of the same general composition in Table 2a, 1955 edition thereof.

[4]Consideration should be given to the possibility of excessive oxidation (scaling) when No. 5 Chromium-Molybdenum Steel is used at temperatures above 1100 F.

Recommendations: Valves with "XR" trim are particularly satisfactory for steam, water, air, gas, and other non-lubricating, relatively non-corrosive fluids such as gasoline, fuel oil, etc.; also for oil of low viscosity such as used in hydraulic systems, especially where seating loads are extremely high. They are recommended for temperatures up to 850 F on steam and up to 500 F on all other services.

Valves with "X" trim should be used for oil or oil vapor at temperatures over 500 F (up to 1100 F) and for most corrosive and unrefined oils regardless of temperature. For lubricating oils up to 500 F, either "X" or "XR" should give equal satisfaction.

Valves with "XU" trim can be used for any of the services for which "XR" or "X" trim is recommended.

Valves with "U" trim are provided primarily for high temperature steam, oil, and oil vapor service or where a premium trim is desired for extremely severe service conditions

Cold service: Between minus 20 F and plus 100 F, ratings shown in the table for 100 F will apply. For temperatures below minus 20 F, steels with suitable impact strength must be used; pressure ratings for such steels will be the same as shown for 100 F.

Gaskets: The use of these ratings for flanged valves requires gaskets conforming to requirements set forth in ASA B16.5-1957. The user is responsible for selecting gaskets of dimensions and materials capable of withstanding the required bolt loading without injurious crushing, as well as being suitable for the service conditions in all other respects.

Flange facings: Flanged valves of the 150 and 300-pound classes have 1/16-inch raised faces; those of 400-pound and higher classes have 1/4-inch male faces.

ASA and API: Crane ratings agree with those in the American Steel Flange Standard, B16.5-1957, and in the American Petroleum Institute (API) Standard No. 600, Fourth Edition, 1958

12

Cast Steel Wedge Gate Valves

Crane Cast Steel Outside Screw and Yoke Wedge Gate Valves are exceptionally sturdy, rugged, and durable. Carefully selected materials of superior quality combined with designs of outstanding merit assure the highest utility. The valves are particularly well suited for high-pressure, high-temperature services and have a wide application in long-distance pipe lines, modern industrial and petro-chemical plants, central power stations, and oil refineries.

Hydrostatic Test Pressures, in Psi

Pressure Class	Screwed Valves		Flanged and Butt-Welding Valves	
	Shell	Seat	Shell	Seat
150-Pound	425	350	425	350
300-Pound	1100	775	1100	775
400-Pound	...	...	1450	1000
600-Pound	...	...	2175	1550
900-Pound	...	...	3250	2250
1500-Pound	...	...	5400	3700

Valve seats are tested 100 psi air-under-water.

For working pressures, see page 121.

The Crane line is complete and includes valves in a wide range of sizes, in seven pressure classes (150, 300, 400, 600, 900, 1500, and 2500-Pound), and with screwed, flanged, or butt-welding ends. Made of carbon cast steel, the valves are furnished with trim materials especially suited for the recommended services, assuring maximum valve performance. The general design of Crane Cast Steel Wedge Gate Valves is described on the pages that follow; material specifications are shown in the table below.

Prices are furnished on request; dimensions are shown on page 128 (dimensions of 2500-pound valves are furnished on application).

Specification of Materials

Valves of all pressure classes are regularly made of Crane Carbon Steel, conforming to ASTM Specification A 216, Grade WCB.

The valves are furnished with a variety of trim materials, as indicated below. Orders should specify both the catalog number and letter suffix; see pages 125 and 127.

When specified, the valves can be made to order of Crane No. 5 Chromium-Molybdenum Alloy Steel (ASTM A 217, Grade C5), as well as a variety of other alloy steels.

Valves made of Crane No. 5 Alloy Steel are recommended particularly for extremely severe oil or oil vapor services.

Trim*	Names of Parts		150 and 300-Pound Valves (Flexible or Solid Disc)	400, 600, and 900-Pound Valves	1500 Pound Valves	2500 Pound Valves
All Trims	Body and Bonnet		Carbon Steel	Carbon Steel		
	Stem		Exelloy	Exelloy		
	Bonnet Gasket		Corrugated Soft Iron	Soft Steel Ring Joint Gasket		
	Bonnet Stud Bolts		Triplex Steel	Triplex Steel		
"XU" Trim§	Disc		Exelloy§	§	§	§
	Body Seat Rings		Stellite-Faced Exelloy§			
"X" Trim	Disc	Up to 4"	Exelloy	Exelloy	Exelloy	Exelloy or Exelloy-Faced Carbon Steel
		5 and 6"	Exelloy-Faced Carbon Steel		Exelloy†	
		8"				
		10" and up		Exelloy-Faced Carbon Steel	—	
	Body Seat Rings		Exelloy	Exelloy	Exelloy	Exelloy
"XR" Trim	Disc	Up to 4"	Exelloy	Exelloy	Exelloy	—
		5 and 6"	Exelloy-Faced Carbon Steel		Exelloy	—
		8"			Exelloy†	—
		10" and up		Exelloy-Faced Carbon Steel	—	—
	Body Seat Rings		No. 49 Nickel Alloy	No. 49 Nickel Alloy		—
"U" Trim	Disc		Stellite-Faced Carbon Steel‡	Stellite-Faced Carbon Steel		
	Seat Rings	Up to 2½"	Stellite-Faced Exelloy‡	Stellite-Faced Carbon Steel		
		3" and up	Stellite-Faced Carbon Steel‡			

*For detailed service recommendations and temperature limitations applying to each type of trim see page 121.

†The disc in 8-inch "X" and "XR" trimmed 1500-pound valves is Exelloy-faced carbon steel

‡Materials apply only to 300-pound valves, the 150-pound valves are not regularly made with "U" trim

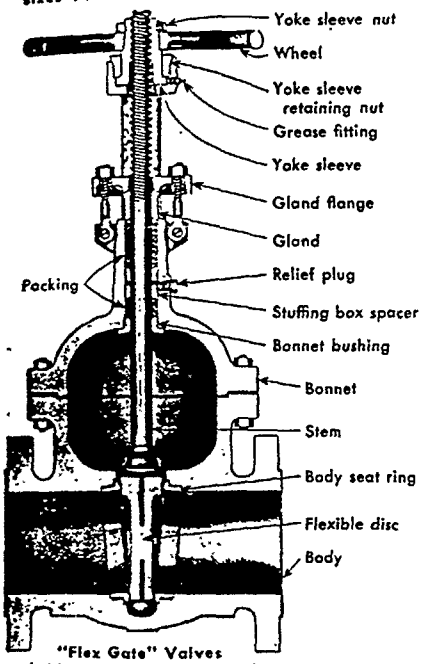
§As shown on page 125, the 150 and 300-pound valves in sizes 2½-inch and smaller are regularly made with "XU" trim. Larger sizes, however, and all sizes of 400-pound and higher pressure classes, can also be furnished with half Stellite or "XU" trim when specified

Pressure-temperature ratings.....page 121
Service recommendations.....page 121
150 and 300-pound valves....pages 123 to 125
400 to 1500-pound valves....pages 126 and 127
2500-pound valves.....page 130
Dimensions.....page 128
By-passes.....page 129
Gearing.....pages 271 to 274
Description of materials.....Section 2

Cast Steel Wedge Gate Valves

150 and 300-Pound

"Flex Gate" Valves
(Sizes 2 to 12-inch regular; sizes 14 to 36-inch on order)



"Flex Gate" Valves
(300-Pound Valve illustrated)

Regularly furnished in sizes 2 to 12-inch, available on order in sizes 14-inch to 36-inch.

A complete line . . . featuring Crane's patented "Flex Gate" design in sizes 2 to 12-inch

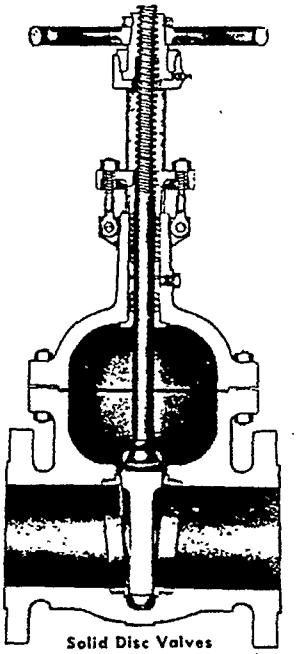
The term "Flex Gate" is a Crane Co. trademark; registration pending in the U.S. Patent Office.

Crane 150 and 300-Pound Cast Steel Wedge Gate Valves offer dependable service in steam, water, oil, and oil vapor lines. Quality materials and fine workmanship combined with tested designs assure high utility in severe service. A variety of trim materials are furnished.

The line, in the popular 2 to 12-inch size range, introduces Crane's "Flex Gate" Valves . . . . with patented one-piece flexible wedge disc . . . . a major step forward in fine valve construction.

"Flex Gate" Valves: Crane "Flex Gate" Valves feature a new concept in valve design . . . . a flexible wedge disc. Instead of being made solid with both seating faces maintained in the same rigid position, flexibility . . . . or resiliency . . . is attained by having the two faces separated from each other except fo a small section at the center. See the two illustrations at the left.

Solid Disc Valves
(Sizes 1½ to 24-inch regular; sizes 30 and 36-inch on order)



Solid Disc Valves
(300-Pound Valve illustrated)

Solid wedge disc valves, except for the disc, are the same design as the "Flex Gate" Valves.

The shape of the flexible disc can be likened to two wheels on a very short axle. The "axle" or spud at the center of the disc is amply strong to carry the two halves of the disc together at all times . . . . and yet, it permits a degree of action between them. It is this "flexibility" that makes the disc tight on both faces over a wide range of pressures . . . . prevents sticking during temperature changes, and assures minimum operating torque.

Although each disc face can move independently of the other . . . . up to two full degrees . . . . the construction is one-piece. There are no loose parts to cause harmful vibration.



Crane's patented one-piece flexible disc . . . solid through the center only . . . permits each disc face to move independently of the other.

Crane "Flex Gate" Valves offer a host of benefits. The design effects easy operation; less torque is required to seat and unseat . . . . the disc will not stick in the closed position, even if closed while hot and allowed to cool . . . . the resiliency of the construction compensates for minor misalignment of seats due to pipeline deflection . . . . and the valves are tight over a wide range of pressures on both the inlet seat and the outlet seat.

Solid Disc Valves: Crane Solid Wedge Disc Valves, illustrated at the upper right, are regularly furnished in the 1½-inch size and in sizes 14 to 24-inch; they are optional in sizes 2 to 12-inch. As in the "Flex Gate" design, careful engineering and workmanship are combined to produce a quality product highly dependable in severe service.

The disc is the solid web type. The facings are smoothly and accurately machined, and are then ground to a mirror-like finish. The disc is carefully fitted into the valve so that an even, wide, and true contact is made with the corresponding faces of the body seat rings.

Disc guides; stem connection: Both the flexible disc and the solid disc have long, machined guide slots which engage the guide ribs in the body to maintain true alignment of the disc throughout its travel. The seating faces do not contact each other until the valve is virtually closed. A tee-head disc-stem connection prevents lateral strains on the stem.

(continued on the next page)

Ratings and recommendations . . page 121
Specification of materials . . . . page 122
Catalog numbers, sizes, and weights . . . . . page 125
400 to 1500-pound gate valves . . . pages 126 and 127

12

Cast Steel Wedge Gate Valves
150 and 300-Pound

Continued from the preceding page; for ratings, tests, service recommendations, and material specifications, see pages 121 and 122.

Crane outside screw and yoke gate valves of the 150 and 300-pound classes . . . . in addition to the flexible disc ("Flex Gate") and solid disc design features described on the preceding page . . . . offer many other refinements in construction.

Body and bonnet: The body and bonnet have unusually heavy metal sections, providing liberal strength with low stress under all working conditions and assuring long service with maximum safety. The smooth flowing contours, combined with generous radius fillets, eliminate hazardous stress concentration.

The bodies of the flanged and welding end valves have straight-through ports without recess except between the seats, assuring minimum turbulence, erosion, and resistance to flow. Long guide ribs in the body mate with full length disc slots in the disc for accurate disc control and alignment.

The bonnet is equipped with a stainless steel (AISI Type 410) bonnet bushing which serves to guide the stem and to provide for back-seating when the valve is wide open and under pressure.

Ball-bearing yoke: The 300-pound valves in sizes 14-inch and larger can be equipped with a ball-bearing yoke on special order.

Body seat rings: All valves have shoulder-type body seat rings which will not loosen in service.

In "XU" and "XU-F" trimmed valves 2½-inch and smaller, the seat rings are rolled into the body.

In "X", "X-F", "XR", and "XR-F" trimmed valves, the seat rings are screwed into the body.

In "U" and "U-F" trimmed valves of the 2 and 2½-inch sizes, the seat rings are rolled into the body; in larger sizes, they are slipped in and seal welded.

Stem: The stem, of liberal diameter, with long and accurately cut threads, has ample engagement with the yoke sleeve.

Stuffing box: The stuffing box in all valves is deep, assuring tightness and long packing life. The 300-pound valves have a lantern type stuffing box.

When wide open, the valves can be repacked while under pressure.

Gland: All valves have a two-piece ball-type gland and gland flange which exert an even pressure on the packing without binding the stem.

Flange facing and finish: End flanges of flanged valves have a 1/16-inch raised face with a serrated finish. A smooth finish, or other types of facings such as ring joint, female, tongue, groove, etc., can be furnished when orders so specify.

By-pass: The valves can be equipped with a by-pass when specified. see page 120.

Gearing: To facilitate operation, the 150-pound valves in sizes 10-inch and larger and the 300-pound valves in sizes 8-inch and larger are available with a gear operator; see pages 271 to 274.

Motor or cylinder operation: These valves can also be equipped with an electric, air, or gas motor, or an operating cylinder; see pages 260 to 270.

Drilling: Unless otherwise ordered, flanged valves are furnished with the end flanges faced, drilled and spot faced (FD & SF) to the corresponding pressure class of the American Steel Flange Standard, B16.5-1957. They can be furnished faced only, when specified.

Butt-welding valves: Butt-welding valves 12-inch and smaller are bored to match the inside diameter of Standard pipe (heaviest weight on 8, 10, and 12-inch sizes), unless otherwise ordered.

Orders for butt-welding valves 14-inch and larger must specify the diameter of bore (I.D. of pipe).

Double blocking service: In certain cycling operations where it is necessary to prevent intermixture of fluids, the practice of "double blocking" with two conventional solid wedge disc valves can be effectively performed by a single Crane "Flex Gate" Valve. The latter valve, when ordered for such service, will be provided with a drilled, tapped, and plugged hole at location "G" (see page 403) for a drain, so that the fluid in the body chamber can be drained away.

Standards: In design and materials, Crane Cast Steel Gate Valves exceed the requirements of Standards issued by the American Standards Association (ASA) and the American Petroleum Institute (API).

End flanges conform to American Standard B16.5-1957. Butt-welding ends conform to the aforementioned Standard and also to the American Standard for Butt-Welding Ends, B16.25-1958; see page 306 for details.

Flanged and butt-welding valves also conform to the American Standard for Face-to-Face Dimensions of Ferrous Flanged and Welding End Valves, B16.10-1957, for their respective pressure class. This Standard does not include 3½-inch steel valves.

All valves except those with "XR" trimming conform to the API Standard for Flanged and Welding End Steel Gate Valves for Refinery Use, No. 600, Fourth Edition, 1958 . . . . and also to the API Standard for Steel Gate Valves for Pipeline Service, No. 6D, Ninth Edition, 1960. These Standards do not include 3½ and 5-inch sizes.

Catalog numbers: Please note that catalog numbers of Crane "Flex Gate" Valves include the letter "F" in their suffix designation; see next page

(continued on the next page)

Cast Steel Wedge Gate Valves

150 and 300-Pound

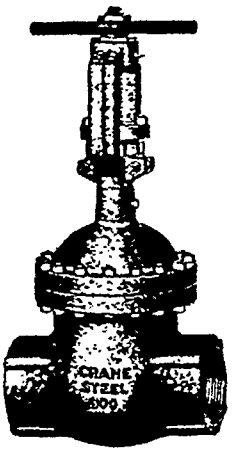
Ratings, material specifications, and descriptions . . . pages 121 to 124.

Catalog suffix: The "X" suffixed catalog numbers indicate valves suitable for oil or oil vapor . . . . "XR", for steam, water, oil, and general service . . . . and "XU", or "U" for steam, water, oil, or oil vapor.

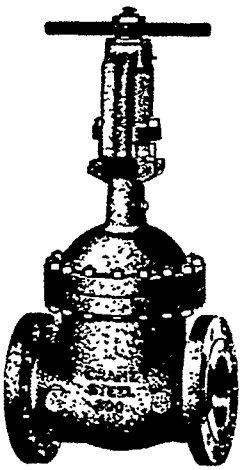
The added suffix "F" distinguishes "Flex Gate" valves from solid disc valves.

Important — ordering: Orders should specify the catalog number and suffix.

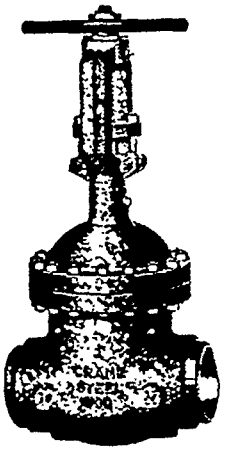
Crane "Flex Gate" Valves are regularly furnished in sizes 2 to 12-inch. For solid disc valves in such sizes, it is advisable to specify both the appropriate catalog number and "solid disc".



Outside Screw & Yoke Gate, Screwed
150 and 300-Pound



Outside Screw & Yoke Gate, Flanged
150 and 300-Pound



Outside Screw & Yoke Gate, Butt-Welding
150 and 300-Pound

Illustrations show 300-Pound Valves; the 150-Pound Valves are similar but have an oval bonnet and conventional stuffing box.

Valves are available with flexible disc ("Flex Gate" with "F" suffix) or solid disc. For catalog numbers of all types furnished, refer to the table below.

Catalog Numbers and Weights (Pounds, Each) — Prices on Request

(Weights shown in light face type indicate optional "Solid Disc" Valves)

Size	150-Pound Valves						300-Pound Valves					
	Screwed		Flanged FD & SF		Butt-Welding		Screwed		Flanged FD & SF		Butt-Welding	
Inches	Flexible Disc	Solid Disc	Flexible Disc	Solid Disc	Flexible Disc	Solid Disc	Flexible Disc	Solid Disc	Flexible Disc	Solid Disc	Flexible Disc	Solid Disc
	No. 46 XU-F	No. 46 XU	No. 47 XU-F	No. 47 XU	No. 47½ XU-F	No. 47½ XU	No. 32 XU-F	No. 32 XU	Nos. 33 XU-F 33 U-F	Nos. 33 XU 33 U	Nos. 33½ XU-F 33½ U-F	Nos. 33½ XU 33½ U
1½	...	...	...	...	...	...	...	...	...	60†	...	...
2	45	45	55	55	45	45	60	60	75	75	60	60
2½	60	60	70	70	60	60	80	80	100	100	80	80
	Nos. 46 X-F 46 XR-F	Nos. 46 X 46 XR	Nos. 47 X-F 47 XR-F	Nos. 47 X 47 XR	Nos. 47½ X-F 47½ XR-F	Nos. 47½ X 47½ XR	Nos. 32 X-F 32 XR-F	Nos. 32 X 32 XR	Nos. 33 X-F 33 XR-F 33 U-F	Nos. 33 X 33 XR 33 U	Nos. 33½ X-F 33½ XR-F 33½ U-F	Nos. 33½ X 33½ XR 33½ U
3*	80	80	95	95	80	80	120	120	145	145	120	120
3½	...	...	110	110	...	...	...	...	...	...	...	...
4	115	115	140	140	120	120	165	165	215	215	170	170
5	...	...	190	190	165	165	...	...	325	325	250	250
6	...	...	240	240	210	210	...	...	420	420	360	360
8	...	...	400	400	340	340	...	...	700	700	590	590
10	...	...	630	630	550	550	...	...	1050	1050	910	910
12	...	...	830	830	730	730	...	...	1490	1490	1220	1220
14	...	...	‡	1150	‡	990	...	...	‡	2170	‡	1960
16	...	...	‡	1580	‡	1460	...	...	‡	2800	‡	2550
18	...	...	‡	1910	‡	1730	...	...	‡	3720	‡	3300
20	...	...	‡	2350	‡	2200	...	...	‡	4640	‡	4350
24	...	...	‡	3900	‡	3350	...	...	‡	7380	‡	6700

30 and 36-inch 150 and 300-Pound Cast Steel Wedge Gate Valves are also available.

*When 3-inch 300-pound flanged valves with ring joint facing are to be bolted to Crane lap joints orders must specify. A groove of special pitch diameter is required. see page 334 for dimensions

†Only the No 33 XU (solid disc) is regularly furnished in the 12-inch size. The No 33 U is not made in the 12-inch size

‡Crane "Flex Gate" Valves (flexible disc) are made to order in sizes 14-inch and larger

Dimensions....page 128
By-passes.....page 129

For gate valves of the 400, 600, 900 and 1500-pound classes, see pages 126 and 127.

Gearing.....pages 271 to 274
Special facings....pages 332 and 334

12

Cast Steel Wedge Gate Valves

400, 600, 900, and 1500-Pound

Crane outside screw and yoke gate valves of the 400 to 1500-pound pressure classes offer excellent performance in high pressure and high temperature installations. Like the 150 and 300-pound valves described on pages 123 to 125, they combine high grade materials with outstanding design.

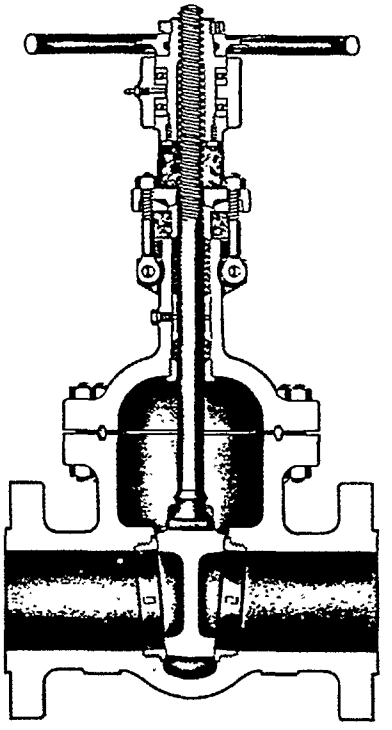
Valves of the 2500-pound class are described on page 130; in general design and construction, they are similar to the 1500-pound valves.

Body and bonnet: The body and bonnet are unusually rugged, having heavy metal sections and ample reinforcement at points subjected to greatest stress. The body has straight-through ports without recess except between the seats, assuring minimum turbulence, erosion, and resistance to flow. The bonnet is equipped with a stainless steel (AISI Type 410) bonnet bushing.

Bonnet joint: All valves have a ring type bonnet joint; Triplex Steel through stud bolts assure a tight, strong joint.

Ball-bearing yoke: The following valves are regularly equipped with a ball-bearing yoke to facilitate operation:

400-Pound.....8-inch and larger
600 and 900-Pound...6-inch and larger
1500 and 2500-Pound. 5-inch and larger



Typical Construction of 400 to 1500-Pound Outside Screw and Yoke Wedge Gate Valves (With Ball-Bearing Yoke)

Pressure-temperature ratings....page 121
Material specifications.....page 122
Sizes and weights.....page 127

When so ordered, valves can be furnished with other types of facing, such as *ring joint, female,* tongue, groove, etc. See pages 333 to 335.

Finish of flange faces: The ¼-inch male faces are finished with approximately 32 concentric grooves per inch, known as a serrated finish.

A smooth finish can be furnished on the male faces when orders so specify.

By-passes: The valves can be equipped with a by-pass; for description and clearance dimensions, see page 129.

Gearing: To facilitate operation, the valves can be equipped with a bevel gear operator in the following sizes:

400-Pound.....8-inch and larger
600-Pound.....6-inch and larger
900-Pound.....6-inch and larger
1500-Pound.....5-inch and larger

For complete information and description of geared valves, see pages 271 to 274.

Motor or cylinder operation: These valves can be equipped with an electric, air, or gas motor, or an operating cylinder; see pages 260 to 265 for cylinder operation and pages 266 to 270 for motor operation.

Body seat rings: All valves have shoulder-type body seat rings. In "X" and "XR" trimmed valves, the seat rings are screwed into the body. In "U" trimmed valves, they are either screwed into the body or slipped in and welded, depending on the valve size.

Disc and stem: The disc is of the solid web type, with long close-fitting guides to maintain accurate seating and to reduce wear. A tee-head disc-stem connection prevents lateral strains on the stem. The stem is of liberal diameter with long and accurately cut threads, and has ample engagement with the yoke sleeve.

Stuffing box: The stuffing box is the lantern type and is deep, assuring tightness and long packing life. When wide open, the valves can be repacked while under pressure.

Gland: All valves have a two-piece ball-type gland and gland flange which exert an even pressure on the packing without binding the stem.

Flange facings: Flanged valves regularly have a ¼-inch male face (large male) on the end flanges.

Standards: In design and materials, Crane Cast Steel Wedge Gate Valves exceed the requirements of Standards issued by the American Standards Association (ASA) and the American Petroleum Institute (API) for valves of the corresponding pressure class.

End flanges conform to American Standard B16.5-1957. Butt-welding ends conform to the aforementioned Standard and also to the American Standard for Butt-Welding Ends, B16.25-1958 (see page 306)

All valves conform to the American Standard for Face-to-Face Dimensions of Ferrous Flanged and Welding End Valves, B16.10-1957, for their respective pressure class. This Standard does not include 3½-inch steel valves.

All valves with Exelloy (X) or Stellite (U) trimming conform to the API Standard for Flanged and Welding End Steel Gate Valves for Refinery Use, No 600 Fourth Edition, 1958.... and also to the API Standard for Steel Gate Valves for Pipeline Service, No 6D, Ninth Edition, 1960. These Standards do not include 3½ and 5-inch sizes

For description of 150 and 300-pound classes, see pages 123 to 125.

Cast Steel Wedge Gate Valves

400, 600, 900, and 1500-Pound

For ratings, materials, and service recommendations, see pages 121 and 122.

For general description, see the facing page.

Catalog suffix: The "X" suffixed catalog numbers indicate valves suitable for oil or oil vapor service . . . . the "XR" suffixed catalog numbers indicate valves suitable for steam, water, oil, and general service . . . . and the "U" suffixed catalog numbers indicate valves suitable for steam, water, oil, or oil vapor service.

For pressure-temperature ratings, see page 121.

Flanged valves: Unless otherwise ordered, flanged valves of each pressure class are furnished with the end flanges faced, drilled, and spot faced (FD & SF) to the corresponding pressure class of the American Steel Flange Standard, B16.5-1957. They can be furnished faced only, when specified.

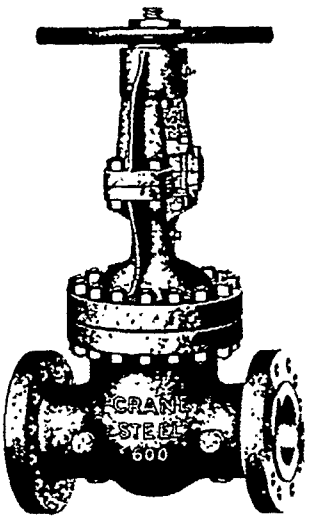
Butt-welding valves: Orders for butt-welding valves must specify the diameter of the bore (inside diameter of pipe).

Sizes smaller than listed: When 400 and 900-pound valves are desired in sizes smaller than listed in the table, valves of the next higher pressure class are recommended.

Crane's extensive line of 600-pound steel gate valves, in addition to those listed on this page, includes 2-inch and smaller reduced and full port types as well as valves with screwed, socket-welding, and flanged ends; see pages 116 to 120.

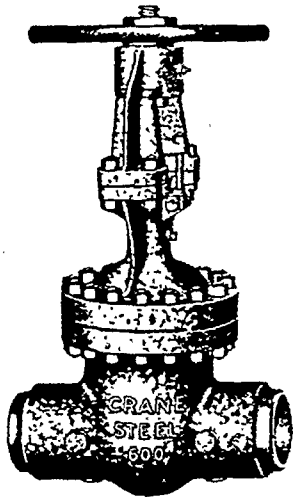
Ordering: When ordering, be sure to specify the catalog number and the suffix.

Dimensions.....page 128
By-passes.....page 129
2500-pound valves.....page 130
Special facings.....pages 333 to 335



Outside Screw and Yoke Flanged

No. 61 X, XR, or U....400-Pound
No. 76 X, XR, or U....600-Pound
No. 83 X, XR, or U....900-Pound
No. 87 X, XR, or U...1500-Pound



Outside Screw and Yoke Butt-Welding

No. 61½ .. XR, or U...400-Pound
No. 76½ X, XR, or U...600-Pound
No. 83½ X, XR, or U...900-Pound
No. 87½ X, XR, or U..1500-Pound

Weights in Pounds, Each — Prices on Request

Size	Flanged — FD & SF				Butt-Welding			
	400 Pound	600 Pound	900 Pound	1500 Pound	400 Pound	600 Pound	900 Pound	1500 Pound
Inches	61 X 61 XR 61 U	76 X 76 XR 76 U	83 X 83 XR 83 U	87 X 87 XR 87 U	61½ XR 61½ U	76½ X 76½ XR 76½ U	83½ X 83½ XR 83½ U	87½ X 87½ XR 87½ U
1	..	...	...	80	...	...	...	65
1¼	..	...	...	90	...	..	...	75
1½	...	...	...	130	...	...	...	105
2	...	95	...	180	...	80	...	155
2½	.	140	...	280	..	120	...	225
3	...	170*	260	370	...	140	220	300
3½		310	...	...	..	.	...	..
4	270	330	430	610	220	270	360	520
5	390	520	660	1020	330	430	560	830
6	530	720	900	1410	460	640	750	1250
8	940	1220	1560	2600	830	1080	1300	1910
10	1530	1880	2350	...	1250	1610	1970	
12	2000	2630	3500	..	1800	2240	3200	
14	2410	3200	4680		2210	3000	4350	
16	3500	4230	6500	.	3100	4030	6000	
18		7200	.	.	...	6760	...	
20	.	9800	.	...	..	8950	.	
24		11800	..	..	..	10500		

*When 3-inch 600-pound flanged valves with ring joint facing are to be bolted to Cranelap joints, orders must specify. A groove of special pitch diameter is required, see page 334 for dimensions.

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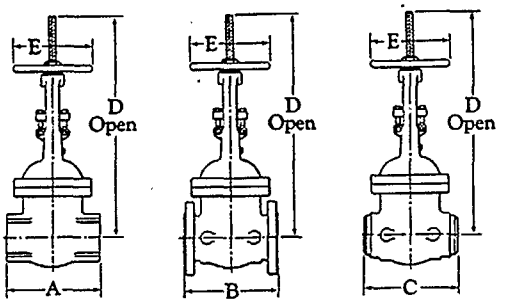
Cast Steel Wedge Gate Valves

150 to 1500-Pound Dimensions



Screwed | Flanged | Butt-Welding

Face to face: Flanged valves of the 150 and 300-pound pressure classes are regularly furnished with a 1/16-inch raised face; those of the 400, 600, 900, 1500, and 2500-pound classes are regularly furnished with 1/4-inch high large male facing; face to face dimensions include these facings.

All flanged and butt-welding valves conform to the American Standard for Face-to-Face Dimensions of Ferrous Flanged and Welding End Valves, B16.10-1957, for their respective pressure class. This Standard does not include 3 1/2-inch steel valves.

Dimensions, in Inches

Class	Size of Valve	A	B	C	D	E
150-Pound	2	6 1/4	7	8 1/2	15 5/4	8
	2 1/2	7	7 1/2	9 1/2	16 1/2	8
	3	7 3/8	8	11 1/8	20 3/4	9
	3 1/2	...	8 1/2	...	23	9
	4	8	9	12	25 3/4	10
	5	...	10	15	30 1/2	12
	6	...	10 1/2	15 7/8	35 1/4	14
	8	...	11 1/2	16 1/2	44	16
	10	...	13	18	52 1/2	18
	12	...	14	19 3/4	60 1/2	18
	14	...	15	22 1/2	70 1/4	22
	16	...	16	24	79 3/4	24
	18	...	17	26	89	27
	20	...	18	28	97 1/4	30
	24	...	20	32	112 3/4	30
300-Pound	1 1/2	...	7 1/2	...	16 3/4	8
	2	7	8 1/2	8 1/2	18	8
	2 1/2	8	9 1/2	9 1/2	19	8
	3	9	11 1/8	11 1/8	23 1/4	9
	4	11	12	12	28 1/4	10
	5	...	15	15	33 1/2	12
	6	...	15 7/8	15 7/8	38 1/2	14
	8	...	16 1/2	16 1/2	47	16
	10	...	18	18	56 1/2	20
	12	...	19 3/4	19 3/4	64 1/4	20
	14	...	30	30	75 1/4	27
	16	...	33	33	81	27
	18	...	36	36	91 1/2	30
	20	...	39	39	99 3/4	36
	24	...	45	45	120 1/2	36
400-Pound	4	...	16	16	30 3/4	12
	5	...	18	18	35	14
	6	...	19 1/2	19 1/2	40 1/4	16
	8	...	23 1/2	23 1/2	50 1/2	20
	10	...	26 1/2	26 1/2	59 3/4	24
	12	...	30	30	67 3/4	24
	14	...	32 1/2	32 1/2	74 3/4	27
	16	...	35 1/2	35 1/2	80 3/4	27

Class	Size of Valve	B	C	D	E
600-Pound	2	11 1/2	11 1/2	18 1/4	8
	2 1/2	13	13	22 1/4	9
	3	14	14	25 3/4	10
	3 1/2	15	...	32	14
	4	17	17	31 1/2	14
	5	20	20	36 3/4	16
	6	22	22	42 3/4	20
	8	26	26	52 1/4	24
	10	31	31	62 1/4	27
	12	33	33	70	27
	14	35	35	77 1/4	30
	16	39	39	83 3/4	30
	18	43	43	93 3/4	36
	20	47	47	104 1/2	36
	24	55	55	126	42
900-Pound	3	15	15	27 1/4	12
	4	18	18	31 1/2	14
	5	22	22	36 3/4	16
	6	24	24	42 3/4	20
	8	29	29	52 1/2	24
	10	33	33	62 1/4	27
	12	38	38	73 1/2	30
	14	40 1/2	40 1/2	77 1/4	30
	16	44 1/2	44 1/2	85 3/4	36
1500-Pound	1	10	10	16	8
	1 1/4	11	11	16 1/2	8
	1 1/2	12	12	20	9
	2	14 1/2	14 1/2	22 1/8	10
	2 1/2	16 1/2	16 1/2	26 3/8	12
	3	18 1/2	18 1/2	28	14
	4	21 1/2	21 1/2	33	16
	5	26 1/2	26 1/2	38 3/4	20
	6	27 3/4	27 3/4	47	24
	8	32 3/4	32 3/4	55	27
2500-Pound	Dimensions of 2500-Pound Valves are furnished on application				

Ratings and material specifications.....pages 121 and 122
Clearance dimensions of by-passes.....page 129
Locations of by-posses, taps and drains for valves.....page 403
Gearing.....pages 271 to 274
Templates for drilling and end flange dimensions....pages 329 to 331

Description and sizes:
150 and 300-pound.....pages 123 to 125
400 to 1500-pound....pages 126 and 127
2500-pound.....page 130

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By-Passes for Cast Steel Wedge Gate Valves

When so ordered, larger size Crane Cast Steel Wedge Gate Valves can be furnished with a Built-Up By-Pass; for sizes, refer to the table below. The by-passes are suitable for "warming up" on steam line service or for equalizing the pressure around main control valves used on steam or other fluids.

Construction: The Crane Built-Up By-Pass is designed to provide maximum strength, durability, and flexibility with a minimum of additional weight on the main valve.

The by-pass is furnished with a steel, bolted bonnet, outside screw and yoke globe valve having socket-welding ends. All connections in the by-pass are socket-welded to assure a permanently tight and strong assembly.

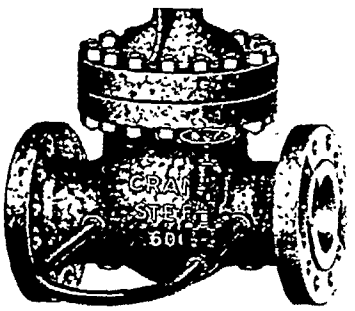
Pipe bends are used on all pressure classes to provide the necessary flexibility and to compensate for expansion strains resulting from unequal temperatures or fluctuating operating conditions.

Materials: High quality materials are used in the by-pass piping and in the by-pass valve. The pipe bend is seamless steel. The pipe and by-pass valves are of ample weight to withstand the pressures and temperatures for which the main valve is recommended, and the by-pass valve is trimmed with materials suitable for the same services as the main valves.

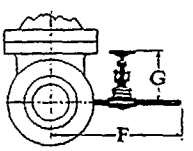
Location of by-pass: When ordered with a main valve, the built-up by-pass will be completely assembled and will be attached to either of the sides or to the bottom of the main valve.

Unless otherwise ordered, the by-pass valve is attached to the side of the main valve, with the stem of both valves parallel and pointing vertically upward.

Special by-passes: By-passes of other designs or specifications can be made to order. Please furnish complete description, drawings, or specifications.



Typical Built-Up By-Pass



By-Pass for Gate Valves
(Side Mounting illustrated)

Clearance dimensions F and G are identical for bottom mounting.

Built-Up By-Pass Sizes and Clearance Dimensions — Prices on Request

Main Valve: Class of trim	Main Valve: Size of valve, Inches	Built-Up By-Passes for Use with Main Valves Of Pressure Classes Specified Below: Size of by-pass, Inches	Approximate Clearance, In Inches: F: 150 Pound	300 Pound	400 Pound	600 Pound	900 Pound	1500 Pound	G (Open): 150 to 600 Pound	900 or 1500 Pound
"XR" Trim	4	¾	...	...	...	...	21¼	21¾	...	9⅛
	5	¾	...	19¾	20⅛	20¼	22⅝	22⅞	8⅞	9⅛
	6	¾	...	20¼	21¼	21½	23⅛	23⅞	8⅞	9⅛
	8	¾	...	22¼	22¾	22⅞	25	26⅝	8⅞	9⅛
	10	1	...	25	26¼	26⅝	28⅞	...	9⅜	10¾
	12	1	25⅜	26½	28⅛	28½	30⅝	...	9⅜	10¾
	14	1¼	27½	30	30¼	30¾	33⅝	...	11	13
	16	1¼	29⅜	31¾	31⅞	32½	35¼	...	11	13
	18	1½	32	35½	..	35¾	...	...	12	..
	20	1½	33¼	36⅝	...	37⅛	.	...	12	.
	24	2	38¾	44	.	45⅜		...	14	
"U" Trim	4	¾	..	...	...	...	21¼	21¾	...	9⅛
	5	¾	...	20⅝	21⅛	21¼	22⅝	22⅞	9⅛	9⅛
	6	¾	..	21¼	22¼	22½	23⅛	23⅞	9⅛	9⅛
	8	¾	...	23¼	23¾	23⅞	25	26⅝	9⅛	9⅛
	10	1		26½	27	27⅜	28⅞	..	10¾	10¾
	12	1	..	28	28⅞	29¼	30⅝	...	10¾	10¾
	14	1¼	..	31⅝	31⅞	32⅜	33⅝	...	13	13
	16	1¼	..	33⅜	33½	34⅛	35¼	..	13	13
	18	1½	..	37⅛	...	37⅞	...	...	13⅝	.
	20	1½	...	38¼	...	39¼	..	...	13⅝	
	24	2	..	47¾	.	48⅝		...	16½	

Description of main valves....pages 124 to 127 Additional data on by-passes....page 403 Taps and drains for valves....page 403

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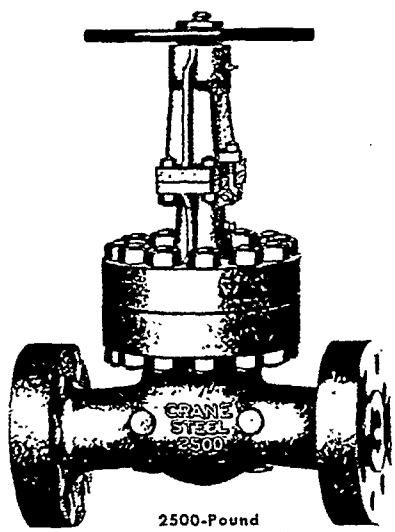
2500-Pound Cast Steel Wedge Gate Valves

063916

For pressure-temperature ratings, see page 121.

For specification of materials, see page 122.



**2500-Pound
Outside Screw and Yoke
Cast Steel Wedge Gate Valves**
(with flanged or butt-welding ends)

For general description, see page 126.

Prices, weights, and dimensions will be furnished on request.

Crane 2500-Pound Cast Steel Outside Screw and Yoke Wedge Gate Valves are available in the 1½, 2, 2½, 3, 4, 5, 6, 8, 10, and 12-inch sizes, with either flanged or butt-welding ends. In these valves are many outstanding features of design necessary for safe, reliable service under the severe operating conditions of the high pressures and elevated temperatures for which they are recommended.

Some of the more important developments in the Crane 2500-Pound Valves are: straight-through port design—eliminates excessive turbulence; shoulder-type body seat rings—provide tightness and security at this point; long, machined disc guides—assure accurate seating with minimum wear; tee-head disc-stem connection—prevents lateral strains on the stem; ring-type bonnet joint with high tensile bolting—makes the joint strong and tight; ball-bearing yoke sleeve on sizes 5-inch and larger—facilitates operation; and deep, lantern-type stuffing box with ball-type gland—assures tightness with minimum wear.

It is recommended that 2500-Pound Cast Steel Gate Valves be equipped with a by-pass on sizes 4-inch and larger; sizes 8-inch and larger should have gearing; further information furnished on request.

Gearing for Crane 150 to 2500-pound cast steel wedge gate valves . . . for easier operation . . . can be installed in the factory or in the field

To facilitate operation, the larger size Crane 150 to 2500-pound cast steel outside screw and yoke wedge gate valves (pages 123 to 127) can be furnished with a bevel geared operator. The Crane gear unit can be factory-installed or can be shipped separately for field installation on Crane valves in service. For complete details and description, see pages 271 to 274. Valves of the 2500-pound class can also be equipped with gears; information on request.

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Class 400 and 600 Cast Steel Pipe-Line Gate Valves

Single Disc — Conduit Type

(Patent Pending)

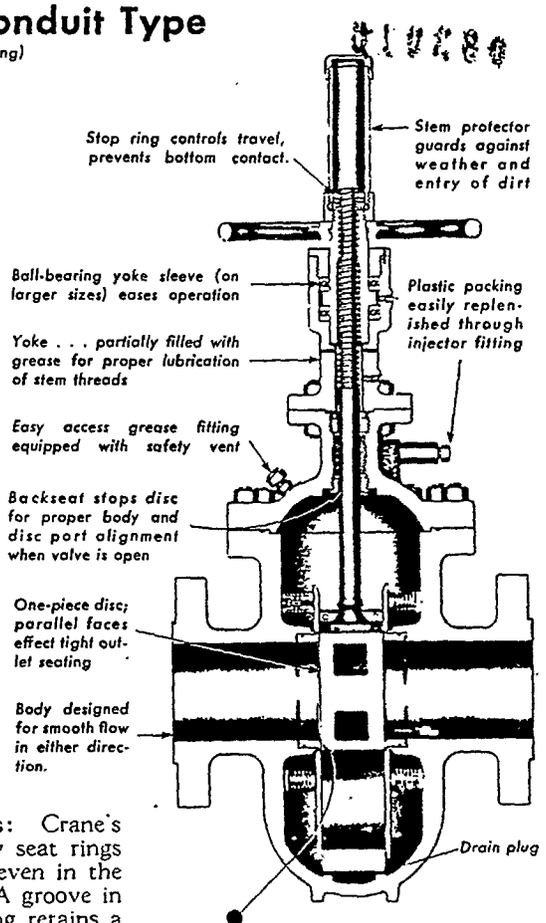
Full-way and venturi type valves . . . single disc design . . . flow in either direction . . . self-sealing, replaceable seats . . . choice of three seat types.

Crane Conduit Type Pipe-Line Gate Valves, described on this and the next two pages, are designed for efficient handling of crude oils, gas, and refined petroleum products of non-corrosive nature, such as gasoline, kerosene, fuel oils, etc. Extensive field tests have proven the valves easy to operate, dependable, and practically maintenance-free.

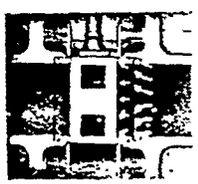
For a complete description of Crane cast steel pipe-line swing check valves, see page 155.

Disc and stem: The simple one-piece disc design permits free flow in either direction. The disc is attached to the stem by means of a slotted tee-head connection which eliminates any tendency of a side-thrust on the stem bearings. The parallel disc faces effect tight outlet seating without excessive stem thrust and with minimum load on the stem head . . . . line pressure does the work. Machined guides in the body prevent lateral disc movement and seating misalignment. The disc cannot stick in operation.

The stem, well lubricated, is enclosed within a capped protector above the yoke sleeve.



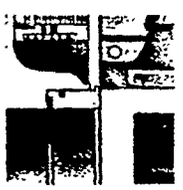
Self-Sealing Seating



Upstream pressure, acting on the area back of the seat ring . . . . an area greater than the port area in contact with the disc . . . . creates a differential pressure for absolutely tight seating.

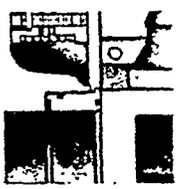
Self-aligning body seat rings: Crane's self-aligning, bottom seated body seat rings can be slipped in by hand . . . even in the field . . . without special tools. A groove in the outside perimeter of each ring retains a synthetic rubber O-ring gasket for positive pressure-tightness. Spring-actuated, oval-shaped disc plates push against the shoulders of the seat rings, maintaining a constant seat-disc contact to assure an immediate seal. Constant lubrication of seating surfaces provides protection against abrasion.

Choice of Three Seats



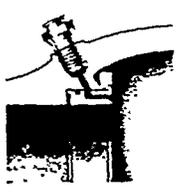
Metal-to-Metal

Seat rings are steel, Stellite faced; also illustrated in full valve view above.



Teflon Insert

Exelloy seat rings with Teflon "soft seating" insert in faces.



Grease-Sealed

Exelloy seat rings grease is supplied to seating faces through two or more fittings to channels in seat rings.

Body, bonnet, and yoke: The body features a flow-through area as straight and smooth as pipe and permits easy passage of a scraper. There is no line turbulence, nor are there pockets in which dirt might accumulate. Triplex Steel stud bolts, drawn up just enough to form a rubber O-ring gasket into a wedge-shaped groove in the face of the body flange, join body and bonnet into a firm metal-to-metal contact. Internal pressure against the gasket insures a tight, leak-proof seal. The body well is partially filled with grease for quick lubrication of parts. An exclusive Crane safety feature precludes excessive pressure build-up in the body-bonnet chamber by providing an escape through the seat into the port.

Spring-Loaded Disc Plates



Spring-loaded disc plates assure constant seat-disc contact . . . prevent entry of dirt into, and contain lubricating grease within, the body well.

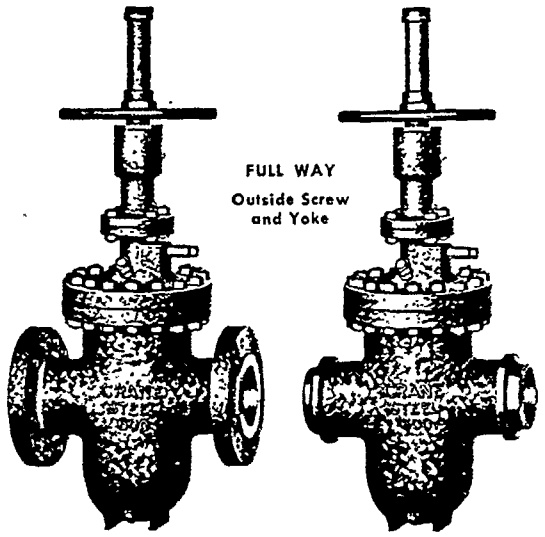
On 4-inch Class 400 and 3-inch and smaller Class 600 Valves, the bonnet and yoke are integral. To facilitate operation, the yoke sleeve is equipped with ball bearings on Class 400 Valves 8-inch and larger and on Class 600 Valves 6-inch and larger

For additional description and dimensions, see next two pages

12

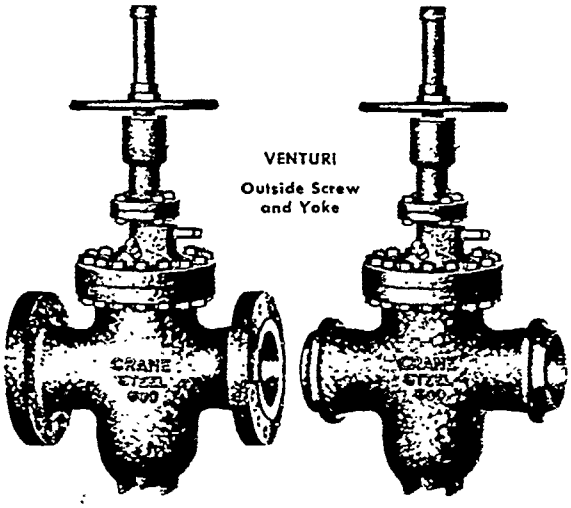
Class 400 and 600 Cast Steel Pipe-Line Gate Valves

Single Disc — Conduit Type



Class 400, Flanged		Class 400, Butt-Welding
No. 1490	Metal-to-Metal Seating	No. 1491
No. 1490-TF	Teflon Insert Seating	No. 1491-TF
No. 1490-GS	Grease-Sealed Seating	No. 1491-GS

Class 600, Flanged		Class 600, Butt-Welding
No. 1690	Metal-to-Metal Seating	No. 1691
No. 1690-TF	Teflon Insert Seating	No. 1691-TF
No. 1690-GS	Grease-Sealed Seating	No. 1691-GS



Class 400, Flanged		Class 400, Butt-Welding
No. 1494	Metal-to-Metal Seating	No. 1495
No. 1494-TF	Teflon Insert Seating	No. 1495-TF
No. 1494-GS	Grease-Sealed Seating	No. 1495-GS

Class 600, Flanged		Class 600, Butt-Welding
No. 1694	Metal-to-Metal Seating	No. 1695
No. 1694-TF	Teflon Insert Seating	No. 1695-TF
No. 1694-GS	Grease-Sealed Seating	No. 1695-GS

Class 400 Valves (not illustrated) are similar to the Class 600

Ratings

Valve Class	Working Pressure	Hydrostatic Test Pressure	
	Cold Oil or Gas	Shell	Seat
Class 400	960 psi	1450 psi	1000 psi
Class 600	1440 psi	2175 psi	1550 psi

Valve seat tested 100 psi air-under-water.

For general construction and features, see preceding page.
For dimensions, see the facing page.

Materials: The body, bonnet, and yoke are Crane Carbon Steel conforming to ASTM A 216, Grade WCB. The stem is Exelloy, an AISI Type 410 stainless steel containing 11½ to 13½ per cent chromium (conforms to ASTM A 182, Grade F6). Disc plates are steel, chromium-plated. The valve wheel is malleable iron.

In all valves, the disc is Crane No. 15 Steel, a high tensile strength, low alloy cast steel containing chromium, nickel, and molybdenum; in addition, the disc is chromium-plated. Three types of body seat rings are available . . . . Steel, Stellite faced . . . . Exelloy with Teflon "soft" seating insert. . . . and Exelloy, Grease-Sealed.

Packing chamber: A special plastic packing contained between V-type end rings insures a tight stem seal. The packing is easily replenished, with the valve on full line pressure and the disc in any position, through a ball-check injector fitting in the bonnet.

Gearing: For easier operation and as a safety factor in event of operation under high pressure differential, gearing should be considered for Class 400 Valves 14-inch and larger and for Class 600 Valves 10-inch and larger. Orders must specify whether bevel or spur gearing is wanted.

Indicator: The valves can be equipped with an indicator, at added charge, when so ordered.

Standards: The valves comply with requirements of the following Standards (in sizes included therein) for their respective pressure class.

End flanges, and ends of butt-welding valves, comply with American Standard B16.5-1957

The valves conform to the American Standard for Face-to-Face and End-to-End Dimensions of Ferrous Flanged and Welding End Valves, B16.10-1957.

The valves also conform to requirements of the American Petroleum Institute (API) Standard for Pipeline Valves, No. 6-D, Ninth Edition (1960)

Flange facings: Flanged valves regularly have a ¼-inch male face (large male) on the end flanges. The faces have a serrated finish (about 32 concentric grooves per inch); a smooth finish is optional.

Other types of facings such as ring joint, female, tongue, groove, etc., can be furnished

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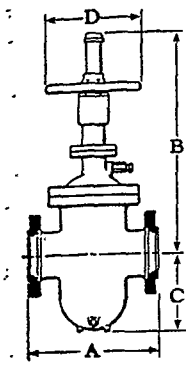
Class 400 and 600 Cast Steel Pipe-Line Gate Valves

Single Disc — Conduit Type



All Valves

Order by catalog number: When ordering, specify the catalog number of the valve desired.

Catalog numbers for each valve type are listed under the valve illustrations on the facing page.

Drilling: Flanged valves are regularly furnished faced, drilled, and spot faced to the corresponding American Standard pressure class.

Faced only valves can be furnished when specified.

Butt-welding: The ends of butt-welding valves are bored to match the inside diameter of the pipe to be used; orders must specify the diameter of bore.

Installation: For best performance install the valves upright. Two ribs at the bottom of the body provide a supporting base.

Dimensions, in Inches — Prices and Weights on Request

Valve Type Flanged or Butt-Welding	Size (*)	A (†)	B	C	D	End Flanges: Dia.	Thickness (†)	Male face dia.	Bolt circle dia.	No. of bolts & dia.	Inside Diameter: Ends	Seats
Class 400 Full-Way	4	16	28¾	9¾	10	10	1⅜	6 3/16	7⅞	8-⅞	4 1/16	4 1/16
	6	19½	36⅝	12¾	12	12½	1⅝	8½	10⅝	12-⅞	6 1/16	6 1/16
	8	23½	46¼	16	16	15	1⅞	10⅝	13	12-1	8 1/16	8 1/16
	10	26½	55	19½	20	17½	2⅛	12¾	15¼	16-1⅛	10	10
	12	30	62¾	23	20	20½	2¼	15	17¾	16-1¼	12	12
	14	32½	69½	25⅞	24	23	2⅜	16¼	20¼	20-1¼	13¼	13¼
	16	35½	78⅛	29⅜	24	25½	2½	18½	22½	20-1⅜	15¼	15¼
	18	38½	88½	32⅝	27	28	2⅝	21	24¾	24-1⅜	17	17
	20	41½	94½	36½	27	30½	2¾	23	27	24-1½	19	19
	22	45	107⅝	39¾	36	33	2⅞	25¼	29¼	24-1⅝	21	21
	24	48½	116⅛	43 3/16	36	36	3	27¼	32	24-1¾	23	23
	26	51½	123½	47⅝	36	38¼	3½	29½	34½	28-1¾	25	25
	30	60	141¾	54⅜	42	43	4	33¾	39¼	28-2	29	29
Class 400 Venturi	8 x 6	23½	36⅝	12¾	12	15	1⅞	10⅝	13	12-1	8 1/16	6 1/16
	10 x 8	26½	46¼	16	16	17½	2⅛	12¾	15¼	16-1⅛	10	8 1/16
	12 x 8	30	46¼	16	16	20½	2¼	15	17¾	16-1¼	12	8 1/16
	16 x 12	35½	62¾	23	20	25½	2½	18½	22½	20-1⅜	15¼	12
	18 x 14	38½	69½	25⅞	24	28	2⅝	21	24¾	24-1⅜	17	13¼
	20 x 16	41½	78⅛	29⅝	24	30½	2¾	23	27	24-1½	19	15¼
	24 x 16	48½	78⅛	29⅝	24	36	3	27¼	32	24-1¾	23	15¼
	24 x 18	48½	88½	32⅝	27	36	3	27¼	32	24-1¾	23	17
	26 x 20	51½	94½	36½	27	38¼	3½	29½	34½	28-1¾	25	19
	30 x 24	60	116⅛	43 3/16	36	43	4	33¾	39¼	28-2	29	23
Class 600 Full-Way	2	11½	19	5¾	8	6½	1	3⅝	5	8-⅝	2 1/16	2 1/16
	2½	13	20¾	6 13/16	9	7½	1⅛	4⅛	5⅞	8-¾	2½	2½
	3	14	25	7¾	10	8¼	1¼	5	6⅝	8-¾	3 1/16	3 1/16
	4	17	29½	9¾	12	10¾	1½	6 3/16	8½	8-⅞	4 1/16	4 1/16
	6	22	38¾	12⅞	16	14	1⅞	8½	11½	12-1	6 1/16	6 1/16
	8	26	48⅞	16 3/16	20	16½	2 3/16	10⅝	13¾	12-1⅛	8 1/16	8 1/16
	10	31	56⅞	19⅞	24	20	2½	12¾	17	16-1¼	10	10
	12	33	64¼	23¼	24	22	2⅝	15	19¼	20-1¼	12	12
	14	35	72⅝	25⅞	27	23¾	2¾	16¼	20¾	20-1⅜	13¼	13¼
	16	39	79	29 9/16	27	27	3	18½	23¾	20-1½	15¼	15¼
	18	43	89	32¾	30	29¼	3¼	21	25¾	20-1⅝	17	17
	20	47	99	37	36	32	3½	23	28½	24-1⅝	19	19
	22	51	110	40¼	36	34¼	3¾	25¼	30½	24-1¾	21	21
	24	55	119	43¾	36	37	4	27¼	33	24-1⅞	23	23
	26	57	130	47⅝	42	40	4¼	29½	36	28-1⅞	25	25
	30	65	144	55	42	44½	4½	33¾	40¼	28-2⅛	29	29
Class 600 Venturi	8 x 6	26	38¾	12⅞	16	16½	2 3/16	10⅝	13¾	12-1⅛	8 1/16	6 1/16
	10 x 8	31	48⅞	16 3/16	20	20	2½	12¾	17	16-1¼	10	8 1/16
	12 x 8	33	48⅞	16 3/16	20	22	2⅝	15	19¼	20-1¼	12	8 1/16
	16 x 12	39	64¼	23¼	24	27	3	18½	23¾	20-1½	15¼	12
	18 x 14	43	72⅝	25⅞	27	29¼	3¼	21	25¾	20-1⅝	17	13¼
	20 x 16	47	79	29 9/16	27	32	3½	23	28½	24-1⅝	19	15¼
	24 x 16	55	79	29 9/16	27	37	4	27¼	33	24-1⅞	23	15¼
	24 x 18	55	89	32¾	30	37	4	27¼	33	24-1⅞	23	17
	26 x 20	57	99	37	36	40	4¼	29½	36	28-1⅞	25	19
	30 x 24	65	119	43¾	36	44½	4½	33¾	40¼	28-2⅛	29	23

*Sizes for venturi type valves indicate the valve ends first, and then the seat.

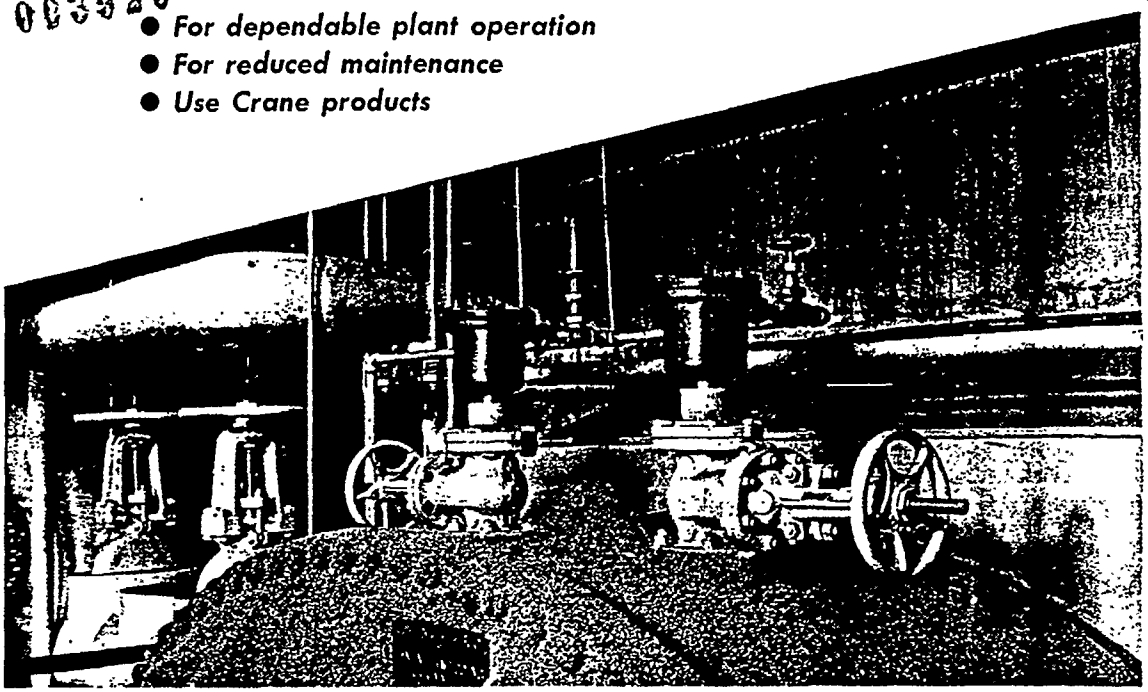
†Dimension "A" (in the case of flanged valves) includes the ¼-inch male faces; the flange thickness does not.

General description.....pages 131 and 132
Cast steel pipe-line swing check valves....page 155
Volume per lineal foot of pipe.....page 354
Templates for drilling.....page 330
Special facings.....pages 333 to 335
Flow of fluids data.....pages 421 to 442

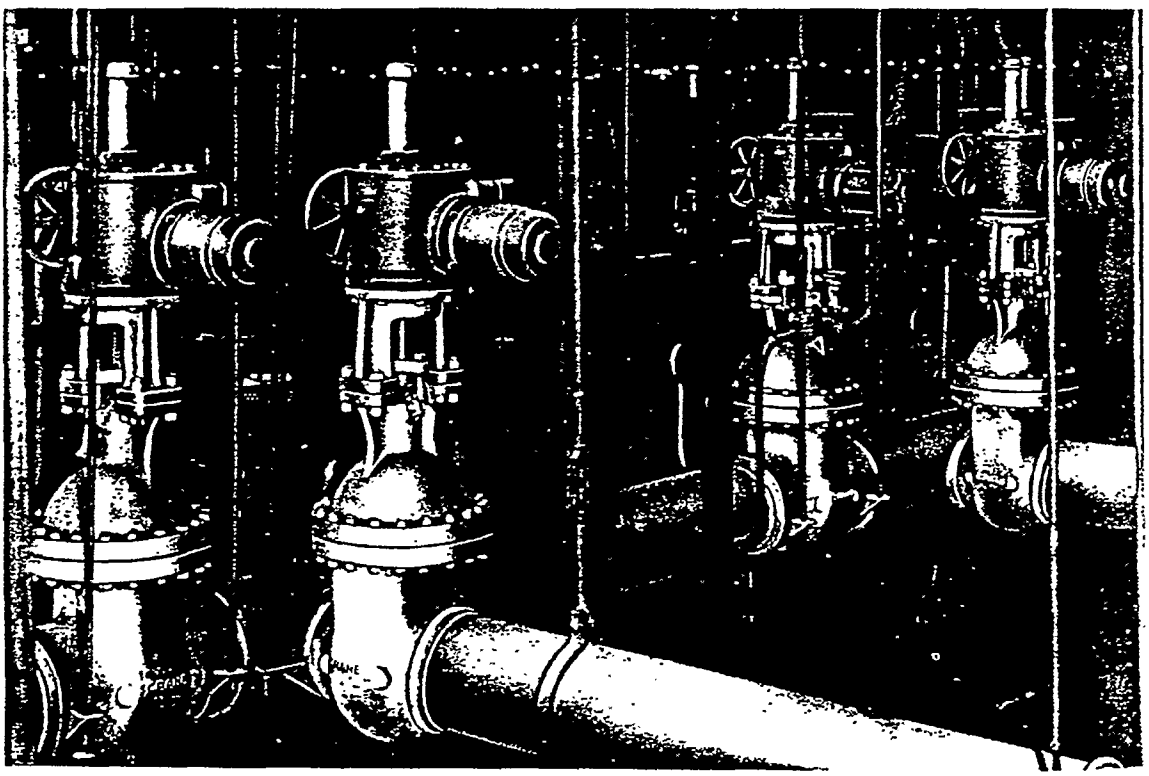
12

003920

- *For dependable plant operation*
- *For reduced maintenance*
- *Use Crane products*



Crane Ferrosteel Body Gate Valves (Section 8) and Air Vent Valves (page 252) on a condenser installation in a municipal electric plant.



Crane Steel Gate Valves (Section 12) in central station service—motorized for easier operation. For a description of Crane cylinder and motor operated valves, see pages 260 to 270.

SECTION 13

Crane Steel Globe and Angle Valves

Bar Stock Valves.....page 136

Forged Steel Valves
600-Pound, Inside Screw.....page 137
600-Pound, Outside Screw and Yoke.....pages 138 and 139
600-Pound, Outside Screw and Yoke, Monel Trimmed.....page 141
6000-Pound Hydraulic (Globe only).....page 150

Valves for Chlorine Service.....pages 140 and 141

Cast Steel Valves
Sizes 2-inch and Smaller
1500-Pound Globe.....page 142

Cast Steel Valves
150, 300, 400, 600, 900, and 1500-Pound
Pressure-Temperature Ratings.....page 143
Service Recommendations.....page 143
Test Pressures and Material Specifications.....page 144
General Description.....pages 145 and 146
Catalog Numbers, Sizes, and Weights.....page 147
Dimensions.....page 148
Gearing.....page 149

2500-Pound Valves, Description and Sizes.....page 149

Crane forged steel valves, and cast steel valves indicated above as being available in sizes 2-inch and smaller, are frequently considered general utility valves and are used in a wide variety of services, often at pressures and temperatures lower than the recommended maximum.

The cast steel valves of the 150 to 2500-pound pressure classes are made in sizes as large as 8-inch; all are similar in design. Globe valves are furnished in each of the American Standard pressure classes. Angle valves are regularly furnished in all classes except the 1500-Pound.

For related data, and for complete description of other Crane steel products, refer to:

Cylinder and motor operation.....pages 260 to 270
Gaskets for steel flanged joints.....page 323
Templates for drilling.....pages 329 to 331
Fabricated piping.....pages 355 to 380

Steel stop-check valves, Pressure-Seal Bonnet.....pages 170 to 173
Steel stop-check valves, bolted bonnet.....pages 219 to 225
Steel sediment separators.....page 254

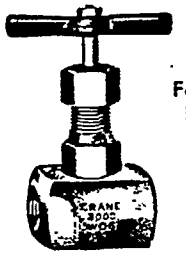
Steel gate valves.....Section 12
Steel check valves.....Section 14
Steel Pressure-Seal and Lip-Seal Bonnet Valves.....Section 15
Packless diaphragm valves.....Section 16
Corrosion-resistant alloy valves.....Section 17
Steel valves for special and extreme services.....Section 21

Steel screwed fittings, unions, and flange unions.....Section 24
Steel welding fittings.....Section 25
Steel flanges.....Section 26

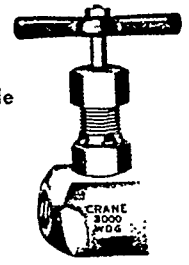
13

High Pressure Bar Stock Valves

Steel and Exelloy

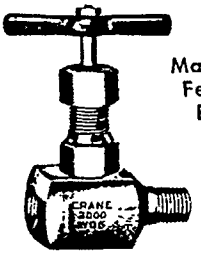


Female Ends



Globe
No. 222 H, Steel
No. 222 X, Exelloy

Angle
No. 223 H, Steel

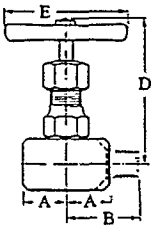


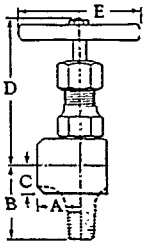
Male and Female Ends



Globe
No. 222½ H, Steel

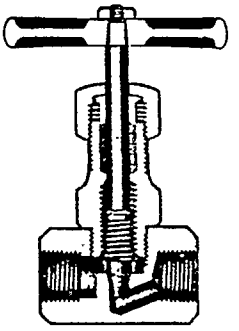
Angle
No. 223½ H, Steel





Working Pressure
3000 psi non-shock
cold water, oil, or gas

Air Tested



Typical cross section shown above is that of a globe valve with female ends.

In valves with male and female ends, the opening in the male end leads to the underside of the disc.

Recommendations: These neat, small, rugged valves find wide application in almost every kind of industry. They are ideal for use on orifice meters, regulator leads, by-passes, gauges, and many other similar services.

The Exelloy valves are particularly suitable for handling oil or gas containing sulphur compounds, or for installations where steel valves do not offer sufficient resistance to atmospheric corrosion.

Steel valves are available in both globe and angle patterns and with female or male and female ends. The Exelloy valves are available in the globe pattern with female ends only.

Construction: The body and bonnet are made from solid bar stock. The thread chambers are extra long. The plug type disc is exceptionally resistant to wear and to foreign matter, and permits accurate flow regulation. The disc is integral with the stem.

The stuffing box is deep, has a gland, and is filled with high grade packing. The valves, when wide open, can be repacked while under pressure.

Materials and identification: Steel valves have a steel body, bonnet, packing nut, and gland, and a chromium-plated steel stem. The valve body is marked "STEEL".

In the Exelloy valves, the foregoing parts are made of Exelloy, a specially heat-treated chromium iron having a chromium content of 11½ to 13½ per cent. The valve body is marked "STEEL-F6".

All of the valves have a malleable iron tee handle.

Weights and Dimensions — Prices on Request

Size	Pounds, Each					Dimensions, in Inches					
	Steel				Exelloy						
Inches	No. 222 H Globe Female Ends	No. 222½ H Globe Male & Female	No. 223 H Angle Female Ends	No. 223½ H Angle Male & Female	No. 222 X Globe Female Ends	A	B	C	D open	E	Diameter of seat opening
⅛	.7		.7	..	...	31/32	..	9/16	3½	29/16	3/16
¼	.7	.7	.7	.7	.7	31/32	1⅝	9/16	3½	29/16	3/16
⅜	1.0	...	1.1	1.2	1.0	13/32	1⅞	11/16	4	29/16	¼
½	1.7	1.8	1.7	1.9	1.7	1¼	2⅛	13/16	4⅞	39/16	5/16
¾	4.0		3.5		..	1⅝	...	1	6⅜	4¾	7/16
1	6.7		6.9		...	2⅛	..	1¼	7⅝	4¾	9/16

For 18-8 SMo Bar Stock Globe Valves, see page 196.

600-Pound Forged Steel Globe and Angle Valves

Inside Screw

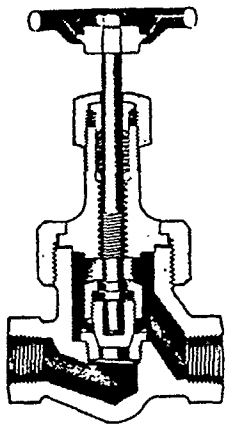
Recommendations: These small, rugged valves with plug type disc and seat are recommended for steam, water, air, gas, oil, oil vapor, and general service at temperatures up to 800 F. They are well used wherever durable, inside screw valves are wanted. The body and bonnet are forged carbon steel conforming to ASTM A 105, Grade II; heavy metal sections assure liberal safety.

Working Pressures
Steam, Water, Air, Gas, Oil, or Oil Vapor

Temp. Deg. Fahr.	Psi Non-Shock	Temp. Deg. Fahr.	Psi Non-Shock
100°	2000	500°	1735
150	1970	550	1640
200	1940	600	1540
250	1915	650	1430
300	1895	700	1305
350	1875	750	1180
400	1850	800	1015
450	1810	...	...

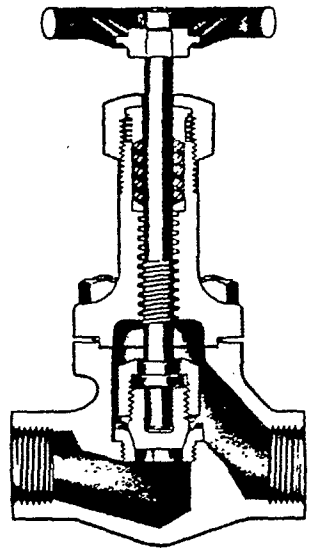
Test Pressures
Shell—**2175** psi hydrostatic
Seat—**2100** psi hydrostatic
Seat tested 100 psi air-under-water

Union Bonnet
Sizes ¼ to ¾-inch



Cross Section, Globe

Bolted Bonnet
Sizes 1 to 2-inch



Cross Section, Globe

Bonnet joints: The bonnet joints are fitted with a corrugated soft iron gasket. The ¼ to ¾-inch valves have a union bonnet, the ring being forged steel. The 1 to 2-inch valves have a compact bolted bonnet of the male and female type equipped with Triplex Steel studs. Both types of joints are strong, yet are easily taken apart and reassembled.

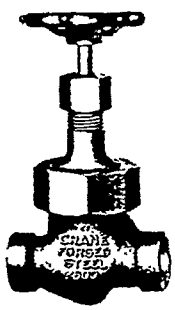
Disc, seat, and stem: The plug type disc and seat are ideal for throttling services. Their wide, carefully finished seating surfaces are unusually resistant to foreign matter and to wiredrawing. The disc is Crane "500 Brinell" Stainless Steel. The body seat ring, screwed into the body, is Exelloy.

The valves feature a swivel disc-stem construction, as illustrated in the cross sections. Clearances are held to a minimum, and the seating load, exerted by the end of the stem on the disc, is much closer to the actual seating surface of the valve.

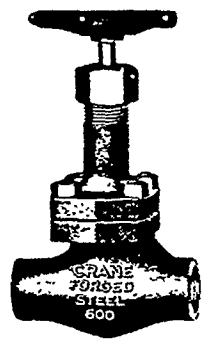
The stem, made of Exelloy, is of generous diameter with long thread engagement in the bonnet. The disc stem ring is locked to the disc by tack welding and will not loosen in service.

Stuffing box; repacking: The stuffing box is exceptionally wide and deep; it is equipped with a gland and filled with cut ring packing. The valves, when wide open, can be repacked while under pressure.

Wheels: Wheels are malleable iron. Sizes 1¼-inch and smaller have a dished design Style A wheel; larger sizes have an oval rim Style D wheel (not illustrated).



No. 3620 XW
Globe, Screwed



No. 3624 XW
Globe, Screwed



No. 3621 XW
Angle, Screwed

Weights and Dimensions — Prices on Request

Type of Bonnet	Size	Pounds, Each			Dimensions, in Inches				
		No. 3620 XW	No. 3621 XW	No. 3624 XW	Globe		Angle		Diameter of wheel
	Inches	Globe	Angle	Globe	End to end	Center to top, open	Center to end	Center to top, open	
Union Bonnet	¼	1.5	1.5	...	2½	4¾	1¼	4¾	2½
	⅜	2.6	2.4	...	3	5 3/16	1½	5 1/16	2½
	½	3.6	3.5	...	3½	6 7/16	1¾	6¼	3
	¾	6.7	6.5	...	4½	7 13/16	2¼	7½	3½
Bolted Bonnet	1	...	...	11.0	5⅛	8¾	...	...	4
	1¼			15.0	6¼	10¾			5
	1½			27.0	7	10 15/16			6
	2			44.0	8⅜	12⅞			7

13

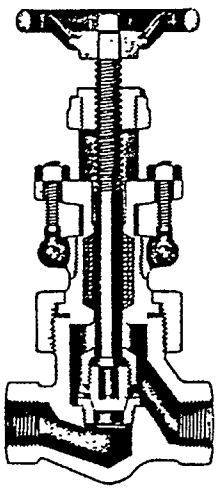
600-Pound Forged Steel Globe and Angle Valves

Outside Screw and Yoke

003924

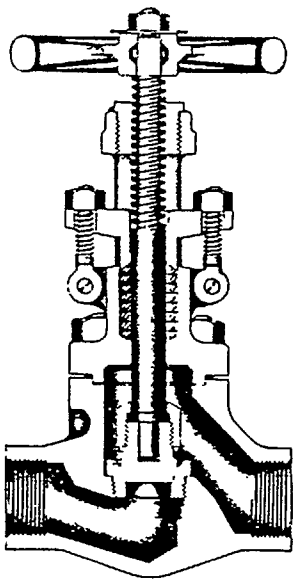
Small, compact union and bolted bonnet valves for steam, water, oil, oil vapor, air, and gas lines

Recommendations: These are compact and rugged valves. Inexpensively priced, yet high in quality, they are ideal for a wide variety of services in oil refineries, oil and gas fields, central power stations, and industrial plants. They offer excellent results on high pressure hydraulic lines and on high-pressure-temperature steam or oil lines.



Union Bonnet Valves

¼ to ¾-inch sizes with screwed ends; ¼ and ⅜-inch sizes with socket-welding ends.



Bolted Bonnet Valves

½ to 2-inch sizes with screwed, socket-welding, or flanged ends.

Sizes, weights, and dimensions are shown on the next page.

For description of materials, see Section 2.

The valves are furnished with Class "XW" trim. They are recommended for steam, water, air, gas, and general service at temperatures up to 850 F and for oil or oil vapor service at temperatures up to 1000 F.

Body, bonnet, and yoke: The body, bonnet, and yoke are made of forged carbon steel conforming to ASTM A 105, Grade II; heavy metal sections assure ample strength. Union bonnet valves have a separate bonnet and yoke joined by long fine threads. On bolted bonnet valves, the bonnet and yoke are forged integral.

Bonnet joint: The bonnet joint is equipped with a corrugated soft iron gasket for tightness and easy maintenance. Union bonnet valves have a forged steel union ring. Bolted bonnet valves have a male and female joint fitted with Triplex steel studs. Both types of joints are unusually strong, yet easy to dismantle and reassemble.

Plug type disc and seat: All valves feature a Crane plug type disc and seat, well known for ability to maintain tightness and for effectiveness on throttling services. The wide, tapered seating surfaces offer excellent resistance to foreign matter and to wiredrawing. The surfaces are carefully ground and then are hand lapped to obtain a fine, mirror-like finish. The body seat ring has heavy sections, with a long thread engagement in the body.

The disc is Crane "500 Brinell" Stainless Steel and the body seat ring is Exelloy. These metals, heat-treated for high hardness, offer excellent resistance to wear, seizure, galling, erosion, oxidation, and corrosion; for details, see page 5.

Stem: The valve stem, made of Exelloy, has precision-cut lifting threads to assure smooth operation.

Disc-stem connection: All valves feature a swivel disc-stem connection which holds all clearances to a minimum and places the seating load closer to the actual seating surface of the valve. The disc stem ring is locked to the disc by tack welding; it will not loosen in service.

Working Pressures

Fluid	Temp. Deg. Fahr.	Psi, Non-Shock: Screwed or Socket-Welding Valves	Psi, Non-Shock: Flanged Valves
Steam, Water, Air, Gas, Oil or Oil Vapor	100°	2000	1440
	150	1970	1420
	200	1940	1400
	250	1915	1380
	300	1895	1365
	350	1875	1350
	400	1850	1330
	450	1810	1305
	500	1735	1250
	550	1640	1180
	600	1540	1110
	650	1430	1030
	700	1305	940
	750	1180	850
	800	1015	730
	850	800	600
Oil or Oil Vapor	875	725	525
	900	600	445
	925	520	375
	950	425	310
	975	330	240
	1000	235	170

Hydrostatic Test Pressures

Valve Ends	Psi: Shell	Psi: Seat
Screwed	2175	2100
Socket-Welding	2175	2100
Flanged	2175	1550

Seat tested 100 psi air-under-water.

Yoke bushing: The long, heavy yoke bushing has liberal stem-thread engagement. Screwed into the yoke and tack welded, it is sturdy and secure.

Bolted gland: The bolted gland eliminates the danger of weakening . . . by threading . . . . the yoke legs. Stainless steel swinging type gland eye bolts, hinged to the bonnet, hold the forged steel one-piece gland and gland flange rigidly in place. The packing load is easily adjusted; the bolts, quickly removed when necessary, will not come off in service.

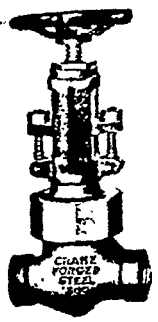
Stuffing box; repacking: The wide, deep stuffing box provides liberal packing space for a tight seal; it is filled with high quality cut ring packing. The valves, when wide open can be repacked while under pressure.

Wheels: Wheels are tough malleable iron. For easier handling, ¼ to 1-inch valves have a dished design wheel with small, rounded gripping knobs

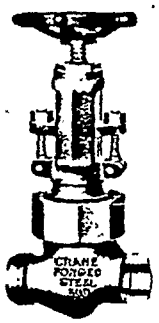
600-Pound Forged Steel Globe and Angle Valves

Outside Screw and Yoke

Union Bonnet Valves



No. 3640 XW
Globe
Screwed

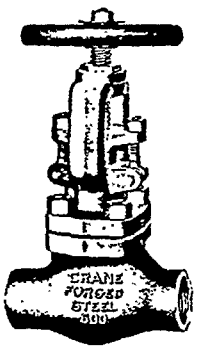


No. 3648 XW
Globe
Socket-Welding

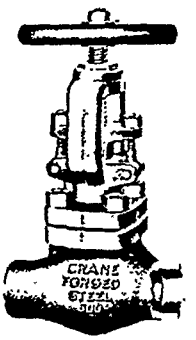
Ratings and details on facing page.

Monel trimmed valves; page 141.

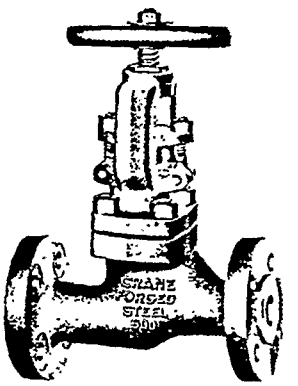
Bolted Bonnet Valves



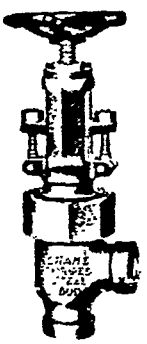
No. 3644 XW
Globe, Screwed



No. 3652 XW
Globe, Socket-Welding



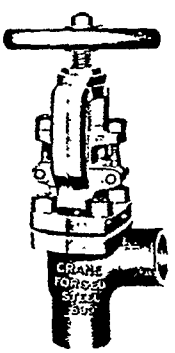
No. 3656 XW
Globe, Flanged



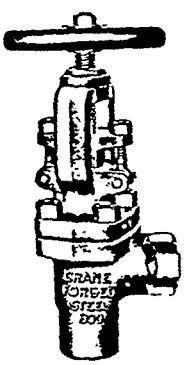
No. 3641 XW
Angle, Screwed

Flanged valves have American Standard B16.10-1957 face-to-face dimensions. End flanges comply with 600-Pound American Standard B16.5-1957 and have a ¼-inch high large male face with a serrated finish; other facings, or valves with 150-pound end flanges can be furnished. Valves are faced, drilled, and spot faced, unless ordered "faced only".

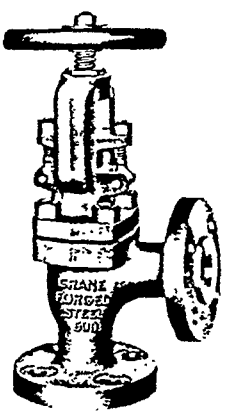
Socket-welding valve ends comply with American Standard B16.11-1946.



No. 3645 XW
Angle, Screwed



No. 3653 XW
Angle, Socket-Welding



No. 3657 XW
Angle, Flanged

Weights and Dimensions — Prices on Request

Type of Bonnet	Size	Pounds, Each						Dimensions, in Inches							Dia. of wheel
		Screwed		Socket-Welding		Flanged FD & SF		Screwed or Socket-Welding				Flanged			
	Inches	Globe Valves	Angle Valves	Globe Valves	Angle Valves	Globe Valves	Angle Valves	Center to end	Center to top, open: Globe	Center to top, open: Angle	Depth of socket	Center to face*	Center to top, open: Globe	Center to top, open: Angle	
		3640 XW	3641 XW	3648 XW	—	—	—								
Union	¼	3.7	3.2	3.5	...	...	...	1½	7⅛	7	7/16	...	...	...	3
	⅜	3.7	3.2	3.5	...	...	...	1½	7⅛	7	9/16	...	...	...	3
	½	4.8	4.6	...	...	...	...	1¾	7 15/16	7⅝	...	...	...	...	3½
	¾	9.0	8.4	...	...	...	...	2¼	9⅝	9⅛	...	...	...	...	4
		3644 XW	3645 XW	3652 XW	3653 XW	3656 XW	3657 XW								
Bolted	½	6.0	5.6	6.0	5.6	11.0	9.6	1 13/16	7⅞	7¼	5/8	3¼	7⅞	7¼	3½
	¾	9.5	8.5	9.5	8.5	17.5	16.0	2 3/16	9⅝	8¾	11/16	3¾	9¾	8¾	4
	1	14.0	11.5	14.0	11.0	22.0	21.0	2 9/16	10	8⅞	¾	4¼	10⅜	9	5
	1¼	20.5	18.0	20.5	18.0	31.5	28.0	3⅛	11½	10	13/16	4½	11¾	10⅛	6
	1½	29.5	25.0	29.5	25.0	42.0	39.0	3½	12¾	10⅞	⅞	4¾	13	11⅛	7
	2	48.0	42.0	48.0	42.0	62.0	57.0	4 3/16	14⅝	12⅝	1	5¾	15¼	12¾	9

*Center to face dimensions include the ¼-inch male face, thickness of flange dimensions (see page 330, do not

Dimensions of end flanges; drilling templates.....page 330
Dimensions of ring joint and special facings....pages 333 to 335

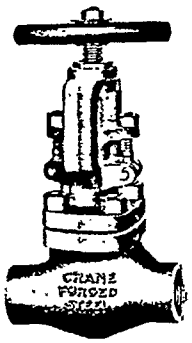
13

Steel Globe and Angle Valves

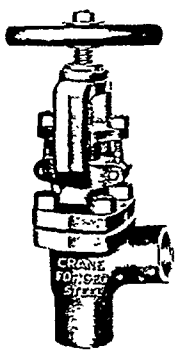
For Chlorine Service

Tight, easy seating valves . . . . with Teflon disc and Teflon packing . . . . for chlorine services at temperatures up to 300 F

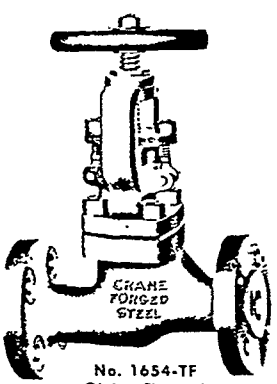
Tested 300 psi air-under-water



No. 1644-TF
Globe, Screwed

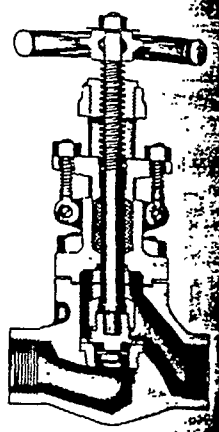


No. 1645-TF
Angle, Screwed

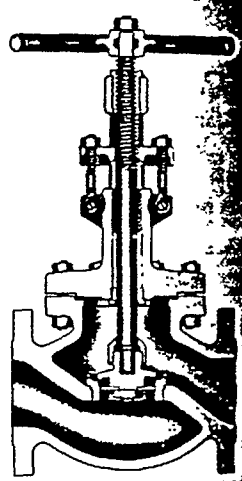


No. 1654-TF
Globe, Flanged

The illustration above of the No. 1654-TF shows typical construction of sizes 2-inch and smaller. For construction of larger sizes, see the bottom sectional view at the right.



Cross section typical of sizes 2-inch and smaller



Cross section typical of sizes 2½-inch and larger

These newly designed globe and angle valves are recommended for use on water-free chlorine gas and liquid service at temperatures up to 300 F. They are ideally suited for the severe service conditions encountered in chlorine manufacturing and processing plants, pulp and paper mills, textile mills, water and sewage plants, etc.

Their Teflon disc seats easily and tightly down and around hard particles, offering superior control over product encrustation on the valve seat, a major problem in chlorine service . . . . and the wide Teflon-to-metal seat bearing assures positive closure.

Materials and construction: The valves are the bolted bonnet, outside screw and yoke type. The body and one-piece bonnet and yoke are carbon forged steel (ASTM A 105, Grade II) in sizes 2-inch and smaller and carbon cast steel (ASTM A 216, Grade WCB) in sizes 2½-inch and larger. All sizes have a rugged male and female body-bonnet joint fitted with a corrugated soft Monel gasket; Triplex steel stud bolts assure a tight joint.

The disc holder, disc stem ring, and stem are Monel. The steel gland and gland flange (one-piece on sizes 2-inch and smaller) are held rigidly in place by steel gland eye bolts; the bolts are easily moved out of the way when servicing of the valve is necessary, yet they will not loosen in service.

Teflon disc and Hastelloy "C" seat: The valves feature a Teflon disc and a Hastelloy "C" body seat ring. The Teflon disc effects a tight seat . . . . with considerably less effort than that required for tight closure of valves having all-metal seating surfaces. The Teflon disc is tough enough to resist tearing, gouging, or scoring from hard particles which tend to accumulate on the seating surfaces in chlorine service, yet is sufficiently resilient to absorb the particles so that tight, positive seating is assured.

Teflon-packed stuffing box: The valves have a wide, deep stuffing box filled with Teflon packing. Teflon packing is highly resistant to abrasion and is unaffected by, and non-contaminating to, chlorine.

Flanged valves: The end flanges of No. 1654 Valves 2-inch and smaller have a ¼-inch male face and conform to the 600-Pound American Steel Flange Standard (B16.5-1957); in sizes 2½-inch and larger, the end flanges have a 1/16-inch raised face and conform to the 300-pound class of the same Standard. Both the ¼-inch male and the 1/16-inch raised faces have a serrated finish.

Flanged valves also conform to the American Standard for Face-to-Face Dimensions of Ferrous Flanged Globe Valves, B16.10-1957 . . . . sizes 2-inch and smaller to the 600-pound steel class, and larger sizes, to the 300-pound class.

Drilling: Flanged valves are regularly furnished faced, drilled, and spot faced to the applicable pressure class of the American Standard; they can be furnished faced only, if specified

For sizes, weights, and dimensions, see the table at the top of the next page.

13

Steel Globe and Angle Valves

For Chlorine Service — cont.

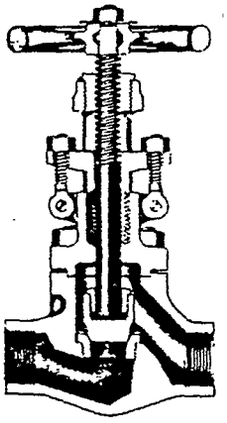
Weights and Dimensions (Inches) — Prices on Request

Size	No. 1644-TF Globe, Screwed			No. 1645-TF Angle, Screwed			No. 1654-TF Globe, Flanged—FD & SF						All Valves
	Weight	Dimensions		Weight	Dimensions		Weight	Dimensions					
		End to end	Center to top, open		Center to end	Center to top, open		Face to face	Center to top, open	End flange diameter	End Flange Thickness*		Diameter of valve wheel
Inches	Pounds Each			Pounds Each			Pounds Each	(*)			1/16" raised face	1/4" male face	
1/2	6.0	3 5/8	7 3/4	5.4	1 13/16	7 1/8	11.0	6 1/2	7 7/8	3 3/4	...	9/16	3 1/2
3/4	9.5	4 3/8	9 1/2	8.5	2 3/16	8 5/8	17.5	7 1/2	9 5/8	4 5/8	...	5/8	4
1	14.0	5 1/8	9 7/8	11.0	2 9/16	8 3/4	22.0	8 1/2	10 3/8	4 7/8	...	11/16	5
1 1/4	20.0	6 1/4	11 3/8	18.0	3 1/8	10	...	...	...	...	...	...	6
1 1/2	29.0	7	12 5/8	25.0	3 1/2	10 7/8	42.0	9 1/2	12 7/8	6 1/8	...	7/8	7
2	48.0	8 3/8	14 5/8	42.0	4 3/16	12 5/8	62.0	11 1/2	15 1/4	6 1/2	...	1	9
2 1/2	...	...	...	...	...	...	90.0	11 1/2	19	7 1/2	1	...	10
3	...	...	...	...	...	...	140.0	12 1/2	19 3/4	8 1/4	1 1/8	...	10
4	...	...	...	...	...	...	215.0	14	24 1/2	10	1 1/4	...	14
6	...	...	...	...	...	...	400.0	17 1/2	30	12 1/2	1 7/16	...	18

**Face to face dimensions include the height of the facings. End flange thicknesses include the 1/16-inch raised face, but not the 1/4-inch male face.*

For 600-pound drilling templates applying to sizes 2-inch and smaller, see page 330. For 300-pound drilling templates applying to sizes 2 1/2-inch and larger, see page 329.

Forged Steel Monel Trimmed Globe Valves



Cross Section, Screwed

Weights — Pounds, Each

Size	No. 3644 A Globe Screwed	No. 3656 A Globe Flanged
Inches		
1/2	6.0	11.0
3/4	9.5	17.5
1	14.0	22.0
1 1/2	29.5	42.0
2	48.0	62.0

Dimensions and tests of the Nos. 3644 A and 3656 A are the same, respectively, as those for the Nos. 3644 XW and 3656 XW valves shown on pages 138 and 139.

Teflon Packed — For Corrosive Services

These rugged valves are patterned after the 600-Pound Forged Steel Globe Valves shown on pages 138 and 139.

Recommendations: No. 3644 A and No. 3656 A Valves are used on refining units in the petroleum industry and for various processes in chemical plants where high quality Monel trimmed steel globe valves are desired.

The valves offer good service in hydrofluoric alkylation units handling anhydrous H.F., and where mixtures of the acids and hydrocarbons are found. They are not recommended for aqueous solutions of hydrofluoric acid where the concentration drops below 80 per cent H.F.

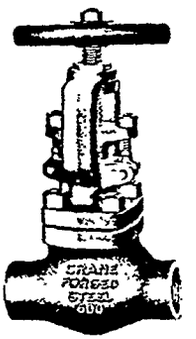
Materials and design: The valve body and one-piece bonnet and yoke are made of carbon forged steel (ASTM A 105, Grade II). The male and female body-bonnet joint is fitted with a soft iron gasket and Triplex steel studs. The valves have a ball-to-35° seat. The disc, body seat ring, stem, and disc stem ring are Monel. Stainless steel swinging eye bolts hold the forged steel one-piece gland and gland flange rigidly in place.

Stuffing box: The wide, deep stuffing box is filled with Teflon packing to provide a tight stem seal, long packing life, and maximum safety.

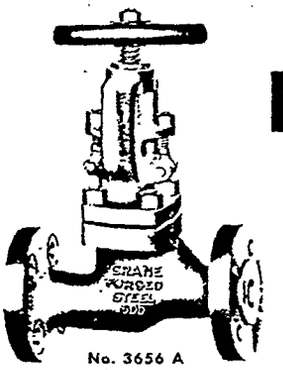
Flanged valves: End flange and face to face dimensions conform, respectively, to the 600-Pound American Standards B16.5-1957 for Steel Pipe Flanges and B16.10-1957 for Face-to-Face Dimensions of Ferrous Globe Valves. End flanges have a 1/4-inch high large male face with a serrated finish; for drilling templates, see page 330.

Flanged valves will be furnished faced, drilled, and spot faced, unless "faced only" is specified.

Monel trimmed steel gate valves....page 120



No. 3644 A
Globe, Screwed

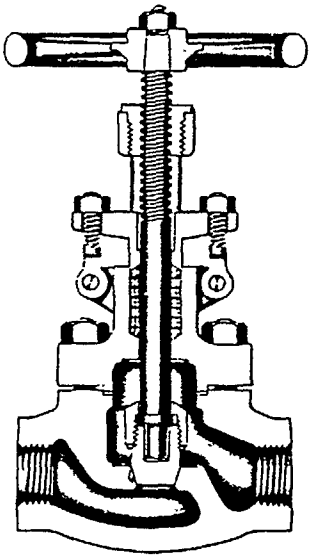


No. 3656 A
Globe, Flanged

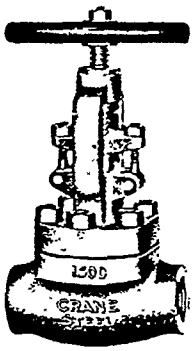
Prices on Request

13

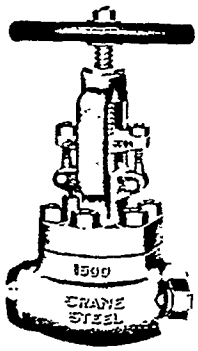
Screwed and Socket-Welding
1500-Pound Cast Steel Globe Valves
Bolted Bonnet—Outside Screw and Yoke



Cross Section, Screwed



No. 3844 U
Globe, Screwed



No. 3852 U
Globe, Socket-Welding

Hydrostatic Test Pressures
Shell—5400 psi Seat—3700 psi

Valve seat is tested 100 psi air-under-water.

These small 1500-pound valves except for heavier, more rugged metal sections are similar to, and feature the same swivel plug disc design as, the 600-pound bolted bonnet valves described on pages 138 and 139.

Recommendations: The valves are ideal for the severe services encountered in oil refineries and modern power plants, on high pressure hydraulic installations, and on high pressure-temperature steam lines.

Equipped with Class "U" trim, the valves are suitable for steam, water, air, gas, oil, oil vapor, and general service at temperatures up to 1000 F.

Materials: The body and yoke bonnet are cast from carbon steel conforming to ASTM A 216, Grade WCB. The male and female body-bonnet joint has a steel gasket to assure tightness and ease of maintenance. Body studs are Triplex steel. The stem is Exelloy, an AISI Type 410 stainless steel. Precision cut stem threads assure smooth operation.

The body has an integral seat. Both the seat and the carbon steel disc are faced with Stellite and offer excellent resistance to wear.

Wheels are made of malleable iron. Sizes ½ and ¾-inch have a Style "A" dished design wheel with round gripping knobs around the outer edge (not illustrated).

Working Pressures
Steam, Water, Oil, Oil Vapor

Temperature Fahr.	Psi Non-Shock	Temperature Fahr.	Psi Non-Shock
100°	3600	650°	2580
150	3550	700	2350
200	3500	750	2125
250	3450	800	1830
300	3415	850	1500
350	3375	875	1305
400	3330	900	1115
450	3255	925	945
500	3125	950	770
550	2955	975	600
600	2770	1000	430

Design features: In addition to their compact, durable construction, the valves have many refinements usually found only in larger size high pressure valves, such as a deep stuffing box and heavy yoke bushing with liberal stem-thread engagement.

The bolted gland avoids threading . . . . and thereby weakening of . . . . the yoke legs. Stainless steel swinging eye bolts hold the steel one-piece gland and gland flange rigidly in place; the bolts will not come off in service. The packing load is easily adjusted.

Repacking: The valves, when wide open, can be repacked while under pressure.

Standard: Socket-welding valves comply with American Standard B16.11-1946 for end dimensions.

Weights and Dimensions — Prices on Request

Size	Pounds, Each		Dimensions, in Inches						
			Screwed		Socket-Welding			All Valves	
Inches	No. 3844 U Screwed Ends	No. 3852 U Socket-Welding	End to end	Center to end	End to end	Center to end	Depth of socket	Center to top, open	Dia. of wheel
½	12.4	12.4	4¼	2⅛	4⅛	2 1/16	⅝	10	4
¾	16.0	16.0	5½	2¾	5⅜	2 11/16	11/16	9⅝	5
1	25.0	25.0	6¼	3⅛	6⅛	3 1/16	¾	11⅛	7
1¼	39.0	39.0	7¼	3⅝	7⅛	3 9/16	13/16	13¼	8
1½	46.0	46.0	7½	3¾	7⅜	3 11/16	⅞	14¼	9
2	88.0	88.0	9½	4¾	9⅜	4 11/16	1	17⅛	14

Description of materials . . . . Section 2

Cast Steel Globe and Angle Valves

Working Pressures

For Valves Described on Pages 144 to 149

Valves with "XR" trim.....for steam up to 850 F.....for water, air, gas, or oil up to 500 F
Valves with "X" trim.....for oil or oil vapor up to 1100 F
Valves with "U" trim.....for steam up to 1200 F.....for oil or oil vapor up to 1200 F

Temp.	Working Pressures—Pounds per Square Inch, Non-Shock For 150-Pound Screwed Valves and 150 to 2500-Pound Flanged or Butt-Welding End Valves												
	Carbon Steel[1] (ASTM A216, Grade WCB)							No. 5 Chromium-Molybdenum Alloy Steel (ASTM A217, Grade C5—made to order)					
Deg. Fahr.	150 Pound	300 Pound	400 Pound	600 Pound	900 Pound	1500 Pound	2500 Pound	300 Pound	400 Pound	600 Pound	900 Pound	1500 Pound	2500 Pound
100°	275	720	960	1440	2160	3600	6000	At temperatures lower than 700 F, ratings for these valves are the same as those shown at the left for the Carbon Steel Valves.					
150	255	710	945	1420	2130	3550	5915						
200	240	700	930	1400	2100	3500	5830						
250	225	690	920	1380	2070	3450	5750						
300	210	680	910	1365	2050	3415	5690						
350	195	675	900	1350	2025	3375	5625						
400	180	665	890	1330	2000	3330	5550						
450	165	650	870	1305	1955	3255	5430						
500	150	625	835	1250	1875	3125	5210						
550	140	590	790	1180	1775	2955	4925						
600	130	555	740	1110	1660	2770	4620						
650	120	515	690	1030	1550	2580	4300						
700	110	470	635	940	1410	2350	3920	485	645	965	1450	2415	4025
750	100	425	575	850	1275	2125	3550	450	600	900	1350	2250	3745
800	92	365	490	730	1100	1830	3050	415	555	835	1250	2080	3470
850	[2]82	[2]300	[2]400	[2]600	[2]900	[2]1500	[2]2500	385	510	765	1150	1915	3190
875	[2]75	[2]260	[2]350	[2]525	[2]785	[2]1305	[2]2180	365	490	735	1100	1830	3055
900	[2]70	[2]225	[2]295	[2]445	[2]670	[2]1115	[2]1855	350	465	700	1050	1750	2915
925	[2]60[3]	[2]190[3]	[2]250[3]	[2]375[3]	[2]565[3]	[2]945[3]	[2]1570[3]	335	445	665	1000	1665	2775
950	[2]55[3]	[2]155[3]	[2]205[3]	[2]310[3]	[2]465[3]	[2]770[3]	[2]1285[3]	315	420	635	950	1585	2640
975	[2]50[3]	[2]120[3]	[2]160[3]	[2]240[3]	[2]360[3]	[2]600[3]	[2]1000[3]	300	400	600	900	1500	2500
1000	[2]40[3]	[2]85[3]	[2]115[3]	[2]170[3]	[2]255[3]	[2]430[3]	[2]715[3]	250	335	500	750	1250	2085
1025	...	...	...	...	...	...	...	215	285	430	645	1070	1785
1050	...	...	...	...	...	...	...	180	240	355	535	890	1485
1075	...	...	...	...	...	...	...	145	195	290	435	730	1215
1100	...	...	...	...	...	...	...	115	150	225	340	565	945
1125[4]	...	...	...	...	...	...	...	95	125	190	285	470	785
1150[4]	...	...	...	...	...	...	...	75	100	150	225	375	630
1175[4]	...	...	...	...	...	...	...	65	85	125	190	315	530
1200[4]	...	...	...	...	...	...	...	50	70	105	155	255	430

[1]Where welded construction is used, consideration should be given to the possibility of graphite formation on Carbon Steel at temperatures above 775 F.

[2]Product used within the jurisdiction of Section 1, Power Boilers of the ASME Boiler and Pressure Vessel Code, is subject to the same maximum temperature limitations placed upon the material in Table P7, 1959 edition thereof.

[3]Product used within the jurisdiction of Section 1, Power Piping of the ASA Code for Pressure Piping, B31.1, is subject to the same maximum temperature limitations placed upon piping of the same general composition in Table 2a, 1955 edition thereof.

[4]Consideration should be given to the possibility of excessive oxidation (scaling) when No. 5 Chromium-Molybdenum Steel is used at temperatures above 1100 F.

Recommendations: Valves with "XR" trim are particularly satisfactory for steam, water, air, gas, and other non-lubricating, relatively non-corrosive fluids such as gasoline, fuel oil, etc.; also for oil of low viscosity such as used in hydraulic systems, especially where seating loads are extremely high. They are recommended for temperatures up to 850 F on steam and up to 500 F on all other services.

Valves with "X" trim should be used for oil or oil vapor at temperatures over 500 F (up to 1100 F) and for most corrosive and unrefined oils regardless of temperature. For lubricating oils up to 500 F, either "X" or "XR" should give equal satisfaction.

Valves with "U" trim are provided primarily for high temperature steam, oil, and oil vapor service or where a premium trim is desired for extremely severe service conditions.

Cold service: Between minus 20 F and plus 100 F, ratings shown in the table for 100 F will apply.

For temperatures below minus 20 F, steels with suitable impact strength must be used; pressure ratings for such steels will be the same as shown for 100 F.

Gaskets: The use of these ratings for flanged valves requires gaskets conforming to requirements set forth in ASA B16.5-1957. The user is responsible for selecting gaskets of dimensions and materials capable of withstanding the required bolt loading without injurious crushing, as well as being suitable for the service conditions in all other respects.

Flange facings: Flanged valves of the 150 and 300-pound pressure classes regularly have 1/16-inch raised faces; those of 400-pound and higher pressure classes have 1/4-inch male faces.

ASA and API Standards: Crane pressure-temperature ratings agree with ratings listed in the American Steel Flange Standard, B16.5-1957, and in the American Petroleum Institute (API) Standard No. 600, Fourth Edition, 1958.

13

Cast Steel Globe and Angle Valves

Crane Cast Steel Globe and Angle Valves are rugged and substantial in construction. Made from carefully selected materials and of improved designs, they possess the necessary qualifications to meet the severe demands of modern installations.

Recognizing the service requirements they must satisfy—accurate control and regulation of flow—extreme care has been exercised in their design, particularly in the case of the disc and seat. For steam and general service, the wide bearing of the plug type disc is exceptionally well suited. Oil services are more efficiently served by a ball-shaped disc contacting a beveled seat in a line bearing.

To avoid the difficulties attending the operation of the larger size or higher pressure valves when used under maximum working pressures, these valves are regularly furnished with gearing. In addition to facilitating operation, the gearing assures accurate regulation of flow.

The valves are available in a wide range of sizes, in 150, 300, 400, 600, 900, 1500, and 2500-pound pressure classes, and with screwed, flanged, or butt-welding ends, as required. Prices of valves of each pressure class, as well as dimensions of the 2500-pound valves, are furnished on request.

Regularly furnished with various kinds of trim as described below, the valves are suitable for a variety of services. They are particularly suited for the severe services so common in modern industrial and power plants, and in oil refineries.

Hydrostatic Test Pressures, in Psi

Pressure Class	Screwed Valves		Flanged and Butt-Welding Valves	
	Shell	Seat	Shell	Seat
150-Pound	425	350	425	350
300-Pound	...	...	1100	775
400-Pound	...	...	1450	1000
600-Pound	...	...	2175	1550
900-Pound	...	...	3250	2250
1500-Pound	...	...	5400	3700

Valve seats are tested 100 psi air-under-water.

For working pressures, see page 143.

Specification of Materials

Valves of all pressure classes are regularly made of Crane Carbon Steel, conforming to ASTM Specification A 216, Grade WCB.

The valves are furnished with a variety of trim materials, as indicated below. Orders should specify both the catalog number and letter suffix; catalog numbers are listed under the valve illustrations on page 146 and also in the weight table on page 147.

When specified, the valves can be made to order of Crane No. 5 Chromium-Molybdenum Alloy Steel (ASTM A 217, Grade C 5), as well as a variety of other alloy steels. Crane cast carbon and alloy steels are described in detail on pages 6 and 7.

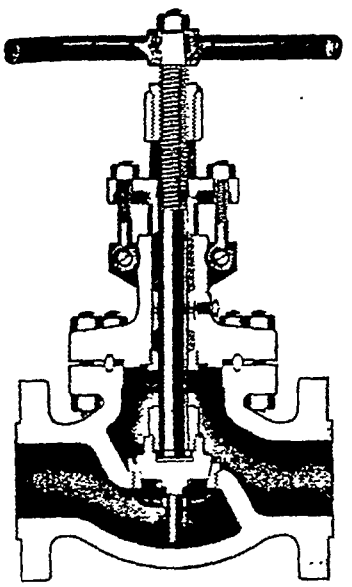
Valves made of Crane No. 5 Alloy Steel are recommended particularly for extremely severe oil or oil vapor services.

Trim	Names of Parts	150 Pound Valves	300 Pound Valves	400 Pound Valves	600 Pound Valves	900 Pound Valves	1500 Pound Valves	2500 Pound Valves
*Class "X" Oil or Oil Vapor	Body and Bonnet	Carbon Steel						
	Disc	Exelloy						‡Exelloy
	Body Seat Ring	Exelloy						
	Stem	Exelloy						
	Bonnet Gasket	Corrugated Soft Iron	Soft Steel Ring Joint Gasket					
	Bonnet Stud Bolts	Triplex Steel (150-pound valves are furnished with studs.)						
*Class "XR" Steam, Water, or Oil	Body and Bonnet	Carbon Steel						2500-pound valves with "XR" trim are not regularly furnished
	Disc	No. 49 Nickel-Alloy						
	Body Seat Ring	Exelloy						
	Stem	Exelloy						
	Bonnet Gasket	Corrugated Soft Iron	Soft Steel Ring Joint Gasket					
	Bonnet Stud Bolts	Triplex Steel (150-pound valves are furnished with studs.)						
*Class "U" Steam, Water, Oil, or Oil Vapor	Body and Bonnet	Not listed	Carbon Steel					
	Disc		Stellite-Faced Carbon Steel					
	Body Seat Ring		Stellite-Faced Carbon Steel					
	Stem		Exelloy					
	Bonnet Gasket		§Soft Iron	Soft Steel Ring Joint Gasket				
	Bonnet Stud Bolts		Triplex Steel					

*For detailed service recommendations, see page 143. ‡Exelloy or Exelloy-Faced Carbon Steel §Corrugated Soft Iron

Additional description....pages 145 to 148
2500-pound valves.....page 149
Sizes and weights....page 147
Dimensions.....page 148
Gearing.....page 149
Description of materials....Section 2

Cast Steel Globe and Angle Valves



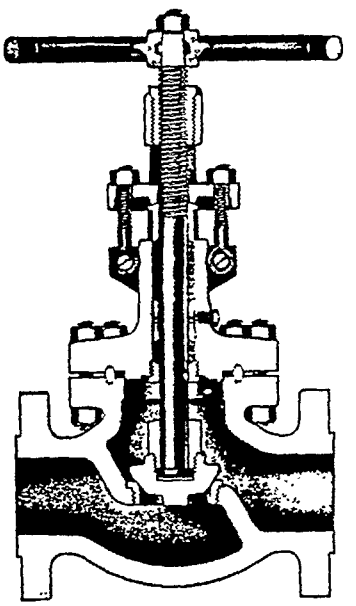
Plug Type Disc

Crane Steel Globe and Angle Valves embody many refinements in design and materials.

Disc and seat: The "XR" trimmed valves (for steam, water, or general service) and "U" trimmed valves (for steam, water, oil, or oil vapor service) in sizes 6-inch and smaller have a plug type disc and seat (illustrated at left); the 8-inch size has a flat disc and seat (not illustrated). The 2-inch valves do not have a disc stem guide.

All sizes of "X" trimmed valves (for oil or oil vapor service) are furnished with a 35° taper seat and a ball shaped seating face on the disc (illustrated at right).

Body seat ring: All valves have the shoulder-type screwed-in body seat ring for utmost tightness and security; in "U" trimmed valves, the rings are also seal brazed or seal welded.



Ball Type Disc

Body and bonnet: The body and bonnet have heavy metal sections with liberal reinforcement at points subjected to greatest stress. The bonnet is fitted with a stem hole bushing.

Bonnet joint: A ring-type bonnet joint holds pressure easily on the 400, 600, 900, 1500, and 2500-pound valves, assuring tightness and maximum strength. On 150 and 300-pound valves, a close-fitting male and female bonnet joint retains the gasket and accurately centers the working parts.

The 300-pound and higher pressure valves have through stud bolts in the bonnet joint. The 150-pound valves employ studs, threaded into the bonnet flange on the body.

Stuffing box: The stuffing box on all valves is deep, assuring tightness and long packing life. The stuffing box is the lantern-type on all except the 150-pound valves. When wide open, the valves can be repacked while under pressure.

Gland: A two-piece ball-type gland and gland flange assure even pressure on the packing without binding on the stem. The gland flange is held in place by swinging eye bolts; the bolts will not loosen in service.

Stem: The stem is of liberal diameter and has unusual strength. Threads are clean and accurately cut and have long engagement with the yoke bushing. The stem and disc are held together by a disc stem ring, which permits the disc to swivel.

Drilling: Flanged valves of each pressure class are furnished with the end flanges faced, drilled, and spot faced (FD & SF) unless otherwise ordered. When orders so specify, flanged valves can be furnished faced only.

Flange facings: The 150 and 300-pound flanged valves are regularly furnished with an American Standard 1/16-inch raised face on the end flanges; the 400, 600, 900, 1500, and 2500-pound flanged valves regularly have a 1/4-inch male face (large male).

When so ordered, valves can be furnished with other types of facings, such as ring joint, female, tongue, groove, etc.; see pages 332 to 335.

Finish of flange faces: The 1/16-inch raised faces of the 150 and 300-pound valves and the 1/4-inch male faces of the 400-pound and higher pressure class valves are regularly furnished with a serrated finish.

A smooth finish can be furnished on the raised or male faces, when specified.

American Standard: In design and materials, Crane Cast Steel Globe and Angle Valves exceed the requirements of Standards issued by the American Standards Association.

The butt-welding valve ends and the dimensions and drilling of end flanges on flanged valves conform to the American Steel Flange Standard, B16.5-1957, for their respective pressure class.

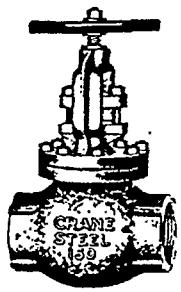
Flanged and butt-welding valves conform to the American Standard for Face-to-Face and End-to-End Dimensions of Ferrous Flanged and Welding End Valves, B16.10-1957, for their respective pressure class. This Standard does not include 3 1/2-inch steel valves.

13

Pressure-temperature ratings....page 143 *Specification of materials.....page 144* *Sizes and weights....page 147*
Service recommendations.....page 143 *Catalog numbers....pages 146 and 147* *Dimensions.....page 148*

Cast Steel Globe and Angle Valves

For ratings, materials, and general description, see pages 143 to 145.



Globe, Screwed
No. 142 X or XR.....150-Pound

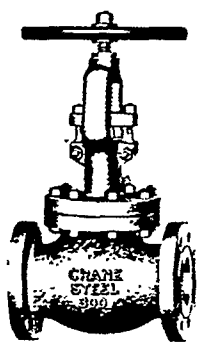
Crane Cast Steel Globe and Angle Valves are regularly furnished in the types and pressure classes listed on this page; for sizes and weights, see the facing page.

"X" suffixed catalog numbers indicate valves suitable for oil or oil vapor service . . . . "XR" suffixed catalog numbers indicate valves suitable for steam, water, oil, and general service . . . . and "U" suffixed catalog numbers indicate valves for steam, water, oil, or oil vapor service.

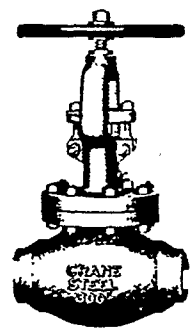
For complete service recommendations and pressure-temperature ratings, see page 143; for specification of materials, see page 144.

Ball-bearing yoke; gearing: In the larger sizes of the 300-pound and higher pressure classes, the valves are regularly equipped with a ball-bearing yoke and either bevel or spur gearing; for sizes so equipped, refer to the right hand column in the table on the facing page.

Gearing is described on page 149; orders must specify whether bevel or spur gears are wanted. Also, if specified, such sizes can be furnished without gears (plain bearing yoke).



Globe, Flanged
No. 143 X, XR.....150-Pound
No. 151 X, XR, or U.....300-Pound
No. 161 X, XR, or U.....400-Pound
No. 171 X, XR, or U.....600-Pound
No. 183 X, XR, or U.....900-Pound
No. 189 X, XR, or U.....1500-Pound



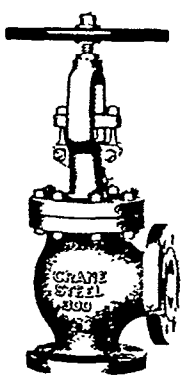
Globe, Butt-Welding
No. 143½ X, XR.....150-Pound
No. 151½ X, XR, or U.....300-Pound
No. 161½...XR, or U.....400-Pound
No. 171½ X, XR, or U.....600-Pound
No. 183½ X, XR, or U.....900-Pound
No. 189½ X, XR, or U....1500-Pound

Drilling: Flanged valves are regularly furnished faced, drilled, and spot faced to the corresponding pressure class of the American Steel Flange Standard, B16.5-1957. They can be furnished faced only, when specified.

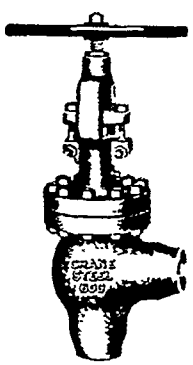
Butt-welding valves: Unless otherwise ordered, 150 and 300-pound butt-welding valves are bored to match the inside diameter of Standard pipe (the heaviest weight on the 8-inch size). For all other pressure classes, orders must specify the diameter of the bore (inside diameter of pipe).

By-pass: The valves can be equipped with a by-pass when specified; information on request.

Motor operation: To facilitate operation, the valves can be equipped with an electric, air, or gas motor; see pages 266 to 270.



Angle, Flanged
No. 145 X, XR.....150-Pound
No. 153 X, XR, or U.....300-Pound
No. 163 X, XR, or U.....400-Pound
No. 173 X, XR, or U.....600-Pound
No. 185 X, XR, or U.....900-Pound



Angle, Butt-Welding
No. 173½ X, XR, or U....600-Pound

When ordering, be sure to specify the catalog number and suffix.

Sizes smaller than listed on the facing page: When 600-pound valves are desired in sizes smaller than listed, use the forged steel valves described on pages 138 and 130.

When 400 and 900-pound flanged and butt-welding globe valves are desired in sizes smaller than listed, use valves of the next higher pressure class.

When 1500-pound screwed and socket-welding globe valves are desired in sizes 2-inch and smaller, use the steel valves shown on page 142.

Ordering: Orders should specify the catalog number and suffix.

For sizes and weights, see the next page; for dimensions, see page 148.

Cast Steel Globe and Angle Valves

Types, Sizes, and Weights — Prices on Request

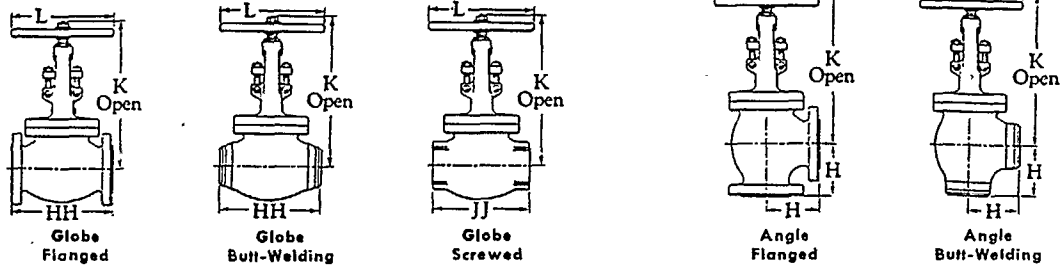
Valve Type	Pressure Class	Valve Ends	Catalog No.	Weights in Pounds, Each For Valve Sizes (Inches) Indicated								Sizes Regularly Furnished with Ball-Bearing Yoke & Gears
				2	2½	3*	3½	4	5	6	8	
Globe	150-Pound	Screwed	142 X	41	...	...	...	...	...	...	...	...
			142 XR	41	...	...	...	...	...	...	...	
		Flanged	143 X	47	64	80	...	140	...	250	420	
			143 XR	47	64	80	100	140	190	250	420	
		Butt-Welding	143½ X	34	...	75	...	120	...	220	...	
			143½ XR	34	53	75	...	120	150	220	395	
	300-Pound	Flanged	151 X	82	90	120*	...	220	...	390	740	8-inch
			151 XR	82	90	120*	170	220	280	390	740	
			151 U	82	90	120*	170	220	280	390	740	
		Butt-Welding	151½ X	62	80	105	...	180	...	350	640	
			151½ XR	62	80	105	...	180	...	350	640	
			151½ U	62	80	105		180	..	350	640	
	400-Pound	Flanged	161 X	Use 600-Pound Valves.				250	350	500	820	6 and 8-inch
			161 XR					250	350	500	820	
			161 U					250	350	500	820	
		Butt-Welding	161½ XR	Use 600-Pound Valves.			...	230	315	510	900	
			161½ U					230	315	510	900	
	600-Pound	Flanged	171 X	90	110	160*	215	320	480	640	...	5 and 6-inch
			171 XR	90	110	160*	215	320	480	640	...	
			171 U	90	110	160*	215	320	480	640	...	
		Butt-Welding	171½ X	78	100	130	...	230	450	560	...	
			171½ XR	78	100	130	...	230	450	560	...	
			171½ U	78	100	130	...	230	450	560	...	
	900-Pound	Flanged	183 X	Use the 1500-Pound Valves listed below.		225	...	390	...	920	...	4 and 6-inch
			183 XR			225	...	390	...	920	...	
			183 U			225	. .	390	.	920	. .	
		Butt-Welding	183½ X			180	...	330	...	650	...	
			183½ XR			180	...	330	...	650	...	
			183½ U			180	.	330	...	650	...	
	1500-Pound	Flanged	189 X	215	320	460	...	. .	...	...	...	3-inch
			189 XR	215	320	460	...	...	...	...	...	
			189 U	215	320	460	...	...	...	...	...	
		Butt-Welding	189½ X	160	265	425	. .	...	...	...	...	
			189½ XR	160	265	425	...	...	. .	...	...	
			189½ U	160	265	425	...	...	...	...	..	
Angle	150-Pound	Flanged	145 X	38	56	70	...	110	...	210	360	...
			145 XR	38	56	70	...	110	160	210	360	
	300-Pound	Flanged	153 X	72	90	120*	...	200	...	370	680	8-inch
			153 XR	72	90	120*	...	200	...	370	680	
			153 U	72	90	120*	150	200	285	370	680	
	400-Pound	Flanged	163 X	...	Use 600-Pound Valves.			235	340	385	685	6 and 8-inch
			163 XR	...				235	340	385	685	
			163 U	.				235	340	385	685	
	600-Pound	Flanged	173 X	. .	120	180*	200	315	500	630	...	5 and 6-inch
			173 XR	.	120	180*	200	315	500	630	...	
			173 U	..	120	180*	200	315	500	630	...	
		Butt-Welding	173½ X	..	110	130	...	170	370	490	...	
			173½ XR	.	110	130	...	170	370	490	...	
			173½ U		110	130	..	170	370	490	...	
	900-Pound	Flanged	185 X	...	...	230	..	370	...	1000	...	4 and 6-inch
			185 XR		..	230	...	370	...	1000	...	
			185 U	.	. .	230	...	370	..	1000	...	

*When 3-inch 300 and 600-pound flanged valves with ring joint facing are to be bolted to Crane lap joints, orders must so specify. A groove of special pitch diameter is required see page 334 for dimensions

General description.....pages 143 to 146
Dimensions.....page 148
Gearing and 2500-pound valves....page 149

13

Cast Steel Globe and Angle Valves



Globe Flanged | Globe Butt-Welding | Globe Screwed | Angle Flanged | Angle Butt-Welding

Dimensions, in Inches

All dimensions shown below apply to valves without gears; dimensions "HH" and "H" apply also to valves with gears. For sizes regularly furnished with gears, see asterisked (*) note at right.

Class	Size	Globe Valves						Angle Valves		All Valves
		Flanged		Butt-Welding		Screwed		Flanged or Butt-Welding†		
		HH	K	HH	K	JJ	K	H	K	L
150 Pound	2	8	13¾	8	13¾	8	13¾	4	12½	8
	2½	8½	14½	8½	14½	...	...	4¼	13	8
	3	9½	16½	9½	16½	...	...	4¾	15	9
	3½	10½	17¼	...	...	...	...	...	...	9
	4	11½	19¾	11½	19¾	...	...	5¾	17¾	10
	5	14	23	14	23	...	...	7	20¾	10
	6	16	24½	16	24½	...	...	8	21¾	12
	8	19½	26	19½	26	...	...	9¾	23½	16
300 Pound	2	10½	17¾	10½	17¾	...	...	5¼	17¾	9
	2½	11½	19	11½	19	...	...	5¾	19	10
	‡3	12½	20½	12½	20½	...	...	6¼	20½	10
	3½	13¼	22½	...	...	...	...	6⅝	22½	12
	4	14	24¾	14	24¾	...	...	7	24¾	14
	5	15¾	26½	...	...	...	...	7⅞	26½	16
	6	17½	29¾	17½	29¾	...	...	8¾	29¾	18
	8	22	36½	22	36½	...	...	11	36½	24
400 Pound	4	16	25¼	16	25¼	...	...	8	25¼	14
	5	18	28½	18	28½	...	...	9	28½	18
	6	19½	31¼	19½	31¼	...	...	9¾	31¼	20
	8	23½	38¼	23½	38¼	...	...	11¾	38¼	27
600 Pound	2	11½	19	11½	19	...	...	...	...	10
	2½	13	21¼	13	21¼	...	...	6½	21¼	12
	‡3	14	23½	14	23½	...	...	7	23½	12
	3½	15	25	...	...	...	...	7½	25	14
	4	17	27½	17	27½	...	...	8½	27½	18
	5	20	30¾	20	30¾	...	...	10	30¾	20
	6	22	35	22	35	...	...	11	35	24
900 Pound	3	15	24	15	24	...	...	7½	24	12
	4	18	29½	18	29½	...	...	9	29½	20
	6	24	37¾	24	37¾	...	...	12	37¾	27
1500 Pound	2	14½	25⅛	14½	25⅛	...	...	...	...	14
	2½	16½	28⅛	16½	28⅛	...	...	...	...	18
	3	18½	33½	18½	33½	...	...	...	...	24

†Angle butt-welding valves are made only in the 600-pound class in sizes 2½, 3, 4, 5, and 6-inch.

‡When 3-inch 300 and 600-pound flanged valves with ring joint facing are to be bolted to Cranelap Joints, orders must so specify, a groove of special pitch diameter is required; see page 334 for dimensions.

Pressure-temperature ratings....page 143
General description.....pages 144 to 147
2500-pound valves.....page 149
Templates for drilling....pages 329 to 331
Special facings.....pages 332 to 335
Taps and drains for valves.....page 403

*Ball-bearing yoke; gearing: Crane Cast Steel Globe and Angle Valves, in the larger sizes of the 300-pound and higher pressure classes, are regularly furnished with a ball-bearing yoke and spur or bevel gears, as follows:

300-Pound.....8-inch
400-Pound.....6 and 8-inch
600-Pound.....5 and 6-inch
900-Pound.....4 and 6-inch
1500-Pound.....3-inch

Orders must state whether spur or bevel gears are wanted; see page 149 for description.

When specified, the above valves can be furnished without gears (plain bearing yoke).

Note: All dimensions apply to valves without gears. Face to face (HH) and center to face (H) dimensions also apply to valves with gears; for additional dimensions of geared valves; see page 149.

Face to face: The 150 and 300-pound flanged valves are regularly furnished with a 1/16-inch raised face; valves of the 400-pound and higher pressure classes have a 1/4-inch high large male face. The face to face (HH) and center to face (H) dimensions include this facing.

Flanged and butt-welding valves conform to the American Standard for Face-to-Face Dimensions of Ferrous Flanged and Welding End Valves, B16.10-1957. This Standard does not include steel valves in the 3½-inch size.

Ordering: When ordering, specify catalog number and suffix; see preceding page

Catalog Nos. and weights page 147

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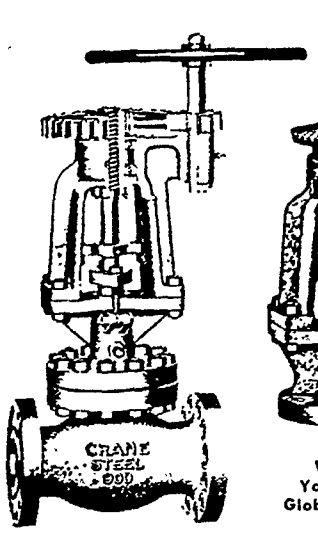
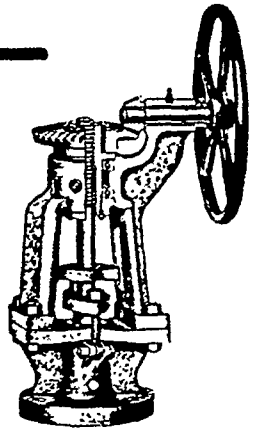
Gearing for Cast Steel Globe and Angle Valves



Spur Gearing With Ball-Bearing Yoke Sleeve for Steel Globe and Angle Valves

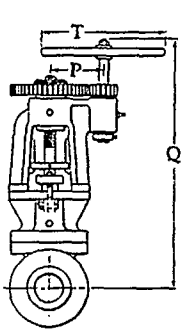
Gearing, bonnet, and yoke are shown turned 90° from position regularly furnished



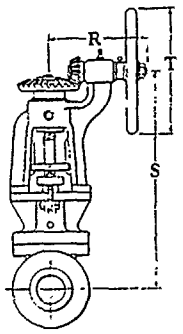
Bevel Gearing With Ball-Bearing Yoke Sleeve for Steel Globe and Angle Valves

Large size or high pressure steel globe and angle valves without gearing would be difficult to open or close when used at the maximum recommended working pressures Such valves, therefore, are regularly equipped with a ball-bearing yoke sleeve and either bevel or spur gearing; for valves so furnished, see table.

In addition to facilitating operation, the gearing provides closer control of flow under the severest service conditions.



Spur Geared



Bevel Geared

Dimensions, in Inches

Valve Class	Size	Spur P	Spur Q	Bevel R	Bevel S	T
300-Pound	8	9⅜	44	15	38	20
400-Pound	6	8⅝	40¼	13¼	34½	18
	8	10¾	48½	17¼	41¾	24
600-Pound	5	8⅝	40½	13¼	34¾	18
	6	9⅜	43¼	15	37¼	20
900-Pound	4	8⅝	39¾	13¼	34	18
	6	10¾	47¼	17¼	40½	24
1500-Pound	3	9⅜	42½	15	36½	20
2500-Pound	On application					

Dimensions not shown are the same as for valves without gears; see page 148

Bevel gearing: Globe and angle valves equipped with bevel gearing will have the pinion shaft extending at right angles to the run of the valve with the handwheel *on the left side* when facing the port opening from above the valve seat.

Spur gearing: Spur gearing will have the pinion shaft, extending upward, parallel to the main valve stem, with the handwheel above the gearing and *on the left side* when facing the port opening from above the valve seat.

Ordering: Orders should specify whether bevel or spur gears are wanted. Orders for gearing placed in positions other than those mentioned above must clearly indicate what is wanted.

2500-Pound Cast Steel Globe and Angle Valves

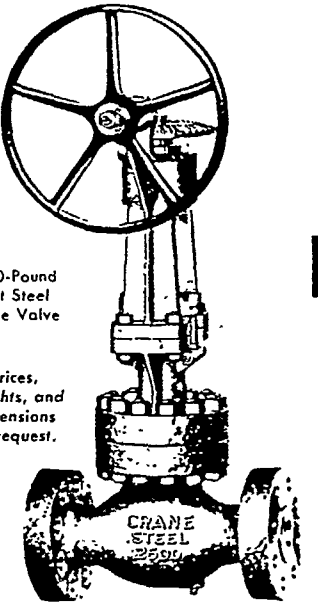
Crane 2500-Pound Cast Steel Globe and Angle Valves are available in the 1½, 2, 2½, 3, 4, 5, and 6-inch sizes, with either flanged or butt-welding ends. In addition, the globe valves are made in the ¾, 1, and 1¼-inch sizes, with either butt or socket-welding ends.

The valves can be furnished with Class "X" trimming for oil and oil vapor or with Class "U" trimming for steam, water, oil, and oil vapor. The "U" trimmed valves have a plug type disc; the "X" trimmed have a 35° taper seat and a ball shaped seating face on the disc.

Globe and angle valves in sizes 3-inch and larger are regularly equipped with a ball-bearing yoke and gearing, to facilitate operation.

Working pressures and service recommendations.....page 143
General description and specifications of materials....pages 144 and 145

For high-pressure, high-temperature steam, boiler feed, and similar service in central stations and industrial plants, Crane Pressure-Seal and Lip-Seal Bonnet Valves are available. They embody many excellent features which contribute to long life and efficient operation. Refer to Section 15.

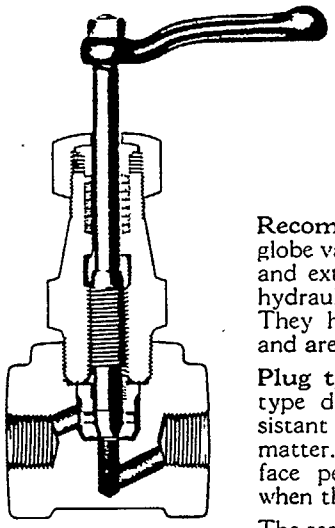


2500-Pound Cast Steel Globe Valve

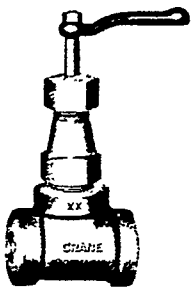
Prices, weights, and dimensions on request.

13

6000-Pound Hydraulic
Forged Steel Globe Valves
Plug Type Disc



Cross Section
Globe



No. 225 H
Globe
Screwed

The 1¼-inch size (not illustrated) has a bolted bonnet and a separate disc and stem.

Working Pressure
6000 psi cold water or oil, non-shock

Test Pressure
6500 psi hydrostatic

Recommendations: These forged steel globe valves are recommended for severe and extremely high pressure service on hydraulic lines not subject to shock. They have very heavy metal sections and are exceptionally rugged.

Plug type disc and seat: The plug type disc and seat are unusually resistant to wiredrawing and to foreign matter. The wide tapered seating surface permits easy regulation of flow when throttling.

The seat bushing is made of Exelloy and can be renewed easily. The disc is made of bronze.

Body and bonnet: The body is a solid forging and is made of steel conforming to requirements of ASTM Specification A 105, Grade II. The bonnet, made of bronze, is screwed into the body on sizes 1-inch and smaller and is bolted to the body on the 1¼-inch size.

Disc-stem connection: Sizes 1-inch and smaller have an integral disc and stem, as illustrated in the cross section at the left; the 1¼-inch size has a separate disc and stem with a swivel type connection.

The stem, in all sizes, is bronze.

Stuffing box: The valve stuffing box is large and deep, is filled with high grade packing, and is equipped with a gland.

Repacking: The valves, when wide open can be repacked while under pressure

Seat opening: The diameter of the port opening in these valves is slightly smaller than the inside diameter of Extra Strong Pipe.

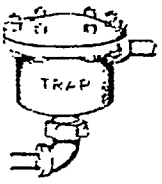
Weights and Dimensions — Prices on Request

	Size	Weight	Dimensions, in Inches			
	Inches	Pounds Each	End to end	Center to end	Center to top, open	Center to end of handle
No. 225 H Globe	¼	3.6	2⅞	1 7/16	6¾	3⅛
	⅜	3.6	2⅞	1 7/16	6¾	3⅛
	½	6.0	3⅝	1 13/16	7⅝	3½
	¾	14.5	5	2½	9¾	4¼
	1	20.0	5¼	2⅝	10¾	5
	1¼	37.0	7	3½	12⅝	5¾

13

Stop Drainage Waste!

When steam lines or steam heated equipment are not fully drained, waste is inevitable. All too frequently accumulation of condensate robs steam of its heat. Excessive heating costs, unsatisfactory operation, and sometimes damaged equipment are the results



Crane Inverted Open Float Steam Traps provide a complete and efficient method of handling condensate from piping, coils, heaters, and steam heated equipment of many kinds. Low in price and simple in design, they give long and trouble-free service. See pages 250 and 251.

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SECTION 14

Crane Steel Check Valves

(Including Pipe-Line Valves)

Forged Steel Lift Check
600-Pound, Union Cap.....pages 152 and 153
600-Pound, Bolted Cap.....pages 152 and 153
6000-Pound Hydraulic.....page 160

Cast Steel Lift and Swing Check
(2-inch and Smaller)
600-Pound Ball Check.....page 153
600-Pound Swing Check.....page 154

Cast Steel Swing Check
(150, 300, 400, 600, 900, and 1500-Pound)
Pressure-Temperature Ratings.....page 156
Specification of Materials.....page 157
Description.....page 158
Sizes, Weights, and Dimensions.....page 159
With Lever and Weight.....page 157
2500-Pound.....page 160

Cast Steel Pipe-Line Swing Check
Class 600.....page 155

Crane forged steel check valves, and cast steel check valves indicated above as being available in sizes 2-inch and smaller, are frequently considered general utility valves. They are used in a wide variety of services, often at pressures and temperatures lower than the recommended maximum.

The cast steel swing check valves of the 150 to 2500-pound pressure classes, in general, are similar in design. The valves are available in each of the American Standard pressure classes; depending on the pressure class, they range in sizes as small as 1¼-inch to sizes as large as 16-inch.

For related data, and for complete description of other Crane steel products, refer to:

Gaskets for steel flanged joints.....page 323
Templates for drilling.....pages 329 to 331
Pipe volume, per lineal foot.....page 354
Fabricated piping.....pages 355 to 380
Proper sizing of check valves.....page 427

Steel stop-check valves, Pressure-Seal Bonnet.....pages 170 to 173
Steel stop-check valves, bolted bonnet.....pages 219 to 225
Steel sediment separators.....page 254

Steel globe and angle valves.....Section 13
Steel Pressure-Seal and Lip-Seal Bonnet Valves.....Section 15
Corrosion-resistant alloy valves.....Section 17
Steel valves for special and extreme services.....Section 21

Steel screwed fittings, unions, and flange unions.....Section 24
Steel welding fittings.....Section 25
Steel flanges.....Section 26

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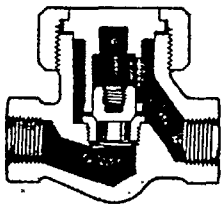
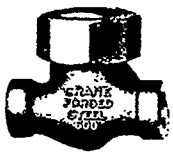
600-Pound Forged Steel Lift Check Valves

Union Cap



Cross section of union cap horizontal lift check valve



No. 3670 X
Screwed

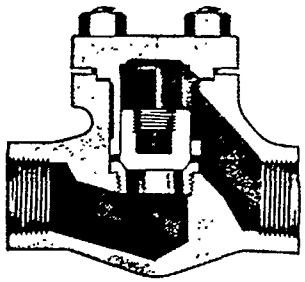
Rugged horizontal lift checks for high pressure-temperature steam and oil lines

Weights — Pounds, Each

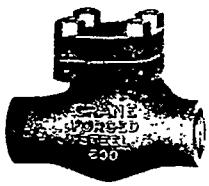
Size	Union Cap	Bolted Cap		
	No. 3670 X	No. 3674 X	No. 3682 X	No. 3686 X
Inches	Screwed	Screwed	Socket-Welding	Flanged FD & SF
¼	2.0	...	...	...
⅜	2.0	...	...	...
½	2.4	3.8	3.8	8.0
¾	5.0	5.7	5.7	13.0
1	...	8.0	8.0	17.0
1¼	...	10.0	10.0	21.0
1½	...	20.5	20.5	33.0
2	...	32.0	32.0	50.0

For dimensions and additional data, see next page.

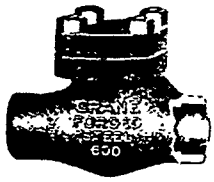
Bolted Cap



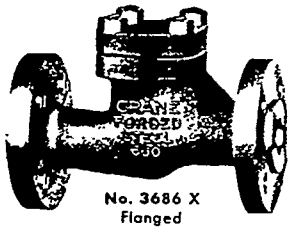
Cross section of bolted cap horizontal lift check valve



No. 3674 X
Screwed



No. 3682 X
Socket-Welding



No. 3686 X
Flanged

Crane 600-Pound Forged Steel Lift Check Valves, described on this and the upper portion of the next page, are made to withstand severe service on high-pressure, high-temperature steam and oil lines.

Rugged and durable, the valves have been carefully designed to assure maximum strength and long life. Their Exelloy seat and disc make them suitable for steam, water, oil, oil vapor, air, gas, and general service at temperatures up to 1000 F.

Body: The valves have a rugged body made of forged carbon steel conforming to requirements of ASTM Specification A 105, Grade II. Unusual compactness and heavy metal sections provide a high margin of safety.

Working Pressures

Steam, Water, Oil, Oil Vapor (Union or Bolted Cap Valves)

Temp.	Psi, Non-Shock	
	Screwed or Socket-Welding	Flanged
Deg. Fahr.		
100°	2000	1440
150	1970	1420
200	1940	1400
250	1915	1380
300	1895	1365
350	1875	1350
400	1850	1330
450	1810	1305
500	1735	1250
550	1640	1180
600	1540	1110
650	1430	1030
700	1305	940
750	1180	850
800	1015	730
850	800	600
875	725	525
900	600	445
925	520	375
950	425	310
975	330	240
1000	235	170

For description of materials, see Section 2.

Cap joint: The cap joint in both the union and bolted cap valves is furnished with a corrugated soft iron gasket; tightness and ease of maintenance are assured.

On union cap valves, a large, strong union ring reinforces the joint. On bolted cap valves, maximum compactness has been obtained through the use of studs instead of through-bolts; the studs are made of Triplex steel and the joint is the male and female type. Cap joints, even on the larger sizes, can be easily dismantled and reassembled.

Disc and seat: Both the disc and seat are made of wear-resisting Exelloy, an ideal material for seating surfaces in check valves. The disc has a ball shaped face which seats against a flat, angular shaped face on the body seat ring, forming what is virtually a line bearing seating contact. The disc operates in a specially designed cap which assures proper guiding and square seating, eliminates chattering, and produces high disc lift with resultant low pressure drop. To facilitate regrinding when necessary, the top of the disc is tapped with pipe threads so that a nipple can be inserted.

The seat ring has long thread engagement with the body; shoulder-seated and screwed in under machine power, the ring will not loosen in service.

Hydrostatic Test Pressures

Valve Ends	Psi	
	Shell	Seat
Screwed	2175	2100
Socket-Welding	2175	2100
Flanged	2175	1550

Valve seat is also tested hydrostatically at 40 psi.

600-Pound Forged Steel Lift Check Valves

(continued from the preceding page)

Flanged valves: Flanged valves conform to the American Standard for Face-to-Face Dimensions (B16.10-1957) of 600-Pound Steel Lift Check Valves.

End flanges conform to the 600-Pound American Steel Flange Standard B16.5-1957. They have a large male face ¼-inch high with a serrated finish (approximately 32 concentric grooves per inch). Flanged valves are regularly furnished faced, drilled, and spot faced; they can be furnished faced only, when specified.

When specified, other types of facings such as ring joint, female, tongue, and groove can be furnished.

Valves with 150-pound end flanges can be furnished on special order.

Socket-welding valves: Dimensions of socket-welding ends comply with American Standard B16.11-1946. The Crane line of steel socket-welding fittings is described in detail on pages 294 to 297.

Dimensions, in Inches — Prices on Request

Size	Union Cap Valve No. 3570 X, Screwed		Bolted Cap Valves									
			No. 3674 X, Screwed No. 3682 X, Socket-Welding			No. 3686 X, Flanged						
	End to end	Center to top	End to end	Center to top	Depth of socket	Face to face *	Center to top	Flange diameter	Flange thickness *	Dia. of male face	Dia. of bolt circle	No. & dia. of bolts
¼	3	2	...	...	...	...	...	...	...	...	...	...
⅜	3	2	...	...	...	...	...	...	...	...	...	...
½	3½	2⅜	3⅝	2½	⅝	6½	2 9/16	3¾	9/16	1⅜	2⅝	4—½
¾	4½	3	4⅜	3 1/16	11/16	7½	3¼	4⅝	⅝	1 11/16	3¼	4—⅝
1	...	...	5⅛	3 11/16	¾	8½	4 1/16	4⅞	11/16	2	3½	4—⅝
1¼	...	...	6¼	4⅛	13/16	9	4 5/16	5¼	13/16	2½	3⅞	4—¾
1½	...	...	7	5⅛	⅞	9½	5⅜	6⅛	⅞	2⅞	4½	4—¾
2	...	...	8⅜	6	1	11½	6 9/16	6½	1	3⅝	5	8—⅝

*The face to face dimensions of flanged valves include the ¼-inch male faces; the flange thicknesses do not.

Templates for drilling.....page 330
Proper sizing of check valves....page 427
600-pound cast steel screwed swing check valves.....page 154
Dimensions of ring joint and special facings...pages 333 and 334

600-Pound Cast Steel Ball Check Valves

Working Pressures
Oil or Oil Vapor

Temp. Deg. Fahr.	Psi Non-Shock
100°	2000
150	1970
200	1940
250	1915
300	1895
350	1875
400	1850
450	1810
500	1735
550	1640
600	1540
650	1430
700	1305
750	1180
800	1015
850	800
875	725
900	600
925	520
950	425
975	330
1000	235

Materials....Section 2

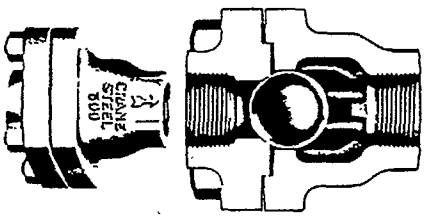
Hydrostatic Test Pressures
Shell—**2175** psi Seat—**2100** psi

Seat is also tested hydrostatically at 40 psi

These compact 600-pound ball check valves are specially designed for oil or oil vapor service at temperatures up to 1000 F.

Design: The two-part body, made of cast carbon steel (ASTM A216, Grade WCB), is held together by Triplex steel studs; the male and female joint is fitted with a corrugated soft iron gasket. The seat is integral with the body. The highly polished ball disc, made of solid Exelloy, is uniform in diameter. Ribs in the outlet half of the body guide the ball.

Installation: The No. 3692 XS preferably should be installed in a horizontal line to reduce pressure drop and to eliminate the possibility of chattering at very low flow. The valve can also be installed in a vertical line with upward flow but, in such service, the valve size should not be larger than the outlet end of the pump connection.



No. 3692 XS
Ball Check, Screwed

(May be used in a vertical position, also)

Weights and Dimensions

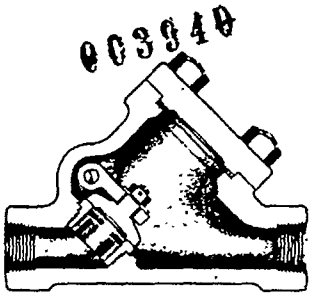
Size Inches	No. 3692 XS Pounds Each	End to end Inches	Over-all width Inches
½	4.0	3⅛	2 15/16 sq
¾	5.0	3 11/16	3⅛ sq.
1	8.0	4⅛	3⅝ sq
1¼	11.0	4⅞	4 1/16 sq.
1½	19.0	5⅝	5⅞ dia
2	29.0	6⅞	6⅝ dia

Prices on Request

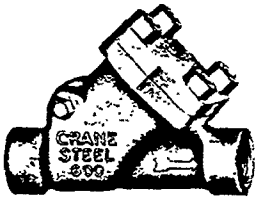
14

600-Pound Cast Steel Swing Check Valves

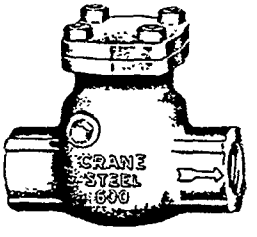
Bolted Cap—Screwed Ends



Cross section showing construction typical of sizes 1-inch and smaller. Larger sizes have a straightway body and the seat face lies at only a slight angle from vertical.



No. 3694 X
Y-Pattern Swing Check
Screwed
(Sizes 1-inch and Smaller)



No. 3694 X
Straightway Swing Check
Screwed
(Sizes 1¼-inch and Larger)

New small size 600-pound screwed end valves . . . with Crane Exelloy seating surfaces and a spiral wound stainless steel gasket . . . for steam, water, oil, and oil vapors

The No. 3694 X are compact, small size bolted cap swing check valves. Made from carefully selected materials, unusually well designed . . . . and featuring an unusually tight body-cap joint equipped with a spiral wound metal gasket . . . . they possess the qualifications required for dependable service in modern piping installations.

The valves have an Exelloy disc and seat. They are recommended for steam, water, oil, and oil vapor services at temperatures up to 1000 F.

Body and cap: The body and cap are made of cast carbon steel conforming to requirements of ASTM Specification A 216, Grade WCB.

Sizes ½, ¾, and 1-inch have a Y-pattern body, as shown in the two upper illustrations at the left. The cap is on the same center line as the seat.

Sizes 1¼, 1½, and 2-inch have a straightway body, as shown in the lower illustration at the left. The seat face is at a slight angle from vertical so as to permit full flow.

Body-cap joint: All sizes have a male and female body-cap joint equipped with Triplex Steel studs for maximum security. Easy maintenance and a tight joint is assured through the use of a spiral wound gasket made of AISI Type 316 stainless steel with asbestos filler.

When necessary, cap joints are easily dismantled and reassembled.

Disc and seat: Both the disc and seat are made of wear-resistant Crane Exelloy, a high grade, heat-treated chromium steel unusually well suited for use in check valves.

Working Pressures
Steam, Water, Air, Gas, Oil, Oil Vapor

Temp. Deg. Fahr.	Psi Non-Shock	Temp. Deg. Fahr.	Psi Non-Shock
100°	2000	650°	1430
150	1970	700	1305
200	1940	750	1180
250	1915	800	1015
300	1895	850	800
350	1875	875	725
400	1850	900	600
450	1810	925	520
500	1735	950	425
550	1640	975	330
600	1540	1000	235

Hydrostatic Test Pressures
Shell—2175 psi Seat—2100 psi

Valve seat is also tested hydrostatically at 40 psi.

The disc is suspended from the hinge; sufficient clearance is allowed between the disc spud and the bore of the hinge so that the disc can rotate freely, thus assuring proper seating.

The shoulder-type seat ring, screwed into the body, provides an ideal seating surface.

Hinge and hinge pin: The valves have the hinge suspended in the body. Easy access to both ends of the hinge pin is provided by a tapped and plugged opening in each of the two bosses on the body.

Both the hinge and the hinge pin are stainless steel.

A complete line: Crane's line of small size 600-pound steel check valves is unusually complete.

For forged steel union cap valves with screwed ends, or bolted cap valves with screwed, socket-welding and flanged ends, see pages 152 and 153.

For cast steel ball check valves see page 153.

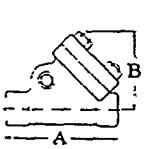
For cast steel swing check valves with flanged and butt-welding ends in sizes as small as 1¼-inch, see pages 158 and 159.

Weights and Dimensions

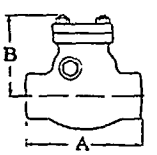
Size Inches	No. 3694 X Pounds Each	Dimensions, in Inches A	B
½	4.5	4⅝	3⅜
¾	8.0	6	4
1	12.0	7	4½
1¼	30.0	7½	5½
1½	40.0	8½	6¼
2	50.0	9½	6¼

Prices on Request

Description of materials.....Section 2
Proper sizing.....page 427



Sizes 1-inch and smaller

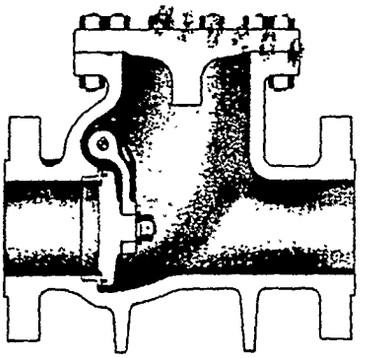


Sizes 1¼-inch and larger

Class 600 Cast Steel Pipe-Line Swing Check Valves

(Patent Pending)

Designed for crude oil, gas, or finished products . . . . Clearway shallow-cavity body for straight-line flow . . . . Stellite-faced seat ring and rubber-seated disc for "soft" tight seating



Cross Section, Flanged

These valves are recommended for all petroleum pipe-line services. They are a companion line to the Steel Pipe-Line Gate Valves shown on pages 131 to 133.

Materials: The body, cap, hinge, and disc are Crane Carbon Steel conforming to ASTM A 216, Grade WCB. The disc has a synthetic rubber insert in the seating face. The body seat ring is steel, Stellite faced.

Design: The smooth, shallow-cavity body provides virtually straight-line flow, assures liberal clearance around the disc, and permits easy passage of a scraper. Triplex Steel stud bolts, combined with a synthetic rubber O-ring gasket compressed within a groove in the face of the body flange, insure a rugged, tight, body-cap connection.

The shoulder-type, screwed-in body seat ring and rubber seated disc provide "soft" tight seating on backflow. The disc swings entirely clear of the fluid-way; a disc stop prevents it from sticking in the open position.

Hinge assembly: The hinge is keyed to a stainless steel hinge pin which rides in two Teflon sleeve bushings. Each bushing runs the full length of a screwed retaining plug at each side of the body wall. Rubber O-rings provide a seal between the plugs and body; Teflon spacer washers are used between the plugs and hinge. The bushings, easily replaced when necessary, absorb normal wear in the assembly.

Working Pressure	Hydrostatic Test Pressure	
Cold Oil or Gas	Shell	Seat
1440 psi	2175 psi	1550 psi

Valve seat is also hydrostatically tested at 40 psi.

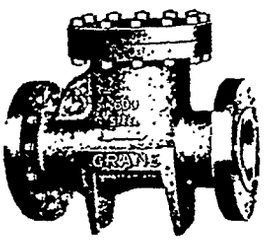
Standards: End flanges, and ends of butt-welding valves, comply with American Standard, B16.5-1957, for swing check valves of the 600-pound class.

The valves, in sizes included therein, also comply with the American Standard for Face-to-Face and End-to-End Dimensions of Ferrous Flanged and Welding End Valves, B16.10-1957, and to the American Petroleum Institute (API) Standard for Class 600 Steel Valves for Pipeline Service, No. 6-D, Ninth Edition (1960).

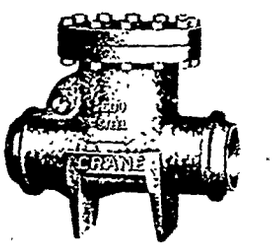
Flanged valves: End flanges have a ¼-inch large male face finished with about 32 concentric grooves per inch (serrated finish); a smooth finish, or special facings such as ring joint, female, tongue, groove, etc., can be furnished when specified.

Flanged valves are regularly faced and drilled to the 600-Pound American Standard, and are spot faced. Faced only valves can be furnished if specified.

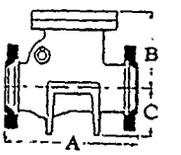
Butt-welding valves: Ends are bored to match the inside diameter of the pipe to be used. Orders must specify the diameter of the bore (I.D. of pipe).



No. 1640, Flanged



No. 1641, Butt-Welding



Flanged or Butt-Welding

Dimensions in Inches — Prices on Request

Size	Pounds, Each		Dimensions, in Inches								
						End Flanges					Dia. of ports
Inches	No. 1640 Flanged FD & SF	No. 1641 Butt-Welding	A (*)	B	C	Diameter	Thickness (*)	Male face dia.	Bolt circle dia	No. & dia. of bolts	
4	Weights furnished on request		17	10½	5⅝	10¾	1½	6 3/16	8½	8-⅞	4 1/16
6			22	13¾	7¾	14	1⅞	8½	11½	12-1	6 1/16
8			26	16¾	9	16½	2 3/16	10⅝	13¾	12-1⅛	8 1/16
10			31	19½	10¾	20	2½	12¾	17	16-1¼	10
12			33	22	12	22	2⅝	15	19¼	16-1¼	12
14			35	24¾	12⅞	23¾	2¾	16¼	20¾	20-1⅜	13¼
16			39	27½	14½	27	3	18½	23¾	20-1½	15¼
18			43	30⅞	15⅝	29¼	3¼	21	25¾	24-1⅝	17
20			47	33⅛	16½	32	3½	23	28½	24-1⅝	19
24			55	38¾	19	37	4	27¼	33	24-1⅞	23

Installation: Two ribs at the bottom of the body provide a base for supporting the valve on a foundation. An arrow cast on the side of the body indicates the correct direction of flow.

*Dimension A includes the ¼-inch male faces on flanged valves; the flange thickness does not

Drilling templates . . . . . page 330
Special facings . . . . pages 333 and 334
Proper sizing of checks . . . . . page 427
Cast steel pipe-line gate valves . . . pages 131 to 133
Wrought steel pipe data . . . . . pages 346 and 347
Volume per lineal foot of pipe . . . . . page 354

14

Cast Steel Swing Check Valves

Working Pressures

For Valves Described on Pages 157 to 160

Temp. Deg. Fahr.	Working Pressures—Pounds per Square Inch, Non-Shock For 150 and 300-Pound Screwed Valves and 150 to 2500-Pound Flanged or Butt-Welding End Valves												
	Carbon Steel[1] (ASTM A216, Grade WCB)							No. 5 Chromium-Molybdenum Alloy Steel (ASTM A217, Grade C5—made to order only)					
	150 Pound	300 Pound	400 Pound	600 Pound	900 Pound	1500 Pound	2500 Pound	300 Pound	400 Pound	600 Pound	900 Pound	1500 Pound	2500 Pound
100°	275	720	960	1440	2160	3600	6000	At temperatures lower than 700 F, ratings for these valves are the same as those shown at the left for the Carbon Steel Valves.					
150	255	710	945	1420	2130	3550	5915						
200	240	700	930	1400	2100	3500	5830						
250	225	690	920	1380	2070	3450	5750						
300	210	680	910	1365	2050	3415	5690						
350	195	675	900	1350	2025	3375	5625						
400	180	665	890	1330	2000	3330	5550						
450	165	650	870	1305	1955	3255	5430						
500	150	625	835	1250	1875	3125	5210						
550	140	590	790	1180	1775	2955	4925						
600	130	555	740	1110	1660	2770	4620						
650	120	515	690	1030	1550	2580	4300						
700	110	470	635	940	1410	2350	3920	485	645	965	1450	2415	4025
750	100	425	575	850	1275	2125	3550	450	600	900	1350	2250	3745
800	92	365	490	730	1100	1830	3050	415	555	835	1250	2080	3470
850	[2]82	[2]300	[2]400	[2]600	[2]900	[2]1500	[2]2500	385	510	765	1150	1915	3190
875	[2]75	[2]260	[2]350	[2]525	[2]785	[2]1305	[2]2180	365	490	735	1100	1830	3055
900	[2]70	[2]225	[2]295	[2]445	[2]670	[2]1115	[2]1855	350	465	700	1050	1750	2915
925	[2]60[3]	[2]190[3]	[2]250[3]	[2]375[3]	[2]565[3]	[2]945[3]	[2]1570[3]	335	445	665	1000	1665	2775
950	[2]55[3]	[2]155[3]	[2]205[3]	[2]310[3]	[2]465[3]	[2]770[3]	[2]1285[3]	315	420	635	950	1585	2640
975	[2]50[3]	[2]120[3]	[2]160[3]	[2]240[3]	[2]360[3]	[2]600[3]	[2]1000[3]	300	400	600	900	1500	2500
1000	[2]40[3]	[2]85[3]	[2]115[3]	[2]170[3]	[2]255[3]	[2]430[3]	[2]715[3]	250	335	500	750	1250	2085
1025	...	...	...	...	...	...	...	215	285	430	645	1070	1785
1050	...	...	...	...	...	...	...	180	240	355	535	890	1485
1075	...	...	...	...	...	...	...	145	195	290	435	730	1215
1100	...	...	...	...	...	...	...	115	150	225	340	565	945
*1125[4]	...	...	...	...	...	...	...	95	125	190	285	470	785
*1150[4]	...	...	...	...	...	...	...	75	100	150	225	375	630
*1175[4]	...	...	...	...	...	...	...	65	85	125	190	315	530
*1200[4]	...	...	...	...	...	...	...	50	70	105	155	255	430

[1]Where welded construction is used, consideration should be given to the possibility of graphite formation on Carbon Steel at temperatures above 775 F.

[2]Product used within the jurisdiction of Section 1, Power Boilers of the ASME Boiler and Pressure Vessel Code, is subject to the same maximum temperature limitations placed upon the material in Table P7, 1959 edition thereof.

[3]Product used within the jurisdiction of Section 1, Power Piping of the ASA Code for Pressure Piping, B31.1, is subject to the same maximum temperature limitations placed upon piping of the same general composition in Table 2a, 1955 edition thereof.

[4]Consideration should be given to the possibility of excessive oxidation (scaling) when No. 5 Chromium-Molybdenum Steel is used at temperatures above 1100 F.

Recommendations: The seating surfaces of swing check valves are subject to different operating conditions than those in gate, globe, or angle valves. The contact area is wide and flat and, since the disc swings and swivels freely, there is no tendency to gall or score.

Crane Cast Steel Swing Check Valves are regularly made with only one trim . . . . "X" (Exelloy to Exelloy) . . . . which is suitable for steam, oil, oil vapor, and general service at temperatures up to 1100 F. The valves can be used in any installation where the fluid handled requires "X", "XR", "XW", "XU", or "U" trimmed steel gate, globe or angle valves.

*Over 1100 F, ratings in the table apply only if valves have a special trim; data on request.

Cold service: Between minus 20 F and plus 100 F, ratings shown in the table for 100 F will apply

For temperatures below minus 20 F, steels with suitable impact strength must be used; pressure ratings for such steels will be the same as shown for 100 F.

Gaskets: The use of these ratings for flanged valves requires gaskets conforming to requirements set forth in ASA B16.5-1957. The user is responsible for selecting gaskets of dimensions and materials capable of withstanding the required bolt loading without injurious crushing, as well as being suitable for the service conditions in all other respects.

Flange facings: Flanged valves of the 150 and 300-pound pressure classes regularly have 1/16-inch raised faces; those of 400-pound and higher pressure classes have 1/4-inch male faces.

ASA and API Standards: Crane pressure-temperature ratings agree with ratings listed in the American Steel Flange Standard, B16.5-1957, and in the American Petroleum Institute (API) Standard No 600, Fourth Edition, 1958.

Lever and weight: For services in which the disc must be more sensitive to flow reversal or must be balanced for low velocities, valves with an outside lever and weight can be furnished, refer to page 157.

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Cast Steel Swing Check Valves

Crane Cast Steel Swing Check Valves, described on pages 156 to 160, are unusually strong and rugged in construction.

Low working stresses, secured through the careful distribution of metal and by the use of heavy metal sections, assure a maximum of safety over the recommended pressures and temperatures.

Hydrostatic Test Pressures, in Psi

Pressure Class	Screwed Valves		Flanged and Butt-Welding Valves	
	Shell	Seat	Shell	Seat
150-Pound	425	350	425	350
300-Pound	1100	775	1100	775
400-Pound	...	...	1450	1000
600-Pound	...	...	2175	1550
900-Pound	...	...	3250	2250
1500-Pound	...	...	5400	3700

Valve seats are also hydrostatically tested at 40 psi.

For working pressures, see page 156.

The line is complete and includes valves in a wide range of sizes, in seven pressure classes (150, 300, 400, 600, 900, 1500, and 2500-pound), and with flanged, screwed, or butt-welding ends, as required. Weights and dimensions for 2500-pound valves are furnished on request; for description, see page 160.

Swing check valves are used to prevent the reversal of flow in horizontal or vertical pipe lines. In vertical lines, or for any angle from horizontal to vertical, they should be used for upward flow only.

The valves are well suited for severe services such as are found in modern industrial and power plants, long distance pipe lines, and in oil refineries.

Specification of Materials

All valves are regularly made of Crane Carbon Steel conforming to requirements of ASTM Specification A 216, Grade WCB.

The valves are furnished with "X" trim; for complete specifications, see the table below.

For extremely severe oil or oil vapor service, valves can be made to order of Crane No. 5 Chromium-Molybdenum Steel (ASTM A 217, Grade C5; valves made of other alloy steels can also be made to order.

Orders for these valves should specify the catalog number and suffix. Refer to page 158.

Trim	Names of Parts	150 Pound Valves	300 Pound Valves	400 Pound Valves	600 Pound Valves	900 Pound Valves	1500 Pound Valves	2500 Pound Valves
†Class "X" Steam, Water, Oil, Oil Vapor	Body and Cap	Carbon Steel						
	Disc 8" and smaller	Exelloy			Exelloy			
	Disc 10" and larger	Exelloy-Faced Carbon Steel						
	Body Seat Ring	Exelloy						
	Hinge	Alloy Steel						
	Cap Gasket	Corrugated Soft Iron		Soft Steel Ring Joint Gasket				
	‡Cap Stud Bolts	Triplex						

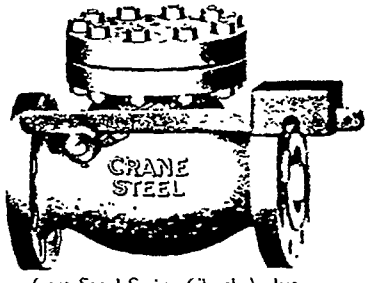
For detailed service recommendations, see page 156. ‡150-pound valves use Triplex Steel cap studs

Catalog numbers....page 158 *Weights and dimensions....page 159* *Description of materials....Section 2*

Valves with Outside Lever and Weight

When so ordered, Crane Cast Steel Swing Check Valves can be furnished with an outside lever and an adjustable weight. Orders must specify whether the weight is to balance the disc or to assist it in closing. Unless otherwise ordered, the lever and weight are mounted on the right hand side of the valve when facing the inlet. Prices are furnished on application.

With the lever and weight mounted so that the weight assists the disc in closing, the valves close the instant the flow stops. Valves so fitted are especially recommended for liquid lines where a sudden reversal of flow may gather considerable momentum before an ordinary valve disc would close, resulting in dangerous or damaging shock. By closing instantly and preventing reversal of flow, they eliminate shock.



Cast Steel Swing Check Valve With Outside Lever and Weight

With the lever and weight mounted so that the weight balances the weight of the disc, the valve becomes more sensitive to low inlet velocities.

The floating or feathering action of the disc causes the valve to open with a minimum of pressure, and resistance to flow past the disc is minimized.

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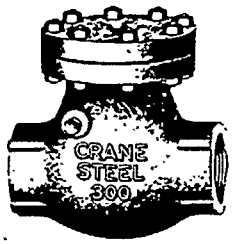
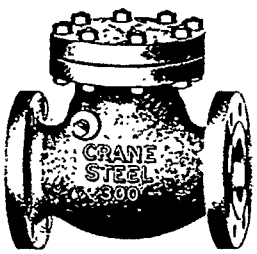
Cast Steel Swing Check Valves



Screwed

For Oil, Oil Vapor, Steam, or Water

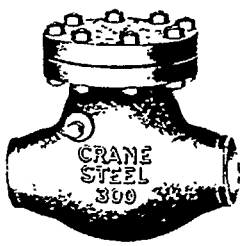
No. 148 X, 150-Pound
No. 158 X, 300-Pound



Flanged

For Oil, Oil Vapor, Steam, or Water

No. 147 X, 150-Pound
No. 159 X, 300-Pound
No. 169 X, 400-Pound
No. 175 X, 600-Pound
No. 187 X, 900-Pound
No. 199 X, 1500-Pound



Butt-Welding

For Oil, Oil Vapor, Steam, or Water

No. 147½ X, 150-Pound
No. 159½ X, 300-Pound
No. 169½ X, 400-Pound
No. 175½ X, 600-Pound
No. 187½ X, 900-Pound
No. 199½ X, 1500-Pound

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Ratings . . . . page 156

For small size 600-pound cast steel swing check valves with screwed ends, see page 154.

A rugged line . . . designed for severe service on oil, oil vapor, steam, and water lines.

Crane Cast Steel Swing Check Valves, described on these facing pages, embody the many refinements in design and materials necessary to withstand severe service.

For working pressures, test pressures, service recommendations, and specification of materials, see pages 156 and 157. For weights and dimensions, see the facing page.

Materials: These valves, in all pressure classes, are regularly furnished with a body and cap made of Crane Carbon Steel conforming to requirements of ASTM A 216, Grade WCB.

Seating materials are Exelloy to Exelloy (Class "X" trim), suitable for steam, water, oil, oil vapor, air, or gas.

Design: On flanged and butt-welding valves the full port area is maintained without pockets, from the inlet port to the valve seat, to avoid turbulence. On the outlet side of the valve seat, the body is of generous proportions, allowing full swing of the disc and minimizing erosion and flow resistance.

Body seat ring: A shoulder-type screwed-in body seat ring provides maximum tightness and security.

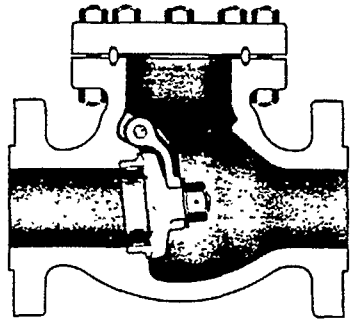
Cap joint: Valves of the 150 and 300-pound pressure classes have a male and female type cap joint.

Valves of the 400, 600, 900, 1500, and 2500-pound pressure classes have a ring type cap joint.

Crane Triplex Steel studs and stud bolts assure an unusually strong and tight joint. The 150-pound valves are equipped with studs; all other valves have through stud bolts.

Flange facings: The 150 and 300-pound flanged valves are regularly furnished with an American Standard 1/16-inch raised face on the end flanges.

The 400, 600, 900, 1500, and 2500-pound flanged valves are regularly furnished with a 1/4-inch male face (large male).



Cross Section of Cast Steel Swing Check Valve

Note: The 150-pound valves in sizes 14 and 16-inch (not Illustrated) have a bottom seated body seat ring . . . . and the complete disc, hinge, and hinge pin assembly is suspended from a hinge bracket; the bracket is securely fastened to a pad which is cast integral with the body.

When so ordered, flanged valves can be furnished with other types of facings, such as ring joint, female, tongue, groove, etc.

Finish of flange faces: The 1/16-inch raised faces and the 1/4-inch male faces are regularly furnished with a serrated finish.

A smooth finish can be furnished on raised or male faces, when specified.

Standards: In design and materials, Crane Cast Steel Swing Check Valves exceed the requirements of Standards issued by the American Standards Association and the American Petroleum Institute.

The end flanges on flanged valves as well as the dimensions of butt-welding valve ends conform to the American Steel Standard, B16.5-1957, for their respective pressure class.

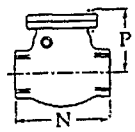
Flanged and butt-welding valves of all classes, in sizes 12-inch and smaller, conform to the American Standard for Face-to-Face and End-to-End Dimensions of Ferrous Flanged and Welding End Valves, B16.10-1957, for their respective pressure class. This Standard does not include 3½-inch steel valves.

Flanged and butt-welding valves of all classes conform also to the API Standard for Pipe Line Valves, No, 6-D. Ninth Edition, April, 1960. This Standard does not include a 3½ or 5-inch size.

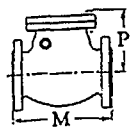
Prices: Prices of all valves are furnished on request.

For additional description, weights, and dimensions, see the facing page.

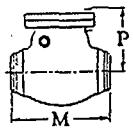
Cast Steel Swing Check Valves



Screwed



Flanged



Butt-Welding

When ordering, specify catalog number and suffix; see the preceding page.

Drilling: Flanged valves are regularly furnished with end flanges faced, drilled and spot faced (FD & SF); they are drilled to the corresponding pressure class of the American Standard; they can be furnished faced only, when specified.

Face to face: Face to face dimensions (M) of flanged valves include the 1/16-inch raised face on the 150 and 300-pound pressure classes and the 1/4-inch high large male face on the 400-pound and higher pressure classes.

Butt-welding valves: Unless otherwise ordered, 150 and 300-pound butt-welding valves are bored to match the inside diameter of standard pipe (heaviest weight on the 8, 10, and 12-inch sizes). For all other pressure classes, orders must specify the diameter of the bore (I.D. of pipe).

Smaller size 400 and 900-pound valves: For smaller size 400-pound valves, use the 600-pound valves. For smaller size 900-pound valves, use the 1500-pound valves.

2500-pound valves: Prices, weights, and dimensions of 2500-pound valves are furnished on request. For sizes and general description, see page 160.

Ratings and description...pages 156 to 158
Specification of materials.....page 157
Lever and weight valves.....page 157
Special facings.....pages 332 to 335
Volume per lineal foot of pipe....page 354
Proper sizing of check valves.....page 427

Weights and Dimensions — Prices on Request

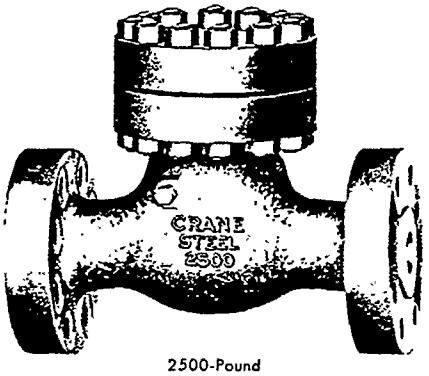
Pressure Class	Size Inches	Pounds, Each: Screwed Valves	Flanged Valves FD & SF	Butt-Welding Valves	Dimensions, in Inches: Screwed N	Screwed P	Flanged or Butt-Welding M	Flanged or Butt-Welding P
150 Pound	2	27	34	25	8	5	8	5
	2½	40	50	30	8½	5½	8½	5½
	3	50	65	50	9½	6	9½	6
	3½	...	94	...	...	...	10½	6½
	4	96	100	100	11½	7	11½	7
	5	...	140	120	...	...	13	8
	6	...	200	160	...	...	14	9
	8	...	390	360	...	...	19½	10¼
	10	...	510	...	...	...	24½	12⅛
	12	...	775	...	...	...	27½	13¾
	14	...	1200	...	...	...	35	on
	16	...	1450	...	...	...	39	request
300 Pound	2	40	62	47	9½	6¾	10½	6¾
	2½	70	80	60	10¾	8	11½	8
	*3	100	120	80	11¾	8½	12½	8½
	4	...	180	130	...	...	14	9¾
	5	...	250	240	...	...	15¾	10¾
	6	...	330	260	...	..	17½	11¾
	8	...	620	510	...	...	21	14
	10	...	920	760	...	...	24½	15
	12	...	1290	1015	...	...	28	16¾
400 Pound	4	...	200	190	...	...	16	10
	5		270	265	...	...	18	12
	6		395	310			19½	12½
	8		680	580	...		23½	14½
	10	..	900	820	...	...	26½	15¼
	12	...	1250	1150	...	...	30	16⅞
600 Pound	1¼	...	38	32	...	...	9	6¼
	1½	...	58	40	...	...	9½	6¾
	2	...	70	55	...	...	11½	7
	2½	...	105	70	...	...	13	8¼
	*3	..	140	100	...	...	14	9
	4	...	260	170	...	...	17	10¼
	5	...	400	300	...	...	20	12¾
	6	...	530	420	...	...	22	13½
	8	...	900	740	...	...	26	15¼
	10	...	1440	880	...	...	31	18¾
	12	...	1970	1200	...	...	33	21½
900 Pound	3	...	180	155	...	...	15	9½
	4	..	340	240	...	...	18	11
	6	..	640	500		...	24	13¾
	8		1180	890		...	29	16½
1500 Pound	1½	...	110	80	...	..	12	8¼
	2		160	130			14½	9¾
	2½	...	245	170			16½	10½
	3		280	210		...	18½	11¼
	4		630	390	..	...	21½	13¼
	5		950	480	..		26½	15¼
	6		1360	780			27¾	15¾
	8		2100	1320			32¾	18¼

*3-inch Cranelap Joints: When 3-inch 300 and 600-pound flanged valves with ring joint facing are to be bolted to Cranelap Joints, orders must so specify. A groove of special pitch diameter is required. See page 334 for dimensions.

Templates for drilling and dimensions of end flanges....pages 329 to 331

14

2500-Pound
Cast Steel Swing Check Valves



2500-Pound
Cast Steel
Swing Check Valve

Specification of materials....page 157
Description of materials.....Section 2

For working pressures, service recommendations, and general description, see pages 156 to 158.

Crane 2500-Pound Cast Steel Swing Check Valves with flanged or butt-welding ends are available in the 4, 5, 6, 8, and 10-inch sizes.

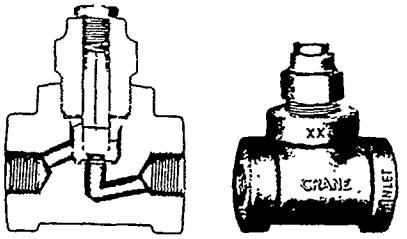
The valves are recommended for the high pressures and temperatures encountered in modern central power stations and oil refineries. They are regularly furnished with Class "X" trimming (Exelloy to Exelloy) and are suitable for oil, oil vapor, steam, water, or general service.

These are extremely heavy valves. They are ruggedly constructed and are amply proportioned throughout.

The full port area is maintained without pockets, from the inlet flange to the valve seat, to avoid turbulence. On the outlet side of the valve seat, the body is of generous proportions, allowing full swing of the disc and minimizing erosion and flow resistance.

Prices and dimensions will be furnished on application.

6000-Pound Hydraulic
Forged Steel Lift Check Valves



No. 227 H
Horizontal, Screwed

Sizes 1-inch and smaller are made with a screwed cap, as illustrated; the 1¼-inch size has a bolted cap.

Working Pressure
6000 psi cold water or oil, non-shock

Test Pressure
6500 psi hydrostatic

Extremely rugged valves designed for severe high pressure, hydraulic service

Recommendations: These valves are recommended for severe and extremely high pressure service on hydraulic lines not subject to shock. They have very heavy metal sections and are exceptionally rugged.

Body and cap: The body is made from a solid steel (ASTM A 105, Grade II) forging. Sizes 1-inch and smaller have a screwed cap as shown in the illustrations; the 1¼-inch size has a bolted cap

Disc and seat: The disc is made of bronze and is accurately guided to assure square seating. The seat bushing is made of Exelloy and can easily be renewed.

The valves are equipped with a small spring between the disc and cap.

Seat opening: The diameter of the port opening in these valves is slightly smaller than the inside diameter of Double Extra Strong Pipe

Prices on Request

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Weights and Dimensions

	Size	Pounds	End to end	Center to top
	Inches	Each	Inches	Inches
No. 227 H Horizontal	⅜	2.6	2⅞	2⅝
	½	5.6	3⅝	3¼
	¾	11.6	5	4⅜
	1	17.0	5¼	4⅞
	1¼	32.0	7	5⅝

SECTION 15

003947

Crane Pressure-Seal Bonnet and Lip-Seal Bonnet Valves

Pressure-Seal Bonnet Valves
General Description of Pressure-Seal Bonnet.....pages 162 and 163
Pressure-Temperature Ratings and Tests.....page 164
Gate.....pages 165 to 167
Globe and Angle.....pages 168 and 169
Stop-Check (Non-Return Valves).....pages 170 and 171
Lift-Check.....page 175
Selecting the Proper Size Stop-Check Valves.....pages 172 and 173
Determining Pressure Drop in Stop-Check Valves....pages 172 and 173
By-passes for Gate Valves.....page 174

Pressure-Seal Line Joints.....page 180

Lip-Seal Bonnet Valves
Globe and Angle.....pages 176 to 178

Lip-Seal Cap Valves
Lift Check.....page 179

For special valves for extreme pressures and temperatures, or for unusual services, see Section 21.

Crane Pressure-Seal Bonnet Valves have revolutionized the design and construction of valves intended for high-pressure, high-temperature steam and general service in modern power, industrial, and chemical plants. Utilization of the internal fluid pressure to seal the bonnet joint is the principal feature, but each type . . . . gate, globe, angle, stop-check, and lift check . . . . has individual refinements that contribute to greater efficiency.

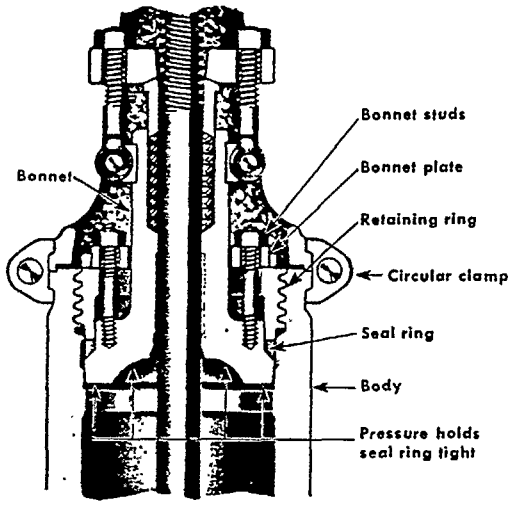
New records for valve performance have been set, not only in the United States but also in many foreign countries. Backed by the tremendous facilities for research, engineering, and production which are Crane's, the line has grown rapidly.

The valves are now a part of the large family of "regular" Crane manufactured product. In addition, patterns and equipment for many other types and sizes are available, and the Pressure-Seal Bonnet principle has been successfully applied to scores of special valves for unusual operating requirements. Inquiries for non-listed items in conventional sizes and types of valves, or for special designs for unique flow control problems, are given prompt attention.

Crane Lip-Seal Bonnet Globe and Angle Valves and Lip-Seal Cap Lift Check Valves are characterized by their superior design Developed by the same Crane resources which have made Pressure-Seal Bonnet Valves so outstanding in their field, thoroughly tested under rigorous experimental conditions, and proved through the years in demanding services, they fulfill the need for small size valves required in high-pressure, high-temperature steam service.

The exclusive Crane Lip-Seal design has made it possible to produce a compact, relatively lightweight valve without sacrificing strength and without resorting to reduced seat area. Absolute tightness, freedom from bonnet joint maintenance, and easy installation are only a few of the features See pages 176 to 179

The Crane Pressure-Seal Bonnet

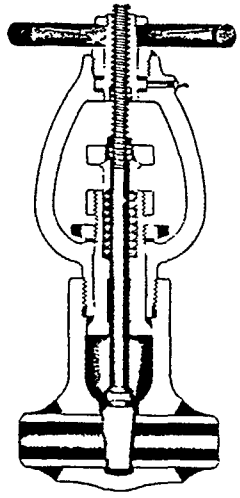


Section of typical Crane Pressure-Seal Bonnet as used on the larger sizes of gate valves.

A general description of Crane's Pressure-Seal Bonnet design . . . as used in gate, globe, angle, stop-check, and lift check valves . . . for better control of high pressure-temperature steam.

Crane Pressure-Seal Bonnet Valves have introduced a new era in valve engineering. Their design, unique in many respects, has eliminated the major problems attending the control of high pressure-temperature steam and water in modern power plant operation.

Announced some years ago after extensive research and experimentation backed by exhaustive laboratory and field testing, the valves were immediately acclaimed by leading power engineers throughout the country. Now, performance-tested in actual use, with their all-around superiority over conventional designs established, they are eagerly accepted for steam and boiler feed service in large central station installations and are being specified . . . . . more and more . . . . . as standard equipment on high-pressure, high-temperature services in the power stations of public utilities, oil refineries, and industrial and chemical plants, as well as for various process piping.



In gate valves 5-inch and smaller, the yoke and retaining ring are integral and screw into the body to hold the seal ring. The 1½-inch 1500-Pound Gate is illustrated.

Pressure-Seal Bonnet: Although each type of valve in the Crane line embodies many distinctive features of design that contribute to high efficiency and outstanding serviceability, each has in common the Crane Pressure-Seal Bonnet. The Pressure-Seal joint, being wholly contained within the valve body, utilizes the pressure inside the valve to seal the joint. Once the joint is initially made tight, it automatically remains so without further attention; no bolts or threads are relied upon to retain pressure.

Depending on the valve style and size, several minor modifications in mechanical structure are employed to assemble the body, the bonnet, the yoke, and the seal ring, but the principle of design is alike in all valves. The illustration at the upper left shows a typical Crane Pressure-Seal Bonnet, as used on larger sizes of gate valves.

The bonnet fits into the body, followed by the wedge-shaped seal ring. The retaining ring is then screwed into the body, the bonnet plate added, and the assembly drawn together by the bonnet studs.

Neither the threaded body and retaining ring connection nor the studs are expected to retain high pressure; they merely position the assembly and hold the parts firmly and snugly together

High sealing pressure: Internal fluid pressure acting upon the entire underside of the bonnet reacts upon the smaller contacting area of the wedge-shaped ring, sealing the joint. Because of the design, the sealing pressure is always many times greater than the pressure of the fluid in the line; leakage is impossible. The higher the internal pressure, the greater is the sealing pressure. In larger size valves, a stainless steel inlay deposited in the seal ring area of the body neck precludes any possibility of leakage due to minute porosity in that area of the body.

Maintenance of the joint is completely eliminated, and yet the assembly can be dismantled and reassembled in a fraction of the time required to open or close any other type of bonnet joint.

Wherever necessary, all mating parts are properly lubricated or plated to prevent corrosion or galling, and to eliminate "freezing" when the valves are subjected to high temperatures for long periods.

Designed for efficiency: The valves are built especially for the exacting demands of high-pressure, high-temperature steam and power piping systems. Each type of valve has in common, in addition to the Pressure-Seal Bonnet, many other features that contribute to efficient operation and long life.

Scope of Crane line

The Crane Pressure-Seal Bonnet line includes, in a full range of most commonly used sizes, 600, 900, 1500, and 2500-pound gates, 1500-pound globe and angles, and 900 and 1500-pound stop-check and lift checks.

Complete data on sizes, types, pressure classes, and materials not listed in this section will be furnished on request.

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The Crane Pressure-Seal Bonnet

(continued from the preceding page)

Less weight . . . . less space: Crane Pressure-Seal Bonnet Valves have liberal strength and a high factor of safety, but no unnecessary weight. The light weight of the parts of the Pressure-Seal Bonnet, the use of ample metal sections but without the extra thickness usually added for corrosion allowance on valves also recommended for oil refining services, and the unique compactness of design, make a surprising reduction in weight.

The valves are lighter in weight than corresponding sizes and types of conventional valves . . . . as much as 60 per cent on the larger sizes of the 1500-pound class. Less weight makes the valves easier to handle during erection and in maintenance. Savings in supporting structures or in the suspension of piping are thereby possible.

The end to end dimensions are as short as practicable, commensurate with good design. Close nesting of welding end valves is possible where necessary, without interference from overhanging flanges as is the case with conventional bolted bonnet valves.

In addition, the over-all compactness of Crane Pressure-Seal Bonnet Valves substantially reduces the distance from the center to the top of the valve; thus, less head room is required and installation problems are simplified.

Illustrated directly to the right is an 8-inch 1500-Pound Pressure-Seal Bonnet Gate Valve with an 8-inch bolted bonnet valve silhouetted in the background. The comparison typifies the compactness and the space-saving advantages that are characteristic of the Crane Pressure-Seal line.

Streamlined body: The body in all valves features smooth flowing contours without abrupt changes in metal thickness.

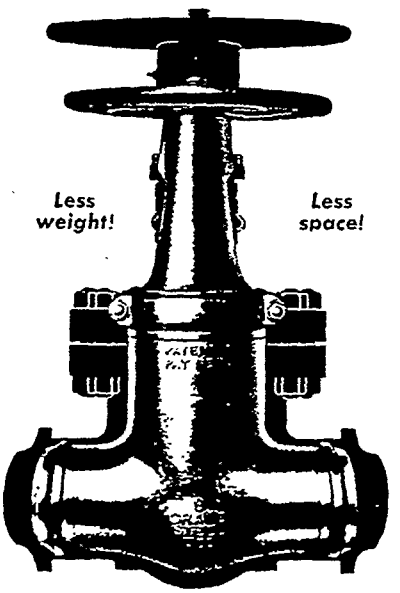
On butt-welding end valves, starting with pipe wall thickness at the ends, the metal sections increase gradually to the full body thickness, eliminating areas where acute stresses might otherwise concentrate.

Easy to insulate: The application of insulation is made easier due to the streamlined body. Less insulating material and labor are required, and neater, more effective results are obtained.

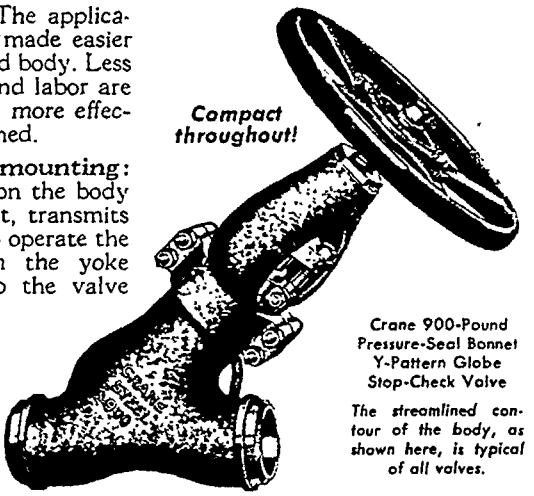
Direct yoke-body mounting: The yoke, mounted on the body instead of the bonnet, transmits the forces required to operate the valve, directly from the yoke sleeve or bushing to the valve body, without going through the bonnet.

The yoke is rugged and accurately centered; true alignment is maintained with the stem.

In smaller sizes, the yoke and retaining ring are integral and screw into the body. In larger sizes, the yoke sets atop the body, positioned by a male and female joint and held rigidly in place by a simple circular clamp; this construction is especially desirable on large sizes which may be ordered geared or motor operated, since the yoke can be turned if necessary, providing an unlimited choice of positions for the operating unit.



Crane 8-inch 1500-Pound Pressure-Seal Bonnet Gate Valve compared with an 8-inch bolted bonnet valve. Note the compactness and saving in weight.



Crane 900-Pound Pressure-Seal Bonnet Y-Pattern Globe Stop-Check Valve

The streamlined contour of the body, as shown here, is typical of all valves.

Liberal stuffing box: The stuffing box has generous space for stem packing. All valves have a bolted gland, equipped with swinging gland eye bolts.

Stellited seating surfaces: To assure extra long life on high pressure-temperature steam, boiler feed, and similar services, all Crane Pressure-Seal Bonnet Valves are regularly made with Stellited seating surfaces. Body seat rings are accurately fitted into the body and securely welded into place; they cannot loosen in service.

Body and bonnet materials: Depending upon the service, Crane Pressure-Seal Bonnet Valves have the body and bonnet made either of Crane Carbon Steel (ASTM A 216, Grade WCB) or Crane No. 7 Chromium-Molybdenum Alloy Steel (ASTM A 217, Grade WC6).

Valves can be made to order of Crane No. 9 Chromium Molybdenum Alloy Steel (ASTM A 217, Grade WC9) when specified; this steel is recommended where greater strength and resistance to steam corrosion are desired at elevated temperatures.

For a complete description of Crane metals, see Section 2.

Ratings and recommendations.....page 164
Gate valves.....pages 165 to 167
Globe and angle valves...pages 168 and 169
Stop-check valves.....pages 170 to 173
Lift-check valves.....page 175

Description of materials.....Section 2
Lip-Seal Bonnet Valves....pages 176 to 179

15

Steel Pressure-Seal Bonnet Valves

Ratings, Tests, and Recommendations

Gate valves.....pages 165 to 167
Globe and angle valves....pages 168 and 169
Stop-check valves.....pages 170 to 173
Lift-check valves.....page 175

Recommendations: Crane Pressure-Seal Bonnet Valves, described in detail in this section, are primarily intended for the high pressure-temperature steam and hot water services encountered in modern steam generating stations and for similar services in large industrial and chemical plants.

The valves, having Stellite faced seating surfaces, are also well suited for air, gas, high pressure hydraulic systems using water or low viscosity oil, and for other fluids in services not involving a major problem of corrosion, erosion, or coking.

"U" suffixed catalog numbers indicate valves have a Crane Carbon Steel body and bonnet; they are recommended for a maximum temperature of 1000 F.

"U7" suffixed catalog numbers indicate valves have a body and bonnet made of Crane No. 7 Chromium-Molybdenum Alloy Steel; they are recommended for a maximum temperature of 1200 F. Crane No. 7 Steel, alloyed especially for welding end valves used on steam service at temperatures over 775 F, exhibits much greater stability against graphitization at elevated temperatures than does carbon steel.

Where greater strength and resistance to steam corrosion are desired at temperatures over 1000 F, up to 1200 F, valves made of Crane No. 9 Chromium-Molybdenum Alloy Steel are recommended; such valves are made to order only.

Flanged valves: The Crane line of Pressure-Seal Bonnet Valves includes 600-pound flanged end gate valves: the flanges are regularly furnished with large male faces ¼-inch high.

Gaskets: The use of these ratings for flanged valves requires gaskets conforming to requirements set forth in ASA B16.5-1957. The user is responsible for selecting gaskets of dimensions and materials capable of withstanding the required bolt loading without injurious crushing, as well as being suitable for the service conditions in all other respects.

ASA and API Standards: Crane pressure-temperature ratings agree with ratings listed in the American Steel Flange Standard, B16.5-1957, and in the American Petroleum Institute (API) Standard No. 600, Fourth Edition, 1958.

Tests: In addition to the hydrostatic tests shown in the table below, lift check valves are given a 40 psi hydrostatic seat test and all other valves are given a 100 psi air-under-water seat test.

Larger size butt-welding end valves have the ends of the body shaped to permit the use of a testing clamp; smaller sizes are plain, being tested without the use of such a clamp.

Hydrostatic Test Pressures

Pressure Class	Shell Test	Seat Test	
	All Valves	All Valves except Stop-Check	Stop-Check Valves
600-Pound	2175 psi	1550 psi	
900-Pound	3250 psi	2250 psi	1350 psi
1500-Pound	5400 psi	3700 psi	2250 psi

Description of the Crane Pressure-Seal Bonnet.....pages 162 and 163

Pressure-Temperature Ratings
Flanged, Butt-Welding, or Socket-Welding Valves

Crane Steel	Temp. Deg. Fahr.	Psi, Non-Shock 600 Pound	900 Pound	1500 Pound
[1]Carbon Steel ASTM A216-WCB "U" Valves	100°	1440	2160	3600
	150	1420	2130	3550
	200	1400	2100	3500
	250	1380	2070	3450
	300	1365	2050	3415
	350	1350	2025	3375
	400	1330	2000	3330
	450	1305	1955	3255
	500	1250	1875	3125
	550	1180	1775	2955
	600	1110	1660	2770
	650	1030	1550	2580
	700	940	1410	2350
	750	850	1275	2125
	800	730	1100	1830
	850	[2]600	[2]900	[2]1500
	875	[2]525	[2]785	[2]1305
	900	[2]445	[2]670	[2]1115
	925	[2][3]375	[2][3]565	[2][3]945
	950	[2][3]310	[2][3]465	[2][3]770
	975	[2][3]240	[2][3]360	[2][3]600
	1000	[2][3]170	[2][3]255	[2][3]430
[4]No. 7 Chromium-Moly. ASTM A217 Grade WC6 "U7" Valves	At 650 F and lower, ratings are same as for Carbon Steel.			
	700	965	1450	2415
	750	900	1350	2250
	800	835	1250	2080
	850	765	1150	1915
	875	735	1100	1830
	900	700	1050	1750
	925	665	1000	1665
	950	635	950	1585
	975	600	900	1500
	1000	535	800	1335
	1025	[2]455	[2]685	[2]1140
	1050	[2]375	[2]565	[2]945
	1075	[2]325	[2]490	[2]815
	1100	[2]275	[2]410	[2]685
	1125	[2][3]225	[2][3]335	[2][3]555
	1150	[2][3]170	[2][3]255	[2][3]430
	1175	[2][3]125	[2][3]190	[2][3]315
	1200	[2][3]80	[2][3]125	[2][3]205
[4]No. 9 Chromium-Moly. ASTM A217 Grade WC9 (special)	At 1000 F and lower, ratings are same as for No. 7 Steel.			
	1025	465	700	1165
	1050	400	595	995
	1075	[2]345	[2]515	[2]855
	1100	[2]290	[2]430	[2]720
	1125	[2]245	[2]370	[2]615
	1150	[2]205	[2]310	[2]515
	1175	[2][3]170	[2][3]255	[2]430
	1200	[2][3]135	[2][3]205	[2]345

[1]Where welded construction is used consideration should be given to the possibility of graphite formation on carbon steel at temperatures over 775 F.

[2]Product used within the jurisdiction of Section I, Power Boilers of the ASME Boiler and Pressure Vessel Code, is subject to the same maximum temperature limitations placed upon the material in Table P7, 1959 edition thereof.

[3]Product used within the jurisdiction of Section I Power Piping of the ASA Code for Pressure Piping B31.1, is subject to the same maximum temperature limitations placed upon piping of the same general composition in Table 2a, 1955 edition thereof.

[4]Consideration should be given to the possibility of excessive oxidation (scaling) when No. 7 or No. 9 Steel is used at temperatures over 1050 F.

CRTX 999

Pressure-Seal Bonnet
Cast Steel Wedge Gate Valves

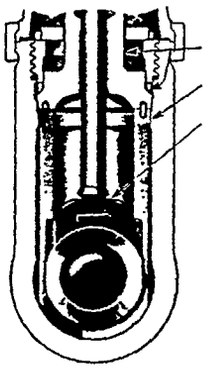
(Patented and Patent Pending)

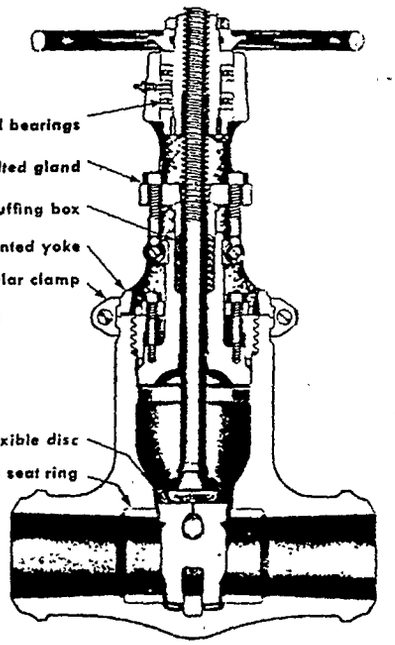
600, 900, 1500, and 2500-Pound Butt-Welding Ends

600-Pound Flanged Ends

he sectional views at the right re typical of the larger size rane Pressure-Seal Bonnet ate Valves.

Sections illustrating typical construction of the larger size Pressure-Seal Bonnet Gate Valves





Crane's unusual disc guide and tee-head disc-stem connection is shown at the left.

Body: The body is made without abrupt change in metal section, providing protection against a concentration of stresses produced by pressure, temperature differences, and pipe line strains.

There are no pockets between the end of the body and the seat to cause turbulence or friction.

Body seat rings: The body seat rings are Stellite faced. Accurately made to precision fit, they are slipped in parallel to the run of the valve and are securely welded in place. In 1500-pound valves 1½-inch and smaller, the seat rings extend through the body to form the welding ends of the valve, and the body is welded to the rings.

Disc: These valves have a wedge disc with Stellited seating faces. In sizes 3-inch and smaller, the disc is solid. In sizes 4-inch and larger, a one-piece flexible disc, solid through the center section but not around the outer portion, provides enough flexibility to eliminate sticking, thus requiring less torque to open the valve when cold after having been closed while hot. In addition, the disc seating faces adjust themselves to any slight variations in alignment caused by body contraction or pipe line strains.

Disc guide: Sizes 2½-inch and larger have an improved full length, separate "U" shaped disc guide extending along the sides of the body and fitted into a specially machined groove around the bottom of the body. Full disc guiding, even near the point of seating where the maximum force is exerted against the disc by the fluid flow, is assured by this design. The groove in the body for the disc guide and the machining for the body seat rings are made with the same machine setting to maintain proper alignment between the disc, guide, and body seat rings. Sizes 2-inch and smaller have the disc guides integral with the disc, and the body is slotted.

Disc-stem connection: The valves have a sturdy tee-head disc-stem connection. Ample clearance between the head on the stem and the slot in the disc prevents side strains on the stem. The stem is only required to move the disc up and down; it is not forced to also serve as a guide for the disc.

Other features: These valves have the other features common to all of the valves in this line, such as Pressure-Seal Bonnet, direct-mounted yoke, deep stuffing box, and two-piece bolted gland. In addition, 600-pound valves 8-inch and larger and 900 and 1500-pound valves 6-inch and larger are regularly supplied with a ball-bearing yoke sleeve; sizes 1½-inch and larger have a grease fitting to permit proper lubrication of the yoke sleeve.

In sizes 5-inch and smaller (of all pressure classes), the yoke and the retaining ring are integral and screw into the body to hold the seal ring. Larger sizes have the separate yoke and retaining ring, with the yoke held to the body by the circular clamp. The lower end of the stem hole in the bonnet is Stellite faced on sizes 2½-inch and larger, assuring a better back-seat and guide for the stem.

1500-Pound Socket-Welding Ends

Socket-welding end 1500-pound gate valves in sizes 1, 1¼, 1½, and 2-inch also are included in the Crane Pressure-Seal Bonnet line. They are similar in construction to the smaller sizes of the butt-welding end valves described above. In 2-inch valves, the body seat rings are slipped in parallel to the run of the valve and are securely welded in place. Sizes 1½-inch and smaller have longer body seat rings, welded into the body; the welded end of the ring forms the end of the socket in the body.

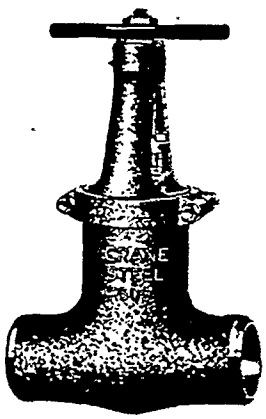
15

General description....pages 162 and 163 Ratings....page 164 Weights and dimensions....pages 166 and 167

Pressure-Seal Bonnet
Cast Steel Wedge Gate Valves

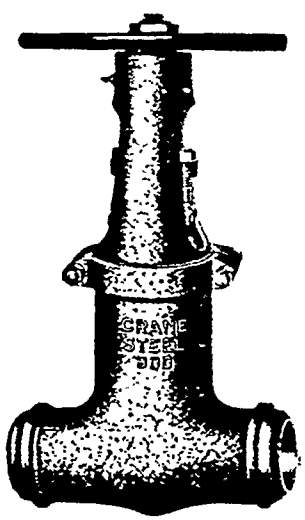
For description, see pages 162 to 165.
For ratings and recommendations, see page 164.

600-Pound Butt-Welding



No. 776 U, Carbon Steel
No. 776-U7, No. 7 Alloy Steel

900, 1500, and 2500-Pound Butt-Welding



900-Pound
No. 783 U, Carbon Steel
No. 783-U7, No. 7 Alloy Steel

1500-Pound
No. 787 U, Carbon Steel
No. 787-U7, No. 7 Alloy Steel

2500-Pound
No. 797 U, Carbon Steel
No. 797-U7, No. 7 Alloy Steel

Weights and dimensions....page 167

High in strength yet light in weight, Crane Pressure-Seal Bonnet Gate Valves offer unusual compactness and rugged durability. Streamlined design permits close nesting of welding end valves . . . . and installation in minimum space. In addition, center to top dimensions are noticeably smaller than usual, making less headroom necessary.

Materials: The body seat rings, welded in place, and the disc, are made of the same material as the body and bonnet and have the seating surfaces faced with Stellite. The stem is made of Exelloy.

"U" suffixed catalog numbers indicate valves have a Crane Carbon Steel body and bonnet; this steel conforms to requirements of ASTM A 216, Grade WCB.

"U7" suffixed catalog numbers indicate valves have a Crane No. 7 Chromium-Molybdenum Alloy Steel body and bonnet; this steel conforms to requirements of ASTM A 217, Grade WC6.

ASA Standards: The dimensions of end flanges and butt-welding ends conform to those in American Standard, B16.5-1957, for valves of the corresponding pressure class.

Flanged and butt-welding end valves also conform to the American Standard for Face-to-Face and End-to-End Dimensions of Ferrous Gate Valves, B16.10-1957, of corresponding pressure classes.

End flange dimensions are listed below. Face to face and end to end dimensions are listed on the next page.

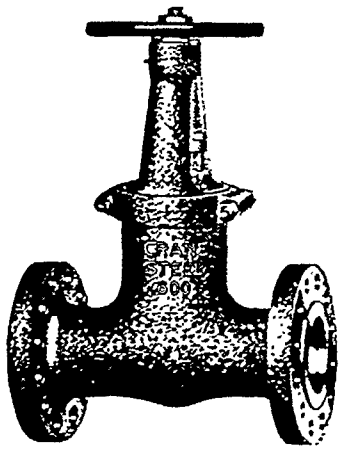
Flange facings: Flanged valves have a large male face, ¼-inch high with a serrated finish (approximately 32 concentric grooves per inch). Ring joint and other types of facings can also be furnished.

600-Pound End Flange Dimensions, Inches

Size Inches	Flange diameter	Flange thickness *	Dia. of male face	Dia. of bolt circle	No. & dia. of stud bolts
2½	7½	1⅛	4⅛	5⅞	8-¾
3	8¼	1¼	5	6⅝	8-¾
4	10¾	1½	6 3/16	8½	8-⅞
5	13	1¾	7 5/16	10½	8-1
6	14	1⅞	8½	11½	12-1
8	16½	2 3/16	10⅝	13¾	12-1⅛
10	20	2½	12¾	17	16-1¼
12	22	2⅝	15	19¼	20-1¼

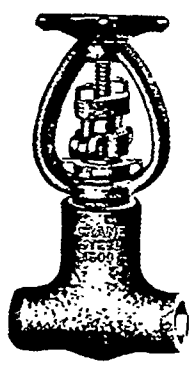
*Thickness of flange dimensions do not include the ¼-inch male face. face to face dimensions shown on the next page, include the male faces

600-Pound Flanged



No. 676 U, Carbon Steel
No. 676-U7, No. 7 Alloy Steel

1500-Pound Socket-Welding



No. 7811-U7, No. 7 Alloy Steel

Ordering butt-welding valves: Orders for butt-welding valves must specify the inside diameter of the pipe with which they are to be used, or its wall thickness, so that valve ends can be bored to match.

Prices: Prices of all valves will be furnished on request.

Flanged valves, as regularly furnished, include drilling to the 600-Pound American Steel Flange Standard, and spot facing; the valves can be furnished faced only, when specified

CRTX 1001

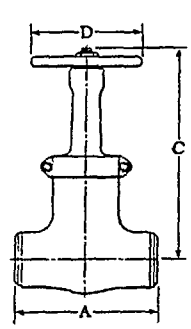
Pressure-Seal Bonnet
Cast Steel Wedge Gate Valves

Weights and Dimensions — Prices on Request

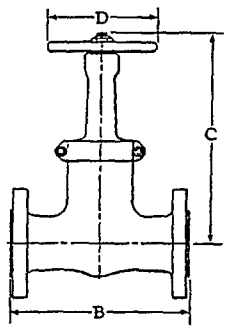
Catalog suffix indicates material of body and bonnet.
U = Crane Carbon Steel U7 = Crane No. 7 Chromium-Molybdenum Alloy Steel

Valve Type and Catalog Nos.	Size Inches	Weight Pounds Each	Dimensions, in Inches A	B*	C open	D	By-pass size ¶
600-Pound Flanged No. 676 U No. 676-U7	2½	75	...	13	19¼	8	...
	3	105	...	14	22	9	...
	4	190	...	17	27	10	...
	5	350	...	20	31¾	12	¾
	6	425	...	22	35	14	¾
	8	855	...	26	45	20	¾
	10	1300	...	31	53½	24	1
	12	1750	...	33	61½	24	1
600-Pound Butt-Welding No. 776 U No. 776-U7	2½	45	8½	...	19¼	8	...
	3	70	10	...	22	9	...
	4	110	12	...	27	10	...
	5	180	15	...	31¾	12	¾
	6	285	18	...	35	14	¾
	8	615	23	...	45	20	¾
	10	915	28	...	53½	24	1
	12	1405	32	...	61½	24	1
	14	1900	35	...	67½	27	1¼
	16	2575	39	...	74½	30	1¼
	18	3400	43	...	80	36	1½
	20	5200	47	...	98	36	1½
	24	7900	55	...	113	42	2
900-Pound Butt-Welding No. 783 U No. 783-U7 *For smaller sizes, use 1500-Pound*	3	105	12	...	23	10	...
	4	165	14	...	27¾	14	¾
	5	260	17	...	33½	16	¾
	6	425	20	...	39½	20	¾
	8	810	26	...	47	24	¾
	10	1130	31	...	52½	24	1
	12	1750	36	...	61½	27	1
	14†	2360	39	...	66½	30	1¼
	16†	2900	43	...	73½	36	1¼
	18†	4000	furnished on request				1½
1500-Pound Butt-Welding No. 787 U No. 787-U7	1	21	5½	...	13	5	...
	1¼	24	6½	...	13¾	5	...
	1½	37	7	...	17¼	8	...
	2	47	8½	...	18½	8	...
	2½	70	10	...	20	9	...
	3	110	12	...	23	10	...
	4	190	16	...	27¾	14	¾
	5	315	19	...	33½	16	¾
	6	490	22	...	39	20	¾
	8	900	28	...	46½	24	¾
	10	1540	34	...	52½	27	1
	12	2400	39	...	61½	30	1
	14†	2710	42	...	66½	36	1¼
	16†	4700	47	...	75½	36	1¼
1500-Pound Socket Welding No. 7811-U7‡	1	22	5½	...	13	5	...
	1¼	25	6½	...	13¾	5	...
	1½	39	7	...	17¼	8	...
	2	53	8½	...	18½	8	...
2500-Pound Butt-Welding No. 797 U No. 797-U7	2500-Pound Valves are available in sizes up to 18-inch; weights and dimensions will be furnished on request.						

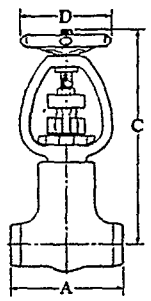
General description, pages 162 to 166 | *Drilling templates, pages 330 and 331* | *Flange facings, pages 333 and 334*



600, 900, 1500, and 2500-Pound Butt-Welding



600-Pound Flanged



1500-Pound Socket-Welding

¶**By-passes:** When specified, 600-pound valves 5-inch and larger and 900 and 1500-pound valves 4-inch and larger can be furnished with a by-pass for steam and general service.

By-pass sizes are indicated in the table at the left. The by-passes are rugged and durable, and have the necessary flexibility to compensate for expansion strains resulting from unequal temperatures or fluctuating operating conditions. Seamless steel pipe is used; all piping connections are welded. The by-pass valve is the full equivalent of the main valve insofar as ratings and service recommendations are concerned.

For description of by-passes and clearance dimensions, see page 174.

Motor operation: Valves installed in inaccessible locations, or used for emergency or other unusual purposes, are frequently required equipped with an electric, air, or gas motor unit; see pages 260 to 270.

Gearing: To facilitate operation, 600 and 900-pound valves 6-inch and larger, and 1500-pound valves 5-inch and larger, can be equipped with a bevel gear operator; see pages 271 to 274. Extension stems also are available.

*Face to face dimensions (B) include the ¼-inch male faces. The thickness of flange dimensions (shown on facing page) do not.

†Carbon steel 900 and 1500-pound butt-welding valves (No. 783 U and No. 787 U) are not made in sizes 14-inch and larger

‡Socket depth. Depths of sockets on the No. 7811-U7 Valves are ½ inch on sizes 1¼-inch and smaller and ⅝ inch on the 2-inch size.

15

Pressure-Seal Bonnet
Cast Steel Globe and Angle Valves

1500-Pound Globe
Butt-Welding Ends

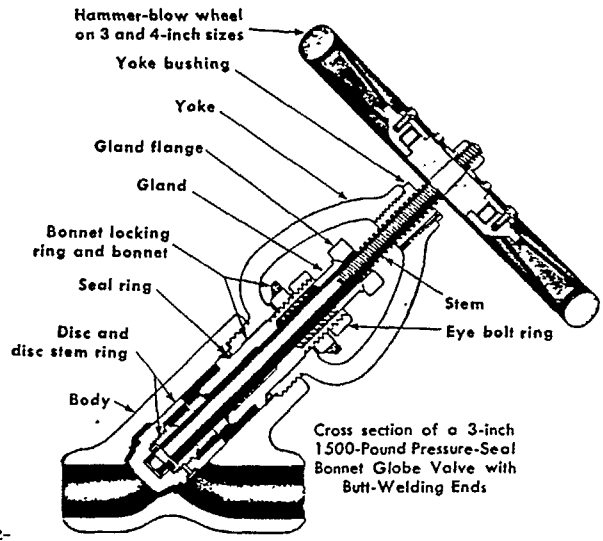
Crane Pressure-Seal Bonnet Globe Valves, like the gate valves described on the preceding pages, feature many advantages. The valves are compact, light in weight, and can be installed in less space than required for conventional valves. Their Pressure-Seal Bonnet assures freedom from bonnet joint leakage and maintenance.

Body: The body is "Y" pattern; it has unusually smooth contours with only gradual changes in metal thickness. The area above the seat is considerably enlarged, and the low side of the seat is practically on the centerline of the body. The design of the seat and disc in combination with the special shape of the interior of the body produces minimum turbulence and offers little resistance to flow. Pressure drop through these valves is surprisingly low for globe type construction.

Body seating surface: The body seating surface, consisting of a wide layer of Stellite facing, is integral with the body casting.

Stellite faced disc: The valves feature a newly designed, improved, swivel plug type disc faced with Stellite. In the 2-inch size, the disc stem ring is screwed onto the disc and tack welded in place, as shown in the illustration of the socket-welding end valve below. In sizes 2½-inch and larger, the disc is piston guided; the disc stem ring is screwed in, pinned, and tack welded to the disc as shown in the illustration at the right.

Rising, turning stem: The stem is the rising, turning type and operates through a threaded yoke bushing screwed into and pinned to the yoke. The stem is fully guided by long engagement with the yoke bushing and the lower end of the bonnet.



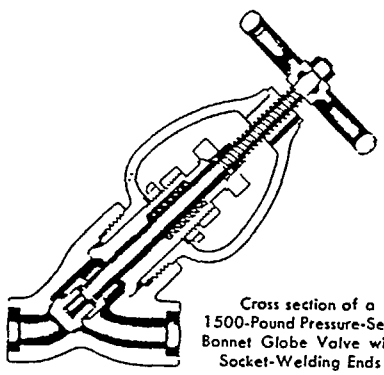
Cross section of a 3-inch 1500-Pound Pressure-Seal Bonnet Globe Valve with Butt-Welding Ends

Bonnet and yoke: The valves have the Crane Pressure-Seal Bonnet, the yoke and retaining ring being integral. The wide yoke arms permit easy accessibility to the stuffing box.

Stuffing box and gland: The stuffing box is large and deep; it is filled with high grade packing. The two-piece gland consists of a gland and gland flange held in place by swinging gland eye bolts; the bolts will not loosen in service.

Handwheel: Sizes 2 and 2½-inch have a conventional style malleable iron wheel; sizes 3 and 4-inch have a cast steel hammer-blow wheel.

1500-Pound Globe and Angle
Socket-Welding Ends


Cross section of a 1500-Pound Pressure-Seal Bonnet Globe Valve with Socket-Welding Ends

Socket-welding end 1500-Pound Globe and Angle Valves in sizes 1, 1¼, 1½, and 2-inch also are included in the Crane Pressure-Seal Bonnet line. They are similar in construction to the 2-inch butt-welding end globe valves described above, except for the end connections; they are also made in the angle pattern.

The globe valve is the Y-pattern design, having an integral Stellite faced seat. The angle valves have a low seat, with a separate Stellite faced seat ring securely welded into the body. Both valves have unusually good flow characteristics, assuring low pressure drop.

The Stellite faced disc is the improved Crane swivel plug type with a new disc stem ring connection and a long vertical fit between the bore of the disc and the pilot end of the stem. The characteristics of this construction assure the maximum in rigidity, while still permitting the disc to swivel.

15

General description....pages 162 and 163 *Pressure—temperature ratings....page 164* *Weights and dimensions....page 169*

CRTX 1003

003955

Catalog

Pressure-Seal Bonnet

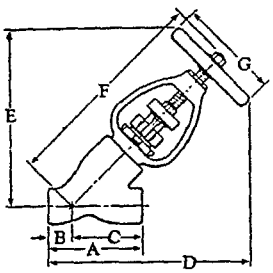
Cast Steel Globe and Angle Valves

(continued from the preceding page.)

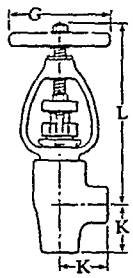
Materials: Valves having the catalog number suffixed with the designation "U" are furnished with a body and bonnet made of Crane Carbon Steel conforming to requirements of ASTM A 216, Grade WCB, and are suitable for temperatures up to 1000 F. The disc is carbon steel with Stellited face.

Valves having the catalog number suffixed with the designation "U7" are furnished with a body and bonnet made of Crane No. 7 Chromium-Molybdenum Alloy Steel conforming to ASTM A 217, Grade WC6, and are suitable for temperatures up to 1200 F. The disc is No. 7 Steel with Stellited face.

All valves have an Exelloy stem, Crane No. 7 Chromium-Molybdenum disc stem ring, cast carbon steel yoke, and Cast Manganese Bronze yoke bushing. Sizes 2½-inch and smaller have a conventional type malleable iron handwheel; sizes 3 and 4-inch have a hammer-blow type cast steel handwheel.



Globe Valves



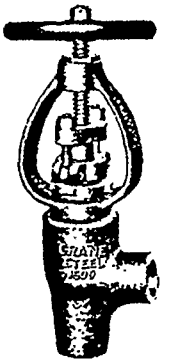
Angle Valves

Butt-welding valves: Butt-welding valve ends comply with American Standard, B16.5-1957, for valves of the 1500-pound class. In addition, end to end dimensions of the valves are the same as those shown in American Standard, B16.10-1957, for 1500-pound pressure-seal bonnet gate valves.

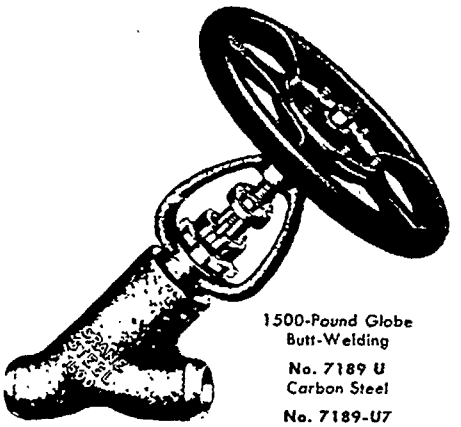
Orders must specify the inside diameter of the pipe with which the valves are to be used, or the pipe wall thickness, so that the valve ends can be bored to match.



1500-Pound Globe
Socket-Welding
No. 7852-U7
No. 7 Alloy Steel



1500-Pound Angle
Socket-Welding
No. 7853-U7
No. 7 Alloy Steel



1500-Pound Globe
Butt-Welding
No. 7189 U
Carbon Steel
No. 7189-U7
No. 7 Alloy Steel

Higher pressure and smaller size valves: Larger sizes, and valves for higher pressures, also are available; information on request. If smaller size valves are desired, use Crane Lip-Seal Bonnet Globe and Angles (pages 176 to 178) They are made in sizes ½ to 2-inch and in three pressure classes . . . . 1500-Pound, 1570 psi at 1050 F, and 2520 psi at 1050 F.

Weights and Dimensions — Prices on Request

Size	Pounds, Each				Dimensions, in Inches									
	Socket-Welding		Butt-Welding		Globe						Angle		Dia. of wheel	Depth of socket
	No. 7852-U7 Globe	No. 7853-U7 Angle	No. 7189 U Globe	No. 7189-U7 Globe	A	B	C	D open	E open	F open	K	L open	G	
Inches	No. 7 Steel	No. 7 Steel	Carbon Steel	No. 7 Steel										
1	20	20			5½	1⅜	4⅛	12⅝	11¼	13⅝	2¾	12⅛	5½	½
1¼	30	29			6½	1⅝	4⅞	16	13⅜	16⅛	3¼	14	7	½
1½	45	42			7	2	5	17½	15½	18⅞	3½	16¼	8	½
2	55	53			8½	2 7/16	6 1/16	19¾	17¼	20⅝	4¼	17½	10	⅝
2			55	55	8½	2 7/16	6 1/16	20	17½	20½	...	...	10	
2½			104	104	10	2⅞	7⅛	24⅝	21¾	25			14	
3			127	127	12	3⅜	8⅝	28⅜	25	26			20	
4			197	197	16	4½	11½	33¾	29¼	32½			20	

Description of Pressure-Seal Bonnet . . . . pages 162 and 163

Ratings, tests, and recommendations . . . . page 164

CRTX 1004

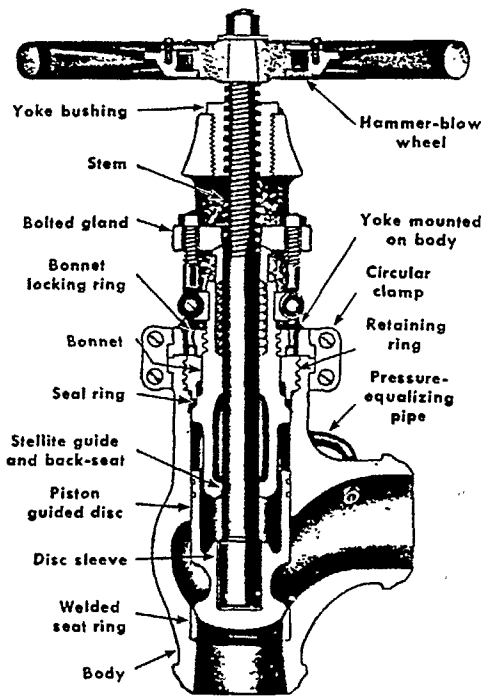
Pressure-Seal Bonnet
Cast Steel Stop-Check Valves

Freedom from bonnet joint leakage and maintenance, savings in space and weight, long service life, unusually low pressure drop—these and other benefits accrue to the user of Crane Pressure-Seal Bonnet Stop-Check Valves.

Body: The body of these valves—Y-pattern in the globe type—has streamlined contours with liberal internal area above the seat. Combined with the special shape of the seat and disc, this design offers minimum resistance to flow. Pressure drop through the valve is lower than is usually accepted as good performance for non-return or stop-check valve service.

The body is equipped with a specially designed external pressure-equalizing pipe, welded in place, connecting the chamber above the disc with the outlet end of the body. The pipe is so assembled to the body that the end on the outlet protrudes into the path of flow. Under high flow conditions, an aspirator effect is produced by the pipe, assuring lower pressure above the disc than beneath the disc and permitting high disc lift; should the flow reverse, the pipe admits the higher pressure to the top of the disc chamber, thereby forcing the disc to close quickly.

900 and 1500-Pound Butt-Welding Ends



Cross section of a 6-inch 900-Pound Pressure-Seal Bonnet Angle Stop-Check Valve

Body seat ring: The body seat ring is of special design; it is slipped into an accurately machined recess in the body and is securely welded in place. It will not loosen in service. The seating surface is Stellite faced.

Disc: The disc, also Stellite faced, is of piston guided construction, and is equipped with two piston rings. It fits snugly in the body, and is additionally guided by the long shoulder on the end of the stem. This shoulder operates in a sleeve fastened in the disc; to prevent galling and scoring, the sleeve and the washer between the stem end and the disc are made of a steel having extreme hardness.

Stem: The stem is of liberal diameter, amply strong, and well guided. It has a long thread engagement with the yoke bushing.

The stem hole in the lower end of the bonnet is Stellite faced to provide a good bearing and back-seat for the stem.

Pressure-Seal Bonnet: These valves have the Crane Pressure-Seal Bonnet described on pages 162 and 163. On the 6 and 8-inch sizes, the retaining ring and bonnet are drawn together by a threaded bonnet locking ring as shown in the cross section at the left.

The 10 and 12-inch sizes have a bonnet plate with bonnet studs, similar to the construction illustrated on page 162.

Direct yoke-body mounting: The yoke is mounted directly on the body, and the connection is secured by a simple but efficient circular clamp, using two Triplex Steel stud bolts on each side of the two halves of the clamp

Handwheel: The handwheel is steel and is mounted on the stem end. It is of hammer-blow construction to enable closing the valve under unbalanced pressure conditions or against boiler test pressure.

Stuffing box: A tight stem seal is provided by the large and deep stuffing box, which is filled with high grade packing.

The valves have a two-piece ball-type gland, consisting of a gland and gland flange. This construction maintains an even load on the packing and prevents the gland from binding on the stem. The swinging gland eye bolts move out of the way when the stuffing box is being repacked.

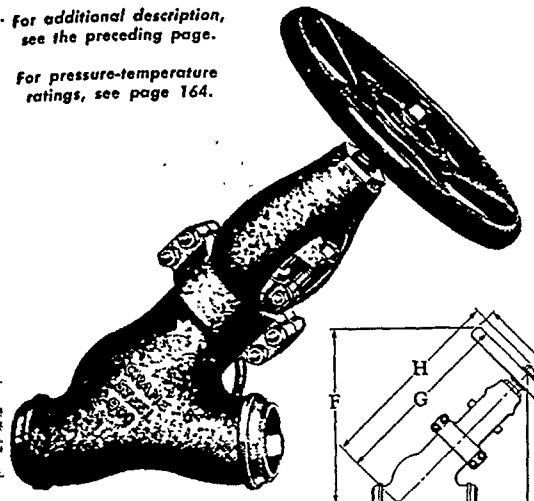
Selecting the proper size: To determine the most efficient size stop-check valve to use, refer to the information shown on pages 172 and 173.

Description of Pressure-Seal Bonnet...pages 162 and 163
Pressure-temperature ratings.....page 164
Weights and dimensions.....page 171

Pressure-Seal Bonnet
Cast Steel Stop-Check Valves

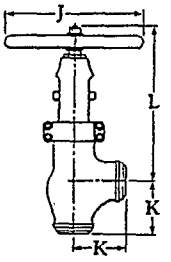
For additional description, see the preceding page.

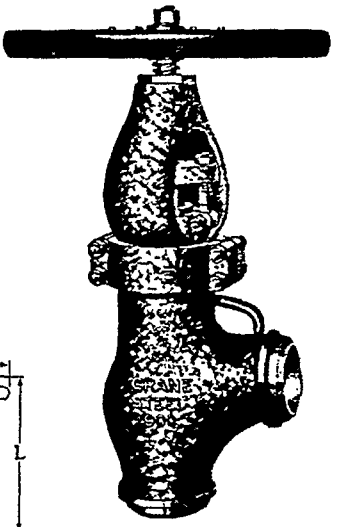
For pressure-temperature ratings, see page 164.



Globe Y-Pattern, Butt-Welding
Crane No. 7 Alloy Steel
No. 7186-U7... 900-Pound
No. 7192-U7... 1500-Pound

Important
A simple and direct method of determining the best size of stop-check valve, as well as the pressure drop under varying conditions of flow will be found on pages 172 and 173.





Angle, Butt-Welding
Crane No. 7 Alloy Steel
No. 7188-U7... 900-Pound
No. 7194-U7... 1500-Pound

Materials: These valves have a Crane No. 7 Chromium-Molybdenum Alloy Steel body, bonnet, body seat ring, and disc, the seating surfaces being faced with Stellite; the seat ring is securely welded in the body. The stem, strong and durable, is made of Crane Exelloy.

Crane No. 7 Chromium-Molybdenum Steel conforms to requirements of ASTM A217, Grade WC 6.

Test pressures: The 900-pound valves are given a 3250 psi shell test and a 1350 psi seat test; 1500-pound valves are given a 5400 psi shell test and a 2250 psi seat test. All valves are also given a 100 psi air-under-water seat test. They are suitable for boiler test conditions one and one-half times the nominal ratings to comply with the ASME Boiler Code. For complete pressure-temperature ratings and service recommendations, see page 164.

The valves are equipped with a hammer-blow handwheel and can be manually closed against boiler test pressure. They can also be equipped with toggle operators, gears, or motor operators on special order.

Valve ends: Dimensions of butt-welding ends conform to those in American Standard, B16.5-1957, for valves of the corresponding pressure class. Orders must specify the inside diameter of the pipe to be used with the valves, or pipe wall thickness, so that valve ends can be bored to match.

End to end and center to end dimensions agree with those in ASA B16.10-1957 for pressure-seal bonnet gate valves of corresponding pressure class.

Weights and Dimensions — Prices on Request

Pressure Class	Size	Pounds, Each		Dimensions, in Inches										
		Globe	Angle	Globe								Angle		Wheel
	Inches	Butt-Welding	Butt-Welding	A	B	C	D open	E open	F open	G open	H open	K	L open	J
		No. 7186-U7	No. 7188-U7											
900 Pound	6	weights on request	weights on request	20	5	15	27	41¼	36¼	38	39¾	10	32	26
	8			26	6¾	19¼	32½	50	43¼	46	47¾	13	37¾	30
	10			31	7¾	23¼	37½	57½	50	53	55	15½	42½	36
	12			36	9 5/16	26 11/16	45	66½	57	63½	65½	18	51	36
		No. 7192-U7	No. 7194-U7											
1500 Pound	8	weights on request	weights on request	28	7¾	20¼	32½	51	43¼	46	47¾	14	37¾	30
	10			34	9	25	37½	58¾	50	53	55	17	42½	36
	12			39	11 5/16	27 11/16	45	68½	57	63½	65½	19½	51	36

15

Crane Pressure-Seal Bonnet Stop-Check Valves

Selecting the Proper Size — Determining Pressure Drop

A problem confronting the power piping designer is the selection of the best size of stop-check valve for his service conditions. This type valve has a floating disc member, hence it is important that the valve be sized to provide full disc lift under flow conditions prevailing during the major portion of the service life of the installation. If the valve is too large for flow conditions, the disc will float in a partially open position; this may result in fluttering of the disc and rapid wear of valve parts. Conversely, if the valve is too small for flow conditions encountered, pressure drop will be excessive.

Crane has conducted numerous tests both in the laboratory and in the field over a period of many years to establish the flow characteristics of Crane Pressure-Seal Bonnet Stop-Check Valves. As a result, Crane Engineers have developed the chart shown on the opposite page.

The chart is a graphical presentation of flow data which were determined by test. Its use offers a simple method of determining the best size of stop-check valve, as well as the pressure drop under varying conditions of flow, without any computation.

How to Use the Chart Shown on the Opposite Page

Given: Steam Pressure.....1,000 psi, gauge
Steam Temperature...850 F
Flow Rate.....200,000 pounds per hour, maximum

Find: The catalog number of the valve and the best size for the above installation.

Solution: Reference to the pressure-temperature ratings on page 164 indicates a stop-check valve of the 900-pound pressure class will be required: thus, either of the following may be used:

No. 7186-U7, Globe
No. 7188-U7, Angle

The choice between the globe or angle depends, of course, upon the piping arrangement. The flow characteristics of Crane Pressure-Seal Bonnet Stop-Check Valves are identical for both globe and angle types. *Now, follow the text below and proceed as indicated by the arrows on the chart.*

1. Enter the chart at a temperature of 850 F. Move vertically upward to the curved line for 1000 psi gauge pressure, then horizontally to the right to establish a point on the specific volume scale. From this point, draw a line through the flow rate being investigated (200,000 pounds per hour) and establish a point on Index 1.

2. From the point on Index 1, draw another line through any assumed size of the No. 7186-U7 or No. 7188-U7 (for example, the 6-inch size) and establish a point on Index 2. Move horizontally to the diagonal line in the right side of the chart and read the pressure drop at the intersection as 12 psi.

Chart solutions resulting in a point on Index 2 that falls below Line A-A indicate the valve disc will not be fully lifted under the flow conditions used. Operation under such conditions is not recommended, but at times, must be tolerated for short periods during the low load portion of the operating cycle.

3. Enter the chart where Line A-A intersects Index 2. Move diagonally upward through the size being investigated (6-inch) and establish a second point on Index 1. From this point, extend a line to the specific volume established in Step 1, and at its intersection with the flow rate line, read 74,000 pounds per hour as the minimum flow rate at which the disc will be in the fully lifted position. The pressure drop at this flow rate is 2 psi. At all flow rates less than 74,000 pounds per hour through 6-inch valves, the pressure drop may be expressed as "2 psi or less".

4. Repeat Steps 2 and 3 for all other probable sizes and determine the pressure drop and minimum flow rate for the wide open position. Results are shown at the right.

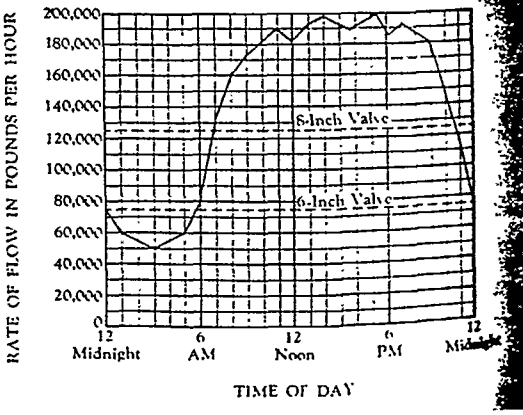
Valve Size Inches	Pressure Drop at Maximum Flow Rate of 200,000 lbs. per hour (In Psi)	Minimum Flow Rate for Wide Open Valve Pounds per hour
6	12.0	74,000
8	4.8	125,000
10	2.2	190,000
12	Less than two	280,000

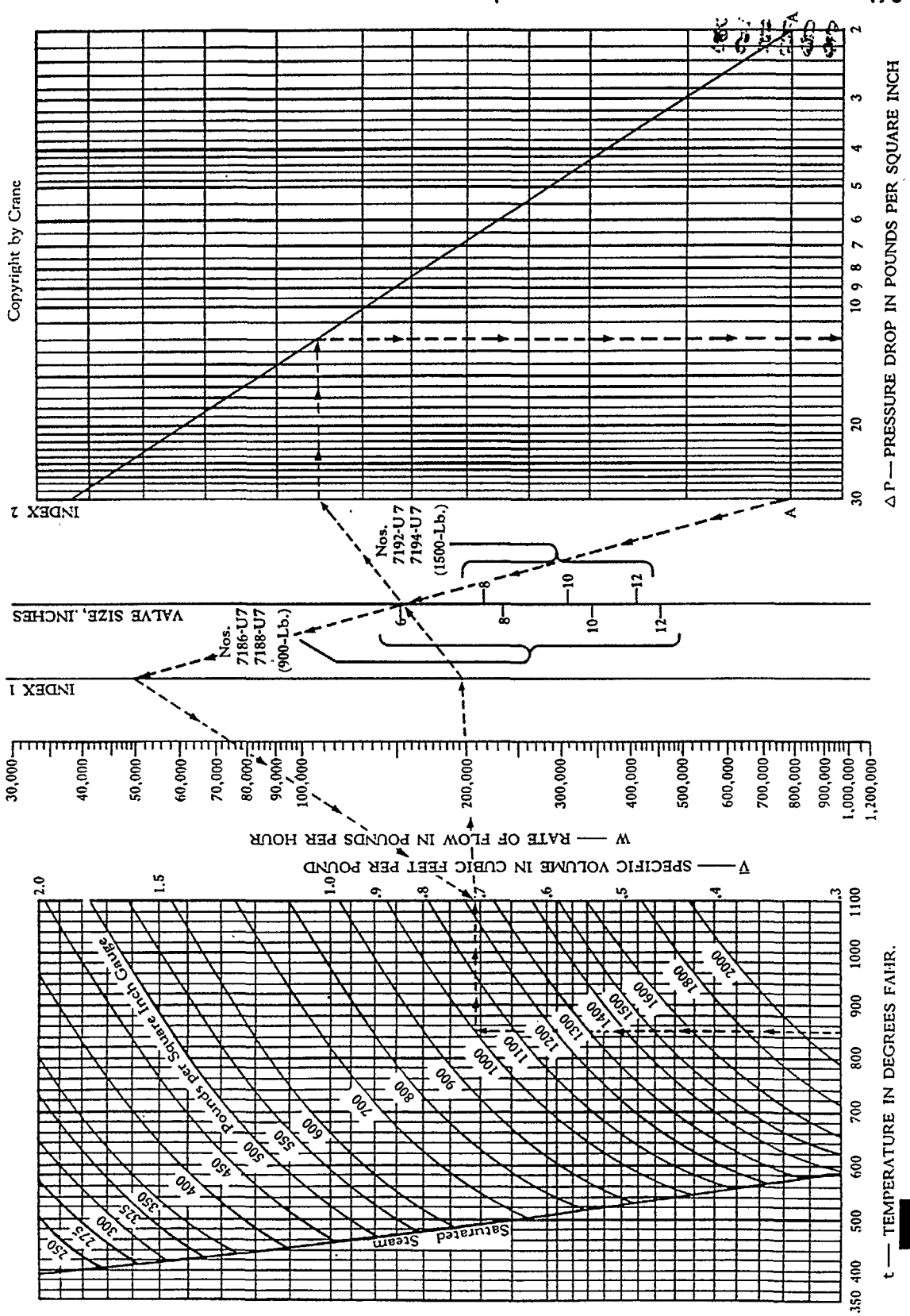
5. Since the flow rate of 200,000 pounds per hour is designated as maximum, it may be assumed that the boiler will frequently be operated at lower flow rates. On this basis, it is obvious both the 10 and 12-inch sizes would be too large. The choice between the 6 and 8-inch size depends upon the load-demand curve and the final selection rests with the piping designer.

6. A typical daily load-demand curve, as shown on the chart below, indicates the advisable size is 8-inch. Minimum flow rates for a fully lifted disc for both 6 and 8-inch sizes are shown in the chart. The disc will not be fully lifted for about 6 hours in the 6-inch valve and for about 8 hours in the 8-inch valve. However, since the pressure drop for the 8-inch is much lower during high-load operation, it appears to be a better choice than the 6-inch.

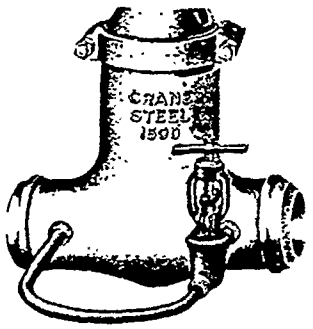
Pressure drop for any intermediate flow condition can be determined as outlined in Steps 1 and 2.

Typical Daily Load-Demand Curve

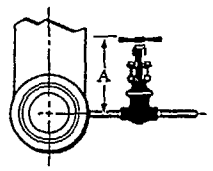



Copyright by Crane
ΔP — PRESSURE DROP IN POUNDS PER SQUARE INCH
INDEX 2
A
Nos. 7192-U7 7194-U7 (1500-Lb.)
VALVE SIZE, INCHES
Nos. 7186-U7 7188-U7 (900-Lb.)
INDEX 1
W — RATE OF FLOW IN POUNDS PER HOUR
V — SPECIFIC VOLUME IN CUBIC FEET PER POUND
t — TEMPERATURE IN DEGREES FAHR.
Saturated Steam
Pounds per Square Inch Gauge
CRTX 1008

By-Passes for Cast Steel
Pressure-Seal Bonnet Gate Valves



Standard Arrangement for Crane One-Valve Built-Up By-Pass



Dimension "A" indicates center to top distance for all by-pass valves.

When so ordered, Crane Pressure-Seal Bonnet Gate Valves (pages 165 to 167) can be furnished with a Built-Up By-Pass suitable for "warming up" on steam line service or for equalizing the pressure around main control valves used on steam or other fluids.

One-valve, two-valve, and three-valve by-passes, set up as shown in the line illustrations at the right, are standard types regularly furnished.

Construction: Crane by-passes are designed to provide maximum strength, durability, and flexibility with a minimum of additional weight on the main valve. The by-pass is furnished with an outside screw and yoke Lip-Seal Bonnet globe valve having socket-welding ends. All connections in the by-pass are welded to assure a permanently tight, secure assembly.

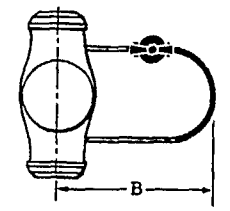
Pipe bends are used on all pressure classes to provide the necessary flexibility and to compensate for expansion strains resulting from unequal temperatures or fluctuating operating conditions.

Materials: High quality materials are used in the by-pass piping and for the by-pass valve. The by-pass valve will be made of carbon steel or Crane No. 7 Chromium-Molybdenum Alloy Steel to correspond with the material of the main valve. Similarly, the piping will be seamless carbon steel or seamless chromium-molybdenum alloy steel.

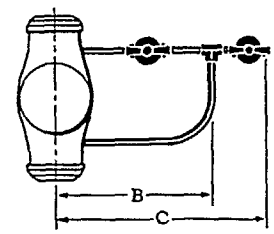
The piping and the by-pass valve are of ample weight to withstand the pressures and temperatures for which the main valve is recommended, and the by-pass valve is trimmed with materials suitable for the same services as the main valve.

Location of by-pass: By-pass valves are regularly furnished attached to the side of the main valve. The stems of the main valve and the by-pass valve or valves will be parallel and will point upward. When ordering, specify whether a one-valve, two-valve, or three-valve by-pass is desired.

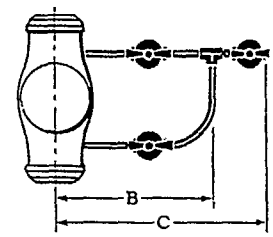
Special by-passes: By-passes of other designs or to other specifications can be made to order. Please furnish complete description, drawings, etc.



One-Valve By-Pass



Two-Valve By-Pass



Three-Valve By-Pass

Built-Up By-Pass Sizes and Clearance Dimensions — Prices on Request

Main Valve Size	By-Pass Valve Size	Approximate Clearance Dimensions, in Inches							
		A-Open (all pressure classes)		B			C		
		Crane Carbon Steel By-Pass	Crane No. 7 Chromium-Molybdenum By-Pass	600 Pound Class	900 Pound Class	1500 Pound Class	600 Pound Class	900 Pound Class	1500 Pound Class
Inches	Inches								
4	¾	11¼	11⅝	17⅝	17¾	17¾	24	24⅜	24⅜
5	¾	11¼	11⅝	17¾	18⅛	18⅛	24⅛	24⅝	24⅝
6	¾	11¼	11⅝	19	19¼	19¼	25⅜	26	26
8	¾	11¼	11⅝	20⅜	19⅝	19⅝	26¾	26⅛	26⅛
10	1	11¾	12⅛	23½	23½	23½	30⅞	31⅛	31⅛
12	1	11¾	12⅛	24⅛	24½	24½	31½	32	32
14	1¼	14	14	27¼	27⅝	27⅝	36⅞	36⅜	36⅜
16	1¼	14	14	28⅜	28⅝	28⅝	36⅞	37⅜	37⅜
18	1½	16	16 3/16	32½	34		42	43¾	
20	1½	16	16 3/16	33⅞			43⅞		
24	2	18¼	18¾	41			52⅛		

Description of main valves....pages 165 to 167 *Additional data on by-passes....page 403* *Taps and drains for valves....page 403*

Pressure-Seal Cap

Cast Steel Lift Check Valves

(Patented)

New 900 and 1500-pound valves . . . with Crane's exclusive "cage type" disc guide and disc design

These valves are a new addition to Crane's line of Pressure-Seal Bonnet Valves. Like the others, they feature compactness, relatively light weight, and an absolutely tight, leak-proof body-cap joint. Their Y-pattern body, cage type disc guide and disc, and reduced seat opening combine to provide the benefits of full disc lift with minimum pressure drop. The valves are recommended for boiler feed service.

Body and cap: The Y-pattern body has smooth contours with only gradual changes in metal thickness. The area above the seat is considerably enlarged, and the low side of the seat is practically on the centerline of the body. The cap and seal ring set into the neck of the body, and are held snug by a retaining ring. Valves 6-inch and smaller have a cap locking ring and washer; larger sizes have a cap plate secured by means of Triplex steel studs and steel stud nuts.

Disc guide and disc: The valves feature Crane's patented cage type disc guide and disc, each designed with three large ports (see illustration below). The disc guide, shoulder seated and tack welded in the body, accurately guides the movement of the piston type disc.

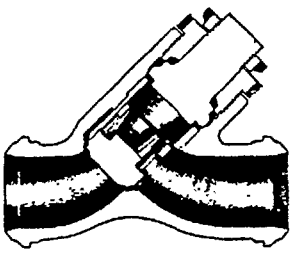
With the disc in the open position, the ports in the disc guide permit unrestricted flow through the valve.



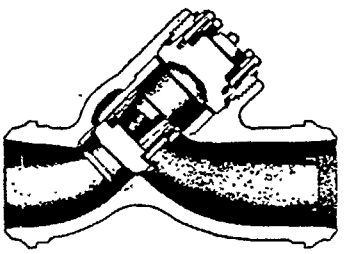
Disc guide (or liner) and disc

With the disc in the closed (or open) position, the ports in the disc guide and the disc allow an open space from the area above the disc to the downstream (outlet) side of the valve, thus equalizing the pressure between these points . . . . and eliminating any need for an equalizer pipe.

The Crane design assures a tight seat, minimizes chattering, and produces high disc lift with minimum pressure drop. It effects a fully opened valve during normal flow . . . and a quick, positive shut-off when the flow is reversed.



Cross Section
Sizes 6-inch and Smaller



Cross Section
Sizes 8-inch and Larger

Seat: Valves 6-inch and smaller have a Stellite faced seating surface integral with the body casting; larger sizes have a steel body seat ring faced with Stellite.

Materials: The body, disc guide, disc, retaining ring, and the locking ring or cap plate are Crane Carbon Cast Steel conforming to ASTM A 216, Grade WCB. The disc seating surface is faced with Stellite. The portions of the disc guide and disc in contact with each other are chromium-plated to prevent galling.

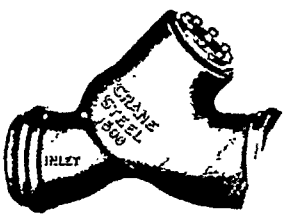
Standards: Dimensions of valve ends comply with American Standard B16.5-1957 for butt-welding valves of the same pressure class. End to end dimensions are the same as those listed in American Standard B16.10-1957 for Pressure-Seal Bonnet Gate Valves of the same pressure class.

Ordering: Orders must specify the inside diameter of the pipe with which the valves are to be used, or the pipe wall thickness, so that the valve ends can be bored to match.

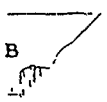
Ratings: For pressure-temperature ratings and tests, see page 164.



No. 7140 U
900-Pound Butt-Welding

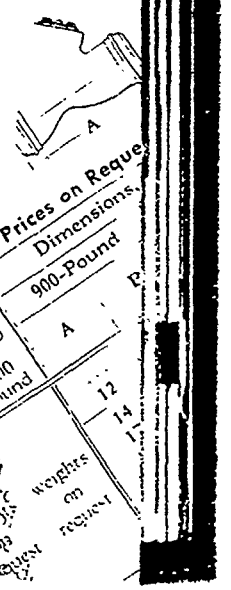


No. 7150 U
1500-Pound Butt-Wel



Weights and Dimensions —

	Size	Pounds, Each	
		No. 7140 U	No 715
	Inches	900 Pound	
Butt-Welding Lift Check Valves	2½		
	3		
	4		
	5		



Descripti
Pressu

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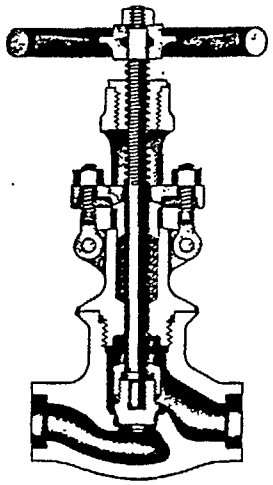
Lip-Seal Bonnet
Cast Steel Globe and Angle Valves

(Patented)



Typical Cross Section
Lip-Seal Bonnet Globe Valve
Outside Screw and Yoke
Socket-Welding Ends

½ to 2-inch valves in three pressure classes . . . 1500-Pound, 1570 psi at 1050 F, and 2520 psi at 1050 F . . . for high pressure-temperature service

Crane globe and angle valves with patented Lip-Seal Bonnet Joint have proved to be a marked advancement in small steel valve construction. Crane Lip-Seal design has made possible compact, relatively light-weight valves without sacrificing strength or durability. Absolute tightness, full seating area, freedom from bonnet joint maintenance, minimum weight and bulk, and easy dismantling and reassembly are a few of the advantages.

The valves are especially recommended for use in modern power, industrial, and chemical plants on main steam, auxiliary steam, boiler feed, and miscellaneous piping, as well as for drips, drains, by-pass, blowdown, and similar service.

Lip-Seal Bonnet joint: Crane's Lip-Seal design features simplicity. The body and bonnet are screwed together until a firm metal-to-metal contact is made between the smoothly machined, flat surfaces on the shoulder of the bonnet and the top of the body. The lips around the periphery are then seal welded. A small shoulder on the bonnet insures perfect centering of the bonnet on the body, eliminating the possibility of stem binding due to bonnet misalignment.

The welded seal is not subjected to bending moments which might break the seal, nor is it ever required to carry the mechanical load exerted upon the body-bonnet joint by pressure and stem thrust. Threaded members . . . . plated to resist corrosion and to prevent galling or seizure . . . . carry the entire mechanical load at relatively low stresses. The welded seal simply guards against any leakage.

sy dismantling and reassembly: Dismantling the valve asy. Merely grind off the seal weld (chipping or burning cessary) and unscrew the bonnet. With ordinary care, al weld may be repeatedly ground off for dismantling lded upon reassembly with no damage to the valve.

em connection: The disc-stem connection holds nces to a minimum and places the seating load closer to the actual seating surface of the valve. In assembly, the disc stem ring is screwed down finger tight, axially forming a continuous metal-to-metal contact between the disc and stem. The disc stem ring is then ocked to the disc by a tack weld. The stem fully guided by a yoke bushing and by long agement with the lower end of the bonnet.

num radial clearance, long vertical fit n the pilot end of the stem and the the disc, and no axial clearance maximum rigidity while permitisc to swivel

(continued on the next two pages)

Maximum Non-Shock Working Pressures, psi

Temp. Deg. Fahr.	(Regular Material) Crane Carbon Cast Steel* ASTM A216-WCB 3800 Series Nos.	Crane No. 7 Chromium-Molybdenum Cast Steel† ASTM A217-WC6 3900 Series Nos.	Crane No. 7 Chromium-Molybdenum Cast Steel† ASTM A217-WC6 4000 Series Nos.	(Made to Order) Crane No. 9 Chromium Molybdenum Cast Steel† ASTM A217-WC9 Special 3900 Series	Crane No. 9 Chromium Molybdenum Cast Steel† ASTM A217-WC9 Special 4000 Series
100°	3600	6000	7450		
150	3550	5915	7450		
200	3500	5830	7450		
250	3450	5750	7450		
300	3415	5690	7450		
350	3375	5625	7450		
400	3330	5550	7450	Up to 1000 F, ratings are same as for 3900 Series Valves of No. 7 Steel	Up to 1000 F, ratings are same as for 4000 Series Valves of No. 7 Steel
450	3255	5430	7450		
500	3125	5210	7450		
550	2955	4925	7450		
600	2770	4620	7385		
650	2580	4300	6880		
700	2350	4025	6440		
750	2125	3745	6000		
800	1830	3470	5545		
850	[1]1500	3190	5105		
875	[1]1305	3055	4880		
900	[1]1115	2915	4665		
925	[1]945[2]	2775	4440		
950	[1]770[2]	2640	4225		
975	[1]600[2]	2500	4000		
1000	[1]430[2]	2230	3560		
1025	...	[1]1900	[1]3040	1945	3105
1050	...	[1]1570	[1]2520	1655	2655
1075	...	[1]1355	[1]2175	[1]1430	[1]2280
1100	...	[1]1145	[1]1825	[1]1200	[1]1920
1125	...	[1]930[2]	[1]1480[2]	[1]1030	[1]1650
1150	...	[1]715[2]	[1]1145[2]	[1]855	[1]1370
1175	...	[1]530[2]	[1]840[2]	[1]715[2]	[1]1145[2]
1200	...	[1]345[2]	[1]545[2]	[1]570[2]	[1]910[2]

Cold Service. For temperatures from −20 F to 100 F, the ratings shown for 100 F apply.

*Where welded construction is used, consideration should be given to the possibility of graphite formation on Carbon steel at temperatures above 775 F.

†Consideration should be given to the possibility of excessive oxidation (scaling) when No. 7 or No. 9 Steel is used at temperatures above 1050 F.

[1]Product used within the jurisdiction of Section I Power Boilers of the ASME Boiler and Pressure Vessel Code, is subject to the same maximum temperature limitations placed upon the material in Table P7 1959 edition thereof.

[2]Product used within the jurisdiction of Section 1, Power Piping of the ASA Code for Pressure Piping B31.1, is subject to the same maximum temperature limitations placed upon piping of the same general compositions in Table 2a of ASA B31.1-1955.

Hydrostatic Test Pressures

Valve	[1]1500-Pound (Carbon Steel)	[1]1570psi—1050F (No. 7 Steel)	2520psi—1050F (No. 7 Steel
Shell	5400 psi	9000 psi	11,175 psi
Seat	3700 psi	6100 psi	7,550 psi

Seat tested 100 psi air-under-water.

Lip-Seal Bonnet
Cast Steel Globe and Angle Valves

(Patented)

(continued from preceding page)

Disc and seat: The plug type disc and seat, ideal for rigorous service, provide a wide seating contact not easily affected by foreign matter or wiredrawing. The seating surfaces are faced with Stellite, a material that withstands corrosion and erosion unusually well and displays excellent resistance to wear, seizure, galling, and abrasion.

Body: Valve bodies of each pressure class, similar in design, are well proportioned throughout. Specially shaped internal contours provide excellent flow characteristics and the flow path is designed to reduce turbulence and minimize disc vibration. Ports and seat opening are full line size.

Yoke and yoke bushing: The yoke has heavy metal sections and is cast integral with the bonnet. The yoke bushing, screwed into the yoke and tack welded in place, will not loosen in service.

Stuffing box and gland: The stuffing box, of liberal proportions and filled with highest quality packing, provides a tight seal around the stem. The two-piece ball type gland, consisting of a gland and gland flange, maintains an even load on the packing and prevents binding of the stem. The gland flange is held in place by swinging eye bolts.

Repacking: The valves can be repacked while under pressure. When wide open, the top of the disc stem ring meets the underside of the bonnet in an angle-to-ball seat, forming a tight, line bearing contact.

Materials: As indicated under the illustrations at the right, Crane Lip-Seal Bonnet Globe and Angle Valves are regularly made in three pressure classes . . . 1500-Pound ASA . . . 1570 psi at 1050 F (2500-Pound ASA) . . . and 2520 psi at 1050 F.

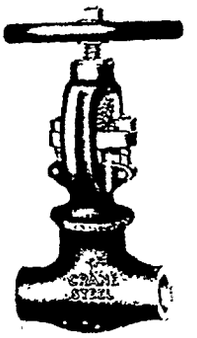
Valves of the 1500-Pound pressure class (Series 3800 catalog numbers) have a body and bonnet made of Crane Carbon Steel conforming to requirements of ASTM A 216, Grade WCB.

Valves of the 1570 psi, 1050 F and the 2520 psi, 1050 F pressure classes (Series 3900 and 4000 catalog numbers respectively) regularly have a body and bonnet made of Crane No. 7 Chromium-Molybdenum Alloy Steel conforming to ASTM A 217, Grade WC6. This steel combines excellent corrosion-erosion resistance, stability against graphitization, and strength retention at elevated temperatures.

For even greater strength and better resistance to steam corrosion at extremely high temperatures, the Series 3900 and 4000 Valves can be made to order of Crane No. 9 Chromium-Molybdenum Alloy Steel (ASTM A 217, Grade WC9).

All valves have Stellited seating surfaces and an Exelloy stem. The yoke bushing is made of Cast Manganese Bronze. The gland is bronze on the smaller sizes and siliconized steel on the larger sizes. The gland flange is forged steel and the gland eye bolts are stainless steel.

Ratings: Working pressures are shown on the facing page. Ratings for Series 3800 and 3900 Valves agree with those of the American Steel Flange Standard, B16.5-1957, for the 1500-pound and 2500-pound pressure classes respectively. The Standard does not include ratings for pressure classes above 2500-pound.

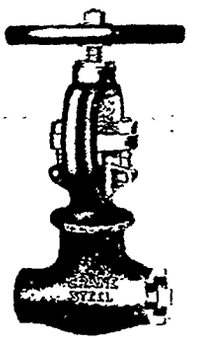


Globe, Screwed

No. 3866 U
1500-Pound
Carbon Steel

No. 3966-U7
1570 psi at 1050 F
No. 7 Alloy Steel

No. 4066-U7
2520 psi at 1050 F
No. 7 Alloy Steel



Globe, Socket-Welding

No. 3868 U
1500-Pound
Carbon Steel

No. 3968-U7
1570 psi at 1050 F
No. 7 Alloy Steel

No. 4068-U7
2520 psi at 1050 F
No. 7 Alloy Steel

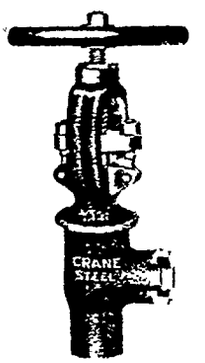


Angle, Screwed

No. 3867 U
1500-Pound
Carbon Steel

No. 3967-U7
1570 psi at 1050 F
No. 7 Alloy Steel

No. 4067-U7
2520 psi at 1050 F
No. 7 Alloy Steel



Angle, Socket-Welding

No. 3869 U
1500-Pound
Carbon Steel

No. 3969-U7
1570 psi at 1050 F
No. 7 Alloy Steel

No. 4069-U7
2520 psi at 1050 F
No. 7 Alloy Steel

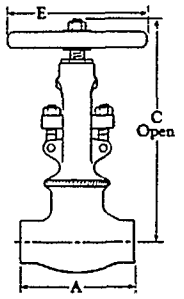
All valves in the smaller sizes have a Style S tee handle (not illustrated).

Full seating area: The diameter of the seat opening in these valves is the same as the port diameter, being at least equivalent to the inside diameter of Schedule 160 pipe on Series 3800 Valves and to Double Extra Strong pipe on Series 3900 and 4000 Valves.

Description of materials . . . Section 2 *Prices on Request* *For sizes, weights, and dimensions, see next page.*

Lip-Seal Bonnet
Cast Steel Globe and Angle Valves

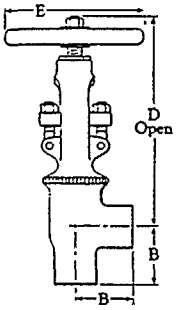
Weights and Dimensions



Globe Valves
Screwed or Socket-Welding

Prices on Request

For ratings and complete description, see pages 176 and 177.



Angle Valves
Screwed or Socket-Welding

Pressure Class	Regular Body and Bonnet Metal	Size	Pounds, Each				Dimensions, in Inches						
			Screwed		Socket-Welding		A	B	C open	D open	E†	Dia. of port & seat opening	Depth of socket
		Inches	Globe	Angle	Globe	Angle							
			No. 3866 U	No. 3867 U	No. 3868 U	No. 3869 U							
1500-Pound ASA	Crane Carbon Steel	½	9.0	8.5	9.0	8.5	4	2	9	8½	4⅛	½	⅜
		¾	13.0	12.0	13.0	12.0	4¾	2⅜	11¼	10¾	6	⅝	½
		1	16.0	15.5	16.0	15.5	5½	2¾	11¾	11⅛	7	13/16	½
		1¼	24.0	23.0	24.0	23.0	6½	3¼	14	13⅛	8	15/32	½
		1½	36.0	33.0	36.0	33.0	7	3½	16	15	10	111/32	½
		2	51.0	49.0	51.0	49.0	8½	4¼	18¼	17⅛	12	111/16	⅝
			No. 3966-U7	No. 3967-U7	No. 3968-U7	No. 3969-U7							
1570 psi at 1050 F 2500-Pound ASA	Crane No. 7 Steel*	½	12.0	12.0	12.0	12.0	4	2	8⅞	8⅜	4⅛	⅜	⅜
		¾	16.0	14.5	16.0	14.5	4¾	2⅜	11⅝	113/16	6	½	½
		1	21.0	19.5	21.0	19.5	5½	2¾	12⅛	11⅝	7	⅝	½
		1¼	30.0	26.0	30.0	30.0	6½	3¼	14	135/16	8	⅞	½
		1½	45.0	40.0	45.0	40.0	7	3½	163/16	15⅜	10	15/32	½
		2	65.0	63.0	65.0	63.0	8½	4¼	18¾	17¾	12	1½	⅝
			No. 4066-U7	No. 4067-U7	No. 4068-U7	No. 4069-U7							
2520 psi at 1050 F	Crane No. 7 Steel*	½	Weights on request		Weights on request		4½	2¼	12¼	1115/16	6	⅜	⅜
		¾					5½	2¾	14½	141/16	7	½	½
		1					6½	3¼	17	16½	8	⅝	½
		1¼					7½	3¾	1911/16	19	12	⅞	½
		1½					8½	4¼	215/16	207/16	14	15/32	½
		2					9½	4¾	2211/16	21⅝	16	1½	⅝

*Valves regularly made of Crane No. 7 Chromium-Molybdenum Steel are also available made to order of Crane No. 9 Chromium-Molybdenum Steel; orders must so specify. Dimensions shown apply to valves made of No. 7 or No. 9 Steel.

†Dimension "E" indicates the length of the handle or the diameter of the wheel. The ½ and ¾-inch Series 3800 and 3900, and the ½ to 1-inch Series 4000 Valves, have a Style S Tee Handle; larger sizes have a Style D wheel, as illustrated

Pressure-Seal Bonnet Valves....pages 162 to 175

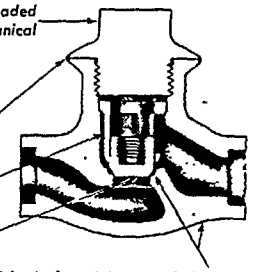
Lip-Seal Cap Lift Check Valves....page 179

CRTX 1013

Lip-Seal Cap
Cast Steel Lift Check Valves

(Patented)

Small size 1500-pound and 1570 psi, 1050 F horizontal lift checks for severe steam services



These valves are a companion line to the Crane Lip-Seal Bonnet Globe and Angle Valves described on the preceding three pages. Like those valves, they feature construction considerably superior to that generally used for small steel valves . . . . compactness and relatively light weight without sacrifice of strength or durability . . . . absolute tightness, freedom from cap joint difficulties, and easy handling . . . . superior performance on high pressure-temperature steam lines . . . . and wide application in modern power, industrial, and chemical plants.

Lip-Seal-joint: Crane's Lip-Seal design is extremely simple. The cap and body are screwed together until a firm metal-to-metal contact is made between the smoothly machined flat surfaces on the shoulder of the cap and the top of the body. The small lips around the outer periphery are then seal welded.

The threaded body-cap connection . . . . with threads plated to resist corrosion and to prevent galling or seizure . . . . carries the entire mechanical load, and at relatively low stresses. The welded seal merely guards against leakage.

Easy dismantling: Dismantling the valve is easy. Simply grind off the seal weld and unscrew the cap. With ordinary care, the seal weld may be repeatedly ground off for dismantling, and welded upon reassembling, with no damage to the valve.

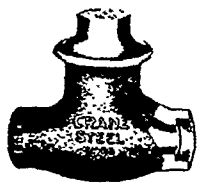
Disc and seat: All valves have an Exelloy disc. The body seating surface is faced with Stellite, a material that withstands corrosion and erosion unusually well. The disc and seat are plug type in shape but, through a reasonable difference in angles, effect what is virtually a line bearing seating contact. A cage type disc guide, tack welded in the body, accurately guides the movement of the disc. This construction, another patented Crane development, assures square seating, minimizes chattering, and produces high disc lift with minimum pressure drop.

Materials: The body and cap are Crane Carbon Steel (ASTM A 216, Grade WCB) in the 1500-Pound Valves and Crane No. 7 Chromium-Molybdenum Alloy Steel (ASTM A 217, Grade WC6) in valves of the 1570 psi, 1050 F class. The latter steel offers high corrosion-erosion resistance and excellent strength retention at elevated temperatures. For even greater resistance and strength at extremely high temperatures, valves can be made to order of Crane No. 9 Chromium-Molybdenum Alloy Steel (ASTM A 217, Grade WC9).

1500-Pound



No. 3886 XU
Screwed
Carbon Steel

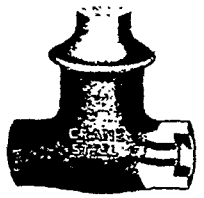


No. 3888 XU
Socket-Welding
Carbon Steel

1570 psi at 1050 F
(2500-Pound ASA)



No. 3986-XU7
Screwed
No. 7 Alloy Steel



No. 3988-XU7
Socket-Welding
No. 7 Alloy Steel

Weights and Dimensions — Prices on Request

Size	Pounds, Each				Dimensions, in Inches					
	1500-Pound Carbon Steel		1570 psi, 1050 F No 7 Alloy Steel		End to end	Center to top of cap		Diameter of seat opening		Depth of socket
Inches	No. 3886 XU Screwed	No. 3888 XU Socket-Welding	No. 3986-XU7 Screwed	No. 3988-XU7 Socket-Welding		1500 Pound Class	1570 psi at 1050 F Class	1500 Pound Class	1570 psi at 1050 F Class	
½	4.2	4.2	5.4	5.4	4	3 9/16	4 1/16	7/16	7/16	3/8
¾	7.8	7.8	11.0	11.0	4 3/4	4 3/16	5 1/16	5/8	½	½
1	8.7	8.7	12.3	12.3	5½	4¼	5 1/16	¾	5/8	½
1¼	14.0	14.0	22.0	22.0	6½	4 7/8	5 9/16	1 1/16	¾	½
1½	20.0	20.0	27.5	27.5	7	5 9/16	6 7/16	1¼	1 1/16	½
2	30.0	30.0	44.0	44.0	8½	6 3/16	7 3/8	1 9/16	1 9/16	5/8

Ratings: Ratings for these valves agree with those in the American Steel Flange Standard, B16.5-1957, and are the same as listed for Crane Lip-Seal Bonnet Globe and Angle Valves of the same material and pressure class; see page 176.

Test: Series 3800 and 3900 Valves are given hydrostatic shell tests of 5400 psi and 9000 psi, respectively. The seats are given a 40 psi hydrostatic test.

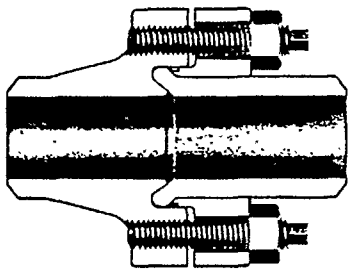
Description of materials . . . . Section 2
Proper sizing . . . . . page 427

15

003966

Pressure-Seal Line Joints

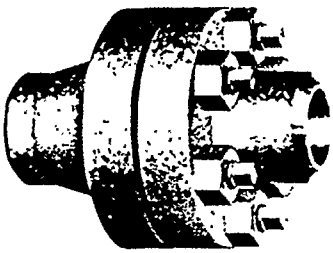
Butt-Welding Ends



Cross Section
1500-Pound Line Joint

Crane Pressure-Seal Line Joints are designed for use on high-pressure high-temperature steam service in welded piping where access to equipment may be desired without necessitating torch-cutting of a line and where conventional flanged joints are susceptible to leakage or require constant maintenance.

Prices and dimensions are furnished on request.



1500-Pound
Pressure-Seal Line Joint

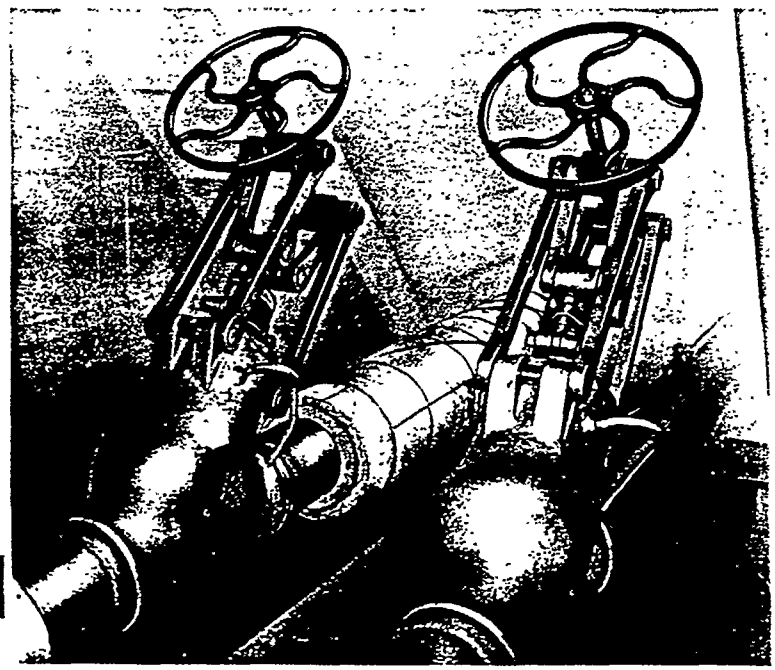
Construction: These joints are considerably smaller and lighter in weight than regular bolted joints of corresponding size made with American Standard flanges. They utilize the internal fluid pressure to assist in forcing the seal ring and mating parts together; the seal ring loading increases as the pressure increases, thus maintaining tightness. All Pressure-Seal Line Joints have butt-welding ends.

The smaller sizes are made with a screwed union ring, a stub end, a seal ring, and a socket end. Larger sizes are semi-flanged, as illustrated above; they are made with a stub end, a ring flange, a seal ring, a socket flange with welding end, and studs and nuts.

Pressure classes and sizes: Pressure-Seal Line Joints are made to order in the 600, 900, and 1500-pound pressure classes, in sizes 1 to 16-inch, with the ends bored for any schedule of pipe.

Material: These joints can be made of a variety of alloy steels to meet specific requirements, or of a combination of alloys, one for each half of the joint. In the latter case, they provide an ideal means of joining dissimilar metals in a piping system, where the welding together of those metals might present an extremely difficult problem.

Inquiries and orders: Inquiries and orders should specify: quantity; size; service conditions in terms of fluid, pressure, and temperature; materials required on each or both ends; schedule number or the outside and inside diameter of the pipe or tubing being used.



Special 12-inch 1500-Pound Crane Pressure-Seal Bonnet Globe Y-Pattern Stop Check Valves installed in the main steam lines of a central station operating at 900 psi, 900 F

For valves for extremely high pressures and temperatures . . . for nuclear applications . . . for missile and rocket service . . . for extreme vacuums . . . or for other unusual conditions . . . see Crane's Special Service Valves in Section 21.

SECTION 16

Crane Packless Diaphragm Valves

(Patented and Patents Pending)

General Description.....pages 182 and 183

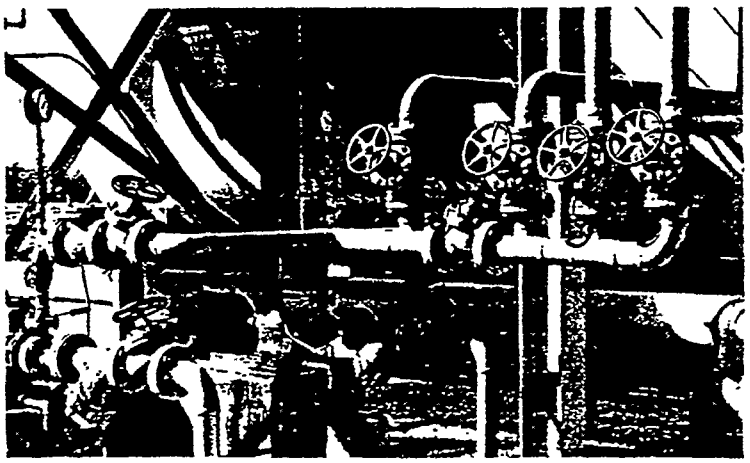
Unlined Valves—Wheel Operated
Description.....pages 184 and 185
Working Pressures.....page 184
Sizes and Weights.....page 185
Dimensions.....page 188

Lined Valves—Wheel Operated
Description.....page 186
Working Pressures.....page 186
Sizes and Weights.....page 186
Dimensions.....page 188

Sliding Stem Valves
Description.....page 187
Working Pressures.....page 187
Sizes.....page 187
Dimensions.....page 188

When ordering valves for corrosive services, refer to the Crane Corrosion Questionnaire on page 202.

The Crane line of Y-Pattern Packless Diaphragm Valves embraces a host of types . . . . . unlined, neoprene-lined, or rubber lined . . . . all available for wheel or sliding stem operation. The unlined valves are furnished in bronze, cast iron, aluminum, or 18-8 SMo and . . . . to further increase their versatility . . . . there is a choice of disc insert and diaphragm materials . . . . Neoprene, Buna N, natural rubber, Kel-F, or Teflon. For industrial fluid handling, for general or corrosive service, wherever absolute tightness around the stem is a primary consideration . . . . a Crane Packless Diaphragm Valve may be the answer.



Crane packless diaphragm valves fulfill the requirements of a variety of general and corrosive services . . . a petro-chemical installation is illustrated

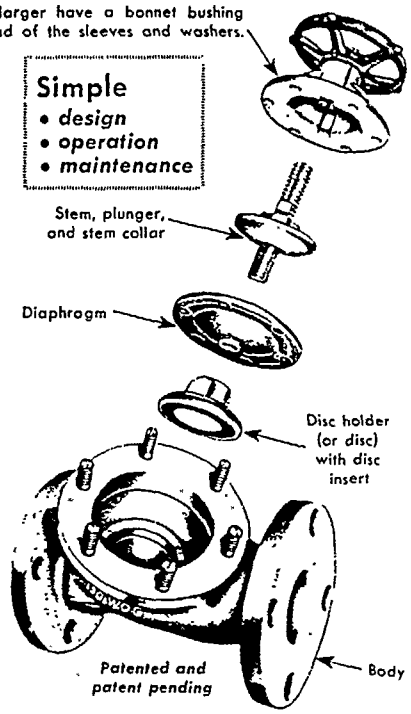
Packless Diaphragm Valves

Unlined and lined types . . . . for general and corrosive services

Choice of . . . bronze, iron, aluminum, or 18-8 SMo Y-pattern body and disc . . . . diaphragm and disc insert materials . . . . wheel or sliding stem operation.

Bonnet, yoke sleeve, and phenolic sleeve and washers . . . sizes 2½-inch and larger have a bonnet bushing instead of the sleeves and washers.

Simple
- ***design***
- ***operation***
- ***maintenance***

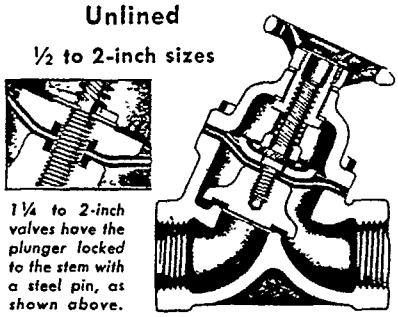


Crane Packless Diaphragm Valves, distinguished by advanced design, proven performance, and a choice of body, disc insert, and diaphragm materials, fulfill the need for moderately priced valves effective on both general and corrosive services. Unlined valves are made with screwed ends in sizes ½ to 2-inch and with flanged ends in sizes up to 14-inch; lined valves, furnished with flanged ends only, are made in sizes ½ to 6-inch. All valves are available with a wheel for hand operation or a sliding stem for application of power operators.

Basically, the valves feature the same design, size for size, as illustrated at the left. Lined valves, of course, have a lined body and coated disc; sliding stem valves differ in their upper end construction. See illustrations on next page.

Unlined

½ to 2-inch sizes



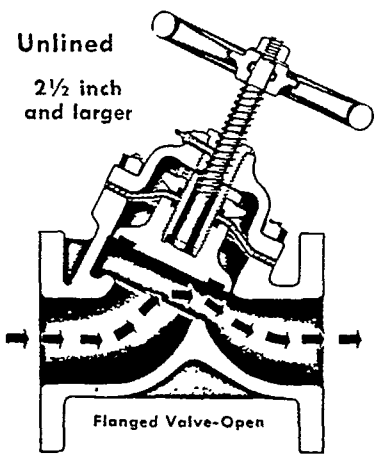
1¼ to 2-inch valves have the plunger locked to the stem with a steel pin, as shown above.

Screwed Valve-Closed

All ½ to 2-inch Crane diaphragm valves (available with screwed or flanged ends) feature the same basic design. Note the diaphragm's sole function is to seal the bonnet. Tightness at the seat, obtained only by the disc . . . . an exclusive Crane feature . . . . assures a positive shut-off of flow even if the diaphragm should fail.

Unlined

2½ inch and larger



Flanged Valve-Open

2½-inch and larger diaphragm valves (available with flanged ends only) feature the same basic design. Note, in the open position, how the high disc lift creates a flat, smooth surface in the upper chamber of the body. This, coupled with the Y-pattern body design, assures an even flow of fluid with minimum turbulence and low pressure drop.

Crane's superior "packless" design provides a tight stem seal . . . . protects working parts . . . . reduces maintenance

In many services, a frequent problem of valve maintenance is to keep a tight stuffing box seal around the stem. With the increasing use of volatile, corrosive, and hard-to-hold fluids as well as of high vacuum processes, and even in the handling of general fluids, the need for absolute tightness around the valve stem is often the primary consideration in valve selection. Under such conditions, provided other essential requirements are met, the Crane diaphragm valve is an inexpensive and logical choice.

No stem packing is used or required in Crane diaphragm valves. They belong to that general class known as "packless" valves, so called because the customary stuffing box around the stem has been eliminated through the use of a flexible diaphragm mounted between the body and bonnet.

The diaphragm keeps an absolutely tight stem seal. There is no chance for leakage and no need for stuffing box maintenance. Because line fluids cannot enter the valve bonnet, operating parts are not exposed to corrosion; nor can costly fluids be contaminated through contact with working parts. Since the diaphragm is used only to form a pressure-tight bonnet closure . . . . and not for seating . . . . it is not subject to cutting crushing, or rapid wear.

A separate flat-faced disc equipped with a soft insert, or completely coated on lined valves, performs the seating function. The disc, firmly attached to the end of the stem and fastened to the center of the diaphragm by means of a plunger, bears against a crown-shaped seat in the body, assuring leakproof closure on all fluids.

When the valve is operated (see "open" and "closed" illustrations at left), the stem raises or lowers the non-turning disc and the diaphragm flexes to permit this travel

Packless Diaphragm Valves

Choose a Crane Valve for these advantages

Longer diaphragm life because the diaphragm performs the sole function of sealing the bonnet. It is not subject to the crushing, cutting, and abrasion incident to seating . . . . factors which cause rapid wear.

No escape of fluids even if the diaphragm should fail. Tightness at the seat is obtained by the disc, independently of the diaphragm . . . . an exclusive Crane safety feature.

"Packless" construction eliminates the annoyance and expense of stuffing box leakage and maintenance.

Low resistance to flow with Crane's Y-pattern body design. Flow is more accurately controlled . . . . pressure drop is minimized.

Easier operation because Crane's separate disc and diaphragm design reduces the torque . . . . and number of turns . . . . needed to open and close the valves.

Easier maintenance because all parts are readily accessible. Simply unbolt the bonnet and lift out the diaphragm and working parts; the body need not be removed from the line.

High quality materials and rugged construction

Crane diaphragm valves are the compact bolted bonnet type.

Unlined valves have a body and disc of bronze, cast iron, aluminum, or 18-8 SMo. These are available with a neoprene, Buna N, natural rubber, or Kel-F diaphragm and disc insert.

Neoprene and Buna N are synthetic rubber compounds and, like natural rubber, are excellently suited for a wide range of fluids at temperatures up to 180 F.



Section of a Kel-F trimmed valve. The Kel-F diaphragm is heavily reinforced by another member.

Kel-F (trade name for polytrifluorochloroethylene) is an unusually stable thermo-plastic. It is inert to inorganic acids and alkalies in all concentrations, has low cold flow characteristics, and is suitable for temperatures up to 200 F.

Tight seating is accomplished by the disc operating on the stem end. A disc insert, of the same material as the diaphragm, is vulcanized or molded into a recess in the face of the disc and closes against a crowned seating surface in the body. The insert is pliable enough to absorb small particles of foreign matter that might otherwise cause leakage.

The diaphragm is not used as the seating member . . . . it merely retains the fluid. It has a hole through its center and is locked between the disc and plunger. When the valve is operated, the diaphragm flexes to permit the travel of the disc.

Valves ½ to 2-inch have a concealed non-turning, rising bronze stem operating in a bronze yoke sleeve. Guide lugs on the plunger above the diaphragm ride in recesses in the bonnet to keep the stem from turning.

Valves 2½-inch and larger have a turning, rising bronze stem operating in a bronze bonnet bushing. The disc is held to the stem by a threaded bronze sleeve on the plunger which allows the stem to rotate freely.

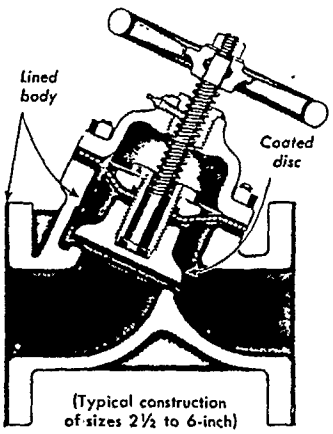
All valves have a cast iron bonnet. Wheels are malleable iron. The plunger is bronze on sizes 1-inch and smaller and cast iron on larger sizes.

Lined valves (see illustration at upper right) have a cast iron body and disc. They are the same, size for size, as the unlined pattern except the body interior, flange faces, and in some cases, the body exterior, are covered with neoprene or natural rubber. In addition, the disc, instead of having an insert, is completely coated with neoprene or natural rubber. Thus, all parts contacting fluid in the line are protected.

Sliding stem valves, designed for easy application of power operators, are available in the same range of sizes and with the same material combinations as wheel-operated valves.

Except for the sliding stem and upper end design, they are the same, size for size, as the wheel-operated valves. As shown at the right, the upper end of the bonnet terminates in a flange (with machined face) which has an inner threaded opening. The flange can be drilled and tapped for a bolted connection or the threaded opening can be used for insertion of a screwed-in adapter, permitting a slip-on or threaded connection.

Valves Lined With Neoprene or Rubber

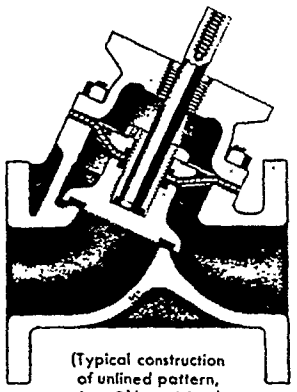


(Typical construction of sizes 2½ to 6-inch)

Lined valves (sizes ½ to 6-inch with flanged ends only) are furnished wheel-operated or with a sliding stem.

Except for the neoprene or hard rubber lining in the body and on the end flanges, and the neoprene or soft rubber coated disc, they feature the same design, size for size, as unlined valves.

Sliding Stem Valves



(Typical construction of unlined pattern, sizes 2½ to 6-inch)

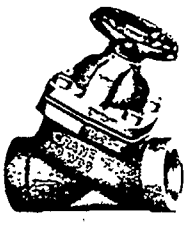
Sliding stem valves are especially designed for the application of hydraulic or pneumatic operators. They are made in the same range of sizes, with the same body ends, and with the same material combinations as unlined and lined wheel-operated valves . . . . and except for the sliding stem and upper end construction, are the same design, size for size.

Unlined valves .....pages 184 and 185
Lined valves . ...page 186
Sliding stem valves ....page 187
Dimensions . . . .page 188

663870

Packless Diaphragm Valves

Unlined — Wheel Operated



Screwed

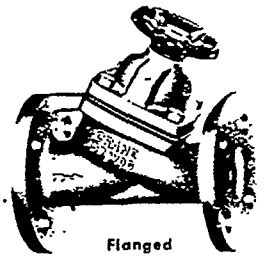
Bronze, Cast Iron, Aluminum, or 18-8 SMo Body

Sizes ½ to 2-inch. Available with Neoprene, Buna N, natural rubber, or Kel-F diaphragm and disc insert.

Working Pressures, Non-Shock

Valve Size	All Valves Except Those with Kel-F Diaphragm	Valves with Kel-F Diaphragm	No. 1650 and No. 1651 Valves	No. 1652 Valve Underwriters' Approved	
				Oxygen Service	Acetylene Service
Inches	Water, Oil, Air, or Gas 180 F Max.	Water, Oil, Air, or Gas 200 F Max.	Vacuum Service 180 F Max.	180 F Max.	180 F Max.
½ to 4	150 psi	150 psi	all	150 psi	15 psi
6	125 psi	125 psi	degrees	...	...
8	100 psi	...	...	...	...
10	80 psi	...	...	...	...
12	65 psi	...	...	...	...
14	50 psi	...	...	...	...

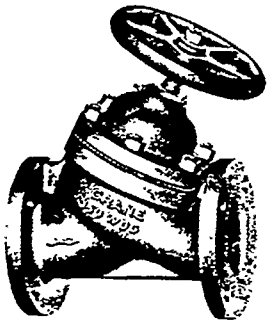
Air Tested



Flanged

Cast Iron, Aluminum, or 18-8 SMo Body

Sizes ½ to 14-inch with cast iron body; sizes ½ to 6-inch with other body metals. All are available with Neoprene, Buna N, natural rubber, or Kel-F diaphragm and disc insert.



2½-inch and larger valves have a rising, turning stem.

For additional description and sectional illustrations, see two preceding pages.

Catalog numbers and weights are listed in the table on the next page.

Recommendations: Crane unlined diaphragm valves are built for hard usage. Being packless, they are used on many services where ordinary valves may fail, or be only moderately effective, due to difficulties with stuffing box leakage. All parts exposed to line fluids are available in a choice of corrosion-resistant materials, making the valves suitable for an extensive list of corrosive services.

The selection of the proper materials combined with the "packless" design render these valves ideal for use on oil, compressed air, compressed and liquefied gases of many commercial kinds, natural and corrosive waters such as mine water, molasses, ammonia liquors, magnesium sulfate, alcohols, and a variety of other fluids.

Among unlined valves are those suitable for the following special services:

Sprinkler service . . . . use the No. 1610. It has been tested and approved for sprinkler service by the Underwriters' Laboratories, Inc., Chicago, and is marked "UL".

Vacuum service . . . . use the No. 1650 and 1651. They have been prepared for all degrees of vacuum (mercury).

No. 1650 and 1651 valves can be given a special mass spectrometer test.

Oxygen and acetylene service . . . . use the No. 1652. This valve, specially handled, has all working parts treated with a non-inflammable lubricant. It has been tested and approved for commercial oxygen and for acetylene service by the Underwriters' Laboratories, Inc., Chicago, and is marked "UL".

Limited space prohibits a complete listing of services for which Crane diaphragm valves are suitable. Specific advice and recommendations on the handling of many corrosive fluids will be furnished on request.

Construction: Valves 2-inch and smaller have a rising, non-turning, bronze stem operating in a bronze yoke sleeve. Guide lugs on the plunger above the diaphragm ride in recesses in the bonnet to keep the stem from turning.

Valves 2½-inch and larger have a rising, turning, bronze stem operating in a bronze bonnet bushing. The disc is held to the stem by a threaded bronze sleeve on the plunger, which allows the stem to rotate freely.

For complete description of construction, see the two preceding pages.

Materials: The body and disc holder are bronze (ASTM B62), cast iron (ASTM A126, Class A in sizes 6-inch and smaller and Class B in sizes 8-inch and larger), aluminum, or 18-8 SMO Alloy Cast Steel (ASTM A351, Grade CF-8M). These materials are described in Section 2.

Valves made of the foregoing materials are regularly furnished with a neoprene, Buna N, natural rubber, or Kel-F diaphragm and disc insert.

All valves have a cast iron bonnet and a malleable iron wheel. The plunger is bronze on sizes 1-inch and smaller, and cast iron on the larger sizes.

Special valves and linings: Diaphragm valves made of metals or with trim material other than listed can be made to order.

Complete details furnished on request

063571

Packless Diaphragm Valves

Unlined — Wheel Operated

Weights — Pounds, Each

Diaphragm and disc insert materials are indicated by the catalog number and suffix:
No suffix = Neoprene SB = Buna N RN = Natural Rubber KF = Kel-F

Valve Type	Size	With Bronze Body	With Cast Iron Body		With Aluminum Body		With 18-8 SMo Body		With Cast Iron Body For Special Services		
									Vacuum		Oxygen or Acetylene
	Inches	Screwed	Screwed	Flanged F & D	Screwed	Flanged F & D	Screwed	Flanged F & D	Screwed	Flanged F & D	Screwed
		Nos. 1600 1600-SB 1600-RN	Nos. 1610 1610-SB 1610-RN	Nos. 1611 1611-SB 1611-RN	Nos. 1620 1620-SB 1620-RN	Nos. 1621 1621-SB 1621-RN	Nos. 1630 1630-SB 1630-RN	Nos. 1631 1631-SB 1631-RN	No. 1650 — —	No. 1651 — —	No. 1652 — —
Unlined Valves Wheel-Operated	½	1.8	1.6	3.3	1.0	1.9	1.6	3.8	1.5	3.3	1.6
	¾	3.0	2.6	4.7	1.6	2.8	2.7	5.0	2.6	4.7	2.7
	1	5.2	4.6	7.1	2.6	5.0	4.7	8.3	4.5	7.2	4.6
	1¼	8.4	7.2	10.3	4.1	6.0	7.5	12.0	7.1	10.3	7.2
	1½	12.2	10.6	14.8	6.3	8.3	11.2	16.0	10.6	14.2	10.6
	2	21.3	19.2	24.8	10.8	14.0	19.4	28.0	18.9	25.0	19.0
	2½	...	...	38.6	...	21.0	...	43.0	...	39.0	...
	3	...	...	50.0	...	30.0	...	58.0	...	51.0	...
	4	...	...	80.0	...	48.0	...	97.0	...	87.0	...
	6	...	...	150.0	...	87.0	...	130.0	...	150.0	...
	8	...	...	290.0	...	...	...	...	...	...	...
	10	...	...	440.0	...	...	...	...	...	...	...
	12	...	...	616.0	...	...	...	...	...	...	...
	14	...	...	860.0	...	...	...	...	...	...	...
		No. 1600-KF	No. 1610-KF	No. 1611-KF	No. 1620-KF	No. 1621-KF	No. 1630-KF	No. 1631-KF	—	—	—
	½	1.8	1.6	3.3	1.0	1.9	1.6	3.8	...	...	...
	¾	3.0	2.6	4.7	1.6	2.8	2.7	5.0	...	...	...
	1	5.2	4.6	7.1	2.6	5.0	4.7	8.3	...	...	...
	1¼	8.4	7.2	10.3	4.1	6.0	7.5	12.0	...	...	...
	1½	12.2	10.6	14.8	6.3	8.3	11.2	16.0	...	...	...
	2	21.3	19.2	24.8	10.8	14.0	19.4	28.0	...	...	...
	2½	...	...	38.6	...	21.0	...	43.0	...	...	...
	3	...	...	50.0	...	30.0	...	58.0	...	...	...
	4	...	...	80.0	...	48.0	...	97.0	...	...	...
	6	...	...	150.0	...	87.0	...	130.0	...	...	...

Flange dimensions and facings: The dimensions and drilling of end flanges on valves 1-inch and larger conform to the American Cast Iron Flange Standard Class 125 (B16.1-1948). This Standard does not include sizes smaller than 1-inch.

End flanges of ½ and ¾-inch valves have the same diameter and drilling as 150-Pound American Standard Steel Flanges, but the thickness and facing are different.

Flanges are plain faced, with a smooth finish.

Face to face: Flanged valves 2-inch and larger conform to the American Standard, for Face-to-Face Dimensions (B16.10-1957) for 125-pound cast iron globe valves. This Standard does not include sizes smaller than 2-inch.

Facing and drilling: Flanged valves are regularly furnished faced and drilled (F & D). They can be furnished faced only, when specified.

Lined valves: Lined valves are illustrated and described on the next page.

Sliding stem valves: Sliding stem valves are available in the same types, sizes, and material combinations as wheel-operated valves. They can also be furnished with practically any type of power actuator, when specified. For complete details, see page 187.

Special valves: Diaphragm valves made of metals or with trim material other than listed can be made to order. Complete details will be furnished on request.

Additional description . . . pages 182 to 184

Prices on Request

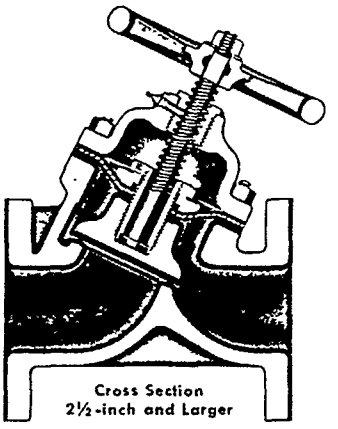
Dimensions . . . page 188

16

CRTX 1020

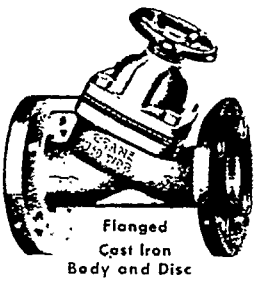
Packless Diaphragm Valves

Neoprene and Rubber Lined — Wheel Operated



Cross Section
2½-inch and Larger

Sizes 2½-inch and larger have a rising, turning stem as shown. Smaller sizes (see below) have a rising, non-turning stem.



Flanged
Cast Iron
Body and Disc

No. 1615, Wheel-Operated

The body is neoprene-lined and the disc is neoprene-coated. The diaphragm is neoprene.

No. 1615-RN, Wheel Operated

The body is hard natural rubber-lined and the disc is soft natural rubber-coated. The diaphragm is natural rubber.

Designed for corrosive services, and particularly for corrosive process fluids, sludges, and slurries

Working Pressures, Non-Shock

Sizes	Water, Oil, Air, or Gas
½ to 4-inch	150 psi, 180 F Max.
6-inch	125 psi, 180 F Max.

Air Tested

Weights in Pounds, Each

Sizes	Flanged, F & D	
	No. 1615	No. 1615-RN
Inches	Neoprene Lined	Rubber Lined
½	3.5	3.5
¾	5.0	5.0
1	7.6	7.6
1¼	10.8	10.8
1½	15.0	15.0
2	28.0	28.0
2½	40.0	40.0
3	52.0	52.0
4	85.0	85.0
6	155.0	155.0

Dimensions....page 188

In the selection of Crane Packless Diaphragm Valves, new wide application, particularly for corrosive services, is afforded by neoprene and rubber lined valves.

Recommendations: Lined valves are recommended for fluids corrosive to metals but non-active chemically upon neoprene or rubber. They offer excellent resistance to the action of many types of corrosive process fluids, to sandy waters, sludges, slurries, sewage, liquids with solids in suspension, etc. The neoprene-lined valves are particularly effective where abrasion is a destructive factor. The hard rubber lined valves, however, are not recommended for abrasive service, nor in services where they may be subjected to thermal shock, unusually severe stresses, or rough handling.

Lined body and coated disc: The body is made of cast iron conforming to ASTM Specification A 126, Class A. As shown in the cross section, the interior of the body is fully lined with neoprene or natural rubber. The lining extends over the end flange faces, and the exterior of the valve body may also be covered depending on the size, material, and process used. Instead of having a disc insert, as the unlined valves do, the entire outside surface of the disc is coated. Thus, all parts contacting fluid in the line are protected.

In all sizes the coating on the disc is substantially thicker than the lining to allow for the indentation that results from seating loads.

Construction: Lined valves except for their lined body and coated disc are the same, size for size, as the unlined pattern; for complete construction details, see pages 182 and 183

End flanges: The dimensions (excluding lining) and drilling of end flanges on valves 1-inch and larger conform to the American Cast Iron Flange Standard, Class 125 (B16.1-1948.) This Standard does not include sizes smaller than 1-inch.

End flanges of ½ and ¾-inch valves have the same diameter and drilling as 150-Pound American Standard Steel Flanges, but the thickness and facing are different.

End flanges in all sizes have a smooth finish.

Drilling: The valves are regularly furnished faced and drilled (F & D), they can be furnished faced only, when specified.

Larger sizes: Lined valves in sizes larger than listed, up to 14-inch can be furnished to order; information on request.

Special linings: Special body linings and disc coatings, such as Teflon (Du Pont polytetrafluoroethylene) can be furnished to order.

Sliding stem valves: Sliding stem lined valves (No. 5015 and No. 5015-RN) are available in the same sizes and material combinations as the wheel-operated valves. They can be furnished with practically any type of power actuator, when specified. For complete details see facing page.

Prices: Prices of all valves are furnished on request.

Additional description....pages 182 and 183

Packless Diaphragm Valves

Unlined or Lined—Sliding Stem

A complete line . . . . for hydraulic or pneumatic operation

Crane offers a complete selection of sliding stem packless diaphragm valves suitable for use with hydraulic or pneumatic operators. Except for stem and bonnet construction, the valves, size for size, are duplicates of . . . and feature the same construction as . . . the wheel-operated valves shown on pages 184 to 186.

They are available in the same range of sizes, in the same materials, and with the same diaphragms, discs, disc inserts, and linings.

As illustrated at the right, the upper end of the valve bonnet terminates in a flange (with machined face), which has an inner threaded opening. The flange can be drilled and tapped for a bolted connection, or the threaded opening can be used for the insertion of a screwed-in adapter permitting a slip-on or threaded connection. Thus, almost any make of hydraulic or pneumatic actuator can be readily mounted on these sliding stem valves.

Power actuators: Crane can supply these sliding stem diaphragm valves with air-operated actuators for simple open and close type service, and with air-operated actuators that are spring-loaded to close or spring-loaded to open in case of air supply failure.

Working Pressures, Non-Shock

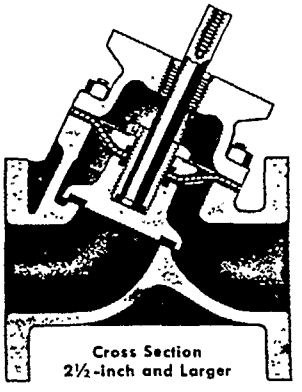
Valve Sizes	For Water, Oil, Air, or Gas	
	Valves with Other Than Kel-F Diaphragm	Valves with Kel-F Diaphragm
Inches	180 F Max.	200 F Max.
½ to 4	150 psi	150 psi
6	125 psi	125 psi
8	100 psi	. . .
10	80 psi	. . .
12	65 psi	. . .
14	50 psi	. . .

Air Tested

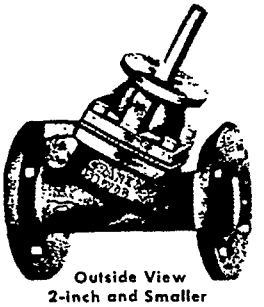
Inquiries should specify the quantity, size, valve catalog number, type of actuator, line pressure, and air-supply pressure. If a particular make of actuator is desired, the manufacturer's name should also be specified.

In addition, Crane sliding stem diaphragm valves are available through such manufacturers, with a wide choice of actuators for manual, automatic, or positioned-control service. Specify "Crane" on your next inquiry for packless diaphragm valves equipped with power operator and control mechanism.

Prices: Prices of valves, with or without actuators, will be furnished on request.



Cross Section
2½-Inch and Larger



Outside View
2-Inch and Smaller

These valves, except for the stem and bonnet construction, are the same as corresponding type wheel operated valves; for general description, see pages 182 and 183.

Types, Size Ranges, and Catalog Numbers

Body and Disc Holder Material	Valve Ends	Range of Sizes	Catalog Numbers of Unlined Valves				Catalog Numbers of Lined Valves	
			Diaphragm and Disc Insert Materials					
		Inches	Neoprene	Buna N	Natural Rubber	Kel-F	Neoprene Lining and Diaphragm	Rubber Lining and Diaphragm
Bronze	Screwed	½ to 2	No. 5600	No. 5600-SB	No. 5600-RN	No. 5600-KF	. . .	. . .
Cast Iron	Screwed	½ to 2	No. 5610	No. 5610-SB	No. 5610-RN	No. 5610-KF	. . .	. . .
	Flanged	½ to 14*	No. 5611	No. 5611-SB	No. 5611-RN	No. 5611-KF	No. 5615	No. 5615-RN
Aluminum	Screwed	½ to 2	No. 5620	No. 5620-SB	No. 5620-RN	No. 5620-KF	. . .	
	Flanged	½ to 6	No. 5621	No. 5621-SB	No. 5621-RN	No. 5621-KF	. . .	
18-8 SMo	Screwed	½ to 2	No. 5630	No. 5630-SB	No. 5630-RN	No. 5630-KF	. .	.
	Flanged	½ to 6	No. 5631	No. 5631-SB	No. 5631-RN	No. 5631-KF		

*Nos. 5611-KF, 5615, and 5615-RN are regularly made in sizes ½ to 6-inch.

Additional description . . . . pages 182 and 183
Wheel operated valves . . . . pages 184 to 186
Dimensions . . . . page 188
Weights . . . . . on request

Do you have a corrosion problem?

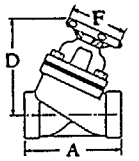
Behavior of metals and alloys in contact with corrosive fluids is often affected by factors which are not obvious. If your inquiry concerns a corrosion problem, Crane's "Corrosion Questionnaire" on page 202 may prove helpful.

CRTX 1022

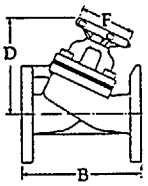
003974

Packless Diaphragm Valves
Dimensions, in Inches

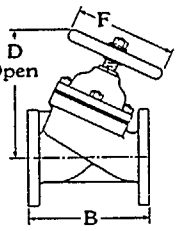
Unlined Valves



Screwed
All Sizes

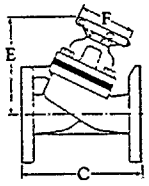


Flanged
½ to 2-inch

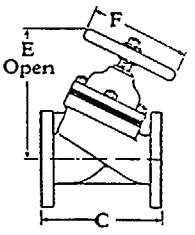


Flanged
2½-inch and larger

Lined Valves



Flanged
½ to 2-inch



Flanged
2½-inch and larger

Sliding stem valves have the same end to end (dimension A), face to face (dimensions B and C), and end flange dimensions as corresponding type wheel-operated valves.

Size	Unlined Valves Only			Lined Valves Only			Unlined or Lined Valves						
									End Flanges				
	A	B	D	C	E		F			Thickness			
	End to end	Face to face	Center to top	Face to face	Center to top	Thickness of lining	Dia. of wheel	Turns to open	Dia. of end flange	Without lining	With lining	Dia. of bolt circle	No. & dia. of bolts
½	3	4¼	3 5/16	4⅜	3⅜	1/16	2	1½	3½	⅜	7/16	2⅜	4-½
¾	3½	4½	3 15/16	4⅝	4	1/16	2¼	2	3⅞	13/32	15/32	2¾	4-½
1	4¼	5¼	4⅜	5⅜	4½	1/16	2¼	2¾	4¼	7/16	½	3⅛	4-½
1¼	5¼	5¾	5¼	5⅞	5⅜	1/16	3	3½	4⅝	½	9/16	3½	4-½
1½	6	6½	6⅛	6¾	6¼	⅛	4	3¾	5	9/16	11/16	3⅞	4-½
2	7	8	7¼	8¼	7⅜	⅛	5	3½	6	⅝	¾	4¾	4-⅝
2½	...	8½	9⅞	8¾	10	⅛	7	4¼	7	11/16	13/16	5½	4-⅝
3	...	9½	11⅜	9¾	11½	⅛	8	4	7½	¾	⅞	6	4-⅝
4	...	11½	13⅞	11¾	14	⅛	10	5¼	9	15/16	1 1/16	7½	8-⅝
6	...	14	17¼	14⅜	17½	3/16	14	7½	11	1	1 3/16	9½	8-¾
8	...	19½	21⅛	...	...	...	16	9½	13½	1⅛	...	11¾	8-¾
10	...	24½	25¼	...	...	...	20	11¼	16	1 3/16	...	14¼	12-⅞
12	...	27½	29	...	...	...	24	13	19	1¼	...	17	12-⅞
14	...	31	33⅝	...	...	...	30	15	21	1⅜	...	18¾	12-1

Flange dimensions and drilling: The dimensions (excluding lining) and drilling of end flanges on valves 1-inch and larger conform to the American Cast Iron Flange Standard, Class 125 (B16.1-1948). This Standard does not include sizes smaller than 1-inch.

End flanges of the ½ and ¾-inch valves have the same diameter and drilling as 150-Pound American Standard Steel Flanges, but the thickness and facing are different.

Flanges are plain faced, with a smooth finish.

Face to face dimensions: The face to face dimensions of unlined valves 2-inch and larger conform to the American Ferrous Flanged Valve Standard (B16.10-1957), for 125-Pound Cast Iron Globe Valves. This Standard does not include valves smaller than 2-inch.

The face to face of lined valves is slightly longer than that of the unlined due to the thickness of the lining. Lining thicknesses are indicated in the table.

Dimensions of sliding stem valves: End to end, face to face, and end flange dimensions apply to both wheel-operated and sliding stem valves. Other dimensions for sliding stem valves will be furnished on request.

General description.....pages 182 to 187
Ratings and recommendations....page 184

Catalog numbers of wheel-operated valves....pages 185 and 186
Catalog numbers of sliding stem valves.....page 187

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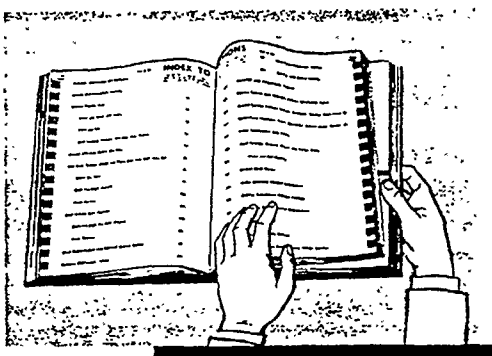
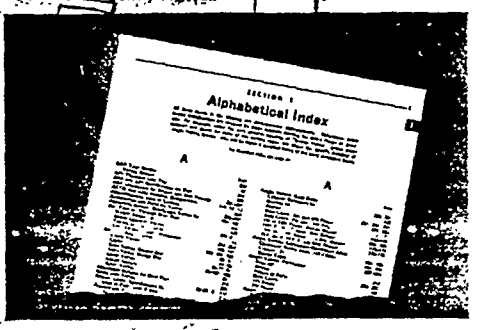
3 EASY WAYS TO FIND WHAT YOU WANT

THE CONDENSED SECTION INDEX on the inside pages of this colored paper insert—shows everything in the No. 60 Catalog, classified under condensed section headings and section numbers. The marginal section number markers—with the help of your thumb—take you to the section you want. There, on the first page is a concise table of contents for the section. This page also gives cross-references to semi-related equipment listed in other sections.

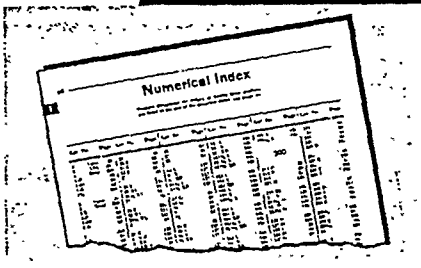
Regular users of the No. 60 Catalog—those more or less familiar with the Crane Line—will find the Section Index a real time-saver.



THE ALPHABETICAL INDEX—Starting on page 1 of section one—is perhaps the most complete and thoroughly cross-indexed listing of piping materials ever cataloged. This is the index to use if you're looking for something by name—if you need something new or unusual—or if you want to see all the varieties of one type of equipment available from Crane.

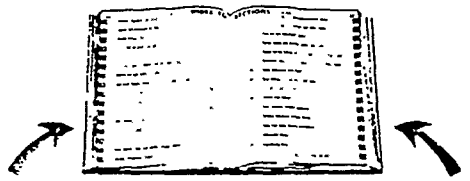


THE NUMERICAL INDEX—which immediately follows the alphabetical index in section one—is always popular with users who have learned to know Crane products by catalog number. Every product with a catalog number is listed here, giving the page number on which it's described. Storeroom and purchasing department personnel, specification and price checkers, etc., will also appreciate this index.



MANY OTHER PRACTICAL FEATURES OF THE CRANE CATALOG

Section Index in Center of Catalog



Commonly used Bronze, Iron and Steel Valves are Grouped in Front Part of Catalog.

Special Service Valves, Specialties, Fittings, Flanges, Piping and Engineering Data are Grouped in Back Part.

More Compact Cataloging—Less Turning of Pages
Items of Common Usage are Grouped Together
Standard Page Style Saves Needless Reading
Clear Cross-Section Cuts Appear Throughout
All Data is Concise—in Clear, Easy-to-Read Type
All Tables are Standardized for Convenient Use
Full Dimensional Data are Given with Drawings
Catalog Numbers are Prominently Shown
Handy Engineering Data Section Plus an All-New "Flow of Fluids" Section is Included.

SECTION NUMBER

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START ON PAGE

INDEX TO

If the item you are looking for does not readily fall into any of the classificati shown, you will find it in the compl

1 ..... **Indexes** (Alphabetical and Numerical) i

2 ..... **Metals and Materials;** Markings 1

3 ..... **Bronze Valves,** Gate 15

4 ..... Globe and Angle; AAR Valves 27

5 ..... Check and Foot 45

6 ..... Quick-Opening, Radiator, and Hose; Hose Threads 55

7 ..... **Bronze and Iron Cocks;** Gas Stops 63

8 ..... **Iron Body Valves,** Wedge and Clamp Gate; Pulp Stock; Alloy Iron 69

9 ..... Double Disc Gate 89

10 ..... Globe and Angle; Butterfly 97

11 ..... Check and Foot 105

12 ..... **Steel Valves,** Gate; Pipe-Line 115

13 ..... Globe and Angle; Bar Stock; Chlorine 135

14 ..... Check; Pipe-Line 151

15 ..... **Steel Pressure-Seal and Lip-Seal Bonnet Valves** 161

16 ..... **Packless Diaphragm Valves** 181

SECTIONS

Alphabetical Index in Section One. If you know the catalog number of the product, refer to the Numerical Index, Section One.

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START ON PAGE		SECTION NUMBER
189	**Corrosion-Resistant Valves**	17
203	**Safety and Relief Valves**	18
217	**Blow-Off and Stop-Check Valves**	19
227	**Marine Valves and Fittings;** Military Specification Valves	20
237	**Special Service Valves;** Nuclear; Cryogenic; Vacuum; Water Flood; Etc.	21
245	**Specialties;** Regulators; Traps; Separators; Exhaust Heads; Gauges; Etc.	22
259	**Valve Accessories and Parts**	23
285	**Steel Fittings,** Screwed; Unions and Flange Unions	24
293	Socket and Butt-Welding	25
307	**Forged Steel Flanges**	26
315	**Bolts; Gaskets; Thread Lubricants**	27
325	**Drilling Templates; Flange Facings**	28
337	**Pipe; Pipe Data; Thread Information**	29
355	**Fabricated Piping**	30
381	**Engineering Data,** General	31
421	Flow of Fluids Through Valves, Fittings, and Pipe	32

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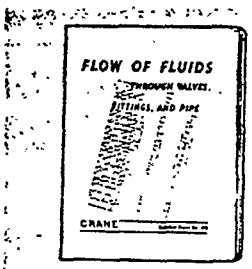
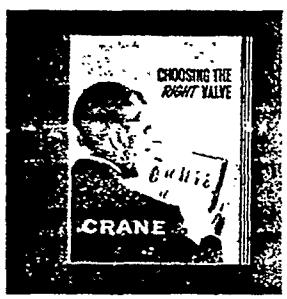
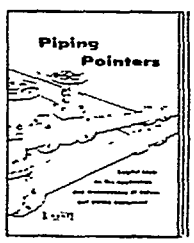
HELPFUL LITERATURE FOR USERS AND SPECIFIERS OF VALVES AND PIPING



"FLOW OF FLUIDS THROUGH VALVES, FITTINGS, AND PIPE"
One of the most popular Crane Technical Papers—A 128-page handbook on the theory of flow, with formulas and procedures for solving flow control problems. Contains an abundance of data, presented in chart form for quick graphical calculation with a minimum of reading matter. Deals with flow of steam, water, oil, liquids other than water, air, gases, and vapors. Technical Paper No. 410
Price $2.00 each.



"CHOOSING THE RIGHT VALVE"
20-page fully illustrated handbook of basic data on valve design and operating characteristics, with notations on adaptability to specific service needs under given working conditions. Ideal refresher and authoritative reference for specifiers and buyers. (Motion picture on this subject also available for showing in your plant.) Circular ADB-1016.



"PIPING POINTERS"
A refresher for veterans, a basic for trainees, this 32-page handbook tells all about piping system installation and maintenance. Contains helpful hints on valve maintenance to lengthen the life of any valve. (Motion picture on this subject also available for use in your plant training program). Circ. ADB-1017.

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SECTION 17

17

Crane Corrosion-Resistant Valves

18-8 SMo Alloy Valves

Gate, Non-Rising Stem.....page 190
Gate, Outside Screw and Yoke, Plug Type.....page 191
Gate, Outside Screw and Yoke, Split-Wedge Type..pages 192 and 193
Globe, Union Bonnet.....page 190
Globe, Outside Screw and Yoke.....pages 194 and 195
Globe, Bar Stock.....page 196
Angle.....pages 194 and 195
Swing Check.....page 197
Safety-Relief.....page 198

Craneloy 20 Alloy Valves

Gate.....pages 192 and 193
Globe.....pages 194 and 195
Angle.....pages 194 and 195
Swing Check.....page 197

***Other Corrosion-Resistant Valves**

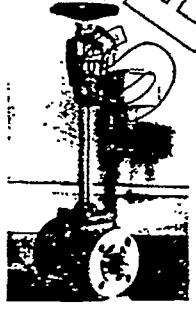
Packless Diaphragm Valves.....page 196
All-Iron Valves.....page 199
Pulp-Stock.....page 199
Gate, 3% Nickel Cast Iron.....page 200
Gate, Ni-Resist Cast Iron.....page 200
Gate, Nodular Cast Iron.....page 200
Gate, Steel, Monel Trimmed.....page 201
Globe, Steel, Monel Trimmed.....page 201

18-8 SMo Liquid Level Gauge.....page 198

Corrosion Questionnaire.....page 202

*Please note the valves listed under "Other Corrosion-Resistant Valves" are described but briefly in this section . . . . and that their description in this section includes references to other pages in the catalog where the product is described in detail, complete with illustrations, ratings, sizes, dimensions, and weights.

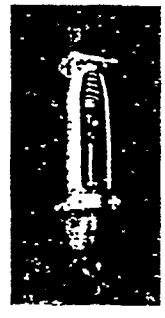
SEE CATALOG VG-1500



Stainless steel extended bonnet globe . . . . Teflon packed and Kel-F disc . . . . for cryogenic service.

Crane Valves for Special and Unusual Services

Supplementing Crane's regular lines of high pressure-temperature steel valves, corrosion-resistant valves, etc., are special valves designed for even tougher services, such as . . . . nuclear applications . . . . extreme pressures and temperatures . . . . extreme vacuum . . . . cryogenic service . . . . water flooding service, etc. For illustrations and description, refer to Crane's Special Service Valve Section 21, pages 237 to 244.



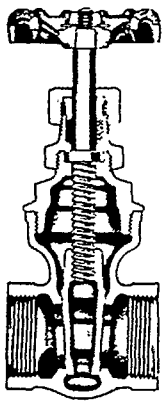
Stainless steel cylinder operated Y-pattern globe for liquid oxygen service as low as 297 F.

17

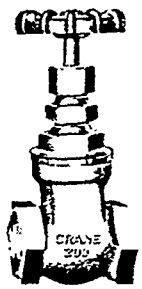
18-8 SMo Gate and Globe Valves

Gate

Wedge Disc
Non-Rising Stem



Cross Section
18-8 SMo Gate



No. 18840
Gate, Screwed
18-8 SMo Alloy Steel

Working Pressure
(Liquid or Gas, Non-Shock)
200 psi, 350 F max. temp.

Small size gates and globes for dependable low-cost operation in corrosive services.

These 18-8 SMo Alloy Steel Gate and Globe Valves are carefully designed and assembled to assure efficient operation and long life in a variety of corrosive services. The valves are ruggedly constructed throughout. Metal sections are more than ample.

Material: In both the gate and globe valves, all parts coming into contact with the fluid in the line are made of Crane 18-8 SMo Alloy Steel.

Crane 18-8 SMo is a high grade alloy steel equivalent to AISI Type 316 wrought stainless steel; it offers excellent resistance to many forms of corrosive action and conforms to ASTM A 351, Grade CF-8M.

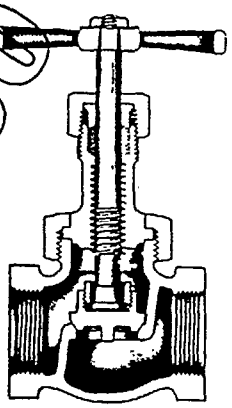
Gate valves: The No. 18840 Gate Valves are the non-rising stem, wedge disc type. They have a screwed bonnet. The body seats are cast as part of the body and are carefully and accurately machined to match the seating surfaces of the disc. All sizes are provided with a machined backseat.

Globe valves: The No. 18801 is a union bonnet type globe valve. The union bonnet construction utilizes a union ring which reinforces the bonnet joint and facilitates dismantling and reassembling without danger of injuring the valve. All sizes are provided with a machined backseat.

In sizes ¾-inch and larger, the disc swivels on the stem, as shown in the cross section at the right. The disc and stem are attached by means of a disc stem ring screwed tightly into the disc; the ring will not loosen in service. In the ½-inch size, the disc is integral with the stem. In both constructions, seating is quick and accurate, and the disc is well guided.

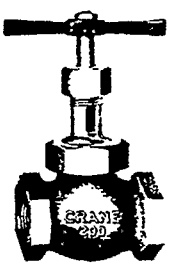
Globe

Union Bonnet



Cross Section
18-8 SMo Globe

Globe valves ¾-inch and larger have a swivel type disc and a disc stem ring, as shown above; in the ½-inch size, the disc and stem are integral.



No. 18801
Globe, Screwed
18-8 SMo Alloy Steel

Stuffing box and gland: The stuffing box in these valves is amply deep to assure pressure-tightness. It is filled with high grade Teflon packing and is equipped with a gland.

Wheel or handle: The gate valves are equipped with a Style F wheel. The globe valves have a Style X cross handle. For description, see page 278.

*¼ and ⅜-inch globes: When globe valves smaller than ½-inch are required, use the Crane 18-8 SMo bar stock valves shown on page 190.

Weights and Dimensions (Inches) — Prices on Request

Size	No. 18840 Gate, Screwed				No. 18801 Globe, Screwed			
In	Weight Pounds Each	End to end	Center to top	Diameter of wheel	Weight Pounds Each	End to end	Center to top of stem, open	Distance across handle
¼	.8	1⅞	3¾	1¾	*	...	...	...
⅜	.8	1 15/16	3¾	1¾	*	...	...	...
½	1.0	2⅛	4 1/16	2 1/16	1.3	2¼	4 3/16	3¾
¾	1.7	2⅜	4 11/16	2 9/16	2.0	2¾	5	3¾
1	2.8	2 13/16	5⅝	2¾	3.0	3 5/16	5⅝	4¾
1¼	3.5	3 3/16	6 7/16	3 1/16	4.5	3⅞	6½	4¾
1½	5.5	3 7/16	7¼	3⅝	6.5	4½	7 7/16	6
2	8.0	3⅞	8¾	4 1/16	10.0	5¼	8¼	7

Description of materials....Section 2

CRANE 1500

18-8 SMo Plug Gate Valves

Working Pressures (Liquid or Gas, Non-Shock)	Hydrostatic Test Pressures
150 psi.....500 F max. temp.	Shell — 300 psi
230 psi.....100 F max. temp.	Seat — 275 psi

For Unrestricted Flow! For Throttling!

In some services, particularly on discharge lines in the handling of fluids where constant speed pumps are used, a conventional gate valve when wide open offers minimum resistance to flow but, when used for throttling, is subjected to rapid wear. A globe valve in the same service, while suited for throttling, introduces high resistance to flow even when wide open, consequently reducing the maximum capacity of the pumps.

Crane Plug Gate Valves are ideal for unrestricted flow or throttling. They are excellent for two-way flow; either end serves as the inlet.

Materials: Crane 18-8 SMo Alloy Steel, used for the body, bonnet, disc, stem, disc-stem plug, and gland, is the casting equivalent of AISI Type 316 wrought stainless steel and conforms to requirements of ASTM A 351, Grade CF-8M.

The yoke bushing is made of Cast Manganese Bronze and the bonnet gasket is Cranite.

Body: These are outside screw and yoke valves. The stem threads, being on the outside of the valve, can be lubricated easily and are not exposed to corrosion or sediment in the line. The body features straight-through ports, circular in shape and full in area. When the valve is wide open, the disc is entirely clear of the seat opening, providing a clear, unobstructed passageway through the valve. Curved seat-faces, cast as part of the body, are accurately machined to match the curved surface of the disc.

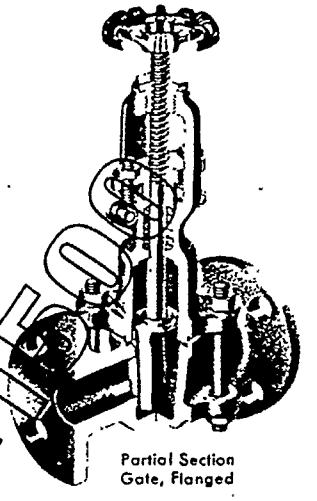
Bolted bonnet: The one-piece yoke and bonnet assures strength and stiffness. The bonnet is bolted to a flange at the bottom of the valve body by four stud bolts spaced so as to provide compactness and uniform pressure on the gasket.

Tapered plug disc: The disc, a tapered plug riding loosely on the stem end, is held in place by a collar on the stem and by a threaded plug screwed into the bottom of the disc. The connection is strong and provides accurate seating. The disc will not fall off the stem in service, even if the disc-stem plug should accidentally loosen.

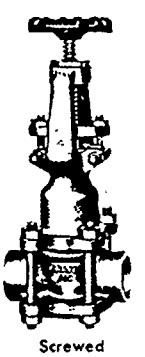
The curved surface of the disc seats against two curved faces in the body when the valve is closed. Two sides of the disc are flat, permitting the disc to fit between similarly shaped faces on the inside of the bonnet. The disc rises into the bonnet, but the flat faces keep it from turning. Even wear on the seating surfaces during operation, and freedom from foreign matter when the valve is closed, assure long-time seat tightness.

Seats: Seats are cast integral with the body. All valves are provided with a machined backseat.

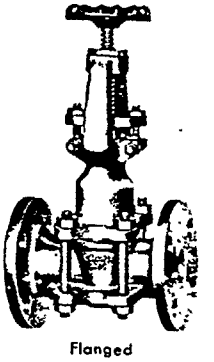
Stuffing box: The stuffing box is large, deep, and is filled with high grade packing. The one-piece bolted gland, pulled up by means of two eye-bolts hinged to the bonnet, maintains an even pressure on the packing. The yoke is designed with liberal space above and around the gland.



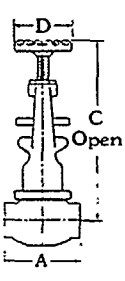
Partial Section Gate, Flanged

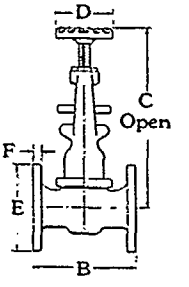


Screwed
No. 18850
18-8 SMo Alloy



Flanged
No. 18851
18-8 SMo Alloy





Weights and Dimensions — Prices on Request

Size	Pounds, Each		Dimensions, in Inches					
	No. 18850	No. 18851					End Flanges	
Inches	Screwed	Flanged F & D	A	B	C	D	E	F
½	3.3	5.5	3	4¼	7⅛	2⁹⁄₁₆	3½	⅜
¾	4.0	6.8	3¼	4⅝	8	2⁹⁄₁₆	3⅞	¹³⁄₃₂
1	6.0	10.0	3¾	5	9⅝	2¾	4¼	⁷⁄₁₆
1¼	9.0	13.0	4¼	5½	10¾	3¹⁄₁₆	4⅝	½
1½	14.5	22.0	4¾	6½	12¾	3⅝	5	⁹⁄₁₆
2	21.5	30.0	5½	7	15	4¹⁄₁₆	6	⅝

Description of materials....Section 2

Templates for drilling....page 326

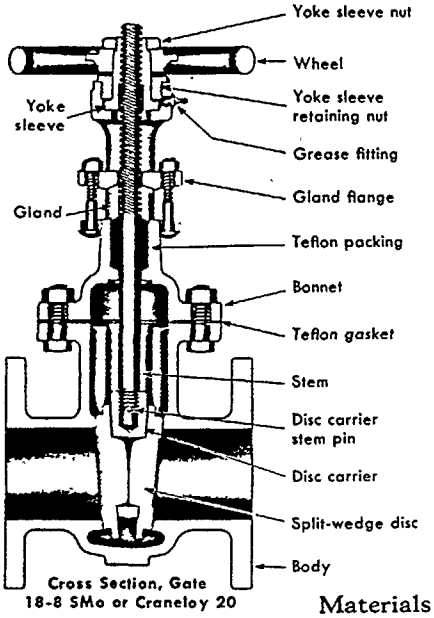
Flanged valves: Face to face, flange dimensions, and drilling conform to the MSS 150-Pound Corrosion Resistant Cast Flanged Valve Standard, No. SP-42-1957. Flanges are plain faced, with a serrated finish

The valves are furnished faced and drilled unless "faced only" is specified. Full face gaskets should be used, see page 321.

CRANE CO.

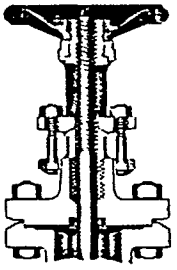
17

18-8 SMo and Craneloy 20
Split-Wedge Gate Valves

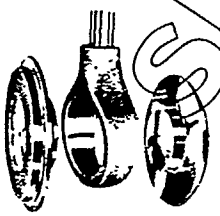


Cross Section, Gate
18-8 SMo or Craneloy 20

Section above is typical of sizes 2½-inch and larger; smaller sizes, with minor modifications, are similar.



Valves 2-inch and smaller have a dished design, Style A wheel and the body-bonnet joint is the male and female type with retained gasket.



New split-wedge disc design.... patent pending....combines the benefits of free rotation with uniform seat load pressure.

For added description, weights, and dimensions, see facing page

Working Pressures (Liquid or Gas, Non-Shock)	Hydrostatic Test Pressures
150 psi....500 F max. temp.	Shell — 300 psi
230 psi....100 F max. temp.	Seat — 275 psi

Improved "free-to-rotate" split-wedge disc design assures tight, uniform seating . . . longer valve life . . . . . dependability in corrosive services

This outstanding line of 18-8 SMo and Craneloy 20 Gate Valves offers chemical and process industries top performance, with greater economies in a host of corrosive services. The valves, alike except for materials, feature many advantages, such as, preferred outside screw and yoke construction . . . . . rugged bolted bonnet for strength and rigidity . . . . . smoothly proportioned internal areas for full flow with minimum turbulence . . . . and most important, Crane's split-wedge disc design which combines the benefits of free rotation with uniform seat load pressure, eliminating the potential weaknesses of ordinary split-wedge gate valves used in corrosive services.

Materials: All parts of these valves in contact with the fluid in the line, including the body, bonnet, disc, disc carrier, stem, and gland, are made of Crane 18-8 SMo Alloy Steel in the No. 18844 and No. 18845 Valves and of Craneloy 20 Alloy Steel in the No. 20044 and No. 20045 Valves.

Crane 18-8 SMo, a high grade material equivalent to AISI Type 316 wrought stainless steel, offers excellent resistance to the corrosive action of many fluids; it conforms to requirements of ASTM A 351, Grade CF-8M. Craneloy 20 is a high-nickel, high-chromium stainless steel having exceptional resistance to a wide range of sulfuric acid concentrations at elevated temperatures; in addition, its high chromium content insures good resistance to oxidizing media.

The valves have a yoke sleeve made of Crane Cast Manganese Bronze, a material offering good bearing qualities and excellent resistance to wear. The gland flange and the bolts and nuts for the bonnet and gland are stainless steel. The stuffing box packing and bonnet gasket are Teflon.

Split-wedge disc: The outstanding efficiency of these valves is due principally to Crane's unique split-wedge disc design. The Crane design features two identical disc halves, each perfectly circular in shape and each having a convex-surfaced trunnion or boss at the back.

The discs are carried back-to-back in a disc carrier with the convex surface of the trunnions bearing against each other. The disc carrier, in turn, is screwed and rigidly pinned to the stem. The discs are free to rotate within the carrier, but they are also well guided by the protruding flange on each disc which bears in a matching slot in the body.

In the closing operation, the downward thrust of the stem transmits equal pressure to both discs through contact between the carrier and the angular surface on the outer periphery of the disc trunnions. When the lower portions of the disc halves contact the seats, the downward movement ceases, and the disc halves are then forced outward against the seats effecting a tight seal along the entire seating surface.

Since the closing forces are uniformly distributed over both discs, and since both discs are of ample, identical strength, there is no danger of buckling a weaker disc member, as in conventional ball and socket construction.

In the opening operation, the first upward movement of the stem and carrier frees the discs from the seats.

The valves are exceptionally easy to operate under all conditions. The freedom of movement of the discs plus the uniform seating and unseating pressure reduce seat wear and prevent galling of the seating surfaces.

SELECTION GUIDE

18-8 SMo and Craneloy 20
Split-Wedge Gate Valves

(continued from the preceding page)

Construction: The outside screw and yoke design is ideal for chemical and process industries. Stem threads are on the outside of the valve, free of damage by corrosion and sediment from fluid in the line; stem thread lubrication is simplified and the rising stem effectively indicates the position of the disc.

Body: The body is rugged and well proportioned throughout; internal areas are designed to minimize turbulence.

Bolted bonnet: The yoke in valves 8-inch and smaller is cast integral with the bonnet. In larger sizes, the yoke consists of two halves bolted together at the top, and also to the bonnet.

The bolted bonnet provides a rugged, secure joint, yet it can be easily dismantled and reassembled without danger of damaging the valve. The body-bonnet joint is equipped with a Teflon gasket and has four or more through bolts depending on the size of the valve.

Sizes ½ to 2-inch have a male and female bonnet joint, with a retained gasket; larger sizes have an oval bonnet with a flat-faced flange.

Ball-type gland: All valves have a two-piece, ball-type gland and gland flange. The gland and gland flange exert an even pressure on the packing and prevent binding on the stem even if gland bolts are drawn up unevenly.

Stem: The stem, of liberal diameter, is unusually strong. Threads are clean, accurately cut, and have a long engagement with the yoke sleeve.

Seats: Body seats, cast integral with the body, are carefully machined to match the seating surfaces of the discs. All valves have a machined backseat.

Stuffing box: The stuffing box is filled with high grade Teflon packing and is unusually large and deep to assure pressure-tightness.

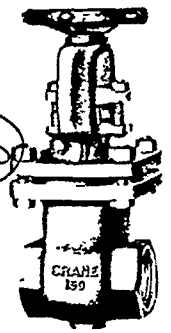
Bosses: Valves 1½-inch and larger are provided with a boss at the bottom of the body which will be tapped and fitted with a plug for a drain or flushing connection, when specified.

Lubricating fitting: In valves 2½ to 8-inch, the bonnet yoke is equipped with a lubricating fitting to permit easy lubrication of the yoke sleeve; in sizes 2½ to 12-inch, the yoke sleeve may be removed and replaced without dismantling the valve itself.

Wheel: Valve wheels, made of tough malleable iron, provide a sure, easy grip. Sizes 2-inch and smaller are equipped with a Style A dished design wheel having small, rounded gripping knobs; larger sizes have a rugged Style E wheel.

Flanged valves: The face to face and end flange dimensions of flanged valves conform to the MSS 150-Pound Corrosion Resistant Cast Flanged Valve Standard, No. SP-42-1957. End flanges are plain faced, with a serrated finish.

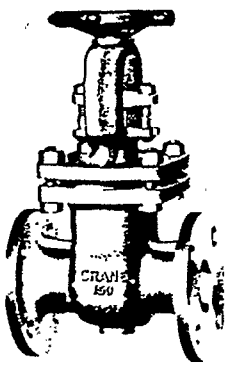
Drilling: Flanged valves are regularly faced and drilled to the MSS 150-Pound Corrosion Resistant Standard; they can be furnished faced only, when specified. Use full face gaskets; see page 321.



Outside Screw and Yoke Screwed

No. 18844
18-8 SMo Alloy

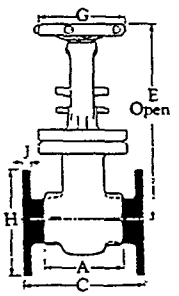
No. 20044
Craneloy 20 Alloy



Outside Screw and Yoke Flanged

No. 18845
18-8 SMo Alloy

No. 20045
Craneloy 20 Alloy



Screwed or Flanged Valve Dimensions

For drilling templates, see page 326.

For description of materials, see Section 2.

Weights and Dimensions — Prices on Request

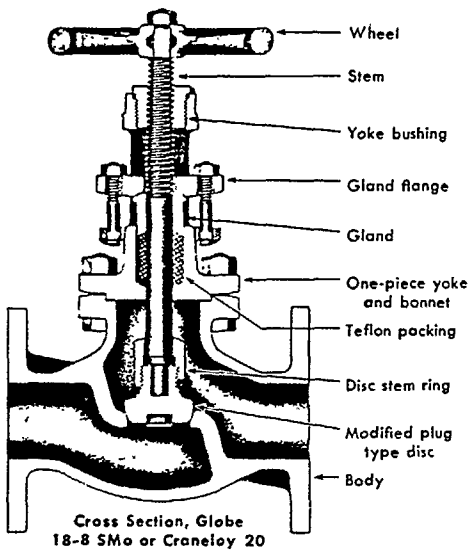
Size	Pounds Each				Dimensions, in Inches					
	Screwed		Flanged, F & D						End Flanges	
	No. 18844	No. 20044	No. 18845	No. 20045	A	C	E	G	H	J
Inches	18-8 SMo	Craneloy 20	18-8 SMo	Craneloy 20						
½	4.5	4.5	6.7	6.7	2⅝	4¼	6½	3	3½	⅜
¾	5.7	5.7	8.5	8.5	2⅞	4⅝	7½	3½	3⅞	13/32
1	8.0	8.0	11.6	11.6	3¼	5	9	4	4¼	7/16
1¼	11.5	11.5	15.5	15.5	4	5½	9¾	4	4⅝	½
1½	17.5	17.5	23.0	23.0	4¼	6½	12	5	5	9/16
2	24.0	24.0	33.0	33.0	4½	7	13½	5	6	⅝
2½	...	...	46.0	46.0	...	7½	15½	7	7	⅝
3	...	...	60.0	60.0	...	8	18	8	7½	⅝
4	...	...	90.0	90.0	...	9	23	9	9	11/16
6			165.0	165.0		10½	31¼	10	11	13/16
8			280.0	280.0		11½	38⅞	12	13½	15/16
10			445.0	445.0		13	48¼	14	16	1
12			660.0	660.0		14	57¾	16	19	1 1/16

CLEVELAND 1500

17

18-8 SMo and Craneloy 20
Globe and Angle Valves

003984



Cross Section, Globe 18-8 SMo or Craneloy 20

For added description, weights and dimensions, see facing page.

Working Pressures (Liquid or Gas, Non-Shock)	Hydrostatic Test Pressures
150 psi....500 F max. temp.	Shell — 300 psi
230 psi....100 F max. temp.	Seat — 275 psi

A new line . . . featuring Crane's modified plug type disc and an improved disc-stem connection . . . for better control of process fluids.

These new alloy globe and angle valves are especially useful in chemical and process industries. Their modified plug type disc design for easy, positive seating with better resistance to erosion combined with their improved disc-stem construction for accurate disc guidance and better control of seating loads assure long valve life and superior handling of process fluids.



Improved disc-stem connection

The valves are available in 18-8 SMo or Craneloy 20 Alloy Steels and, except for materials, are alike. They feature many advantages, such as, high quality materials throughout . . . . preferred outside screw and yoke construction . . . . rugged bolted bonnet for strength and rigidity . . . . and smoothly proportioned internal areas for full flow with minimum turbulence.

Materials: In the 18-8 SMo Valves, all parts in contact with the fluid in the line, including the body, one-piece bonnet and yoke, disc, stem, disc stem ring, and gland, are made of Crane 18-8 SMo Alloy Steel. In the Craneloy Valves, these parts are made of Craneloy 20 Alloy Steel.

Crane 18-8 SMo Alloy Steel, a high grade material equivalent to AISI Type 316 wrought stainless steel, offers excellent resistance to the corrosive action of many fluids; it conforms to requirements of ASTM A 351, Grade CF-8M.

Craneloy 20 is a high-nickel, high-chromium stainless steel having excellent resistance to a wide range of sulfuric acid concentrations at elevated temperatures; in addition, its high chromium content assures good resistance to oxidizing media.

All valves have a yoke bushing made of Crane Cast Manganese Bronze, a material having good bearing properties and excellent resistance to wear. The gland flanges, and the bolts and nuts for the bonnet and gland, are stainless steel.

Construction: The valves are the bolted bonnet, outside screw and yoke type. Stem threads are on the outside of the valve, free of damage by corrosion and sediment from the fluid in the line; stem thread lubrication is simplified and the rising stem effectively indicates the position of the disc.

Body: The valve body is rugged and well proportioned throughout; its smooth contours minimize turbulence and assure a more uniform flow.

Bolted bonnet: The yoke and bonnet are cast in one piece to assure maximum strength and rigidity. The bonnet joint is the retained gasket, male and female type; it provides a strong, secure joint, yet it can be easily dismantled and reassembled without danger of injuring the valve.

The body-bonnet joint is equipped with a Teflon gasket, and four or more through-bolts, depending on the valve size.

Disc and stem assembly: Crane's modified plug type disc design provides easy, positive seating and offers excellent resistance to erosion.

All valves feature an improved swivel disc-stem connection, as illustrated in the partial section at the upper right. The new design holds all clearances to a minimum and places the seating load closer to the actual seating surface of the valve.

In assembly, the disc stem ring is screwed down hand tight, axially forming a continuous metal-to-metal contact between the disc and stem. The disc stem ring is then locked to the disc by a tack weld. The stem, of liberal diameter with clean, accurately cut threads, is fully guided by a yoke bushing and by engagement with the lower end of the bonnet.

Minimum radial clearance, the long vertical fit between the pilot end of the stem and the bore in the disc, and no axial clearance produce maximum rigidity while still permitting the disc to swivel. Chattering of the disc under high velocities is eliminated and wear is greatly reduced.

OBSOLETE

18-8 SMo and Craneloy 20
Globe and Angle Valves

(continued from the preceding page)

Seats: Body seats, cast as part of the body, are accurately machined to match the seating surface of the disc. All valves are provided with a machined backseat.

Stuffing box: The stuffing box is filled with high grade Teflon packing and is unusually large and deep to assure pressure-tightness.

Ball-type gland: All valves are furnished with a two-piece ball-type gland and gland flange. The gland and gland flange exert an even pressure on the packing and prevent binding the stem even if the gland bolts are drawn up unevenly.

Wheel: The valve wheel is made of tough malleable iron. Sizes 2½-inch and larger have a rugged Style D wheel as shown in the illustrations; smaller sizes are equipped with a Style A dished design wheel having small, rounded gripping knobs.

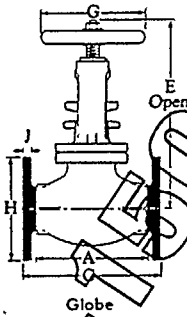
Standard: The center to face and end flange dimensions of flanged valves conform to the MSS 150-Pound Corrosion Resistant Cast Flanged Valve Standard, No. SP-42-1957.

Flange facing: End flanges are regularly furnished plain faced, with a serrated finish.

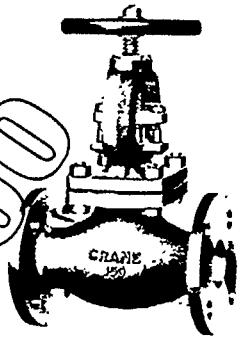
Drilling: Flanged valves are regularly furnished faced and drilled to the MSS 150-Pound Corrosion Resistant Standard; they can be furnished faced only, when specified. Full face gaskets should be used; see page 321.



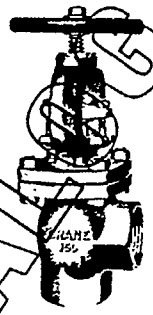
Globe, Screwed
No. 18810
18-8 SMo Alloy
No. 20010
Craneloy 20 Alloy



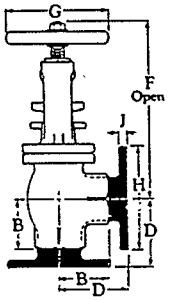
Globe
Screwed or Flanged



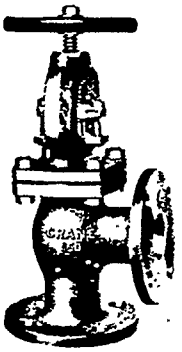
Globe, Flanged
No. 18811
18-8 SMo Alloy
No. 20011
Craneloy 20 Alloy



Angle, Screwed
No. 18812
18-8 SMo Alloy
No. 20012
Craneloy 20 Alloy



Angle
Screwed or Flanged



Angle, Flanged
No. 18813
18-8 SMo Alloy
No. 20013
Craneloy 20 Alloy

CRANE CATALOG VC-1500

Weights and Dimensions — Prices on Request

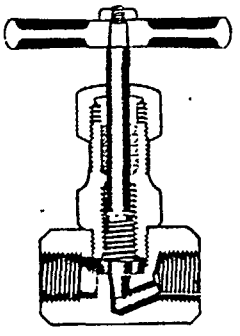
Size	Pounds, Each				Dimensions, in Inches								
	Screwed		Flanged, F & D									End Flanges	
	Nos. 18810 20010	Nos. 18812 20012	Nos. 18811 20011	Nos. 18813 20013	A	B	C	D	E	F	G	H	J
Inches	Globe	Angle	Globe	Angle									
½	4.5	4.5	6.0	6.0	3⅜	1 9/16	4¼	2¼	6½	6½	3	3½	⅜
¾	6.0	6.0	8.0	8.0	3¾	1¾	4⅝	2½	7¼	7	3½	3⅞	13/32
1	7.0	7.0	10.0	10.0	4¼	1⅞	5	2¾	7¾	7¼	3½	4¼	7/16
1¼	11.5	11.5	15.0	15.0	5	2¼	5½	3	9½	9¼	4	4⅝	½
1½	14.5	14.5	19.5	19.5	5½	2½	6½	3¼	10	9½	5	5	9/16
2	22.0	22.0	30.0	30.0	6½	2⅞	8	4	11¼	10¾	6	6	⅝
2½	..	..	46.0	46.0	..	..	8½	4¼	13½	12¾	8	7	⅝
3			65.0	65.0			9½	4¾	14¼	13¾	9	7½	⅝
4			95.0	95.0			11½	5¾	15¼	14¼	10	9	11/16
6			170.0	170.0			16	8	19½	18½	12	11	13/16

Templates for drilling....page 326 *Materials....Section 2*

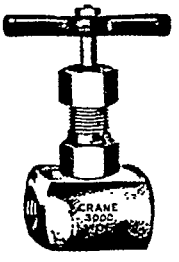
17

18-8 SMo Bar Stock Globe Valves

For High Pressures



Cross Section



No. 222 SS
Globe, 18-8 SMo
Female Ends, Screwed
(prices on request)

Working Pressure
3000 psi non-shock cold water, oil, or gas
Air Tested

Recommendations: These small rugged valves are excellently used on orifice meters, regulator leads, gauges, bypasses, and many similar services. They are especially suited for oil containing hydrogen sulphide and sulphur dioxide when moisture is apt to be present.

The valves are a companion line to the steel and Exelloy bar stock globe and angle valves described on page 136.

Construction: The body and bonnet are made from solid bar stock. The thread chambers are extra long. The plug type disc offers exceptional resistance to wear and to foreign matter, and permits accurate flow regulation. The disc is integral with the stem. The tee handle, made of malleable iron provides quick, easy operation.

The stuffing box is deep and is filled with high grade packing. The valves, when wide open, can be repacked while under pressure.

Materials: The body, bonnet, packing nut, gland, and stem are Crane 18-8 SMo, an alloy steel containing approximately 18 to 21 per cent chromium, 9 to 12 per cent nickel, and 2 to 3 per cent molybdenum. It offers fine resistance to many forms of corrosive action.

Identification: The valve body includes the marking "STEEL-F8".

Weights and Dimensions

Size In.	No. 222 SS Pounds Each	Dimensions, in Inches: Center to end	Center to top, open	Length of tee handle	Dia. of seat opening
1/8	.7	31/32	3 1/2	.2 9/16	3/16
1/4	.7	31/32	3 1/2	2 9/16	3/16
3/8	1.1	1 3/32	4	2 9/16	1/4
1/2	1.7	1 1/4	4 7/8	3 9/16	5/16
3/4	4.1	1 5/8	6 3/8	4 3/4	7/16
1	8.0	2 1/8	7 5/8	4 3/4	9/16

Steel and Exelloy bar stock valves....page 136

SUPERSEDED
CATALOG ITEM

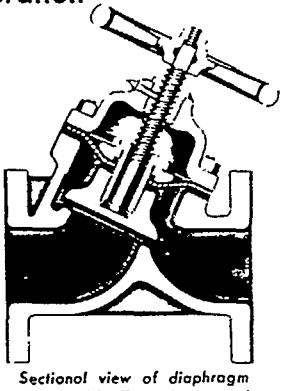
Packless Diaphragm Valves

Unlined or Lined — Wheel or Sliding Stem Operation

Recommended for a variety of corrosive services

Diaphragm valves . . . . in a wide choice of linings or body and disc insert materials . . . . sizes up to 14-inch . . . . for a complete description of the entire Crane line, see Section 16.

Crane Y-Pattern Packless Diaphragm Valves, built for hard usage, are excellent for a wide variety of corrosive, as well as ordinary, services. The flexible diaphragm mounted between the body and bonnet (eliminates the need for a stuffing box) and the tight-seating disc facing make the valves ideal for conveying liquids, compressed air, gases, volatile fluids, etc.



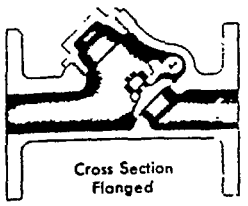
Sectional view of diaphragm valve with lined body and coated disc; for complete details, see pages 181 to 188

Lined valves, illustrated at the right, have the interior of the body as well as the end flanges completely lined (and the disc is coated) with neoprene or natural rubber. The valves offer excellent resistance to the action of many types of corrosive process fluids, to sandy waters, sludges, slurries, sewage, liquids with solids in suspension, etc.

Screwed and flanged unlined bronze, cast iron, aluminum, or 18-8 SMo valves, each available with a disc insert of neoprene, Buna N, natural rubber, or Kel-F, can also be furnished. Diaphragm valves are rated for pressures up to 150 psi. All valves are available with wheel or sliding stem operation; for details, see Section 16.

18-8 SMo and Craneloy 20
Swing Check Valves

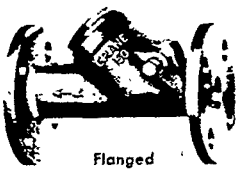
Y-Pattern
Sizes ½ to 2-inch



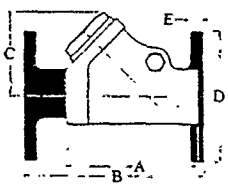
Cross Section
Flanged



Screwed
No. 18826, 18-8 SMo Alloy
No. 20026, Craneloy 20 Alloy



Flanged
No. 18827, 18-8 SMo Alloy
No. 20027, Craneloy 20 Alloy



Working Pressures (Liquid or Gas, Non-Shock)	Hydrostatic Test Pressure
150 psi....500 F max. temp.	Shell — 300 psi
230 psi....100 F max. temp.	Seat — 275 psi

Materials: The body, cap, and all internal parts are Crane 18-8 SMo Alloy Steel in the 18-8 SMo Valves and Craneloy 20 Alloy Steel in the Craneloy 20 Valves.

Crane 18-8 SMo is a high grade material equivalent to AISI Type 316 wrought stainless steel. It offers excellent resistance to the corrosive action of many fluids and conforms to requirements of ASTM A 351, Grade CF 8M. Craneloy 20 is a high-nickel, high-chromium stainless steel having exceptional resistance to a wide range of sulfuric acid concentrations at elevated temperatures; in addition, it offers good resistance to oxidizing media.

Y-pattern valves: These valves are the regrinding type. The body, Y-pattern in shape, is smoothly contoured at all points to allow swift, easy flow with minimum pressure drop. The cap, screwed into the body with long, accurately machined threads, is on the same center line as the seat opening. When the cap is removed, internal parts are readily accessible.

Seating surfaces, integral with the body, can be reground while the body is in the line; a slot in the disc-spud enables rotating the disc with a screw driver.

Straightway valves: These valves have a straightway body with an integral seat. The seat face lies at only a slight angle from vertical, so as to permit full flow with low turbulence. The bolted cap and Teflon gasket provide a tight joint which is easily dismantled when necessary. Cap bolts and nuts are stainless steel.

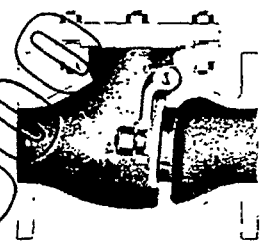
Disc and hinge: In all valves, the disc and hinge, suspended from the body by means of a hinge pin, swing freely. The disc is designed to close of its own weight and to rest on the seat when there is no flow; backflow cannot gain sufficient velocity to cause "water hammer".

Lever and weight: Straightway valves can be equipped with an outside lever and adjustable weight; information on request. The lever can be applied to assist the disc in closing, or, to balance the disc so that the valve will open under minimum pressure.

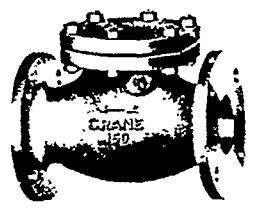
Flanged valves: Face to face and end flange dimensions conform to the MSS 150-Pound Corrosion Resistant Cast Flanged Valve Standard, No. SP-42-1957. Flanges are plain faced, with a serrated finish.

Flanged valves regularly are furnished faced and drilled to the MSS 150-Pound Standard. They can be furnished faced only, when specified. Full face gaskets should be used see page 321

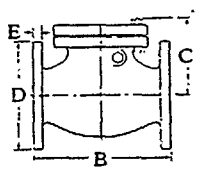
Straightway
Sizes 2½ to 6-inch



Cross Section



Flanged
No. 18829, 18-8 SMo Alloy
No. 20029, Craneloy 20 Alloy



Weights and Dimensions — Prices on Request

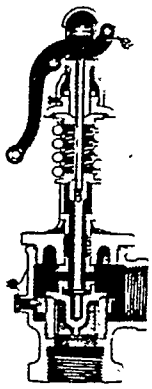
Size	Pounds, Each						Dimensions, in Inches				
	Y-Pattern				Straightway					End Flanges	
	Screwed		Flanged, F & D		Flanged, F & D						
	No. 18826	No. 20026	No. 18827	No. 20027	No. 18829	No. 20029	A	B	C	D	E
Inches	18-8 SMo	Craneloy 20	18-8 SMo	Craneloy 20	18-8 SMo	Craneloy 20					
½	1.1	1.1	2.8	2.8			3	4½	1⅞	3½	⅜
¾	1.9	1.9	4.5	4.5			3½	5	2⅛	3⅞	13/32
1	3.0	3.0	6.5	6.5			4¼	5¾	2¾	4¼	7/16
1¼	4.6	4.6	9.5	9.5			5	6½	3⅛	4⅝	½
1½	6.8	6.8	12.0	12.0			5½	7¼	3½	5	9/16
2	9.0	9.0	18.5	18.5			6½	8½	4¼	6	⅝
2½					40.0	40.0		8½	5 1/16	7	⅝
3					52.0	52.0		9½	5 7/16	7½	⅝
4					80.0	80.0		11½	6 7/16	9	11/16
6					145.0	145.0		14	8½	11	13/16

Materials....Section 2 Templates for drilling....page 326 Proper sizing of checks....page 427

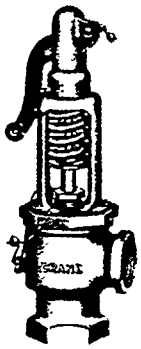
SAMPLE

17

18-8 SMo Safety Relief Valves



Cross Section



No. 18854
Relief Valve
Female Inlet
Side Outlet

Orders should include the catalog number, inlet size, and the set pressure desired.

250 psi maximum set pressure
600 F maximum temperature

The No. 18854 Safety Relief Valves feature a body, bonnet, and disc made of Crane 18-8 SMo Alloy Steel, a high grade material (ASTM A 351, Grade CF-8M) equivalent to AISI Type 316 wrought stainless steel. Other parts in contact with the fluid in the line are also stainless steel.

Gas service: When ordered specifically for gas, the No. 18854 is furnished with a specially ground seat.

Construction: The valves are ruggedly constructed to assure dependable operation. They are the outside spring type and have a screwed bonnet and lifting lever. A stuffing box around the stem prevents any escape of fluid while the valve is discharging.

All sizes except the ⅜-inch have a regulating ring which permits readjustment of the blowdown when the set pressure is changed. The adjustment of this ring can be made from the outside, without interfering with the set pressure; a wire seal prevents unauthorized adjustments.

Code compliance: Sizes ½-inch and larger comply with requirements of the ASME Unfired Pressure Vessel Code, Section VIII, and bear the Code symbol. The Code does not include a ⅜-inch size.

Weights and Dimensions — Prices on Request

Size (inlet) Inches	No. 18854 Pounds Each	Dimensions, in Inches: Size of side outlet	Center to top of cap	Center to end of inlet	Center to end of outlet
⅜	1.5	½	5⅝	1 11/16	1 11/16
½	1.5	½	5⅝	1 11/16	1 11/16
¾	2.5	¾	5⅞	2	1 5/16
1	4.0	1	7	2 3/16	1⅝
1¼	7.0	1¼	8¼	2⅝	2 1/16
1½	10.5	1½	9¼	2⅞	2⅜
2	18.0	2	11½	3 7/16	2¾

Discharge Capacities

Set Pressure psi	Gallons of Water per Minute At 10% Overpressure, 70 F: ½ inch	¾ inch	1 inch	1¼ inch	1½ inch	2 inch	Pounds of Steam per Hour* At 10% Overpressure: ½ inch	¾ inch	1 inch	1¼ inch	1½ inch	2 inch
25	.25	.42	1.00	1.33	1.74	2.50	90	135	188	361	446	629
50	.40	.67	1.70	2.66	3.20	5.00	138	212	357	632	808	1037
75	.55	.90	2.40	3.62	4.83	7.20	193	268	442	881	1085	1391
100	.71	1.15	3.05	4.25	6.40	9.00	247	307	531	1025	1229	1712
125	.88	1.40	3.62	4.84	7.95	10.85	295	342	604	1122	1434	1973
150	1.09	1.60	4.10	5.30	9.50	12.70	339	391	677	1237	1667	2295
175	1.30	1.80	4.75	5.90	11.40	14.55	391	436	761	1351	1892	2603
200	1.52	2.00	5.25	6.50	12.60	16.40	442	494	841	1446	2110	2907
225	1.73	2.20	5.80	7.05	14.20	18.20	482	550	938	1584	2321	3194
250	1.94	2.40	6.35	7.60	15.80	20.00	533	608	1008	1680	2561	3473

**Note: These valves are not recommended for steam; however, steam capacities are shown so that capacities for other vapors can be determined from formulas.*

General Information, pages 204 and 205

18-8 SMo Liquid Level Gauge



No. 18898
Liquid Level
Gauge, Complete

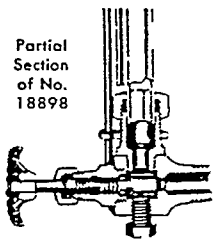
For 150 psi liquid — 350 F maximum temperature

The Crane No. 18898 is a sturdy, well-constructed liquid level gauge. All parts coming in contact with the fluid in the line, including the bodies, bonnets, stems, packing nuts, glands, glass retainers, and drain plug are made of Crane 18-8 SMo Alloy Steel, a material equivalent to AISI Type 316 wrought stainless steel.

Construction: The valve bodies are the square type, each with an integral seat; the disc and stem also are integral. The gauge glass, ⅝-inch in outside diameter, is protected by two guard rods.

Special gauges: When ordered with a drain, the bottom valve will be fitted with a ¼-inch short nipple and a ¼-inch No. 18840 (see page 190) Gate Valve. Gauges having an automatic check can also be furnished; in such gauges, the bottom valve is equipped with a special adapter, a special stem and a 9/16-inch diameter ball

Prices on Request



Partial Section of No. 18898

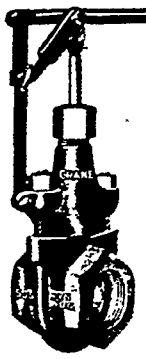
Size Inches	No. 18898 Weight, Each With Standard 14" Centers
½	2.5 pounds

Centers other than 14" are available on special order.

SPECIMEN COPY

17

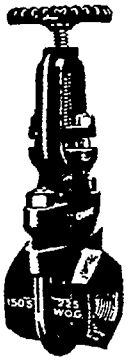
All-Iron Valves



Quick-Opening Clamp Gate



Inside Screw Clamp Gate



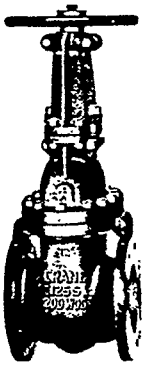
O. S. & Y. Clamp Gate

Although cast iron is not specifically termed a corrosion-resisting metal, all-iron valves have a wide application in many services where bronze valves, or valves trimmed with bronze, are not entirely suited.

Without good inherent resistance to corrosion, cast iron frequently depends for its general serviceability upon the fact that, in many situations, initial corrosion is followed by the formation of protective coatings which slow up the rate of corrosion or entirely prevent it.



Non-Rising Stem Wedge Gate



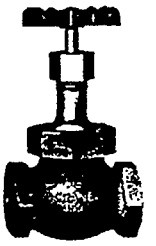
O. S. & Y. Wedge Gate

Some of the common types of all-iron valves made by Crane are illustrated on this page. The valves are described in detail elsewhere in the catalog; refer to the following sections:

All-Iron Clamp Gate.....Section 8
All-Iron Wedge Gate.....Section 8
All-Iron Double Disc Gate...Section 9
All-Iron Globe and Angle....Section 10
All-Iron Check.....Section 11
All-Iron Relief.....Section 18

For a more detailed listing of all-iron products available from Crane, refer to the alphabetical index.

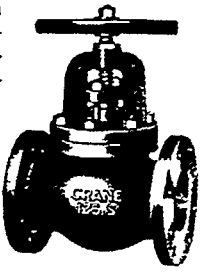
In addition to the all-iron valves indicated above, Crane manufactures valves of alloy irons such as 3% nickel cast iron, Ni-Resist, and nodular iron; see illustrations on next page.



All-Iron Union Bonnet Globe



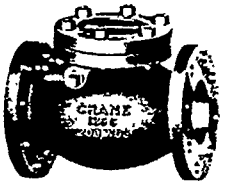
All-Iron Relief For Ammonia, Air, Gas, or Water



All-Iron Bolted Bonnet Globe



All-Iron Bolted Bonnet Angle

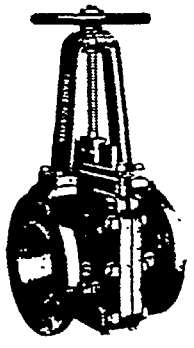


Bolted Cap Swing Check



Malleable Iron Swing Check

Pulp Stock Valves

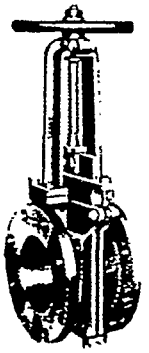


Cast iron and 3% nickel cast iron pulp stock valves are available in sizes 2 to 24-inch. See pages 84 and 85.

Self-cleaning, non-clogging Crane pulp stock valves are especially designed for use in pulp stock lines. They are highly recommended for dependable service on discharge lines, on filter, hydrofiner, and Jordan lines, on pulp stock beater lines, etc. The valves feature Crane's exclusive shearing action disc for clog-proof closure and a positive shut-off. The thoroughness of the shearing action permits the disc to close completely without leaving any accumulation of fibers to wash out later and cause leakage. Once the valve is in a closed position, the pulp packs around the disc, assuring a tight shut-off.

The Crane line includes wheel-operated and quick-opening valves with cast iron or 3% nickel cast iron bodies (see pages 84 and 85) as well as short face-to-face 18-8 SMo valves (see page 86).

Crane pulp stock valves are described on pages 84 to 86.



18-8 SMo Pulp Stock Valves feature short face-to-face dimensions. The disc is also 18-8 SMo. See page 86.

17

Corrosion Questionnaire

Information Required for Developing Recommendations

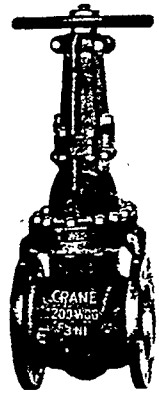
The behavior of metals and alloys in contact with corrosive fluids is often affected by factors which are not obvious. Because of this, it is difficult to submit a sufficiently comprehensive questionnaire without appearing unduly inquisitive. The questions below are those which apply to practically any installation; and the answers to them will, in many cases, provide all the necessary information. It is not to be expected, however, that the information so obtained will be sufficient in all cases; and it is hoped that the questions will be considered as a guide to the type of information desired rather than as a limitation to the amount that is needed.

Since apparently extraneous physical factors often exert a tremendous influence on the progress of corrosion, it is also desirable to know something about the installation itself. This is particularly true when there is a background of previous experience; and when a rough sketch of the layout of tanks, piping, etc. can be accompanied by notations showing the locations at which corrosion has been the most severe. An opportunity to examine corroded pipe, valves, or fittings will often aid materially in the making of recommendations.

1. What is the name or composition of fluid to be handled?
2. What is the concentration (percentage strength, specific gravity, pH value, etc.)?
3. What is the size of the pipe line? Also, what is the operating pressure and the temperature range? Is the service full flow or throttling?
4. If the fluid is not a water solution but a gas, organic fluid, etc., is water or water vapor apt to be present at any time or at any particular location? If so, explain.
5. If the fluid is a water solution, are substances other than water (abrasive solids, oil, etc.) present at any time or at any particular location? If so, explain.
6. Is there much opportunity for air in-leakage?
7. Is the flow through the system intermittent or continuous?
8. If intermittent, is the system ever drained entirely of fluid and allowed to dry?
9. Is the piping system washed or rinsed at regular intervals, and if so, with what materials?
10. Is a slight amount of corrosion objectionable from the standpoint of contamination or discoloration of product?
11. If so, what metals are particularly objectionable?
12. What materials are being used or proposed for piping, tanks, etc.?
13. Has any specific trouble been experienced with these materials?
14. What materials have been used for valves and fittings?
15. In general, what is the comparative life of the different materials which have been used?
16. What packings give the best service?

Alloy Iron Valves

3% Nickel Cast Iron Wedge Gate and Swing Check

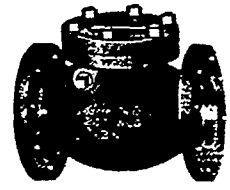


No. 14477
3% Nickel Cast Iron
Flanged Gate Valve
(see page 82)

Crane 3% Nickel Cast Iron Gate and Swing Check Valves are widely used in the petroleum industry to handle oils containing traces of mineral acids, in the wood treating industry for creosote vapors and oils, in the pulp and paper industry to handle various kinds of alkaline liquors, and in many other installations where corrosion is a factor. Both valves feature stainless steel seating surfaces as an added deterrent to corrosive effects.

The No. 14477 Gate has a solid web disc; long disc guides lessen drag on the seating surfaces; sizes 12-inch and smaller have a tee-head disc-stem connection. The No. 14493 Swing Checks are rugged, well-proportioned valves; the body is designed to provide ample flow area around the disc when the valve is wide open; the disc will not stick in the open position. The gate and the swing check are regularly furnished in sizes 2 to 18-inch.

For complete description, see page 82 for the No. 14477 Gate Valves and page 114 for No. 14493 Swing Check Valves.



No. 14493
3% Nickel Cast Iron
Flanged Swing Check Valve
(see page 114)

In many cases, regular type Crane all-iron valves suffice for a variety of corrosive services; see illustrations on preceding page.

Ni-Resist Cast Iron Wedge Gate



No. 1671
Ni-Resist Cast Iron
Flanged Gate Valve
(see page 83)

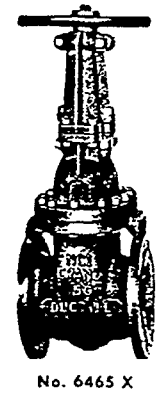
Crane Ni-Resist Gate Valves are frequently used where the strength of cast iron is adequate . . . . but where the substantially higher corrosion resistance of Ni-Resist Cast Iron is desired. The valves are especially suitable for soda and sulfate pulp mill service, for creosote use in wood preserving, for handling sour distillates and crudes in petroleum refineries, and for similar services.

The valves are the outside screw and yoke type with stem threads on the outside where they are not exposed to corrosive action of the fluid in the line and where they are easy to lubricate. The valves have stainless steel seating surfaces; the body seat rings are screwed into the body and the disc is the solid wedge type. Valves 3-inch and smaller have a clamp type bolted bonnet and a one-piece bolted gland; larger sizes have a conventional bolted bonnet and a two-piece bolted gland. Both types of bonnets are easily dismantled and reassembled when necessary.

Ni-Resist valves are available with screwed ends (No. 1670) in sizes ½ to 2-inch or with flanged ends, as illustrated at the left, in sizes 1 to 8-inch.

For complete description of Crane Ni-Resist Valves, see page 83.

Nodular Cast Iron Wedge Gate



No. 6465 X
Nodular Cast Iron
Flanged Gate Valve
(see page 87)

Crane Nodular Cast Iron Valves are well suited for oil and oil vapor services where high resistance to thermal shock, impact, and bending stresses are essential. Crane Nodular (Ductile) Iron conforms to requirements of ASTM Specification A-395 and has corrosion resistance equal to that of regular gray iron, with strength approximating that of carbon steel.

The valves are the outside screw and yoke type; the external stem threads do not contact the fluid in the line and are easily lubricated when necessary. The solid wedge disc is made of Exelloy in sizes 4-inch and smaller and is carbon steel faced with Exelloy in sizes 6-inch and larger. The stem, and the shoulder-type screwed-in body seat rings, are also Exelloy. The stem is finished with a tapered shoulder for backseating in the Exelloy bonnet bushing. The two-piece ball-type gland, consisting of a siliconized steel gland and a malleable iron gland flange, maintains an even load on the packing and prevents binding on the stem even when the gland bolt nuts are not pulled up evenly.

No. 6465X Valves are regularly furnished in sizes 2 to 12-inch, see page 87.

For complete description of Crane Nodular Iron Valves, see page 87.

Crane Safety and Relief Valves

General Information — Installation and Maintenance

Safety and relief valves are automatic pressure-actuated relieving devices with one primary intent . . . the promotion of safety. Through a better understanding of the qualifications of each type of valve, and the knowledge that design is based on natural laws of mechanics and phenomena of fluids, the correct valve can be selected for any particular application.

Any safety valve must respond to pressure and open when that pressure reaches the point at which the valve is set. However, the fluid handled will make some of the valves, influenced by design, respond in different ways. The fluid, then, becomes an important factor in selecting the proper valve.

Pop safety valves: Pop safety valves are characterized by a "pop" action and are intended for gas or vapor service. Their design is based on the use of a compressible and therefore expansible fluid which, acting through the seat opening or primary orifice against secondary surfaces in the valve, adds lifting power to the disc, thus causing the valve to suddenly "pop" open. . . . a large flow area and consequently high capacity are provided. A blowdown regulating ring forms part of the secondary orifice and must be properly adjusted to obtain desired popping action.

Relief valves: Relief valves have no "pop" action. Although suitable for any type of fluid, they are used primarily on liquid service. Their rate of discharge is lower, action not as positive, and closing-off pressure not as definite as the blowdown of the pop safety valve. Of the simple poppet type without auxiliary disc-lifting means, they respond to the rise and fall of pressure as rapidly, or gently, as the rate of pressure change in the system. Liquids, like water and oil, are practically noncompressible and do not expand when released to lower pressure regions. The use of a secondary orifice would tend to induce chattering; therefore, the valves do not contain blowdown regulating rings.

Safety relief valves: Safety relief valves are basically like pop safety valves. They have a blowdown ring, a huddling chamber, and are characterized by a "pop" action when used on gases or vapors. This is desirable when the valves are used primarily for pressure relief due to thermal expansion in liquid-laden vessels. As long as the liquid state exists, the flow rate required is low and will not unduly influence performance. When these same vessels tend to generate vapor, due to uncontrolled heat input, the low density of the vapor requires a greater discharge; in such cases, the huddling chamber serves to obtain a high disc lift and discharge.

The valves are readily adjusted to "non-pop" action by screwing down the blowdown ring out of the flow path; they then become simple relief valves which can be rated at higher overpressures to obtain high liquid discharge capacities.

Weighted safety valves: Dead weight or lever and weight safety valves, due to their low cost and easy adjustment of pressure settings, are sometimes used for ordinary low pressure steam relief service. In some cases, safety codes may prohibit their use.

Crane iron body lever and weight safety valves are illustrated and described on page 215.

Capacity determines selection: Valves should be selected on the basis of rated discharge capacity and not on the pipe size. The capacity should be equal to, or slightly greater than, the maximum generating capacity or output of the system.

The ASME Boiler and Pressure Vessel Code permits testing on steam, air, natural gas, or, in the case of liquid relief valves, on water. Crane discharge capacities are listed on the product page. The page also indicates valves complying with ASME Codes.

Installation: Always install valves in a vertical position (preferably inverted on air and gas service) directly on the apparatus to be protected. Horizontal or angular installation may result in damage to the seating surfaces. Before installing a valve on a new system, be sure the line is blown clean.

Piping should be carefully planned. Outlet piping preferably as short as possible with minimum turns, should never be smaller in size than the valve outlet. Inlet piping, if needed, should be full size and not longer than a "tee" fitting of corresponding size. Stop valves should not be used between the safety valve and the equipment being protected.

Side outlet valves should be used where it is desirable to pipe the discharge away from the immediate vicinity. Discharge piping should be independent of the valve, supported close to the valve, and sloped slightly downward so as to drain away condensate

Maintenance: Manual operation at regular intervals will free valves of any accumulated foreign matter and assure proper action. This should be done in a positive manner, for a reasonable time, and when at least 75% of the normal operating pressure is in the system. Valves without levers must be dismantled and the matter removed by hand or the pressure must be built up so as to effect automatic relief

Glossary

set pressure . . . pressure at which valve is set to open

overpressure or accumulation . . . difference between the set pressure and the pressure at which the valve is relieving

relieving pressure . . . pressure at which the valve is rated as to relieving capacity, this is set pressure plus overpressure

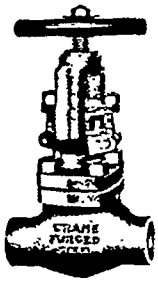
normal operating pressure . . . pressure in the system during normal processing (must be below the set pressure of the valve)

blowdown or blowback . . . difference between the pressures at which a safety valve (pop type) opens and closes

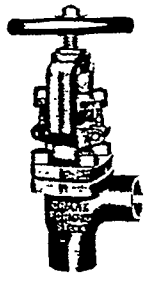
Steel Globe and Angle Valves

For Chlorine Service

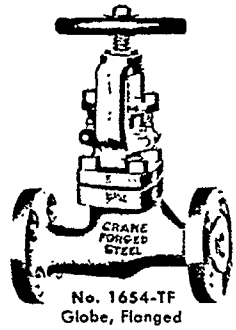
Teflon disc-insert and packing . . . sizes up to 6-inch . . . tested 300 psi air-under-water



No. 1644-TF
Globe, Screwed



No. 1645-TF
Angle, Screwed



No. 1654-TF
Globe, Flanged

Sizes ½ to 2-inch are forged steel; sizes 2½ to 6-inch are cast steel.

These valves are recommended for anhydrous (water-free) chlorine gas and liquid service at temperatures up to 300 F. They are especially suited to the severe service conditions prevalent in chlorine processing and manufacturing and have a wide application in chemical plants, pulp and paper mills, textile mills, water treatment plants, and similar installations.

The valves feature a Teflon disc-insert and Teflon packing. The Teflon insert is soft enough to seat tightly down and around hard particles so as to effect positive seating, yet is tough enough to resist abrasion. In addition, the modified plug type body seat ring provides a wide bearing surface minimizing possible scoring and gouging of the insert.

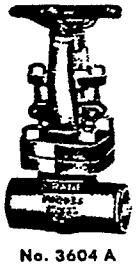
The body seat ring is made of Hastelloy "C"; the disc holder, disc stem ring, and stem are Monel; and the male and female body-bonnet joint is fitted with a corrugated soft Monel gasket. The body and one-piece bonnet and yoke are carbon forged steel (ASTM A 105, Grade II) in sizes 2-inch and smaller and carbon cast steel (ASTM A 216, Grade WCB) in sizes 2½ to 6-inch. All sizes have stainless steel swinging gland eye bolts. Stud bolts are Triplex Steel.

Types and sizes: Screwed globe and angle valves are regularly made in sizes ½ to 2-inch; flanged globe valves are available in sizes ½ to 6-inch. See page 140.

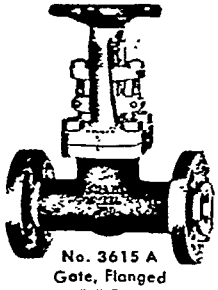
For complete description of these chlorine valves, including sizes, weights, and dimensions, see pages 140 and 141.

Steel Gate and Globe Valves

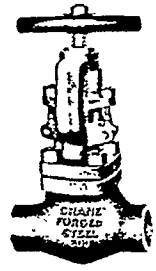
Monel Trimmed — Teflon Packing



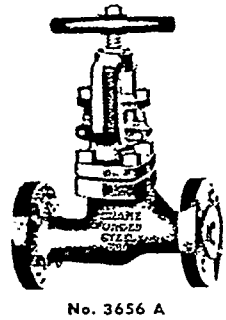
No. 3604 A
Gate, Screwed
Reduced Port



No. 3615 A
Gate, Flanged
Full Port



No. 3644 A
Globe, Screwed



No. 3656 A
Globe, Flanged

These unusually sturdy and compact gate and globe valves are used particularly on refining units in the petroleum industry and for various processes in chemical plants where high quality steel valves with Monel trim and Teflon packing are desired. They offer good service in hydrofluoric alkylation units handling anhydrous H.F., and where mixtures of the acid and hydrocarbons are found. They are not recommended for aqueous solutions of hydrofluoric acid where the concentration drops below 80 per cent H.F.

The valves are the bolted bonnet type and have a one-piece bonnet and yoke. The body is made of carbon cast steel (ASTM A 216, Grade WCB) on the No. 3615 A Valves and forged carbon steel (ASTM A 105, Grade II) on all other valves. The male and female body-bonnet joint is equipped with a spiral wound Monel gasket with Teflon filler on the gate valves and with a corrugated soft iron gasket on the globe valves.

All valves feature Monel trim and an extra deep stuffing box filled with long-lasting Teflon packing. The swinging gland eye bolts are stainless steel.

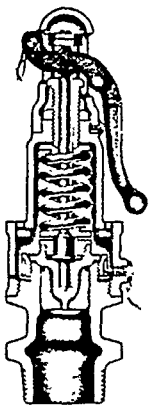
Types and sizes: Both the gate and globe valve types are available in sizes ½, ¾, 1, 1½, and 2-inch.

For complete description of Monel trimmed gate valves, see page 120.

For complete description of Monel trimmed globe valves see page 141.

Bronze Pop Safety Valves
For Steam

18



Top Discharge



No. 2500
With Wire Seal

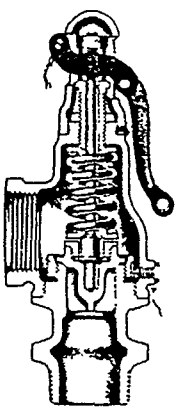
Set at any specified pressure
from 3 to 250 psi; 406 F maximum

Discharge Capacities

Set Pressure	Pounds of Steam per Hour 90% Actual Discharge at 3% Overpressure*							
psi	*3/8 inch	1/2 inch	3/4 inch	1 inch	1 1/4 inch	1 1/2 inch	2 inch	2 1/2 inch
25	6	82	169	290	317	441	630	785
50	38	135	256	414	460	646	957	1191
75	72	169	360	558	640	899	1246	1597
100	108	210	377	683	810	1170	1466	2095
125	113	241	495	738	855	1440	1718	2487
150	117	278	559	814	1080	1440	1922	2880
175	122	308	603	945	1080	1561	2032	3240
200	126	342	621	1020	1260	1716	2301	3600
225	131	367	702	1095	1440	1871	2569	3960
250	136	392	810	1170	1620	2025	2838	4320

*Capacities for the 3/8-inch size are at 10% overpressure.

Interpolate for capacities at intermediate pressures.



Side Outlet



No. 2501
With Wire Seal

Orders must specify the set pressure as well as the catalog number and inlet size.

Recommendations: These bronze pop safety valves are recommended for steam service on boilers, on miniature boilers, and on unfired pressure vessels such as receivers, pipe lines, etc., at temperatures up to 406 F.

Pressure setting: The valves can be ordered set at any pressure from 3 to 250 psi. Pop safety valves for steam service are preferably set 10 per cent higher than the normal operating pressure in the system.

A main spring regulating adjustment permits increasing or decreasing the set pressure 10 per cent; these limits must be strictly observed as one spring cannot cover the complete range of pressures at which the valve may be set. A wire seal prevents tampering with the factory setting.

Design: The valves are of the single disc type. Sizes 1/2-inch and larger have a regulating ring which permits readjustment of the blowdown when the set pressure is changed.

Materials: The body and base are bronze (ASTM B 62). The disc is also bronze. The spring, spring washer, and stem are steel. The lifting lever is malleable iron.

Lifting lever: The lifting lever is reversible and can be arranged for pull-up operation (illustrated) or reversed for push-or-pull-down operation. When installing, allow ample clearance. Complete rotation of the lever is possible without disturbing the setting of the valve.

Installation: The valves should always be installed in a vertical position (preferably upright) directly on the apparatus to be protected. Horizontal or angular installation may result in damage to the seating surfaces.

For additional information concerning installation, as well as proper maintenance, see page 204

Code compliance: These valves in all sizes except 3/8-inch comply with requirements of the ASME Power Boiler Code, Section I, 1950, Miniature Boiler Code, Section V, 1950, and Unfired Pressure Vessel Code, Section VIII, 1950; they bear the Code cloverleaf symbol. The Codes do not include a 3/8-inch size

Weights and Dimensions (Inches) — Prices on Request

Size (inlet)	No. 2500 Top Discharge			No. 2501 Side Outlet				
	Pounds	Over-all Height		Pounds	Size of side outlet	Center of Valve to:		
		To top of cap	To top of lever, open			Top of cap	Top of lever, open	Bottom of male inlet	End of side outlet
Inches	Each			Each					
3/8	.8	6	7 5/8	.8	1/2	3 3/4	5 3/8	2 1/4	1 1/8
1/2	1.0	6	7 5/8	1.0	1/2	3 3/4	5 3/8	2 1/4	1 1/8
3/4	2.0	6 1/2	8 1/4	2.0	3/4	3 3/4	5 1/2	2 3/4	1 3/8
1	3.0	7 7/8	9 3/4	3.0	1	4 5/8	6 1/2	3 1/4	1 5/8
1 1/4	4.0	7 7/8	9 3/4	4.0	1 1/4	4 3/8	6 1/4	3 1/2	1 3/4
1 1/2	5.0	9 1/8	11 3/8	5.0	1 1/2	5 1/4	7 1/2	3 7/8	2 1/8
2	7.0	10 5/8	13 1/2	8.0	2	6 1/8	9	4 1/2	2 7/16
2 1/2	13.0	12 3/4	16	13.0	2 1/2	7 3/4	11	5	2 7/8

General information and additional capacity data . . . . pages 204 and 205

SECTION 18

Crane Safety and Relief Valves

page

Names of Parts and General Information.....203 and 204

Capacity
For listed capacities..... see product page
Determination of air capacities at other than 60 F.....205
Determination of gas capacities at any temperature.....205
Converting steam capacities to air capacities.....205

Pop Safety Valves
Bronze.....steam.....3-250 psi, 406 F.....ASME[1,2,3].....206
Bronze.....steam.....3-250 psi, 406 F.....208
Bronze.....air, gas.....3-250 psi, 406 F.....ASME[2].....207
Bronze.....air, gas.....3-250 psi, 406 F.....ASME[2].....208
Iron body....steam heating boilers.....15 psi, saturated.....ASME[4].....209

Safety Relief Valves
Bronze.....steam, water, oil.....3-250 psi, 406 F.....ASME[2].....210
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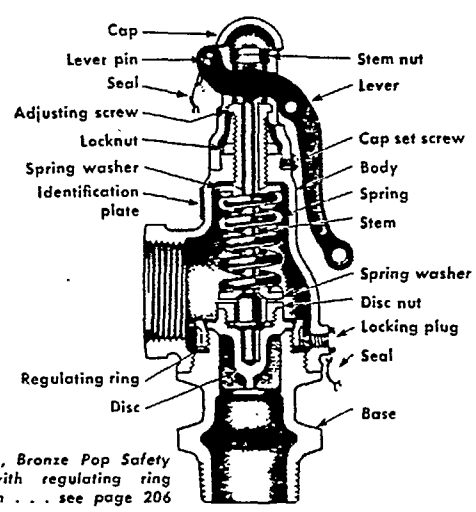
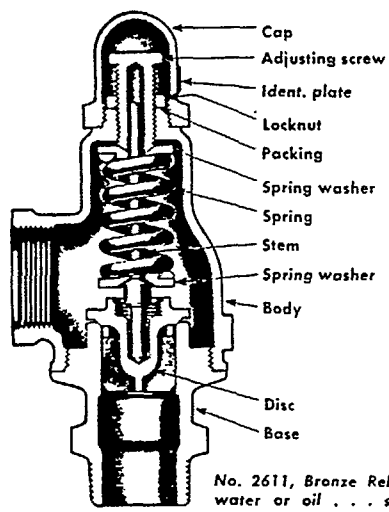
Iron body....steam.....15-30 or 30-100 psi, saturated.....215

[1]Valves comply with ASME Power Boiler Code.....Section I, 1959
[2]Valves comply with ASME Unfired Pressure Vessel Code...Section VIII, 1959
[3]Valves comply with ASME Miniature Boiler Code.....Section V, 1959
[4]Valves comply with ASME Code for Low Pressure Heating Boilers 1959

NAMES OF PARTS



No. 2501, Bronze Pop Safety Valve with regulating ring for steam . . . see page 206



No. 2611, Bronze Relief Valve for water or oil . . . see page 212

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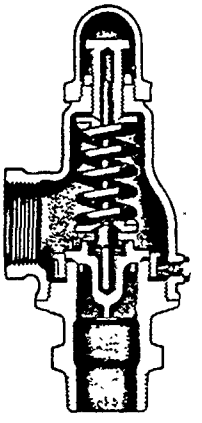
Bronze Pop Safety Valves

For Steam — For Air and Gas



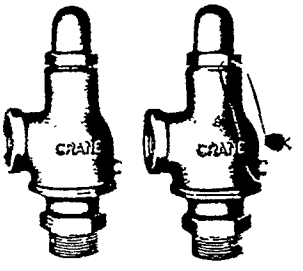
Cross section showing typical construction of No. 2601 or 2651

Set at any specified pressure
from 3 to 250 psi; 406 F maximum

Discharge Capacities

Set Pressure	(No. 2601 Valve) Pounds of Steam per Hour At 10% Overpressure						(No. 2651 Valve) Cubic Feet of Free Air per Minute At 10% Overpressure, 60 F					
psi	½ inch	¾ inch	1 inch	1¼ inch	1½ inch	2 inch	½ inch	¾ inch	1 inch	1¼ inch	1½ inch	2 inch
25	90	135	188	361	446	629	32	48	67	129	156	224
50	138	212	357	632	808	1037	49	76	127	225	288	370
75	193	268	442	881	1085	1391	69	95	157	314	386	495
100	247	307	531	1025	1229	1712	88	110	189	365	438	610
125	295	342	604	1122	1434	1973	105	122	215	399	511	703
150	339	391	677	1237	1667	2295	121	139	241	441	594	817
175	391	436	761	1351	1892	2603	139	155	271	481	674	927
200	442	494	841	1446	2110	2907	157	176	300	515	752	1035
225	482	550	938	1584	2321	3194	172	196	334	564	827	1138
250	533	608	1008	1680	2561	3473	190	217	359	598	912	1237

Interpolate for capacities at intermediate pressures. For air capacities at other than 60 F, or for capacities of gases other than air, see page 205.



For Steam No. 2601 Male Inlet Side Outlet

For Air and Gas No. 2651 Male Inlet Side Outlet

Orders must specify the set pressure as well as the catalog number and inlet size.

Recommendations: These bronze pop safety valves are pressure-tight on the outlet side and can discharge against low back pressures.

The No. 2601 (for steam) are used on non-code vessels, pipe lines, presses, cylinders, pumps, etc.

The No. 2651 (for air and gas) are recommended for pipe lines, air or gas compressors, cylinders, etc., subject to the ASME Code, as well as for non-code receivers and tanks. Being pressure-tight on the outlet, they are ideal for handling noxious or inflammable gases.

Pressure setting: The valves can be ordered set at any pressure from 3 to 250 psi. Safety valves for steam service preferably are set 10 per cent higher, and those for air and gas 25 per cent higher, than the normal operating pressure in the system. A main spring regulating adjustment permits increasing or decreasing the set pressure 10 per cent; however, the maximum pressure recommended for the valve must not be exceeded.

Design: The No. 2651 are sealed to prevent tampering with adjustments; in addition, seating surfaces are carefully ground to assure audible tightness up to 80 per cent of the set pressure. Otherwise, they are similar to the No. 2601.

Both valves are the single disc type with bottom guide to assure proper seating. Sizes ½-inch and larger have a regulating ring which permits readjustment of the blowdown when the set pressure is changed. A stuffing box around the spring adjusting screw is filled with asbestos packing to form an effective seal for the body

Materials: The body and base are made of bronze conforming to ASTM B 62. The disc is also bronze. The spring and stem are made of steel.

Installation: The valves should be installed directly on the apparatus to be protected with the stem in a vertical position. Valves for air and gas service are preferably installed inverted to allow moisture to collect and seal the seating surfaces.

For additional information concerning installation, see page 204.

Code compliance: No. 2651 Valves in sizes ½-inch and larger comply with requirements of the ASME Unfired Pressure Vessel Code, Section VIII, 1959, for noxious or inflammable gas service and bear the Code cloverleaf symbol. The Code does not include a ⅜-inch size.

Weights and Dimensions — Prices on Request

Size (inlet)	Pounds, Each		Dimensions, in Inches			
	No. 2601	No. 2651	Size of outlet	Center to top	Center to male inlet	Center to side outlet
Inches	For Steam	For Air or Gas				
⅜	1.0	1.0	½	3⅛	2¼	1⅛
½	1.2	1.2	½	3⅛	2¼	1⅛
¾	2.0	2.0	¾	3¼	2¾	1⅜
1	3.0	3.0	1	3⅝	3¼	1⅝
1¼	5.0	5.0	1¼	4¼	3¾	2 1/16
1½	7.0	7.0	1½	5⅜	4⅜	2 7/16
2	11.0	12.0	2	6⅝	4½	2¾

General information....pages 204 and 205

Crane Safety and Relief Valves

Determination of Air Capacities at Other than 60 F and Gas Capacities at Any Temperature

The capacities of Crane Pop Safety and Relief Valves are shown on pages describing the product. Capacities of valves recommended for air and gas service are based on "standard conditions" and are given in terms of cubic feet of free air per minute at 60 F. (scfm).

The specific gravity and temperature conversion factors listed in Table 1 at the upper right can be used in conjunction with the formulas shown in Table 2 at the lower right to determine capacities for other operating conditions, namely:

a. for air at temperatures other than 60 F.

b. for gases other than air at any temperature.

Use of formulas: In most cases, use of the formulas requires that either, or both, the specific gravity of the gas (if other than air) and its temperature at operating conditions be known. Using Table 1, convert these values to Factors A and B respectively.

Substitute all known values in the appropriate formula shown in Table 2 and make the necessary calculations to determine the resultant capacity.

Nomenclature: Nomenclature used in Table 2 formulas are defined as follows:

(Factor A) . . . Conversion factor for the specific gravity of the gas, as determined from Table 1.

(Factor B) . . . Conversion factor for the temperature of the gas at operating conditions, as determined from Table 1.

(scfm air) . . . Capacity in cubic feet of free air per minute at standard conditions (60 F) Crane capacities are based on these conditions.

(cfm air) . . . . Capacity in cubic feet of free air per minute at temperatures other than 60 F

(cfm gas) . . . Capacity in cubic feet of free gas other than air, per minute at any temperature

Table 1 — Conversion Factors for Specific Gravity and Temperature

Specific Gravity Factors				Temperature Factors					
Specific Gravity	Factor A	Specific Gravity	Factor A	Temp. Fahr.	Factor B	Temp. Fahr.	Factor B	Temp. Fahr.	Factor B
0.20	2.236	1.15	.933	10°	.951	200°	1.127	390°	1.279
0.25	2.000	1.20	.913	20	.961	210	1.135	400	1.287
0.30	1.826	1.25	.894	30	.971	220	1.144	410	1.293
0.35	1.690	1.30	.887	40	.981	230	1.152	420	1.301
0.40	1.581	1.40	.845	50	.990	240	1.160	430	1.308
0.45	1.491	1.50	.816	60	1.000	250	1.168	440	1.316
0.50	1.414	1.60	.791	70	1.010	260	1.177	450	1.323
0.55	1.348	1.70	.767	80	1.019	270	1.185	460	1.330
0.60	1.291	1.80	.745	90	1.028	280	1.193	470	1.337
0.65	1.240	1.90	.725	100	1.038	290	1.201	480	1.345
0.70	1.195	2.00	.707	110	1.047	300	1.209	490	1.352
0.75	1.155	2.25	.667	120	1.056	310	1.217	500	1.359
0.80	1.118	2.50	.632	130	1.065	320	1.225	...	...
0.85	1.085	2.75	.603	140	1.074	330	1.233	...	...
0.90	1.054	3.00	.577	150	1.083	340	1.240	...	...
0.95	1.026	3.25	.555	160	1.092	350	1.248	...	...
1.00	1.000	3.50	.535	170	1.101	360	1.256	...	...
1.05	.976	4.00	.500	180	1.110	370	1.263	...	...
1.10	.953	...	...	190	1.118	380	1.271	...	...

Table 2 — Formulas for Conversion of Crane Valve Air Capacities

Determine the air capacity necessary at 60 F to accommodate a required capacity at other than 60 F.	*Given:*	Required air capacity . . . . . (cfm air) Air temp. at operating conditions . . . . (Factor B)
	Find:	Necessary Crane valve air capacity . . (scfm air)
	Formula:	$(\text{scfm air}) = \frac{(\text{cfm air})}{(\text{Factor B})}$
Determine the air capacity necessary at 60 F to accommodate a required gas capacity at any temperature	*Given:*	Required gas capacity . . . . . (cfm gas) Specific gravity of gas . . . . . (Factor A) Gas temp. at operating conditions . . . . (Factor B)
	Find:	Necessary Crane valve air capacity . . (scfm air)
	Formula:	$(\text{scfm air}) = \frac{(\text{cfm gas})}{(\text{Factor A}) \times (\text{Factor B})}$
Determine the air capacity resulting at a temperature other than 60 F, when air capacity at 60 F is known.	*Given:*	Crane valve air capacity . . . . . (scfm air) Air temp. at operating conditions . . . . (Factor B)
	Find:	Resulting air capacity . . . . . (cfm air)
	Formula:	(cfm air) = (scfm air) × (Factor B)
Determine the gas capacity resulting at any specified temperature when the air capacity at 60 F is known	*Given:*	Crane valve air capacity . . . . . (scfm air) Specific gravity of gas to be used . . . . (Factor A) Gas temp. at operating conditions . . . . (Factor B)
	Find:	Resulting gas capacity . . . . . (cfm gas)
	Formula:	(cfm gas) = (scfm air) × (Factor A) × (Factor B)

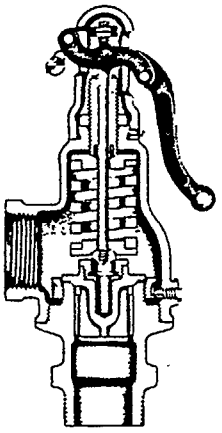
Accuracy of factors: The use of Factors A and B are satisfactory for all practical purposes. For a greater degree of accuracy, calculations can be based on the method described in the 1959 edition of the ASME Unfired Pressure Vessel Code.

Converting steam capacities: When capacities are given in pounds of steam per hour, they may be converted to cubic feet of free air per minute at standard conditions (60 F), as follows

(pounds per hour steam) × (0.35) = (scfm air)

Bronze Safety Relief Valves
For Water, Oil, or Steam

18



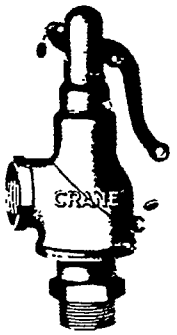
Cross Section

Set at any specified pressure
from 3 to 250 psi; 406 F maximum

Discharge Capacities

Set Pressure psi	Gallons of Water per Minute At 10% Overpressure, 70 F						Pounds of Steam per Hour At 10% Overpressure					
	½ inch	¾ inch	1 inch	1¼ inch	1½ inch	2 inch	½ inch	¾ inch	1 inch	1¼ inch	1½ inch	2 inch
25	.25	.42	1.0	1.3	1.7	2.5	90	135	188	361	446	629
50	.40	.67	1.7	2.7	3.2	5.0	138	212	357	632	808	1037
75	.55	.90	2.4	3.6	4.8	7.2	193	268	442	881	1085	1391
100	.71	1.15	3.0	4.2	6.4	9.0	247	307	531	1025	1229	1712
125	.88	1.40	3.6	4.8	7.9	10.8	295	342	604	1122	1434	1973
150	1.09	1.60	4.2	5.3	9.5	12.7	339	391	677	1237	1667	2295
175	1.30	1.80	4.7	5.9	11.4	14.5	391	436	761	1351	1892	2603
200	1.52	2.00	5.2	6.5	12.6	16.4	442	494	841	1446	2110	2907
225	1.73	2.20	5.8	7.0	14.2	18.2	482	550	938	1584	2321	3194
250	1.94	2.40	6.3	7.6	15.8	20.0	533	608	1008	1680	2561	3473

Interpolate for capacities at intermediate pressures.



No. 2606
Male Inlet
Side Outlet

Orders must specify the set pressure as well as the catalog number and size.

Recommendations: The No. 2606 are high grade, sturdy, bronze safety relief valves suitable for liquid and saturated steam service. They are especially recommended for use on water heaters where a valve of outstanding quality is required.

Design: The valves are of the single disc type with bottom guide to assure proper seating. All sizes have a pop chamber and blowdown regulating ring which enable the valves to operate with the same positive action as a pop safety valve, should steam develop in the water heater. A stuffing box around the stem prevents leakage of hot water from the top of the valve.

The regulating ring provides a means of adjusting the blowdown of pressure when changing or regulating the set pressure. This adjustment may be made from outside of the valve without interfering with the pressure setting. A locking plug screwed through the wall of the valve body prevents the regulating ring from loosening once it has been set for blowdown.

Materials: The body and base are made of bronze conforming to ASTM Specification B 62. The disc is also bronze. The spring and stem are made of steel.

Lever: The lever is malleable iron and is japanned maroon. Illustrated in the pull-up position, it can be reversed for push-or-pull-down operation. Complete rotation is possible without disturbing the set pressure of the valve.

Pressure setting: Safety relief valves for liquid service preferably are set 25 per cent higher, and for steam service 10 per cent higher, than the normal working pressure in the system to avoid waste due to minor fluctuations of pressure.

The valves can be ordered set for any pressure from 3 to 250 psi.

The original setting may be readjusted for pressures up to 10 per cent higher or lower but not to exceed the maximum recommended rating of the valve. This variation must be strictly observed as one spring cannot cover the complete range of pressures at which the valve may be set.

After the valves are set at the factory, they are sealed in a manner to prevent tampering or unauthorized readjustment of the set pressure and blowdown.

Installation and maintenance: Proper installation and maintenance are essential for efficient performance. The valves should be installed in a vertical position directly on the apparatus to be protected. They should be manually operated at regular intervals to assure proper action. Their stuffing box gland should be pulled up only to "finger tightness"; excessive tightness on the packing could be detrimental. For further information, see page 204.

Code compliance: No 2606 Valves comply with requirements of the ASME Unfired Pressure Vessel Code, Section VIII 1950 and bear the Code cloverleaf symbol.

Weights and Dimensions — Prices on Request

Size Inlet or Outlet Inches	No. 2606 Pounds, Each	Dimensions, in Inches: Center to top of cap	Center to top of lever, open	Center to male inlet	Center to side outlet
½	1.0	3¾	5⅜	2¼	1⅛
¾	1.7	3¾	5½	2¾	1⅜
1	2.8	4⅝	6½	3¼	1⅝
1¼	4.8	5¼	7½	3¾	2 1/16
1½	7.3	6⅛	9	4⅜	2 7/16
2	12.0	7¾	11	4½	2¾

General information....pages 204 and 205

Bronze Pop Safety Valves
For Air and Gas

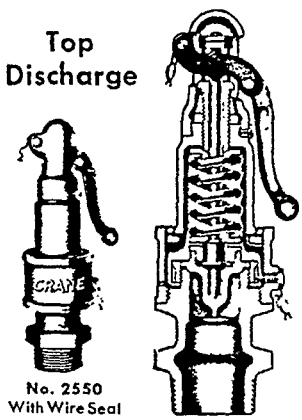
Set at any specified pressure
from 3 to 250 psi; 406 F maximum

Discharge Capacities

Set Pressure	Cubic Feet of Free Air per Minute At 10% Overpressure, 60 F							
psi	⅜ inch	½ inch	¾ inch	1 inch	1¼ inch	1½ inch	2 inch	2½ inch
25	3	32	48	67	92	114	274	473
50	13	49	76	127	192	249	540	706
75	25	69	95	157	285	355	788	937
100	37	88	110	189	318	440	973	1133
125	40	105	122	215	351	485	1107	1310
150	42	121	139	241	390	525	1243	1485
175	43	139	155	271	428	570	1381	1655
200	45	157	176	300	461	615	1515	1827
225	47	172	196	334	497	655	1652	2004
250	48	190	217	359	529	699	1795	2177

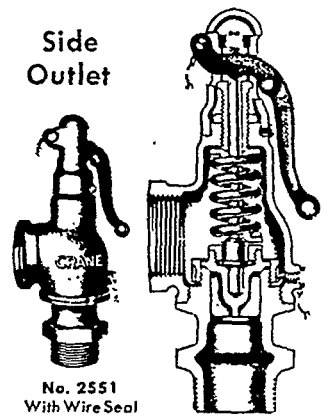
Interpolate for capacities at intermediate pressures. For air capacities at other than 60 F, or for capacities of gases other than air, see page 205.

Top Discharge



No. 2550
With Wire Seal

Side Outlet



No. 2551
With Wire Seal

Orders must specify the set pressure as well as the catalog number and inlet size.

Recommendations: These valves are used on receivers, tanks, pipe lines, and similar vessels. For air, either is suitable, but for gases, the side outlet type is generally used, the discharge being piped away.

Pressure setting: The valves can be ordered set at any pressure from 3 to 250 psi. Pop safety valves for air and gas are preferably set 25 per cent higher than the normal operating pressure in the system.

A main spring regulating adjustment permits increasing or decreasing the set pressure 10 per cent; this must be strictly observed as one spring cannot cover the complete range of pressures at which the valve may be set. A wire seal prevents tampering with the factory setting.

Design: The valves are the single disc type. Sizes ½-inch and larger have a regulating ring which permits readjustment of the blowdown when the set pressure is changed. Seating surfaces are carefully prepared by grinding to assure audible tightness at all pressures up to 80 per cent of the set pressure.

Materials: The body and base are bronze (ASTM B 62). The disc is also bronze. The lifting lever is malleable iron. The spring, spring washer, and stem are steel.

Lifting lever: The lifting lever, shown in the pull-up position, can be reversed for push-or-pull-down operation. Complete rotation is possible without disturbing the set pressure.

Installation: The valves always should be installed with the stem in a vertical position. They are preferably installed inverted to allow moisture to collect and seal the seating surfaces.

For additional information concerning installation, as well as proper maintenance, see page 204.

Noxious gases: Side outlet valves having a pressure-tight outlet side should be used for noxious or inflammable gases. Bronze valves suitable for such service are the No. 2651 Pop Safety shown on page 208 and the No. 2668 Safety Relief on page 211.

Code compliance: All sizes except the ⅜-inch comply with requirements of the ASME Unfired Pressure Vessel Code, Section VIII, 1959, and bear the Code cloverleaf symbol. The Code does not include a ⅜-inch size.

Weights and Dimensions (Inches) — Prices on Request

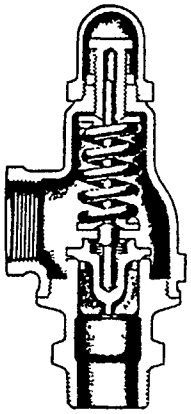
Size (inlet)	No. 2550 Top Discharge			No. 2551 Side Outlet				
	Pounds	Over-all Height		Pounds	Size of side outlet	Center of Valve to:		
		To top of cap	To top of lever open			Top of cap	Top of lever, open	Bottom of male inlet	End of side outlet
Inches	Each			Each					
⅜	.8	6	7⅝	2.0	½	3¾	5⅜	2¼	1⅛
½	1.0	6	7⅝	2.3	½	3¾	5⅜	2¼	1⅛
¾	2.0	6½	8¼	3.0	¾	3¾	5½	2¾	1⅜
1	3.0	7⅞	9¾	3.5	1	4⅝	6½	3¼	1⅝
1¼	4.0	7⅞	9¾	4.0	1¼	4⅜	6¼	3½	1¾
1½	5.0	9⅛	11⅜	5.0	1½	5¼	7½	3⅞	2⅛
2	8.0	10⅝	13½	8.5	2	6⅛	9	4½	2 7/16
2½	13.0	12¾	16	13.0	2½	7¾	11	5	2⅞

General information and additional capacity data . . . . pages 204 and 205

804002

Bronze Relief Valves
For Water or Oil

18



Cross Section
No. 2611



No. 2611, With Cap
Male Inlet, Side Outlet



No. 2612, With Wheel
Male Inlet, Side Outlet



No. 2614, With Cap
Female Inlet, Side Outlet

Valves Are Set at Any Pressure Within the Limits Indicated Below

Valve Size	Setting Limits (psi)	
Inches	400 F	200 F
⅜ to 2½	5-250	251-300
3	5-200	201-250

Specify catalog number, inlet size, and set pressure.

These valves are recommended for liquid service on pipe lines, presses, pumps, cylinders, and similar installations.

Discharge Capacities

Set Pressure	Gallons of Water per Minute At 25% Overpressure, 70 F								
psi	⅜ inch	½ inch	¾ inch	1 inch	1¼ inch	1½ inch	2 inch	2½ inch	3 inch
25	.2	1.2	2.1	5.0	6.6	8.7	12.5	28.0	58.0
50	.3	2.0	3.3	8.5	13.3	16.0	25.0	37.0	77.0
75	.6	2.7	4.5	12.0	18.1	24.2	36.0	46.0	92.0
100	1.1	3.5	5.7	15.2	21.2	32.0	45.0	55.0	106.0
125	1.7	4.4	7.0	18.1	24.2	39.7	54.2	64.0	120.0
150	2.1	5.4	8.0	20.9	26.5	47.5	63.5	73.0	134.0
175	2.6	6.5	9.0	23.7	29.5	57.0	72.7	82.0	147.0
200	3.1	7.6	10.0	26.2	32.5	63.0	82.0	91.0	161.0
225	3.9	8.6	11.0	29.0	35.2	71.0	91.0	101.0	175.0
250	5.0	9.7	12.0	31.7	38.0	79.0	100.0	110.0	189.0
275	6.1	10.7	13.2	34.4	41.0	87.0	109.0	119.0	...
300	7.3	11.8	14.5	37.0	44.0	95.0	118.0	128.0	...

Interpolate for capacities at intermediate pressures. For capacities at 10% overpressure, divide above values by 5.

Relief valves are intended to relieve excessive pressures; they should not be used in an attempt to relieve shock pressures in hydraulic lines. These valves are pressure-tight on the outlet side and can discharge against low head pressures.

Design: The valves are the single disc type with long bottom guide to assure true seating. The seat is integral with the base of the valve. A stuffing box around the adjusting screw for the main spring is filled with asbestos packing to form an effective seal for the body.

Materials: The body and base are made of bronze (ASTM B 62). The disc is also bronze. The spring is steel. The stem is steel on sizes 2-inch and smaller and bronze on sizes 2½ and 3-inch.

Fire protection service: Valves used in fire protection installations usually must comply with various Underwriters' specifications; before ordering valves for such service, a study should be made of local specifications.

Pressure settings: The valves are set at the factory at any specified pressure within the ranges indicated in the small table at the upper left. They should be set at least 25 per cent higher than the normal operating pressure in the system.

Pressure adjustment: The set pressure of the valves may be adjusted after installation to any pressure within a range of 10 per cent above or below the original factory setting, but the maximum recommended pressure for the valve size should not be exceeded.

Installation: Relief valves should always be installed with the stem in a vertical position to assure proper seating of the disc. For information on installation and maintenance, see page 204.

Code compliance: The No. 2611 and No. 2614 Valves in sizes 1½-inch and larger comply with requirements of the ASME Unfired Pressure Vessel Code, Section VIII, 1959, for liquid service. The Code does not include a ⅜-inch size.

Weights and Dimensions — Prices on Request

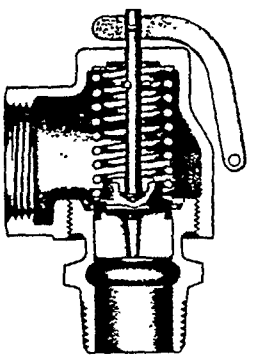
Size (inlet)	Pounds, Each			Dimensions, in Inches					
	No. 2611	No. 2612	No. 2614	Center to Top		Center to male inlet	Center to female inlet	Center to side outlet	Size of side outlet	Dia of wheel
Inches	Male Inlet	Male Inlet	Female Inlet	Nos 2611 2614	No 2612 only					
⅜	1.0	1.0	...	3⅛	3⅜	2¼		1⅛	½	2⁹⁄₁₆
½	1.0	1.0	1.0	3⅛	3⅜	2¼	2	1⅛	½	2⁹⁄₁₆
¾	2.0	2.0	1.5	3¼	3⅜	2¾	2⅜	1⅜	¾	2⁹⁄₁₆
1	3.0	3.0	2.8	3⅝	3⅞	3¼	2¾	1⅝	1	3¹⁄₁₆
1¼	5.0	5.0	4.5	4¼	4⅜	3¾	3⅜	2¹⁄₁₆	1¼	3⅝
1½	7.0	7.0	6.8	5⅜	5⅛	4⅜	3⅞	2⁷⁄₁₆	1½	4¹⁄₁₆
2	11.0	12.0	11.0	6⅝	6¾	4½	4⅜	2¾	2	4¾
2½			17.0	7⅝			4⅞	3	2½	
3			28.0	8½			5³⁄₁₆	3½	3	

General information....pages 204 and 205

Low Pressure Iron Body Pop Safety Valves
For Steam Heating Boilers

Set Pressure—Non-Adjustable
15 psi saturated steam

Important: The valves are non-adjustable. They are set at the factory and sealed by means of a sealing pin. The popping pressure cannot be altered nor can valves be taken apart without breaking the seal, thereby showing evidence of tampering. An attached identification plate indicates the setting.



Cross Section
No. 2568

Recommendations: High capacity, tested design, and sturdy construction make these the ideal valves for use on low pressure steam heating boilers, or on receivers, tanks, piping, and other apparatus carrying steam pressures not exceeding 15 psi.

Efficiency through high capacity: Because safety valves used on steam heating boilers should have a relieving capacity sufficient to discharge all of the steam generated, their selection is based on capacity rather than size.

Crane's high capacity valves permit the use of smaller sizes, and frequently, fewer valves. The result is a saving in size and number of boiler openings, in discharge piping, and in over-all cost.

Features: These are flat seat valves. The seat, and a recess which forms a huddling chamber, are machined in the top surface of the base. The disc has wing guides to assure accurate guidance in the seat opening; a lip on the outer edge of the disc forms the top of the huddling chamber. This construction provides the desired "popping" action.

A long, flexible spring contributes to the high disc-lift so necessary for high relieving capacity. The spring, compressed within the body, bears down on the top of the disc. The body is screwed on the top of the base and locked in place by the sealing pin.

Materials and finish: The body is made of cast iron conforming to ASTM Specification A 126, Class A. The base and disc are bronze (ASTM B 62). To assure good resistance against corrosion, all other internal parts except the spring, are also made of bronze.

Sizes 1¼-inch and smaller have a stainless steel spring and a bronze lever; on larger sizes, the spring is carbon steel, cadmium-plated and the lever is malleable iron

The body and malleable iron lever have an attractive black enamel finish

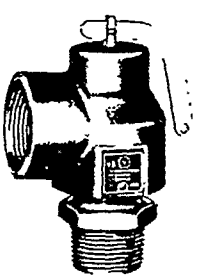
Blowdown: The blowdown pressure, fixed and non-adjustable, is about 3 psi. Thus, since the valve is factory set at 15 psi, it "pops" open when the inlet pressure mounts to 15 psi and closes when the pressure drops to about 12 psi.

Proper installation: Always install the No. 2568 with the stem vertical and the lifting lever at the top.

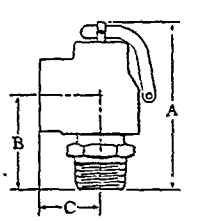
The discharge piping should be independent of the valve. It should be supported close to the valve and sloped slightly downward so as to drain away condensate. Full instructions accompany each valve.

Maintenance: To assure proper action, manually operate the valves at regular intervals. Do this only when sufficient pressure is available within the boiler or pressure vessel to blow any accumulated foreign matter clear of the seating surfaces. This applies particularly when a new boiler is started up.

Code compliance: These valves comply with requirements of the 1959 ASME Code for Low Pressure Heating Boilers and are registered with the National Board of Boiler and Pressure Vessel Inspectors.



No. 2568
Side Outlet



Weights, Dimensions, and Capacities — Prices on Request

Valve	Size (inlet) Inches	Weight Pounds Each	Dimensions, in Inches A	B	C	Size of side outlet	Steam Capacity Pounds Per Hour
No. 2568 Side Outlet	¾	1.0	4¼	2½	1½	1	360
	1	2.0	4¾	2¾	1¾	1¼	580
	1¼	2.9	5⅜	3⅛	2	1½	870
	1½	4.4	6⅛	3½	2¼	2	1125
	2	7.0	7¼	4⅛	3	2½	2140
	2½	12.0	9	5⅛	3 9/16	3	3485
	3	18.0	10½	6¼	4 1/16	3½	4865

Specify catalog number and size of inlet.

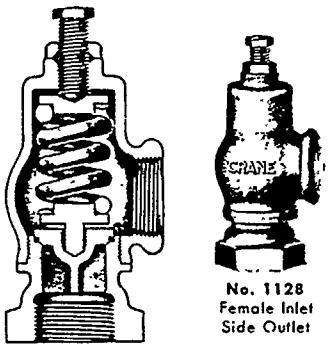
General data....pages 204 and 205

Bronze Hydraulic Relief Valves

For temperatures up to 200 F

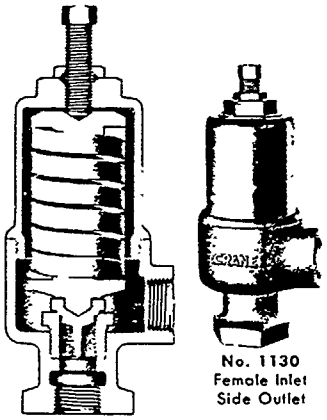
18

Recommendations: These valves are particularly designed to safeguard high pressure oil lines and pumping systems and various hydraulic apparatus operating at high pressures, such as hydraulic presses and elevators. The valves are to be used at atmospheric temperatures and for services discharging to atmosphere. They should never be used as unloading valves or in an attempt to relieve shock in hydraulic systems.



No. 1128
Female Inlet
Side Outlet

All sizes set at any specified pressure from 300 to 600 psi.



No. 1130
Female Inlet
Side Outlet

Set at any specified pressure within the following ranges:

½-inch.....601 to 8000 psi
¾-inch.....601 to 6000 psi
1-inch.....601 to 4500 psi
1¼-inch.....601 to 4000 psi
1½ or 2-inch...601 to 2600 psi

Design: Both valves are characterized by rugged construction, simplicity of design, and the use of high grade materials.

The No. 1128 have a base and disc cast of Crane Special Bronze conforming to ASTM B 61. The seat ring is integral with the base. The body is bronze.

The No. 1130 have a body and base made of bronze (ASTM B 62). The disc is Exelloy on ½ and ¾-inch sizes and Crane 18-8 SMo Alloy Steel on larger sizes. The renewable, screwed-in body seat ring is made of Crane No. 49 Nickel Alloy.

Both valves have an exceptionally long spring made of high quality steel, cadmium plated. The valves have an adjusting screw with a hexagon end for wrench engagement. A lock nut permits the adjusting screw to be locked at the desired set pressure. The valves are pressure-tight on discharge. A stuffing box around the adjusting screw, and under the lock nut, is filled with high grade packing to seal the top end of the valve.

Discharge Capacities

Valve	Set Pressure psi	Gallons of Water per Minute At 25% Overpressure, 70 F ½ inch	¾ inch	1 inch	1¼ inch	1½ inch	2 inch
No. 1128	300	8	14	20	45	70	95
	325	9	15	22	48	75	102
	350	10	17	24	52	81	110
	375	11	18	26	56	86	117
	400	12	20	28	60	92	125
	425	12	21	29	64	98	132
	450	13	22	31	67	103	140
	475	13	23	32	71	109	148
	500	14	24	34	75	115	156
	525	15	25	35	79	121	164
	550	16	26	37	82	126	172
	575	16	27	38	86	132	180
	600	17	28	41	90	138	188
No. 1130	601	17	28	41	90	138	188
	1000	27	50	66	150	225	330
	1500	40	70	102	220	340	470
	2000	53	92	132	290	450	640
	2500	66	115	165	360	575	810
	3000	80	140	198	440	..	..
	3500	93	164	230	510	..	..
	4000	106	185	264	590	..	..
	4500	120	210	290	..	..	
	5000	132	230	..	..	..	
	5500	146	255	..	..	..	..
	6000	160	278	..	..	..	..
	6500	172	..	..	..	..	..
	7000	186	..	..	..	..	..
	7500	198	..	..	..	..	..
	8000	212	..	..	..	..	..

Interpolate for capacities at intermediate pressures. For capacities at 10% overpressure, divide above values by 2.

Pressure setting: These valves are regularly set at any specified pressure within the ranges indicated under the illustrations at the left.

Hydraulic relief valves can be readjusted for pressures up to 10 per cent above or below the original set pressure, but they should never be set at pressures in excess of the maximum rating for which the valve is designed. If a greater change in the set pressure is to be made, a new spring may be required, since one spring will not cover the entire range of pressures at which the valve may be set.

Relief valves should be set at least 25 per cent higher than the normal working pressure in the system in order to avoid wasting water or oil in discharges due to minor fluctuations of pressures.

These valves are intended to protect apparatus and piping against excessive pressures. they are not to be used to maintain pressure at a maximum point. Operating pressures maintained continuously close to the set pressure of the valve will tend to cause leakage and maintenance difficulties

Weights and Dimensions — Prices on Request

Size	No. 1128 Pounds	Dimensions, in Inches				No. 1130 Pounds	Dimensions, in Inches			
Inches	Each	Size of outlet	Center to top	Center to inlet	Center to side outlet	Each	Size of outlet	Center to top	Center to inlet	Center to side outlet
½	1.8	½	2⅞	2⅛	1⅜	14.5	1	7¼	3	2 11/16
¾	1.7	¾	2⅞	2⅛	1⅜	14.5	1	7¼	3	2 11/16
1	2.8	1	3⅝	2½	1⅝	14.5	1	7¼	3	2 11/16
1¼	4.2	1¼	3⅞	2 15/16	1¾	27.5	1½	9½	3⅝	3 3/16
1½	9.0	1½	4½	3⅛	2	30.0	1½	9½	3⅝	3 3/16
2	10.0	2	5⅝	3⅝	2½	55.0	2	11 3/4	4⅛	3 13/16

Specify catalog number, inlet size, and set pressure

General information . . . pages 204 and 205

Bronze Safety Relief Valves
For Gasoline and Noxious Gases

Discharge Capacities*

Set Press.	½ inch	¾ inch	1 inch	1¼ inch	1½ inch	2 inch
psi	Cubic Feet of Free Air per Minute At 10% Overpressure, 60 F					
25	32	48	67	129	159	224
50	49	76	127	225	288	370
75	69	95	157	314	386	495
100	88	110	189	365	438	610
125	105	122	215	399	511	703
150	121	139	241	441	594	817
175	139	155	271	481	674	927
200	157	176	300	515	752	1035
225	172	196	334	564	827	1138
250	190	217	359	598	912	1237
275	215	237	383	610	985	1350
300	240	257	410	635	1069	1475
psi	Gallons of Water per Minute At 10% Overpressure, 70 F					
25	.2	.4	1.0	1.3	1.7	2.5
50	.4	.7	1.7	2.7	3.2	5.0
75	.5	.9	2.4	3.6	4.8	7.2
100	.7	1.1	3.0	4.2	6.4	9.0
125	.9	1.4	3.6	4.8	7.9	10.8
150	1.1	1.6	4.2	5.3	9.5	12.7
175	1.3	1.8	4.7	5.9	11.4	14.5
200	1.5	2.0	5.2	6.5	12.6	16.4
225	1.7	2.2	5.8	7.0	14.2	18.2
250	1.9	2.4	6.3	7.6	15.8	20.0
275	2.1	2.6	6.9	8.2	17.4	21.8
300	2.4	2.9	7.4	8.8	19.0	23.6

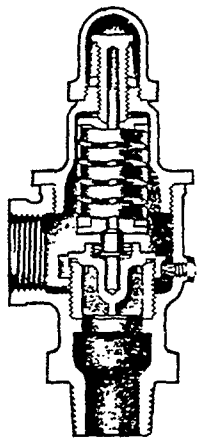
Weights & Dimensions — Prices on Request

No. 2668	Size (inlet) Inches	Pounds Each	Dimensions, in Inches: Size of outlet	Center to top	Center to male inlet	Center to side outlet
	½	2.0	½	3¼	2 7/16	1 1/16
	¾	2.0	¾	3⅜	2⅞	1 5/16
	1	3.5	1	4	3 3/16	1⅝
	1¼	6.5	1¼	4⅞	3 11/16	2 1/16
	1½	9.4	1½	6¼	4	2⅜
	2	14.5	2	7¼	4 11/16	2¾

Orders must specify the catalog number, inlet size, and set pressure desired.

***Set at any specified pressure** from 3 to 300 psi; 400 F max.*

**Interpolate for capacities at intermediate pressures. For air capacities at other than 60 F, or for capacities of gases other than air, see page 205.*

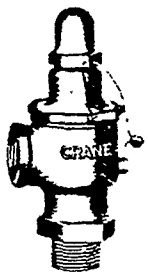


Cross Section

Recommendations: No. 2668 Valves are recommended particularly for gasoline and noxious gases and are used where a pressure drop of 10% is permissible. They are pressure-tight on the outlet and can discharge against low back pressures. The valves are easily dismantled without disturbing piping connections.

Construction: The valves are of the single disc type with bottom guide to assure proper seating. Their regulating ring permits adjusting the blowdown when the set pressure is changed. An asbestos-packed stuffing box surrounding the spring adjusting screw forms an effective seal for the body. All sizes have a screwed-in seat bushing.

The body is made of Crane Special Bronze (ASTM B 61); the bonnet and disc are also bronze. The spring and stem are steel, the stem point being case-hardened.



No. 2668
Male Inlet, Side Outlet

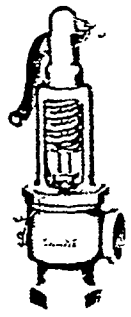
Settings: Factory settings are adjustable up to 10% higher or lower (maximum rating of valve should not be exceeded). For air and gas use, the valves should be ordered set at least 25% higher than the normal operating pressure of the system.

Tight seat: Carefully ground seating surfaces assure audible tightness at all pressures up to 80% of the set pressure.

Code compliance: All sizes comply with requirements of the ASME Unfired Pressure Vessel Code, Section VIII, 1950, and bear the Code cloverleaf symbol.

18-8 SMo Safety Relief Valves
For Water, Oil, or Gas

Set at any specified pressure up to 250 psi; 600 F maximum



No. 18854
Female Inlet
Side Outlet

No. 18854 Valves, made in sizes ⅜ to 2-inch, are used for liquid and gas services subject to corrosive conditions. The body, bonnet, and disc are Crane 18-8 SMo, an alloy steel equivalent to AISI Type 316 wrought stainless steel; other parts in contact with fluid in the line also are stainless steel.

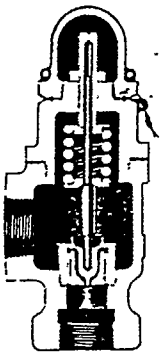
Valves specified for gas service are furnished with a specially ground seat.

The valves are the outside spring type. A stuffing box around the valve stem prevents any escape of fluid during a discharge. A regulating ring on sizes ½-inch and larger permits adjusting the blowdown when the set pressure is changed.

Sizes ½ to 2-inch comply with the ASME Unfired Pressure Vessel Code, Section VIII 1950, and bear the Code cloverleaf symbol

Prices on request. No. 18854 Valves are described in detail, complete with weights, dimensions, and capacities, in the Corrosion-Resistant Valve Section 17; see page 198

All-Iron Relief Valves
For Ammonia, Water, Air, or Gas



Cross Section



No. 1151
Screwed Inlet
and Side Outlet

The 1½ and 2-inch sizes have a bolted bonnet (not shown).

Orders must specify the catalog number, inlet size, service, and set pressure.

Set at any specified pressure
from 3 to 300 psi, 400 F maximum

Discharge Capacities

Set Pressure	Cubic Feet of Free Air per Minute [1]At 25% Overpressure, 60 F						Gallons of Water per Minute [2]At 25% Overpressure, 70 F					
	½ inch	¾ inch	1 inch	1¼ inch	1½ inch	2 inch	½ inch	¾ inch	1 inch	1¼ inch	1½ inch	2 inch
25	5.5	9.3	22.2	29.4	38.6	55.4	1.2	2.1	5.0	6.6	8.7	12.5
50	10.5	17.6	44.6	70.0	84.0	131.0	2.0	3.3	8.5	13.3	16.0	25.0
75	16.6	27.1	72.3	109.0	145.0	217.0	2.7	4.5	12.0	18.1	24.2	36.0
100	24.1	38.6	102.0	143.0	215.0	302.0	3.5	5.7	15.2	21.2	32.0	45.0
125	32.4	51.5	133.0	177.0	292.0	399.0	4.4	7.0	18.1	24.2	39.7	54.2
150	43.3	63.6	185.0	210.0	378.0	505.0	5.4	8.0	21.0	26.5	47.5	63.5
175	55.1	76.5	201.0	250.0	484.0	619.0	6.5	9.0	23.7	29.5	57.0	72.7
200	68.4	90.2	236.0	293.0	568.0	739.0	7.6	10.0	26.2	32.5	63.0	82.0
225	82.1	91.8	275.0	334.0	674.0	864.0	8.6	11.0	29.0	35.2	71.0	91.0
250	96.5	119.0	316.0	378.0	786.0	996.0	9.7	12.0	31.7	38.0	79.0	100.0
275	112.0	137.0	358.0	427.0	906.0	1135.0	10.7	13.2	34.4	41.0	87.0	109.0
300	128.0	157.0	400.0	488.0	1003.0	1280.0	11.8	14.5	37.0	44.0	95.0	118.0

[1]For air capacities at 10% overpressure, multiply the air capacities above by 0.18.
[2]For liquid capacities at 10% overpressure, divide the water capacities above by 5.

Interpolate for capacities at intermediate pressures. For air capacities at other than 60 F, or for capacities of gases other than air, see page 205.

Recommendations: The No. 1151 are all-iron relief valves. They are recommended for ammonia, water, air, or gas lines and are generally used where all-iron construction is preferred because of conditions corrosive to bronze.

Design: The valves are sturdily constructed and simple in design. They are of the single disc type with bottom guide to assure proper seating. The seat is oil-sealed, a preferred treatment for valves used on air or gas service.

Sizes 1¼-inch and smaller have a screwed bonnet as illustrated; larger sizes have a bolted bonnet. The bonnet-body and bonnet-cap joints are sealed with a lead gasket.

Materials: The body and bonnet are made of Crane Ferrosteel (ASTM A 126, Class B); the body seat ring and disc are stainless steel, and the stem is steel with a casehardened point.

Weights and Dimensions — Prices on Request

	Size (inlet) Inches	Weight Pounds Each	Dimensions, in Inches: Size of outlet	Center to top	Center to inlet	Center to side outlet
No. 1151	½	2.7	¾	3⅜	2¼	1⅜
	¾	4.6	1	4¼	2⅝	1⅝
	1	8.0	1¼	5⅜	3⅛	2
	1¼	14.0	1½	6¾	3¾	2½
	1½	19.0	2	6⅞	3 5/16	3
	2	32.0	2½	7½	4⅜	3 15/16

General information and capacity data....pages 204 and 205

Regrinding: Seating surfaces are easily reground. Pipe threads tapped into the top of the disc permit insertion of a pipe nipple for rotating the disc.

Pressure setting: The valves are set at the factory at any specified pressure from 3 to 300 pounds per square inch.

These valves should always be ordered set at least 25 per cent higher than the normal working pressure in the system so as to prevent wastage of fluid when minor fluctuations of pressure occur.

Pressure adjustment: The set pressure of these valves can be readjusted after installation to any pressure up to 10 per cent above or below the original factory setting, but the maximum recommended rating of 300 psi must not be exceeded.

Installation: Relief valves should always be installed with the stem in a vertical position. For air and gas service, they are preferably inverted to allow moisture to seal the seating surfaces.

For additional information concerning installation, as well as proper maintenance, refer to page 204.

Code compliance: These valves comply in all respects to the requirements of the ASME Unfired Pressure Vessel Code, Section VIII, 1950 for liquid service only

CRTX 1055

Bronze Relief Valves for Vacuum Service

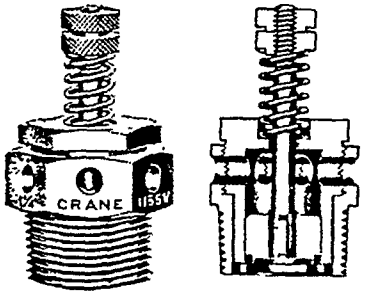
18

No. 1155 V

Size Inches	Weight Pounds Each	Height Inches	Dia. of 6 Holes Inches
½	.31	2⅞	⅛
¾	.46	3	5/32
1	.75	3⅜	9/32
1¼	1.0	3½	⅜
1½	1.7	4¼	15/32

Prices on Request

Recommendations: The No. 1155 V is designed for use as a vacuum breaker. It is used on low pressure tanks, steam jacketed kettles, and similar apparatus where possible formation of a vacuum could result in damage to the apparatus through the effects of atmospheric pressure. It is rated for steam pressures up to 250 psi, 406 F.



No. 1155 V
Vacuum Relief Valve

The No. 1155 V is rated for steam pressures up to 250 psi, 406 F.

Operation: In service, the disc of the valve is normally held to its seat, both by spring tension and by the pressure in the apparatus to which the valve is attached. When the pressure in the vessel falls below atmosphere, the spring tension is overcome and the disc is pulled from its seat. Air is then admitted through the valve, thus preventing the vacuum from reaching the danger point.

Design: The valves have a two-piece body and seat bushing which removes the seat from the influence of body distortion when the valve is being installed.

The body, seat bushing, and disc are bronze. The spring is stainless steel.

Pressure setting: The valves are regularly set to open at 5 inches vacuum mercury and have a spring which permits an adjustment range of 10 inches vacuum mercury. Springs for a higher or lower adjustment range are available on special order.

Tests: The valves are regularly tested for tightness at the seat with 50 psi water pressure.

Discharge Capacities

Set Pressure		Absolute Pressure in Closed Tank or Vessel Into Which Valve Is Discharging			Relief Capacity In Cubic Feet of Free Air per Minute At 60 F				
Absolute Press. Psia	Vacuum Mercury Inches	Absolute Press. Psia	Vacuum Mercury Inches	Differential Psi	½ inch	¾ inch	1 inch	1¼ inch	1½ inch
12.2	5.09	11.7	6.11	0.5	.8	3.0	6.0	11.0	20.0
		11.2	7.13	1.0	1.4	5.6	11.0	20.5	38.0
		10.7	8.14	1.5	2.1	8.3	16.3	30.0	56.3
		10.2	9.16	2.0	2.8	11.0	21.7	39.3	73.2
		9.7	10.18	2.5	3.5	13.7	26.9	48.4	81.6
		9.2	11.20	3.0	4.2	16.4	32.2	57.6	106.6
		8.7	12.22	3.5	4.9	19.1	37.2	66.7	123.5
		8.2	13.23	4.0	5.6	21.9	42.3	75.9	139.2
		7.7	14.25	4.5	6.3	24.5	47.5	84.7	156.0
9.7	10.18	8.7	12.22	1.0	4.2	8.8	14.4	22.2	33.2
		8.2	13.23	1.5	6.1	12.7	20.9	32.4	48.6
		7.7	14.25	2.0	8.1	16.7	27.3	42.3	62.0
		7.2	15.27	2.5	10.0	20.7	33.8	52.6	77.8
		6.7	16.29	3.0	11.9	24.5	40.3	63.2	93.2
		6.2	17.31	3.5	13.9	28.5	47.0	71.5	108.2
		5.7	18.32	4.0	15.8	32.4	53.5	81.7	124.2
		5.2	19.34	4.5	17.8	36.4	60.0	92.0	138.0
		4.7	20.36	5.0	19.7	40.3	64.6	101.8	152.0

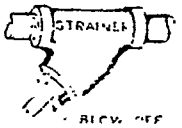
Capacities: Capacities are shown above. Since the set pressure is a point at which the valve is set to open but at which it is actually still closed, no flow rates are consequently obtainable. In order to cause the valve to open and provide flow rates, a pressure differential must exist between the set pressure and the pressure at which the valve discharges. The pressure differential, generally known as overpressure or accumulation, is obtained by an increase in the upstream pressure

In vacuum service, upstream pressure is considered for practical purposes to be a constant 14.7 psia. It is possible to obtain the pressure differential necessary for flow rates, only by an increase in the vacuum or by a decrease in the absolute pressure on the downstream side of the valve. With each increase in the pressure differential, the valve will open wider providing an increased flow orifice area and a higher flow rate. Capacities in the table reflect these conditions.

General information....pages 204 and 205

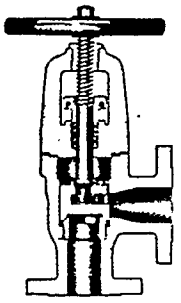
Pipe scale and dirt in piping systems are the greatest enemies of valves, regulators, meters, and other mechanical devices. They can cause endless trouble and serious damage. Such foreign matter lodges on valve seats and starts leakage; it gets into automatic devices with close-fitting, moving parts and prevents proper operation; and it collects at points of low velocity, obstructing passage of flow.

Dirt in Piping

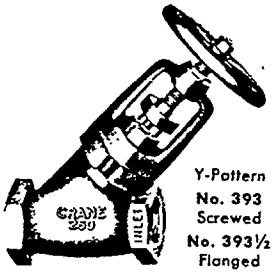


Regardless of how clean piping materials are when being installed, a generous use of strainers or sediment separators is a sound investment, and considering the protection provided, relatively inexpensive. For the Crane line of Y-pattern sediment separators, refer to page 254. Proper maintenance, such as blowing out lines at regular intervals, will assure a practically trouble-free installation.

250-Pound Ferrosteel Blow-Off Valves



Angle
No. 390 Screwed
No. 391 Flanged



Y-Pattern
No. 393 Screwed
No. 393½ Flanged

Working Pressure
250 psi boiler blow-off service

Hydrostatic Test Pressures
550 psi seat — 800 psi shell

Recommendations: These valves have been particularly designed for boiler blow-off service, but are also well suited for blow-off service on tanks or receivers where dirty, gritty water is to be handled.

Boiler Code requirements: The Y-Pattern Valves do not comply with requirements of the 1959 edition of the ASME Boiler Code. The Angle Valves comply with the Code for bottom blow-off, except the maximum allowable working pressure under the Code is 200 psi instead of 250 psi.

Features of construction: The valves have a renewable seat and a slip-on disc in order to permit quick repairs. Contrary to ordinary globe valve construction, the seating surface is on the outside of the seat ring where it is protected from the cutting effect of water passing the seat.

The bonnet is held to the body with two bolts, which facilitate dismantling the valve for inspection or repair. The outside screw and yoke construction, with stem threads outside the flow of water, lengthens the life of the threads and prevents the valves from becoming inoperative due to scale and foreign matter jamming the threads. All parts are sturdily constructed.

The stuffing box is unusually deep and holds ample high grade packing, eliminating frequent repacking.

Materials: The body and bonnet are Ferrosteel, a high grade cast iron (ASTM A 126, Class B). Cast iron, proven very satisfactory for blow-off service, is used also for the disc and body seat ring. The stem is Cast Manganese Bronze. The two-piece gland consists of a siliconized steel gland and a malleable iron gland flange.

Flanged valves: The dimensions and drilling of end flanges conform to the American Cast Iron Flange Standard, Class 250 (B16b-1944); the flanges have a 1/16-inch raised face finished with approximately 16 concentric grooves per inch, known as a "serrated" finish.

Flanged valves are furnished faced and drilled (F & D); they can be furnished faced only, when specified.

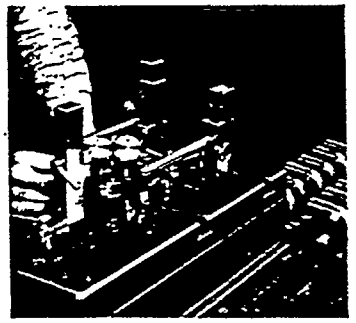
Weights and Dimensions — Prices on Request

Size	Pounds, Each				Dimensions, in Inches								
	Angle		Y-Pattern		Angle			Y-Pattern			Wheel diameter	End Flanges	
	No. 390	No. 391	No. 393	No. 393½	Center to end	Center to face	Center to top, open	End to end	Face to face	Center to top, open		Diameter	Thickness
Inches	Screwed	Flanged F & D	Screwed	Flanged F & D	No. 390	No. 391		No. 393	No. 393½				
1½	39	45	42	...	4	4½	12½	7¼	...	12¾	8	6⅛	13/16
2	55	58	54	65	4½	5	13¾	8	11	14	9	6½	⅞
2½	74	87	76	91	5	5¾	15½	9⅛	12¼	15¾	10	7½	1

Templates for drilling....page 328

Extra body seat rings and discs, for replacement purposes, can be furnished.

If It's a Crane Product—It's a Tested Product!



Checking disc taper. Parts, like finished products, are thoroughly checked.



Stress distribution is revealed photoelastically.



Metal structure is examined through a metallographic microscope.

Bronze Relief Valves
For Air or Gas

Set at any specified pressure
from 251 to 500 psi; 400 F max.

No. 2674 are high pressure bronze relief valves recommended for use on air or gas compressors, cylinders, pipe lines, etc. They are pressure tight on the outlet side and can discharge against low head pressures.

Materials and design: The valves are the single disc type with bottom guide to assure proper seating. Their base and disc are Crane Special Bronze, a high grade, leaded tin bronze conforming to ASTM B61; the body is also bronze. The spring and stem are steel, the stem point being case hardened.

The asbestos-packed stuffing box around the adjusting screw, provides a tight seal at the upper end of the valve. Seating surfaces are carefully ground to insure audible tightness up to 80 per cent of the set pressure.

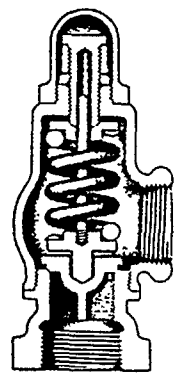
Pressure setting: The valves should be set at least 25 per cent higher than the normal operating pressure in the system. The original setting can be readjusted up to 10 per cent higher or lower but the maximum rating of the valve must not be exceeded.

Installation: The valves should be installed vertically, and preferably inverted, to allow moisture to collect and seal the seating surfaces: see page 204 for further details.

Discharge Capacities

Set Pressure Pounds	Cubic Feet of Free Air per Minute At 25% Overpressure, 60° F.					
	½ inch	¾ inch	1 inch	1¼ inch	1½ inch	2 inch
251	96	119	316	378	786	996
275	112	138	358	433	894	1138
300	128	157	400	488	1003	1280
325	155	180	450	555	1115	1435
350	180	210	500	625	1230	1595
375	200	235	550	690	1345	1760
400	230	260	600	760	1460	1920
425	250	289	650	830	1570	2070
450	277	315	700	900	1690	2230
475	301	341	750	968	1810	2390
500	327	370	800	1035	1930	2550

Interpolate for capacities at intermediate pressures. For air capacities at 10% overpressure, multiply the above values by 0.18. For air capacities at other than 60 F, or for capacities of gases other than air, see page 205.



Cross Section
No. 2674

Weights and Dimensions

	Size	Pounds	Dimensions, Inches		
	Inches	Each	Center to side outlet	Center to inlet	Center to top
No. 2674	½	1.8	1⅜	2⅛	3¼
	¾	2.0	1⅜	2⅛	3¼
	1	4.0	1⅝	2½	3½
	1¼	7.3	1¾	2 15/16	4¼
	1½	9.5	2	3⅛	5⅜
	2	11.0	2½	3⅝	6¼

Prices on Request



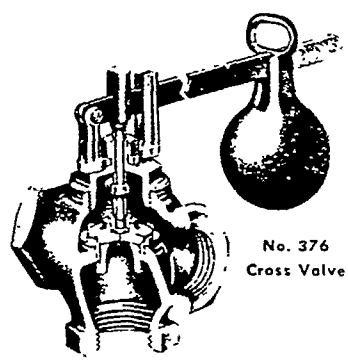
No. 2674
Female Inlet
Side Outlet

Iron Body Lever and Weight Safety Valves

Furnished for saturated steam pressure ranges
of 15-30 psi or 30-100 psi, as specified

The No. 376 Safety Valve with lever and weight is used for ordinary low pressure steam relief service where a simple, inexpensive valve is wanted; it should not be used on air or gas. Unlike spring-loaded pop safety and relief valves, this valve has a large blowdown of pressure, low capacity, and no positive opening or closing point.

Material: The valve body is made of cast iron conforming to ASTM A126, Class A. The body seat ring, disc, stem, and bonnet are made of bronze. The fulcrum is malleable iron; the weight is cast iron. The lever, graduated in 5-pound increments for the 15-30 psi range and in 10-pound increments for the 30-100 psi range, is steel.



No. 376
Cross Valve

Weights and Dimensions — Prices on Request

	Size	Pounds, Each		Center of port to end of body	Center of stem to end of lever
		For 15-30 psi range	For 30-100 psi range		
No. 376	Inches			Inches	Inches
	2	22	38	3¼	2 13/16

General information....page 204

Pressure setting: Pressure settings should be at least 20 per cent above the normal operating pressure in the system to avoid continual leakage past the disc.

Installation: The valve has two inlet openings and one outlet. Installation can be on vertical lines with the side inlet plugged or on horizontal lines with the bottom inlet plugged. In either case, the stem must be vertical and the lever horizontal.

Ferrosteel and Cast Steel Stop-Check Valves

Features of the Crane design

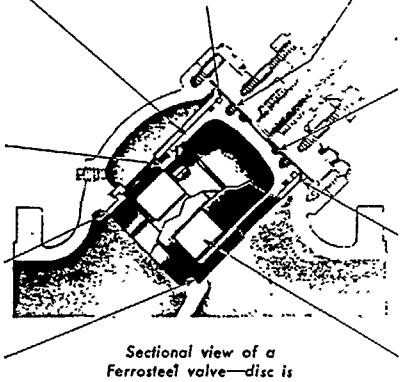
Cylindrical-shaped disc is the one moving part. Light in weight with ample guiding surface, it is specially designed to produce a maximum lift at minimum velocities. There are no wing guides to cause "spinning" with resultant rapid wear.

Long throttling lip on disc retards flow when seating position is approached. Disc chattering is prevented and wiredrawing of seating surfaces is reduced.

Flat seats, accurately machined, facilitate true seating.

Removable liner guides the disc throughout the full travel. Being entirely independent of the body, it is not subject to distortion by expansion strains.

Piston ring adds to dashpot's ability to avoid rapid disc movements. Where pulsations are extremely severe, two rings can be installed.



Sectional view of a Ferrosteel valve—disc is in the open position. Cast steel valves feature the same design.

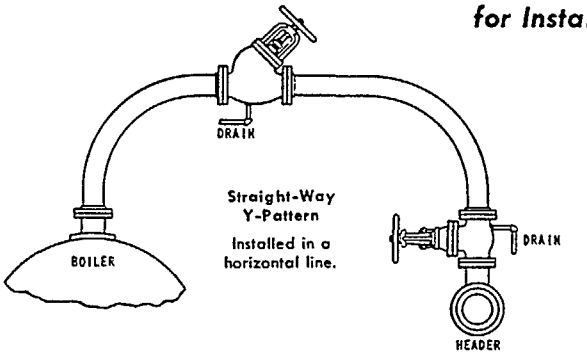
Easy regrinding—tapped bosses on top of the disc permit inserting nipples or eye bolts to facilitate quick removal of the disc and regrinding.

Dashpot is self-contained in the liner. It provides an effective cushion for the disc to prevent pipe line vibrations or hammering on the seat at low velocities or on pulsating loads.

Dashpot vent acts as a governor to control the disc speed and to assure smooth action and operation of the valve.

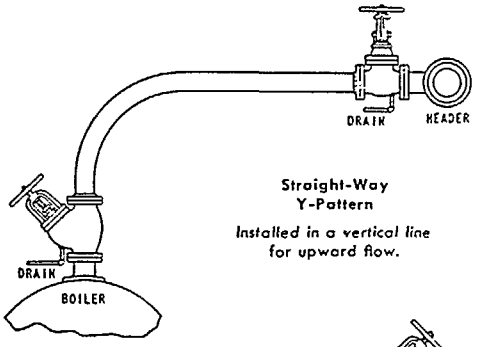
Large port areas in the liner produce only a minimum of pressure drop through the valve and assure unrestricted movement of the disc.

Recommendations for Installation



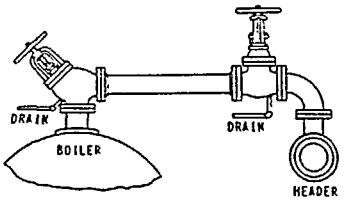
Straight-Way Y-Pattern

Installed in a horizontal line.



Straight-Way Y-Pattern

Installed in a vertical line for upward flow.

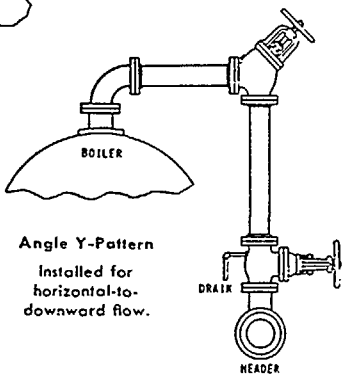


Angle Y-Pattern

Installed for upward-to-horizontal flow.

Crane 250-Pound Ferrosteel and 300-Pound Cast Steel Stop-Check Valves are available in two styles, the straight-way Y-pattern and the angle Y-pattern. Each can be used in two positions in a boiler installation as illustrated in the diagrams. The proper method for draining is shown for each position.

Important, too, to top efficiency is the use of the proper size valve. For a complete explanation, see pages 224 and 225.



Angle Y-Pattern

Installed for horizontal-to-downward flow.

For additional description, see page 219.

For weights and dimensions, see pages 221 to 223.

For selection of proper size, see pages 224 and 225

SECTION 19

Crane Blow-Off and Stop-Check Valves

Blow-Off Valves

250-Pound Ferrosteel.....page 218

Bolted Bonnet
Stop-Check Valves (Non-Return Valves)

Service and General Description.....page 219
Features and Recommended Installation.....page 220
Selecting the Proper Size.....pages 224 and 225
Determining Pressure Drop.....pages 224 and 225

Sizes, Weights, and Dimensions:
250-Pound Ferrosteel.....page 221
300-Pound Cast Steel.....page 222
600-Pound Cast Steel.....page 223

19

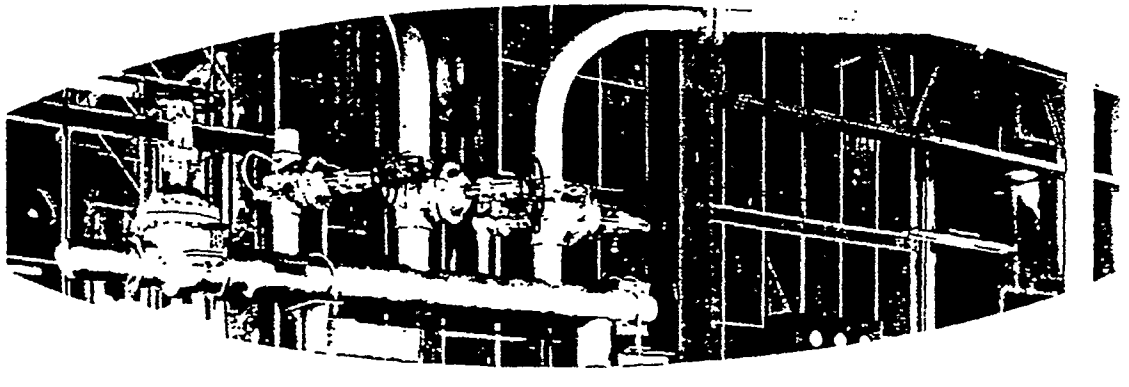
Nearly every piping installation requires the use of at least a few items which are generally termed "specialties", or more specifically, "special duty valves" . . . . . valves which are designed for only one particular service or which automatically perform a special function. The Crane line of such valves includes a varied assortment of types and sizes to fill all normal requirements.

For greater convenience in catalog use, the Crane line of special duty valves and specialties has been divided into several groups. In addition to those indexed above, there are:

Bronze lever-operated quick-opening valves.....pages 56 to 58
Bronze butterfly valves.....page 58
Iron butterfly valves.....page 99
Safety and relief valves.....pages 203 to 216

Pressure regulators.....pages 246 to 249
Steam traps.....pages 250 and 251
Y-pattern sediment separators.....page 254
Bronze water gauges.....page 256

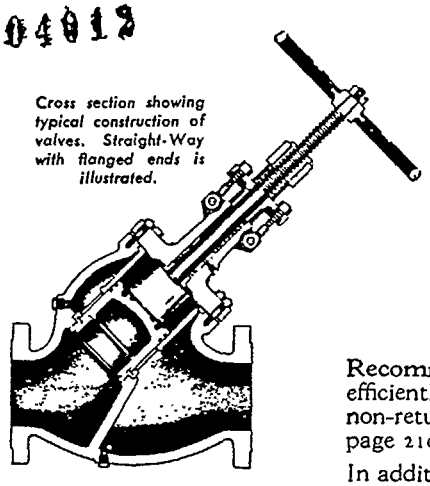
For Pressure-Seal Bonnet Stop-Check Valves, see pages 170 to 173.



Crane valves....a popular choice in power plant installations.

300-Pound Cast Steel Stop-Check Valves

19



Cross section showing typical construction of valves. Straight-Way with flanged ends is illustrated.

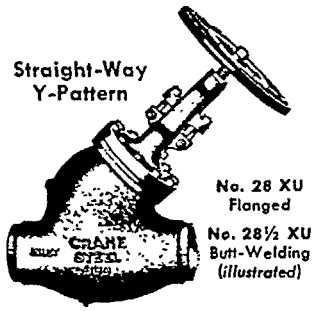
Working Pressures
Same as Cast Steel Globe and Angle Valves; see page 143.
Maximum temperature...850 F

Test Pressure
Shell test — 1100 psi hydrostatic

Valves are suitable for boiler test conditions one and one-half times the nominal rating to comply with the ASME Boiler Code.

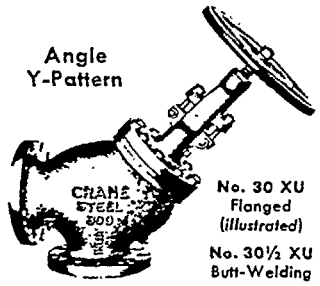
Valves are tested at 100 psi air-under-water.

Straight-Way Y-Pattern



No. 28 XU Flanged
No. 28½ XU Butt-Welding *(illustrated)*

Angle Y-Pattern



No. 30 XU Flanged *(illustrated)*
No. 30½ XU Butt-Welding

Recommendations: These valves efficiently perform all duties of a non-return boiler stop valve; see page 219 for complete details.

In addition, they are ideal wherever check valves of outstanding quality are needed, such as in discharge lines from boiler feed or other high pressure type pumps.

Straight-way valves may be used in horizontal lines . . . . or in vertical lines for upward flow. Angle valves may be used for upward-horizontal or horizontal-downward flow. See page 220 for typical installations.

Materials: Only high grade materials are used. The body, bonnet, and removable liner are Crane Carbon Steel (ASTM A 216, Grade WCB). The stem and seat ring are Exelloy. The disc is Stellite-faced carbon steel. The yoke bushing is Cast Manganese Bronze.

The bonnet joint is equipped with Triplex Steel studs. The 8 and 10-inch valves are equipped with a hammer-blow hand-wheel.

Butt-welding valves: Ends are bored to match the inside diameter of Standard pipe (heaviest weight on 8 and 10-inch sizes).

Valve ends: Dimensions of end flanges and ends of butt-welding valves conform to American Standard B16.5-1957, for valves of the 300-pound class.

Flanged valves are furnished with the end flanges faced, drilled, and spot faced (FD & SF); they can be furnished faced only, when specified.

Flanges regularly have a 1/16-inch raised face, with a serrated finish; a smooth finish can be furnished.

Ring joint, male, female, or other types of facings can be furnished.

Drain: Bodies have two ½-inch drain openings fitted with steel plugs.

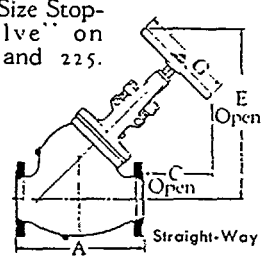
***3-inch Cranelap Joints:** When 3-inch valves with ring joint facing are to be bolted to Cranelap Joints, orders must so specify. They require a groove of special diameter; see page 334 for dimensions.

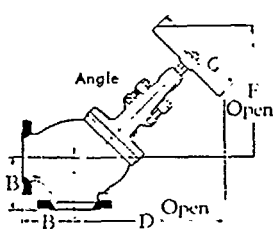
Selecting the proper size: The size of a stop-check valve should be based on boiler capacity rather than on the size of the boiler outlet or existing piping. See "Selecting the Proper Size Stop-Check Valve" on pages 224 and 225.

Weights and Dimensions — Prices on Request

Size	Pounds, Each				Dimensions, in Inches						
	Straight-Way		Angle		Straight-Way			Angle			All Valves
	No. 28 XU Flanged FD & SF	No. 28½XU Butt-Welding	No. 30 XU Flanged FD & SF	No. 30½XU Butt-Welding	At†	C	E	Bt†	D	F	G
Inches											
3*	140	120	120	90	14¾	9½	21½	6¼	18½	16½	10
4	260	225	200	160	17	12½	26½	7	23	21	14
5	320	250	285	215	19	13½	29	7⅞	25	22½	16
6	430	395	370	320	21½	16	33½	8¾	29½	26½	18
8	770	755	680	570	26	20	40½	10½	36½	32	20
10	1320	1265	1120	970	30	23	47½	12¼	43	38	20

†For flanged valves, dimensions "A" and "B" include the 1/16-inch raised face on the end flanges





General description and features....pages 219 and 220

Templates for drilling....page 329

Ferrosteel and Cast Steel Stop-Check Valves

250-Pound Ferrosteel Valves . . . . 300-Pound and 600-Pound Cast Steel Valves . . . . for new and existing boiler installations

Crane Ferrosteel and Cast Steel Stop-Check Valves are described in detail on this and the four pages following. Available in various body types and materials, they provide maximum safety and are excellent for use on new or existing boiler installations.

Safe boiler operation: Stop-check valves are as essential to the safe operation of a boiler plant as safety valves or other safety devices attached to the boiler. The valves are intended to perform four important functions in boiler steam piping:

First...to act as an automatic non-return valve by preventing a back flow of steam from the main steam header to the boiler to which it is connected, in the event of failure in that boiler.

Second...to assist in cutting out a boiler, when ceasing to fire. In this case, the disc automatically closes and prevents header pressure from entering the boiler.

Third...to assist in bringing a boiler into service after a shut-down. This operation requires considerable care when performed manually but is accomplished automatically by a stop-check valve without pressure fluctuations or disturbance of the water level.

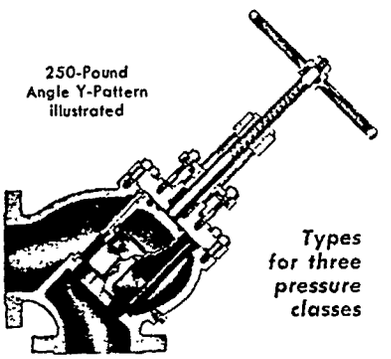
Fourth...to act as a "safety first" valve by preventing back flow of steam from the header into a boiler, shut down for inspection or repairs, should an attendant accidentally open the valve.

When more than one boiler is connected to a main steam header, a stop-check valve should be installed in the pipe line between each boiler and the header. The valves should always be placed so that the pressure in the boiler is under the disc.

Simple, rugged design: All Crane Stop-Check Valves incorporate simplicity, ruggedness, and strength. Carefully selected materials and the simple, durable design assure long, reliable service.

The valves have but one moving part....the disc. Internal parts are easily accessible and, when necessary, replacements can be made without removing the body from the line.

Manual operation: The valves are equipped with a handwheel. This permits closing the valves while under pressure or, if already closed automatically permits holding the disc in the closed position.



250-Pound Angle Y-Pattern illustrated

Types for three pressure classes

250-Pound Ferrosteel: Available with flanged ends in either the Straight-Way or Angle Y-Pattern. See page 221.

300-Pound Cast Steel: Available with flanged or butt-welding ends in either the Straight-Way or Angle Y-Pattern. See page 222.

600-Pound Cast Steel: Available with flanged or butt-welding ends in either the globe or angle pattern. See page 223.

For additional description and weights, see pages 220 to 223.

For installation recommendations, see page 220.

For selection of the proper size, see pages 224 and 225.

There is no mechanical connection between the disc and stem, and when the stem is raised by the handwheel, only the boiler pressure can lift the disc. The assembly for manual operation is the outside screw and yoke type, wherein stem threads are not directly exposed to the high temperature of the steam.

Bonnet joint: The 250-pound Ferrosteel and 300-pound cast steel valves have a male and female bonnet joint, bolted with studs driven into the body. The 250-pound valves are fitted with a Cranite gasket; the 300-pound valves, with a corrugated soft iron gasket.

The 600-pound cast steel valves have ring joint bonnet facing, a soft steel ring joint gasket, and are equipped with through type stud bolts. Tightness and strength are assured.

Body seat ring: The body seat ring is the shoulder seated type. It is held in place by a removable liner in Ferrosteel valves and is screwed into the body in the cast steel valves.

Piston type disc: The piston type disc operates in the removable liner and is the only pressure actuated part in the valves. It is designed to produce maximum lift at minimum velocities.

Stuffing box: Cast steel valves have a lantern type stuffing box equipped with a siliconized steel ball type gland and a steel gland flange. Packing above and below the lantern assures tight sealing. The lantern provides space for a cooling chamber which is tapped and fitted with a steel plug.

Ferrosteel valves have an exceptionally deep stuffing box filled with high grade packing and fitted with a two-piece gland and gland flange.

Repacking: All valves, when the stem is in the wide open position, can be repacked while under pressure.

Code conformance: Crane Ferrosteel and Cast Steel Stop-Checks conform to the ASME Boiler Construction Code for Non-Return Stop Valves.

Tight closure against boiler test pressures: The valves can be closed tight against boiler test pressures (one and one-half times the recommended working pressure). For this purpose, the 600-pound steel valves in sizes 6-inch and larger and valves of other pressure classes in sizes 8-inch and larger are regularly equipped with a hammer-blow handwheel.

For Cast Steel Pressure-Seal Bonnet Stop-Check Valves, see pages 170 to 173.

Crane Bolted Bonnet Stop-Check Valves

Selecting the Proper Size—Determining Pressure Drop

A problem confronting the power piping designer is the selection of the best size of stop-check valve for his service conditions. This type valve has a floating disc member, hence it is important the valve be sized to provide full disc lift under flow conditions prevailing during the major portion of the service life of the installation. If the valve is too large for flow conditions the disc will float in a partially open position; this may result in fluttering of the disc and rapid wear of valve parts. Conversely, if the valve is too small for flow conditions encountered, pressure drop will be excessive.

Crane has conducted numerous tests both in the laboratory and in the field over a period of many years to establish the flow characteristics of Crane Bolted Bonnet Stop-Check Valves. As a result, Crane Engineers have developed the chart shown on the opposite page.

The chart is a graphical presentation of flow data which were determined by test. Its use offers a simple method of determining the best size of stop-check valve, as well as the pressure drop under varying conditions of flow, without any computation.

How to Use the Chart Shown on the Opposite Page

Given: Steam Pressure.....300 psi, gauge
Steam Temperature....750 F
Flow Rate.....100,000 pounds per hour, maximum

Find: Valve Catalog No. and best size for above installation.

Solution: Reference to the pressure-temperature ratings on page 143 indicates a valve of the 300-pound pressure class will be required. Therefore, the following valves may be used:

Globe...No 28 XU, Flanged or No. 28½ XU, Butt-Welding
Angle...No. 30 XU, Flanged or No. 30½ XU, Butt-Welding

The choice between the globe and angle, as well as between flanged and butt-welding ends depends, of course, upon the piping arrangement and local conditions. *Now, follow the text below and proceed as indicated by the arrows on the chart.*

1. Enter the chart at a temperature of 750 F. Move vertically upward to the curved line for 300 psi gauge pressure, then horizontally to the right to establish a point on the specific volume scale. From this point, draw a line through the flow rate being investigated (100,000 pounds per hour) and establish a point on Index 1.

2. From the point on Index 1, draw another line through any assumed valve size, for example the 8-inch size, and establish a point on Index 2. Now move horizontally to the diagonal line in the right hand portion of the chart which represents the pressure drop through the valve being investigated. Where these lines intersect, read the pressure drop as 9 psi for the 8-inch 300-pound globe valve and 10 psi for the 8-inch 300-pound angle valve.

Chart solutions resulting in a point on Index 2 that falls below the Line A-A for 250 and 300-pound valves, or below Line B-B for 600-pound valves, indicate the valve disc will not be fully lifted under the flow conditions used. Operation under such conditions is not recommended but, at times, must be tolerated for short periods during the low load portion of the operating cycle.

3. Enter the chart where Line A-A intersects Index 2. Move diagonally upward through the size being investigated (8-inch) and establish a second point on Index 1. From this point, extend a line to the specific volume established in Step 1, and at its intersection with the flow rate line, read 42,000 pounds per hour as the minimum flow rate at which the disc will be in the fully lifted position. The pressure drop at this flow rate is 1.9 psi for globe and 2.1 psi for angle valves. At all flow rates less than 42,000 pounds per hour through 8-inch valves, the pressure drop may be expressed as "1.9 psi or less" for globe and "2.1 psi or less" for angle valves

4. Repeat Steps 2 and 3 for all other probable sizes and determine the pressure drop and minimum flow rate for the wide open position. Results are shown at the right.

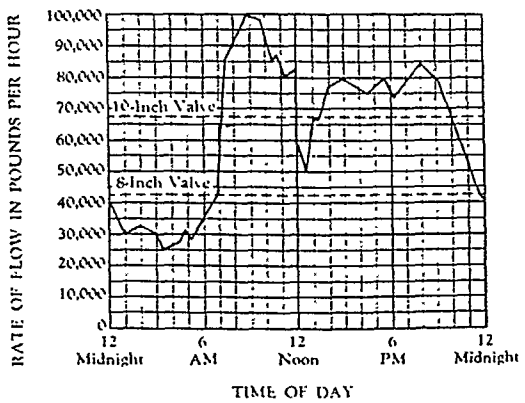
Valve Size	Pressure Drop at Maximum Flow Rate of 100,000 lbs. per hour (in psi)		Minimum Flow Rate for Wide Open Valve
Inches	Globe	Angle	Pounds per hour
6	24	26	24,000
8	9	10	42,000
10	3.8	4.2	68,000
12	2.1	2.3	95,000

5. Since the flow rate of 100,000 pounds per hour is designated as maximum, it may be assumed the boiler will frequently be operated at lower flow rates. On this basis, the 12-inch size would obviously be too large and pressure drop through the 6-inch valve would probably be considered excessive. The choice between the 8 or 10-inch size depends upon the load-demand curve, and the final selection rests with the piping designer.

6. A typical daily load-demand curve, shown in the chart below, indicates the advisable size is 10-inch. Minimum flow rates for a fully lifted disc for both 8 and 10-inch sizes are shown in the chart. The disc will not be fully lifted for about 7 hours in the 8-inch valve and for about 10½ hours in the 10-inch valve. However, since the pressure drop for the 10-inch is so much lower during high-load operation, it appears to be a better choice than the 8-inch.

Pressure drop for any intermediate flow condition can be determined as outlined in Steps 1 and 2.

Typical Daily Load-Demand Curve



CRTX 1063

250-Pound Ferrosteel Stop-Check Valves

Working Pressure
250 psi steam
Maximum temperature...450 F

Test Pressure
Shell test — **500 psi hydrostatic**

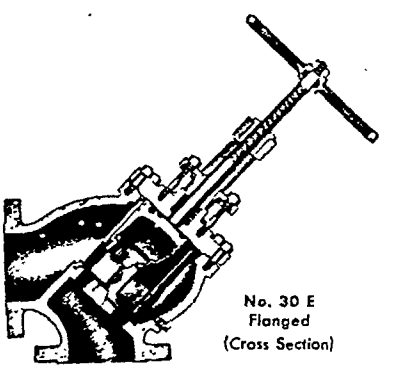
These valves are suitable for boiler test conditions one and one-half times the nominal rating to comply with the ASME Boiler Code.

Straight-Way Y-Pattern



No. 28 E
Flanged

Angle Y-Pattern



No. 30 E
Flanged
(Cross Section)

Recommendations: Crane Stop-Check Valves are recommended for use in the pipe line between each boiler and the main steam header, when more than one boiler supplies the same header; refer to page 219 for details.

They are also ideally suited for discharge lines from boiler feed pumps or from other high pressure pumps where a high quality check valve is needed.

Straight-way valves may be used in horizontal lines . . . . or in vertical lines for upward flow. Angle valves are suited for horizontal-downward or upward-horizontal flow. See page 220 for typical installations.

Materials and design: The body, bonnet, and yoke are made of Crane Ferrosteel, a high grade iron conforming to ASTM A 126, Grade B. The renewable liner is cast iron. The stem is cold rolled steel, nickel-plated.

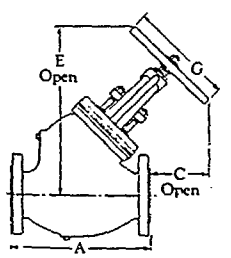
The seat ring in all sizes, and the disc in sizes 5-inch and smaller, are made of Crane Special Bronze, a high grade leaded tin bronze; in sizes 6-inch and larger, the disc is iron with a Crane Special Bronze seating face and throttling lip.

Handwheel: In sizes 6-inch and smaller, the valves have a conventional style malleable iron wheel; 8 and 10-inch valves have a cast steel hammer-blow wheel.

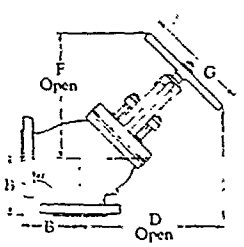
Drain: Bodies have two ½-inch drain openings fitted with iron plugs.

End flanges: The end flanges conform to the American Cast Iron Flange Standard, Class 250 (B16b-1944). The valves are regularly furnished faced and drilled (F & D); they can be furnished faced only, when specified.

The flanges have a 1/16-inch raised face finished with concentric grooves, approximately 16 per inch, known as a "serrated" finish.



Straight-Way



Angle

Weights and Dimensions — Prices on Request

Size	Pounds, Each Flanged, F & D		Dimensions, in Inches							
	No. 28 E	No. 30 E	No. 28 E				No. 30 E			
Inches	Straight-Way	Angle	A*	C	E	G	B*	D	F	G
2½	100	70	13	5	15¾	9	5¾	14½	13¼	9
3	120	110	14¾	7¼	19¾	10	6¼	16½	14¾	10
4	220	180	17	7¾	21¾	10	7	18½	16¼	10
5	300	260	19	10½	25¾	14	7⅞	22	19½	14
6	420	340	21½	11¾	29¼	16	8¾	25½	22½	16
8	625	570	26	16¼	36¾	20	10½	33¼	28¾	20
10	1170	915	30	17¾	41¾	20	12¼	37¾	32½	20

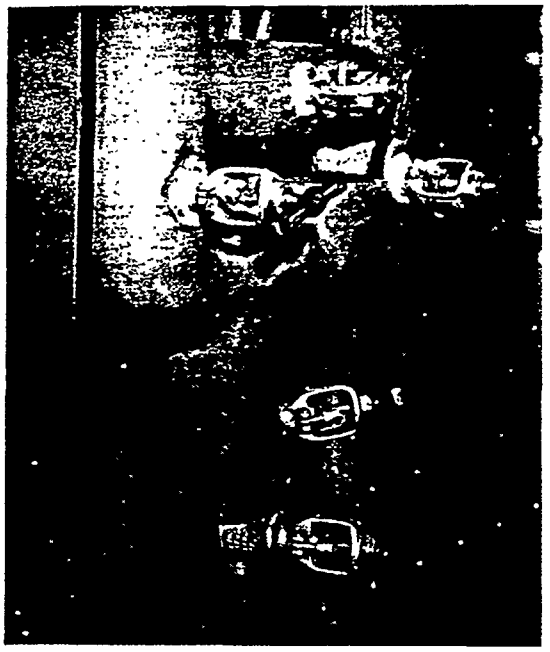
*Dimensions "A" and "B" include the 1/16-inch raised face on the end flanges.

Selecting the proper size: Determining the proper size valve needed is important. The size of a stop-check valve should be based on the boiler capacity, rather than on the size of the boiler outlet or existing piping. See "Selecting the Proper Size Stop-Check Valve" on pages 224 and 225.

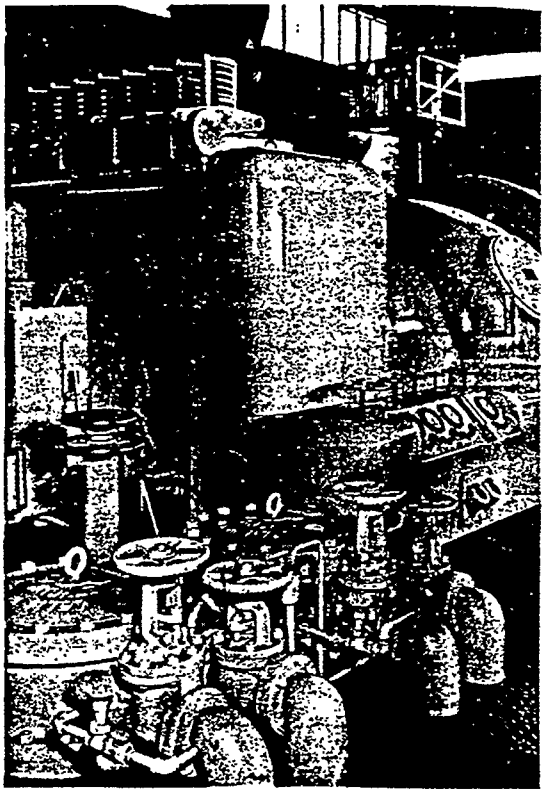
General description and features.....pages 219 and 220
Dimensions of end flanges and drilling templates....page 328

Crane products . . .

always a step ahead



Crane Lip-Seal Bonnet Valves (Section 15) installed in a drain line of a power plant.

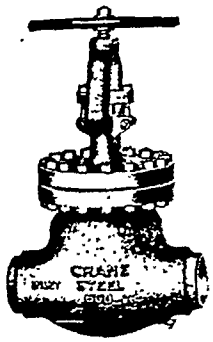


An electric plant installation . . . . equipped with Crane iron body gate and globe valves.

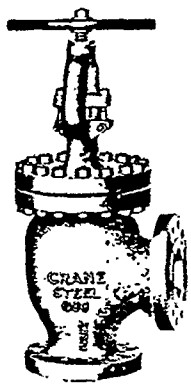


An outdoor power plant . . . . equipped with Crane Pressure-Seal Bonnet Valves (Section 15).

600-Pound Cast Steel Stop-Check Valves



600-Pound
Globe Pattern
No. 179 U, Flanged
‡No. 179½ U, Butt-Welding



600-Pound
Angle Pattern
‡No. 180 U, Flanged
No. 180½ U, Butt-Welding

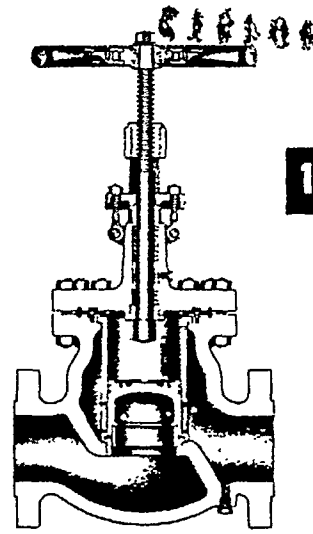
‡Illustrated

Working Pressures
Same as Cast Steel Globe and Angle Valves; see page 143.
Maximum temperature . . . 1000 F

Test Pressure
Shell test — 2175 psi hydrostatic

Valves are suitable for boiler test conditions one and one-half times the nominal rating to comply with the ASME Boiler Code.

Valves are tested at 100 psi air-under-water



Cross section showing typical construction of all valves. Flanged globe is illustrated.

These valves feature high quality materials. Their body, bonnet, and liner are Crane Carbon Steel conforming to ASTM A 216, Grade WCB. The body seat ring (screwed-in and seal-welded) and the disc are carbon steel faced with Stellite. The stem is Exelloy. The bonnet joint utilizes a soft steel ring joint gasket and is equipped with Crane Triplex Steel stud bolts.

The general construction of the valves, except for the stem position, bonnet joint, and materials, is similar to that of the valves on the preceding two pages. For details, refer to the general description of stop-checks on pages 219 and 220.

Handwheel: Size 6-inch and larger have a hammer-blow handwheel.

Drain: Valve bodies have a drain at the outlet end fitted with a steel plug; for sizes, see table below.

Valve ends: Dimensions of end flanges and ends of butt-welding valves conform to American Standard, B16.5-1957, for valves of the 600-pound class.

End flanges are regularly furnished with an American Standard ¼-inch male face (large male); the male face is finished with concentric grooves, approximately 32 grooves per inch, known as a "serrated" finish; a smooth finish can be furnished.

Ring joint, female, or other types of facings can be furnished.

Drilling: Flanged valves are furnished faced, drilled, and spot faced to the 600-Pound American Steel Flange Standard, B16.5-1957. They can be furnished faced only, when specified.

Butt-welding valves: Orders must specify the inside diameter or wall thickness of the pipe so that the valve ends can be bored to match the pipe.

Installation: For proper operation, the valves must be installed with the stem in a vertical position.

***3-inch Cranelap Joints:** When 3-inch valves with ring joint facing are to be bolted to Cranelap Joints, orders must specify. They require a groove of special pitch diameter; see page 334 for dimensions.

Selecting the proper size: The size of a stop-check valve should be based on the boiler capacity rather than on the size of the boiler outlet or existing piping. See "Selecting the Proper Size Stop-Check" on pages 224 and 225.

Crane Pressure-Seal Bonnet Stop-Checks . . . . . for higher pressures . . . higher temperatures . . . see pages 170 and 171.

Weights and Dimensions — Prices on Request

Size	Pounds, Each				Dimensions, in Inches					
	Globe Pattern		Angle Pattern		Globe		Angle		All Valves	
Inches	No. 179 U Flanged FD & SF	No. 179½ U Butt-Welding	No. 180 U Flanged FD & SF	No. 180½ U Butt-Welding	Face to face or end to end	Center to top, open	Center to face or center to end	Center to top, open	Diameter of wheel	Size of drain
2½	165	145	180	150	13	24	6½	23¾	10	¼
*3	215	175	220	165	14	26¼	7	26	12	¼
4	400	345	380	330	18	28¾	9	28	14	⅜
5	590	500	575	415	20½	33	10¼	32	16	⅜
6	790	735	745	695	23	37½	11½	36	20	⅜
8	1470	1325	1300	1290	28	47½	14	44¾	26	½
10	2275	2200	2170	2070	32½	56½	16¼	53½	30	½
12	2500	2300	2390	3090	42	66¾	21	63½	30	½

†Face to face and center to face dimensions include the ¼-inch male face on the end flanges.

General description and features . . . . pages 219 and 220 *Templates for drilling . . . . page 330*

Valves and Fittings for Marine Service

MARINE REGULATIONS

The "Marine Engineering Regulations and Material Specifications" (CG-115; dated March, 1958) issued by the United States Coast Guard set forth the requirements for valves, fittings, and other products used for marine service. The Regulations meet the requirements specified in the "Rules for Building and Classing Steel Vessels" in accordance with the American Bureau of Shipping.

20

Although certain types of piping such as fuel oil service piping, boiler mountings, etc., are covered separately, as explained later, the Marine Engineering Regulations divide piping on board ship into two general classes . . . . Class I and Class II.

Class I Piping

Class I piping includes the various systems conveying mediums exceeding either pressures or temperatures shown in the following table:

Service	Pressure	Temperature
Lethal gases and vapors	any	any
Gases or vapors	*150 psi	500-650 F
Water	150 psi	300 F
Lubricating oil	150 psi	200 F
Fuel oil	150 psi	150 F
Compressed gases	150 psi	.....

*For gases or vapors, the pressures shall not exceed the following: 150 psi at 500 F. . . .140 psi at 550 F . . . .130 psi at 600 F . . .and 120 psi at 650 F.

Class II Piping

Class II includes all piping for pressures and temperatures that do not require Class I piping. Products suitable for Class I piping can, of course, be used for Class II.

GENERAL MARINE REQUIREMENTS

There are numerous requirements and limitations governing marine service which prohibit the use of many ordinary commercial items; for convenient reference, the most important of these are included on these facing pages. The limitations specifically apply to Marine Engineering Regulations, and do not necessarily agree with Crane recommendations for commercial services.

Metals

Regular Crane metals comply with requirements for marine service, as follows:

Grade A bronze may be used for pressures up to 150 psi and for temperatures not exceeding 366 F. This is Crane Steam Cast Bronze, ASTM B62.

Grade B bronze may be used for steam pressures up to 300 psi and for temperatures not exceeding 450 F or for air and water at pressures over 300 psi with temperatures not exceeding 150 F. This is Crane Special Cast Bronze, ASTM B61.

Gray iron castings may be used for pressures up to 125 psi and for temperatures not exceeding 450 F. These are Crane Cast Iron, Ferrosteel, and High Tensile Iron (ASTM A126, Classes A, B, and C, respectively).

Carbon cast steel may be used for temperatures not exceeding 800 F. This is Crane Carbon Cast Steel (ASTM A216, Grade WCB).

Carbon forged steels may be used for temperatures not exceeding 800 F. These are Crane Carbon Forged Steels (ASTM A105, Grade II. . . .A181, Grade II. . . . or A234, Grade B).

Alloy cast steel may be used for temperatures not exceeding 1000 F. This is Crane No. 5 Chromium-Molybdenum Alloy Cast Steel (ASTM A217, Grade C5).

Alloy forged steel may be used for temperatures not exceeding 1000 F. This is Crane No. 5 Chromium-Molybdenum Alloy Forged Steel (ASTM A182, Grade F5a).

Nodular (ductile) iron may be used for temperatures not exceeding 650 F and for pressures as authorized by the Coast Guard Regulations. This is Crane Nodular Iron (ASTM A395).

Working pressures

Working pressures for the product shall not exceed those for the material, as specified above. Marine ratings for Crane bronze and iron valves are listed on page 230; marine ratings for Crane steel valves and flanges are listed on page 231.

Iron valves may be used on steam, water, and oil transfer and filling systems (not fuel oil pumps to burners), and for boiler mountings where maximum pressure does not exceed 30 psi.

In addition to the foregoing limitations, valves and fittings for boiler feed or blow-off service can be used only at working pressures up to 83 1/3 per cent of the recommended steam working pressure.

Tests

Bronze and cast iron valves for steam service must be given a hydrostatic shell test equal to twice the primary pressure rating marked on the valves. Bronze valves for liquid or gas service up to 150 F must be given a hydrostatic shell test equal to one and one-half times the secondary pressure rating marked on the valve. In many cases, regular Crane tests comply; in some cases, however, a special test is required.

Steel valves and fittings must be tested in accordance with American Standard B16.5-1957, regular Crane tests meet this requirement.

Boilers must be hydrostatically tested to one and one-half times the working pressure; stop-check valves are also subject to this requirement.

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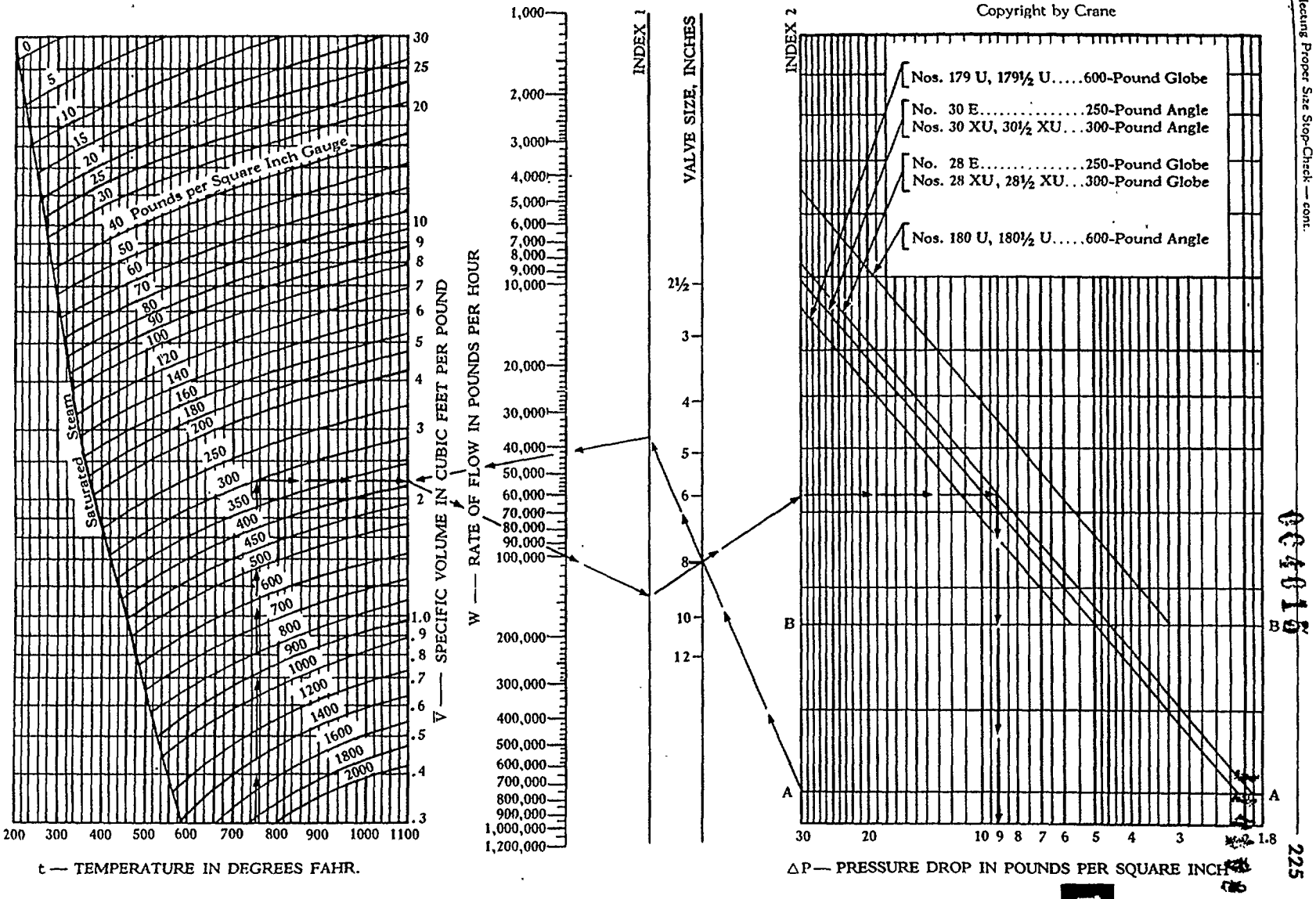


Crane Bronze and Iron Valves for Class I and Class II Piping

Crane Valve Recommended				Maximum Marine Rating For Class I Piping			Maximum Marine Rating For Class II Piping			Valve Data
Type		Catalog No.	Sizes Inches	Steam over 150 psi	Water over 300 F; Oil over 150 F	Cold Water, Oil, Gas over 150 psi	Steam up to 150 psi	Water up to 300 F; Oil up to 150 F	Cold Water, Oil, Gas up to 150 psi	See page below
Bronze Gate	Screwed	432	2½, 3	...	...	...	100#-338 F	100#	100#	58
		432	½-2	...	...	...	125#-353 F	150#	150#	58
		428	¼-3	...	...	..				19
		428-UB	¼-2	...	...	...				20
		430	½-3	...	...	...	125#-353 F	150#	150#	19
		430-UB	½-2	...	...	...				20
		440	¼-3	...	...	...				19
		431	¼-3	...	...	...	150#-366 F	150#	150#	22
		435	½-3	...	...	...				22
		431-UB	¼-2	...	150#-366 F	300#				23
		435-UB	½-2	...	150#-366 F	300#				23
		424	¼-3*	200#-388 F	200#-388 F	400#				24
		634 E	¼-3*	300#-450 F	300#-450 F	1000#				25
	Flanged	4437	2-8	...	125#-353 F	...	125#-353 F	150#	150#	21
		429	1-3	...	...	...	150#-366 F	150#	150#	22
		623½ E	1-3	300#-450 F	300#-450 F	500#	150#-366 F	150#	150#	26
Bronze Globe	Screwed	1	⅛-3	...	...	...	125#-353 F	125#	150#	31
		7	⅛-2	...	150#-366 F	300#	150#-366 F	150#	150#	32
		7	2½, 3	...	...	...				32
		141½ P	⅛-2	...	150#-366 F	300#				33
		141½ P	2½, 3	...	...	...				33
		88	⅛-¾	...	...	...				36
		70	⅛-2	200#-388 F	200#-388 F	400#	150#-366 F	150#	150#	39
		70	2½, 3	...	...	...				39
		212 P	¼-2	200#-388 F	200#-388 F	400#				38
		212 P	2½, 3	...	...	...				38
		229 C	¼-2	200#-388 F	200#-388 F	400#	150#-366 F	150#	150#	38
		362 E	¼-2	300#-450 F	300#-450 F	600#				41
		382 P	¼-2	300#-450 F	300#-450 F	1000#				40
		382 P	2½, 3	...	...	...				40
	Flanged	9	1-3	...	150#-366 F	225#	150#-366 F	150#	150#	32
		71	1-2	...	150#-366 F	225#				39
		71	2½, 3	...	...	...				39
		4197	1½-4	...	150#-366 F	225#				34
		4297	1½-4	...	150#-366 F	225#	150#-366 F	150#	150#	234
		87 P	1½-3	300#-450 F	300#-450 F	500#				43
		383 P	1-3	300#-450 F	300#-450 F	500#				40
Bronze Angle	Screwed	2	⅛-3	...	...	...	150#-366 F	150#	150#	31
		161½ P	¼-2	...	150#-366 F	300#				33
		17	⅛-2	...	150#-366 F	300#				32
		85, 89	⅛-¾	...	...	...	150#-366 F	150#	150#	36
		214 P	¼-2	200#-388 F	200#-388 F	400#				38
		701	⅛-2	200#-388 F	200#-388 F	400#				36
		384 P	¼-2	300#-450 F	300#-450 F	1000#				40
	Flanged	711	1-2	...	150#-366 F	225#	150#-366 F	150#	150#	39
		711	2½, 3	...	...	...				39
		4199	1½-4	...	150#-366 F	225#				34
		4299	1½-4	...	150#-366 F	225#				234
		87½ P	1½-3	300#-450 F	300#-450 F	500#				43
	Hose	117	¾-2½	...	...	...	...	...	150#	61
Bronze Check	Screwed	20, 34	⅛-3	...	...	...	125#-353 F	125#	150#	48
		27	¼-3	...	...	...	150#-366 F	150#	150#	49
		36, 72	¼-2	200#-388 F	200#-388 F	400#				52
		36	2½, 3	...	...	...				52
		218	½-2	200#-388 F	200#-388 F	400#				51
		239 C	¼-2	200#-388 F	200#-388 F	400#				51
		76 E	¼-2	300#-450 F	300#-450 F	1000#	150#-366 F	150#	150#	53
		76 E	2½, 3	...	...	...				53
		366 E	¼-2	300#-450 F	300#-450 F	1000#				53
		366 E	2½, 3	...	...	...				53
	Flanged	38	1-3	...	...	...	150#-366 F	150#	150#	52
		4033	3, 4	...	150#-366 F	225#				50
		4063	on app	..						50
Iron Gate Iron Globe Iron Angle Iron Check	Flanged	4467	3-12	..	..	..	125#-353 F	125#	125#	233
		351	2-10	..	..	...				101
		353	2-10	..	..					101
		373	2-24	..	..					101

*The 2½ and 3-inch Nos. 424 and 634 E are suitable for Class II piping only.

As indicated above, valves for Class I piping may also be used for Class II.

Pressures (#) are shown in pounds per square inch

SECTION 20

Crane Valves and Fittings for Marine Service

(and Military Standards and Specifications)

Marine Regulations.....page 228

General Marine Requirements.....pages 228 and 229

Crane Recommendations for Class I and Class II Piping

Bronze and Iron Valves.....page 230
Steel Fittings and Flanges.....page 231
Steel Valves.....page 231

Bronze Valves

Gate.....page 232
Globe and Angle.....page 232
Check.....page 232

Iron Valves

Gate.....page 233
Globe and Angle.....page 233
Check.....page 234

Steel Valves

Gate.....page 235
Globe and Angle.....page 235
Check.....page 235
Pressure-Temperature Ratings.....page 231

Miscellaneous Valves

Main Injection.....page 234
Screw-Down Check.....page 234

Valves Conforming to Military Standards and Specifications

Bronze Valves.....page 236
Steel Valves.....page 236

Part of this section is devoted to comments on the "Marine Engineering Regulations and Material Specifications" issued March, 1958, by the United States Coast Guard, and its requirements in general. In addition, there are recommendations on Crane valves, fittings, and flanges as regularly manufactured for commercial purposes, which also conform to the requirements for marine service, valves made especially for marine service, and valves most commonly used in marine piping.

The extra quality built into Crane valves and fittings makes them accepted everywhere. It is this quality that has long maintained for Crane its enviable position for meeting marine requirements—safety, ruggedness, and durability. Then too, the completeness of the Crane line is important. Whether it be the smallest tug or the largest passenger liner—a vessel for river, lake, or ocean service—a wide selection of Crane products is available.

Marine Bronze Valves

Gate

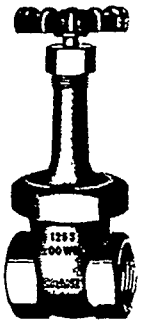
Crane bronze gate valves are liberally proportioned to assure a high factor of safety over recommended working pressures.

No. 428 and No. 428-UB: These screwed and union bonnet valves are the inside screw, rising stem type. They have a solid wedge disc and are suitable for Class II piping. They are made in sizes up to 3 and 2-inch, respectively, and are rated commercially for 125 psi saturated steam and for 200 psi non-shock cold water, oil, or gas.

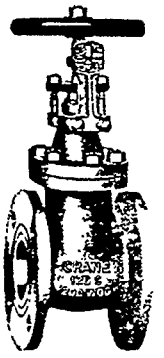
No. 4437: This bolted bonnet, non-rising stem gate valve has a solid wedge disc, renewable body seat rings, and an indicator. Sizes 2 to 8-inch are suitable for Class I or II piping. They are rated commercially for saturated steam pressures up to 125 psi and, depending on the size, for non-shock cold water, oil, or gas pressures up to 200 psi.



No. 428
Gate, Screwed with Screwed Bonnet
(page 19)



No. 428-UB
Gate, Screwed with Union Bonnet
(page 20)



No. 4437
Gate, Flanged with Indicator and Bolted Bonnet
(page 21)

Globe and Angle

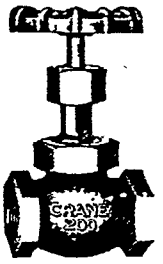
No. 1: This integral seat valve is made in sizes ⅛ to 3-inch and is suitable for Class II piping. All sizes are rated commercially for 125 psi saturated steam and for 200 psi non-shock cold water, oil, or gas. No. 2 Angle Valves also are available.

No. 70: This line of union bonnet, integral seat, regrinding type valves also includes globe flanged (No. 71) and angle screwed and flanged (No. 701 and 711) patterns. Sizes up to 2-inch are suitable for Class I piping. For commercial ratings, see page 39.

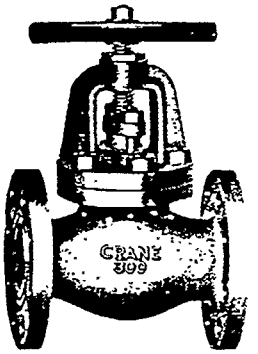
No. 87 P: This bolted bonnet, outside screw and yoke valve has a "500 Brinell" stainless steel plug type disc and renewable seat. Sizes 1½ to 3-inch are suitable for Class I or II piping. All are rated commercially for 300 psi steam, 550 F. For angle valve, see No. 87½ P.



No. 1
Globe, Screwed with Screwed Bonne
(page 31)



No. 70
Globe, Screwed with Union Bonnet
(page 39)



No. 87 P
Globe, Flanged with Bolted Bonnet
(page 43)

Swing Check and Lift Check

The horizontal check valves illustrated have integral seats which can be reground without removing the body from the line; all are rated commercially for 550 F steam . . . 200 psi for the No. 36, 300 psi for the No. 366 E, and 150 psi for the No. 4033.

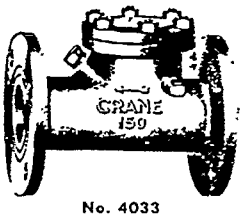
The Nos. 36 and 366 E are suitable for Class I or II piping in sizes ¼ to 2-inch and for class II piping only in sizes 2½ and 3-inch; the No. 36 is also available with flanged ends (No. 38). The No. 4033 is suitable for Class I or II piping in sizes 3 and 4-inch.



No. 36
Swing, Screwed with Screwed Cap
(page 52)



No. 366 E
Lift, Screwed with Union Cap
(page 53)



No. 4033
Swing, Flanged with Bolted Cap
(page 50)

For marine ratings of these and other Crane bronze valves, see page 230; for complete description and dimensions, refer to the pages below the illustrations. For screw-down check valves, see page 234.

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Valves and Fittings for Marine Service

Valve design

For Class I piping, bronze, cast iron, and steel valves 2-inch and smaller may have a screwed bonnet but the bonnet must be the union type; check valves, however, may have an ordinary screwed cap. Bronze and cast iron valves in sizes 2½-inch and larger for Class I piping must have a bolted bonnet; steel valves in such sizes must have a bolted or Pressure-Seal Bonnet.

All non-rising stem valves must have an approved type indicator. Discs, disc faces, seats, stems, and other wearing parts should be made of non-corrosive material.

For Class II piping, bronze valves of all sizes may have an ordinary screwed type bonnet. Non-rising stem valves, except those for oil transfer and filling systems, must have an approved type indicator.

Flanged product

In reference to flanged product, marine regulations cite the following American Standards:

125-pound cast iron.....ASA B16.1
150 and 300-pound bronze.....ASA B16.24
150 to 2500-pound steel.....ASA B16.5

Crane flanged product of corresponding material and pressure classes conform to these Standards.

Marking

Regular Crane markings comply with marine requirements.

Pipe connections

For Class I piping, screwed, socket-welding, and slip-on welding joints are restricted to sizes 2-inch and smaller. Sizes 2½-inch and larger must have flanged or butt-welded joints; the flanged joints must be made with lap joint (Cranelap) flanges or with welding neck flanges.

For boiler mountings and attachments, flanged joints must be used on sizes 1½-inch and larger.

For Class II piping, there is no limitation on the size of screwed, socket-welding, or slip-on welding joint.

Boiler mountings and attachments

Boiler mountings are defined as nozzle connections, distance pieces, valves, or fittings attached directly to the boiler.

All valves, fittings, and flanges must be cast or forged steel except that Crane Special Bronze may be used where the temperature does not exceed 450 F and cast iron may be used where the pressure does not exceed 30 psi.

Valves and fittings in sizes 1½-inch and larger must have flanged ends.

Main and auxiliary globe stop valves must be installed with the pressure under the disc; such valves in sizes larger than 6-inch require a by-pass.

Fuel oil service piping

Valves and fittings for fuel oil pressure piping from pumps to burners (not including cargo oil transfer or discharge piping) must conform to Class I requirements and, in addition, must be designed for at least 250 psi steam working pressure.

Cast iron valves and fittings are not permitted; bushings and street elbows are not permitted.

Cocks

For Class I piping, cocks must be designed so that the cap holds the plug in place; conventional cocks which have a nut holding the plug are not permitted. There are no restrictions on cocks for Class II Piping.

Specialties

Relief valves, safety valves, expansion joints, fusible plugs, and other specialties must be of approved design.

CRANE FITTINGS AND FLANGES FOR CLASS I OR CLASS II PIPING

Crane forged steel screwed fittings in sizes 2-inch and smaller are suitable for Class I piping; all sizes are suitable for Class II piping. For description, see pages 286 to 288.

Crane forged steel socket-welding fittings in sizes 2-inch and smaller, and steel butt-welding fittings in all sizes, are suitable for both Class I and Class II piping. For description, see Section 25.

Crane forged steel flanges are suitable for both Class I and Class II piping; however, for Class I piping, the flanges are not suitable for gases or vapors . . . . nor can screwed, slip-on welding, or socket-welding flanges be used in sizes 2½-inch and larger. For marine ratings, see page 231; for description, see Section 26.

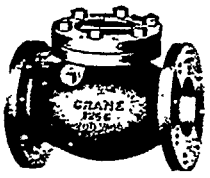
CRANE VALVES FOR CLASS I OR CLASS II PIPING

A great number of Crane bronze, iron, and steel valves, as regularly manufactured, conform to the requirements for marine service. These valves fill the need for a large portion of Class I and Class II piping; those most commonly used are listed on the two pages that follow. In addition, several of the valves are illustrated and described on pages 232 to 235.

CRANE VALVES MEETING MILITARY SPECIFICATIONS AND STANDARDS

Crane can also furnish a number of bronze and steel valves especially designed to meet requirements of various military specifications and standards. For complete details, see page 236.

Marine Ferrosteel Swing Check Valves



No. 373
Swing Check
Flanged
Bronze Trimmed
(see page 108)

No. 373 are sturdily constructed, well proportioned swing check valves. They are regularly made in sizes 2 to 24-inch.

The valves are commercially rated for 125 psi saturated steam in sizes up to 16-inch. On non-shock cold water, oil, and gas lines, they are rated for 200 psi working pressures in sizes 12-inch and smaller and for 150 psi working pressures in sizes 14 to 24-inch.

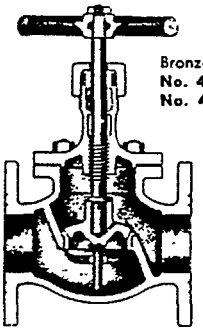
For complete commercial ratings, description, and dimensions, see pages 108 and 109. For marine ratings, see page 230.

The body, made of Crane Ferrosteel in sizes 16-inch and smaller, and of Crane High Tensile Iron in sizes, 18-inch and larger, is oval or globular in shape, providing an ample flow area around the disc when the valve is wide open.

The seat ring is bronze, screwed into the body. On sizes 3-inch and smaller, the disc is solid bronze; on larger sizes, the disc is iron faced with bronze . . . . a solid bronze disc can be made to order.

Nodular iron: The No. 373 can be made to order of Crane Nodular (Ductile) Iron conforming to ASTM A395

Marine Screw-Down Check Valves



Bronze Screw-Down Checks
No. 4297, Globe, Flanged
No. 4299, Angle, Flanged

Screw-Down Check Valves are available made of bronze, iron, or steel.

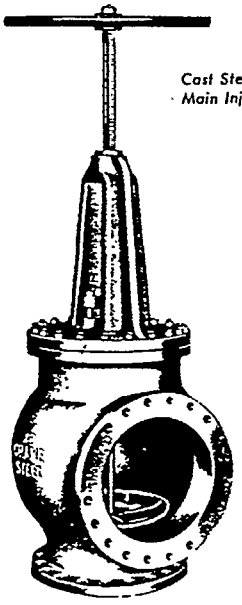
The cross section at the left shows the construction typical of a globe type screw-down check valve; the stem and disc are in the closed position. The Crane design makes it possible for a single valve to serve as both a stop valve and a check valve.

Sizes 1½ to 4-inch are available.

The bolted bonnet, flanged globe and angle screw-down check valves listed at the left are also available made of iron or steel. In addition, bronze valves are available with union bonnet and flanged ends.

Complete details will be furnished on request.

Marine Main Injection Valves



Cast Steel High Lift Angle Main Injection Valve

Main Injection Valves are available made of iron or steel.

Crane Main Injection Valves can be made to order in a wide range of sizes. They can be furnished made of cast iron with bronze trimmings or of cast steel with bronze trimmings. Complete information will be furnished on request.

The illustration at the left is that of a 20-inch cast steel main injection valve with flanged ends. It shows the disc raised out of the path of flow with the disc guide stem extending through the bridge of the body seat ring.

Maximum Marine Pressure-Temperature Ratings

For information on maximum pressure-temperature ratings to which Crane valves may be subjected, as defined in Marine Engineering Regulations, see pages 230 and 231.

For Marine regulations, general requirements, etc., see pages 228 and 229.

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Crane Steel Valves and Flanges for Class I Piping

Valves: Crane steel valves listed in the table below comply with Marine Engineering Regulations and Material Specifications (CG-115) for Class I Piping.

Materials: Valves listed in the "Small Size" category of the table are regularly made of carbon forged steel except for Nos. 3607 XU, 3611 XU, and 3615 XU Gates, No. 3694 X Checks, and Nos. 3844 U and 3852 U Globes which are carbon cast steel.

Valves listed in the "Large Size" category of the table are regularly made of carbon cast steel, except valves having a "U7" suffix are made of Crane No. 7 Chromium-Molybdenum Alloy Cast Steel.

Valves of other materials can be made to order; for description of Crane steels, see pages 6 to 8.

Special valves: As illustrated elsewhere in this section, special valves for marine service can be furnished. In addition, flanged valves in sizes ½ to 2-inch are available with 150-pound end flanges; these are made special from patterns of the "Small Size" 600-pound flanged valves listed in the table.

Flanges: Crane Forged Steel Flanges are available in ASA 150 to 2500-Pound pressure classes, also comply with Marine requirements for Class I piping. For complete description and ratings, see Section 26.

Important note-ratings: All ratings for Crane steel flanged valves, butt-welding valves, and flanges (see page references for ratings in table) agree with those in the American Steel Flange Standard (B16.5-1957). Such ratings also comply with Marine Engineering Regulations *up to the temperature limitations imposed by those regulations.*

No ratings are shown in the Marine Regulations for steel screwed and socket-welding valves; ratings for such valves, therefore, are Crane ratings.

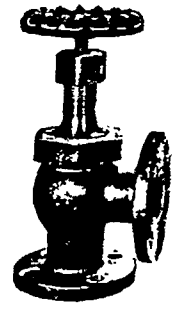
General Size Range	Bonnet Type	Valve Type	ASA Pressure Class	Catalog Nos. and Valve Ends: Screwed	Socket-Welding	Flanged	Butt-Welding	Size Range, Inches	*For ratings, see page:	For description, see page:
Small Sizes 2-inch and smaller	Union	Globe	600#	3640 XW	3648 XW	...	...	¼-¾	138	138, 139
		Angle	600#	3641 XW	...	...	...	¼-¾	138	138, 139
		Check	600#	3670 X	...	...	...	¼-¾	152	152
	Bolted	Gate	600#	3634 XU	...	...	...	¼-2	116	116
			600#	3604 XU	3605 XU	...	...	¼-2	117	117
			600#	3607 XU	3611 XU	3615 XU	...	½-2	118	118, 119
		Globe	600#	3644 XW	3652 XW	3656 XW	...	½-2	138	138, 139
		Angle	600#	3645 XW	3653 XW	3657 XW	...	½-2	138	138, 139
		Check	600#	3674 X	3682 X	3686 X	...	½-2	152	152, 153
		Check	600#	3694 X	...	...	...	½-2	154	154
		Globe	1500#	3844 U	3852 U	...	...	½-2	142	142
Large Sizes Up to 24-inch	Bolted	Gate	150#	...	...	†47 XU,X,XR	†47½ XU,X,XR	2-24	121	123-125
			300#	...	...	†33 XU	†33½ XU	1½-2½		
			300#	...	...	†33 X,XR,U	†33½ X,XR,U	3-24		
			400#	...	...	61 X,XR,U	61½ XR,U	4-16	121	126, 127
			600#	...	...	76 X,XR,U	76½ X,XR,U	2-24		
			900#	...	...	83 X,XR,U	83½ X,XR,U	3-16		
			1500#	...	...	87 X,XR,U	87½ X,XR,U	1-8		
		Globe	150#	...	...	143 X,XR	143½ X,XR	2-8	143	144-147
			300#	...	...	151 X,XR,U	151½ X,XR,U	2-8		
			400#	...	...	161 X,XR,U	161½ XR,U	4-8		
			600#	...	...	171 X,XR,U	171½ X,XR,U	2-6		
			900#	...	...	183 X,XR,U	183½ X,XR,U	3-6		
			1500#	...	...	189 X,XR,U	189½ X,XR,U	2-3		
		Angle	150#	...	...	145 X,XR	...	2-8	143	144-147
			300#	...	...	153 X,XR,U	...	2-8		
			400#	...	...	163 X,XR,U	...	4-8		
			600#	...	...	173 X,XR,U	173½ X,XR,U	2½-6		
			900#	...	...	185 X,XR,U	...	3-6		
		Swing Check	150#	...	...	147 X	147½ X	2-16	156	157-159
			300#	...	...	159 X	159½ X	2-12		
			400#	...	...	169 X	169½ X	4-12		
			600#	...	...	175 X	175½ X	1¼-12		
			900#	...	...	187 X	187½ X	3-8		
			1500#	...	...	199 X	199½ X	1½-8		
		Stop-Check	300#	...	...	28 XU, 30 XU	28½ XU, 30½ XU	3-10	222	222
			600#	...	...	179 U, 180 U	179½ U, 180½ U	2½-12	223	223
	Pressure-Seal	Gate	600#	...	...	676 U or U7	776 U or U7	2½-24	164	165-167
			900#	...	...	...	783 U or U7	3-18		
			1500#	...	...	...	787 U or U7	1-16		
			2500#	...	...	...	797 U or U7	up to 18		
		Globe	1500#	...	...	...	7189 U or U7	2-4	164	168, 169
		Check	900#	...	...	...	7140 U	2½-12	164	175
			1500#	...	...	...	7150 U	2½-12		
		Stop-Check	900#	...	...	...	7186 U7, 7188-U7	6-12	164	170, 171
			1500#	...	...	...	7192 U7, 7194-U7	8-12		

*See "Important note — ratings" in text above. †Flexible or solid disc types.

Marine regulations....pages 228 and 229

Crane Bronze and Steel Valves

Conforming to Military Standards and Specifications



Bronze low pressure flanged angle valve; complies with B-135.

Crane can furnish bronze and steel valves in a variety of types to comply with various Military Standards and Specifications as listed below; details on request.

BRONZE VALVES

Military Standard B-135
Low pressure flanged globe and angle stop and stop-check valves . . . . for 100 psi steam, 425 F.

Military Standard B-136
High pressure flanged globe, angle, and cross valves . . . . for 101 to 200 psi steam, 425 F.

Military Standard 810-1385714 (formerly B-165)
Solder-joint union end gate valves with copper alloy (Monel) trim. Tail-pieces with or without inserts. For 200 psi steam, 425 F.

Military Standard 810-1385721 (formerly B-194)
Applies to swing check valves; otherwise, same as the preceding Standard.

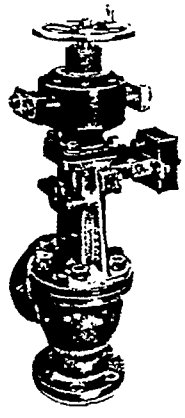
Military Standard 810-1385722 (formerly B-164)
Applies to globe and angle valves; otherwise, same as the preceding two Standards.

Specification MIL-V-1187
Valves complying with this specification are described in detail on page 42.

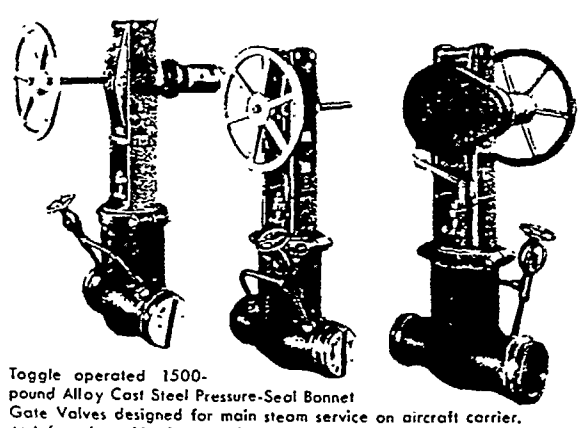
Specification MIL-V-1189 (Ships)
Flanged outside screw and yoke gate valves, Type I, Rising Stem. Class 1 for 100 psi water, oil, and gas . . . . Class 2 for 250 psi sea water; made to Bureau of Ships Plan 5000-S4824-F-1385602.

Specification MIL-V-2187 (Ships)
Flanged globe and angle hose valves . . . . 1½ and 2½-inch . . . . 100 psi.

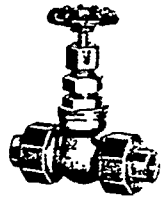
Specification MIL-V-17547 (Navy)
Low pressure flanged horizontal swing check valves . . . . Type A . . . . 100 psi.



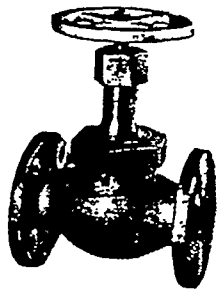
Special bronze angle valve equipped with hydraulic fluid operator; complies with B-135 modified.



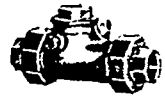
Toggle operated 1500-pound Alloy Cast Steel Pressure-Seal Bonnet Gate Valves designed for main steam service on aircraft carrier. At left, valve with air motor for emergency closing . . . . in center, manually operated valve . . . . at right, manual gear-operated valve.



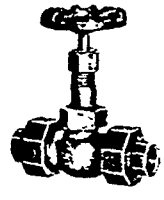
Solder-joint union end gate valve with Monel trim; complies with Mil. Std. 810-1385714.



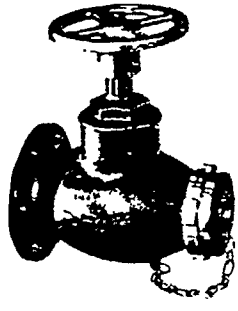
Bronze low pressure flanged globe valve; complies with B-135.



Solder-joint union end check valve with Monel trim; complies with Mil. Std. 810-1385721.



Solder-joint union end globe valve with Monel trim; complies with Mil. Std. 810-1385722.



Bronze flanged globe type hose valve; complies with MIL-V-2187.

STEEL VALVES

Military Standard B-137
Flanged 300-pound cast steel bolted bonnet globe, angle, and cross valves . . . . for 300 psi steam, 650 F.

Military Standard B-215
Flanged 150-pound cast steel globe, angle, cross, stop, and stop-check valves . . . . for 150 psi steam, 650 F . . . . for 150 psi hydraulic service.

Specification MIL-V-18110 (Ships)
Cast or forged carbon and alloy steel outside screw and yoke gate valves . . . . 150, 300, and 400-pound with bolted bonnet . . . . 600, 900, 1500, and 2500-pound with Pressure-Seal Bonnet.

Specification MIL-V-22052 (Ships)
Cast and forged steel globe and angle valves 2½-inch and larger . . . . 150 and 300-pound with bolted bonnet . . . . 600-pound to 2500-pound with Pressure-Seal Bonnet.

Specification MIL-V-22094 (Ships)
600 and 1500-pound bolted bonnet globe and angle valves with spiral wound bonnet gaskets 2-inch and smaller

Marine Ferrosteel Wedge Gate Valves

Working Pressure
125 psi saturated steam
125 psi non-shock cold water or oil



No. 4467
Flanged
Bronze Trimmed
Non-Rising Stem
With Cleanout
and Indicator

No. 4467 Valves, except for being specially fitted for use in marine cargo oil systems, are similar to, and have the same dimensions size for size as, the No. 461 non-rising stem wedge gate valves described on pages 74 and 75.

Sizes: The valves are regularly made in sizes 3, 4, 6, 8, 10, and 12-inch.

Construction and materials: The oval-shaped body and bonnet combine liberal metal sections with proper metal distribution for maximum strength. The straight-through ports with tie ribs between the bonnet flange and the end flanges provide additional resistance to line strains.

The body and bonnet are Crane Ferrosteel (ASTM A126, Class B). The body is equipped with two tapped and plugged bosses, one on the side opposite the single side cleanout and one on the bottom, suitable for ¾-inch steaming out connections. The body seat rings are bronze, screwed into the body. The disc, cast iron with a bronze seating face, is bronze-bushed where it engages the stem threads. The stem, also bronze, is liberal in diameter.

The ball-type gland and gland flange maintain an even packing load and prevent binding on the stem even when the bronze gland bolt nuts are not pulled up evenly. The gland bolts and gland flange hold the stuffing box to the bonnet; the stem collar recess is bronze-bushed, top and bottom, to minimize friction and to prevent corrosion.

Stuffing box: The stuffing box is exceptionally deep and is filled with high grade packing. The valves, when wide open, can be repacked while under pressure.

End flanges; drilling: The dimensions and drilling of end flanges conform to the American Cast Iron Flange Standard, Class 125 (B16.1-1948). The flanges are plain faced, with a smooth finish.

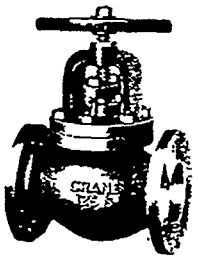
The valves are regularly furnished faced and drilled unless ordered faced only.

Face to face: The valves conform to the American Standard for Face-to-Face Dimensions (B16.10-1957) for 125-Pound Cast Iron Flanged Wedge Gate Valves.

Specials: Screwed end valves, larger sizes, or valves with a solid bronze disc, special trim, or bottom cleanout can be furnished on special order. Outside screw and yoke valves with flanged ends and a side cleanout are also available; complete information will be furnished on request.

Nodular iron: The No. 4467 can be made to order of Crane Nodular (Ductile) Iron conforming to requirements of ASTM A395. For outside screw and yoke wedge gate valves made of nodular iron, refer to the No. 6465 X described on page 87. For description of nodular iron, see page 3.

Marine Ferrosteel Globe and Angle Valves



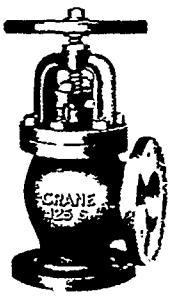
No. 351
Globe, Flanged
Bronze Trimmed
(page 101)

These valves are made in sizes 2 to 10-inch. They are rated commercially for 125 psi saturated steam and 200 psi non-shock cold water, oil, or gas. For marine ratings, see page 230. For complete description and dimensions, see pages 100 and 101.

The valves have a rugged yoke-type bolted bonnet. The body and bonnet are made of Crane Ferrosteel (ASTM A126, Class B). The valves are bronze fitted throughout. Their disc is solid bronze on sizes 6-inch and smaller, and iron with a bronze seating face, on sizes 8 and 10-inch. The screwed-in body seat ring, stem hole bushing, gland studs, and gland nuts also are bronze. The stem and yoke bushing are Cast Manganese Bronze. The disc is accurately guided throughout its travel by a guide stem through a bridge which is cast integral with the body seat ring.

The gland is of the two-piece ball-type construction, consisting of a siliconized steel gland and a malleable iron gland flange.

Nodular iron: The No. 351 and No. 353 can be made to order of Crane Nodular (Ductile) Cast Iron conforming to requirements of ASTM A395; for description of nodular iron, see page 3.

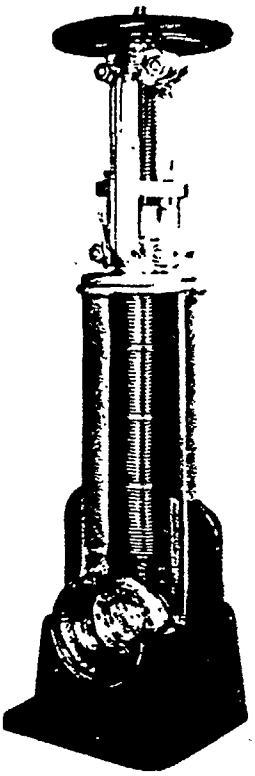


No. 353
Angle, Flanged
Bronze Trimmed
(page 101)

For marine regulations, general requirements, etc., see pages 228 and 229.
For Ferrosteel swing check, screw-down check, and main injection valves, see next page.

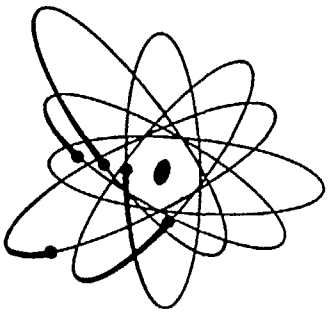
004628

Valves in Atomic Power



Retractable and expandable double disc gate valve with Teflon face. Holds very high vacuum. All-welded construction, nickel-plated for maximum tightness and resistance to corrosion.

Since the very beginnings of the application of controlled atomic power, Crane has been called on to supply valves and technical assistance to solve the flow control problems of this dynamic industry. Crane valves have been chosen for most of the Navy's nuclear powered warships, and they are the first choice of designers working on modern, land-based nuclear power plants.



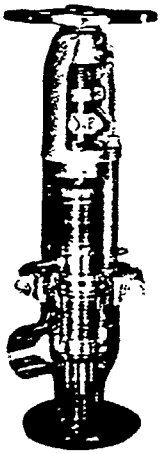
One reason for the exceptionally high quality of Crane Valves for the atomic industry is the painstaking quality control maintained in production and testing. Recognizing the importance of valve reliability in nuclear installations, Crane designed and built a facility to test the operation and pressure tightness of primary coolant valves under simulated conditions of temperature and pressure. This test facility, completed several years ago, allows production and engineering testing of hermetically-sealed cylinder operated valves, and hand or motor operated valves. Leak rates of valve seats, piston rings, and shaft seals are measured; power to operate is determined; and performance of the working parts is observed under cyclical conditions on pressurized hot and cold water.

Testing Facilities

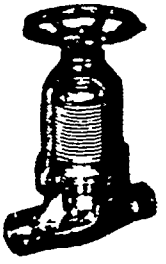
There are two basic test systems . . . . one for cold testing and one for hot testing. Each is equipped with its own instruments. The cold loop has three test stations, used for applying static water pressure to valve bodies and seats. Actuator systems for opening and closing cylinder-operated valves are separate from these. These systems can produce static pressures up to 6000 psi in the valve, and cylinder operating pressures up to 3000 psi. The maximum pressure differential across the valve piston is 1000 psi at any cylinder pressure up to 2000 psi.

The hot testing system consists of a closed pipe loop with connections to three test stations. Thus, one large valve can be tested while others are being set up for test in adjacent stations. Banks of small valves can also be connected to the hot loop. Maximum pressure and temperature in the hot test loop is 2500 psi and 600 F. Maximum pressure and temperature in the hot actuator loop is 3000 psi and 450 F, with up to 1000 psi differential across the valve piston. An AEC approved canned-rotor pump circulates the water in the hot test loop. Pump rating is 150 gpm at 290 feet of head, which is equivalent to 102 psi at 475 F, or 88 psi at 600 F. The hot test and hot actuator loops are pressurized with nitrogen to reduce oxidation.

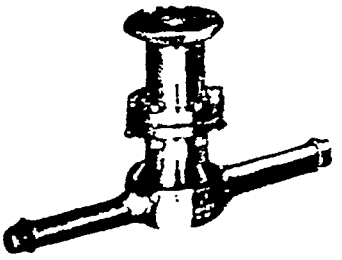
(continued on the next page)



Angle valve with double bellows seal in tandem All-stainless steel construction For high temperature liquid metal service



Globe valve . . . Monel body and bellows seal for high vacuum radioactive service Metal-to-metal seat for high temperature service Plastic seat for low temperature service

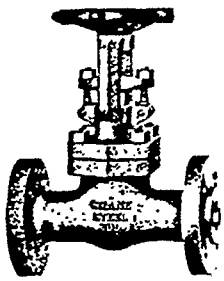


Globe valve with bellows seal, plastic seat, and all-stainless steel construction For chemical processing of radioactive material

Marine Steel Valves

004025

Gate

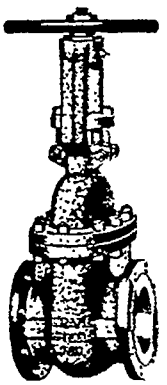


No. 3615 XU
Gate, Flanged
(see page 119)

The bolted bonnet gate valves illustrated are the outside screw and yoke type. The body, bonnet, and yoke are cast carbon steel. The disc features close fitting guides to maintain accurate seating and to reduce wear. The tee-head disc stem connection prevents lateral strains on the Exelloy stem. The valves are rated commercially for a maximum of 850 F steam or water.

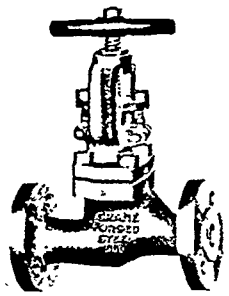
No. 3615 XU: These compact valves have a solid wedge disc made of Exelloy. The body seat rings are Exelloy faced with Stellite. In addition to the flanged valve illustrated, the line includes screwed (No. 3607 XU) and socket-welding (No. 3611 XU) valves. Sizes ½ to 2-inch are available; for complete details, see pages 118 and 119.

No. 47 XR-F: This line features Crane's revolutionary new flexible wedge disc design in sizes 12-inch and smaller; in larger sizes, up to 24-inch, the disc is the solid web type. Screwed (No. 46 XR-F) and butt-welding (No. 47½ XR-F) valves are also available; see pages 123 to 125 for full details.



No. 47 XR-F
Gate, Flanged
(see page 125)

Globe and Angle

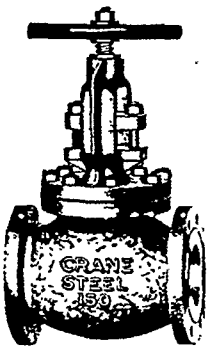


No. 3656 XW
Globe, Flanged
(see page 139)

No. 3656 XW and No. 143 XR are bolted bonnet, outside screw and yoke valves. They have an Exelloy stem. Sizes 6-inch and smaller have a plug type disc and seat; the 8-inch size has a flat disc and seat. The valves are rated commercially for a maximum of 850 F steam or water.

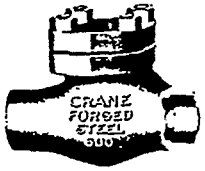
No. 3656 XW: This forged steel line includes both globe and angle valves with screwed (Nos. 3644 XW and 3647 XW), socket-welding (Nos. 3652 XW and 3653 XW), and flanged (Nos. 3656 XW and 3657 XW) ends. They have a Crane "500 Brinell" stainless steel disc and an Exelloy body seat ring. Sizes ½ to 2-inch are available. See pages 138 and 139 for complete details.

No. 143 XR: These cast steel valves have an Exelloy body seat ring and a Crane No. 49 Nickel Alloy disc. Sizes 2 to 8-inch are available. Companion globe valves are the No. 142 XR screwed and No. 143½ XR butt-welding. Angle valves with flanged ends (No. 145 XR) are also available. For complete details of the entire Crane line, see pages 145 to 148.



No. 143 XR
Globe, Flanged
(see page 146)

Check

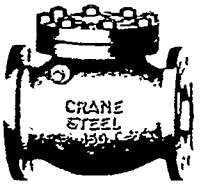


No. 3682 X
Check, Socket-Welding
(see page 152)

The bolted cap check valves shown have an Exelloy or Exelloy-faced carbon steel disc and an Exelloy body seat ring. They are rated commercially for a maximum of 1000 F steam or water.

No. 3682 X: The No. 3682 X is a socket-welding end valve. Companion valves include screwed (No. 3674 X) and flanged (No. 3686 X) types. All are available in sizes ½ to 2-inch. For complete details, see pages 152 and 153.

No. 147 X: The No. 147 X is a cast steel flanged end valve available in sizes 2 to 16-inch. Companion valves are the No. 148 X screwed in sizes 2 to 4-inch and the No. 147½ X butt-welding in sizes 2 to 8-inch. For complete details, see pages 156 to 159.



No. 147 X
Check, Flanged
(see page 158)

For marine ratings of these and other Crane steel valves, see page 231; for complete description and dimensions, refer to the pages below the illustrations. For screw-down check valves, see page 234.

Valves for Extreme Temperatures

004080



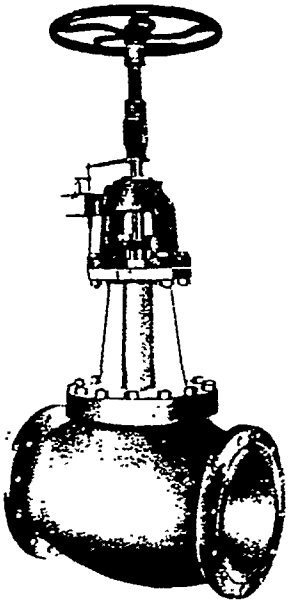
All-bronze globe valve with extended bonnet. For sub-zero temperatures.

The increased use of extreme temperature ranges, both hot and cold, in chemical process work has stimulated the need for equipment of the proper design and metallurgy. High temperatures over 1400 F, and sub-zero temperatures below minus 400 F, are now being used in some process piping. Considerable product development work is still underway on the extremes in temperatures, and Crane is participating in the design of valves to meet the needs, as illustrated on these facing pages.

Cryogenic Valves For Missile Ground Support Equipment

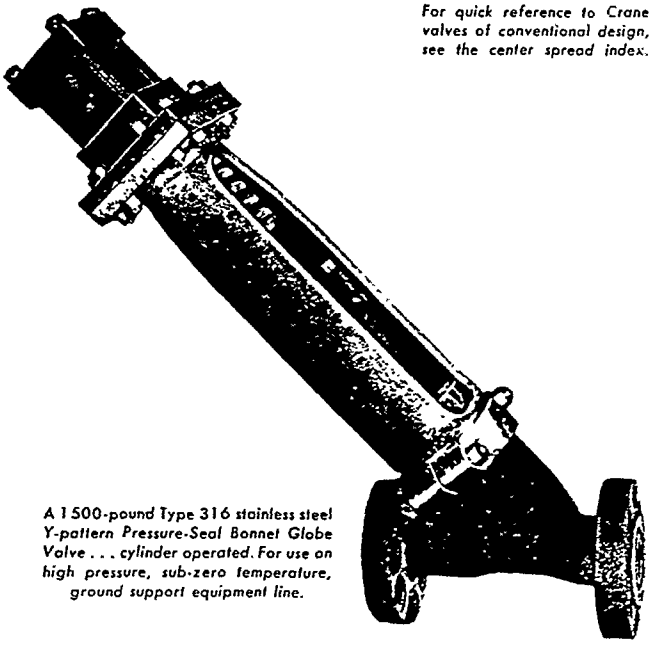
Cryogenics, or the science of extremely low temperatures, while not new, is only now finding widespread application in chemical process and petro-chemical work. One of the problems of this technology is the piping and valving of fluids such as liquid oxygen and nitrogen at temperatures in the range of minus 297 F to minus 320 F. It is in this area of process piping that Crane engineers have developed valve designs for use in the guided missile industry. The high degree of seat tightness required is achieved with specially prepared seats with plastic or synthetic rubber discs. Positive sealing of the stem at the stuffing box area requires special packing and extension of the bonnet so that the stuffing box is kept out of the frost zone.

Several photographs showing typical Cryogenic valves as used by the guided missile industry are shown on this page. These represent only a few of the types Crane has built.



A 12-inch Type 316 stainless steel globe valve with extended bonnet and plastic disc for minus 297 F liquid oxygen service. Valve is equipped with micro-switch for remote position indication

For quick reference to Crane valves of conventional design, see the center spread index.



A 1500-pound Type 316 stainless steel Y-pattern Pressure-Seal Bonnet Globe Valve . . . cylinder operated. For use on high pressure, sub-zero temperature, ground support equipment line.

SECTION 21

Crane Valves for Special Services

Valves in Atomic Power
Typical valves.....pages 238 and 239
Testing facilities.....pages 238 and 239

Valves for Extreme Temperatures
Cryogenic type for missile ground support equipment.....page 240
For sub-zero temperatures.....pages 240 and 241
For high temperatures.....pages 240 and 241

Valves for High Pressures.....page 242

Valves for High Vacuums.....page 243

Valves for Unusual Conditions
For extremely corrosive conditions.....page 244
For water flood injection systems.....page 244

21

One of the most basic concerns of American industry today is the constant search for new ideas, new methods of production, and new products. Large annual expenditures for research in the fields of chemicals, pharmaceuticals, synthetic fibers, synthetic rubbers and plastics, radiation and nuclear technology . . . . to name just a few industries . . . . have created practically an unlimited supply of new ideas and new product developments that have revolutionized industry.

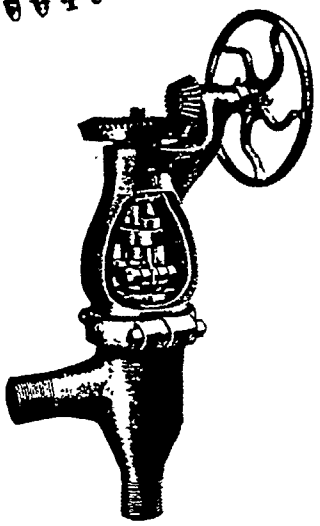
Crane has responded to this exciting challenge with many new piping products, designed to meet every requirement, in every representative area of fluid and gas handling. The photographs on the pages that follow illustrate valves that were designed specifically to meet unusual conditions of operation, special corrosion resistance requirements in the fields of nuclear power and processing . . . . as well as valves that depict explorations into areas of extreme high and low ranges in pressures and temperatures.

In many cases, regular Crane Valves meet the demands of high pressure-temperature services, extreme corrosive conditions, etc. Refer to the following:

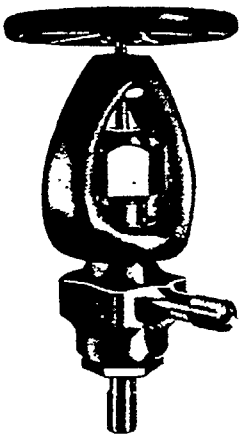
Steel Gate Valves.....Section 12
Steel Globe and Angle Valves.....Section 13
Steel Check Valves.....Section 14
Steel Pressure-Seal Bonnet Valves.....Section 15
Steel Lip-Seal Bonnet Valves.....Section 15
Packless Diaphragm Valves.....Section 16
Stainless Steel Valves.....Section 17

004032

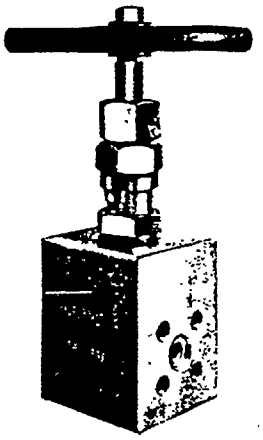
Valves for High Pressures



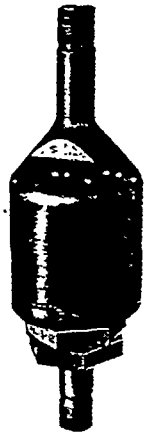
Bevel gear operated cast steel angle valve for 7,500 psi gas service. The bonnet is the Pressure-Seal type.



A 30,000 psi angle valve for use in polyethylene production and other gas processing operations. The valve uses a Pressure-Seal type closure on the seat and the valve inlet connection.



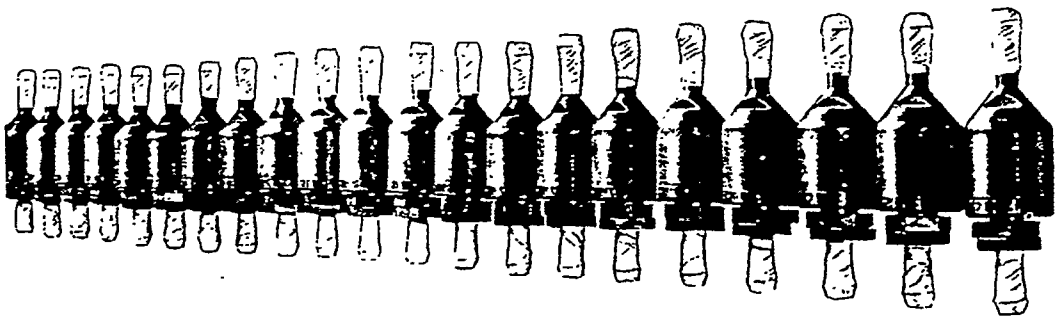
A Type 304 stainless steel block valve for 6,000 psi high pressure processing



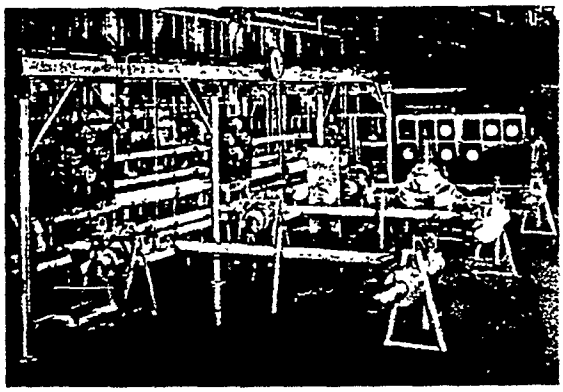
Above and below: Vertical check valves for gas processing at pressures up to 30,000 psi. Used in polyethylene production. Incorporate Pressure-Seal principle for closure.

In recent years, the trend to higher pressures in the process industries has moved forward rapidly, not only because of the discovery of new products, but because of the improvement in processes for old established products. The need for anhydrous ammonia led to the construction of synthetic ammonia plants operating at 5,000, 10,000, and 15,000 psi Production of polyethylene created the need for operating pressures at 30,000 psi . . . . and there is every indication that process pressures will go considerably higher.

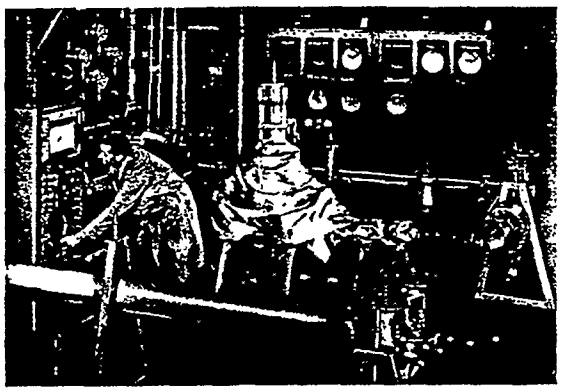
The talents of Crane engineers and metallurgists were called upon to solve the high pressure piping and valving problems. A few of the designs developed to meet the needs of our customers are illustrated on this page.



Valves in Atomic Power



Over-all view of test facility for nuclear valves.



Close-up of a portion of the hot test loop.

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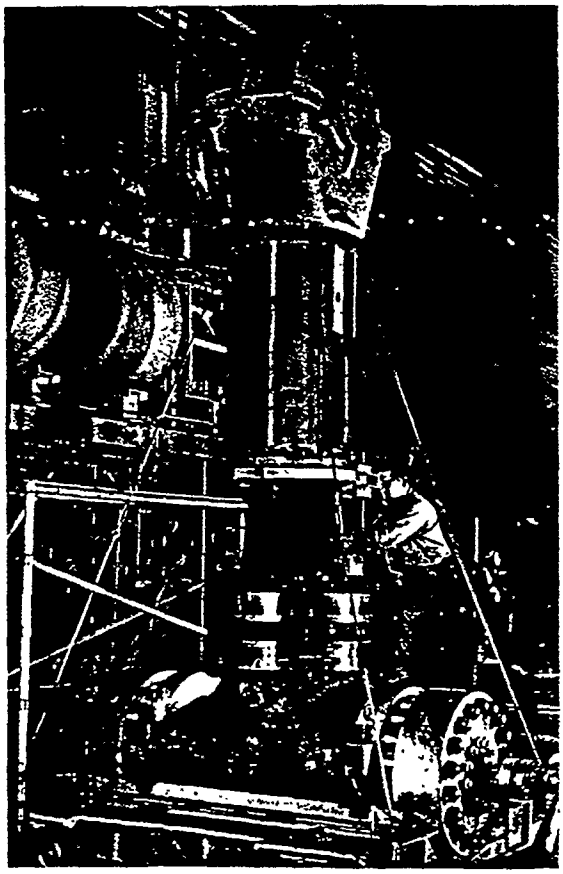
Assembly of 24-inch stainless steel gate valves for a nuclear power plant.

Testing Facilities — continued

Test water is demineralized, has a pH of 6 to 8, and a specific resistivity above 500,000 ohm/cm (2 micromhos conductance). Purity is achieved by passing city water through a sand filter, a carbon filter, and a mixed-bed deionizer, into a stainless steel storage tank. Before entering the hot loop, this purified water is passed through a degasifier to remove oxygen, carbon dioxide, and entrapped air. Water condition is constantly monitored.

Extra care is exercised to see that the area in which the test loops are located is kept clean. This test area is adjacent to the clean room where the valves are assembled

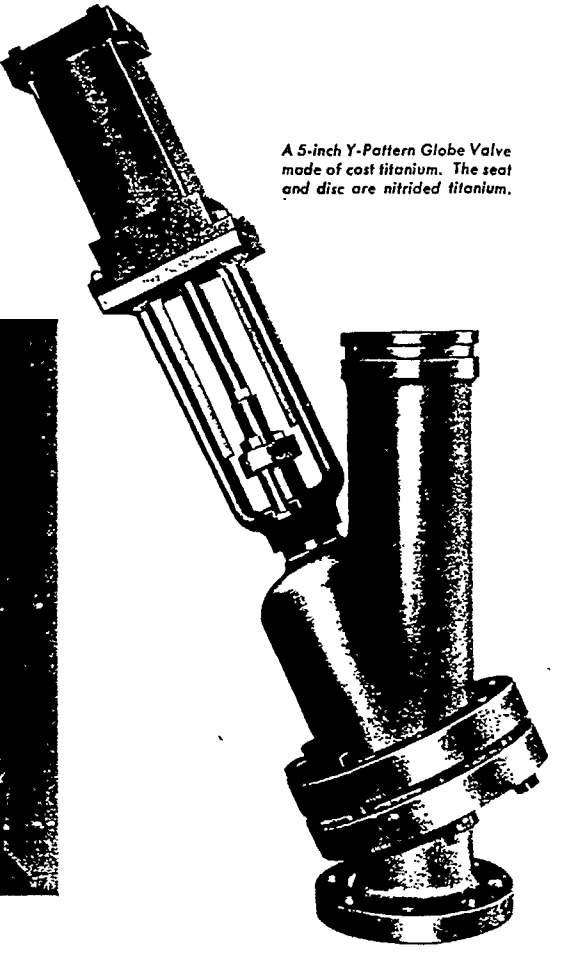


One of eight 24-inch stainless steel gate valves built for a nuclear power plant. The valves are intended for service on a reactor inlet and outlet at 1800 psi and 650 F. Each valve weighs about 15 tons . . . measures 15' 3" from centerline to top . . . measures 70" from end to end

004834

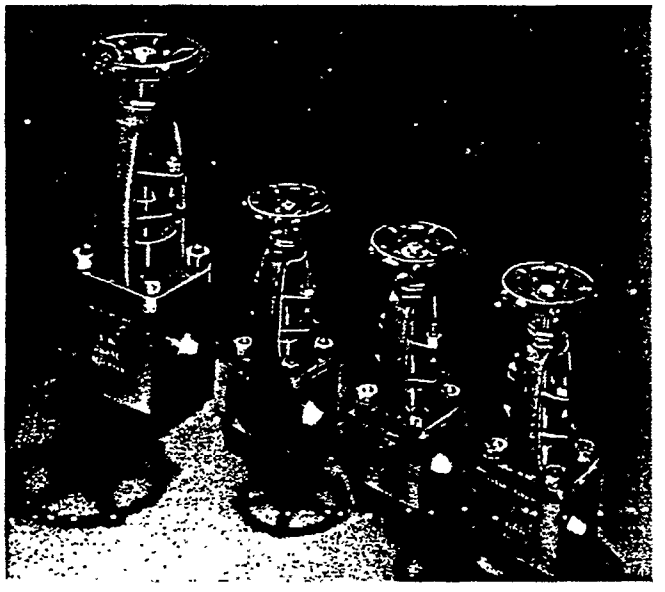
Valves for Unusual Services

On many applications, Crane engineers are asked to design valves for service conditions for which there is no background of experience. In such cases, a comprehensive study of the problem is undertaken in conjunction with the customer's engineers. The results of these studies in design and metallurgy are thoroughly tested . . . . and ultimately proved out in the customer's pilot plant operation. Typical examples are illustrated on this page.

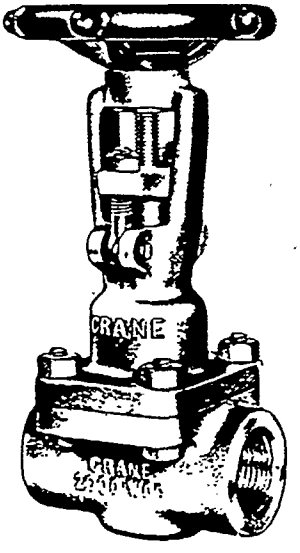


A 5-inch Y-Pattern Globe Valve made of cast titanium. The seat and disc are nitrided titanium.

21



A group of Crane Titanium Plug Gate Valves. All parts in contact with fluid in the line are made of forged titanium.



Stainless Steel Plug Gate Valve
For Water Flood Injection Control

The Crane No. 18870 is designed to handle tough corrosion and erosion problems on all types of water flood installations. Developed after extensive laboratory and field testing under actual water flood conditions . . . . and built to last the life of the flood . . . . this valve assures positive control, eliminates costly shutdowns due to valve maintenance, and increases oil recovery.

All parts in contact with fluid in the line are Crane 18-8 SMo Alloy Steel The tapered plug gate design, with reduced area at the seat, is ideal for close throttling, provides a tight shutoff, and is non-galling on the seat. The rubber O-ring gasket assures a tight body-bonnet joint. The two-piece ball-type packing gland maintains uniform pressure on the packing without binding on the stem.

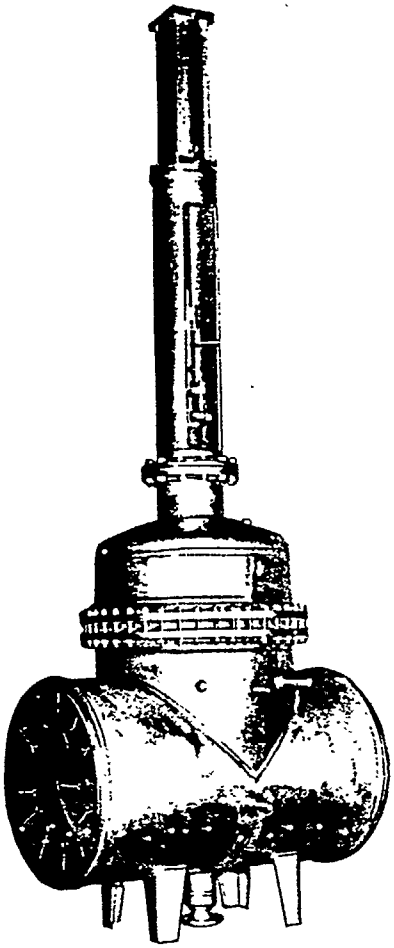
The valve is recommended for working pressures up to 2000 psi at atmospheric temperature and is hydrostatically tested at 3000 psi on the shell and 2100 psi on the seat.

No. 18870 Water Flood Valve

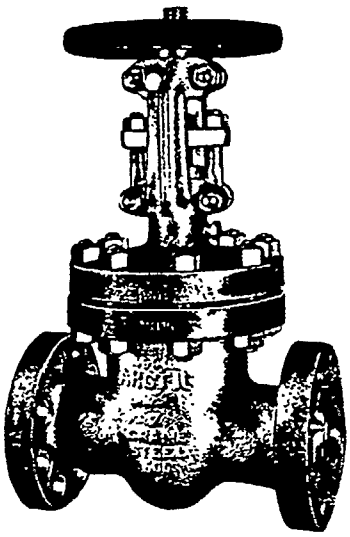
Size	End to end	Center to top, open	Dia. of wheel
Inches	Inches	Inches	Inches
1	3¾	8	4

Price and additional information furnished on request

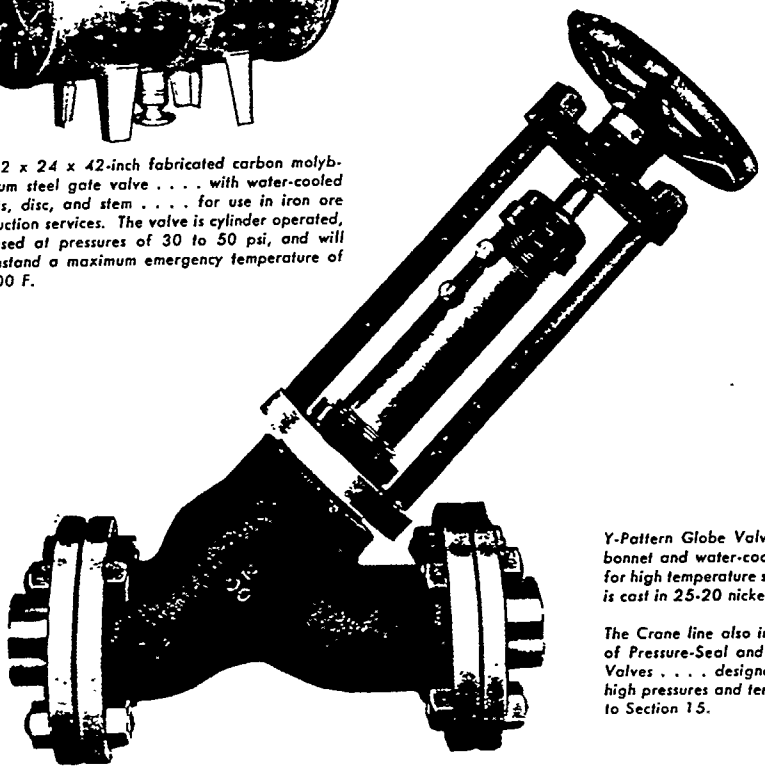
Valves for Extreme Temperatures



A 42 x 24 x 42-inch fabricated carbon molybdenum steel gate valve . . . . with water-cooled seats, disc, and stem . . . . for use in iron ore reduction services. The valve is cylinder operated, is used at pressures of 30 to 50 psi, and will withstand a maximum emergency temperature of 1600 F.



Crane "Arctic" Nickel Alloy Cast Steel Gate Valve. For use on minus 150 F chemical processing.



Y-Pattern Globe Valve with extended bonnet and water-cooled stuffing box for high temperature service. The valve is cast in 25-20 nickel-chromium steel.

The Crane line also includes a variety of Pressure-Seal and Lip-Seal Bonnet Valves . . . . designed especially for high pressures and temperatures, refer to Section 15.

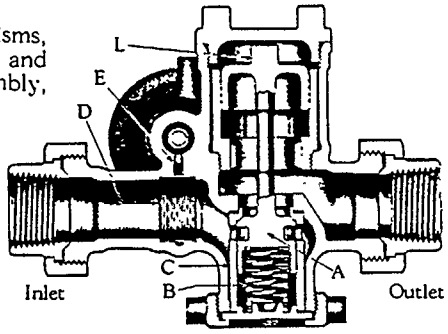
004636

Bronze Pressure Regulators

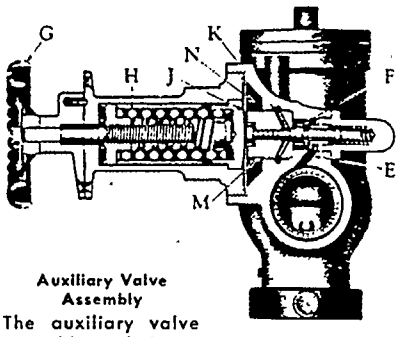
Featuring separate main valve and auxiliary valve assemblies for greater accuracy in regulation of steam and air pressures

Two important mechanisms, a main valve assembly and an auxiliary valve assembly, assure top efficiency in Crane Pressure Regulators. Interconnected for the transmission of pressure, but independent mechanically, they operate in the same body.

Except for necessary pipe connections, the regulator would function as well with the units separated.



Main Valve and Piston Assembly
The main valve assembly includes a disc and seat. The opening movement of the disc is controlled by a piston which is actuated by pressure from the auxiliary valve.



Auxiliary Valve Assembly
The auxiliary valve assembly includes a device to manually set the desired outlet pressure, an auxiliary valve to control operation of the main valve, and a mechanism to operate the auxiliary valve itself.

22

Step-by-step operation

With the regulator properly installed in the line and ready for service, the successive steps taking place in its operation are:

1. High pressure steam (or air) from the inlet piping flows into the inlet side of the regulator as far as the main disc A, which is held lightly to its seat by the main disc spring B.

2. This high pressure then passes into the main disc spring chamber through the ports in the liner C and acts to hold the main disc tightly to its seat.

3. A portion of the high pressure steam (or air) in the regulator inlet passes through the screen D into the high pressure port E and fills the chamber around the auxiliary valve F, which is held lightly to its seat by the auxiliary valve spring.

4. When the handwheel G is turned in a clockwise direction, the regulating spring H is compressed, deflecting the diaphragm J. This deflection of the diaphragm moves the auxiliary valve F off its seat and allows pressure to flow through the intermediate pressure port K into the chamber above the piston L.

5. The piston then moves downward, overcoming resistance of the main disc A, forcing it off its seat.

6. Steam (or air) then flows past the main disc A and fills the outlet piping system. Pressure from the outlet of the regulator is transmitted back through the low pressure port M to the diaphragm chamber N. As the pressure builds up in this chamber, it finally overcomes the tension on the diaphragm J, caused by the regulating spring H, and forces the diaphragm back toward its original position.

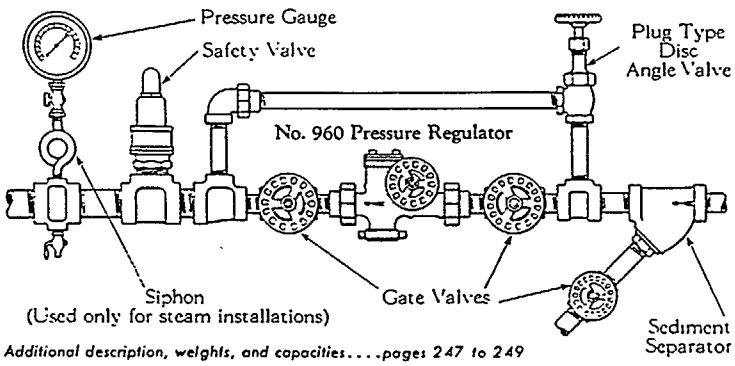
7. Just as soon as the diaphragm returns to its original position, the auxiliary valve closes, thus cutting off the pressure to the top of the piston L.

8. The high pressure in the spring chamber of the main disc A then forces the main disc back to its seat, cutting off the steam (or air) supply to the outlet side of the regulator.

9. As the outlet pressure falls, the pressure in the diaphragm chamber also falls, with the result that the regulating spring tension again deflects the diaphragm and moves the auxiliary valve off its seat.

10. The entire cycle of operations is then repeated The cycle is automatic and practically instantaneous; there is no lag between operations.

Recommended piping arrangement



Additional description, weights, and capacities. . . . pages 247 to 249

Automatically maintained pressure

When the handwheel is set to obtain any desired outlet pressure, this pressure is maintained within close limits if the quantity of steam or air being used remains fairly constant.

Continually proportioned flow

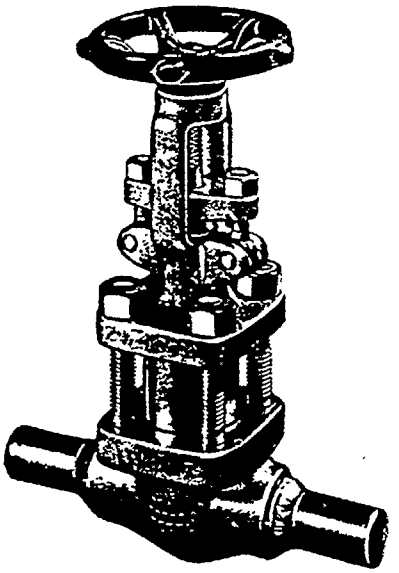
When steam or air is being used in the outlet system, the regulator actually operates in a "floating" position; that is, both the main disc and the auxiliary valve move back and forth without pausing at any one position, and thus continually proportion the flow of steam or air to satisfy the outlet requirements.

Valves for High Vacuums

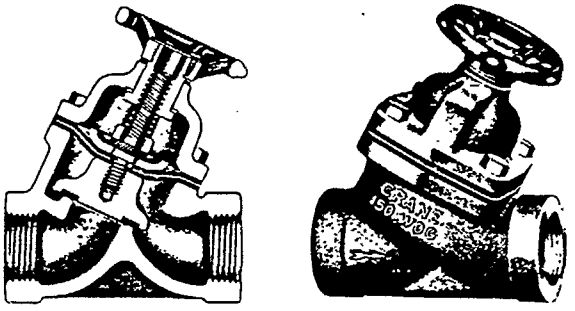
The years following World War II marked the beginning of processing and testing under extreme vacuum conditions that were not considered possible earlier. Vacuum test equipment is now required to withstand vacuums approaching near perfect . . . . and to be sensitive to leak rates of .01 micron/cu. ft/hr.

To meet the challenge, Crane engineers developed valves shown on this page. Because the tightness requirements of vacuum processing will not permit a conventional stuffing box or metal to metal seating, special means have been taken to seal these points of potential leakage.

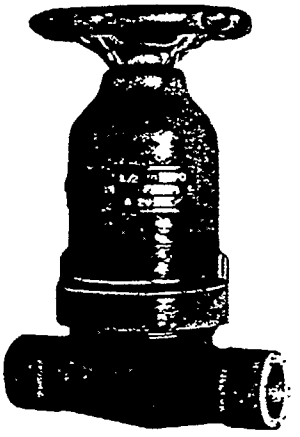
The Crane Diaphragm Valves, illustrated below and described in detail in Section 16, are of the "packless" design. They are suitable for service on all degrees of vacuum. The diaphragm seals off the bonnet area and the stem . . . . the soft seat assures a positive shutoff. For special services at high temperatures, bellows sealed valves can be furnished.



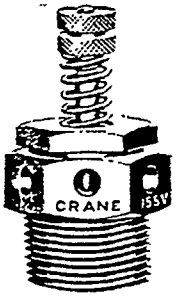
Forged carbon steel globe valve with bellows sealed stem for vacuum processing. Supplementary stuffing box is provided for maximum safety



Crane No. 1650 Y-Pattern Packless Diaphragm Valve . . . . designed for all degrees of vacuum at temperatures up to 180 F and furnished in sizes ½ to 2-inch. Also available with flanged ends (No. 1651) in sizes up to 6-inch. For complete details, see pages 184 and 185.



Forged Monel globe valve with plastic seat. Double bellows type with inner and outer bellows.



No 1151 V Bronze Relief Valve designed for use as a vacuum breaker. Regularly furnished in sizes ½ to 1½-inch For complete details, see page 213

Complete information concerning special valves for high vacuum service will be furnished on request

No. 960 Pressure Regulators—Steam and Air Capacities

004638

For description and dimensions, see the preceding two pages.

For capacities, see the facing page.

Explanation of data in table: The steam and air capacities of Crane No. 960 Bronze Pressure Regulators are shown in the table on the facing page. An explanation of the data in the table follows:

Inlet Pressures

Inlet pressures for each regulator size are shown in convenient increments from 30 to 250 psi.

Pounds Change in Outlet Pressure To Obtain Rate of Flow

The values in these columns indicate the rate of flow or capacity at various pounds change in outlet pressure; *the values apply to any outlet pressure.*

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For example, assume that steam at 100 psi is to be reduced through a ½-inch regulator to a maximum or dead-end outlet pressure of 20 psi. Referring to the ½-inch size in the table, read the rates of flow for steam indicated to the right of "100 psi inlet pressure". Then:

At 19 psi outlet pressure (1 pound decrease), the regulator would deliver 41 pounds of steam per hour.

At 18 psi outlet pressure (2 pound decrease), the regulator would deliver 70 pounds of steam per hour.

At 12 psi outlet pressure (8 pound decrease), the regulator would deliver 225 pounds of steam per hour.

In this example, if the selected maximum or dead-end outlet pressure were 60 psi (or any other pressure) instead of 20 psi, the rate of flow or capacity at a 1, 2, or 8-pound change (or decrease) would still be 41, 70, and 225 pounds respectively.

Heavy Black Lines In Table

The heavy black lines running at right angles in the table indicate the point for each inlet pressure, at which the regulator is at approximately 50 per cent of its maximum capacity. For instance, in the example above, the ½-inch regulator at an 8-pound decrease in pressure is delivering 225 pounds of steam per hour; the value "225 pounds" is immediately to the left of the heavy black line and is slightly less than half of the maximum capacity of the regulator.

The normal flow demand of the outlet system should correspond with the capacity of the regulator as shown near the black line. This assures the use of a regulator which will function properly and will provide practical variation in lower or higher capacity when the flow demand varies from normal.

Maximum Flow—No Regulation

The values in this column indicate maximum rate of flow at the various inlet pressures. Maximum rate of flow occurs when the flow demand is so great that the outlet pressure has dropped to the point where the regulator is delivering full capacity (no regulation).

These values are listed to enable correct sizing of the safety valve which should be installed in the outlet piping. For proper protection and maximum safety, the safety valve should be capable of discharging at least the maximum flow through the regulator.

How to use the table: Unlike most capacity tables, Crane's has been designed to show accurate and complete capacity ratings under any combination of varying operating conditions.

Example: Assume a regulator is desired that will reduce an inlet steam pressure of 100 psi to approximately 40 psi on the outlet and deliver steam at a normal rate of 225 pounds per hour.

1-inch regulator is too large

Adjusted for 40 psi maximum or dead-end outlet pressure, a 1-inch regulator will deliver the desired rate of flow at about a 2-pound change between dead-end and normal-flow outlet pressures, but it would be too large for most satisfactory operation.

¾-inch regulator is also too large

The ¾-inch regulator would also deliver the desired rate of flow at about 36 psi if adjusted to 40 psi dead-end outlet pressure, or at about 40 psi if adjusted to 44 psi dead-end outlet pressure (4-pound changes). However, this size should be rejected also, since like the 1-inch, it is too large for the conditions.

½-inch regulator fulfills requirements

The ½-inch regulator adjusted for 40 psi maximum or dead-end outlet pressure will deliver the desired rate of flow when the outlet pressure has dropped 8 pounds or is 32 psi. This regulator would also have additional capacity . . . . up to 410 pounds per hour with an outlet pressure of 20 psi . . . . for warming-up periods. At the same time, it will have an ample range of lower capacity at 35, 36, 37, 38, or 39 psi outlet pressure, when the required rate of flow is less than normal. The ½-inch regulator with an outlet pressure of 40 psi is ideal for the conditions

If originally adjusted to 48 psi maximum or dead-end outlet pressure, this regulator would deliver the desired rate of flow at 40 psi, but the pressure in the outlet would build up to a maximum of 48 psi when the flow demand ceased entirely. Consequently, the ½-inch size with a 40 psi dead-end outlet pressure is the better choice.

Choosing the proper regulator: The regulator should be chosen on the basis of its capacity to provide the desired rate of flow without requiring manual attention of the regulating wheel. Make sure the regulator operates within acceptable limits of variation between dead-end outlet pressure and actual outlet pressure, under the desired flow conditions. Use of the regulating wheel can, of course, narrow these limits if manual adjustment is made following changes in flow demand.

The regulators are not recommended for use where the desired outlet pressure is more than 80 per cent of the inlet pressure.

For additional information essential to the selection of the proper regulator, see the preceding page.

SECTION 22

Crane Specialties

Regulators, Steam Traps, Air Vent and Water Drain Valves, Separators, Exhaust Heads, Gauges, Swing Joints, and Safety Vent

Bronze Pressure Regulators
Operation.....pages 246 and 247
General Description, Weights, and Dimensions.....page 247
Capacities.....pages 248 and 249

Inverted Open Float Steam Traps
General Description, Weights, and Dimensions.....page 250
Capacities.....page 251
Suggested Installation.....page 253

Air Vent and Water Drain Valves
General Description, Weights, and Dimensions.....page 252
Capacities.....page 252
Suggested Installation.....page 253

Y-Pattern Sediment Separators
125-Pound Iron Body.....page 254
250-Pound Iron Body.....page 254
600-Pound Cast Steel.....page 254

Crane-Swartwout Exhaust Heads.....page 255

Bronze Water Gauges
100-Pound.....page 256
175-Pound.....page 256
250-Pound.....page 256

All-Iron Liquid Gauges.....page 257

Bronze Swing Joints.....page 257

Safety Gas Vent Elbow.....page 257

22

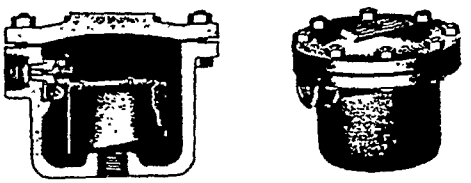
For other products in the "Specialty" class, refer to:

Bronze lever-operated quick-opening valves.....pages 56 to 58
Bronze butterfly valves.....page 58
Iron butterfly valves.....page 99
18-8 SMo liquid level gauge.....page 198
Pulp stock valves.....pages 84 to 86
Stop-check valves, Pressure-Seal Bonnet.....pages 170 to 173
Stop-check valves, bolted bonnet.....pages 219 to 225
Blow-off valves.....page 218
Safety and relief valves.....pages 203 to 216

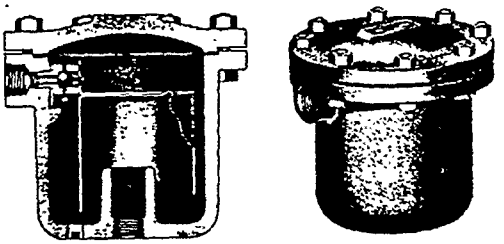
Inverted Open Float Steam Traps

(Patented)

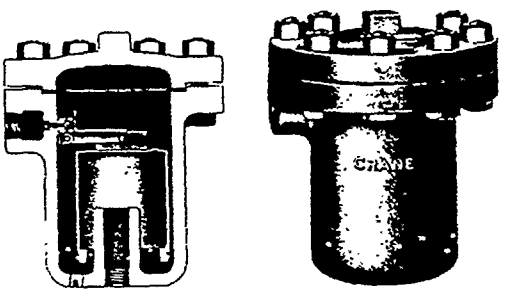
Range of Working Pressures
1 to 300 psi saturated steam



No. 9810 — 1 to 150 psi saturated steam



No. 9812 — 1 to 200 psi saturated steam
No. 9814 — 1 to 200 psi saturated steam



No. 9820 — 25 to 300 psi saturated steam

Weights, Dimensions, Orifice Sizes, Maximum Pressures, and Seat Numbers — Prices on Request

Trap No. and Pipe Size	Wt. Lbs Each	Overall height In.	Diameter In.	Orifice Size In.	Max. Pressure psi	Seat No.
No. 9810 ½-inch	8	4½	5⅜	.059	150	16A
				1/16	125	15A
				5/64	75	14A
				3/32	50	13A
				1/8	30	12A
				5/32	15	11A
No. 9812 ¾-inch	23	7⅜	7½	3/32	200	26A
				1/8	150	25A
				5/32	100	24A
				3/16	50	23A
				1/4	30	22A
				5/16	15	21A
No. 9814 1-inch	62	12 3/16	8¾	7/32	200	36A
				1/4	150	35A
				5/16	100	34A
				3/8	50	33A
				1/2	30	32A
				5/8	15	31A
No. 9820 ¾-inch	47	9⅝	8⅜	3/32	300	13A
				1/8	250	12A

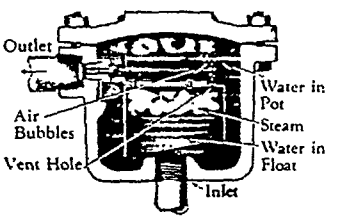
Recommendations: Crane Open Float Steam Traps provide a simple, trouble-free method for removing condensate from steam piping, separators, and all types of steam heated equipment. By draining condensate from steam lines as rapidly as it accumulates, they prevent waste of fuel and reduction of efficiency and, at the same time, save many fuel dollars by recovering condensate for heating, for hot water needs, or for return to boilers.

Construction: The traps are small, compact, and free from complex operating mechanism yet feature high discharging capacities. Extremely simple, their one moving part is the float which actuates the disc through a simple lever. The ball-type disc is guided to its seat and holds pressure easily. The body has an internal inlet nozzle which retains the water seal and precludes the possibility of live steam passing through the trap. A small hole in the top of the float allows air and other non-condensable gases to accumulate at the top of the trap.

The cover or cap is bolted to the body, the joint being fitted with a Cranite gasket. The No. 9810 has a 1/16-inch raised face on the body and cap; the other traps have a male and female joint. Bolts are arranged so that the cap can be assembled in one position only, at which the word "Outlet" on the cap is directly over that opening on the side of the body.

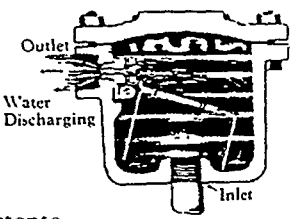
Materials: The body and cap are cast iron on the Nos 9810, 9812, and 9814, and Ferrosteel on the No. 9820. These metals conform to ASTM A 126, Classes A and B, respectively. The Exelloy renewable seat bushing and fulcrum rod, and the 16 to 18 per cent chromium steel ball disc offer excellent resistance to wear, erosion, and corrosion. The float, lever, and lever supports are bronze or copper.

Operation: The traps are actuated solely by the rise and fall of the float resting on the accumulated condensate. The float is buoyant when filled with incoming steam and the discharge valve is closed. When incoming condensate floods the float, it sinks, thereby opening the valve and permitting the condensate to be discharged by the effective pressure.



Trap closed—incoming steam under the float buoys the float up, keeping the outlet closed.

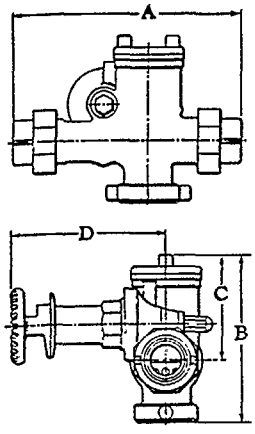
Air or other non-condensable gas vents through a small hole in the top of the float and collects in the upper part of the trap. At each operation, this air or gas is discharged. The entire cycle of operation is practically instantaneous. If the condensate accumulates at a rate equal to the trap capacity, continuous discharge may occur; for these conditions, a larger capacity trap should be used See "Capacity" on next page



Trap open — incoming condensate fills float, sinks it, and opens outlet.

For added description and capacities see next page.

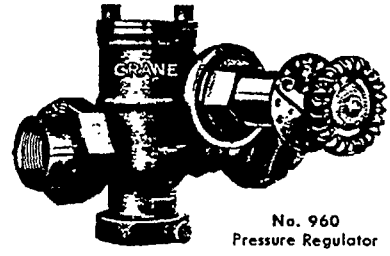
Bronze Pressure Regulators



Maximum Inlet Pressures
250 psi steam, 450 F 250 psi air

Weights and Dimensions

Size Inches	No. 960 Pounds Each	Dimensions, Inches A	B	C	D
½	10	7	5⅛	3⅜	6
¾	12	8¼	5¾	3⅝	6¼
1	16	9⅛	6⅜	4	7¼
1¼	21	9⅝	7	4½	7½
1½	26	10¾	8	5	7½
2	34	12	9⅛	5⅝	7½



No. 960
Pressure Regulator

For description, operation, and recommended installation, see the preceding page. For steam and air capacities, see the next two pages.

Prices on Request

Recommendations: Crane Bronze Pressure Regulators have been specifically designed to provide accurate, automatic pressure regulation on steam and air. They are particularly suitable for use in modern process work, on vulcanizers, cookers, dryers, paper machines, heating systems, air tools, air blasts, and many other services. They may be used to reduce pressure to engines and pumps if ample receiver capacity to eliminate pulsations is provided between the engine or pump and the regulator.

The No. 960 should not be used where the outlet pressure desired is more than 80% of the inlet pressure..

Materials: Quality materials are used throughout The valve body, piston, piston cylinder, and piston chamber cap are Crane Special Bronze (ASTM B 61). The discs in the main and auxiliary valves are Crane Exelloy. The valve seat is Crane No. 49 Nickel Alloy. The regulators have malleable iron union rings and tailpieces on the inlet and outlet ends.

Fundamental characteristics: These regulators should not be confused with ordinary reducing valves. They will not allow the outlet pressure to build up to the inlet pressure when no steam or air is being used in the outlet piping. Reasonable fluctuations of the inlet pressure do not affect the outlet pressure.

The regulators feature a wide range of available reduced pressures, simplicity of operation, and easy accessibility for inspection and repairs.

Locking: Each regulator is equipped with a locking device to permit protection of the pressure setting against tampering. Locks are not furnished.

Outlet pressure ranges: Regulators are fitted with regulating springs and diaphragms to suit any one of the following ranges of outlet pressures:

1 to 10 psi 5 to 30 psi 20 to 100 psi 90 to 200 psi

How to order: Specify the size of the regulator (or capacity desired; see pages 248 and 249) and the outlet pressure. Regulators suitable for steam will be furnished unless "air service" is specified.

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Operating Characteristics of Crane Pressure Regulators

A pressure regulator should be chosen on the basis of its capacity to provide the rate of flow required in the outlet piping. The nearer correct it is to the proper size, the more trouble-free it will be and the longer it will last. A regulator that is too large is not only subject to extreme throttling and undue wear but may also supply steam or air in surges, causing pulsations. A regulator that is too small, particularly on low pressures, will dance and chatter.

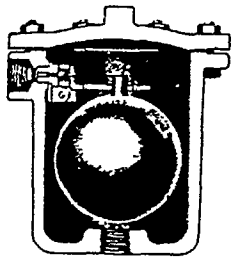
Best results are obtained when the regulator is selected to supply flow rates that are approximately 50 per cent of the maximum obtainable through the regulator. This condition keeps the disc unseated—keeps it properly throttling the flow by holding the disc in a "floating" position—while at the same time permitting variations in flow demand in either direction. In addition, the damaging effects of wiredrawing and the danger of having small particles of foreign matter adhere to the seating surfaces and cause an increase in the outlet pressure, are substantially reduced.

Theoretically, if the flow demand remained fixed at all times, it would be possible to select a regulator (an orifice would give the same results) that would deliver the required amount of steam or air at exactly the desired outlet pressure. Actually, however, such ideal conditions seldom exist, because the flow demand in outlet piping varies with many factors, such as shut-off intervals, number of pieces of equipment in operation, warming-up periods, etc. Under practical operating conditions, therefore, when a regulator is set for one condition of flow demand and this condition changes, the regulator will strive automatically to compensate for the change, but in so doing will produce some variation in the outlet pressure. An increase in demand will cause a decrease in the outlet pressure, up to the point where the regulator is delivering its fullest possible capacity; in other words, is providing no regulation at all, if the demand is great enough. A decrease in demand will cause an increase in the outlet pressure, up to the point of the actual outlet or dead-end pressure setting on the regulator, if the demand ceases entirely.

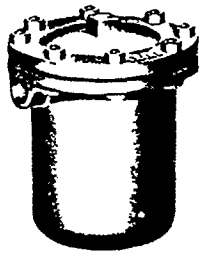
Important: Select the regulator on the basis of its capacity. See pages 248 and 249 for capacity tables. Orders should always specify the desired outlet pressure. The regulator is then equipped with the proper springs and diaphragm as indicated under "outlet pressure ranges above; the regulating wheel permits adjustment throughout the range.

004042

Air Vent or Water Drain Valves
Ball Float Type



Cross Section



No. 976 or No. 977
Air Vent or
Water Drain Valve

22

Range of Working Pressures

As Air Vent Valve
1 to 30 psi or 10 to 150 psi
(maximum pressure is marked on cap)

As Water Drain Valve
1 to 30 psi or 10 to 125 psi

Recommendations: These simple, efficient, and economical devices automatically remove air from water piping, oil piping and pressure vessels, or water or oil from compressed air systems.

The valves should not be used on steam lines. For rapid drainage of condensate from steam lines, use Crane Inverted Open Float Steam Traps described on pages 250 and 251.

Air vent valve: To remove air from water or oil-laden systems, the valve should be installed at the highest point in the system where air will collect. Normally the valve is filled with water or oil; as the air accumulates, it displaces the liquid in the body causing the float to drop and the valve to open. As the air is discharged and the water or oil re-enters the body, the float rises and closes the valve to prevent escape of the liquid.

Water drain valve: To remove water or oil from air-laden systems, the valve must be installed in an inverted position (with cap down) at the lowest point in the system. The cycle of operation is the reverse of that described in the paragraph above. It is recommended that a Y-pattern sediment separator be installed in the line leading to the drain valve (see typical installation on page 253); for description of sediment separators, see page 254.

Materials: The valves are ruggedly constructed. Their body and cap are made of cast iron conforming to ASTM A 126, Class A; the body-cap joint is fitted with a Cranite gasket and is bolted. The ball-type disc, made of 16 to 18 per cent chromium steel, is guided to an Exelloy seat. The ball float is copper.

Capacity and pressure range: Each valve is furnished with one of two sizes of seat orifices. The size of the orifice determines both the discharge capacity at various effective seat pressures and the pressure range of the valve, as indicated in the adjacent table.

Selecting the proper valve: Select a valve on the basis of its capacity. To assure intermittent discharge, allow an ample factor of safety (at least 2 to 1) between the maximum capacity required for the system and the continuous discharge capacity of the valve.

Ordering: Orders must specify the catalog number, the maximum operating pressure, and either the orifice size or seat number.

Installation suggestions: For installation suggestions, see piping layout and explanation on page 253

Prices: Prices are furnished on request

Weights, Dimensions, and Continuous Discharge Capacities (70 F)

Catalog No.	No. 976		No. 977	
Pipe Size In.	½		¾	
Height In.	6⅜		7⅜	
Diameter In.	5⅝		7½	
Pounds Each	9.0		25 0	
Orifice Size In.	5/32	5/64	3/16	3/32
Seat Number	11A	14A	23A	26A
*Effective Seat Pressure Pounds per Square Inch	Capacities as Air Vent Valve Cubic Feet of Free Air per Minute			
1	2.3	...	3.3	...
2 to 4	3.2	...	4.6	...
5 to 9	5.0	...	7.2	...
10 to 14	7.0	1.8	10.0	2.6
15 to 19	8.7	2.2	12.3	3.1
20 to 24	10.0	2.5	14.4	3.7
25 to 29	11.6	2.9	16.5	4.2
30	13.0	3.3	18.6	4.7
31 to 39	...	3.3	...	4.7
40 to 49	...	4.0	...	5.8
50 to 74	...	4.7	...	6.8
75 to 99	...	6.6	...	9.4
100 to 124	...	8.4	...	12.0
125 to 149	...	10.2	...	14.7
150	...	12.0	...	17.3
*Effective Seat Pressure Pounds per Square Inch	Capacities as Water Drain Valve Pounds Water per Hour (Inverted Position)			
1	270	...	385	...
2 to 4	370	...	535	...
5 to 9	575	...	830	...
10 to 14	785	195	1130	280
15 to 19	955	240	1380	345
20 to 24	1090	275	1575	390
25 to 29	1225	305	1765	440
30	1320	330	1905	475
31 to 39	...	330	...	475
40 to 49	...	380	...	545
50 to 74	...	420	...	605
75 to 99	...	510	...	710
100 to 124	...	575	...	825
125	...	650	...	930

*Effective seat pressure is the net difference between the valve inlet and outlet pressure

Suggested installation . page 253

No. 960 Pressure Regulators — Steam and Air Capacities

Size of regulator	Inlet Pressure Psi	Rate of Flow of Saturated Steam In Pounds per Hour — Pounds Change in Outlet Pressure To Obtain Rate of Flow											Maximum No regulation	Rate of Flow of Free Air In Cubic Feet per Minute, at 70 F — Pounds Change in Outlet Pressure To Obtain Rate of Flow										Maximum No regulation
		1	2	3	4	5	8	10	12	15	20	25		1	2	3	4	5	8	10	12	15	20	25	
½ inch	30	27	50	70	90	110	150	..	..	..	..	..	187	10	18	25	32	39	53	..	..	..	..	..	66
	40	29	55	80	100	125	175	..	..	..	..	..	228	10	19	28	35	44	62	..	..	..	..	..	81
	50	31	58	85	110	135	200	225	..	..	..	..	270	11	20	30	39	48	71	..	..	..	..	..	96
	60	33	60	88	113	138	205	230	270	..	..	..	311	12	21	31	40	49	72	81	92	..	..	..	110
	70	35	62	91	116	141	210	240	280	..	..	..	353	12	22	32	41	50	74	85	99	..	..	..	125
	80	37	64	94	119	144	215	250	290	320	..	..	394	13	23	33	42	51	76	89	103	114	..	..	140
	90	39	68	97	122	147	220	260	300	340	..	..	436	14	24	34	43	52	78	92	107	121	..	..	155
	100	41	70	100	125	150	225	270	310	360	410	..	478	15	26	35	44	53	80	96	111	128	146	..	170
	125	43	76	108	135	165	245	295	340	390	450	..	580	16	27	38	48	58	87	105	121	138	160	..	206
	150	45	82	117	150	185	270	325	375	425	490	520	685	16	29	41	53	65	96	115	133	151	174	184	244
	175	47	88	126	160	200	295	355	405	460	535	565	790	17	34	45	57	71	105	126	144	163	190	200	280
	200	49	95	135	175	215	320	385	435	495	580	610	895	18	37	48	62	76	114	137	154	176	206	216	318
	250	55	110	165	215	270	410	485	540	605	685	710	1060	20	39	59	76	96	146	172	192	215	243	252	376
¾ inch	30	48	89	124	160	195	265	..	..	..	..	..	330	18	32	44	57	69	94	..	..	..	..	..	117
	40	51	97	142	175	220	310	..	..	..	..	..	405	18	34	50	62	78	110	..	..	..	..	..	143
	50	55	103	150	195	240	355	400	..	..	..	..	480	19	35	53	69	85	126	..	..	..	..	..	170
	60	58	106	155	200	245	365	405	480	..	..	..	550	21	37	55	71	87	127	143	163	..	..	..	195
	70	62	110	160	205	250	370	425	495	..	..	..	625	21	39	57	73	88	131	150	175	..	..	..	221
	80	65	113	165	210	255	380	440	515	565	..	..	695	23	41	58	74	90	135	158	182	202	..	..	248
	90	69	120	170	215	260	390	460	530	600	..	..	770	25	42	60	76	92	138	163	189	214	..	..	274
	100	73	124	175	220	265	400	480	550	635	725	..	845	27	46	62	78	94	142	170	196	227	258	..	300
	125	76	135	190	240	290	435	520	600	690	795	..	1025	28	48	67	85	103	154	186	214	244	283	..	365
	150	80	145	205	265	325	480	575	665	750	865	920	1210	28	51	73	94	115	170	204	235	267	308	326	432
	175	83	155	225	285	355	520	630	715	815	945	1000	1400	30	60	80	101	126	186	225	255	289	336	354	495
	200	87	170	240	310	380	565	680	770	875	1025	1080	1585	32	65	85	110	135	202	242	273	312	365	382	565
	250	97	195	290	380	480	725	860	955	1070	1210	1255	1875	35	69	104	135	170	258	304	340	380	430	446	665
1 inch	30	84	155	215	280	340	465	..	..	..	..	..	580	31	56	77	99	121	164	..	..	..	..	..	205
	40	90	170	250	310	390	540	..	..	..	..	..	705	31	59	87	109	136	192	..	..	..	..	..	251
	50	96	180	265	340	420	620	700	..	..	..	..	835	34	62	93	121	149	220	..	..	..	..	..	298
	60	102	185	275	350	430	635	715	835	..	..	..	965	37	65	96	124	152	223	251	285	..	..	..	341
	70	108	190	280	360	435	650	745	870	..	..	..	1095	37	68	99	127	155	229	264	307	..	..	..	388
	80	115	200	290	370	445	665	775	900	990	..	..	1220	40	71	102	130	158	236	276	319	353	..	..	434
	90	121	210	300	380	455	680	805	930	1055	..	..	1350	43	74	105	133	161	242	285	332	375	..	..	480
	100	127	215	310	390	465	700	835	960	1115	1270	..	1480	47	81	109	136	164	248	298	344	397	453	..	525
	125	133	235	335	420	510	760	915	1055	1210	1395	..	1800	50	84	118	149	180	270	326	375	428	496	..	640
	150	140	255	365	465	575	835	1010	1165	1320	1520	1610	2125	50	90	127	164	202	298	356	412	468	540	570	755
	175	146	275	390	495	620	915	1100	1255	1425	1660	1750	2450	53	105	140	177	220	326	390	446	505	590	620	870
	200	152	295	420	540	665	990	1195	1350	1535	1800	1890	2775	56	115	149	192	236	353	425	477	545	640	670	985
	250	170	340	510	665	835	1270	1505	1675	1875	2125	2200	3285	62	121	183	236	298	453	533	595	665	755	780	1165
1¼ inch	30	145	270	380	490	595	815	..	..	..	..	..	1015	54	98	136	174	212	288	..	..	..	..	..	358
	40	155	300	435	545	680	950	..	..	..	..	..	1240	54	103	152	190	239	337	..	..	..	..	..	440
	50	170	315	460	595	735	1085	1220	..	..	..	..	1465	60	109	163	212	261	386	..	..	..	..	..	520
	60	180	325	480	615	750	1115	1250	1465	..	..	..	1690	65	114	168	217	266	391	440	500	..	..	..	595
	70	190	335	495	630	765	1140	1305	1520	..	..	..	1915	65	119	174	223	272	402	462	540	..	..	..	680
	80	200	350	510	645	780	1165	1360	1575	1740	..	..	2140	71	125	179	228	277	413	483	560	620	..	..	760
	90	210	370	525	660	800	1195	1410	1630	1845	..	..	2365	76	130	185	233	282	424	500	580	655	..	..	840
	100	225	380	545	680	815	1220	1465	1685	1955	2225	..	2595	81	141	190	239	288	434	520	605	695	795	..	925
	125	235	415	585	735	895	1330	1600	1845	2120	2445	..	3150	87	147	206	261	315	472	570	655	750	870	..	1120
	150	245	445	635	815	1005	1465	1765	2035	2310	2660	2825	3720	87	157	223	288	353	520	625	720	820	945	1000	1325
	175	255	480	685	870	1085	1600	1930	2200	2500	2905	3070	4290	92	185	244	310	386	570	685	780	885	1030	1085	1520
	200	265	515	735	950	1165	1740	2090	2360	2690	3150	3310	4860	98	201	261	337	413	620	745	835	955	1120	1175	1725
	250	300	595	895	1165	1465	2225	2635	2930	3285	3720	3855	5755	109	212	320	413	520	795	935	1045	1165	1320	1370	2040
1½ inch	30	190	350	490	630	770	1050	..	..	..	..	..	1310	70	126	175	224	273	371	..	..	..	..	..	462
	40	205	385	560	700	875	1225	..	..	..	..	..	1595	70	133	196	245	308	434	..	..	..	..	..	565
	50	215	405	595	770	945	1400	1575	..	..	..	..	1890	77	140	210	273	336	497	..	..	..	..	..	670
	60	230	420	615	790	965	1435	1610	1890	..	..	..	2175	84	147	217	280	343	505	565	645	..	..	..	770
	70	245	435	635	810	985	1470	1680	1960	..	..	..	2470	84	154	224	287	350	520	595	695	..	..	..	875
	80	260	450	660	835	1010	1505	1750	2030	2240	..	..	2760	91	161	231	294	357	530	625	720	800	..	..	980
	90	275	475	680	855	1030	1540	1820	2100	2380	..	..	3050	98	168	238	301	364	545	645	750	845	..	..	1085
	100	285	490	700	875	1050	1575	1890	2170	2520	2870	..	3345	105	182	245	308	373	560	670	775	895	1020	..	1190
	125	300	530	755	945	1155	1715	2065	2380	2730	3150	..	4060	112	189	266	336	406	610	735	845	965	1120	..	1440
	150	315	575	820	1050	1295	1890	2275	2625	2975	3430	3640	4795	112	203	287	371	455	670	805	930	1055	1220	1290	1710
	175	330	615	880	1120	1400	2065	2485	2835	3220	3745	3955	5530	119	238	315	399	497	735	880	1010	1140	1330	1400	1960
	200	345	665	945	1225	1505	2240	2695	3045	3465	4060	4270	6265	126	259	336	435	530	800	960	1080	1230	1440	1510	2225
	250	385	770	1155	1505	1890	2870	3395	3780	4235	4795	4970	7420	140	273	413	530	670	1020	1205	1345	1505	1700	1765	2630
2 inch	30	215	400	560	720	880	1200	..	..	..	..	..	1495	80	144	200	256	312	424	..	..	..	..	..	530
	40	230	440	640	800	1000	1400	..	..	..	..	..	1825	80	152	224	280	352	496	..	..	..	..	..	650
	50	250	465	680	880	1080	1600	1800	..	..	..	..	2160	88	160	240	312	384	570	..	..	..	..	..	770
	60	265	480	705	905	1105	1640	1840	2160	..	..	..	2490	96	168	248	320	392	575	650	735	..	..	..	880
	70	280	495	730	930	1130	1680	1920	2240	..	..	..	2825	96	176	256	328	400	590	680	790	..	..	..	1000
	80	295	510	750	950	1150	1720	2000	2320	2560	..	..	3150	104	184	264	336	408	610	710	825	910	..	..	1120
	90	310	545	775	975	1175	1760	2080	2400	2720	..	..	3490	112	192	272	344	416	625	735	855	965	..	..	1240
	100	330	560	800	1000	1200	1800	2160	2480	2880	3280	..	3825	120	208	280	352	424	640	770	890	1025	1170	..	1360
	125	345	610	865	1080	1320	1960	2360	2720	3120	3600	..	4640	128	216	304	384	464	695	840	970	1105	1280	..	1650
	150	360	655	935	1200	1480	2160	2600	3000	3400	3920	4160	5480	128	232	328	424	520	770	920	1065	1210	1390	1470	1950
	175	375	705	1010	1280	1600	2360	2840	3240	3680	4280	4520	6320	136	272	360	456	570	840	1010	1150	1305	1520	1600	2240
	200	390	760	1080	1400	1720	2560	3080	3480	3960	4640	4880	7160	144	296	384	496	610	910	1095	1230	1410	1650	1730	2545
	250	440	880	1320	1720	2160	3280	3880	4320	4840	5480	5680	8480	160	312	472	610	770	1170	1375	1535	1720	1945	2015	3010

Description and operating characteristics, pages 246 and 247

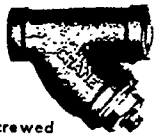
Interpolate for rates of flow at intermediate pressures

Explanation of table, page 248

22

Y-Pattern Sediment Separators

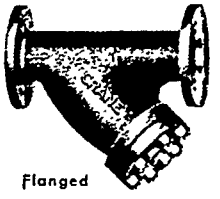
Iron Body



Screwed

No. 988½, 125-Pound
No. 990½, 250-Pound

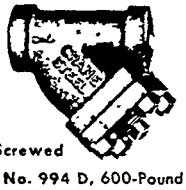
Iron separators have a screwed cap on sizes 1½-inch and smaller as shown; larger sizes have a bolted cap (see section at right).



Flanged

No. 989½, 125-Pound
No. 991½, 250-Pound

Cast Steel



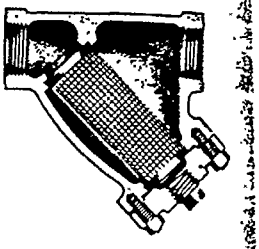
Screwed

No. 994 D, 600-Pound

Working Pressures

Separator		Saturated Steam	Cold Water, Oil, or Gas
Iron	125-Pound	125 psi	200 psi
	250-Pound	250 psi	500 psi
Steel	Rated for 600 psi steam, 900 F Other ratings same as 600-Pound Steel Screwed Gate Valves; see page 118.		

Crane Y-Pattern Sediment Separators protect equipment against damage from dirt, grit, scale, and all foreign matter in steam, water, air, oil, and gas lines. The No. 944 D is used where severe services require the strength and durability of steel.



Typical Cross Section (Iron Body, Bolted Cap)

Features: Simple design, rugged construction, and large screening area make the separators exceptionally efficient. Internal parts are readily accessible. The separators not only prevent passage of foreign matter, but also furnish a pocket for its accumulation, from which the matter can be easily removed through the blow-off connection. The connection is fitted with a plug.

Materials: Iron body separators are furnished with a screwed bronze cap on sizes 1½-inch and smaller and a bolted iron cap on larger sizes.

Cast steel separators have a body and bolted cap made of carbon steel (ASTM A 216, Grade WCB). The joint between the body and cap, of the male and female type, is equipped with a metallic gasket; Triplex Steel studs are used.

Screens: The strainer element is a Monel mesh screen rolled into the shape of a cylinder. The ends are reinforced. One end fits into a recess in the diagonal wall of the body and the other is retained by the cap. The screen is secure; it will not loosen in service.

The mesh type of screen is furnished for greater efficiency and increased screening area. The screening area in Crane Separators, much greater than the area of the pipe (more than 500 per cent on the 20 mesh screen), assures free fluid flow with minimum pressure loss.

If not otherwise specified, separators are furnished with a 20 mesh Monel screen (400 holes per square inch) suitable for steam, water, and medium or heavy oils.

When specified, separators will be furnished with a 40 mesh Monel screen (1600 holes per square inch) suitable for steam, air, gas, gasoline, light oils, and Grades 1, 2, and 3 fuel oils. To strain dirt from air or gases, a 40 mesh Monel screen packed with Everdur wool is recommended.

Finer mesh screens, perforated screens, or screens made of steel or 18-8 Chromium-Nickel Alloy can be furnished when orders so specify.

Flange dimensions and drilling: Inlet and outlet flanges on No. 989½ Separators conform to American Cast Iron Flange Standard, Class 125 (B16.1-1948); on the No. 991½, the flanges conform to American Cast Iron Flange Standard, Class 250 (B16b-1944).

Flanged sediment separators include facing and drilling (F & D) to the Standard applying. They can be furnished faced only, when specified.

Weights and Dimensions — Prices on Request

Catalog Number and Type	Size, Inches	Weights, Pounds Each	Dimensions, Inches: End to end or face to face	Dimensions, Inches: Center to extreme bottom	Dimensions, Inches: Size of blow-off
No. 988½ 125-Pound Screwed	¼	1	3¼	2¼	⅜
	⅜	1	3¼	2¼	⅜
	½	2	3¾	2¾	⅜
	¾	3	4¼	3	½
	1	5	5	3¾	¾
	1¼	7	6	4½	¾
	1½	10	7	5¼	1
	2	22	8½	8	1
	2½	33	10	9¼	1¼
	3	46	11½	10½	1¼
No. 990½ 250-Pound Screwed	½	2	3¾	2¾	⅜
	¾	4	4¼	3	½
	1	6	5	3¾	¾
	1¼	9	6	4½	¾
	1½	13	7	5¼	1
	2	27	8½	8	1
No. 989½ 125-Pound Flanged F & D	2	35	10¾	8	1
	2½	46	11⅞	9¼	1¼
	3	64	13¼	10½	1¼
	4	120	16¼	13	1¼
	5	165	18	15	1½
	6	220	20½	16½	1½
	8	360	25	20	2
	10	615	31	24½	2
	12	1125	34½	28	2
No. 991½ 250-Pound Flanged F & D	2	40	11¼	8	1
	2½	60	12½	9¼	1¼
	3	85	14	10½	1¼
	4	140	17	13	1¼
	5	215	19	15½	1½
	6	285	21½	17	1½
	8	490	26	20½	2
	10	830	33	25	2
	12	1200	36	28	2
No. 994 D 600-Pound Screwed	½	5	3¾	3⅝	½
	¾	7	4¼	4	½
	1	10	5	4½	¾
	1¼	15	6	5½	¾

Templates for drilling....pages 327 and 328

Inverted Open Float Steam Traps

Capacity: Pipe size is not a factor in determining capacity. Capacity is determined by trap design and construction, size of seat orifice, and effective seat pressure. The only force available to open the disc against effective seat pressure in the trap is the weight of the float multiplied by the lever arm attached to the disc, and this is a fixed quantity for any one trap. As effective seat pressure is increased, orifice area must be decreased. If the area is too large, the trap will fail to function; if the area is too small, the trap will function properly but at reduced capacity. Crane traps should be selected on the basis of their ability to discharge the maximum rate of condensation expected in the system.

Effective seat pressure: Effective seat pressure, also known as "differential pressure", is calculated by subtracting outlet pressure from inlet pressure. When discharging into a vacuum, the effective seat pressure is the inlet pressure plus 1 pound for each 2 inches of vacuum. Where inlet and outlet pressures vary, use the minimum effective seat pressure to determine the size of orifice for required capacity, and use the maximum effective seat pressure to determine the maximum pressure of the trap.

Safety factor: To assure intermittent discharge and reserve capacity in event of errors in estimating condensate load, a factor of safety (at least 2 to 1) should be allowed between actual continuous discharge capacity of the trap and the condensation rate of the system. In fact, selecting a trap with three or four times more capacity than expected is often considered good practice. Where heavy condensate loads must be discharged in a short time, as during warm-up periods, selection should be based on the period in minutes required to evacuate the condensate.

Ordering: Each trap is available with one of several sizes of seat orifices. Since capacity and maximum pressure at which each trap can be used depend upon the orifice size, selections should be made with care. The maximum pressure at which each trap will operate is stamped on the trap cover. Traps will operate at the lower pressures for which capacities are given but not at pressures higher than the maximum.

When ordering, specify the trap catalog number and maximum pressure. If the latter is not included, specify the orifice size or seat number; see table on preceding page. Capacities are listed below.

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Continuous Discharge Capacities in Pounds of Water per Hour

Effective Seat Pressure		No. 9810						No. 9812						No. 9814						No. 9820	
		Orifice Size, Inches																			
		.059	1/16	5/64	3/32	1/8	5/32	3/32	1/8	5/32	3/16	1/4	5/16	7/32	1/4	5/16	3/8	1/2	5/8	3/32	1/8
	Pounds per Square Inch	Maximum Pressure—Pressure Marking on Trap																			
		250	125	75	50	30	15	200	150	100	50	30	15	200	150	100	50	30	15	300	250
2	3 & 4					240	370					955	1490					3815	5970		
5	6 to 9			145	205	370	575			575	830	1475	2300			2300	3315	5890	9205		
10	11 to 14	110	125	195	280	500	785		500	785	1130	2015	3145	1540	2015	3145	4530	8050	12580		
15		135	155	240	345	615	955	345	615	955	1380	2455	3835	1880	2455	3835	5520	9815	15340		
	16 to 19	135	155	240	345	615		345	615	955	1380	2455		1880	2455	3835	5520	9815			
20	21 to 24	155	175	275	390	700		390	700	1090	1575	2800		2140	2800	4370	6295	11190			
25	26 to 29	175	195	305	440	785		440	785	1225	1765	3140		2405	3140	4895	7060	12540			785
30		185	210	330	475	850		475	850	1320	1905	3385		2595	3385	5290	7620	13350			850
	31 to 39	185	210	330	475			475	850	1320	1905			2595	3385	5290	7620				850
40	41 to 49	215	245	380	545			545	970	1550	2180			2970	3880	6060	8725			545	970
50		240	270	420	605			605	1075	1690	2430			3310	4320	6735	9710			605	1075
	51 to 59	240	270	420				605	1075	1690				3310	4320	6735				605	1075
60	61 to 74	260	295	460				660	1175	1840				3610	4715	7365				660	1175
75		285	325	510				710	1295	2030				3975	5190	8095				710	1295
	76 to 89	285	325					710	1295	2030				3975	5190	8095				710	1295
90	91 to 99	310	355					795	1410	2205				4320	5645	8820				795	1410
100		325	370					825	1470	2300				4505	5880	9170				825	1470
	101 to 124	325	370					825	1470					4505	5880					825	1470
125		365	415					930	1655					5075	6625					930	1655
	126 to 149	365						930	1655					5075	6625					930	1655
150		390						1000	1770					5435	7100					1000	1770
	151 to 174							1000						5435						1000	1770
175	176 to 199							1105						6005						1105	1955
200								1170						6365						1170	2075
	201 to 224																			1170	2075
225	226 to 249																			1270	2270
250																				1310	2325
	251 to 274																			1310	
275	276 to 299																			1345	
300																				1375	

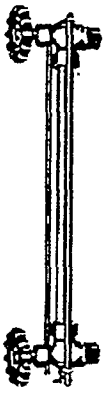
Figures enclosed by heavy black lines show most advantageous capacities for each orifice. For example, assume a trap is needed on a 15 pound line to discharge (including safety factor) 250 pounds of water per hour against 5 psi outlet pressure (10 psi effective seat pressure)....the No. 9810 would fulfill this need with orifices and capacities, as follows 3/32-inch, 280 pounds, 1/16-inch, 500 pounds, or 5/32-inch, 785 pounds. The latter figure (enclosed within heavy black lines) would be the best choice from the standpoint of intermittent discharge, liberal safety factor, etc.

Suggestions for Installation; see page 253.

Bronze Water Gauges

004046

100-Pound



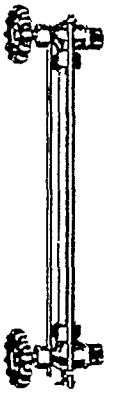
No. 627
Rough



No. 628
Rough

Nos. 627 and 628 are ½-inch gauges for pressures up to 100 psi. Regularly furnished with standard centers of 14 inches and 8 inches respectively.

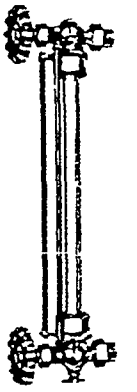
175-Pound



No. 630
Polished

½ and ¾-inch sizes for pressures up to 175 psi. Regularly furnished with standard centers of 14 inches and 18 inches respectively.

250-Pound



No. 631
Polished

½-inch size only; suitable for pressures up to 250 psi and regularly furnished with standard centers of 14 inches.

These newly designed bronze water gauges are sturdily constructed to assure long, dependable service. Quality materials are used throughout. The 100-pound gauges are furnished rough; the 175 and 250-pound gauges are furnished polished.

Materials: Except for the valve wheels, packing, and glass, all parts are made of bronze, with the valve bodies being made of bronze conforming to requirements of ASTM Specification B 62.

The No. 628 has a Style L molded composition valve wheel; the other gauges have Style F non-heat, round pattern metal wheels. Valve wheels are described on pages 278 and 279.

All gauges are equipped with high pressure glass tubing ⅝-inch in diameter and, at the bottom of the lower valve, a ⅛-inch drain cock.

Standard centers: Unless otherwise ordered, the gauges are furnished with the standard centers (center to center of valves) indicated in the table below. On special order, they can be furnished with shorter centers or with longer centers (up to 36 inches).

Centers over 36 inches: When water gauges with centers greater than 36 inches are required, two gauges of shorter lengths, staggered on the boiler, tank, or vessel are recommended.

Ordering: When ordering, be sure to specify the quantity, pipe size, and catalog number. Also, specify any center other than standard.

Other gauges: In addition to bronze water gauges, the Crane line includes the all-iron liquid gauge shown on the facing page and the corrosion-resistant liquid level gauge shown on page 198.

Weights, Dimensions, and General Data — Prices on Request

Finish	Pressure Class	Catalog No.	Pipe Size, Inches	Weight, Pounds Each	Standard Centers, *Furnished If Not Otherwise Specified	Dimensions, in Inches (Glass and guard rod lengths apply only to gauges with standard centers) O. D and length of glass	O. D and length of guard rods	Valve center to wheel, open	Valve center to male end	Size of drain cock
Rough	100-Pound	No. 627	½	2.0	14-inch	⅝ x 13	3/16 x 16	2⅜	1⅜	⅛
		No. 628	½	1.7	8-inch	⅝ x 7	3/16 x 10	2⅜	1⅜	⅛
Polished	175-Pound	No. 630	½	2.5	14-inch	⅝ x 13	3/16 x 16	2⅜	1⅜	⅛
			¾	3.5	18-inch	⅝ x 16¾	3/16 x 20	2⅜	1½	⅛
Polished	250-Pound	No. 631	½	3.0	14-inch	⅝ x 13	3/16 x 14	3	1¾	⅛

*Centers shorter or longer than standard can be furnished when specified, refer to "standard centers" in description above.

Corrosion-Resistant Liquid Level Gauge....page 198

All-Iron Liquid Gauge....page 257

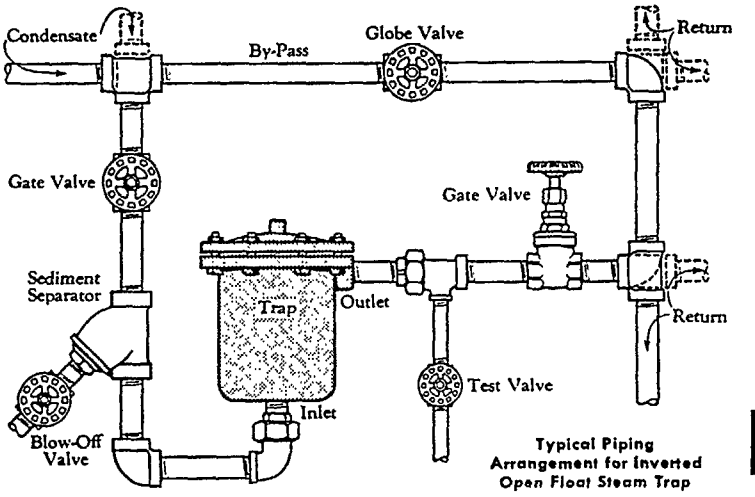
CRTX 1095

Installation of Steam Traps, Air Vent Valves, and Water Drain Valves

Use Crane Plug Type Disc Globe or Angle Valves for all throttling services.

Crane Inverted Open Float Steam Traps, Air Vent Valves, and Water Drain Valves can only be used for discharging to regions where the pressure is less than that in the trap or valve. They can be used to discharge into a back pressure or vacuum, but the pressure rating of the trap or valve must be greater than, (a) the difference between the back pressure and the inlet pressure, or (b) the sum of the vacuum and the inlet pressure. For complete description, capacities, etc., see pages 250 to 252.

Each trap and valve is thoroughly and carefully tested before shipment. Properly selected and installed, they will give many years of satisfactory, efficient service. The illustrations on this page show a preferred, typical piping arrangement for each. The piping is designed so that the trap or valve is accessible for the periodic inspection and cleaning usually required of any automatic device.

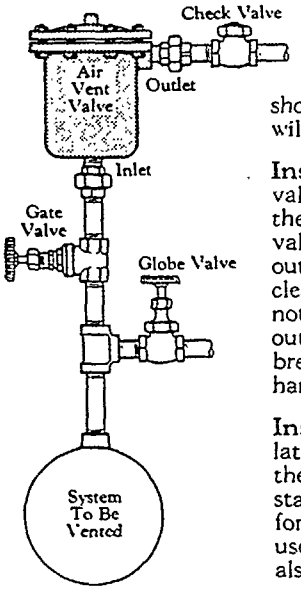


Typical Piping Arrangement for Inverted Open Float Steam Trap

22

Installation of steam traps: Wherever possible, install the trap below the lowest point in the system, with the line leading to the trap pitched downward to assure good drainage. Use a sediment separator just ahead of the trap to prevent scale, sediment, and other foreign matter from entering the trap and interfering with proper operation; a valve on the separator will make it possible to periodically blow-out accumulated foreign matter. The gate valves in the inlet and outlet lines, when shut, permit isolating the trap for inspection and cleaning. If only the gate valve in the outlet line is closed, the test valve can be opened to observe the operation of the trap; if the trap is functioning properly, there will be no flow of water between periods of discharge, nor any flow of steam. A by-pass line with a globe valve makes it possible to rid the system of condensate by hand throttling while the trap is out of service. A check valve (not illustrated) should be used in the outlet or return line where two or more traps are discharging into a common line; should one trap be shut down, the check valve will prevent back-flow from the remaining units.

Blow new lines clear of all foreign matter before installing traps, air vent valves, or water drain valves.

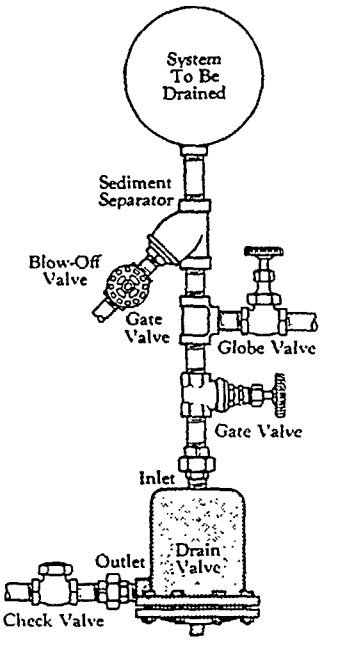


Typical Piping Arrangement for Air Vent Valve

Installation of air vent valves: Install the valve at the highest point in the system, pitching the inlet line upward to the vent valve. A gate valve in the inlet line and the check valve in the outlet make it possible to isolate the valve for cleaning and inspection. The check valve will not allow air to pass back into the system; without it, the air vent valve will also act as a vacuum breaker. The globe valve permits venting by hand throttling when the gate valve is shut.

Installation of water drain valves: The installation for the water drain valve is similar to that of the air vent valve, except it is inverted and is installed at the lowest point in the system. Since foreign matter tends to collect at low points, the use of a sediment separator with blow-off valve also is recommended.

Do not install an air vent or water drain valve where it can freeze.



Typical Piping Arrangement for Water Drain Valve

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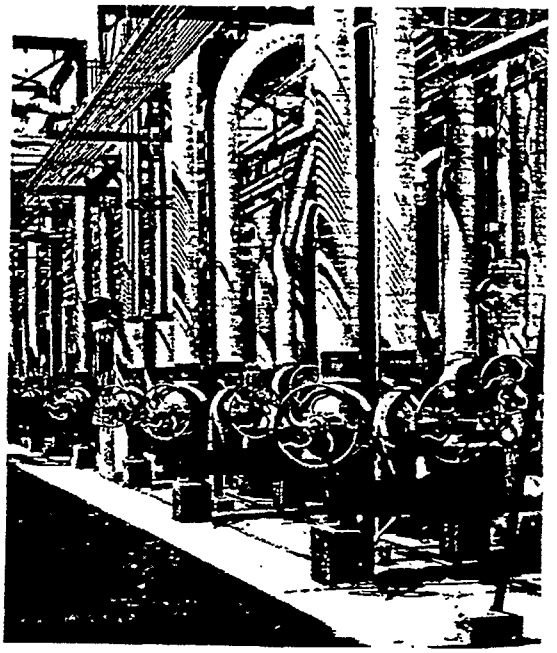
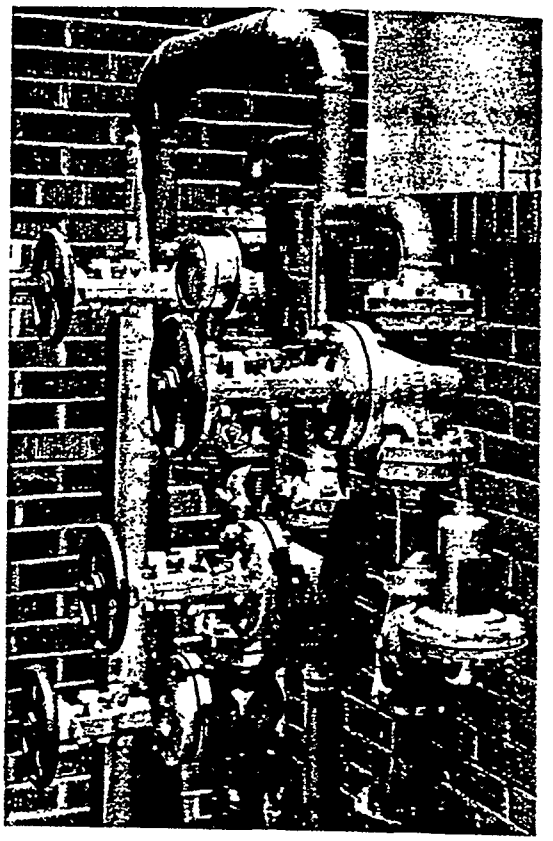
Dependable performance . . . .

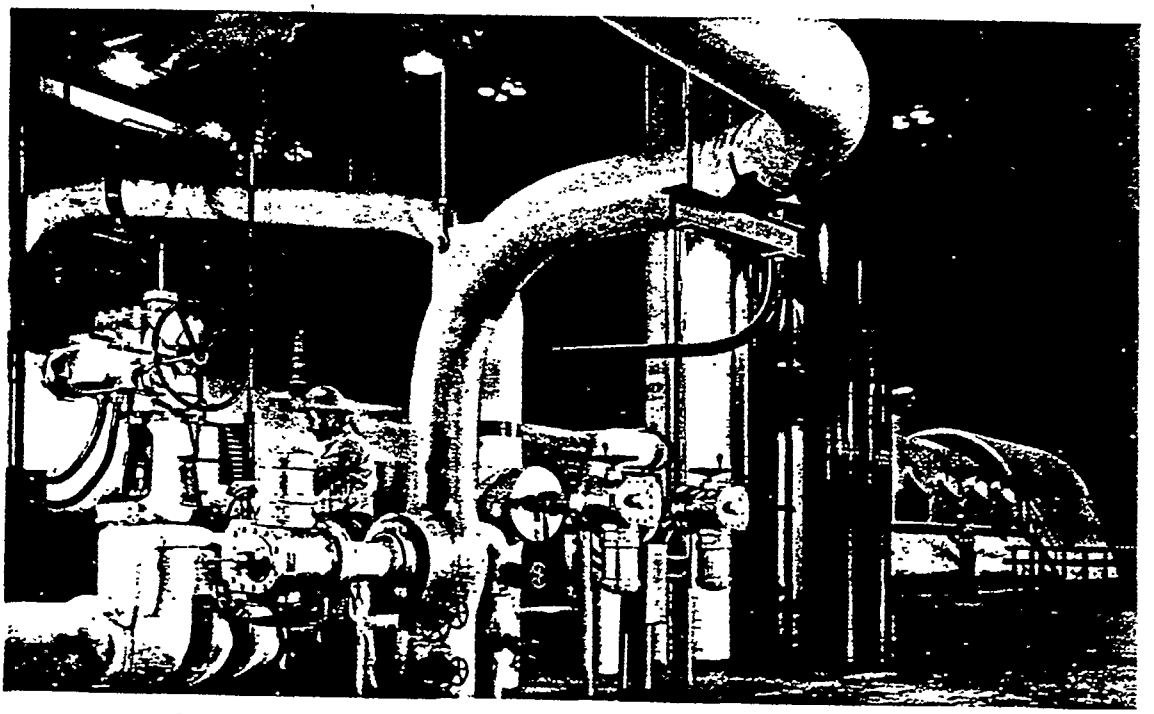
with every Crane product



A butane plant utilizes Crane valves on a boiler feedwater installation.



An air compressor tank equipped with Crane steel gate valves (Section 12).



Central station plants frequently standardize on Crane . . . . for maintenance-free dependability.

Crane-Swartwout Cast Iron Exhaust Heads

Durable, non-corrosive exhaust heads for thorough, removal of water and oil from exhaust steam lines

Water and oil entrained in exhaust steam frequently necessitate costly maintenance on roofs and side walls of buildings. When discharged directly from the pipe to the atmosphere, the water and oil tend to rot roofs and walls during warm weather . . . and form unsightly accumulations of ice and grime during cold weather.

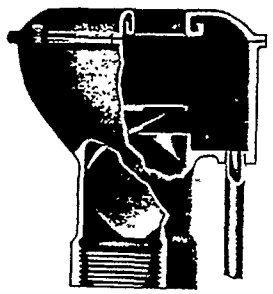
Features: Rugged, non-corrosive Crane-Swartwout Exhaust Heads effectively remove practically all moisture and oil from exhaust steam; only clean, dry steam is discharged to the atmosphere. The exhaust heads neither interrupt nor slow down the flow of steam. There are no plates, grids, screens, or other parts to cause flow reversals, velocity heads, vibration, or noise.

Materials: The body and cap are made of cast iron conforming to requirements of ASTM Specification A 126, Class A. The body-cap joint is equipped with a gasket.

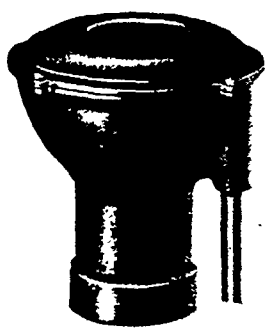
Design: The heads feature an exclusive helico-centrifugal principle of design. The internal area is constructed to impart a swirling motion to the flowing media; liquids and solids contained therein are then hurled . . . by the resulting centrifugal force . . . to the outer walls of the exhaust heads and, subsequently, gravitate to the drain for controlled disposal. There is no restriction of the vapor flow.

The exhaust heads will not crack nor corrode, and require no attention or maintenance. They are exceptionally durable and ornamental. Once installed, they will last indefinitely with no need for replacement except where plant expansion requires the use of a larger size. In such cases, the old unit can be relocated on another application with no loss of efficiency.

Drip pipe: The exhaust heads are equipped with a drip pipe (see sizes in table); the pipe should be carried full size to the catch basin or sewer.



Sizes 5-inch and smaller have a screwed connection, as shown in the partial section . . . . . larger sizes have a flanged connection.

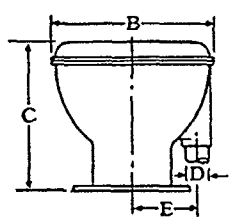


No. 900, Screwed
No. 901, Flanged

Weights, Volume, Dimensions, and Capacity — Prices on Request

Size	Weight, Each		Volume Crated	Dimensions, in Inches					Capacity (*)
	Net	Gross, Crated		Dia. across Body Lugs	B	C	D	E	Pounds Exhaust Steam Per Hour
Inches	Pounds	Pounds	Cubic Feet						
No. 900—Screwed									
1	18	20	.5	9	7¾	8½	½	2⅞	160
1¼	18	20	.5	9	7¾	8½	½	2⅞	160
1½	18	20	.5	9	7¾	8½	½	2⅞	160
2	28	35	.9	10½	9⅛	10¾	¾	3 7/16	380
2½	28	35	.9	10½	9⅛	10¾	¾	3 7/16	380
3	34	52	1.5	11½	9 13/16	10¾	¾	3¾	800
3½	34	52	1.5	11½	9 13/16	10¾	¾	3¾	800
4	42	64	2.0	13⅛	11¾	12⅛	1	4 9/16	1,280
5	65	93	2.8	15	13⅞	13	1	5⅜	1,600
No. 901—Flanged, F & D									
6	80	126	3.7	17	16	13¾	1	6 9/16	2,300
8	135	235	7.5	19⅝	18⅜	18⅛	1¼	7⅝	4,000
10	232	365	13.5	24½	23	21⅝	2	9⅜	6,300
12	385	470	24.5	30¼	28½	24¾	2½	11¾	9,100
14	480	647	30.0	31½	30½	26⅝	2½	12⅜	11,800
16	710	925	39.0	36	34⅛	31⅜	3	14	14,700
18	970	1160	52.0	39⅞	37⅞	33⅞	3	15⅝	19,400
20	1125	1485	66.0	43¾	41¼	38⅜	3½	16¾	23,400
24	2500	2900	122.0	59½	56⅞	46	4	19½	34,000
30	3200	4650	240.0	64½	61¾	57⅛	4	24	54,000

*Based on recommended velocity of 5000 feet per minute at atmospheric pressure



Flanged end: Dimensions and drilling of the end flange of the No. 901 conform to the American Cast Iron Flange Standard, Class 125, B16.1-1948.

The No. 901 is regularly furnished faced and drilled (F & D); the bolt holes are drilled to straddle the center line of the drip outlet. When specified, the end flange will be furnished faced only.

Drilling templates....page 327

Cylinder Operated Gate, Globe, and Angle Valves

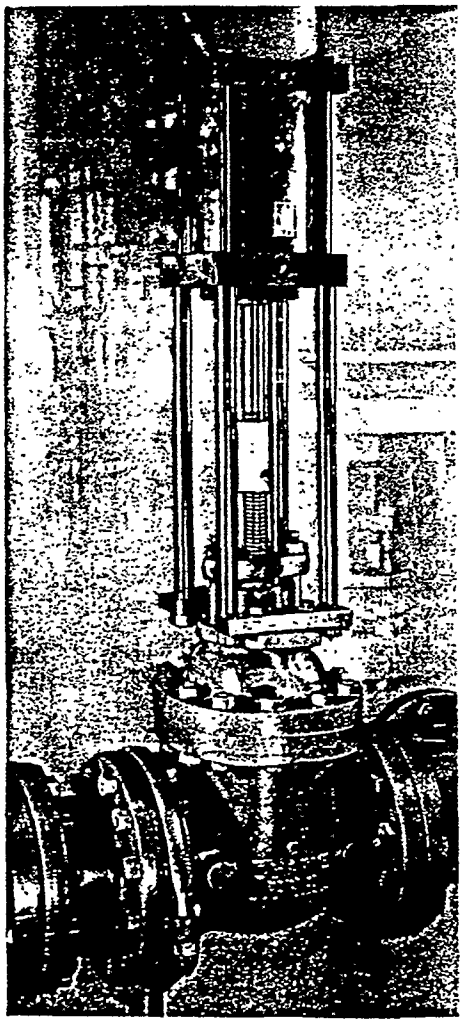
For All Pressures and Purposes

004050

With the ever-increasing tempo of modern industry, power operation of valves is becoming a necessity in many plants. To speed the opening and closing of valves, or for use when valves are in inaccessible locations, cylinder operation is often ideal.

Crane Cylinder Operated Gate, Globe, and Angle Valves are well suited for many installations, giving highly satisfactory service with low operating and maintenance costs. Under normal conditions and with proper care, the cylinders will last as long as the valves.

As the name implies, these valves are actuated by means of a double acting piston and cylinder, using water, air, or oil as the operating medium. Control is obtained by operating a four-way valve located in any convenient place within reasonable distance from the valve.



A Crane 6-inch 250-Pound Ferrosteel Wedge Gate valve with an air operated cylinder.

Remote control: When remote control is required, the piping connecting the cylinder and the four-way control valve must be large enough to compensate for pressure drop and back pressure resulting from the actuating and exhausting operations of the cylinder. Proper size pipe eliminates the possibility of faulty operation of the cylinder due to choking of supply lines.

Maintaining disc position: In order to keep the valve disc in either the open or closed position, the actuating pressure must be retained in the cylinder at all times, except in the following cases:

1. On globe and angle valves when closed . . . . if the cylinder is installed above the valve and the line pressure is on top of the disc.
2. On gate valves when fully open . . . . if the valve is installed with the stem horizontal, or if the valve is in an inverted position with the stem pointed down.

Cylinders: Cylinders conform to the latest J.I.C. (Joint Industry Conference) standards for pneumatic and hydraulic operators. The cylinder barrels, accurately honed and finished, are made from brass tubing. The heads and caps are steel and employ tie bars of high tensile strength.

Piston: The piston construction offers maximum strength with minimum weight and bulk. Synthetic rubber cup seals are used on air and water operated cylinders; leather cup seals are used on oil cylinders. Water operated cylinders have a chrome plated steel piston and a chrome plated, stainless steel piston rod. Air and oil operated cylinders have a steel piston and a chrome plated, case-hardened steel piston rod.

Wipers and seals: Teflon dirt wipers clean the piston rod, keeping the cylinder free from dirt and dust. The piston rod seals are tamper-proof and wear-compensating; they require no adjustment. The Teflon end seal on the barrel guarantees tightness even under shock loads.

(continued on next page)

All-Iron Liquid Gauges

With Special Lead Seat

300 psi liquid working pressure
300 psi air-under-water test

These all-iron gauges are recommended for water, oil, ammonia, air, gas, and general liquid service at pressures up to 300 psi.

The valve bodies are made of Crane Ferrosteel conforming to requirements of ASTM Specification A 126, Class B.

Ball check: Each main valve is equipped with a ball check valve in their inlet end. In the event the glass tube is broken, the check valves close instantly and automatically, preventing escape of fluid or gas.

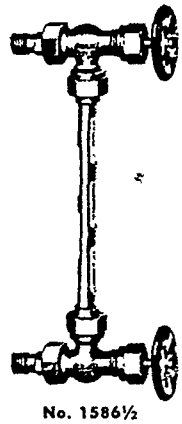
Standard centers: The gauges, as regularly furnished, have 15-inch centers (center to center of valves). Centers up to 24-inch can be furnished on special order.

Prices: Prices of complete gauges, as well as prices of parts such as the lower and upper valves, gauge glass, guard, rubber gauge glass gasket, stuffing box washer, etc., will be furnished on request.

Weights and Dimensions

No. 1586½ Gauge	Pipe Size, Inches	Weight, Pounds Each	Standard Center to Center of Valves, Inches	Outside Diameter of Glass, Inches
	½	7.5	15	⅝
	¾	8.5	15	⅝

Bronze water gauges.....page 256
Corrosion-resistant liquid level gauge....page 198



No. 1586½ Liquid Gauge Special Lead Seat

22

Bronze Swing Joints

150 psi non-shock cold water, oil, or gas working pressure

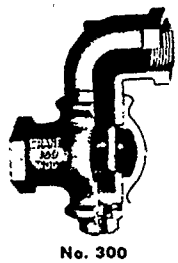
The No. 300 bronze swing joint is designed to make an adjustable connection in piping to tanks and other apparatus where permanently fixed connections cannot be made.

Basically, the joints consist of an ell-shaped plug held in the body with a nut and washer. All parts are bronze to eliminate any binding of the plug by corrosion.

Operation is similar to that of an ordinary plug cock. The design of the body and port assures free flow of fluid. There is no restriction of port area regardless of the angle at which the plug is turned. No packing is used.

Weights and Dimensions

No. 300 Swing Joint	Size, Inches	Weight, Pounds Each	Center to End, Inches	Center to Center of Pipe, Inches
	¼	.4	13/16	1 5/32
	⅜	.5	⅞	1 5/16
	½	.8	1 1/16	1 9/16
	¾	1.3	1¼	1⅞
	1	2.2	1½	2¼



No. 300 Swing Joint
Prices on request

Safety Gas Vent Elbow

An all-weather gas vent with a non-clogging flexible screen

Crane's Safety Gas Vent Elbow, completely non-corrosive with its die cast zinc alloy body and flexible stainless steel coil spring, assures safe, dependable venting of gas even in sub-zero weather.

In the normal (closed) position, the coil spring serves as a screen. The narrow slit-like openings between the windings of the spring keep out bugs, dirt, and other foreign matter which might clog ordinary rigid screen or bar type vents.

When gas is vented, the spring flexes outward, enlarging the space between the coils for fast, full-open venting of gas and expulsion of foreign matter. In addition, the flexing action of the coil spring performs a self-cleaning operation.

The coil spring is deeply recessed for protection against the elements and tampering. A stainless steel spring clip, ⅜-inch wide and irregularly shaped, retains the coil spring in position.

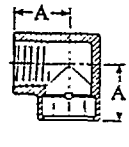
Weight and Dimensions

Gas Vent Elbow	Size, Inches	Pounds Per 100	A, Inches
	¾	30.5	1⅛

Price on Request



Gas Vent Elbow



Cylinder Operators

004052

For Iron and Ferrosteel Gate and Pulp Stock Valves

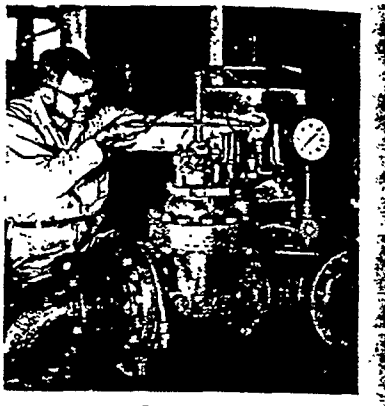
The Crane Cylinder Operator, one of the many new Crane products coming your way, represents a marked advancement in operator design.

Available in cylinder-valve combination from the factory, or as a conversion kit for field installation, this universal type cylinder is easy to operate, easy to maintain . . . . and is quickly installed, as illustrated on this page.

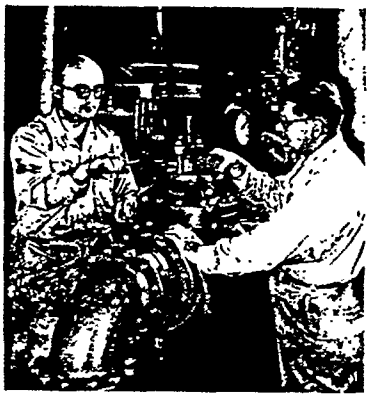
Additional data . . . pages 263 to 265



1. *Remove handwheel and yoke from valve.*



2. *Cut stem to the specified length.*



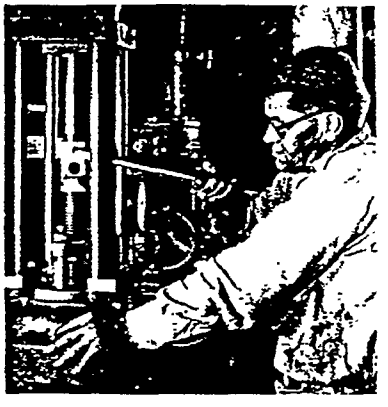
3. *Bolt the cylinder adapter plates to the bonnet.*



4. *Screw the mounting posts into the cylinder tie rods.*



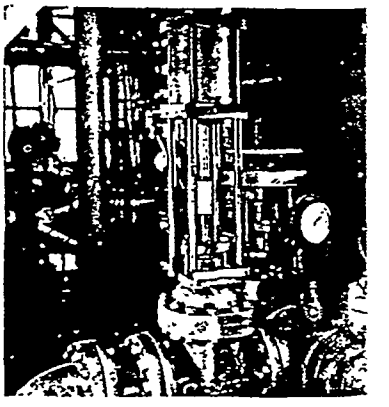
5. *Bolt the cylinder to the adapter plates.*



6. *Thread the square coupling onto the valve stem.*



7. *Attach the cylinder to the air, oil, or water lines.*



8. *And your valve is equipped for automatic operation.*

SECTION 23

Crane Valve Accessories and Parts

Cylinder Operation
General description; typical control systems.....pages 260 and 261

Cylinder Operation for Iron Gate and Pulp Stock Valves
Installation.....page 262
Ordering and dimensional data.....page 263
Selecting the proper size cylinder.....pages 264 and 265

Motor Operation
General description and accessories.....pages 266 to 269
Typical wiring diagrams.....page 270

Gear Operators for Crane Gate Valves
General description.....pages 271 to 274
Installation.....pages 272 and 273
Dimensions.....page 274
Special gear types.....page 274

Indicator Posts
For non-rising stem gate valves.....page 275

Floor Stands and Extension Stems.....pages 276 and 277

Operating Wheels and Handles
General description; types.....pages 278 and 279
How to order.....page 279

Chain Wheels.....page 280
Composition Discs.....page 281

By-Passes
For Iron Gate Valves.....page 282

Miscellaneous Accessories
Indicators and cleanouts for iron gate valves.....page 283
Keys for bronze lock shield valves.....page 283

23

For convenience of the catalog user, the following accessories are grouped with related products: refer to the pages indicated:

Valves parts for AAR Valves.....page 42
Wrenches for cocks and stops.....page 68
By-passes for steel bolted bonnet gate valves.....page 129
By-passes for steel globe and angle valves (data on request)..page 146
By-passes for steel Pressure-Seal Bonnet gate valves.....page 174
Gearing for steel globe and angle valves.....page 149
Machine bolts.....page 316
Stud bolts: Triplex and Templex Steel.....page 317
Sheet packings and gaskets.....pages 320 to 323
Thread lubricant and compound.....page 324

Ordering Replacement Parts

Replacement parts, such as stems, bonnets, discs, etc., for any Crane valve can be furnished upon receipt of an order. When ordering parts, specify the name of the part required and the catalog number and size of the valve for which it is intended. In addition, since the valve must be clearly identified before a part that will fit correctly can be furnished, indicate how the valve is marked and where the marking appears. For "Identification of Crane Products" see pages 12 and 13

Selection of Cylinder Operators

For Iron and Ferrosteel Gate and Pulp Stock Valves

The tables shown below and on the facing page present an easy method of determining the correct cylinder operator to use with any of the following types of Crane cast iron and alloy iron valves:

Cast Iron Pulp Stock.....pages 84 and 85
3% Nickel Cast Iron Pulp Stock.....pages 84 and 85
125-Pound Ferrosteel Wedge Gate.....pages 74 to 77
250-Pound Ferrosteel Wedge Gate.....pages 80 and 81
25-Pound Cast Iron Double Disc Gate.....pages 92 and 93
200-Pound WOG Ferrosteel Double Disc Gate.pages 94 and 95
500-Pound WOG Ferrosteel Double Disc Gate.....page 96

How to use the tables: Refer to the first and second columns of the table to determine the applicable valve type and valve size.

In the upper portion of the table, locate the column representing the *minimum cylinder operating pressure* that is available.

At the intersection downward from the minimum cylinder operating pressure, and horizontally to the right from the valve type and size, locate the block of values representing the *line pressures* on the valve.

Select the line pressure value which is equal to, or greater than, the actual line pressure. From this value, proceed horizontally to the two columns at the far right to determine the required cylinder bore and the cylinder catalog number.

Example: A 14-inch pulp stock valve, under a line pressure of 50 psi with a cylinder supply pressure of 70 psi, requires a 10-inch bore cylinder .... Catalog No. H-12.

If the line pressure were 60 psi, the valve would require a 12-inch bore cylinder .... Catalog No. H-13.

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Valve Type	Valve Size	Cylinder Operating Pressure										Cylinder to Use	
		20 psi	30 psi	40 psi	50 psi	60 psi	70 psi	80 psi	90 psi	100 psi	120 psi	Bore	Catalog No.
	Inches	Line Pressure, in Pounds per Square Inch										Inches	
Cast Iron and 3% Nickel Cast Iron Pulp Stock Valves	4	.. ..	.. ..	.. ..	.. 35	.. 60	5 60	35 60	60 ..	.. ..	.. ..	4 5	H-1 H-2
	6	.. ..	.. ..	.. ..	.. 15	.. 45	10 60	30 60	55 60	60 ..	60 ..	5 6	H-3 H-4
	8	.. ..	.. ..	.. 20	.. 55	.. 60	15 60	35 60	50 60	60 ..	60 ..	6 8	H-5 H-6
	10	.. ..	.. 10	.. 40	15 60	35 60	55 60	60 ..	60 ..	60 ..	60 ..	8 10	H-7 H-8
	12	.. ..	.. .	. 15	. 40	15 60	30 60	45 60	55 60	60 ..	60 ..	8 10	H-9 H-10
	14	.. .. ..	. . 10	.. 5 30	.. 20 50	.. 35 60	10 50 60	20 60 ..	30 60 ..	40 60 ..	60	8 10 12	H-11 H-12 H-13
	16	.. .. ..	. . ..	. . 20	. 10 35	. 20 55	. 35 60	10 45 60	15 60 .	25 60 ..	45 60	8 10 12	H-14 H-15 H-16
	18	.. .. ..	 10	.. 10 30	.. 25 50	10 40 60	20 50 60	30 60 ..	40 60 ..	50 60 ..	60	10 12 14	H-17 H-18 H-19
	20	.. .. ..	.. .. ..	 20	.. 15 35	5 25 50	10 40 60	20 50 60	30 60 ..	35 60 ..	55 60 ..	10 12 14	H-20 H-21 H-22
	24	.. .. .	 5	.. 5 20	.. 20 35	10 30 50	20 40 60	30 50 60	35 60 ..	45 60 ..	60	12 14 16	H-23 H-24 H-25
Cast Iron 25-Pound WOG Double Disc Gate Valves	10	.. . ..	.. . 20	. 5 35	.. 15 50	10 25 50	15 35 50	20 45 50	25 50 ..	30 50 ..	40 50 ..	5 6 8	D-1 D-2 D-3
	12	.. ..	.. 10	. 5 25	.. 10 35	5 15 45	10 20 50	15 25 50	20 30 50	25 35 50	35 45 50	5 6 8	D-4 D-5 D-6
	14	.. . 10	. 5 20	.. 15 35	5 25 50	10 35 50	15 40 50	20 50	25 50 ..	30 50 .	40 50	6 8 10	D-7 D-8 D-9
	16	. 5	5 15	10 25	5 20 35	10 25 45	10 30 50	15 35 50	20 40 50	25 45 50	30 50	6 8 10	D-10 D-11 D-12
	18	. 10	. 10 20	5 20 30	10 25 40	15 35 50	20 40 50	25 50	30 50 .	35 50 .	45 50	8 10 12	D-13 D-14 D-15
	20	.. . 5	. 10 15	5 15 25	10 20 35	15 25 45	20 35 50	20 40 50	25 45 50	30 50	40 50	8 10 12	D-16 D-17 D-18
	24	5 10	5 10 15	10 15 25	15 25 35	20 30 45	25 35 50	25 40 50	30 45 50	35 50	45 50	10 12 14	D-19 D-20 D-21

(continued on the next page)

Cylinder Operated Gate, Globe, and Angle Valves

For All Pressures and Purposes

(continued from the preceding page)

Speed control: All cylinders are regularly supplied with orifice fittings in the cylinder ports, designed to obtain an operating speed of one inch per second. When specified, speed control valves are supplied on air-operated cylinders, to provide a fine degree of speed regulation. On gate valves, it is recommended that a pressure regulator be installed in the air line to prevent pressure fluctuations which could jam the disc too tightly into its seat.

Control valves: Four-way valves can be furnished with cylinder operated valves when specified. Manual, solenoid operated, pilot controlled, hydraulic, or air operated four-way valves for local or remote control can be furnished at extra cost.

Emergency operation: Cylinders are regularly furnished with a single rod end. Emergency manual operation can be accomplished by inserting a bar in a hole provided in the cylinder rod-valve stem coupling. Special double rod end cylinders with a lifting loop can be supplied when specified.

Accessories: Clean air, water, or oil, are requisites for proper cylinder operation.

Installation of a sediment separator is recommended in the line between the source of supply and the four-way valve. The separator will eliminate the possibility of dirt, grit, scale, or foreign matter entering the cylinder and scoring the walls, damaging the cups, or clogging the orifice openings.

In air operated cylinders, a mist oiler or other suitable device should be installed in the supply line. All accessory equipment should conform to J.I.C. Standards.

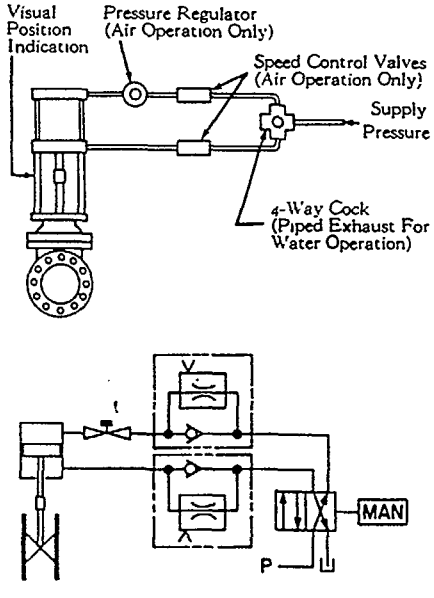
Special equipment: When so ordered, cylinder operated valves can be furnished with special equipment, depending upon the requirements.

Inquiries and orders for special equipment must be accompanied by complete specifications and description of the proposed installation.

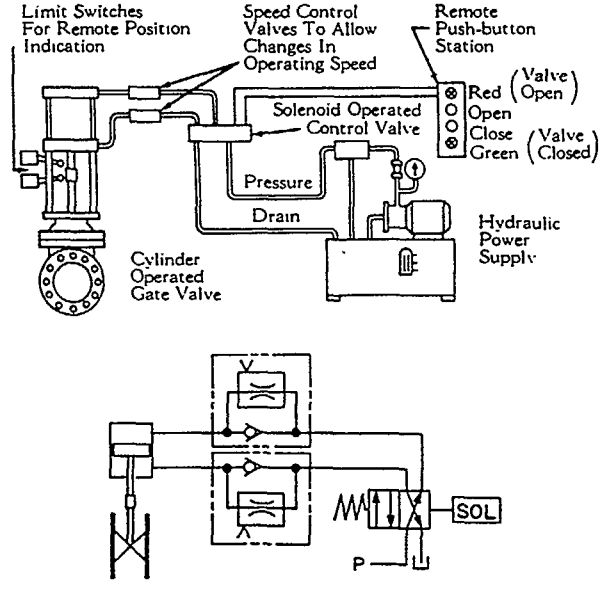
Typical Control Systems

The two systems illustrated below represent both simple and relatively elaborate control schemes. They are intended as examples only, since the requirements of any particular installation will determine the system to be used. Crane Engineers can recommend one to fill your needs.

Schematic and J.I.C. Diagrams Of Air or Water Operated Cylinder With Manual Four-Way Cock



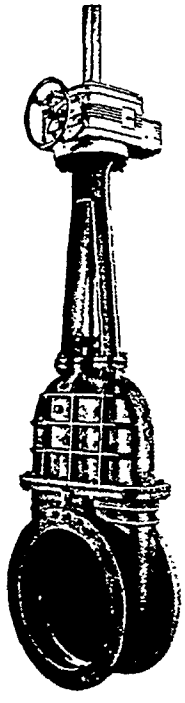
Schematic and J.I.C. Diagrams Of Hydraulically (Oil) Operated Cylinder With Solenoid Control Valve



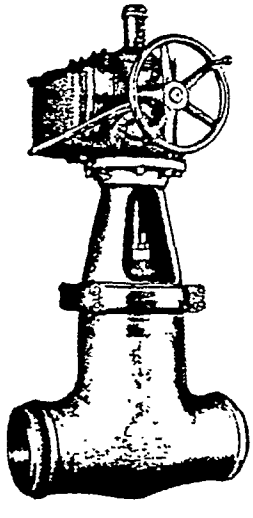
Crane cylinder operator for iron body gate and pulp stock valves....pages 262 to 265

Motor Operated Valves

Electric Motor Units — Air or Gas Motor Units



A 30-inch Crane Low Pressure Iron Body Gate Valve Equipped with an Electric Motor Operator



Electric Motor Operator Installed on a 12-inch Crane 1500-Pound Steel Pressure-Seal Bonnet Gate Valve

See pages 267 to 270 for additional information

Valves that are to be mechanically operated by electricity, air, or gas, require specially designed motor operators to control valve performance. These operators consist of the basic motor unit, a set of gearing, and various switches needed to start and stop the operation. The motor unit itself may be actuated electrically, or by air or gas.

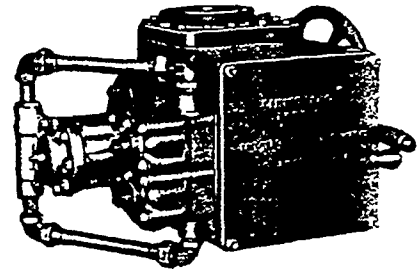
Motor operated valves have a wide range of application in piping systems. Their use makes possible the automation of complex systems, and provides a high degree of safety in emergencies. On valves operated frequently, and on valves requiring considerable power and time to open or close, the motor operator is indispensable. It provides a perfect means of reducing the manual effort necessary to operate the valves.

Automation: In complex piping systems, the use of motor operators allows rapid operation of individual valves, and simultaneous operation of groups of valves by remote control from any number of convenient points. Automatic operation through the use of pressure switches, interlocks, and other electrical devices provides almost unlimited means of controlling the flow in complicated and inter-connected piping arrangements. Motor operated valves are a convenient means of securing these desirable advantages. The cost is amply justified when these elements of modern piping design are given full consideration.

Emergency operation: As a matter of insurance against destruction due to mechanical failure of pipe lines or apparatus, the motor controlled valve is of great benefit, because it can be operated instantly from remote positions, outside of the danger zones.

Motor operator assemblies: Motor operator units consist of a special high starting torque motor, reduction gearing, limit switches (if operated by electric motors), or valves (if operated by air motors), and handwheel engaging mechanism, all contained in one weather-proof or explosion-proof assembly, with all gears running in oil. A hammer-blow device allows the motor to reach full speed before the full load is engaged.

The ball bearing motor is totally enclosed. A handwheel is provided for manual operation



Air Motor Operator Assembly

In closing the valve, the motor is stopped by a predetermined thrust exerted on the valve stem, acting on a switch, or valve. This also affords protection should any foreign matter obstruct the closing of the valve. In opening the valve, the motor is stopped by the mechanical limit switch, or limit valve, which stops the movement of the stem before the valve can back-seat.

The switches and valves for opening and closing are adjustable and operate independently of each other.

Motor operators are available for unusual conditions and for various speeds of operation.

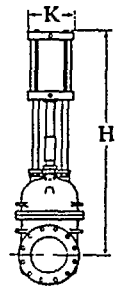
Electric motors: Electric motor operators require a specially built, high starting torque reversing motor. The motor is designed for intermittent duty, is capable of exerting its maximum power by the time the unit sleeve in the operator completes one-eighth of a turn, and absorbs the shock of the built-in hammerblow mechanism . . . . all without danger of injury or overheating.

Air or gas motors: Air motors are of the rotary vane or reciprocating piston reversible types. These are high speed, high starting torque motors, equipped with special air limit valves. Maximum air pressure is 125 pounds per square inch. Gas may be used instead of air to operate the motors. Air or gas used for operation must be free of grit, dirt, or chemicals, which may be injurious to the motor.

Air motor units are of particular advantage in refineries, on oil and gas lines, and in various process industries, where sparks from electric motors and wires will ignite an explosive-laden atmosphere.

CC4853

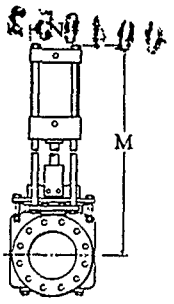
Cylinder Operators—Ordering and Dimensional Data



Gate Valves

When ordering cylinder operated iron or Ferrosteel gate and pulp stock valves listed in the table below, please specify:

1. Valve size and catalog number.
2. If by-pass is wanted, state its location in relation to the valve.
3. Position of valve stem . . . horizontal or vertical.
4. ntended service for valve . . . . steam, water, oil, gas, etc.
5. Maximum working pressure and maximum differential pressure valve opens against.
6. Fluid to be used for operating the cylinder . . . . air, oil, or water.
7. Minimum and maximum pressures available for operating the cylinder. It is recommended that the operating pressure be as high as possible, thus allowing the use of a minimum bore cylinder; see sizing tables on pages 264 and 265.
8. Maximum temperature, working or ambient, to which cylinder will be subjected.
9. Desired speed of operation; if not specified, cylinders are factory regulated for disc travel of approximately one inch per second.



Pulp Stock Valves

Clearance Dimensions (Inches) for Cylinder Operated Iron and Ferrosteel Gate and Pulp Stock Valves

Valve Size	Cylinder Cat. No.	25-Pound Iron Body Double Disc Gate Valves		Cylinder Cat. No.	125-Pound Ferrosteel Wedge Gate Valves		200-Lb. WOG Ferrosteel Double Disc Gate Valves		Cylinder Cat. No.	250-Pound Ferrosteel Wedge Gate Valves		500-Lb. WOG Ferrosteel Double Disc Gate Valves		Cylinder Cat. No.	Cast and Alloy Iron Pulp Stock Valves	
Inches		H	K		H	K	H	K		H	K	H	K		M	N
2	...	...	...	B-1	28	4½	28	4½	C-1	27½	4½	...	...	...	...	...
	...	...	...	B-2	28½	5½	28	5½	C-2	28	5½	...	...	...	...	...
	...	...	...	...	...	...	...	...	C-3	29½	6½	...	...	...	...	...
2½	...	...	...	B-3	30	4½	29	4½	C-4	32	4½	...	...	...	...	...
	...	...	...	B-4	30½	5½	29½	5½	C-5	32½	5½	...	...	...	...	...
	...	...	...	...	...	...	...	...	C-6	33½	6½	...	...	...	...	...
3	...	...	...	B-5	34	4½	33½	4½	C-7	35	5½	35½	5½	...	...	...
	...	...	...	B-6	34	5½	33½	5½	C-8	36	6½	37	6½	...	...	...
	...	...	...	B-7	35½	6½	35	6½	C-9	37	8½	37	8½	...	...	...
3½	...	...	...	B-8	35½	4½	...	...	...	...	...	...	...	...	...	...
	...	...	...	B-9	35½	5½	...	...	...	...	...	...	...	...	...	...
	...	...	...	B-10	37	6½	...	...	...	...	...	...	...	...	...	...
4	...	...	...	B-11	39	4½	40½	4½	C-13	38½	6½	38½	6½	H-1	26	4½
	...	...	...	B-12	39½	5½	41	5½	C-14	38½	8½	38½	8½	H-2	26	5½
	...	...	...	B-13	40½	6½	42	6½	C-15	40	10⅝	40½	10⅝	...	...	...
5	...	...	...	B-14	40½	5½	...	...	C-16	43	6½	...	...	...	...	...
	...	...	...	B-15	41½	6½	...	...	C-17	43½	8½	..	..	...	...	...
	...	...	...	B-16	42	8½	...	...	C-18	45	10⅝	...	..	...	...	...
6	...	...	...	B-17	44	5½	43½	5½	C-19	48	8½	47½	8½	H-3	31½	5½
	...	...	...	B-18	45½	6½	45	6½	C-20	50	10⅝	49½	10⅝	H-4	32	6½
	...	...	...	B-19	45½	8½	45	8½	C-21	51	12¾	50½	12¾	...	..	...
8	...	...	...	B-20	54½	5½	54½	5½	C-22	60½	10⅝	60½	10⅝	H-5	40½	6½
	...	...	...	B-21	55½	6½	55	6½	C-23	61	12¾	61	12¾	H-6	41	8½
	...	...	...	B-22	56	8½	55½	8½	C-24	63½	14¾	63½	14¾	...	...	...
	...	...	...	B-23	58	10⅝	57½	10⅝	C-25	61	17	60½	17	..	...	...
10	D-1	61½	5½	B-24	66½	6½	66	6½	C-26	71½	12¾	...	...	H-7	46	8½
	D-2	62	6½	B-25	67	8½	66½	8½	C-27	74	14¾	...	...	H-8	47½	10⅝
	D-3	63	8½	B-26	67½	10⅝	67	10⅝	C-28	71	17	...	...	...	...	...
	...	...	..	B-27	68	12¾	67½	12¾	C-29	72½	19	.	...	..	...	...
12	D-4	69½	5½	B-28	74½	8½	73½	8½	C-30	81	14¾	...	...	H-9	51½	8½
	D-5	70	6½	B-29	74½	10⅝	74	10⅝	C-31	78	17	...	...	H-10	53	10⅝
	D-6	70	8½	B-30	75½	12¾	75	12¾	C-32	79	19	...	...	..	...	...
	...	...		B-31	77½	14¾	77½	14¾	C-33	80	21	...	...	..	...	...
14	D-7	79	6½	B-32	81¾	8½	83	8½	...	...	..	...	..	H-11	56½	8½
	D-8	79	8½	B-33	81¼	10⅝	83½	10⅝	...	...	...	...	...	H-12	58	10⅝
	D-9	79½	10⅝	B-34	83	12¾	84½	12¾	...	...	...	.	...	H-13	59	12¾
	...	...	.	B-35	85½	14¾	86½	14¾	..	...	.	.	.	..	..	..
16	D-10	86	6½	B-36	93	10⅝	93½	10⅝	..	.	.	..	..	H-14	62	8½
	D-11	86	8½	B-37	94	12¾	94	12¾	. .	. .	..	.		H-15	63½	10⅝
	D-12	87	10⅝	B-38	96½	14¾	96½	14¾	..	...	..	.	.	H-16	64½	12¾
	...	...		B-39	93½	17	94½	17		.					...	...
18	D-13	96	8½	B-40	103	12¾	103	12¾						H-17	68	10⅝
	D-14	96½	10⅝	B-41	105	14¾	105	14¾	...	..	.	...	...	H-18	69	12¾
	D-15	97½	12¾	B-42	102	17	103	17	...	..	...	...	.	H-19	71½	14¾
	...	..	.	B-43	104	19	104	19		.	.	.		...	...	...
20	D-16	103	8½	B-44	115	14¾	113	14¾		..	.	..	..	H-20	76	10⅝
	D-17	104	10⅝	B-45	112	17	110	17	. .	.	. .	..	.	H-21	76½	12¾
	D-18	105	12¾	B-46	113	19	112	19	.	.	.	..	.	H-22	79	14¾
		...		B-47	117	21	113	21				..			...	...
24	D-19	119	10⅝	B-48	132	14¾	132	14¾	.	..	...	...	.	H-23	87½	12¾
	D-20	119	12¾	B-49	129	17	129	17		.	..	.		H-24	90½	14¾
	D-21	122	14¾	B-50	131	19	130	19						H-25	86	17
		.		B-51	132	21	131	21							.	.

Installation . . . page 262

How to select and size cylinder operators . . . pages 264 and 265

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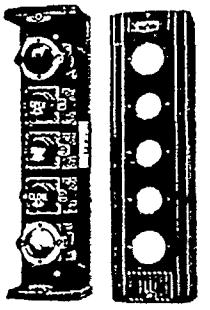
Motor Operated Valves

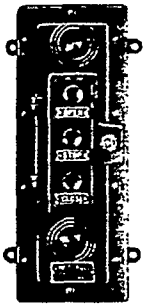
Push Button Control Stations



Surface mounted, 3-button, 2-light control station.



Surface mounted control station with two indicating lights and a valve position selector switch.



Flush mounted, 3-button, 2-light push button control station; with break-glass door and lock.

The push button control station provides the means for remote valve actuation. It may be located at a control center, or at any other convenient point in the plant. Several stations may be provided for any one valve, when operating conditions make this desirable.

Control stations are available, in a variety of types, some of which are illustrated on this page. The specific requirements of any particular application determine the kind of control station to be used.

Ordinarily, valve operation would require the use of at least a 3-button station, with buttons to open and close the valve, and to stop it at any intermediate position. If position indicating lights are desirable, a 3-button, 2-light station may be used.

Push button stations are available in either surface or flush mounted enclosures. For special services they can be supplied with break-glass doors and locks. A selector switch may be specified instead of push buttons, if desired. Stations may be obtained in all standard NEMA enclosures.

Position Indicators

It is frequently desirable to have an indicator showing the exact position of the disc at all times, especially on globe valves, which are used for throttling purposes. Motor operators are furnished with protectors for the valve stem extension above the motor unit, to prevent mechanical damage to the stem and the accumulation of dust and dirt which might be carried into the yoke sleeve or yoke bushing by the stem. The valve stem, therefore, cannot act as an indicator.

All valve motor operators can be equipped with position indicators, of either the integral or remote type. The integral type is placed on the operator case, with a pointer indicating the disc position. The remote type is connected to a transmitter attached to the integral type indicator. Remote indicators may be in multiple.

A rod position indicator attached to the top of the stem of the valve, operating through a hole in the cap of the stem protector, is frequently furnished.

Floor Stands

Motor operators may be mounted on floor stands for operating valves below a floor, when it is impractical to mount the operator directly on the valve.

The floor stands may be of the plain type with the contactor panel and push button station mounted elsewhere, or of the combined type having the panel and station mounted on the side of the floor stand.

When a floor stand is used and the distance from the valve to the floor is within practical limits, a one-piece stem for the valve will be provided, extending through the floor stand. If the distance is too great for a one-piece stem, or the valve itself is in a line, which will impart movement to the valve through expansion or contraction, universal joints and spline couplings must be used in the stem.

Placing the floor stand at a location other than directly above the valve is not practical, due to the power absorbed by the required bevel gears, and the lost motion involved.

Motor operated valves. . . . pages 266 to 270

Selection of Cylinder Operators

For Iron and Ferrosteel Gate and Pulp Stock Valves

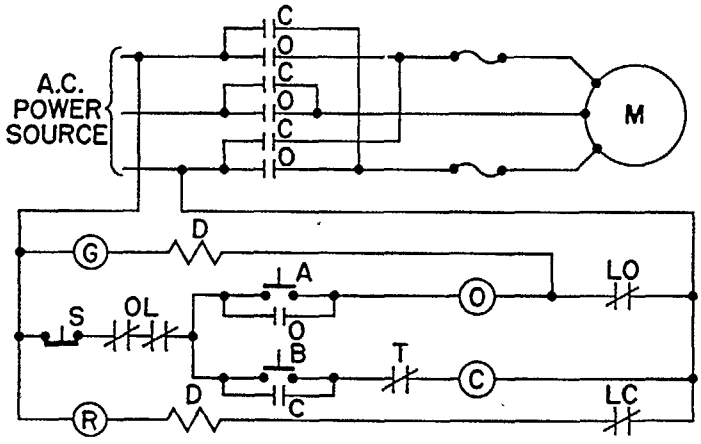
Valve Type	Valve Size	Cylinder Operating Pressure — Line Pressures, in Pounds per Square Inch										Cylinder to Use	
		20 psi	30 psi	40 psi	50 psi	60 psi	70 psi	80 psi	90 psi	100 psi	120 psi	Bore	Catalog No.
	Inches											Inches	
Ferrosteel 125-Pound Wedge Gate and 200-Pound WOG Double Disc Gate Valves	2	..	..	..	20	120	200	200	200	200	..	4	B-1
		..	..	150	200	200	..	..	..	..	..	5	B-2
	2½	..	..	..	10	75	140	200	200	200	200	4	B-3
		..	..	100	200	200	200	..	..	..	..	5	B-4
	3	..	..	..	..	20	60	105	150	195	200	4	B-5
		..	..	35	105	175	200	200	200	200	..	5	B-6
		..	55	155	200	200	..	..	..	..	..	6	B-7
	3½	..	..	..	..	15	45	80	110	145	200	4	B-8
		..	..	25	80	130	180	200	200	200	..	5	B-9
		..	40	110	185	200	200	..	..	..	..	6	B-10
	4	..	..	..	..	..	15	40	65	90	140	4	B-11
		..	..	..	40	80	120	160	200	200	200	5	B-12
		..	10	55	120	175	200	200	..	..	..	6	B-13
	5	..	..	..	10	35	60	85	110	135	185	5	B-14
		..	..	30	65	100	135	170	200	200	200	6	B-15
		15	80	145	200	200	200	200	..	..	..	8	B-16
	6	..	..	..	10	25	40	60	75	95	130	5	B-17
		..	..	20	45	70	95	120	145	170	200	6	B-18
		10	55	100	145	190	200	200	200	200	..	8	B-19
	8	..	..	..	..	5	15	25	35	45	65	5	B-20
		..	..	..	15	30	45	60	75	90	120	6	B-21
		..	20	45	75	100	125	150	175	200	200	8	B-22
		25	65	105	145	185	200	200	200	..	..	10	B-23
	10	..	..	..	..	10	20	30	40	50	70	6	B-24
		..	5	25	40	55	70	95	100	115	145	8	B-25
		10	35	60	85	110	135	160	185	200	200	10	B-26
		30	70	105	140	175	200	200	200	..	..	12	B-27
	12	..	5	15	25	40	50	60	70	80	100	8	B-28
		5	25	40	60	80	100	115	130	150	190	10	B-29
		20	45	70	95	120	145	170	195	200	200	12	B-30
		40	75	110	145	180	200	200	200	..	..	14	B-31
	14	..	..	10	20	25	35	45	55	65	80	8	B-32
		..	15	30	45	60	70	80	95	110	140	10	B-33
		15	30	45	70	85	100	125	140	150	150	12	B-34
		25	50	75	100	130	150	150	150	..	..	14	B-35
	16	..	10	20	30	40	50	60	70	80	100	10	B-36
		5	20	35	50	65	80	95	105	120	150	12	B-37
		15	35	55	75	95	115	135	150	150	150	14	B-38
		30	55	80	105	130	150	150	..	..	..	16	B-39
	18	5	15	25	35	50	60	70	80	90	115	12	B-40
		15	30	45	60	75	90	105	120	135	150	14	B-41
		20	40	60	80	100	125	145	150	150	..	16	B-42
		30	60	85	110	135	150	150	..	..	..	18	B-43
	20	10	20	35	50	60	70	85	95	110	135	14	B-44
		15	35	50	65	80	100	115	130	150	150	16	B-45
		25	45	65	90	110	130	150	150	..	..	18	B-46
		35	60	85	110	140	150	..	..	..	..	20	B-47
	24	5	15	20	30	40	50	60	70	75	95	14	B-48
		10	20	35	45	55	70	80	90	100	125	16	B-49
		15	30	45	60	75	90	105	120	130	150	18	B-50
		20	40	60	80	100	115	130	150	150		20	B-51
Ferrosteel 250-Pound Wedge Gate and 500-Pound WOG Double Disc Gate Valves	2	..	..	..	20	120	220	320	420	500	500	4	C-1
		..	..	155	310	470	500	500	500	..	..	5	C-2
		..	200	420	500	500	..	..	..	..	..	6	C-3
	2½	..	..	..	..	25	90	150	215	280	400	4	C-4
		..	..	50	150	250	350	450	500	500	500	5	C-5
		..	80	220	360	500	500	500	..	..	..	6	C-6
	3	..	..	..	70	140	210	280	350	420	500	5	C-7
		..	20	120	220	320	420	500	500	500	..	6	C-8
		85	265	450	500	500	500	..	..	..	..	8	C-9
	4	..	..	45	100	160	220	270	330	390	500	6	C-13
		25	130	230	335	435	500	500	500	500	..	8	C-14
		140	300	465	500	500	..	..	..	..	..	10	C-15
	5	..	..	15	50	90	125	160	200	235	305	6	C-16
		5	70	135	200	270	335	400	465	500	500	8	C-17
		75	180	285	390	490	500	500	500	..	..	10	C-18
	6	..	40	85	130	175	225	270	315	360	450	8	C-19
		45	115	190	260	330	400	470	500	500	500	10	C-20
		110	210	315	415	500	500	500	..	..	..	12	C-21
	8	..	55	95	135	175	215	260	300	340	410	10	C-22
		50	110	170	225	285	340	400	460	500	500	12	C-23
		90	170	250	330	410	490	500	500	..	..	14	C-24
		140	245	350	450	500	500	..	..	..	..	16	C-25
	10	20	60	100	135	170	205	240	275	310	380	12	C-26
		50	100	150	200	250	300	350	400	450	500	14	C-27
		80	150	215	280	350	415	480	500	500	..	16	C-28
		115	200	280	365	450	500	500	..	..	..	18	C-29
	12	35	70	105	140	175	210	245	280	315	385	14	C-30
		55	100	150	200	240	265	330	380	430	500	16	C-31
		80	140	200	250	310	370	430	490	500	..	18	C-32
		110	180	250	325	400	475	500	500	..	..	20	C-33

Additional information on Crane Cylinder Operators....pages 260 to 264

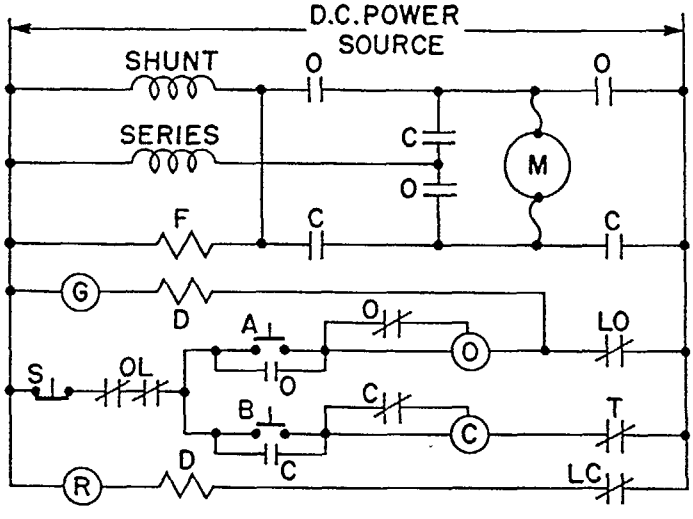
Electric Motor Operators
Typical Wiring Diagrams

Although the needs of a particular installation will dictate the wiring arrangement which must be used, the diagrams on this page may be considered typical. Accurate schematics for specific installations are provided "certified for construction".

WIRING DIAGRAM — A.C.



WIRING DIAGRAM — D.C.



KEY

A — Pushbutton . . . . actuate to open valve.

B — Pushbutton . . . . actuate to close valve.

C — CLOSE coil and contacts of reversing contactor.

D — Lamp resistors (where necessary).

F — Field discharge resistor (where necessary).

G — Green light; lights when valve is closed. Both lights are lit when valve is in any intermediate position.

LC — Limit switch . . . . opens when valve reaches full closed position.

LO — Limit switch . . . . opens motor control circuit when valve reaches full open position.

M — Motor.

O — OPEN coil and contacts of reversing contactor.

OL — Overload relays.

R — Red light . . . . lights when valve is open.

S — Pushbutton . . . . actuate to stop valve.

T — Torque switch . . . . opens motor control circuit when valve reaches seating position

Cylinder operation . . . . pages 261 to 265 Motor operation . . . . pages 266 to 270 Gear operation . . . . pages 271 to 274

Motor Operated Valves

Electrical Equipment

Control of the electric power applied to motors is accomplished through reversing contactor panels set in operation by either push button stations or special electrical equipment.

All motor operators, panels, and control stations are especially built for this service, and conform to the standards established by the National Electrical Manufacturers' Association. Those standards are commonly known as "NEMA".

Careful consideration should be given to the electrical requirements when submitting inquiries, and placing orders, for motor operated valves. Unless otherwise specified, all motors will be furnished in NEMA III Weather-Resisting Enclosures . . . . all panels and control stations in NEMA I General Purpose Enclosures.

Standard Electrical Enclosures For Motors, Contactor Panels, and Control Stations

NEMA I, General Purpose Enclosure serves as protection against dust and indirect splashing, but is not dust-tight or splash-proof.

NEMA III, Weather Resisting Enclosure is suitable for outdoor installation. It meets the requirements for splash-proof, weather-proof, sleet-proof, and moisture-resisting apparatus.

NEMA IV, Water-Tight Enclosure . . . . this is a gasketed, cast or fabricated steel case. It is water-tight and dust-tight, and meets the requirements for water-tight apparatus, but is not submersible.

NEMA VII . . . . this case is designed for hazardous locations and is generally accepted as explosion-proof.

NEMA XII, Dust-Tight Enclosure is suitable for use in cement mills, and other locations where dust must be excluded.

Reversing Contactor Panels

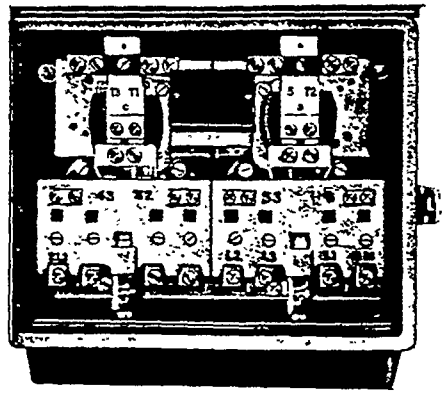
A reversing contactor panel is required for each electric motor operator unit.

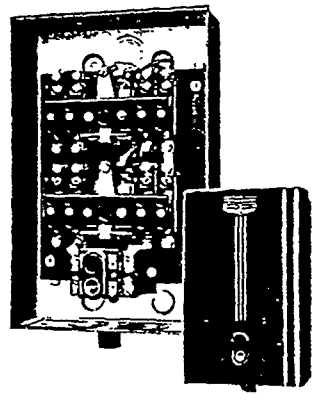
Contactor panels have been developed and designed especially for valve operation. They consist of two mechanically interlocked three-pole contactors with thermal overload protection. The mechanical interlock prevents the simultaneous operation of two opposite buttons.

Panels are furnished wired, provided with terminals, and mounted in an enclosure. Contactors employ arc quenchers for long contact life.

Disconnect switches, fusible plugs, and transformers are available and can be mounted in the panel enclosures.

Single line break contactor panels are available It is recommended, however, that double line break contactor panels be used for valve operation to prevent accidental operation of the valve in case of a ground or short circuit in the wiring.





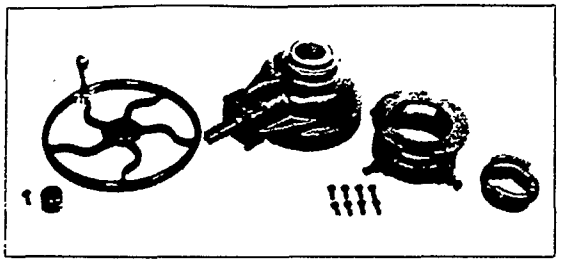
Illustrations show typical Reversing Contactor Panels. Assemblies are furnished completely wired and ready for installation. Auxiliary control equipment may be mounted in panel enclosure if desired.

For additional electrical equipment, see next page.

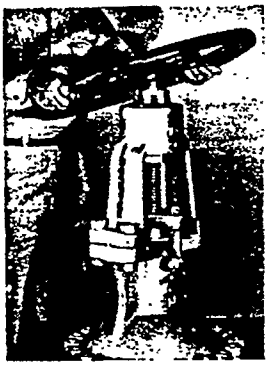
Converto-Gear Operator

For Crane Iron and Steel Gate Valves

Conversion of O. S. & Y. Gate with Ball-Bearing Yoke



The complete conversion kit consists of the Converto-Gear Operator with handwheel, yoke adapter, yoke sleeve adapter, and all necessary mounting bolts. To convert a wheel-operated valve, simply.....

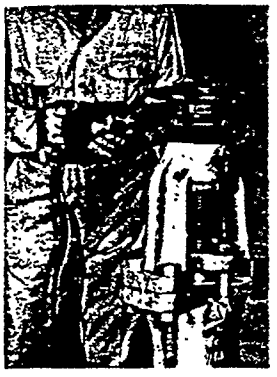


1. Remove the old handwheel.



2. Mount the yoke sleeve adapter.

23



3. Locate yoke adapter on yoke; drill centering holes through pilot plug provided.



4. Countersink four holes for adapter set screws.



5. Bolt the yoke adapter to the valve and mount the Converto-Gear Operator.



6. Bolt the operator in position, mount the handwheel, and the valve is ready for manual operation . . . .



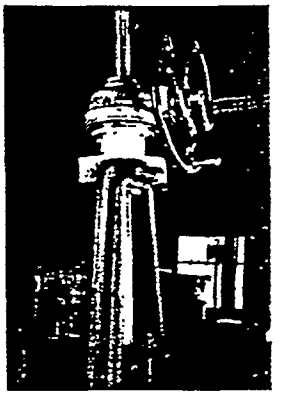
7 Or for rapid power operation with air or electricity.

For conversion of non-rising stem gate valves, see next page

Conversion of O. S. & Y. Gate With Split-Yoke



For split-yoke, outside screw and yoke gate valves, the kit provides different adapters. The operator mounting adapter attaches to bolts connecting the yoke halves.



The completed split-yoke assembly looks like this

Motor Operated Valves

General Recommendations

Rising or non-rising stem valves: The use of non-rising stem valves with motor operators is not generally recommended. The stems in such valves rotate with considerable speed and without interruption, and all of the wear takes place between the stem and the threaded bushing in the disc. Sediment or scale in the line greatly accelerates this wear, and the life of the valve is materially shortened.

In a rising stem valve, the wear is between the stem and the yoke sleeve or yoke bushing, which (being enclosed in the motor operator housing) is protected from all foreign matter. However, when clearance becomes the determining factor, non-rising stem valves can be furnished.

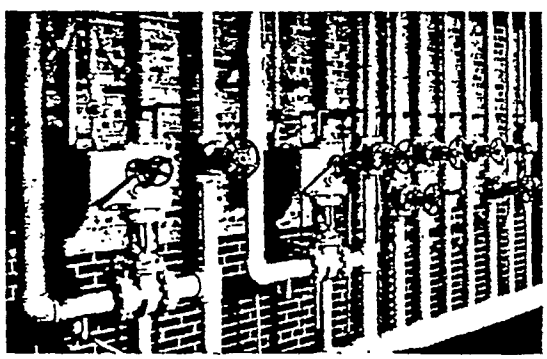
Electrical insulation: The insulation of the electric motor is important. For power plant operation, Class "B" Insulation should always be used, whereas for large water valves, or valves in a low temperature situation, Class "A" Insulation may be used.

Class "A" Insulation consists of cotton, silk, paper or other similar organic material immersed in oil or enamel as applied to conductors.

Class "B" Insulation consists of inorganic materials such as mica or asbestos, in built-up form with binding substances.

Electric current: When alternating current motors are specified, 3-phase motors are regularly furnished. Single phase motors can be supplied for small valves only, requiring not over four-tenths horse power motors.

Closing speeds: Unless otherwise specified, the closing speed of the disc on gate valves will be figured on the basis of approximately 12 inches per minute, and on globe valves, approximately 6 inches per minute. Motor units are available for closing valves at higher speeds, and if required, all details of the installation should be provided.



Air Motor Operated Crane Gate Valves (4-inch size) in the fire-water pump house of a refinery.

Information Required On Inquiries and Orders

1. Quantity, size, and end connections of valves (flanged, screwed, or welding ends).
2. Catalog number of regular valve preferred.
3. Rising or non-rising stem. See "General Recommendations" at left.
4. With or without by-pass. If by-pass is wanted, state its location in relation to the valve.
5. Service . . . . steam, water, oil, air, gas, etc.
6. Working pressure, maximum differential pressure to open against, and operating temperature.
7. Valves used for . . . . main steam, equalizing, boiler feed, circulating water, etc.
8. Information on any special conditions, such as: whether valve must close against full flow, open against full pressure, or if coking is present.
9. Maximum velocity through valve, if obtainable.
10. Position of valve run . . . . horizontal or vertical.
11. On valves with horizontal run, give position of valve stem . . . . vertical up, vertical down, horizontal, or other position.
12. Position of motor operator handwheel: parallel with or across the run of the valve.
13. Approximate maximum temperature at point where valve yoke will be located.
14. Desired closing speed of disc, in inches per minute, or all conditions if high speed closing is required.

When electric motor operator is wanted, include:

15. Electrical characteristics . . . . specify AC or DC, voltage, phase, and cycles per second; indicate whether the control circuit voltage differs from the motor voltage.
16. Panel requirements . . . . see page 267.
17. State whether open-stop-close, open-close, close-only, or open-only stations are wanted; type of enclosure, and whether lock-up or non-lock-up; number of stations per valve. See page 268.

When air or gas motor operator is wanted, include:

18. Pressure of air or gas available for operating motor (70 psi minimum, 125 psi maximum. Normal working pressure, 100 psi. Higher pressures not recommended because of increased vane friction at higher speeds).

For motor operated valve wiring diagrams, see the next page.

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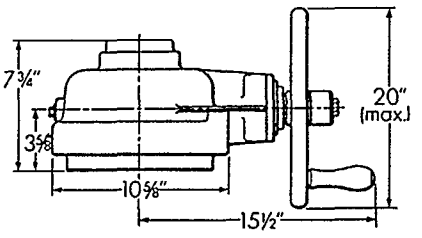
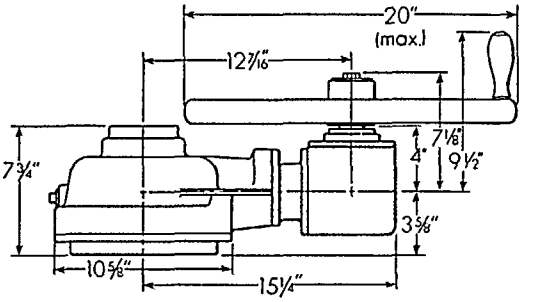
Converto-Gear Operator

For Crane Iron and Steel Gate Valves

Dimensional Data



Style N
Converto-Gear Operator



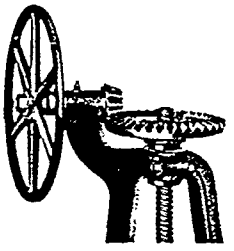
Style P
Converto-Gear Operator

The Crane Converto-Gear Operator is a self-contained unit . . . . totally enclosed and permanently lubricated. For complete description, including installation procedure on outside screw and yoke or non-rising stem gate valves, refer to the three preceding pages.

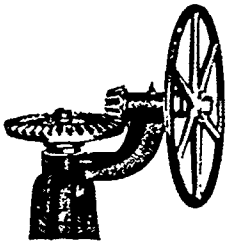
23

Special Gear Operators

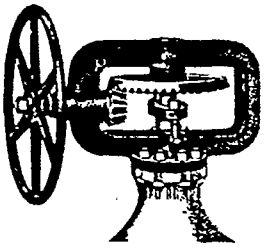
For Large Size Gate Valves or Unusual Conditions



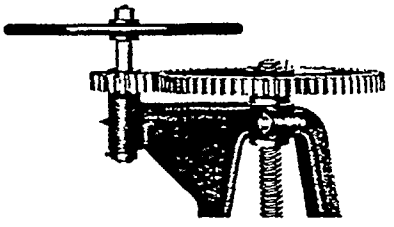
Style N
Bevel Gearing
For Outside Screw & Yoke Valves



Style O
Bevel Gearing
For Outside Screw & Yoke Valves



Style U
Bevel Gearing
For Non-Rising Stem Valves

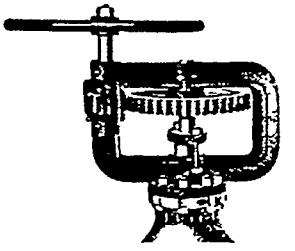


Style P
Spur Gearing
For Outside Screw & Yoke Valves

The larger size Crane iron body, Ferrosteel, and steel wedge or double disc gate valves can be equipped with gears to facilitate operation, when orders so specify.

Bevel gearing: Non-rising stem valves ordered with bevel gearing will regularly be furnished with Style U gearing, the pinion shaft extending at right angles to the run of the valve. They can also be furnished with the shaft parallel to the run, when specified.

With Style N bevel gearing for outside screw and yoke valves, the pinion shaft extends at right angles to the run of the valve; with Style O, parallel to the run. Unless otherwise ordered, Style N is furnished



Style S
Spur Gearing
For Non-Rising Stem Valves

For additional gear operator information, see pages 271 to 273

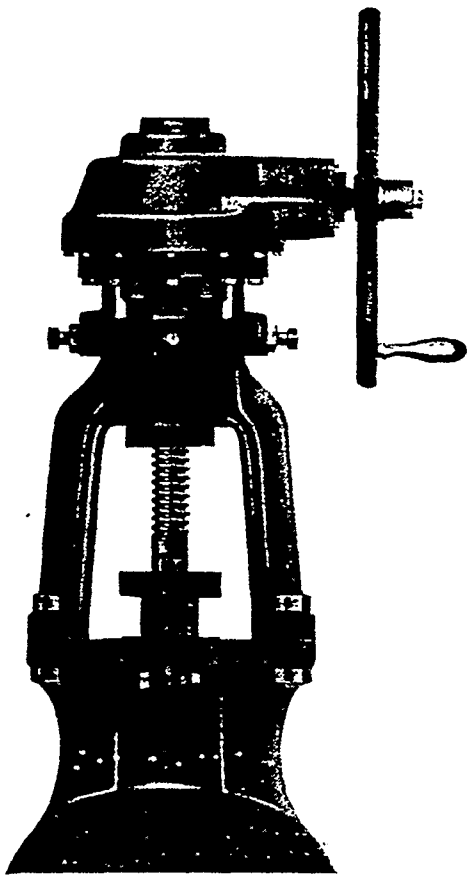
For gearing for steel globe and angle valves, see page 149

Converto-Gear* Operator

For Crane Iron and Steel Gate Valves

The Crane Converto-Gear Operator answers a long-felt need for a standardized, easily mounted gear operator for gate valves. The ordinary gearing supplied with gate valves is often bulky and awkward in installation. Gears are usually of the straight-cut type, requiring high ratios for easy operation, but conversely, resulting in a great many turns of the handwheel to operate the valve. Because the valve is frequently exposed to the weather, or lubrication is uncertain, operation of the valve becomes needlessly difficult.

All of the deficiencies of this old-style gearing are corrected in the Converto-Gear Operator. It is a completely self-contained unit, totally enclosed and permanently lubricated. Light enough to be handled by one man, the Converto-Gear Operator is standard and universal, readily adapted to all Crane iron, Ferrosteel, and steel gate valves having a stem diameter of 2½ inches or less. Special yokes or yokes with cast-on brackets are not required. The Converto-Gear Operator utilizes only a simple two-piece adapter for mounting on the valve body.



Converto-Gear Operator For Crane Iron, Ferrosteel, and Steel Gate Valves
(Patent Pending)

23

Field Conversion

Because of the factors noted above, this new operator may be field-mounted on Crane iron, Ferrosteel, and steel gate valves without removing the valves from the line . . . . and on outside screw and yoke valves, without removing any parts of the valve except the wheel. On non-rising stem valves, both the handwheel and the original stuffing box must be removed. Conversion to gear operation is rapid, ordinarily requiring less than 30 minutes to perform.

Factory Installation

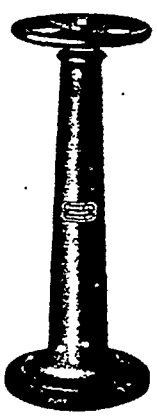
On new orders for gear operated valves, the Converto-Gear unit is simply mounted on a valve from stock. Because special adaptations are not needed, delivery time is very short.

The Converto-Gear Operator employs hardened spiral-cut bevel gearing of a 4.11 to 1 ratio. Efficiency through the gearing is 95%, resulting in extremely easy valve operation. Anti-friction bearings are used at three points in the gear operator, to further reduce operating effort.

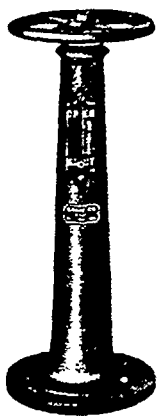
Conversion of Outside Screw and Yoke Gate Valves to Gear Operation.....page 272
Conversion of Non-Rising Stem Gate Valves to Gear Operation.....page 273
Clearance Dimensions.....page 274
Features of the Converto-Gear.....page 274

**The term "Converto-Gear" is a Crane Co. trademark . . . registration pending in the U.S. Patent Office*

Floor Stands



Without Indicator



With Indicator

Prices on Request

For use with stems of 2 7/8-inch diameter or smaller.

For use with stems of 2 1/8-inch diameter or smaller.

23

Weights and Dimensions

Floor Stand Height Inches	Pounds, Each		Base Dimensions, In.		
	Without Indicator	With Indicator	Diameter	Dia. of bolt circle	Size of four holes
20	25	26	9 1/8	7 3/4	9/16
32	70	75	14	12 3/8	9/16

When equipped with the proper extension stem, these floor stands are suitable for operating either non-rising or rising stem valves. As regularly furnished, they include a wheel and wheel stem coupling but not an extension stem, valve stem coupling, or yoke sleeve coupling. Floor stands with indicator include the complete indicator parts.

Applicable valves: The 20-inch high floor stands are for use with valves having a handwheel of 8-inch diameter or smaller. The 32-inch high floor stands are used with valves having a handwheel diameter larger than 8-inch.

Regular floor stands without indicator are furnished for use with stems of 2 7/8-inch diameter or smaller, and those with indicator, for use with stems of 2 1/8-inch diameter or smaller.

When so specified, the 20-inch floor stands can be made to order suitable for use with handwheels and stems of a larger diameter than indicated above.

Finishes: The floor stands are regularly furnished with any one of the following three finishes, as specified:

1. With painted column and japanned handwheel.
2. With finished column and japanned handwheel.
3. With finished column; the rim and hub of the handwheel finished and the spokes japanned.

Bell bottom base: Floor stands with a bell bottom base can be furnished to order; information on request.

Extension stem: Extension stems, described on the facing page, are furnished only when specified; an extra charge applies. For ordering instructions, see below.

Directions for Ordering

Floor Stands Only

For Crane valves, specify:

1. The floor stand style (whether with or without indicator), the finish, and the height.
2. The size and catalog number of the valve and whether it opens by turning to the right or left.
3. The purchase date of the valve and its complete markings.

For other than Crane valves, specify:

1. The floor stand style (whether with or without indicator) and the finish.
2. The valve type, size, and number and whether it opens by turning to the right or left.
3. Name of valve manufacturer.
4. The diameter of the valve handwheel and the number of turns necessary to open the valve.
5. The dimension from the centerline of the valve to the top of the present handwheel. For globe and angle valves, show this dimension for both the open and the closed positions.

Floor Stands With Extension Stems

For Crane valves, specify:

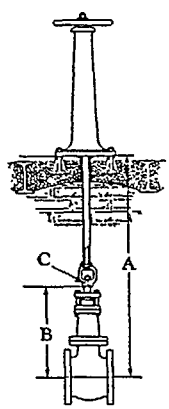
1-3. Same as requested in "1 to 3" directly to the left.

4. Dimension A; center of valve port to the floor level.
5. Details, description, and proximity of structural members or walls available for support of long extension stems.

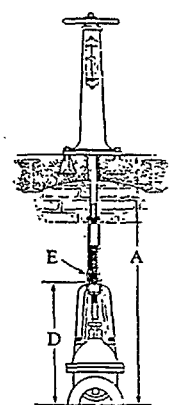
For other than Crane valves, specify:

1-5. Same as for "1 to 5" at left.

6. Dimension A; center of valve port to the floor level.
7. Details, description, and proximity of structural members or walls available for support of long extension stems.
8. For globe, angle, or non-rising stem gate valves, include:
   (a) Dimension B; center of valve to bottom of square on the stem.
   (b) Dimension C; detail dimensions of the square on the stem.
9. For outside screw and yoke gate valves, include:
   (a) Dimension D; center of valve to bottom of hub on the handwheel.
   (b) Dimension E; detail dimensions of that part of the yoke sleeve on which the handwheel fits.



Non-Rising Stem Gate Valve with Floor Stand



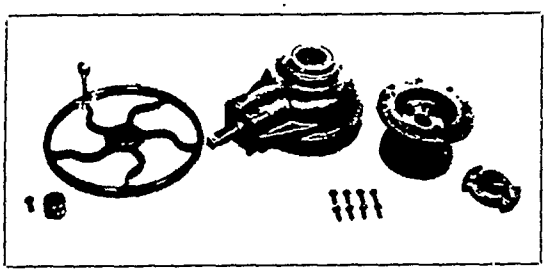
O. S. & Y. Gate Valve with Floor Stand

Unless otherwise ordered, extension stems are made of Extra Strong Pipe. Unusually long stems must be properly supported.

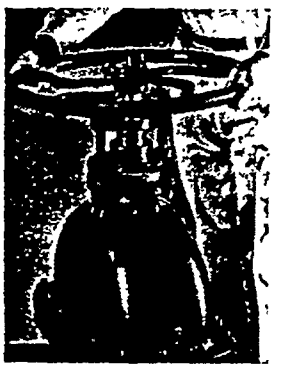
Converto-Gear Operator

For Crane Iron and Steel Gate Valves

Conversion of Non-Rising Stem Gate Valves



The conversion kit is similar to that used for outside screw and yoke gate valves (see facing page) except for variations in the adapters. Bonnet adapter includes a stuffing box containing a high grade packing.



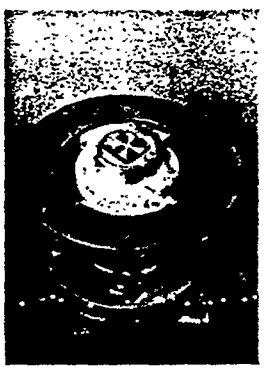
1. Remove the old handwheel.



2. Take off packing gland and old stuffing box.



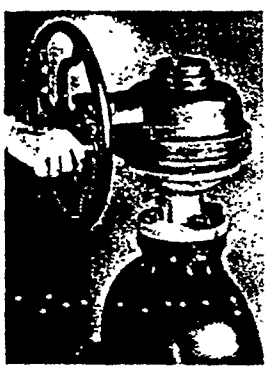
3. Mount the bonnet adapter, using stuffing box bolts.



4. Locate stem adapter on square end of valve stem.



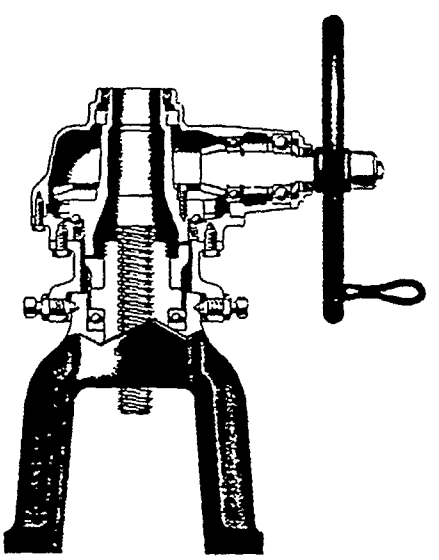
5. Mount the Converto-Gear Operator and bolt in place.



6. Bolt on the handwheel; valve is ready for manual operation

23

Features of the Crane Converto-Gear Operator



The cross section at the right and the text below point out some of the fine construction features of the Crane Converto-Gear Operator.

Cast housing is highly impact-resistant.

Anti-friction bearings are used at three points to reduce operating effort.

Carburized, alloy steel gears are of spiral bevel design . . . . offer 95 per cent operating efficiency. Gear ratio is 4.11 to one.

Entire unit is sealed and permanently lubricated.

Converto-Gear Operator dimensions....page 274
Special gear operators .....page 274

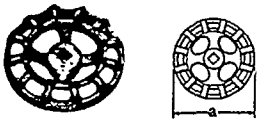
Wheels and Handles for Valves



Style A Wheel
Square or Threaded Hole, as Ordered

An easy-to-grip wheel of a dished design with oval rim. Made of malleable iron.

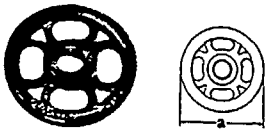
Square hole type used on small size steel globe and angles, pages 137 to 141. Threaded hole type is used on small size outside screw and yoke steel gates shown on pages 117 to 120, on various corrosion-resistant valves, and on 2-inch diaphragm valves.



Style F Wheel
Square Hole

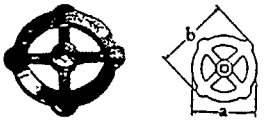
Non-heat, round pattern wheels. Die cast in diameters 4 1/16-inch and smaller and malleable iron in larger diameters.

Widely used on the smaller size bronze, iron, and steel globe, angle, and gate valves (but not on the outside screw and yoke gates); also used on 18-8 SMo plug gate valves and on bronze garden and angle hose valves.



Style M Wheel
Threaded Hole

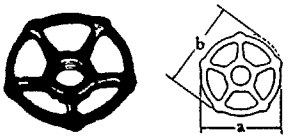
A round-rimmed wheel made of malleable iron. Used only on No. 459 Gate Valves shown on page 26.



Style N Wheel
Square Hole

A polished bronze wheel, known as "Navy" Four-Ball Pattern. Used on special polished valves.

23



Style B Wheel
Threaded Hole

A malleable iron wheel similar to Style A above. Used on 1 1/2-inch and smaller diaphragm valves.



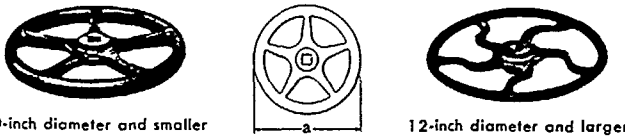
Style L Wheel
Square Socket

Made of a black, molded composition material. Used on bronze radiator valves and on special polished valves.



Style K Lever Handle
Square Hole

Made of malleable iron. Used on smaller size hydraulic bronze and steel globe and angle valves.



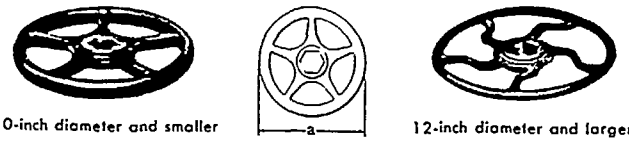
Style D Wheel — Square Hole

Oval rim wheels made of malleable iron. Used on larger size diaphragm valves and on larger size bronze, iron, steel, and corrosion-resistant globe, angle, and gate valves (but not O. S. & Y. Gates); also used on bronze hose gate valves and on the 2 1/2-inch angle hose valve.



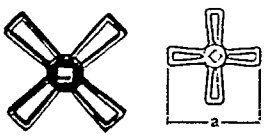
Style S Tee Handle
Square Hole

Made of malleable iron. Used on No. 50 Hose Valves, bar stock valves, and on some lip-seal bonnet and corrosion-resistant globe valves.



Style E Wheel — Hexagon or *Threaded Hole

Malleable iron wheels similar to the Style D above. Hexagon hole type is used on outside screw and yoke iron, steel, and corrosion-resistant gate valves. *The 6 and 7-inch diameter wheels are also available with threaded hole for use on the outside screw and yoke steel gate valves shown on pages 117 to 120.



Style X Cross Handle
Square Hole

Made of malleable iron. Used on some corrosion-resistant valves.

General data and dimensions . . . . page 279

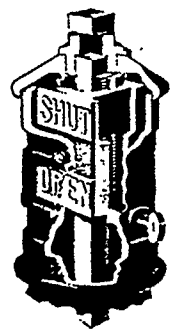
Sizes of wheels for AAR Valves. . . .page 42
How to order wheels and handles. .page 279
Chain wheels. . . . . .page 280

Indicator Posts



No. 520
Applied to
No. 462
Gate Valve

Standard Pattern



Enlarged Sectional View of Head
No. 520 Post

Ordering

When ordering an indicator post for a Crane valve, specify the catalog number of the post, the size and catalog number of the valve with which it will be used, and the depth of the trench (distance from ground level to bottom of pipe line).

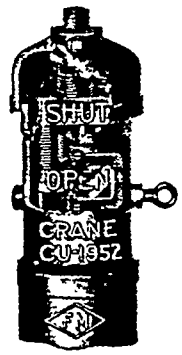
For posts for valves other than Crane, refer to "Special indicator posts" below.

Trench Depths

Indicator posts are not adjustable; they are supplied to suit the exact trench depth specified by the customer.

When extremely shallow trench depths make it necessary, indicator posts having an integral base (not shown) are furnished.

Underwriters' Pattern



Enlarged Sectional View of Head
No. 510 Post



No. 510
Applied to
No. 462½
Gate Valve

Catalog No.	Weights Pounds, per Post With Wrench	For Trench Depths Of 2 to 6 Feet* Price, per Post With Wrench	For Trench Depths Over 6 Feet Add, For Each 6" Over 6 Feet	Distance from Ground Level To Top of Post Inches
No. 520	90	(on request)	(on request)	33¼
No. 510	109			38

Specify the exact trench depth. The minimum depth for No. 510 Post for the 10-inch No. 462½ Valve is 2½ feet.

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Recommendations: Crane Indicator Posts provide an ideal means for operating iron body nonrising stem gate valves buried underground. They are used principally in factory and mill yards, on valves for fire protection service.

The Standard Pattern, recommended when the Underwriters' Pattern is not required, is suitable for valves 2 to 12-inch inclusive. It is generally used with the No. 462 Gate Valves shown on page 74.

The Underwriters' Pattern, approved by the Underwriters' Laboratories, Inc., and the Factory Mutual Laboratories, is used with No. 462½ Underwriters' Pattern Gate Valves shown on page 79. The post is marked "CU" and "FM".

Construction: Crane Indicator Posts are sturdily constructed of cast iron. Each post is furnished with an angle wrench which can be locked or sealed at the side of the post when not in use. The operating nut is 1¼ inches square.

The word "OPEN" or "SHUT", in large, easily read letters, appears behind the indicator glass when the valve is open or closed, respectively. The lower plate, marked "OPEN", is adjustable, and its position is changed to suit the size of the valve. The indicator opening is fitted with a heavy plate glass ½-inch thick; small openings under the cap ventilate the entire post and prevent accumulation of moisture on the glass in cold weather.

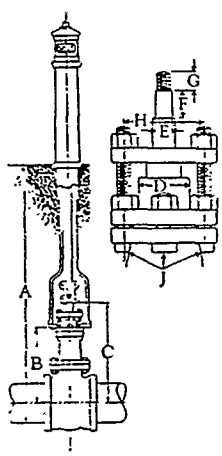
Attaching post to valve: These posts have the standard N.F.P.A. (National Fire Protection Association) flange for attachment to the valve; the operating rod has a socket for the valve stem.

When No. 462 Gate Valves are ordered for use with an indicator post, they are furnished with an indicator post flange bolted on the bonnet at no extra charge. When the No. 520 Indicator Post is required for valves already installed and not equipped with a flange, a separate adaptor plate for the valve is furnished with the post at no extra charge.

No. 462½ Gate Valves used with the No. 510 Indicator Post are furnished regularly with an indicator post flange cast integral with the bonnet.

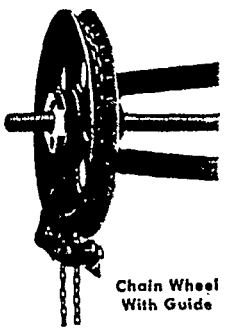
Special indicator posts: Indicator posts for nonrising stem gate valves other than Crane can be made to order at a special price. When ordering, specify the name of the valve manufacturer, the valve size, whether it opens by turning to the right or left, the number of turns to open, and the following dimensions:

A — Depth of trench
B — Center of pipe to top of stuffing box flange
C — Center of pipe to bottom of valve stem square
D — Diameter of stuffing box
E — Size of stem square
F — Height of stem square
G — Length of stem thread
H — Stuffing box bolt circle
J — Number and diameter of stuffing box studs and/or bolts.



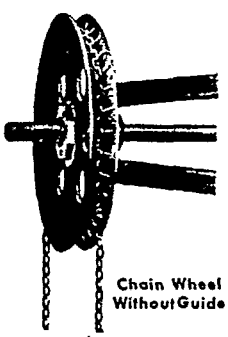
Chain Wheels with Guides
For Bronze, Iron, and Steel Valves

Rugged, dependable, guide-equipped chain wheels for quick, easy operation of hard-to-reach valves . . . . available without guide when specified.



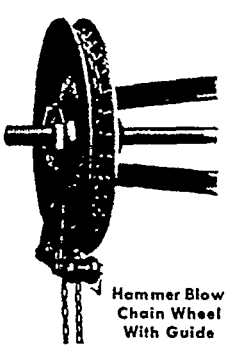
Chain Wheel With Guide

Chain wheels regularly include a guide, as shown above. Chains are extra.



Chain Wheel Without Guide

Chain wheels are available without a guide but only when orders so specify.



Hammer Blow Chain Wheel With Guide

Hammer blow chain wheels with guide are available for large size and high pressure valves.

Chain wheels above are applied to rising stem gate valves. Applications on non-rising stem gate valves and on globe and angle valves, although not illustrated, are similar.

For convenience in operating valves located above a normal reach from floor levels, Crane Chain Wheels with Guides are ideal. They are made from high quality cast iron, are unusually rugged and serviceable, and are designed to provide a positive grip on the chain under the most severe operation.

Through a unique hub design, these chain wheels are easily attached and locked to valves in service. An instruction tag is supplied with each wheel.

Guides: Crane chain wheels regularly include a guide. Guides for chain wheels of 7½-inch pitch diameter and larger are equipped with rollers, as illustrated; guides for smaller size chain wheels have plain loops.

Crane Guides hold the chain in close contact with a large portion of the circumference of the wheel, preventing slipping or jumping of the chain.

Hammer blow chain wheels: When chain wheels are desired for the operation of large size or high pressure valves, additional power is usually necessary for the first effort in unseating the disc, and in the final movement, to effect tight seating. For conditions such as these, a hammer blow chain wheel is recommended.

The design of the Crane Hammer Blow Chain Wheel embodies a "lost motion," wherein the wheel turns freely through a large angle, building up momentum until the heavy operating lugs engage. The resulting "hammer blow" acts upon the valve stem, facilitating opening and closing the valve.

Hammer blow chain wheels are available in pitch diameters of 7½-inch and larger; they are regularly equipped with a guide.

Ordering: Chain wheels with guide (upper left illustration) are furnished *unless orders definitely state that no guide is desired.* In either case, orders must specify the pitch diameter of the chain wheel and the size and catalog number of the valve for which it is intended.

When valves are ordered with chain wheel and guide equipment, the equipment is not mounted on the valve but is packed separately. If the valves use chain wheels of 7½-inch pitch diameter or larger, the valves will be shipped without their regular handwheels.

Chains: Chains can be furnished. Specify length desired and the pitch diameter of the chain wheel for which the chain is intended. Links for connecting the chain ends are also furnished.

Weights and Application of Chain Wheels — Prices on Request
Chain wheels will be furnished with a guide unless ordered "without guide".

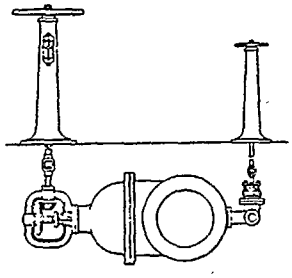
Pitch diameter of chain wheel	Pounds, Each		Application of Chain Wheels — Chain wheels are applicable to valves having a square or hexagon hole wheel or handle of the styles and sizes indicated below:					
	Chain Wheel & Guide	Chain Wheel Only	Style A Wheel*	Style D Wheel	Style E Wheel*	Style F Wheel	Style K Handle	Style S Handle
	For use with rising or non-rising stem valves with square or hexagon hole wheel*		Size	Size	Size	Size	Size	Size
Inches			Inches	Inches	Inches	Inches	Inches	Inches
2⅜	3.0	1.5	3	3½	...	2¾, 3 1/16	3½, 3⅞	4⅛, 4½
3	4.0	2.0	3½	...	..	3⅝, 4 1/16	4¼, 4⅝	4¾, 6
4	5.0	3.5	4, 5	4½, 5½	...	4¾, 5⅜	5	7
5	7.0	5.0	...	6, 7	...	...	5¾	...
7½	21.0	13.0	...	8, 9	6, 7, 8, 9	...	...	...
10	31.0	20.0	...	10, 12	10, 12	...	...	...
14	54.0	41.0	...	14, 16	14, 16	...	...	...
18	83.0	65.0	...	18, 20, 22	18, 20, 22	...	...	...
24	134.0	112.0	...	24, 27	24, 27	...	...	...
30	175.0	145.0	...	30, 36	30, 36	...	...	...

*Chain wheels for valves with threaded hole wheels are made to order, information on request.

Size of hole in chain wheels, valve wheels, or valve handles.....page 279

Floor Stands

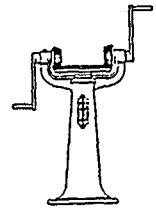
Typical Applications and Special Designs



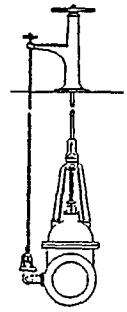
Application E
Floor stands applied to gate valve with by-pass in horizontal position



Application F
Floor stand with single bevel gearing and handwheel



Application G
Floor stand with double bevel gearing and crank handles



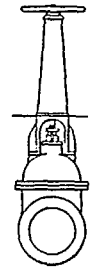
Application K
Floor stand with arm for operating by-pass



Application L
Bell bottom floor stand used on non-rising stem gate valve projecting above floor line

The floor stands shown on the opposite page can be used to operate globe or angle valves or rising or non-rising stem gate valves, either with or without gearing. These meet the requirements of ordinary installations.

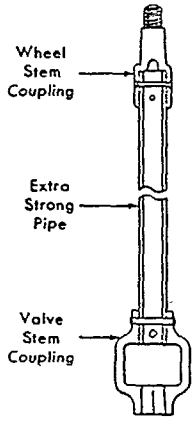
In addition, floor stands of special designs and for special installations, such as illustrated on this page, can be made to order. Inquiries and orders should indicate clearly what is wanted and be accompanied with a sketch including all known dimensions. The dimension from the center of the valve port to the floor line is extremely important and should be determined as accurately as possible.



Application J
Wide bottom floor stand used on rising stem gate valve projecting above floor line

23

Extension Stems

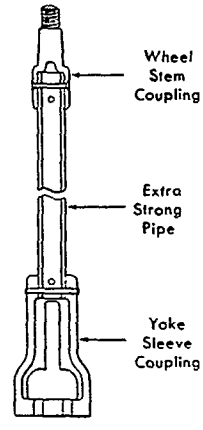


Extension Stem
For non-rising stem gate valves and all globe and angle valves

Extension stems are frequently required for valves that are to be operated from a distance. Ordinarily, a floor stand is used to support the stem and handwheel, but in many installations the extension stem only is used. Extension stems that are long, must be rigidly and properly guided with supporting brackets.

Extension stems for non-rising stem gate valves and for all globe and angle valves are furnished with a wheel stem coupling suitable for a square hole handwheel and a valve stem coupling to fit the square on the valve stem. Those for outside screw and yoke gate valves have the same type wheel stem coupling, but have a hexagon hole yoke sleeve coupling designed to absorb the rise of the valve stem, thus effecting non-rising operation of the extension stem.

Wheels are not furnished with extension stems for non-rising stem valves since the square hole wheel on such valves can be relocated on the floor stand. New square hole wheels are required, however, for outside screw and yoke valves.



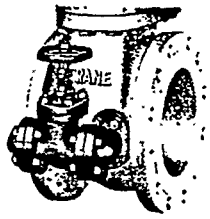
Extension Stem
For rising stem outside screw and yoke gate valves

Inquiries and orders should specify the length of the extension stem measured from the center of the valve port to the bottom of the square on the wheel stem coupling. For use on Crane valves, include the size and catalog number of the valve, the year of purchase and the complete valve markings. For use on valves not of Crane manufacture, include the information requested in lines 2 to 5, 8, and 9 on facing page. Unless otherwise ordered, extension stems are made of Extra Strong pipe.

Prices on Request

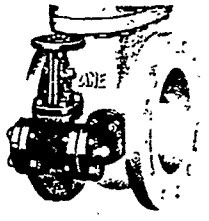
By-Passes for Iron Body Gate Valves

Non-Rising Stem Valves with By-Pass For Water Service



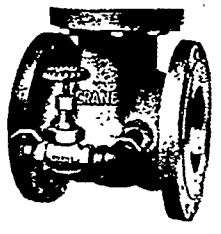
For water service, when the main valve is the non-rising stem gate type, the valve in the by-pass will also be a non-rising stem gate.

Outside Screw & Yoke Valve with By-Pass For Water Service



For water service, when the main valve is the outside screw and yoke gate type, the valve in the by-pass will also be an outside screw and yoke gate.

Non-Rising Stem or Outside Screw & Yoke Valve with By-Pass For Steam Service



For steam service, whether the main valve is the non-rising stem or the outside screw and yoke gate type, the valve in the by-pass will be the globe type.

Prices: Additional information and prices of by-pass valves will be furnished on request

The larger sizes of Crane iron body gate valves .... wedge and double disc types with flanged or hub ends .... can be equipped with a by-pass when orders so specify.

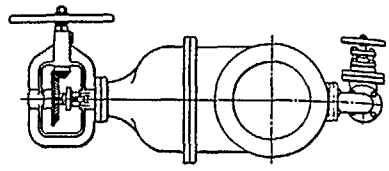
The by-pass facilitates operation of the main valve by equalizing the pressure on both sides of the main valve disc and, in the case of steam service, permits a slow warm-up on the outlet side before the main valve is opened.

By-pass types: As indicated in the table, Crane 125 and 250-pound wedge gate valves and 25, 200, and 500-pound WOG double disc gate valves can be supplied with a large size by-pass suitable for water (or oil or gas).

The valve in the by-pass is a gate valve. It is a non-rising stem valve if the main valve is such, or an outside screw and yoke valve if the main valve is such.

Similarly, the by-pass valve is bronze trimmed if the main valve is bronze trimmed, and all-iron if the main valve is all-iron.

Crane 250-pound wedge gate valves, for steam service, are available with a globe valve in the by-pass.



Unless otherwise ordered, bevel geared valves with by-pass will have the by-pass on the bottom of the main valve.

Position of by-pass: On valves without gearing and on spur geared valves, the by-pass valve is regularly attached to the side of the main valve, with the stem of the main valve and of the by-pass valve parallel, pointing vertically upward, as shown in the illustrations at the left.

On bevel geared valves, the by-pass valve is regularly mounted on the bottom of the main valve, as shown above.

If the by-pass is desired in a position other than regularly furnished, orders must so specify.

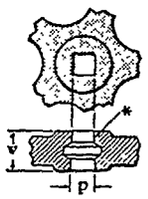
Dimensions: For dimensions of wheel operated valves with by-pass, refer to the catalog page showing the main valve for which the by-pass is intended; for page references, see table below.

Main Valves and Applicable By-Pass Valves

Main Valve Flanged or Hub Ends				By-Pass Valve Type and Size (Inches)		
Valve Type	Pressure Class	Catalog Page Reference	Size	Non-Rising Stem Gate	Outside Screw and Yoke Gate	Globe
			Inches	For Water	For Water	For Steam
Wedge Gate	125-Pound	page 75 or 77	12 and 14	2	2	...
			16 to 20	3	3	.
			24 and 30	4	4	.
			36 and 42	6	6	..
			48	8	8	.
	250-Pound	page 81	5 and 6	1¼	1¼	¾
			8	1½	1½	¾
			10	1½	1½	1
			12	2	2	1
Double Disc Gate	25-Pound WOG	page 93	14	2	2	
			16 to 20	3	3	
			24 and 30	4	4	
			36 and 42	6	6	
			48	..	8	
	200-Pound WOG	page 95	12 and 14	2	2	
			16 to 20	3	3	
			24	4	4	
	500-Pound WOG	page 96	6	1¼	1¼	
			8 and 10	1½	1½	
			12	2	2	

By-passes for steel bolted bonnet gate valves.....page 129
By-passes for steel pressure-seal bonnet gate valves....page 174
Additional information on location of by-passes.....page 403

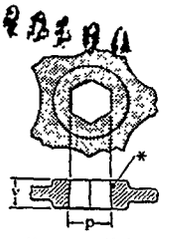
Wheels and Handles for Valves



Square Hole Wheel or Handle

The table below shows sizes (a) of all wheels and handles described on the preceding page, as well as the hole size (p) and hub length (v) of those having a square or hexagon hole. Wheels and handles with the same hole size and same hub length are interchangeable.

Caution: When substitution of wheels and handles involves the use of a size larger than that regularly furnished with the valve, consideration must be given to the effect of the increased power which will be obtained; recommendations will be furnished on request.



Hexagon Hole Wheel

*Total taper per foot is ¾ inches

Sizes, Weights, Dimensions, and Chain Wheel Pitch Diameters — Prices on Request

For illustrations showing dimensions (a) and (b), see facing page; for illustrations showing (p) and (v), see this page.

Size, Inches (a)	Weight Pounds Each	Dimensions, in Inches (b)	(p)	(v)	Chain wheel pitch dia. Inches
Style A Wheel — Square Hole					
2½	.4	2 1/16	.24	.35	...
†3	.5	3¼	.29	.44	...
†3	.5	3¼	.40	.44	2⅜
3½	.6	3⅞	.40	.56	3
4	.8	4 7/16	.53	.62	4
5	1.3	5½	.53	.62	4
Style A Wheel — Threaded Hole					
2½	.4	2 1/16	...	...	...
3	.5	3¼	...	...	...
3½	.6	3⅞	...	...	...
4	.8	4 7/16	...	...	...
5	1.3	5½	...	...	...
Style B Wheel — Threaded Hole					
2	.3	2 3/16	...	...	...
2¼	.4	2 7/16	...	...	...
2½	.5	2 11/16	...	...	...
3	.6	3¼	...	...	...
4	.8	4 7/16	...	...	...
Style F Wheel — Square Hole					
1½	.04	...	.20	.30	...
1¾	.07	...	.24	.35	...
2 1/16	.09	...	.29	.35	...
2 9/16	.12	...	.32	.40	...
2¾	.20	...	.35	.44	2⅜
3 1/16	.26	...	.40	.44	2⅜
3⅝	.37	...	.42	.44	3
4 1/16	.5	...	.45	.56	3
4¾	.7	...	.53	.62	4
5⅜	1.1	...	.53	.62	4
Style N Wheel — Square Hole					
1½	.8	1¾	.20	.30	...
1¾	.9	2	.24	.35	...
2	1.0	2⅜	.29	.35	...
†2½	1.5	3	.32	.40	...
†2½	1.5	3	.35	.44	2⅜
3	2.0	3½	.40	.44	2⅜
3½	2.5	4⅛	.42	.44	3
4	3.0	4⅝	.45	.56	3
5	4.0	5⅝	.53	.62	4
6	4.5	6⅝	56	.87	5
Style D Wheel — Square Hole					
3½	.6	.35	.44	2⅜	
4½	1.5	.37	.62	4	
5½	2.2	.44	1.00	4	
6	2.3	.56	.87	5	
7	3.5	.63	1.00	5	
8	4.2	.69	1.06	7½	
9	5.8	.75	1.19	7½	
†10-S	7.0	.81	1.25	10	
†10-L	7.0	.87	1.37	10	
12	9.0	.94	1.50	10	
14	3.0	1.00	1.62	14	
16	5.0	1.13	1.75	14	
18	19.0	1.25	1.87	18	
20	23.0	1.31	2.12	18	
22	33.0	1.44	2.37	18	
24	38.0	1.50	2.44	24	
27	47.0	1.75	2.50	24	
30	85.0	1.87	2.75	30	
36	148.0	2.00	3.25	30	
42	168.0	2.50	3.50	...	
Style E Wheel — Hexagon Hole					
6	2.4	.99	.69	7½	
7	3.5	.99	.69	7½	
8	4.0	1.16	.75	7½	
9	6.0	1.35	.87	7½	
†10-S	6.7	1.54	.87	10	
†10-L	6.7	1.67	.87	10	
12	8.7	1.86	1.00	10	
14	12.0	2.05	1.06	14	
16	15.0	2.31	1.19	14	
18	20.0	2.38	1.31	18	
20	23.0	2.75	1.31	18	
22	32.0	3.27	1.50	18	
24	40.0	3.46	1.62	24	
27	47.0	3.53	1.69	24	
30	64.0	4.03	1.75	30	
36	115.0	4.56	2.19	30	
†42	140.0	5.16	2.75	...	
†42	140.0	5.75	2.75	...	
Style E Wheel — Threaded Hole					
6	2.4	...	...	...	
7	3.5	...	...	...	
Style L Wheel — Square Socket					
1⅝	.05	...	...	...	
2	.08	...	...	...	
2¼	.10	...	...	...	
2½	.15	...	...	...	
2¾	.20	...	...	...	
3	.24	...	...	...	
Style M Wheel — Threaded Hole					
3 5/16	.6	...	...	...	
3⅝	.7	...	...	...	
3⅞	.8	...	...	...	
4⅜	.8	...	...	...	
4 13/16	.9	...	...	...	
5¾	1.1	...	...	...	
6 11/16	2.0	...	...	...	
Style K Handle — Square Hole					
3⅛	.12	.29	.35	...	
3 5/16	.19	.32	.40	...	
3½	.25	.35	.44	2⅜	
3⅞	.3	.40	.44	2⅜	
4¼	.4	.42	.44	3	
4⅝	.5	.45	.56	3	
5	.6	.53	.62	4	
5¾	1.0	.56	.87	5	
Style S Handle — Square Hole					
†2 9/16	.14	.24	.35	...	
†2 9/16	.14	.29	.35	...	
3 9/16	.20	.32	.40	...	
4⅛	.23	.40	.44	2⅜	
†4½	.27	.35	.44	2⅜	
†4½	.27	.40	.44	...	
4¾	.3	.42	.44	3	
6	.6	.45	.56	3	
7	.7	.53	.62	4	
Style X Handle — Square Hole					
†3	.2	.24	.35	...	
†3	.2	.29	.35	...	
†3¾	.3	.32	.40	...	
†3¾	.3	.35	.44	2⅜	
†4¾	.4	.40	.44	2⅜	
†4¾	.4	.42	.44	3	
6	.8	.45	.56	3	
7	1.1	.53	.62	4	

†The dagger mark indicates wheels or handles made with two sizes of squares or hexagons When ordering such sizes, always include the size and catalog number of the valve on which the wheel or handle will be used

How to order: Specify size and style of wheel or handle...or size and catalog number of valve Valve dimension tables in the catalog include the wheel or handle size. The style can be determined from valve illustrations and the size, or from data shown on this and the preceding page.

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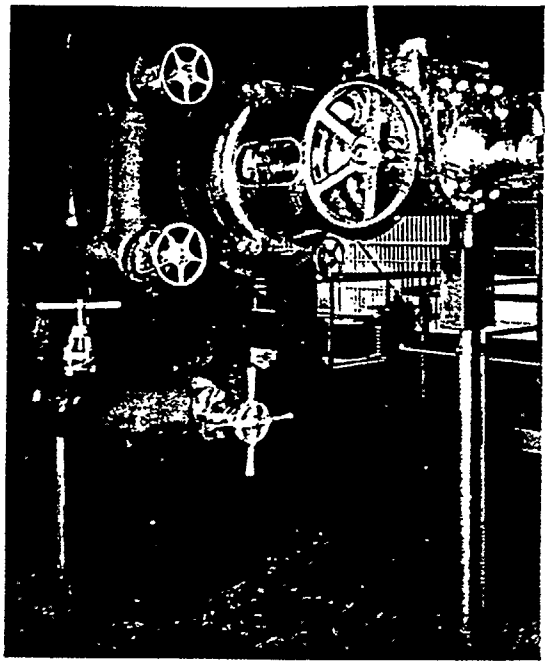
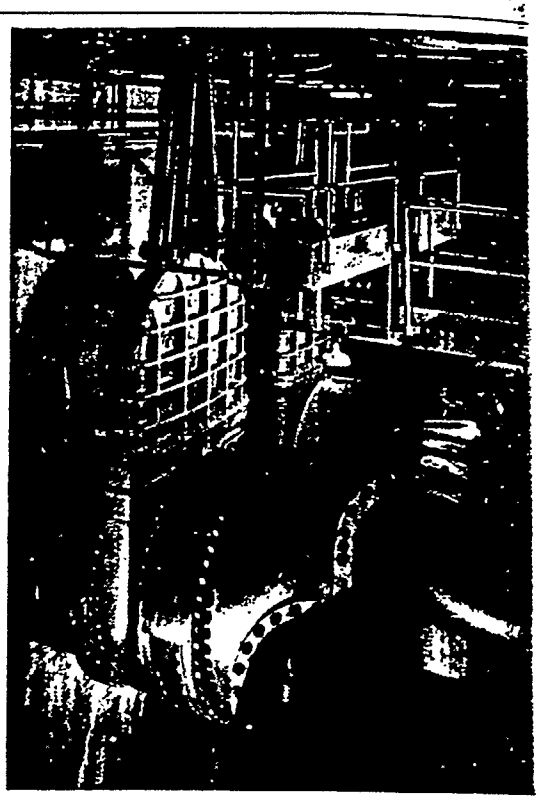
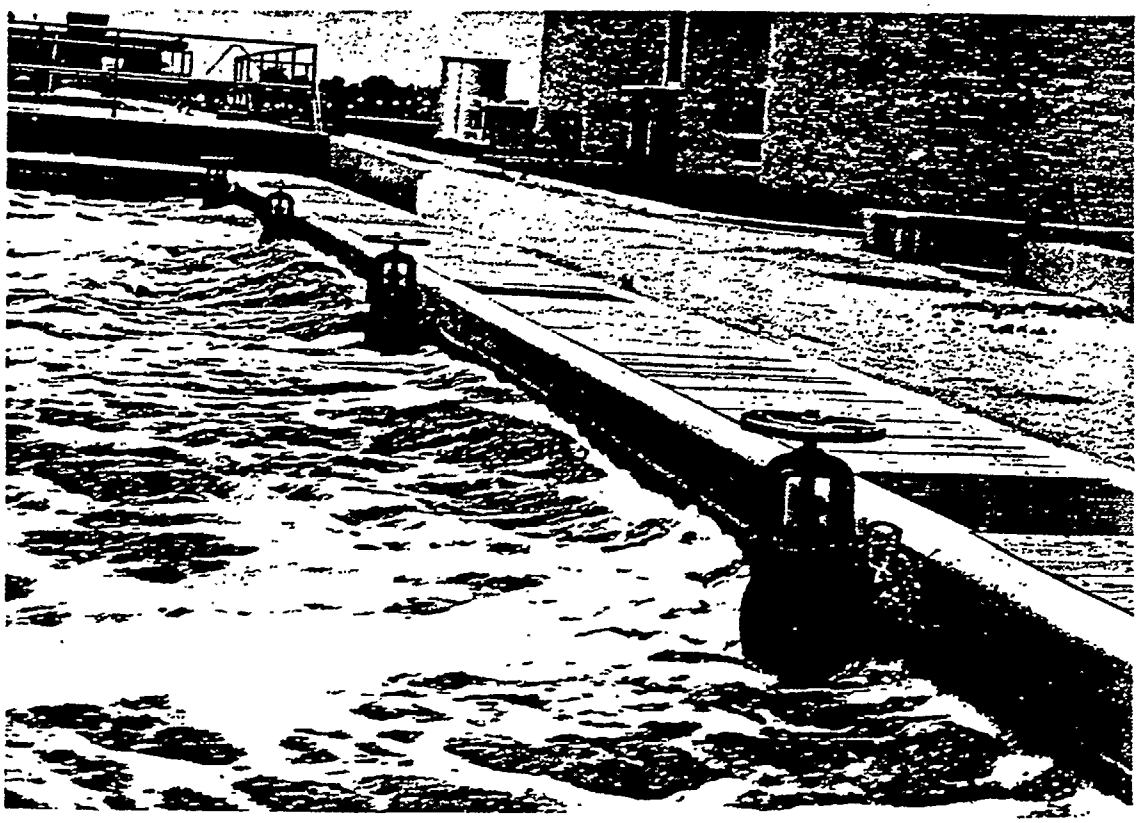
Industry supplies the service—
Crane supplies the equipment



A 2500-pound alloy steel pressure-seal bonnet valve equipped with a motor operator.



Large Crane iron body double disc gate valves (pages 92 and 93) in a low pressure installation.

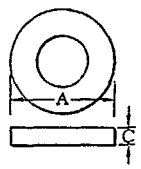


Iron body Crane angle valves (Section 10) on aerator tank service in a sewage disposal plant.

Composition Discs

High quality renewable discs designed for tight seating and long service.

Crane composition discs are made from high quality materials . . . . compounded, cured, and tested for the recommended services. All of the discs are molded and vulcanized. Constant study, research, and control assure uniformity in composition and serviceability.





No. 1, Cranite Disc
Sizes ⅛ to 3-inch — Sizes 3½ to 6-inch

No. 1 Cranite Discs: No. 1 Cranite Discs are made of a specially formulated composition consisting of a synthetic base, with asbestos and other ingredients. Sizes 3-inch and smaller have a plain finish on both sides and, on one side, bear the marking "No. 1 Cranite" and the size; larger sizes are plain on both sides and bear no marking. No. 1 Discs are recommended for:

150 psi steam....366 F maximum
*150 psi water....366 F maximum
*300 psi water....300 F maximum

Dimensions

Catalog Number of Disc	Size	Approximate Dimensions, in Inches	
	Inches	A	C
No. 1 or No. 6	⅛	21/32	7/32
	¼	21/32	7/32
	⅜	¾	7/32
	½	13/16	¼
	¾	1 1/16	¼
	1	1⅜	¼
	1¼	1⅝	11/32
	1½	2	11/32
	2	2 9/16	11/32
	2½	3 3/16	15/32
	3	3 15/16	½
	3½	4⅜	9/16
	4	4⅞	19/32
	5	6 1/16	19/32
	6	7 1/16	19/32
No. 4	⅛	21/32	7/32
	¼	21/32	7/32
	⅜	¾	7/32
	½	13/16	¼
	¾	1 1/16	¼
	1	1⅜	¼
	1¼	1⅝	11/32
	1½	2	11/32
	2	2 9/16	11/32
	2½	3 3/16	15/32
	3	3 15/16	½
No. 10 or No. 12	⅛	½	⅛
	¼	½	⅛
	⅜	19/32	⅛
	½	21/32	3/16
	¾	29/32	7/32
	1	1¼	¼
	1¼	1½	¼
	1½	1 13/16	9/32
	2	2 9/32	5/16

*No 1 or No 4 Disc is suitable for water under 200 F. only when used in globe and angle valves, however, at such water temperatures, especially if the valves are to be operated frequently or must seat easily, the No 6 Disc is recommended

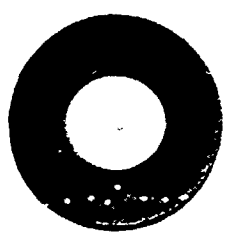
Prices on Request



No. 4
Cranite Disc

No. 4 Cranite Discs: No. 4 Cranite Discs are laminated and consist of a synthetic base with spirally wound long fibre asbestos and other ingredients. They are suitably cured to provide the hardness needed for high temperature, yet they seat with minimum effort. All sizes have serrated faces on both sides and, on one side only, bear the marking "No. 4 Cranite" and the size. No. 4 Discs are recommended for:

300 psi steam....450 F maximum
*600 psi water....420 F maximum

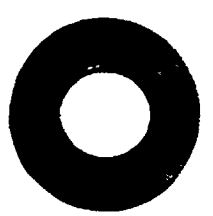


No. 6
Composition Disc

No. 6 Discs: No. 6 Discs are made of a specially formulated composition consisting of a synthetic base with other ingredients. They are soft enough to make a tight seat on air or gas, yet are sufficiently stiff and resistant to withstand hot water and the wear and tear of repeated operation. All sizes are plain on both sides and bear no marking. No. 6 Discs are recommended for:

600 psi water, air, gas, oil, or gasoline.....200 F maximum

No. 6 Discs are also suitable for other hydrocarbons such as propane, butane, etc., at temperatures up to 200 F.



No. 10 or No. 12
Composition Discs

Nos. 10 and 12 Discs: No. 10 and No. 12 Discs are made from homogeneous compounds with synthetic bases. The discs, highly suitable for their recommended services, are dimensionally alike, size for size. All sizes are plain on both sides and bear no marking. They are recommended for the following services:

No. 10 Discs for: 125 psi steam....353 F maximum
No. 12 Discs for: 200 psi water, air, gas, oil, or gasoline..... ..200 F maximum
(also for domestic gas service)

Interchangeability: Nos 1, 4, and 6 Discs have the same dimensions, size for size, and are interchangeable; they are slightly larger in diameter and thickness than the No 10 and No 12. The latter, dimensionally the same are interchangeable with each other.

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SECTIONS 24 TO 26

Crane Steel Screwed Fittings, Welding Fittings, and Flanges

(Including Steel Unions and Flange Unions)

004075

IMPORTANT

DUE TO CHANGES IN MANUFACTURING POLICY, AS INDICATED BELOW, SECTIONS 24, 25, AND 26 HAVE BEEN DELETED FROM THIS REPRINT OF THE CRANE NO. 60 CATALOG

pages		
285-289	Screwed Fittings & Unions	DISCONTINUED
290-292	Flange Unions (& Gaskets)	DISCONTINUED
293-297	Socket-Welding Fittings	DISCONTINUED
298-306	Butt-Welding Fittings	LINE EXPANDED*
307-314	Flanges	LINE EXPANDED*

*A catalog describing Crane's broadened lines of butt-welding fittings and flanges can be obtained from CRANE CO., Midwest Fitting Division, P. O. Box 433, St. Louis, Missouri

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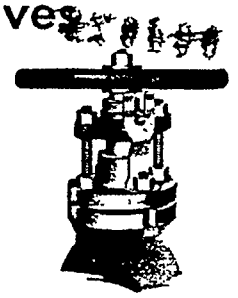
CRTX 1125

Indicators for Iron Body Gate Valves

As illustrated at the right, a "Universal" type indicator can be furnished for bronze trimmed, non-rising stem valves of the 125-Pound Wedge Gate and 200-Pound W.O.G. Double Disc Gate classes. The indicator shows whether the valve is open or shut and is easily installed on valves in stock or service. All parts are bronze. When ordering, specify the valve catalog number and size.



Crane "Universal" Indicator for Non-Rising Stem Gate Valves

Prices on Request

Valves Available with Indicator

Valve Types		Valve Sizes	Valve Description
125-Pound Wedge Gate	No. 460 No. 461	8-inch and smaller 12-inch and smaller	see pages 74 and 75
200-Pound W.O.G. Double Disc Gate	No. 480 No. 481	4-inch and smaller 12-inch and smaller	see pages 94 and 95

Cleanouts

For Flanged Iron Body Gate Valves

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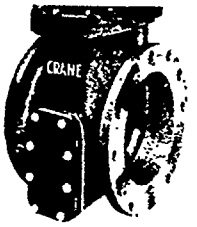
When specified, Crane Ferrosteel 125-Pound Wedge Gate and 200-Pound W.O.G. Double Disc Gate Valves can be equipped with a cleanout installed on the side of the valve body; see illustration at right.

Double disc gate-valves of the 25-pound class can be equipped with two side cleanouts (one on each side of the valve body) which permit passing a rod through the valve between the seats.

Cleanouts facilitate the cleaning of valves used in lines carrying an unusual amount of sediment, tarry fluids, etc., which may accumulate in the valve body.



*Single Side Cleanout for Flanged End Gate Valves

Prices on Request

Valves Available with Cleanout

Flanged Valve Types	Valve Sizes	Valve Description
All 125-Pound Wedge Gates	3-inch; 4 to 12-inch	see pages 74 to 79
All 25-Pound W.O.G. Double Disc Gates*	14-inch and larger	see pages 92 and 93
All 200-Pound W.O.G. Double Disc Gates	3 to 12-inch	see pages 94 and 95

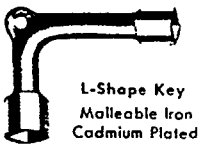
The 25-pound W.O.G. valves will be equipped with double side cleanouts; see page 93.

Keys for Bronze Lock Shield Valves

Keys Used with Lock Shield Valves

Size of Valve	Lock Shield Key No. to Specify						
	For No. 439 Gate	For No. 441 Gate	For No. 1260 Globe	For No. 1261 Angle	For 4272 Globe	For No. 4273 Angle	For No. 68G Angle
Inches	(page 19)	(page 19)	(page 29)	(page 29)	(page 59)	(page 59)	(page 59)
¼ ⅜	... ...	... ...	No. 197	No. 197	...	...	...
½ ¾	No. 197	No. 198			No. 198	No. 198	No. 198
1 1¼	No. 198		No. 198	No. 198	...	...	No. 199
1½ 2	No. 199	No. 199	...	...	...	...	...

Prices of keys furnished on request.



L-Shape Key
Malleable Iron
Cadmium Plated

Key No.	Lbs. Each	Square Hole Sizes
No. 197	19	0.26" 0.20
No. 198	33	0.40 0.32
No. 199	33	0.49 0.43

004078

Machine Bolts



Square Head Machine Bolt
With Heavy Hexagon Nut

Weights, in Pounds — Per Hundred Bolts and Nuts

	Length Inches	½" Dia. Bolt	⅝" Dia. Bolt	¾" Dia. Bolt	⅞" Dia. Bolt	1" Dia. Bolt	1⅛" Dia. Bolt	1¼" Dia. Bolt	1⅜" Dia. Bolt	1½" Dia. Bolt
Regular Square Head Machine Bolts Each furnished with a Heavy Hexagon Nut (see "Nuts" below)	1¼	17.5	31.1	...	...	...	...	...	...	..
	1½	18.9	33.1	52.6	79.2	...	...	...	...	...
	2	21.3	37.1	58.1	86.3	121.0	...	...	...	...
	2½	24.0	40.9	64.0	94.6	131.0	...	...	...	...
	3	26.8	45.1	69.5	102.0	142.0	...	...	*	*
	3½	29.5	49.3	75.6	111.0	152.0	...	...	*	*
	4	32.2	53.6	81.7	118.0	161.0	217.0	287.0	*	*
	4½	34.9	57.8	87.8	127.0	172.0	231.0	304.0	*	*
	5	37.6	62.0	93.8	135.0	183.0	242.0	318.0	*	*
	5½	40.3	66.2	99.9	143.0	194.0	256.0	335.0	*	*
	6	42.7	70.4	106.0	151.0	205.0	270.0	351.0	*	*
	6½	45.4	74.7	112.0	160.0	215.0	...	...	*	*
	7	48.1	78.9	118.0	168.0	226.0	297.0	384.0	*	*
	7½	50.8	83.1	124.0	176.0	237.0	...	...	*	*
	8	53.5	86.9	130.0	184.0	248.0	325.0	418.0	*	*
	8½	56.2	91.1	136.0	193.0	...	...	...	*	*
	9	58.9	95.3	142.0	201.0	269.0	352.0	451.0	*	*
	9½	61.6	99.5	148.0	....	...	...	..	*	*
	10	64.4	104.0	154.0	216.0	290.0	379.0	485.0	*	*
	11	69.8	112.0	166.0	233.0	312.0	407.0	519.0	*	*
	12	75.2	121.0	178.0	249.0	333.0	434.0	553.0	*	*
	13	80.6	129.0	190.0	266.0	354.0	...	...	*	*
	14	86.0	138.0	202.0	282.0	376.0	489.0	620.0	*	*
	15	91.4	146.0	215.0	299.0	397.0	516.0	654.0	*	*

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*Weights for bolts of 1⅜ and 1½-inch diameters are furnished on request.

Recommendations: The use of square head machine bolts and hexagon nuts has been the standard practice of the pipe and fitting industry for a variety of services and for temperatures up to a maximum of 500 F.

Nuts: Machine bolts of 1¼-inch diameter and smaller are regularly furnished with a Heavy Semi-Finished Hexagon Nut; when so ordered, the bolts can be furnished without nuts.

Machine bolts of the 1⅜ and 1½-inch diameters are regularly furnished with a Heavy Hexagon Nut (unfinished); when so ordered, they can be furnished without nuts or with Heavy Semi-Finished Hexagon Nuts.

Standards: Machine bolts and nuts are made from steel conforming to requirements of ASTM Specification A 307, Grade B.

Dimensions of bolt heads and nuts conform to requirements of American Standard B18.2-1955

Threads of bolts and nuts conform to requirements of American Standard B1.1-1949, Coarse Thread Series . . . . Class 2A fit on the bolts and Class 2B fit on the nuts.

Bolts required per flanged joint: The number and sizes of machine bolts required for the popular pressure classes and sizes of bronze, iron, and steel flanged joints are listed on page 318.

Prices: Prices are furnished on request.

Description of materials . . . . page 9

Engineering data on machine bolts . . . . pages 382 and 383

CRTX 1127

SECTIONS 24 TO 26

Crane Steel Screwed Fittings, Welding Fittings, and Flanges

(Including Steel Unions and Flange Unions)

IMPORTANT

DUE TO CHANGES IN MANUFACTURING POLICY, AS INDICATED BELOW, SECTIONS 24, 25, AND 26 HAVE BEEN DELETED FROM THIS REPRINT OF THE CRANE NO. 60 CATALOG

pages		
285-289	Screwed Fittings & Unions	DISCONTINUED
290-292	Flange Unions (& Gaskets)	DISCONTINUED
293-297	Socket-Welding Fittings	DISCONTINUED
298-306	Butt-Welding Fittings	LINE EXPANDED*
307-314	Flanges	LINE EXPANDED*

*A catalog describing Crane's broadened lines of butt-welding fittings and flanges can be obtained from CRANE CO., Midwest Fitting Division, P. O. Box 433, St. Louis, Missouri

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SECTION 27

Crane Bolts, Gaskets, and Thread Lubricants

Machine Bolts
Description, Sizes, and Weights.....page 316
Quantity and Sizes for ASA Flanged Joints.....page 318

Triplex Steel Stud Bolts
Description and Sizes.....page 317
Quantity and Sizes for ASA Flanged Joints.....page 319

Templex Steel Stud Bolts
Description.....page 317
Quantity and Sizes for ASA Flanged Joints.....page 319

Bolting Flanges of Dissimilar Metals.....page 318

Sheet Packings
Cranite.....page 320
C.C. Rubber.....page 320

Gaskets
For Bronze Flanged Joints.....page 321
For Corrosion-Resistant Flanged Joints.....page 321
For Iron Flanged Joints.....page 322
For Steel Flanged Joints.....pages 321 and 323

Thread Lubricants
Crane Thread Lubricant.....page 324
Crane Anti-Seize Thread Compound.....page 324

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For related data, refer to:

General information on sheet packings.....page 11
Gaskets for tongue and groove flange unions.....page 292
Drilling templates.....pages 326 to 331
Flange facings.....pages 332 to 335

Normal engagement between male and female threads.....page 352
Threaded pipe joints.....page 353
Engineering data on Crane bolting.....pages 382 and 383
Assembly and maintenance of flanged joints.....page 384
Engineering data.....pages 381 to 442

Triplex and Templex Alloy Steel Stud Bolts

Prices on Request

Two high quality, performance-proved alloy bolting materials—Triplex Steel for use at temperatures beyond the range of carbon steel and Templex Steel for use at temperatures beyond the range of other ferritic alloy steels—were especially developed by Crane to provide complete safety and dependability under severe operating conditions.

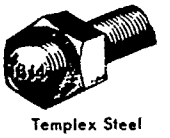
Triplex Steel Stud Bolts: The merits of Crane Triplex, a chromium-molybdenum steel, are well known. Made to rigid manufacturing tolerances, Triplex Steel Stud Bolts provide liberal strength for the bolting of steel flanged joints. They have been used with excellent results in thousands of steel valve and fitting installations, many of which—particularly in oil refineries—are subject to extreme pressures and temperatures.

Templex Steel Stud Bolts: Crane Templex is a specially heat-treated, chromium-molybdenum-vanadium steel. It offers greater resistance to creep than other bolting steels offered on the market today. At extremely high temperatures, especially where joints are made up for permanent service, as in steam power plants, Templex Steel Stud Bolts are ideal.

Marking: On one end of each stud bolt is stamped the identification of the material; Crane Triplex is marked with the symbol "T B7", and Crane Templex is marked with the symbol "T B14". These markings are shown in the accompanying illustrations.



Triplex Steel



Templex Steel

Standard lengths: The lengths of stud bolts are standardized in increments of ¼-inch in accordance with American Standard, ASA B16.5-1957.

When ordering stud bolts for Cranelap requirements, lengths should be selected as follows:

a. If calculated length is 1/16-inch or more longer than a standardized length, use the next longer standard ¼-inch length.

b. If calculated length is less than 1/16-inch longer than a standardized length, use the next shorter standard ¼-inch length.

Threads: Crane Alloy Steel Stud Bolts are threaded their entire length. Threading, including threading on the accompanying nuts, is in accordance with the American Standard for Screw Threads for High Strength Bolting (ASA B1.1)....Coarse Thread Series on sizes 1-inch and smaller and 8-Pitch Thread Series on sizes 1⅛-inch and larger.

Nuts: Each Triplex and Templex Steel Stud Bolt is regularly fitted with two hot forged, medium carbon steel, oil-quenched, heavy semi-finished hexagon nuts. The nuts, having a Brinell hardness of 250 minimum, are capable of developing the full strength of the stud bolt.

Description of materials page 9



Triplex or Templex Steel Stud Bolt

Threaded the entire length. Each stud bolt is regularly furnished with two hexagon nuts.

Sizes (Diameter x Length), in Inches

½×2¼	¾×4¾	1 ×6¼	1¼×7¾	1½×9½	1⅞×12½
×2½	×5	×6½	×8	×9¾	×12¾
×2¾	×5¼	×6¾	×8¼	×10	×13
×3	×5½		×8½	×10¼	×13¼
×3¼		1⅛×5¾	×8¾	×10½	×13½
	7/8×4½	×6		×11	2 ×13¼
5/8×2¾	×4¾	×6¼	1⅜×8¼		×13½
×3	×5	×6½	×8½	1⅝×10¼	×14
×3¼	×5¼	×6¾	×8¾	×10½	×14½
×3½	×5½	×7	×9	×10¾	×14¾
×3¾	×5¾	×7¼	×9¼	×11	×15¼
×4	×6	×7½	×9½	×11¼	2¼×15¾
×4¼		×7¾	×9¾	×11½	×16
¾×3½	1 ×5		×10	×11¾	×16¾
×3¾	×5¼	1¼×6¾	×10¼		2½×16¾
×4	×5½	×7		1¾×10¼	×17
×4¼	×5¾	×7¼	1½×9	×10½	×17¾
×4½	×6	×7½	×9¼	×11	

Sizes indicated above apply only to Triplex Steel stud bolts; the lengths do not include the crowned ends.

Standards: Triplex and Templex Steel Stud Bolts and nuts conform to American Standard B16.5-1957 and to various ASTM Specifications.

Crane Triplex Steel substantially exceeds minimum requirements of ASTM Specification A 193, Grade B7. Crane Templex Steel substantially exceeds minimum requirements of ASTM Specification A 193, Grade B14. The following is a comparison of physical properties:

Physical Properties	ASTM Minimum	Crane Triplex average	Crane Templex average
Tensile strength.....psi	125,000	134,000	145,000
Yield point.....psi	105,000	116,000	118,000
Elongation in 2 inches.....%	16	20	20
Reduction of area.....%	50	57	57
Brinell hardness number.range	260-320	270-300	285-320

The nuts conform to ASTM Specification A 194, Grade 2H; they are made to American Standard ASA B18.2 dimensions for Heavy Semi-Finished Hexagon Nuts.

Thread compound: Crane Anti-Seize Thread Compound is recommended for use with alloy steel stud bolts. On bolting subjected to high temperatures, this compound is unsurpassed. Because it reduces friction, maximum stress can be obtained in the stud bolt with a minimum amount of power applied to the nut. In addition, since it minimizes the tendency of metals to gall or seize, joints can be more readily assembled and taken apart without injuring the bolting. The compound is described on page 324.

Engineering data on bolting pages 382 to 384

Quantity and Sizes of Machine Bolts
For ASA Bronze, Iron, and Steel Flanged Joints

Nominal Pipe Size	Quantity of Machine Bolts, and Size (Inches), Required per Flanged Joint							
	Bronze		Cast Iron				Steel	
	150-Pound	300-Pound	25-Pound		125-Pound	250-Pound	150-Pound	300-Pound
Inches	Plain (Flat) Face	Plain (Flat) Face	See Note A	See Note B	Plain (Flat) Face	1/16" Raised Face	1/16" Raised Face	1/16" Raised Face
1/2	4 - 1/2×1 1/4	4 - 1/2×1 3/4	...	...	...	...	4 - 1/2 ×1 3/4	4 - 1/2 ×2
3/4	4 - 1/2×1 1/2	4 - 5/8×2	...	...	...	...	4 - 1/2 ×2	4 - 5/8 ×2 1/2
1	4 - 1/2×1 1/2	4 - 5/8×2	...	...	4 - 1/2 ×1 3/4	...	4 - 1/2 ×2	4 - 5/8 ×2 1/2
1 1/4	4 - 1/2×1 1/2	4 - 5/8×2	...	...	4 - 1/2 ×2	...	4 - 1/2 ×2 1/4	4 - 5/8 ×2 3/4
1 1/2	4 - 1/2×1 1/2	4 - 3/4×2 1/4	...	...	4 - 1/2 ×2	4 - 3/4 ×2 3/4	4 - 1/2 ×2 1/4	4 - 3/4 ×3
2	4 - 5/8×1 3/4	8 - 5/8×2 1/4	...	...	4 - 5/8 ×2 1/4	8 - 5/8 ×2 3/4	4 - 5/8 ×2 3/4	8 - 5/8 ×3
2 1/2	4 - 5/8×2	8 - 3/4×2 1/2	...	...	4 - 5/8 ×2 1/2	8 - 3/4 ×3 1/4	4 - 5/8 ×3	8 - 3/4 ×3 1/4
3	4 - 5/8×2	8 - 3/4×2 3/4	...	...	4 - 5/8 ×2 1/2	8 - 3/4 ×3 1/2	4 - 5/8 ×3	8 - 3/4 ×3 1/2
3 1/2	8 - 5/8×2 1/4	8 - 3/4×3	...	...	8 - 5/8 ×2 3/4	8 - 3/4 ×3 1/2	8 - 5/8 ×3	8 - 3/4 ×3 3/4
4	8 - 5/8×2 1/4	8 - 3/4×3	8 - 5/8×2 1/4	8 - 5/8×2 1/2	8 - 5/8 ×3	8 - 3/4 ×3 3/4	8 - 5/8 ×3	8 - 3/4 ×3 3/4
5	8 - 3/4×2 1/2	8 - 3/4×3 1/4	8 - 5/8×2 1/4	8 - 5/8×2 1/2	8 - 3/4 ×3	8 - 3/4 ×4	8 - 3/4 ×3 1/4	8 - 3/4 ×4
6	8 - 3/4×2 1/2	12 - 3/4×3 1/4	8 - 5/8×2 1/4	8 - 5/8×2 1/2	8 - 3/4 ×3 1/4	12 - 3/4 ×4	8 - 3/4 ×3 1/4	12 - 3/4 ×4 1/4
8	8 - 3/4×2 3/4	12 - 7/8×3 3/4	8 - 5/8×2 1/4	8 - 5/8×2 3/4	8 - 3/4 ×3 1/2	12 - 7/8 ×4 1/2	8 - 3/4 ×3 1/2	12 - 7/8 ×4 3/4
10	12 - 7/8×3 1/4	...	12 - 5/8×2 1/2	12 - 5/8×3	12 - 7/8 ×3 3/4	16 - 1 ×5 1/4	12 - 7/8 ×3 3/4	16 - 1 ×5 1/4
12	12 - 7/8×3 1/4	...	12 - 5/8×2 3/4	12 - 5/8×3	12 - 7/8 ×3 3/4	16 - 1 1/8×5 1/2	12 - 7/8 ×4	16 - 1 1/8×5 3/4
14	...	...	12 - 3/4×3 1/4	12 - 3/4×3 1/2	12 - 1 ×4 1/4	...	12 - 1 ×4 1/4	20 - 1 1/8×6
16	...	...	16 - 3/4×3 1/4	16 - 3/4×3 1/2	16 - 1 ×4 1/2	...	16 - 1 ×4 1/2	20 - 1 1/4×6 1/2
18	...	...	16 - 3/4×3 1/2	16 - 3/4×2 3/4	16 - 1 1/8×4 3/4	...	16 - 1 1/8×4 3/4	24 - 1 1/4×6 3/4
20	...	...	20 - 3/4×3 1/2	20 - 3/4×4	20 - 1 1/8×5	...	20 - 1 1/8×5 1/4	24 - 1 1/4×7
24	...	...	20 - 3/4×3 3/4	20 - 3/4×4 1/4	20 - 1 1/4×5 1/2	...	20 - 1 1/4×5 3/4	24 - 1 1/2×7 3/4

Note A: For valve to valve. Note B: For valve to flange, or for valve to special 125-pound fitting with 25-pound drilling

Description of machine bolts....page 316 *Templates for drilling....pages 326 to 329*

Bolting Flanges of Dissimilar Metals

In the course of installing piping, it is frequently necessary to make joints by bolting together flanges of two different materials.

To prevent possible breakage of an iron flange when bolted against a steel flange . . . or distortion of the weaker flange when bronze or stainless steel is bolted to steel . . . etc . . . MSS SP-46 has drafted a Standard Practice for the bolting of cast iron, bronze, or stainless steel flanges to steel raised face flanges. This information is summarized below.

As noted on the drilling template pages (326 to 329), the templates of flanges for Class 125 Cast Iron, 150-Pound Bronze, 150-Pound Stainless Steel, and 150-Pound Steel are the same. Likewise, the templates for Class 250 Cast Iron, 300-Pound Bronze and 300-Pound Steel are also the same.

Bolting Practice for Flanges of Dissimilar Metals — Per MSS SP-46-1955

Flange Combination	Facing	Gasket Type	Bolting To Be Used
Class 125 Cast Iron to 150-Pound Steel	1/16-inch raised face on the steel flange shall be removed	Flat Ring	Carbon steel, without heat-treatment other than stress relief, equivalent to ASTM A 307, Grade B
		Full Face	May be heat-treated carbon steel equivalent to ASTM A261 or alloy steel equivalent to ASTM A193
Class 250 Cast Iron to 300-Pound Steel	No change necessary in raised face of either flange. However, preferred practice indicates that the raised face on the steel flange should be removed	Flat Ring	Carbon steel, without heat-treatment other than stress relief, equivalent to ASTM A307, Grade B
Bronze or Stainless Steel (MSS SP-42) to Steel	1/16-inch raised face on the steel flange shall be removed	Full Face Only	Carbon steel, without heat-treatment other than stress relief, equivalent to ASTM A307, Grade B . . . or heat-treated carbon steel equivalent to ASTM A 261 or alloy steel equivalent to ASTM A193

Note: MSS SP-46 states that in all cases where removal of the 1/16-inch raised face is stipulated, it is equally satisfactory to use a full thickness, plain (flat) face steel flange

Quantity and Sizes of Stud Bolts

For ASA Steel Flanged Joints

Flange Facing	Nominal Pipe Size Inches	Quantity of Stud Bolts, and Size (Inches), Required per Steel Flanged Joint					
		150-Pound	300-Pound	400-Pound	600-Pound	900-Pound	1500-Pound
Raised or Male (*)	1/2	4 - 1/2 x2 1/4	4 - 1/2 x2 1/2	...	4 - 1/2 x3	...	4 - 3/4 x4
	3/4	4 - 1/2 x2 1/4	4 - 5/8 x2 3/4	...	4 - 5/8 x3 1/4	...	4 - 3/4 x4 1/4
	1	4 - 1/2 x2 1/2	4 - 5/8 x3	...	4 - 5/8 x3 1/2	...	4 - 7/8 x4 3/4
	1 1/4	4 - 1/2 x2 1/2	4 - 5/8 x3	...	4 - 5/8 x3 3/4	...	4 - 7/8 x4 3/4
	1 1/2	4 - 1/2 x2 3/4	4 - 3/4 x3 1/2	...	4 - 3/4 x4	...	4 - 1 x5 1/4
	2	4 - 5/8 x3	8 - 5/8 x3 1/4	...	8 - 5/8 x4	...	8 - 7/8 x5 1/2
	2 1/2	4 - 5/8 x3 1/4	8 - 3/4 x3 3/4	...	8 - 3/4 x4 1/2	...	8 - 1 x6
	3	4 - 5/8 x3 1/2	8 - 3/4 x4	...	8 - 3/4 x4 3/4	8 - 7/8 x5 1/2	8 - 1 1/8 x6 3/4
	3 1/2	8 - 5/8 x3 1/2	8 - 3/4 x4 1/4	...	8 - 7/8 x5 1/4	...	...
	4	8 - 5/8 x3 1/2	8 - 3/4 x4 1/4	8 - 7/8 x5 1/4	8 - 7/8 x5 1/2	8 - 1 1/8 x6 1/2	8 - 1 1/4 x7 1/2
	5	8 - 3/4 x3 3/4	8 - 3/4 x4 1/2	8 - 7/8 x5 1/2	8 - 1 x6 1/4	8 - 1 1/4 x7 1/4	8 - 1 1/2 x9 1/2
	6	8 - 3/4 x3 3/4	12 - 3/4 x4 3/4	12 - 7/8 x5 3/4	12 - 1 x6 1/2	12 - 1 1/8 x7 1/2	12 - 1 3/8 x10
	8	8 - 3/4 x4	12 - 7/8 x5 1/4	12 - 1 x6 1/2	12 - 1 1/8 x7 1/2	12 - 1 3/8 x8 1/2	12 - 1 5/8 x11 1/4
	10	12 - 7/8 x4 1/2	16 - 1 x6	16 - 1 1/8 x7 1/4	16 - 1 1/4 x8 1/4	16 - 1 3/8 x9	12 - 1 7/8 x13 1/4
	12	12 - 7/8 x4 1/2	16 - 1 1/8 x6 1/2	16 - 1 1/4 x7 3/4	20 - 1 1/4 x8 1/2	20 - 1 3/8 x9 3/4	16 - 2 x14 3/4
	14	12 - 1 x5	20 - 1 1/8 x6 3/4	20 - 1 1/4 x8	20 - 1 3/8 x9	20 - 1 1/2 x10 1/2	16 - 2 1/4 x16
	16	16 - 1 x5 1/4	20 - 1 1/4 x7 1/4	20 - 1 3/8 x8 1/2	20 - 1 1/2 x9 3/4	20 - 1 5/8 x11	...
	18	16 - 1 1/8 x5 3/4	24 - 1 1/4 x7 1/2	24 - 1 3/8 x8 3/4	20 - 1 5/8 x10 1/2	20 - 1 7/8 x12 3/4	...
	20	20 - 1 1/8 x6	24 - 1 1/4 x8	24 - 1 1/2 x9 1/2	24 - 1 5/8 x11 1/4	20 - 2 x13 1/2	...
	24	20 - 1 1/4 x6 3/4	24 - 1 1/2 x9	24 - 1 3/4 x10 1/2	24 - 1 7/8 x12 3/4	20 - 2 1/2 x17	...
Ring Joint	1/2	...	4 - 1/2 x3	...	4 - 1/2 x3	...	4 - 3/4 x4
	3/4	...	4 - 5/8 x3 1/4	...	4 - 5/8 x3 1/4	...	4 - 3/4 x4 1/4
	1	4 - 1/2 x3	4 - 5/8 x3 1/2	...	4 - 5/8 x3 1/2	...	4 - 7/8 x4 3/4
	1 1/4	4 - 1/2 x3	4 - 5/8 x3 1/2	...	4 - 5/8 x3 3/4	...	4 - 7/8 x4 3/4
	1 1/2	4 - 1/2 x3 1/4	4 - 3/4 x4	...	4 - 3/4 x4	...	4 - 1 x5 1/4
	2	4 - 5/8 x3 1/2	8 - 5/8 x4	...	8 - 5/8 x4 1/4	...	8 - 7/8 x5 3/4
	2 1/2	4 - 5/8 x3 3/4	8 - 3/4 x4 1/2	...	8 - 3/4 x4 3/4	...	8 - 1 x6 1/4
	3	4 - 5/8 x4	8 - 3/4 x4 3/4	...	8 - 3/4 x5	8 - 7/8 x5 3/4	8 - 1 1/8 x7
	3 1/2	8 - 5/8 x4	8 - 3/4 x5	...	8 - 7/8 x5 1/2	...	...
	4	8 - 5/8 x4	8 - 3/4 x5	8 - 7/8 x5 1/2	8 - 7/8 x5 3/4	8 - 1 1/8 x6 3/4	8 - 1 1/4 x7 3/4
	5	8 - 3/4 x4 1/4	8 - 3/4 x5 1/4	8 - 7/8 x5 3/4	8 - 1 x6 1/2	8 - 1 1/4 x7 1/2	8 - 1 1/2 x9 3/4
	6	8 - 3/4 x4 1/4	12 - 3/4 x5 1/2	12 - 7/8 x6	12 - 1 x6 3/4	12 - 1 1/8 x7 1/2	12 - 1 3/8 x10 1/4
	8	8 - 3/4 x4 1/2	12 - 7/8 x6	12 - 1 x6 3/4	12 - 1 1/8 x7 3/4	12 - 1 3/8 x8 3/4	12 - 1 5/8 x11 3/4
	10	12 - 7/8 x5	16 - 1 x6 3/4	16 - 1 1/8 x7 1/2	16 - 1 1/4 x8 1/2	16 - 1 3/8 x9 1/4	12 - 1 7/8 x13 1/2
	12	12 - 7/8 x5	16 - 1 1/8 x7 1/4	16 - 1 1/4 x8	20 - 1 1/4 x8 3/4	20 - 1 3/8 x10	16 - 2 x15 1/4
	14	12 - 1 x5 1/2	20 - 1 1/8 x7 1/2	20 - 1 1/4 x8 1/4	20 - 1 3/8 x9 1/4	20 - 1 1/2 x11	16 - 2 1/4 x16 3/4
	16	16 - 1 x5 3/4	20 - 1 1/4 x8	20 - 1 3/8 x8 3/4	20 - 1 1/2 x10	20 - 1 5/8 x11 1/2	...
	18	16 - 1 1/8 x6 1/4	24 - 1 1/4 x8 1/4	24 - 1 3/8 x9	20 - 1 5/8 x10 3/4	20 - 1 7/8 x13 1/4	...
	20	20 - 1 1/8 x6 1/2	24 - 1 1/4 x8 3/4	24 - 1 1/2 x9 3/4	24 - 1 5/8 x11 1/2	20 - 2 x14	...
	24	20 - 1 1/4 x7 1/4	24 - 1 1/2 x10	24 - 1 3/4 x11	24 - 1 7/8 x13 1/4	20 - 2 1/2 x17 3/4	...
Male & Female or Tongue & Groove	1/2	...	...	...	4 - 1/2 x2 3/4	...	4 - 3/4 x3 3/4
	3/4	...	...	...	4 - 5/8 x3	...	4 - 3/4 x4
	1	...	...	...	4 - 5/8 x3 1/4	...	4 - 7/8 x4 1/2
	1 1/4	...	...	...	4 - 5/8 x3 1/2	...	4 - 7/8 x4 1/2
	1 1/2	...	...	...	4 - 3/4 x3 3/4	...	4 - 1 x5
	2	...	...	...	8 - 5/8 x3 3/4	...	8 - 7/8 x5 1/4
	2 1/2	...	...	...	8 - 3/4 x4 1/4	...	8 - 1 x5 3/4
	3	...	...	...	8 - 3/4 x4 1/2	8 - 7/8 x5 1/4	8 - 1 1/8 x6 1/2
	3 1/2	...	...	...	8 - 7/8 x5	...	...
	4	...	...	8 - 7/8 x5	8 - 7/8 x5 1/4	8 - 1 1/8 x6 1/4	8 - 1 1/4 x7 1/4
	5	...	...	8 - 7/8 x5 1/4	8 - 1 x6	8 - 1 1/4 x7	8 - 1 1/2 x9 1/4
	6	...	...	12 - 7/8 x5 1/2	12 - 1 x6 1/4	12 - 1 1/8 x7 1/4	12 - 1 3/8 x9 3/4
	8	...	...	12 - 1 x6 1/4	12 - 1 1/8 x7 1/4	12 - 1 3/8 x8 1/4	12 - 1 5/8 x11
	10	...	...	16 - 1 1/8 x7	16 - 1 1/4 x8	16 - 1 3/8 x8 3/4	12 - 1 7/8 x13
	12	...	...	16 - 1 1/4 x7 1/2	20 - 1 1/4 x8 1/4	20 - 1 3/8 x9 1/2	16 - 2 x14 1/2
	14	...	...	20 - 1 1/4 x7 3/4	20 - 1 3/8 x8 3/4	20 - 1 1/2 x10 1/4	16 - 2 1/4 x15 3/4
	16	...	...	20 - 1 3/8 x8 1/4	20 - 1 1/2 x9 1/2	20 - 1 5/8 x10 3/4	...
	18	...	...	24 - 1 3/8 x8 1/2	20 - 1 5/8 x10 1/4	20 - 1 7/8 x12 1/2	...
	20	...	...	24 - 1 1/2 x9 1/4	24 - 1 5/8 x11	20 - 2 x13 1/4	...
	24	...	...	24 - 1 3/4 x10 1/4	24 - 1 7/8 x12 1/2	20 - 2 1/2 x16 3/4	...

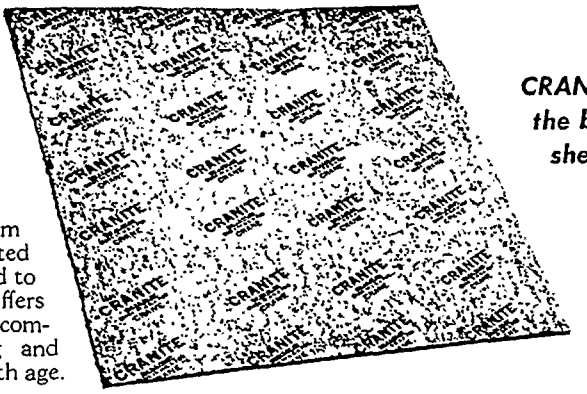
*150- and 300-pound classes with 1/16-inch raised face and 400- to 1500-pound classes with 1/4-inch large male face

Description of stud bolts.....page 317
Templates for drilling....pages 329 to 331

27

Cranite Sheet Packing

The name "CRANITE" is registered in the United States Patent Office.



CRANITE — the best in sheet packing

An asbestos composition manufactured solely for Crane

Cranite Sheet Packing is made from an asbestos composition. The selected long fiber asbestos, cross laminated to provide unusual tensile strength, offers very uniform and high resistance to compression, is exceptionally strong and rugged, and will not deteriorate with age.

Recommendations: The packing is unhesitatingly recommended for a multitude of services such as steam, water, oil, dry air, acids, ammonia, alkali, gases, etc., and is suitable for temperatures up to 750 F.

Underwriters' approved: Cranite Sheet Packing has been approved by the Underwriters' Laboratories, Inc., for use on hazardous liquids.

Easy to stock—no spoilage: The adaptability of Cranite packing to a large number of services and its frequent usage coupled with its high quality and ability to withstand deterioration make it convenient and economical for the user to carry large quantities in stock with no fear of loss through spoilage.

Proper use: For best results, gaskets cut from Cranite packing should be coated with Crane Thread Lubricant or Anti-Seize Thread Compound when being installed. For description of thread lubricant and compound, see page 324.

Sizes and Weights — Prices on Request

Thickness, Inches	Size of square sheet, Inches	Average Weight, Per Square Foot
1/32	36 or 48*	.33 pounds
1/16	36 or 48*	.62 pounds
1/8	36 or 48*	1.23 pounds
1/64, 3/32, 1/4	up to 120 inches made to order	on request

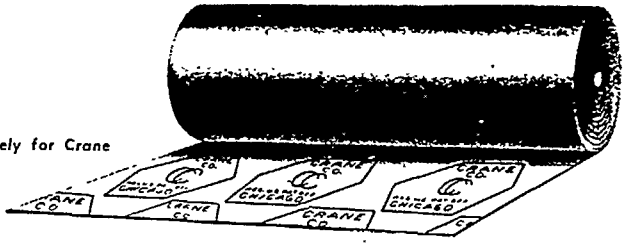
*Other sheet sizes up to 120 inches square, made to order; information on request.

Wide choice of sizes: As indicated in the table above, Cranite packing is regularly furnished in thicknesses of 1/32, 1/16, and 1/8-inch and in sheets 36 or 48 inches square. Other thicknesses and sheet sizes are made to order; information on request.

27

"CC" Rubber Sheet Packing

Manufactured solely for Crane



"CC" Rubber Sheet Packing, manufactured solely for Crane, is especially well adapted for high or low pressure service on saturated steam, hot and cold water, air, gases, etc.

Wide choice of sizes: As indicated in the table at the right, "CC" Rubber Sheet Packing is regularly furnished in rolls 36 inches wide and in thicknesses of 1/16-inch 3/32-inch, or 1/8-inch Other widths, up to 72 inches, are available on special order, information will be furnished on request

Sizes and Weights — Prices on Request

Thickness, Inches	Width of roll, Inches	Average weight, Per Square Yard	Average weight, Per Roll
1/16	36†	5 1/4 pounds	200 pounds
3/32	36†	8 pounds	200 pounds
1/8	36†	10 1/2 pounds	200 pounds

†Rolls of other widths up to 72 inches, made to order, information on request

004083

Gaskets for Bronze, Aluminum, and Corrosion-Resistant Flanged Joints

Diameters of Gaskets, in Inches
(All gaskets are 1/16-inch thick)

Pressure Class and Gasket Material	Size of Joint, Inches	Full Face Gasket: Inside diameter	Full Face Gasket: Outside diameter
150-Pound Cloth Inserted, "CC" Rubber, or Cranite	1/2	27/32	3 1/2
	3/4	1 1/16	3 7/8
	1	1 5/16	4 1/4
	1 1/4	1 21/32	4 5/8
	1 1/2	1 29/32	5
	2	2 3/8	6
	2 1/2	2 7/8	7
	3	3 1/2	7 1/2
	3 1/2	4	8 1/2
	4	4 1/2	9
	5	5 9/16	10
	6	6 5/8	11
	8	8 5/8	13 1/2
	10	10 3/4	16
	12	12 3/4	19
300-Pound "CC" Rubber or Cranite	1	1 5/16	4 7/8
	1 1/4	1 21/32	5 1/4
	1 1/2	1 29/32	6 1/8
	2	2 3/8	6 1/2
	2 1/2	2 7/8	7 1/2
	3	3 1/2	8 1/4

Important: Full face gaskets should always be used for bronze, aluminum, or corrosion-resistant (Monel, 18-8 SMo, or Craneloy 20) flanged joints. Metallic gaskets are not recommended.

Flanged product of the aforementioned materials should not be bolted to Cranelap pipe joints. Also, when such material is bolted to iron or steel material which normally has a raised face, the raised face should be removed to provide a full face bearing for the gasket; see page 318.



Full Face Gasket
1/16-inch Thick
Inside diameter of gasket equals outside diameter of pipe. Outside diameter of gasket extends to outer edge of flange face. Bolt holes are punched only when so specified.

Materials: These full face gaskets are 1/16-inch thick and are regularly made of Cloth Inserted Rubber, "CC" Rubber, and Cranite for 150-pound joints or of "CC" Rubber and Cranite for 300-pound joints; orders must specify the material desired.

Cranite gaskets: When Cranite gaskets are installed, they should be coated with Cranite Thread Lubricant to facilitate making a tight joint. Cranite gaskets are satisfactory for use in oil lines where asbestos gaskets are permitted.

American Standard: The dimensions of all gaskets conform to the American Standard for Nonmetallic Gaskets, B16.21-1951, for their respective pressure class.

Prices: Prices will be furnished on request.

Gaskets for Large Tongue and Groove Flanged Joints

Diameters of Gaskets, in Inches

Pressure Class and Gasket Material	Size of Joint, Inches	Large Tongue and Groove Gaskets: Inside diameter	Large Tongue and Groove Gaskets: Outside diameter
300, 400, 600, 900, and 1500-Pound Steel 1/8-inch Thick Cranite	1/2	1	1 3/8
	3/4	1 5/16	1 11/16
	1	1 1/2	2
	1 1/4	1 7/8	2 1/2
	1 1/2	2 1/8	2 7/8
	2	2 7/8	3 5/8
	2 1/2	3 3/8	4 1/8
	3	4 1/4	5
	3 1/2	4 3/4	5 1/2
	4	5 3/16	6 3/16
	5	6 5/16	7 5/16
	6	7 1/2	8 1/2
	8	9 3/8	10 5/8
	10	11 1/4	12 3/4
	12	13 1/2	15
	14	14 3/4	16 1/4
	16	16 3/4	18 1/2
	18	19 1/4	21
	20	21	23
	24	25 1/4	27 1/4

Cranite gaskets are available for 300, 400, 600, 900, and 1500-pound steel large tongue and groove flanged joints; the gaskets are 1/16-inch thick.

The gaskets are recommended for temperatures up to 750 F and may be used in oil lines where asbestos gaskets are permitted.



Large Tongue and Groove Cranite Gasket
1/16-inch Thick
For 300, 400, 600, 900, or 1500-pound steel flanged joints.

Cranite gaskets are not recommended for use in small male and female joints or in small tongue and groove joints; Cranite offers uniform and high resistance to compression, but inasmuch as the gasket contact area in such joints is so narrow, it is quite possible that the gasket will be crushed.

American Standard: Dimensions of gaskets conform to the American Standard for Nonmetallic Gaskets, B16.21-1951

Thread lubricant: To facilitate making a tight joint, it is recommended that the gaskets be coated with a high grade thread lubricant or compound before installation; see page 324

Prices: Prices will be furnished on request.

Flat Ring and Full Face Gaskets for Cast Iron Flanged Joints.....page 322
Flat Ring and Male and Female Gaskets for Steel Flanged Joints....page 323
Crane Thread Lubricant and Compound.....page 324

27

Gaskets for Cast Iron Flanged Joints



Flat Ring Gasket
1/16-inch Thick

For 25, 125, and 250-pound cast iron flanged joints. Inside diameter of gasket equals outside diameter of the pipe. Outside diameter of gasket extends to the inside edge of the bolts.

Cloth Inserted Rubber
"CC" Rubber
Cranite



Full Face Gasket
1/16-inch Thick

For 25 and 125-pound cast iron flanged joints. Inside diameter of gasket equals outside diameter of the pipe. Outside diameter of gasket extends to outer edge of the flange face. Bolt holes are punched only when so specified.

Crane regularly furnishes Cloth Inserted Rubber, "CC" Rubber, and Cranite gaskets in both flat ring and full face types for cast iron flanged joints. The gaskets are 1/16-inch thick. Inside and outside diameters are shown in the table below.

800-Pound W.O.G. Flanged Joints: Gaskets for 800-Pound W.O.G. cast iron flanged joints are the same, size for size, as those for 600-pound steel flanged joints; for gasket types and diameters, see the next page.

Cranite gaskets: When Cranite gaskets are installed, they should be coated with Crane Thread Lubricant to facilitate making tight joints; see page 324. Cranite gaskets are satisfactory for use in oil lines where asbestos gaskets are permitted.

American Standard: Dimensions of gaskets conform to the American Standard for Nonmetallic Gaskets, B16.21-1951, for their respective pressure class.

Ordering: Specify the quantity, the gasket type and material, and the size, pressure class, and material of the joint. For example . . . 12 pieces, Flat Ring Cranite Gaskets for a 4-inch, 125-pound cast iron flanged joint.

When the gasket type is not specified, the "Flat Ring" will be furnished. When Full Face gaskets are specified, they will be furnished unpunched unless ordered with punched bolt holes.

Other materials: Other commercial sheet packing gaskets are made to order; information on request.

Diameters of Gaskets — Prices on Request

Size of Flanged Joint	Inside Diameter of all Gaskets	Outside Diameter, in Inches								
		Flat Ring Gaskets					Full Face Gaskets			
		25 Pound		125 Pound		250 Pound	25 Pound		125 Pound	
		Cloth Inserted Rubber	"CC" Rubber	Cloth Inserted Rubber	"CC" Rubber or Cranite	"CC" Rubber or Cranite	Cloth Inserted Rubber	"CC" Rubber	Cloth Inserted Rubber	"CC" Rubber or Cranite
Inches	Inches									
1	1 5/16	...	...	2 5/8	2 5/8	...	...	...	4 1/4	4 1/4
1 1/4	1 21/32	...	...	3	3	...	...	...	4 5/8	4 5/8
1 1/2	1 29/32	...	...	3 3/8	3 3/8	3 3/4	...	...	5	5
2	2 3/8	...	...	4 1/8	4 1/8	4 3/8	...	...	6	6
2 1/2	2 7/8	...	...	4 7/8	4 7/8	5 1/8	...	...	7	7
3	3 1/2	...	...	5 3/8	5 3/8	5 7/8	...	...	7 1/2	7 1/2
3 1/2	4	...	...	6 3/8	6 3/8	6 1/2	...	...	8 1/2	8 1/2
4	4 1/2	...	...	6 7/8	6 7/8	7 1/8	...	...	9	9
5	5 9/16	...	...	7 3/4	7 3/4	8 1/2	...	...	10	10
6	6 5/8	...	...	8 3/4	8 3/4	9 7/8	...	...	11	11
8	8 5/8	...	...	11	11	12 1/8	...	..	13 1/2	13 1/2
10	10 3/4	13 5/8	13 5/8	13 3/8	13 3/8	14 1/4	16	16	16	16
12	12 3/4	16 3/8	16 3/8	16 1/8	16 1/8	16 5/8	19	19	19	19
14	14	18	18	17 3/4	17 3/4	19 1/8	21	21	21	21
16	16	20 1/2	20 1/2	20 1/4	20 1/4	21 1/4	23 1/2	23 1/2	23 1/2	23 1/2
18	18	22	22	21 5/8	21 5/8	23 1/2	25	25	25	25
20	20	24 1/4	24 1/4	23 7/8	23 7/8	25 3/4	27 1/2	27 1/2	27 1/2	27 1/2
24	24	28 3/4	28 3/4	28 1/4	28 1/4	30 1/2	32	32	32	32
30	30	35 1/8	35 1/8	34 3/4	34 3/4*	...	38 3/4	38 3/4	38 3/4	38 3/4*
36	36	41 7/8	41 7/8	41 1/4	41 1/4*	...	46	46	46	46*
42	42	48 1/2	48 1/2	48	48*	.	..	53	...	53*
48	48		55	...	54 1/2*	...		59 1/2		59 1/2*

*Cranite gaskets are not made for flanged joints 30-inch and larger

Sheet packings.....page 320
Thread lubricant.....page 324
Bolting flanges of dissimilar metals.....page 318
Gaskets for bronze flanged joints.....page 321

Gaskets for Steel Flanged Joints



Flat Ring Gasket
(1/16-inch Thick Cranite)

The inside diameter of the gasket equals the outside diameter of the pipe. The outside diameter of the gasket extends to the inside edge of the bolts.



Large Male and Female Gasket
(1/16-inch Thick Cranite)

The inside diameter of the gasket equals the outside diameter of the pipe. The outside diameter of the gasket extends to the outer edge of the large male face.



Corrugated Metallic Gasket
(Copper or Soft Iron)

Use with smooth faced flanges only. The inside diameter of the gasket, larger than the outside diameter of the pipe, assures a high unit compressive load

Cranite gaskets: Cranite gaskets are recommended for steam, water, air, gas, and many other similar services, including oil lines on which asbestos gaskets are permitted. Their use is limited to a maximum temperature of 750 F.

Metallic gaskets: Corrugated metallic gaskets (copper or soft iron) are recommended for use with smooth faced flanges only. They have a large inside diameter to assure a high unit compressive load . . . . a mandatory requirement in the case of piping materials used at the higher pressures and temperatures for which they are recommended.

The table below lists recommended dimensions for flat ring and large male and female metallic gaskets; further information furnished on request.

Thread lubricants: At the time of installation, the gaskets should be coated with a high grade lubricant to facilitate making a tight joint. Crane Thread Lubricant or Crane Anti-Seize Thread Compound are recommended; see page 324.

American Standard: The dimensions of all Cranite gaskets conform to the American Standard for Non-Metallic Gaskets, B16.21-1951, for their respective pressure class.

800-Pound W.O.G. Cast Iron Joints: Non-metallic gaskets for 800-Pound W.O.G. Cast Iron Flanged Joints are the same, size for size, as the Cranite gaskets listed in the table for the 600-pound steel class.

Ordering: When ordering, specify the quantity, the gasket type and material, and the size, pressure class, and material of the joint. For example, 12 pieces, Flat Ring Cranite Gaskets for a 4-inch 600-pound steel flanged joint.

Diameters of Gaskets, in Inches — Prices on Request

Size of Flanged Joint	Flat Ring Gaskets									Large Male and Female Gaskets			
	Cranite 1/16-inch Thick							Copper or Soft Iron		Cranite 1/16-inch Thick		Copper or Soft Iron	
	Inside Dia.	Outside Diameters						Inside Dia.	Outside Dia.	Inside Dia.	Outside Dia.	Inside Dia.	Outside Dia.
Inches	For All Classes	For 150 Pound Steel	For 300 Pound Steel	For 400 Pound Steel	For 600 Pound Steel	For 900 Pound Steel	For 1500 Pound Steel	*150 to 1500 Pound Steel		300 to 1500 Pound Steel		300 to 1500 Pound Steel	
1/2	27/32	1 7/8	2 1/8	...	2 1/8	...	2 1/2	1	Same as shown at left for Cranite gaskets for corresponding pressure class	27/32	1 3/8	1	1 3/8
3/4	1 1/16	2 1/4	2 5/8	...	2 5/8	...	2 3/4	1 5/16		1 1/16	1 11/16	1 5/16	1 11/16
1	1 5/16	2 5/8	2 7/8	...	2 7/8	...	3 1/8	1 1/2		1 5/16	2	1 1/2	2
1 1/4	1 21/32	3	3 1/4	...	3 1/4	...	3 1/2	1 7/8		1 21/32	2 1/2	1 7/8	2 1/2
1 1/2	1 29/32	3 3/8	3 3/4	...	3 3/4	...	3 7/8	2 1/8		1 29/32	2 7/8	2 1/8	2 7/8
2	2 3/8	4 1/8	4 3/8	...	4 3/8	...	5 5/8	2 7/8		2 3/8	3 5/8	2 7/8	3 5/8
2 1/2	2 7/8	4 7/8	5 1/8	...	5 1/8	...	6 1/2	3 3/8		2 7/8	4 1/8	3 3/8	4 1/8
3	3 1/2	5 3/8	5 7/8	...	5 7/8	6 5/8	6 7/8	4 1/4		3 1/2	5	4 1/4	5
3 1/2	4	6 3/8	6 1/2	...	6 3/8	...	...	4 3/4		4	5 1/2	4 3/4	5 1/2
4	4 1/2	6 7/8	7 1/8	7	7 5/8	8 1/8	8 1/4	5 3/16		4 1/2	6 3/16	5 3/16	6 3/16
5	5 9/16	7 3/4	8 1/2	8 3/8	9 1/2	9 3/4	10	6 5/16		5 9/16	7 5/16	6 5/16	7 5/16
6	6 5/8	8 3/4	9 7/8	9 3/4	10 1/2	11 3/8	11 1/8	7 1/2		6 5/8	8 1/2	7 1/2	8 1/2
8	8 5/8	11	12 1/8	12	12 5/8	14 1/8	13 7/8	9 3/8		8 5/8	10 5/8	9 3/8	10 5/8
10	10 3/4	13 3/8	14 1/4	14 1/8	15 3/4	17 1/8	17 1/8	11 1/4		10 3/4	12 3/4	11 1/4	12 3/4
12	12 3/4	16 1/8	16 5/8	16 1/2	18	19 5/8	20 1/2	13 1/2		12 3/4	15	13 1/2	15
14	14	17 3/4	19 1/8	19	19 3/8	20 1/2	22 3/4	14 3/4		14	16 1/4	14 3/4	16 1/4
16	16	20 1/4	21 1/4	21 1/8	22 1/4	22 5/8	...	16 3/4		16	18 1/2	16 3/4	18 1/2
18	18	21 5/8	23 1/2	23 3/8	24 1/8	25 1/8	. .	19 1/4		18	21	19 1/4	21
20	20	23 7/8	25 3/4	25 1/2	26 7/8	27 1/2	..	21		20	23	21	23
24	24	28 1/4	30 1/2	30 1/4	31 1/8	33	.	25 1/4		24	27 1/4	25 1/4	27 1/4

*Available in copper only for the 150-pound class and in copper or soft iron for 300 to 1500 pound classes

Sheet packings....page 320 Large tongue and groove gaskets....page 321

SECTION 28

Templates for Drilling and Flange Facings

Templates for Drilling

Bronze.....page 326
Corrosion-Resistant.....page 326
Iron.....pages 327 and 328
Steel.....pages 329 to 331

Flange Facings

Male, Female, Tongue, and Groove.....pages 332 and 333
Ring Joint.....pages 334 and 335

Miscellaneous Data

Bolting on Companion Flanges.....see below
End Protectors.....see below

For additional data relating to the above, refer to:

Bolting flanges of dissimilar metals.....page 318
Quantity and sizes of bolts and stud bolts per flanged joint...pages 318 and 319
Crane bolting.....pages 382 and 383
Assembly and maintenance of flanged joints.....page 384

Sheet packings and gaskets.....pages 320 to 323
Flange finishes.....pages 368 and 369
Taps and drains for flanged fittings.....page 402
Taps and drains for flanged valves.....page 403

Pipe and fabricated piping.....pages 337 to 380
Engineering data.....pages 381 to 442

Bolting on Companion Flanges

Orders for valves with companion flanges bolted on should indicate: the catalog number of the flange and, if necessary, the style of facing on the flanges; the kind of bolts or stud bolts; and the kind of gaskets, if gaskets are required. Unless otherwise ordered, male faced companion flanges will be used when male faced valves are desired.

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End Protectors

Damaged flange faces or valve ends can make it difficult or impossible to make up a tight joint. End protectors offer ample protection to flange faces and ends of products while in transit or prior to installation; in addition, in the case of valves, they shut out foreign matter that might possibly damage seating surfaces. Consequently, in those cases where end protectors are not regularly furnished, they can be a worthwhile extra investment.

Crane regularly furnishes end protectors on all steel flanges, on all screwed and flanged steel valves, and on all valves which are regularly or specially air tested. Complete information on types of protectors will be furnished on request

Crane Thread Lubricant

For Threaded Pipe Joints, Bolt Threads, and Gasket Coating

For Temperatures up to 500 F



Crane Thread Lubricant is available in a choice of four container sizes, as follows:

Quart can.....2¾ pounds, net
Pint can.....1¼ pounds, net
Half-pint can ...10 ounces, net
Tube..... 4 ounces, net

Prices on request

Crane Thread Lubricant is used to make better threaded and flanged joints on steam, water, and gas piping. Pipe joints are made tighter; easy "breaking" is assured. The lubricant has been developed to replace ordinary pipe dope or pipe cement.

Recommended use: Unusual lubricating qualities make Crane Thread Lubricant ideal for all threaded metal connections except those on lines carrying liquids such as gasoline, kerosene, naphthas, fuel oil, etc. It is effectively used on Cranite or corrugated metal gaskets in flanged joints.

The lubricant is particularly suited to the requirements of alloys such as stainless steel, Monel, and nickel, as well as copper, bronze, iron, and steel. It can be used on chrome or nickel finished fittings without smearing or discoloring the trim. Being non-poisonous, it is safely used on pipe lines handling food products as well as for all domestic and industrial uses.

Crane Thread Lubricant reduces the friction common to making a metal-to-metal joint and prevents the galling or seizing which occurs when a good lubricant is not used.

When threads are clean and properly cut, the use of Crane Thread Lubricant permits pulling them up to a tight joint with greater ease. The lubricant will neither separate nor harden, regardless of age. It spreads easily over threaded surfaces, always providing a high degree of lubrication.

Application: The lubricant is usually applied with a brush. Its consistency is such that application can be made from either the can or tube, whichever is more convenient.

Crane Anti-Seize Thread Compound

For High Temperatures — Up to 1050 F

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(potent pending)

Crane Anti-Seize Thread Compound for high temperatures is available in two container sizes, as follows:

Quart can.....4 pounds, net
Half-pint can....1 pound, net

Prices on request

Crane Anti-Seize Thread Compound is an improved and tested formula developed especially for today's high pressure-temperature installations.

The compound combines low frictional qualities with particular suitability for high temperature service. Its use assures better lubrication of threaded pipe joints . . . . greater resistance to seizing and galling of bolt threads under high loading . . . . and tighter metal-to-metal contact for all screwed and flanged joints in high pressure, high temperature service.

Threaded pipe joints made up with Crane Anti-Seize Thread Compound can readily be taken apart without damage to pipe or stud bolt threads, and re-used . . . even after being in service at temperatures up to 1050 F.

Features: The compound provides effective lubricating and anti-seize properties at temperatures up to 1050 F. Highly adherent, it will not run out or drip from vertical joints, even under high heat exposure. It is non-settling, non-skinning, and non-hardening in the can; it retains its homogenized consistency indefinitely. It will not harden, shrink, crack, or crumble on application and it will stay flexible inside of joints. The compound has no deteriorating effect on pipe.

Recommendations: Crane Anti-Seize Thread Compound was specifically prepared for use on male threads of pipe and fittings; for use in valve assembly; for stud bolt threads; for Cranite and corrugated metal gaskets in flanged joints; for washer faces of nuts; for screwed lock rings, friction rings, and retaining rings, as in pressure-seal bonnet valves; etc.

On stud bolts used in flanged joints for high pressure-temperature installations, the tendency of seizing or galling of threads is a common failing due to high bolt loads and increased friction. The use of Crane Anti-Seize Thread Compound permits the maximum stress to be obtained with a minimum of power applied to the nut. Bolted joints are more easily assembled to tightness under high pressures, and damage of threads incidental to high loading is avoided.

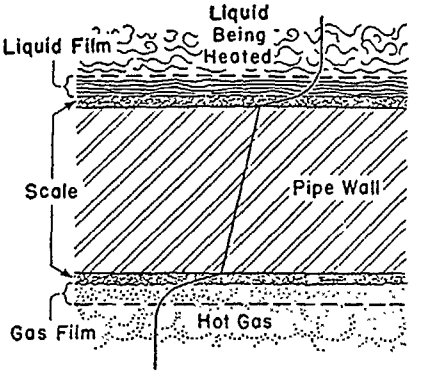
Military Specification: Crane Anti-Seize Compound has been tested and approved by the Bureau of Ships, Department of the Navy. It complies with requirements of Military Specification MIL-A-907

CC4123

Heat Transfer Through Pipe Walls

The conduction of heat through a pipe wall is shown diagrammatically in the illustration at the right. It shows the transfer of heat from a hot gas (such as steam) to a liquid (such as water).

The heat is conducted first from the hot gas through the gas film, then through the corrosion scale on the pipe wall due to the gas, through the pipe wall itself, then through the corrosion scale on the pipe wall due to the liquid, and finally through the liquid film to the liquid.



The general formula for the transfer of heat through pipes is given as

$$Q = U A T \qquad \textit{Formula 1}$$

Where: Q = Total heat to be transmitted, in Btu per hour.
U = Over-all coefficient of heat transfer, in Btu per hour per square feet per degree F.
A = Amount of heating surface in the pipe coil, expressed in square feet.
T = Logarithmic mean temperature difference between hot and cold fluids, in degrees F.

Determination of Q

The total heat to be transmitted, Q, is determined by multiplying the weight of the fluid per unit of time (pounds per hour), the specific heat of the fluid at the average fluid temperature, and the fluid change in temperature in degrees F. If the fluid alters its phase, that is, if the fluid changes from a liquid to a gas or from a gas to a liquid, then the heat of vaporization must be considered in this calculation. If the fluid is to give up heat through radiation, emission, or surface convection, such heat losses also must be considered.

Determination of A

Since A is the unknown to be solved, Formula 1 becomes $A = Q/UT$. The number of square feet of heating surface, A, can be converted readily into the number of feet of pipe of any particular size and wall thickness by dividing the value of A by the external surface area in square feet per foot, as given in the table of Pipe Data, pages 346 and 347.

Determination of T

A true average temperature difference between the hot and cold fluids, T, is called the logarithmic mean temperature difference and is determined by the following formula:

$$T = \frac{GTD - LTD}{2.3 \log \frac{GTD}{LTD}} \qquad \textit{Formula 2}$$

Where:
GTD = Greatest temperature difference between the fluids.
LTD = Least temperature difference between the fluids.

See pages 410 and 411 for Table of Logarithms to Base 10.

Determination of U

The over-all coefficient of heat transfer, U, is dependent upon a large number of variables, including the conductivity and thickness of the metal in the pipe wall, the fluid velocity, specific heat, conductivity, density and viscosity, and the oxidation or scaling effect of the fluid on the pipe wall, as well as other physical characteristics such as the quantity of entrapped gases in the fluid, etc. The value of U may, therefore, be determined accurately only by experiment.

For generally accepted approximations of over-all heat transfer coefficients, see the table on page 386.

If a scale of rust or oxide builds up on either the inner or outer pipe walls, the value of U will be greatly reduced. In some cases, therefore, the substitution of a copper or alloy pipe coil for steel pipe will greatly improve the over-all rate of heat transfer, not because of the change in conductivity of the metal but because the pipe surface stays bright and practically rust free.

Selection of a value for U should be based upon a consideration of the conditions under which the coil will be operated. The maximum values should be used only when the velocity of the cooling and the cooled fluids is high and when corrosion or scaling of the pipe is negligible. The coefficients given in the column headed "Free Convections" are those obtained with pipe coils and pipe immersed in liquids under normally static conditions. The column headed "Forced Convections" covers pipe coils and pipe immersed in liquids that are agitated either by mechanical means or by a continuous flow of the fluid through the vessel.

For "Design of Pipe Coils for Heat Transfer," see the two pages following.

Templates for Drilling

25-Pound and 125-Pound Cast Iron

Dimensions, in Inches

Size	25-Pound Cast Iron							125-Pound Cast Iron						
	Diameter of flange	Thickness of flange	Diameter of bolt circle	Number of bolts	Diameter of bolts	Length of bolts		Diameter of flange	Thickness of flange	Diameter of bolt circle	Number of bolts	Diameter of bolts	Length of bolts	Length of stud bolts with 2 nuts
						X	*Y*							
1	...	...	...	...	...	...	...	4¼	7/16	3⅛	4	½	1¾	...
1¼	...	...	...	...	...	...	...	4⅝	½	3½	4	½	2	...
1½	...	...	...	...	...	...	...	5	9/16	3⅞	4	½	2	...
2	6	½	4¾	4	⅝	1¾	2	6	⅝	4¾	4	⅝	2¼	...
2½	7	9/16	5½	4	⅝	2	2	7	11/16	5½	4	⅝	2½	...
3	7½	⅝	6	4	⅝	2	2¼	7½	¾	6	4	⅝	2½	...
3½	8½	11/16	7	8	⅝	2¼	2¼	8½	13/16	7	8	⅝	2¾	...
4	9	¾	7½	8	⅝	2¼	2½	9	15/16	7½	8	⅝	3	...
5	10	¾	8½	8	⅝	2¼	2½	10	15/16	8½	8	¾	3	...
6	11	¾	9½	8	⅝	2¼	2½	11	1	9½	8	¾	3¼	...
8	13½	¾	11¾	8	⅝	2¼	2¾	13½	1⅛	11¾	8	¾	3½	...
10	16	⅞	14¼	12	⅝	2½	3	16	13/16	14¼	12	⅞	3¾	...
12	19	1	17	12	⅝	2¾	3	19	1¼	17	12	⅞	3¾	...
14	21	1⅛	18¾	12	¾	3¼	3½	21	1⅜	18¾	12	1	4¼	...
16	23½	1⅛	21¼	16	¾	3¼	3½	23½	17/16	21¼	16	1	4½	...
18	25	1¼	22¾	16	¾	3½	3¾	25	19/16	22¾	16	1⅛	4¾	...
20	27½	1¼	25	20	¾	3½	4	27½	111/16	25	20	1⅛	5	...
24	32	1⅜	29½	20	¾	3¾	4¼	32	1⅞	29½	20	1¼	5½	...
30	38¾	1½	36	28	⅞	4¼	...	38¾	2⅛	36	28	1¼	6¼	...
36	46	1⅝	42¾	32	⅞	5	...	46	2⅜	42¾	32	1½	7	...
42	53	1¾	49½	36	1	5¼	...	53	2⅝	49½	36	1½	7½	...
48	59½	2	56	44	1	5½	...	59½	2¾	56	44	1½	7¾	...
54	66¼	2¼	62¾	44	1	5¾	...	66¼	3	62¾	44	1¾	...	10½
60	73	2¼	69¼	52	1⅛	6	...	73	3⅛	69¼	52	1¾	...	10¾
72	86½	2½	82½	60	1⅛	6¼	...	86½	3½	82½	60	1¾	...	11½
84	99¾	2¾	95½	64	1¼	7¼	...	99¾	3⅞	95½	64	2	...	12¾
96	113¼	3	108½	68	1¼	7¾	...	113¼	4¼	108½	68	2¼	...	14

Length of Bolts

X— Valve to valve.

Y— { Valve to screwed companion flange, or
Valve to special 125-pound fitting with 25-pound drilling.

25-Pound Cast Iron: In sizes 4-inch and larger, the 25-pound templates for drilling conform to the American Tentative Standard for Cast Iron Pipe Flanges and Flanged Fittings for 25 psi steam working pressure (B16b2-1931). In sizes 3½-inch and smaller, they are Crane Standard, proportioned from the American Tentative Standard.

125-Pound Cast Iron: The 125-pound templates for drilling conform to the American Standard for Cast Iron Pipe Flanges and Flanged Fittings, Class 125 (B16.1-1948).

Facing: The 25-pound and 125-pound flanges are plain faced, with a smooth finish.

Diameter of port: The diameter of the port on 25-pound and 125-pound flanged valves is the same as the pipe size (nominal).

Bolt holes: For bolts smaller than 1¾-inch diameter, bolt holes are drilled ⅛-inch larger than the diameter of the bolt.

For bolts 1¾-inch diameter and larger, the bolt holes are drilled ¼-inch larger than the diameter of the bolt.

Drilling templates are in multiples of four, so that valves or fittings may be turned to face in any quarter when being installed.

Bolt holes are drilled to straddle the center line unless otherwise ordered.

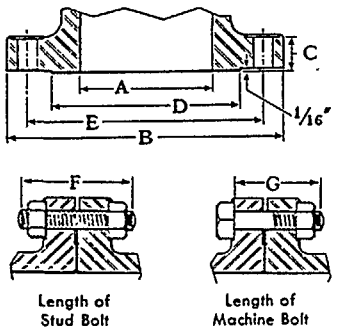
Spot facing: The bolt holes in Crane iron flanged products are not regularly spot faced. When spot facing is desired, orders must so specify

Bolting flanges of dissimilar metals....page 318

Gaskets....page 322

Templates for Drilling

150 and 300-Pound Steel Standards



¼-Inch Raised Face Joint

Dimensions, in Inches

Class	Size	A Valve or fitting	B	C Companion flange	C Valve or fitting	D	E	Bolts or Stud Bolts No.	Bolts or Stud Bolts Dia.	F	G
150 Pound Steel	½	½	3½	7/16	...	1⅜	2⅜	4	½	2¼	1¾
	¾	¾	3⅞	½	...	1 11/16	2¾	4	½	2¼	2
	1	1	4¼	9/16	7/16	2	3⅛	4	½	2½	2
	1¼	1¼	4⅝	⅝	½	2½	3½	4	½	2½	2¼
	1½	1½	5	11/16	9/16	2⅞	3⅞	4	½	2¾	2¼
	2	2	6	¾	⅝	3⅝	4¾	4	⅝	3	2¾
	2½	2½	7	⅞	11/16	4⅛	5½	4	⅝	3¼	3
	3	3	7½	15/16	¾	5	6	4	⅝	3½	3
	3½	3½	8½	15/16	13/16	5½	7	8	⅝	3½	3
	4	4	9	15/16		6 3/16	7½	8	⅝	3½	3
	5	5	10	15/16		7 5/16	8½	8	¾	3¾	3¼
	6	6	11	1		8½	9½	8	¾	3¾	3¼
	8	8	13½	1⅛		10⅝	11¾	8	¾	4	3½
	10	10	16	13/16		12¾	14¼	12	⅞	4½	3¾
	12	12	19	1¼		15	17	12	⅞	4½	4
	14	13¼	21	1⅜		16¼	18¾	12	1	5	4¼
	16	15¼	23½	17/16		18½	21¼	16	1	5¼	4½
	18	17¼	25	19/16		21	22¾	16	1⅛	5¾	4¾
	20	19¼	27½	1 11/16		23	25	20	1⅛	6	5¼
	24	23¼	32	1⅞		27¼	29½	20	1¼	6¾	5¾
300 Pound Steel	½	½	3¾	9/16		1⅜	2⅝	4	½	2½	2
	¾	¾	4⅝	⅝		1 11/16	3¼	4	⅝	2¾	2½
	1	1	4⅞	11/16		2	3½	4	⅝	3	2½
	1¼	1¼	5¼	¾		2½	3⅞	4	⅝	3	2¾
	1½	1½	6⅛	13/16		2⅞	4½	4	¾	3½	3
	2	2	6½	⅞		3⅝	5	8	⅝	3¼	3
	2½	2½	7½	1		4⅛	5⅞	8	¾	3¾	3¼
	3	3	8¼	1⅛		5	6⅝	8	¾	4	3½
	3½	3½	9	13/16		5½	7¼	8	¾	4¼	3¾
	4	4	10	1¼		6 3/16	7⅞	8	¾	4¼	3¾
	5	5	11	1⅜		7 5/16	9¼	8	¾	4½	4
	6	6	12½	17/16		8½	10⅝	12	¾	4¾	4¼
	8	8	15	1⅝		10⅝	13	12	⅞	5¼	4¾
	10	10	17½	1⅞		12¾	15¼	16	1	6	5¼
	12	12	20½	2		15	17¾	16	1⅛	6½	5¾
	14	13¼	23	2⅛		16¼	20¼	20	1⅛	6¾	6
	16	15¼	25½	2¼		18½	22½	20	1¼	7¼	6½
	18	17	28	2⅜		21	24¾	24	1¼	7½	6¾
	20	19	30½	2½		23	27	24	1¼	8	7
	24	23	36	2¾		27¼	32	24	1½	9	7¾

American Standard: The 150 and 300-pound flange dimensions, drilling templates, and stud bolt lengths shown in the table at the right conform, respectively, to the American Standard for 150 and 300-Pound Steel Pipe Flanges and Flanged Fittings, B16.5-1957.

Facing: Unless otherwise ordered, 150 and 300-pound steel flanged valves and companion flanges are regularly furnished with a 1/16-inch high raised face.

The thickness of flange dimension (dimension "C") includes the 1/16-inch high raised face.

Bolt holes: Bolt holes are drilled ⅛-inch larger than the diameter of the bolt.

Drilling templates are in multiples of four, so that valves or fittings may be turned to face in any quarter when installed. Bolt holes are drilled to straddle the center line unless otherwise ordered.

The bolt holes are spot faced.

Bolt and stud bolt lengths: The lengths indicated as dimensions F and G in the table apply for flanged joints other than Cranelap, made up of combinations of 150-pound or of 300-pound valves, fittings, or companion flanges with 1/16-inch high raised faces.

For flanged joints made up of Cranelaps, or for Cranelaps in combination with valves, fittings, or companion flanges having 1/16-inch raised faces, add to dimension F or G, the thickness of the lap for each Cranelap used.

150-Pound Class: The stud bolt lengths established by the American Standard are adequate for all 150-pound joints, made up of any combination of valves, fittings, or flanges having the regular 1/16-inch raised face.

300-Pound Class: For male to female or tongue to groove flanged joints, add the height of the male or tongue (¼-inch) to dimension F or G.

When Cranelaps are used in combinations of male to female flanged joints, add the thickness of the lap for each Cranelap. *Caution:* the male Cranelap must have a minimum lap thickness of ¼-inch.

For Cranelaps of tongue to groove flanged joints, add to dimension F or G the thickness of each lap, plus ¼-inch

Machine bolts.....page 316
Description of stud bolts.....page 317
Special facings.....pages 332 and 334
Length of stud bolts for ring joints....page 334

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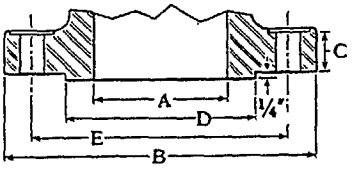
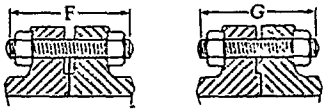
Templates for Drilling
1500 and 2500-Pound Steel Standards





Male to Male Flanged Joint

Male to Female Flanged Joint

Stud Bolt Length "G" also applies for Tongue to Groove Flanged Joint

Dimensions, in Inches

Class	Size	A†	B	C	D	E	Stud Bolts No.	Stud Bolts Dia.	F	G
1500 Pound Steel	1/2	1/2	4 3/4	7/8	1 3/8	3 1/4	4	3/4	4	3 3/4
	3/4	11/16	5 1/8	1	1 11/16	3 1/2	4	3/4	4 1/4	4
	1	7/8	5 7/8	1 1/8	2	4	4	7/8	4 3/4	4 1/2
	1 1/4	1 1/8	6 1/4	1 1/8	2 1/2	4 3/8	4	7/8	4 3/4	4 1/2
	1 1/2	1 3/8	7	1 1/4	2 7/8	4 7/8	4	1	5 1/4	5
	2	1 7/8	8 1/2	1 1/2	3 5/8	6 1/2	8	7/8	5 1/2	5 1/4
	2 1/2	2 1/4	9 5/8	1 5/8	4 1/8	7 1/2	8	1	6	5 3/4
	3	2 3/4	10 1/2	1 7/8	5	8	8	1 1/8	6 3/4	6 1/2
	4	3 5/8	12 1/4	2 1/8	6 3/16	9 1/2	8	1 1/4	7 1/2	7 1/4
	5	4 3/8	14 3/4	2 7/8	7 5/16	11 1/2	8	1 1/2	9 1/2	9 1/4
	6	5 3/8	15 1/2	3 1/4	8 1/2	12 1/2	12	1 3/8	10	9 3/4
	8	7	19	3 5/8	10 5/8	15 1/2	12	1 5/8	11 1/4	11
	10	8 3/4	23	4 1/4	12 3/4	19	12	1 7/8	13 1/4	13
	12	10 3/8	26 1/2	4 7/8	15	22 1/2	16	2	14 3/4	14 1/2
	14	11 3/8	29 1/2	5 1/4	16 1/4	25	16	2 1/4	16	15 3/4
	16	13	32 1/2	5 3/4	18 1/2	27 3/4	16	2 1/2	17 1/2	17 1/4
	18	14 5/8	36	6 3/8	21	30 1/2	16	2 3/4	19 1/4	19
	20	16 3/8	38 3/4	7	23	32 3/4	16	3	21	20 3/4
	24	19 5/8	46	8	27 1/4	39	16	3 1/2	24	23 3/4
2500 Pound Steel	1/2	7/16	5 1/4	13/16	1 3/8	3 1/2	4	3/4	4 3/4	4 1/2
	3/4	9/16	5 1/2	1 1/4	1 11/16	3 3/4	4	3/4	4 3/4	4 1/2
	1	3/4	6 1/4	1 3/8	2	4 1/4	4	7/8	5 1/4	5
	1 1/4	1	7 1/4	1 1/2	2 1/2	5 1/8	4	1	5 3/4	5 1/2
	1 1/2	1 1/8	8	1 3/4	2 7/8	5 3/4	4	1 1/8	6 1/2	6 1/4
	2	1 1/2	9 1/4	2	3 5/8	6 3/4	8	1	6 3/4	6 1/2
	2 1/2	1 7/8	10 1/2	2 1/4	4 1/8	7 3/4	8	1 1/8	7 1/2	7 1/4
	3	2 1/4	12	2 5/8	5	9	8	1 1/4	8 1/2	8 1/4
	4	2 7/8	14	3	6 3/16	10 3/4	8	1 1/2	9 3/4	9 1/2
	5	3 5/8	16 1/2	3 5/8	7 5/16	12 3/4	8	1 3/4	11 1/2	11 1/4
	6	4 3/8	19	4 1/4	8 1/2	14 1/2	8	2	13 1/2	13 1/4
	8	5 3/4	21 3/4	5	10 5/8	17 1/4	12	2	15	14 3/4
	10	7 1/4	26 1/2	6 1/2	12 3/4	21 1/4	12	2 1/2	19	18 3/4
	12	8 5/8	30	7 1/4	15	24 3/8	12	2 3/4	21	20 3/4

†Dimension "A" applies to valves or fittings.

American Standard: The 1500 and 2500-pound flange dimensions, drilling templates, and stud bolt lengths shown in the table at the right conform, respectively, to the American Standard for 1500 and 2500-Pound Steel Pipe Flanges and Flanged Fittings, B16.5-1957.

Facing: Unless otherwise ordered, 1500 and 2500-pound steel flanged valves and companion flanges are regularly furnished with 1/4-inch high large male facing.

The thickness of flange dimension (dimension "C") does not include the 1/4-inch high large male face.

Bolt holes: Bolt holes are drilled 1/8-inch larger than the diameter of the bolt.

Drilling templates are in multiples of four, so that valves or fittings may be turned to face in any quarter when installed. Bolt holes are drilled to straddle the center line unless otherwise ordered.

Spot facing: The bolt holes are spot faced.

Stud bolt lengths: The stud bolt lengths shown in the above table apply for flanged joints other than Cranelap, made up of combinations of valves, fittings, or companion flanges with male, female, tongue, or groove faces. Male or tongue faces are 1/4-inch high; female or groove faces are 3/16-inch deep.

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For flanged joints made up of Cranelaps or for Cranelaps in combination with valves, fittings, or companion flanges, new stud bolt lengths must be established in the following manner:

Stud Bolt Lengths for Cranelap Joints (Based on length "G" for stud bolts)

Cranelap to Cranelap.....Deduct 1/4-inch and add thickness of both laps
Cranelap to 1/4-inch male.....Add thickness of one lap
Cranelap to female.....Deduct 1/4-inch and add thickness of one lap*
Cranelap to female Cranelap.....Deduct 1/4-inch and add thickness of both laps*
Tongue or groove Cranelaps.....Add thickness of each lap

*The Cranelap serving as the male must have a minimum lap thickness of 1/4-inch.

Description of stud bolts.....page 317
Bolting on companion flanges....page 325
Special facings.....pages 333 and 335
Length of stud bolts for ring joints....page 335

Male, Female, Tongue, and Groove Flange Facings

For 400 to 2500-Pound Steel

Dimensions, in Inches

Class	Size	A	B	C	D
400, 600, 900, 1500, or 2500-Pound Steel	½	1⅜	1	23/32	1⅜
	¾	111/16	15/16	15/16	111/16
	1	2	1½	13/16	1⅞
	1¼	2½	1⅞	1½	2¼
	1½	2⅞	2⅛	1¾	2½
	2	3⅝	2⅞	2¼	3¼
	2½	4⅛	3⅜	211/16	3¾
	3	5	4¼	35/16	4⅝
	3½	5½	4¾	313/16	5⅛
	4	63/16	53/16	45/16	511/16
	5	75/16	65/16	5⅜	613/16
	6	8½	7½	6⅜	8
	8	10⅝	9⅜	8⅜	10
	10	12¾	11¼	10½	12
	12	15	13½	12½	14¼
	14	16¼	14¾	13¾	15½
	16	18½	16¾	15¾	17⅝
	18	21	19¼	17¾	20⅛
	20	23	21	19¾	22
	24	27¼	25¼	23¾	26¼

Prices on Request

Dimensions above conform to the American Standard for Steel Pipe Flanges and Flanged Fittings, B16.5-1957.

All of the types of facings can be applied to flanged products in the 400, 600, 900, 1500, and 2500-pound steel classes, conforming to American Standard, B16.5-1957.

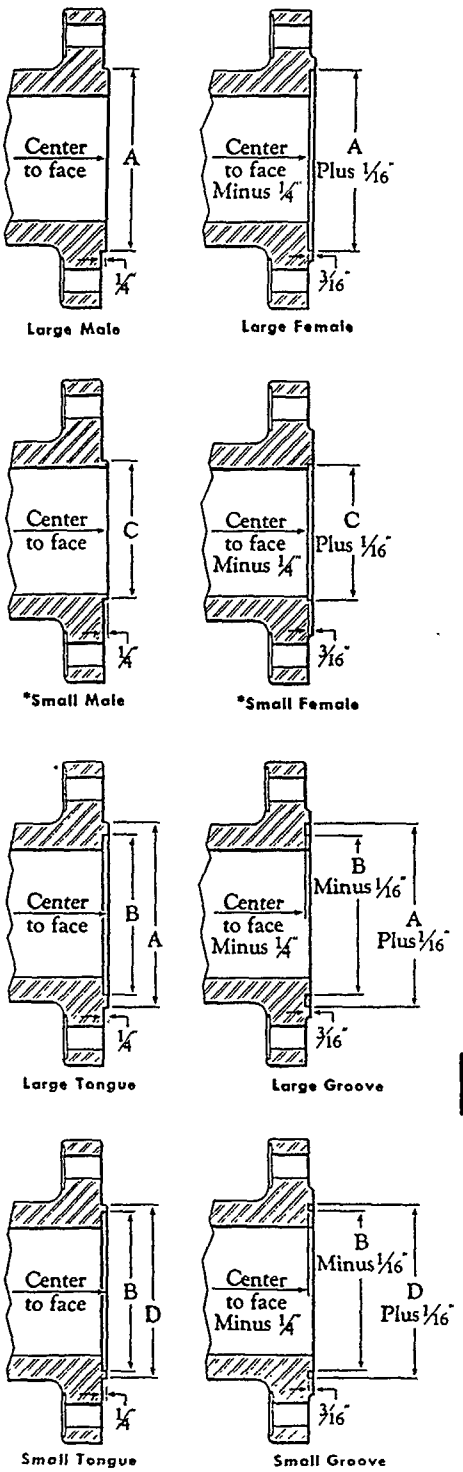
Center to face: The illustrations show how regular valve or fitting center to face dimensions are affected by these special facings. Notice particularly: the male and tongue facings are included in the regular center to face; the female and groove facings require a deduction of ¼-inch from the regular center to face.

Regular facing and finish: Flanged valves and companion flanges of the classes indicated are regularly furnished with a ¼-inch male face.

Male faces are finished with approximately 32 concentric grooves per inch, known as a serrated finish. Female, tongue, and groove faces regularly have a smooth finish.

***Small male and female:** Small male and female facing, when used with steel screwed flanges, makes the joint directly on the end of the pipe. In these cases the pipe must be thick enough to provide a bearing surface of ample width to prevent crushing of the gasket. If a pipe end is to be used as a mating member in a joint, orders should specify the inside diameter of the pipe. In some instances, it may be necessary to lag up the port diameter of valves and fittings to match the I.D. of the pipe, in which case special prices will apply.

Gaskets: Gaskets for male and female and for tongue and groove joints should cover the bottom of the recess with minimum clearances, allowing for the plus or minus tolerance of 0.016 inch (1/64") which is permitted by the American Standard on the inside and outside diameters of facings.



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Dimensions of ring joint facing....pages 334 and 335
Facings on Cranelap Joints.....pages 365 and 366

Bolting on companion flanges.....page 325
Templates for drilling.....pages 330 and 331

Ring Joint Facing and Rings

American Standard—Dimensions, in Inches

(continued from the preceding page)

The dimensions shown on this and the preceding page apply to ring joint facing and rings for the end flanges of steel valves and flanged fittings, and for steel flanges. Rings are described on page 11.

The groove (smooth finish) for the ring is cut in a raised face as illustrated on the preceding page.

Standards: The dimensions of the rings and ring joint grooves, as well as the marking of the rings, conform to American Standard B16.20-1956.

The flange facing dimensions conform to the American Standard for Steel Pipe Flanges and Flanged Fittings, B16.5-1957.

Class	Size	Ring No.	A	B	C	D	E	F	G	H	*J	Stud Bolts No.	Stud Bolts Dia.
900 Pound	3	R 31	4 7/8	7/16	11/16	5/8	15/32	5/16	5/32	6 1/8	5 3/4	8	7/8
	4	R 37	5 7/8	7/16	11/16	5/8	15/32	5/16	5/32	7 1/8	6 3/4	8	1 1/8
	5	R 41	7 1/8	7/16	11/16	5/8	15/32	5/16	5/32	8 1/2	7 1/2	8	1 1/4
	6	R 45	8 5/16	7/16	11/16	5/8	15/32	5/16	5/32	9 1/2	7 1/2	12	1 1/8
	8	R 49	10 5/8	7/16	11/16	5/8	15/32	5/16	5/32	12 1/8	8 3/4	12	1 3/8
	10	R 53	12 3/4	7/16	11/16	5/8	15/32	5/16	5/32	14 1/4	9 1/4	16	1 3/8
	12	R 57	15	7/16	11/16	5/8	15/32	5/16	5/32	16 1/2	10	20	1 3/8
	14	R 62	16 1/2	5/8	7/8	13/16	21/32	7/16	5/32	18 3/8	11	20	1 1/2
	16	R 66	18 1/2	5/8	7/8	13/16	21/32	7/16	5/32	20 5/8	11 1/2	20	1 5/8
	18	R 70	21	3/4	1	15/16	25/32	1/2	3/16	23 3/8	13 1/4	20	1 7/8
	20	R 74	23	3/4	1	15/16	25/32	1/2	3/16	25 1/2	14	20	2
	24	R 78	27 1/4	1	15/16	1 1/4	1 1/16	5/8	7/32	30 3/8	17 3/4	20	2 1/2
1500 Pound	1/2	R 12	1 9/16	5/16	9/16	1/2	11/32	1/4	5/32	2 3/8	4	4	3/4
	3/4	R 14	1 3/4	5/16	9/16	1/2	11/32	1/4	5/32	2 5/8	4 1/4	4	3/4
	1	R 16	2	5/16	9/16	1/2	11/32	1/4	5/32	2 13/16	4 3/4	4	7/8
	1 1/4	R 18	2 3/8	5/16	9/16	1/2	11/32	1/4	5/32	3 3/16	4 3/4	4	7/8
	1 1/2	R 20	2 11/16	5/16	9/16	1/2	11/32	1/4	5/32	3 5/8	5 1/4	4	1
	2	R 24	3 3/4	7/16	11/16	5/8	15/32	5/16	1/8	4 7/8	5 3/4	8	7/8
	2 1/2	R 27	4 1/4	7/16	11/16	5/8	15/32	5/16	1/8	5 3/8	6 1/4	8	1
	3	R 35	5 3/8	7/16	11/16	5/8	15/32	5/16	1/8	6 5/8	7	8	1 1/8
	4	R 39	6 3/8	7/16	11/16	5/8	15/32	5/16	1/8	7 5/8	7 3/4	8	1 1/4
	5	R 44	7 5/8	7/16	11/16	5/8	15/32	5/16	1/8	9	9 3/4	8	1 1/2
	6	R 46	8 5/16	1/2	3/4	11/16	17/32	3/8	1/8	9 3/4	10 1/4	12	1 3/8
	8	R 50	10 5/8	5/8	7/8	13/16	21/32	7/16	5/32	12 1/2	11 3/4	12	1 5/8
	10	R 54	12 3/4	5/8	7/8	13/16	21/32	7/16	5/32	14 5/8	13 1/2	12	1 7/8
	12	R 58	15	7/8	1 1/8	1 1/16	29/32	9/16	3/16	17 1/4	15 1/4	16	2
	14	R 63	16 1/2	1	15/16	1 1/4	1 1/16	5/8	7/32	19 1/4	16 3/4	16	2 1/4
	16	R 67	18 1/2	1 1/8	17/16	1 3/8	1 3/16	1 1/16	5/16	21 1/2	18 1/2	16	2 1/2
	18	R 71	21	1 1/8	17/16	1 3/8	1 3/16	1 1/16	5/16	24 1/8	20 1/4	16	2 3/4
	20	R 75	23	1 1/4	19/16	1 1/2	15/16	1 1/16	3/8	26 1/2	22 1/4	16	3
	24	R 79	27 1/4	1 3/8	1 3/4	1 5/8	1 7/16	1 3/16	7/16	31 1/4	25 1/2	16	3 1/2
2500 Pound	1/2	R 13	1 11/16	5/16	9/16	1/2	11/32	1/4	5/32	2 9/16	4 3/4	4	3/4
	3/4	R 16	2	5/16	9/16	1/2	11/32	1/4	5/32	2 7/8	4 3/4	4	3/4
	1	R 18	2 3/8	5/16	9/16	1/2	11/32	1/4	5/32	3 1/4	5 1/4	4	7/8
	1 1/4	R 21	2 27/32	7/16	11/16	5/8	15/32	5/16	1/8	4	6	4	1
	1 1/2	R 23	3 1/4	7/16	11/16	5/8	15/32	5/16	1/8	4 1/2	6 3/4	4	1 1/8
	2	R 26	4	7/16	11/16	5/8	15/32	5/16	1/8	5 1/4	7	8	1
	2 1/2	R 28	4 3/8	1/2	3/4	11/16	17/32	3/8	1/8	5 7/8	7 3/4	8	1 1/8
	3	R 32	5	1/2	3/4	11/16	17/32	3/8	1/8	6 5/8	8 3/4	8	1 1/4
	4	R 38	6 3/16	5/8	7/8	13/16	21/32	7/16	5/32	8	10 1/4	8	1 1/2
	5	R 42	7 1/2	3/4	1	15/16	25/32	1/2	5/32	9 1/2	12 1/4	8	1 3/4
	6	R 47	9	3/4	1	15/16	25/32	1/2	5/32	11	14	8	2
	8	R 51	11	7/8	1 1/8	1 1/16	29/32	9/16	3/16	13 3/8	15 1/2	12	2
	10	R 55	13 1/2	1 1/8	1 7/16	1 3/8	1 3/16	1 1/16	1/4	16 3/4	20	12	2 1/2
	12	R 60	16	1 1/4	1 9/16	1 1/2	1 5/16	1 1/16	5/16	19 1/2	22	12	2 3/4

Quantity and sizes of stud bolts for American Standard steel flanged joints....page 319

Center to end: When ring joint facing is applied to 150 and 300-pound valves and fittings, the center to end is equal to the regular center to face dimension (which includes the 1/16-inch raised face) plus the depth of the groove.

On ring joint valves and fittings of the 400-pound and higher pressure classes, the center to end is equal to the regular center to face dimension minus 1/4-inch (the height of the large male), plus the depth of the groove.

This practice also applies to loose flanges; that is, the raised face which is equal to the depth of the groove is added to the flange thickness (dimension "B" on pages 312 and 313).

On Cranelap joints with ring joint facing the depth of the groove is added to the minimum thickness of the lap. See pages 363 to 366 for Cranelap joints.

***Stud bolt lengths:** The length of stud bolts, indicated as dimension "J" in the tables on these facing pages, applies for all combinations of ring joint valves, fittings, and flanges other than Cranelap.

For ring joint combinations made up of valves, fittings, or flanges bolted to Cranelaps, add the pipe thickness to dimension "J". For Cranelap to Cranelap ring joints, add twice the pipe thickness to dimension "J".

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Rings for ring joints.....page 11
Description of stud bolts.....page 317
Drilling templates.....pages 329 to 331
End flange dimensions....pages 329 to 331
Dimensions of Cranelap Joints....page 366

SECTION 29

Pipe, Pipe Data, and Thread Information

Wrought Steel and Wrought Iron Pipe

General Notes.....page 338
Specifications.....page 339

Pipe and Tubing

Standard.....page 340
Extra Strong.....page 341
Double Extra Strong.....page 341
API Threaded Line Pipe.....page 342
Large O. D. Pipe.....page 343
Seamless Pressure Pipe.....page 343
Reamed and Drifted Pipe.....page 344
Welded and Seamless Steel Pipe.....page 345
Red Brass and Copper Pipe.....page 348
Copper Water Tube.....page 349

Pipe Data

Bundling Schedule, Steel Pipe.....pages 340 and 341
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Commercial Wrought Steel Pipe Data.....pages 346 and 347
Wall Thickness of Wrought Iron Pipe.....page 348
Determining Inside Diameter of Wrought Iron Pipe.....page 348
Volume of Pipe per Lineal Foot.....page 354

Thread Information

American Standard Taper Pipe Threads.....page 350
American Standard Straight Pipe Threads.....page 351
British Standard Taper Pipe Threads.....page 352
Normal Thread Engagement.....page 352
Discussion of Threaded Pipe Joints.....page 353

For additional data concerning pipe, refer to:

Fabricated piping.....pages 355 to 380
Calculating working pressure, stress, or wall thickness.....pages 388 to 390
Length of pipe in bends.....page 391
Calculation of pipe bends.....pages 392 and 393

Spacing of pipe supports.....pages 394 and 395
Deflection of horizontal pipe lines.....page 395
Thermal expansion and modulus of elasticity of pipe.....page 396
Flow of fluids through valves, fittings, and pipe.....Section 32

Wrought Steel and Wrought Iron Pipe

Seamless — Butt-Welded — Lap-Welded — Electric-Welded

Pipe Specifications

Each length of pipe is inspected and tested hydrostatically at the mill in accordance with various ASTM and API Specifications.

The inspection tests cover such items as permissible variations in weights and dimensions, workmanship, finish, and physical and chemical properties. The hydrostatic test is made to assure that pipe is pressure-tight before it is sold to the customer.

The following paragraphs outline briefly some of the more important aspects of several of the specifications most commonly used in connection with pipe as listed in this catalog.

ASTM A 120 (ASA Designation B36.20)

Covers black and galvanized *welded* and *seamless* steel pipe intended for ordinary uses, such as low pressure service in steam, water, gas, and air lines. Pipe to this specification is not intended for close coiling or bending. Hydrostatic test pressures for each size are prescribed in tables included in the specification. For detailed pressures, see pages 340 and 341 of this catalog.

Steel pipe in Crane stocks conforms to ASTM Specification A 120.

ASTM A 53 (ASA Designation B36.1)

Covers black and galvanized *welded* and *seamless* steel pipe intended for coiling, bending, flanging, and other special purposes. Chemical and tensile requirements as well as flattening and bending tests are indicated to assure that the steel is of proper grade for the purpose for which the pipe is intended. Hydrostatic test pressures for each size are prescribed in tables included in the specification and are the same as those listed for ASTM A 120.

Seamless pipe in Crane stocks generally conforms to ASTM Specification A 53. Butt-welded pipe to this specification can be furnished when specified.

ASTM A 106 (ASA Designation B36.3)

Covers black *seamless* (welded not permitted) steel pipe intended for high temperature service. Full chemical and tensile requirements are listed in addition to flattening, bending, and tensile tests. Hydrostatic test pressures are the same as those listed for ASTM A 120.

Pipe per ASTM A 106 is selected at the mill to meet closer weight and dimensional tolerances as well as the more critical surface finish standards specified.

Seamless pipe per ASTM Specification A 106 can be furnished by Crane when specified.

ASTM A 72 (ASA Designation B36.2)

Covers *welded* wrought iron pipe intended for coiling, bending, flanging, and other special purposes. Butt-welded pipe in sizes 1¼ to 2-inch inclusive is not intended for bending; lap-welded pipe, made in sizes 1¼ to 12-inch inclusive, is more suitable for such use. Hydrostatic test pressures for each size are prescribed in tables included in the specification.

Wrought iron pipe carried in Crane stocks conforms to ASTM Specification A 72.

API 5L

Covers *welded* and *seamless* steel pipe commonly used to convey gas, water, and oil. Hydrostatic test pressures for each size are prescribed in tables included in the specification. Pipe made in accordance with API 5L is stamped with the API monogram.

Pipe Tolerance Table

Pipe Specification	Permissible Variation in Weight per Foot*				Permissible Variation in Outside Diameter At Any Point			Permissible Minimum Wall Thickness At Any Point
	Standard or Extra Strong		Double Extra Strong		Pipe Size	Standard, Extra Strong, or Double Extra Strong		
	Plus	Minus	Plus	Minus	Inches	Plus	Minus	
ASTM A 120 or A 53	5%	5%	10%	10%	1½ & smaller	0.015"	0.031"	Not more than 12½% under the nominal wall thickness specified
					2 & larger	1%	1%	
ASTM A 106	*6½%	*3½%	*10%	*3½%	1½ & smaller	0.015"	0.031"	
					2 to 4	0.031"	0.031"	
					5 to 8	0.062"	0.031"	
					10 to 18	0.093"	0.031"	
					20 and 24	0.125"	0.031"	
API 5L	*10%	*3½%	...	...	1½ & smaller	0.015"	0.031"	
					2 & larger	1%	1%	
ASTM A 72	5%	5%	10%	10%	1½ & smaller	0.015"	0.031"	Not specified
					2 & larger	1%	1%	

*For ASTM A106 and API 5L pipe, permissible variation in weight is on a "per length" rather than "per foot" basis

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Extra Strong and Double Extra Strong Pipe

Black and Galvanized

Dimensions, Weights, and Hydrostatic Test Pressures — Bundling Schedules

Pipe	Nominal Size	ASA Sched. No.	Diameters		Wall Thickness	Weight per Foot, Plain End	Test Pressures, Psi			Bundling Schedule		
			Outside	Inside			Butt-Weld	Seamless		No. of Lengths per Bundle	Approximate Average Per Bundle	
								Grade A	Grade B		Feet	Pounds
	Inches		Inches	Inches	Inches	Pounds						
Extra Strong	⅛	80	.405	.215	.095	.31	850	850	850	30	630	195
	¼	80	.540	.302	.119	.54	850	850	850	24	504	272
	⅜	80	.675	.423	.126	.74	850	850	850	18	378	280
	½	80	.840	.546	.147	1.09	850	850	850	12	252	275
	¾	80	1.050	.742	.154	1.47	850	850	850	7	147	216
	1	80	1.315	.957	.179	2.17	850	850	850	5	105	228
	1¼	80	1.660	1.278	.191	3.00	1100	1500	1600	3	63	189
	1½	80	1.900	1.500	.200	3.63	1100	1500	1600	3	63	229
	2	80	2.375	1.939	.218	5.02	1100	1500	1600	...	...	...
	2½	80	2.875	2.323	.276	7.66	1100	1500	1600	...	...	...
	3	80	3.500	2.900	.300	10.25	1100	1500	1600	...	...	...
	3½	80	4.000	3.364	.318	12.51	1700	1700	1800	...	...	...
	4	80	4.500	3.826	.337	14.98	1700	1700	1800	...	...	...
	5	80	5.563	4.813	.375	20.78	...	1700	1800	...	...	...
	6	80	6.625	5.761	.432	28.57	...	1700	1800	...	...	...
	8	80	8.625	7.625	.500	43.39	...	1700	2400	...	...	...
	10	60	10.750	9.750	.500	54.74	...	1600	1900	...	...	...
	12	...	12.750	11.750	.500	65.42	...	1600	1900	...	...	...
Double Extra Strong	½	...	.840	.252	.294	1.71	1000	...	2500	7	147	251
	¾	...	1.050	.434	.308	2.44	1000	...	2500	5	105	256
	1	...	1.315	.599	.358	3.66	1000	..	2500	3	63	230
	1¼	...	1.660	.896	.382	5.21	1200	...	2500	3	63	328
	1½	...	1.900	1.100	.400	6.41	1200	...	2500	3	63	404
	2	...	2.375	1.503	.436	9.03	...	1800	1900	...	...	...
	2½	...	2.875	1.771	.552	13.70	...	1800	1900	...	...	...
	3	...	3.500	2.300	.600	18.58	...	1800	1900	..	...	...
	4	...	4.500	3.152	.674	27.54	...	2000	2100	...	...	...
	5	...	5.563	4.063	.750	38.55	...	2000	2100	..	...	...
	6	...	6.625	4.897	.864	53.16	...	2000	2100	..	...	..
	8	...	8.625	6.875	.875	72.42	...	2800	2800		...	...

General practice: Unless otherwise ordered, plain end pipe will be furnished.

For pipe fitted with threads or with threads and couplings, orders must specify; an added charge is made.

Extra Strong pipe 4-inch and smaller will be furnished butt-welded unless otherwise ordered.

Lengths: Random lengths are regularly furnished. Cut lengths are furnished at an added charge.

Finish: Black pipe is regularly furnished. Galvanized pipe will be furnished, when specified, at an added charge.

Couplings: When couplings are required, they will be furnished taper tapped.

Weights: Weights listed in the table are calculated. Permissible variations are not more than 5 per cent above or 5 per cent below for Extra Strong pipe and not more than 10 per cent above or 10 per cent below for Double Extra Strong pipe.

For pipe tolerances, see page 339.

Ordering: Order butt-welded pipe in sizes up to 1½-inch by bundles. Order Extra Strong butt-welded pipe in sizes 2 to 4-inch by lengths, using 21 feet as an average length.

Order seamless or electric-welded pipe by lengths, using 20 feet as an average length.

Prices: Prices are furnished on request.

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Bundling schedule for wrought iron pipe.....page 348

Large O. D. Pipe

Plain Ends — Black

General practice: Large O.D. pipe is regularly furnished with plain ends.

Lengths: Random lengths are regularly furnished. Cut lengths are available, when specified, at an added charge.

Finish: Black pipe is regularly furnished.

Weights: Weights listed in the table are calculated. Permissible variation is 10 per cent above or 10 per cent below.

For pipe tolerances, see page 339.

Specify wall thickness: When ordering, be sure to include the wall thickness desired.

Heavier walls; larger sizes: Data on heavier walls or larger O.D. sizes will be furnished on request.

Prices: Prices are furnished on request.

Dimensions, Weights, and Hydrostatic Test Pressures

Size, Outside Diameter	Wall Thickness	ASA Schedule Number	Weight per Foot	Test Pressures (Psi)	
				Seamless Grade A	Seamless Grade B
Inches	Inches		Pounds		
14 OD	1/4	10	36.71	650	750
	5/16	20	45.68	800	950
	3/8	30	54.57	950	1100
	1/2	...	63.37	1300	1500
16 OD	1/4	10	42.05	550	650
	5/16	20	52.36	700	800
	3/8	30	62.58	850	1000
	1/2	40	82.77	1100	1300
18 OD	1/4	10	47.39	500	600
	5/16	20	59.03	600	750
	3/8	...	70.59	750	900
	1/2	...	93.45	1000	1200
20 OD	1/4	10	52.73	450	500
	5/16	...	65.71	550	650
	3/8	20	78.60	700	800
	1/2	30	104.13	900	1000
24 OD	5/16	...	79.06	450	550
	3/8	20	94.62	550	650
	1/2	...	125.49	750	850
26 OD	5/16	...	85.73	450	500
	3/8	...	102.63	500	600
	1/2	...	136.17	700	800

Seamless Pressure Pipe

Plain Ends — Black — ASTM Specification A 106 or A 53

General practice: Seamless Pressure pipe is regularly furnished with plain ends.

Lengths: Random lengths ranging from 17 to 24 feet will be furnished unless otherwise specified.

Finish: Black pipe only is available from pipe mills. Arrangements for galvanizing, however, can be made when desired.

Weights: Weights listed in the table are calculated. Permissible variations are not more than 6½ per cent above or 3½ per cent below for Schedule 40 and 80 pipe and not more than 10 per cent above or 3½ per cent below for Schedule 160 and Double Extra Strong pipe.

For pipe tolerances, see page 339.

Prices: Prices on request.

Dimensions, Weights, and Hydrostatic Test Pressures

Nominal Size	Outside Diameter	Wall Thickness	Weight per Foot	Test Pressure Grade B	Wall Thickness	Weight per Foot	Test Pressure Grade B
Inches	Inches	Inches	Pounds	Psi	Inches	Pounds	Psi
		Standard (ASA Schedule 40)			Extra Strong (ASA Schedule 80)		
1/8	.405	.068	.2447	700	.095	.3145	850
1/4	.540	.088	.4248	700	.119	.5351	850
3/8	.675	.091	.5676	700	.126	.7388	850
1/2	.840	.109	.8510	700	.147	1.088	850
3/4	1.050	.113	1.131	700	.154	1.474	850
1	1.315	.133	1.679	700	.179	2.172	850
1 1/4	1.660	.140	2.273	1100	.191	2.997	1600
1 1/2	1.900	.145	2.718	1100	.200	3.631	1600
		ASA Schedule 160			Double Extra Strong		
1/2	.840	.187	1.304	2500	.294	1.714	2500
3/4	1.050	.218	1.937	2500	.308	2.441	2500
1	1.315	.250	2.844	2500	.358	3.659	2500
1 1/4	1.660	.250	3.765	2500	.382	5.214	2500
1 1/2	1.900	.281	4.859	2500	.400	6.408	2500

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Dimensions and Weights of

Welded and Seamless Steel Pipe

Listed by ASA Schedule Numbers . . . . with Standard, Extra Strong, and Double Extra Strong pipe included for comparison purposes.

Nominal Size Inches	Outside Dia. Inches	Sched. 10	Sched. 20	Sched. 30	Standard	Sched. 40	Sched. 60	Extra Strong	Sched. 80	Sched. 100	Sched. 120	Sched. 140	Sched. 160	Double Extra Strong
Nominal Wall Thicknesses, in Inches														
⅛	.405	...	...	...	.068	.068	...	.095	.095	...	...	...	...	...
¼	.540	...	...	...	.088	.088	...	.119	.119	...	...	...	...	...
⅜	.675	...	...	...	.091	.091	...	.126	.126	...	...	...	...	...
½	.840	...	...	...	.109	.109	...	.147	.147	...	...	...	.187	.294
¾	1.050	...	...	...	.113	.113	...	.154	.154	...	...	...	.218	308
1	1.315	...	...	...	.133	.133	...	.179	.179	...	...	...	.250	.358
1¼	1.660	...	...	...	.140	.140	...	.191	.191	...	...	...	.250	.382
1½	1.900	...	...	...	.145	.145	...	.200	.200	...	...	...	.281	.400
2	2.375	...	...	...	.154	.154	...	.218	.218	...	...	...	.343	.436
2½	2.875	...	...	...	.203	.203	...	.276	.276	...	...	...	.375	.552
3	3.500	...	...	...	.216	.216	...	.300	.300	...	...	...	.438	.600
3½	4.000	...	...	...	.226	.226	...	.318	.318	...	...	...	...	636
4	4.500	...	...	...	.237	.237	...	.337	.337	...	.438	...	.531	.674
5	5.563	...	...	...	.258	.258	...	.375	.375	...	.500	...	.625	.750
6	6.625	...	...	...	.280	.280	...	.432	.432	...	.562	...	.718	.864
8	8.625	...	.250	.277	.322	.322	.406	.500	.500	.593	.718	.812	.906	.875
10	10.750	...	.250	.307	.365	.365	.500	.500	.593	.718	.843	1.000	1.125	...
12	12.750	...	.250	.330	.375	.406	.562	.500	.687	.843	1.000	1.125	1.312	...
14 OD	14.00	.250	.312	.375	.375	.438	.593	.500	.750	.937	1.093	1.250	1.406	...
16 OD	16.00	.250	.312	.375	.375	.500	.656	.500	.843	1.031	1.218	1.438	1.593	..
18 OD	18.00	.250	.312	.438	.375	.562	.750	.500	.937	1.156	1.375	1.562	1.781	..
20 OD	20.00	.250	.375	.500	.375	.593	.812	.500	1.031	1.281	1.500	1.750	1.968	
24 OD	24.00	.250	.375	.562	.375	.687	.968	.500	1.218	1.531	1.812	2.062	2.343	
30 OD	30.00	.316	.500	.625	.375	...	...	.500	..	..	.	..	...	.
Calculated Weights for Plain Ends, in Pounds per Foot														
⅛	.405	...	...	...	.24	.24	...	.31	.31	...	...	...	...	. .
¼	.540	...	...	...	.42	.42	...	.54	.54	...	...	...	...	...
⅜	.675	...	...	...	.57	.57	...	.74	.74	...	...	...	...	...
½	.840	...	...	...	.85	.85	...	1.09	1.09	...	...	...	1.30	1.71
¾	1.050	...	...	...	1.13	1.13	...	1.47	1.47	...	...	...	1.94	2.44
1	1.315	...	...	...	1.68	1.68	...	2.17	2.17	...	...	...	2.84	3.66
1¼	1.660	...	...	...	2.27	2.27	...	3.00	3.00	...	...	...	3.77	5.21
1½	1.900	...	...	...	2.72	2.72	...	3.63	3.63	...	...	...	4.86	6.41
2	2.375	...	...	...	3.65	3.65	...	5.02	5.02	...	...	..	7.44	9.03
2½	2.875	...	...	...	5.79	5.79	...	7.66	7.66	...	...	...	10.01	13.70
3	3.500	...	...	...	7.58	7.58	...	10.25	10.25	...	...	...	14.32	18 58
3½	4.000	...	...	...	9.11	9.11	...	12.51	12.51	...	...	...	.	22 85
4	4.500	...	...	...	10.79	10.79	...	14.98	14.98	...	19.01	.	22.51	27.54
5	5.563	...	...	...	14.62	14.62	...	20.78	20.78	...	27.04		32.96	38.55
6	6.625	...	...	...	18.97	18.97	...	28 57	28.57	...	36.39	.	45.30	53.16
8	8.625	...	22.36	24.70	28.55	28.55	35.64	43 39	43.39	50.87	60.63	67.76	74.69	72 42
10	10.750	...	28.04	34.24	40.48	40.48	54.74	54.74	64.33	76.93	89.20	104.13	115.65	
12	12.750	...	33.38	43.77	49.56	53.56	73.16	65.42	88.51	107.20	125.49	139.68	160.27	.
14 OD	14.00	36.71	45.68	54.57	54.57	63.37	84.91	63.37	106.13	130.73	150.67	170.22	189.12	
16 OD	16.00	42.05	52.36	62.58	62.58	82.77	107.50	82.77	136.46	164.83	192.29	223.50	245.11	.
18 OD	18.00	47.39	59.03	82.06	70.59	104.75	138.17	93.45	170.75	207.96	244.14	274.23	308.51	.
20 OD	20.00	52.73	78.60	104.13	78 60	122.91	166.40	104 13	208.87	256.10	296.37	341.10	379.01	
24 OD	24.00	63.41	94.62	140.80	94 62	171.17	230.91	125.49	296.36	367.40	429.39	483.13	541.94	..
30 OD	30.00	79.43	157.53	196.08	118 65	.		157 53						

General Notes and Pipe Specifications . . . . pages 338 and 339

Standard, Extra Strong, and Double Extra Strong Pipe . . . . pages 340 and 341

CRTX 1156

Commercial Wrought Steel Pipe Data — continued

Nominal Pipe Size (Inches)	Outside Diameter (D) (Inches)	Schedule No. *See Note 1*	Wall Thickness (t) (Inches)	Inside Diameter (d) (Inches)	Area of Metal (a) Square Inches	Transverse Internal Area: Square Inches	Transverse Internal Area: *See Note 2* Square Feet	Moment of Inertia (I) Inches to 4th Power	Weight of Pipe Pounds per foot	Weight of Water Pounds per foot of pipe	External Surface Sq. Ft. per foot of pipe	Section Modulus $(2\frac{I}{D})$
		20	.250	10.250	8.24	82.52	.5731	113.7	28.04	35.76	2.814	21.15
		30	.307	10.136	10.07	80.69	.5603	137.4	34.24	34.96	2.814	25.57
		40s	.365	10.020	11.90	78.86	.5475	160.7	40.48	34.20	2.814	29.90
		60x	.500	9.750	16.10	74.66	.5185	212.0	54.74	32.35	2.814	39.43
10	10.750	80	.593	9.564	18.92	71.84	.4989	244.8	64.33	31.13	2.814	45.54
		100	.718	9.314	22.63	68.13	.4732	286.1	76.93	29.53	2.814	53.22
		120	.843	9.064	26.24	64.53	.4481	324.2	89.20	27.96	2.814	60.32
		140	1.000	8.750	30.63	60.13	.4176	367.8	104.13	26.06	2.814	68.43
		160	1.125	8.500	34.02	56.75	.3941	399.3	115.65	24.59	2.814	74.29
		20	.250	12.250	9.82	117.86	.8185	191.8	33.38	51.07	3.338	30.2
		30	.330	12.090	12.87	114.80	.7972	248.4	43.77	49.74	3.338	39.0
		..s	.375	12.000	14.58	113.10	.7854	279.3	49.56	49.00	3.338	43.8
		40	.406	11.938	15.77	111.93	.7773	300.3	53.53	48.50	3.338	47.1
		..x	.500	11.750	19.24	108.43	.7528	361.5	65.42	46.92	3.338	56.7
12	12.75	60	.562	11.626	21.52	106.16	.7372	400.4	73.16	46.00	3.338	62.8
		80	.687	11.376	26.03	101.64	.7058	475.1	88.51	44.04	3.338	74.6
		100	.843	11.064	31.53	96.14	.6677	561.6	107.20	41.66	3.338	88.1
		120	1.000	10.750	36.91	90.76	.6303	641.6	125.49	39.33	3.338	100.7
		140	1.125	10.500	41.08	86.59	.6013	700.5	133.68	37.52	3.338	109.9
		160	1.312	10.126	47.14	80.53	.5592	781.1	160.27	34.89	3.338	122.6
		10	.250	13.500	10.80	143.14	.9940	255.3	36.71	62.03	3.665	36.6
		20	.312	13.376	13.42	140.52	.9758	314.4	45.68	60.89	3.665	45.0
		30s	.375	13.250	16.05	137.88	.9575	372.8	54.57	59.75	3.665	53.2
		40	.438	13.124	18.66	135.28	.9394	429.1	63.37	58.64	3.665	61.3
		..x	.500	13.000	21.21	132.73	.9217	483.8	72.09	57.46	3.665	69.1
14	14.00	60	.593	12.814	24.98	128.96	.8956	562.3	84.91	55.86	3.665	80.3
		80	.750	12.500	31.22	122.72	.8522	687.3	106.13	53.18	3.665	98.2
		100	.937	12.126	38.45	115.49	.8020	824.4	130.73	50.04	3.665	117.8
		120	1.093	11.814	44.32	109.62	.7612	929.6	150.67	47.45	3.665	132.8
		140	1.250	11.500	50.07	103.87	.7213	1027.0	170.22	45.01	3.665	146.8
		160	1.406	11.188	55.63	98.31	.6827	1117.0	189.12	42.60	3.665	159.6
		10	.250	15.500	12.37	188.69	1.3103	383.7	42.05	81.74	4.189	48.0
		20	.312	15.376	15.38	185.69	1.2895	473.2	52.36	80.50	4.189	59.2
		30s	.375	15.250	18.41	182.65	1.2684	562.1	62.58	79.12	4.189	70.3
		40x	.500	15.000	24.35	176.72	1.2272	731.9	82.77	76.58	4.189	91.5
16	16.00	60	.656	14.688	31.62	169.44	1.1766	932.4	107.50	73.42	4.189	116.6
		80	.843	14.314	40.14	160.92	1.1175	1155.8	136.46	69.73	4.189	144.5
		100	1.031	13.938	48.48	152.58	1.0596	1364.5	164.83	66.12	4.189	170.5
		120	1.218	13.564	56.56	144.50	1.0035	1555.8	192.29	62.62	4.189	194.5
		140	1.438	13.124	65.78	135.28	.9394	1760.3	223.64	58.64	4.189	220.0
		160	1.593	12.814	72.10	128.96	.8956	1893.5	245.11	55.83	4.189	236.7
		10	.250	17.500	13.94	240.53	1.6703	549.1	47.39	104.21	4.712	61.1
		20	.312	17.376	17.34	237.13	1.6467	678.2	59.03	102.77	4.712	75.5
		..s	.375	17.250	20.76	233.71	1.6230	806.7	70.59	101.18	4.712	89.6
		30	.438	17.124	24.17	230.30	1.5990	930.3	82.06	99.84	4.712	103.4
		..x	.500	17.000	27.49	226.98	1.5763	1053.2	92.45	98.27	4.712	117.0
		40	.562	16.876	30.79	223.68	1.5533	1171.5	104.75	96.93	4.712	130.1
18	18.00	60	.750	16.500	40.64	213.83	1.4849	1514.7	138.17	92.57	4.712	168.3
		80	.937	16.126	50.23	204.24	1.4183	1833.0	170.75	88.50	4.712	203.8
		100	1.156	15.688	61.17	193.30	1.3423	2180.0	207.96	83.76	4.712	242.3
		120	1.375	15.250	71.81	182.66	1.2684	2498.1	244.14	79.07	4.712	277.6
		140	1.562	14.876	80.66	173.80	1.2070	2749.0	274.23	75.32	4.712	305.5
		160	1.781	14.438	90.75	163.72	1.1369	3020.0	308.51	70.88	4.712	335.6
		10	.250	19.500	15.51	298.65	2.0740	756.4	52.73	129.42	5.236	75.6
		20s	.375	19.250	23.12	290.04	2.0142	1113.0	78.60	125.67	5.236	111.3
		30x	.500	19.000	30.63	283.53	1.9690	1457.0	104.13	122.87	5.236	145.7
		40	.593	18.814	36.15	278.00	1.9305	1703.0	122.91	120.46	5.236	170.4
		60	.812	18.376	48.95	265.21	1.8417	2257.0	166.40	114.92	5.236	225.7
20	20.00	80	1.031	17.938	61.44	252.72	1.7550	2772.0	208.87	109.51	5.236	277.1
		100	1.281	17.438	75.33	238.83	1.6585	3315.2	256.10	103.39	5.236	331.5
		120	1.500	17.000	87.18	226.98	1.5762	3754.0	296.37	98.35	5.236	375.5
		140	1.750	16.500	100.33	213.82	1.4849	4216.0	341.10	92.66	5.236	421.7
		160	1.968	16.064	111.49	202.67	1.4074	4585.5	379.01	87.74	5.236	458.5
		10	.250	23.500	18.65	433.74	3.0121	1315.4	63.41	187.95	6.283	109.6
		20s	.375	23.250	27.83	424.56	2.9483	1942.0	94.62	183.95	6.283	161.9
		..x	.500	23.000	36.91	415.48	2.8853	2549.5	125.49	179.87	6.283	212.5
		30	.562	22.876	41.39	411.00	2.8542	2843.0	140.80	178.09	6.283	237.0
		40	.687	22.626	50.31	402.07	2.7921	3421.3	171.17	174.23	6.283	285.1
24	24.00	60	.968	22.064	70.04	382.35	2.6552	4652.8	238.11	165.52	6.283	387.7
		80	1.218	21.564	87.17	365.22	2.5362	5672.0	296.36	158.26	6.283	472.8
		100	1.531	20.938	108.07	344.32	2.3911	6849.9	367.40	149.06	6.283	570.8
		120	1.812	20.376	126.31	326.08	2.2645	7825.0	429.39	141.17	6.283	652.1
		140	2.062	19.876	142.11	310.28	2.1547	8625.0	483.13	134.45	6.283	718.9
		160	2.343	19.314	159.41	292.98	2.0346	9455.9	541.94	126.84	6.283	787.9

For volume per lineal foot of pipe, see page 354

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Copper Water Tube

Standard Specifications

These seamless copper tubes are especially designed for plumbing purposes, underground water services, etc., but are also suitable for copper coil water heaters, fuel oil lines, gas lines, certain industrial piping, etc.

Copper tube is furnished in three weights. . . . . Types K and L, in hard and soft temper . . . . and Type M, in hard temper only.

Dimensions and Weights

Nominal size of tube	Actual outside diameter of tube	Type K Tube		Type L Tube		Type M Tube	
		Wall thickness	Weight per foot	Wall thickness	Weight per foot	Wall thickness	Weight per foot
Inches	Inches	Inches	Pounds	Inches	Pounds	Inches	Pounds
1/4	3/8	.035	.145	.030	.126	.025	.106
3/8	1/2	.049	.269	.035	.198	.025	.144
1/2	5/8	.049	.344	.040	.285	.028	.203
5/8	3/4	.049	.418	.042	.362	.030	.263
3/4	7/8	.065	.641	.045	.455	.032	.328
1	1 1/8	.065	.839	.050	.655	.035	.465
1 1/4	1 3/8	.065	1.04	.055	.884	.042	.682
1 1/2	1 5/8	.072	1.36	.060	1.14	.049	.940
2	2 1/8	.083	2.06	.070	1.75	.058	1.46
2 1/2	2 5/8	.095	2.93	.080	2.48	.065	2.03
3	3 1/8	.109	4.00	.090	3.33	.072	2.68
3 1/2	3 5/8	.120	5.12	.100	4.29	.083	3.58
4	4 1/8	.134	6.51	.110	5.38	.095	4.66
5	5 1/8	.160	9.67	.125	7.61	.109	6.66
6	6 1/8	.192	13.9	.140	10.2	.122	8.92
8	8 1/8	.271	25.9	.200	19.3	.170	16.5
10	10 1/8	.338	40.3	.250	30.1	.212	25.6
12	12 1/8	.405	57.8	.280	40.4	.254	36.7

Recommendations: Copper water tube is used for many services, such as for steam, water, air, oil, gas, or similar fluids.

Type K Tube is recommended for general plumbing and heating systems. It is especially recommended for underground use and in installations where conditions are severe; the tube is also used for gas, oil, and steam.

Type L Tube is recommended for interior use in general plumbing and heating work.

Type M Tube is for use with soldered fittings only, for waste, vent, interior drainage, and other non-pressure applications.

On steam installations, the successful application of copper tubes depends not only upon the weight of the tube but also upon the solder used when making joints. The solder must have a melting point high enough to remain unaffected by the temperature of the steam.

Hard copper tube: Hard copper tube is intended primarily for use in straight lengths. It is recommended for field bending only when proper bending equipment is used.

Soft copper tube: Soft copper tube can be bent without special bending equipment; it is recommended for service where bends must be made in the field, as on concealed replacement work.

Soft copper tube while in transit or when being handled may become flattened or distorted. Before being used, the ends of the tube should be sized to assure a tight soldered joint.

Standard lengths: 20-foot straight lengths for both hard and soft copper tube and 60-foot coiled lengths for soft copper tube are generally considered standard. Other lengths can be furnished.

Tinning: Copper tube can be furnished tinned on the outside, on the inside, or on both the outside and the inside.

American Standard: Type K (hard and soft) and Type L (hard and soft) in sizes 3/8 to 12-inch, and Type M (hard) in sizes 2 1/2 to 12-inch conform to the American Standard for Copper Water Tube, ASA No. H23.1-1947 (ASTM B88-49)

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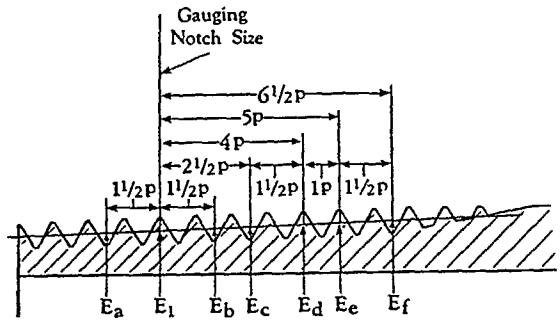
Prices on Request

American Standard Straight Pipe Threads



Dimensions, in Inches

Nominal pipe size	Number of threads per inch	Pitch of thread p	Increase in pitch diameter per turn	Pitch Diameter									
				Straight Thread Couplings* (Internal Thread) for use with taper thread pipe for pressure tight joints (NPSC)		Straight Thread (Free Fitting) Mechanical Joints† (NPSM)				Straight Thread (Loose Fitting) Mechanical Joints† Locknut Connections (NPSL)			
						External		Internal		External		Internal	
				Min. E_a	Max. E_b	Min. E_a	Max. E_f	Min E_f	Max. E_b	Min. E_c	Max. E_d	Min. E_e	Max. E_f
⅛	27	0.03704	0.00231	0.3713	0.3782	0.3713	0.3748	0.3748	0.3782	0.3805	0.3840	0.3863	0.3898
¼	18	0.05556	0.00347	0.4847	0.4951	0.4847	0.4899	0.4899	0.4951	0.4986	0.5038	0.5073	0.5125
⅜	18	0.05556	0.00347	0.6218	0.6322	0.6218	0.6270	0.6270	0.6322	0.6357	0.6409	0.6444	0.6496
½	14	0.07143	0.00446	0.7717	0.7851	0.7717	0.7784	0.7784	0.7851	0.7896	0.7963	0.8008	0.8075
¾	14	0.07143	0.00446	0.9822	0.9956	0.9822	0.9889	0.9889	0.9956	1.0000	1.0067	1.0112	1.0179
1	11½	0.08696	0.00543	1.2305	1.2468	1.2305	1.2386	1.2386	1.2468	1.2523	1.2604	1.2658	1.2739
1¼	11½	0.08696	0.00543	1.5752	1.5915	1.5752	1.5834	1.5834	1.5915	1.5970	1.6051	1.6106	1.6187
1½	11½	0.08696	0.00543	1.8142	1.8305	1.8142	1.8223	1.8223	1.8305	1.8360	1.8441	1.8495	1.8576
2	11½	0.08696	0.00543	2.2881	2.3044	2.2881	2.2963	2.2963	2.3044	2.3099	2.3180	2.3234	2.3315
2½	8	0.12500	0.00781	2.7505	2.7739	2.7505	2.7622	2.7622	2.7739	2.7817	2.7934	2.8012	2.8129
3	8	0.12500	0.00781	3.3768	3.4002	3.3768	3.3885	3.3885	3.4002	3.4081	3.4198	3.4276	3.4393
3½	8	0.12500	0.00781	3.8771	3.9005	3.8771	3.8888	3.8888	3.9005	3.9084	3.9201	3.9279	3.9396
4	8	0.12500	0.00781	4.3754	4.3988	4.3754	4.3871	4.3871	4.3988	4.4067	4.4184	4.4262	4.4379
5	8	0.12500	0.00781	...	...	5.4376	5.4493	5.4493	5.4610	5.4688	5.4805	5.4884	5.5001
6	8	0.12500	0.00781	...	...	6.4943	6.5060	6.5060	6.5177	6.5255	6.5372	6.5450	6.5567
8	8	0.12500	0.00781	...	...	...	...	...	...	8.5196	8.5313	8.5391	8.5508
10	8	0.12500	0.00781	...	...	...	...	...	...	10.6405	10.6522	10.6600	10.6717
12	8	0.12500	0.00781	...	...	...	..	...	...	12.6374	12.6491	12.6569	12.6686

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*Straight pipe threads in couplings are gauged with American Standard Taper Pipe Thread plug gauges, the notch (P.D. = E_1) to come flush at bottom of chamfer with gauging tolerance of one and one-half turns large or small. While this theoretically provides maximum and minimum pitch diameters as shown, the actual pitch diameters of the tapped hole will be slightly smaller than the values given.

†Mechanical joint straight pipe threads are gauged with straight thread gauges

Threaded Pipe Joints

Threads

In screwed joints having strength, tightness, and durability, it is necessary to have clean-cut and uniform threads.

The threads should be tapered and smooth, cut with the correct taper, lead, thread angle, and diameters. Reasonable manufacturing tolerances are allowed on all of the thread elements to take care of variations in threading. The diameters should be such as to allow sufficient hand engagement and yet allow enough threads for wrench or power make-up.

The thread lengths should be long enough to compensate for pipe strains usually present in the various types of thread joint services. A short thread is satisfactory for joints where little or no pipe strains exist, but longer threads are required where extreme pipe strains are encountered, such as in Oil Field Casing Thread joints.

Standardized Threads

Several Standards have been established covering pipe threads for various purposes. The oldest and probably most commonly used is the American Standard for Pipe Threads, known as ASA Standard B-2.1. There are also the American Petroleum Institute Standards No. 5A, 6A, and 5L covering Oil Field Tubular Goods, such as Line Pipe and Casing Threads.

Thread Assembling

In making up screwed pipe joints, it is very important that the threads in both parts be thoroughly cleaned Any threads which may have become burred or bent should be straightened or removed and afterward a good grade of lubricant should be applied to the threads. The lubricant reduces the friction which allows the two parts to be pulled up further, resulting in a more effective pipe joint. Pipe joints should not be screwed together too rapidly in order to avoid raising the temperature of the two parts to a high degree. For Crane thread lubricant and compound, see page 324.

Normal Engagement

The normal amount of engagement to make a tight joint for various types of screwed material is given in the lower table on the facing page. These dimensions have been established from tests made under practical working conditions.

The normal engagement specified for American Standard Pipe Thread and API Line Pipe Thread joints is based on parts being threaded to the American Standard for Pipe Threads or the API Standard for Line Pipe Threads. The shoulder type Drainage Fitting Thread engagement is based on using American Standard Pipe Thread dimensions on the external thread but holding the external thread to a special tolerance as covered in the asterisked footnote of the table

In order to obtain the thread engagements listed in the table it is necessary to vary the torque or power applied according to the size, metal, and weight of material used. For example, it requires considerably less power to make up a screwed joint using a light bronze valve than a high pressure steel valve.

Screwed Companion Flanges

The normal length of thread engagement listed in the table on page 352 does not apply to Screwed Companion Flanges. The length of thread engagement for Screwed Companion Flanges depends upon the weight of the flange, considering pressure, and the type of thread joint employed.

There are two types of threaded flange joints in general use; namely, where the pipe and flange are refaced after assembly, as distinguished from the other, in which the pipe and the flange are not refaced. Pipe threaded for a refaced job should have a thread sufficiently long to extend slightly beyond the face of the flange when assembled, to allow for refacing. For the joint which is not to be refaced, the thread on the pipe should be slightly shorter so that the end of the threaded pipe will be about one thread from the face of the flange when assembled.

Leaky Joints

Leaky joints can usually be traced either to faulty threading or an improper lubricant. Frequently the trouble lies in the thread on the pipe which may have been cut with dull or improperly adjusted threading tools, resulting in wavy, shaved, rough, or chewed threads.

Wavy threads are noticeable both to the eye and touch, due to circumferential waves or longitudinal flats of slightly helical form rather than the desired true circular form. Shaved threads appear to have been threaded with two dies, one not matching the other, giving a double thread appearance at the start of the thread. Rough or chewed threads are noticeably rough and torn.

Should the threads have any of these defects, it is possible that leaky joints might result.

Crane Threaded Products

Crane threaded materials have smooth, accurately cut threads properly gauged and carefully inspected for taper, lead, thread angle, height, out-of-roundness, and alignment.

They are threaded in compliance with established Standards as the requirements may be, and the start of each thread is properly chamfered for ease in assembling.

Crane has taken extraordinary precautions to insure satisfactory thread joints by maintaining constantly careful inspection of not only the product itself but the threading equipment as well, which is the best available.

A complete gauging system has also been established which includes Master Gauges approved by the National Bureau of Standards, Reference Gauges, and Working Gauges. These gauges are checked periodically and frequently so as to keep them well within the allowable tolerances In fact, Crane threading is held to much closer tolerances than actually required to make a tight joint

SECTION 30

Crane Fabricated Piping

IMPORTANT

BECAUSE "FABRICATED PIPING" IS NO LONGER A FUNCTION OF THE INDUSTRIAL PRODUCTS GROUP OF CRANE CO., SECTION 30 (EXCEPT PAGE 368) HAS BEEN DELETED FROM THIS REPRINT OF THE NO. 60 CATALOG. PAGE 368 (ON REVERSE SIDE) HAS BEEN RETAINED FOR ITS REFERENCE VALUE.

Complete details on Crane Fabricating Piping Facilities can be obtained from CRANE CO., ENGINEERED PRODUCTS GROUP, 3130 North 17th Street, Philadelphia, Pennsylvania

SECTION 31

Engineering Data—General

The general engineering information included in this Section is supplemented by the "Flow of Fluids" data in Section 32.

Piping

Crane Bolting....pages 382 and 383
Assembly and Maintenance of Flanged Joints....page 384
Heat Transfer Through Pipe Walls....page 385
Design of Pipe Coils for Heat Transfer....pages 386 and 387

Code for Pressure Piping:
Comments and Pipe Design Formula....page 388
Calculating Working Pressure and Stress....pages 388 to 390
Calculating Wall Thickness....pages 388 to 390

Length of Pipe in Bends....page 391
Calculations of Pipe Bends....pages 392 and 393
Spacing of Pipe Supports....pages 394 and 395
Thermal Expansion of Pipe....page 396
Modulus of Elasticity of Pipe....page 396

American Standard (ASA) Dimensions

Bronze Screwed Fittings....page 397
Bronze Flanges....page 399
Malleable Iron Screwed Fittings....page 398
Cast Iron Screwed Fittings....page 399
Cast Iron Flanged Fittings....page 400
Cast Iron Flanges....page 401

Miscellaneous Valve and Fitting Data

Taps and Drains for Flanged Fittings....page 402
Taps and Drains for Flanged Valves....page 403
Location of By-Passes....page 403
How to Read Reducing Fittings....page 404

Mathematical Data

Circumferences and Areas of Circles....pages 405 to 407
Natural Trigonometric Functions....pages 408 and 409
Four-Place Logarithms to Base 10....pages 410 and 411
Mensuration of Plane Figures....page 412

Conversion and Equivalents

General....page 413
Linear....pages 414 to 417
Weight....page 418
Pressure....page 418
Equivalents of Liquid Measures and Weights....page 419
Equivalents of Pressure and Head....page 419
Temperature....page 420

For additional data of an engineering nature, refer to:

Selecting size of Crane pressure-seal bonnet stop-check valves...pages 172 and 173
Selecting size of Crane bolted bonnet stop-check valves....pages 224 and 225
Proper sizing of check and foot valves....page 427

Increase in pressure due to expansion of liquids....page 14
Expansion of wrought iron, steel, brass, or copper pipe....page 344
Commercial wrought steel pipe data....pages 346 and 347
American and British Standard pipe threads....pages 350 to 352
Normal engagement between male and female threads....page 352
Beveling for welding....page 306

"Flow of Fluids" Data including Steam Tables....Section 32

Crane Bolting

Torque required to produce bolt stress: The torque or turning effort required to produce a certain stress in bolting is dependent upon a number of conditions, some of which are:

1. Diameter of bolt.
2. Type and number of threads on bolt.
3. Material of bolt.
4. Condition of nut bearing surfaces.
5. Lubrication of bolt threads and nut bearing surfaces.

The tables below reflect the results of many Crane tests to determine the relation between torque and bolt stress. Values are based on steel bolting well lubricated with a heavy graphite and oil mixture. It was found that a non-lubricated bolt has an efficiency of about 50 per cent of a well lubricated bolt and also that different lubricants produce results varying between the limits of 50 and 100 per cent of the tabulated stress figures.

Crane thread compound: The graphite and oil mixture mentioned above will give satisfactory results. However, for high temperature service, Crane Anti-Seize High Temperature Thread Compound should be used; see page 324. Through its use, stud bolts can be more readily followed up or disassembled after being subjected to heat.

Data for Use with Machine Bolts and Cold Rolled Steel Stud Bolts

Load in Pounds on Bolts and Stud Bolts when Torque Loads Are Applied

Nominal Diameter of Bolt	Number of Threads	Diameter at Root of Thread	Area at Root of Thread	Stress					
				7,500 psi		15,000 psi		30,000 psi	
Inches	Per Inch	Inches	Sq. Inch	Torque Ft. Lbs.	Compression, Lbs.	Torque Ft. Lbs.	Compression, Lbs.	Torque Ft. Lbs.	Compression, Lbs.
1/4	20	.185	.027	1	203	2	405	4	810
5/16	18	.240	.045	2	388	4	675	8	1350
3/8	16	.294	.068	3	510	6	1020	12	2040
7/16	14	.345	.093	5	698	10	1395	20	2790
1/2	13	.400	.126	8	945	15	1890	30	3780
9/16	12	.454	.162	12	1215	23	2430	45	4860
5/8	11	.507	.202	15	1515	30	3030	60	6060
3/4	10	.620	.302	25	2265	50	4530	100	9060
7/8	9	.731	.419	40	3143	80	6285	160	12570
1	8	.838	.551	62	4133	123	8265	245	16530
1 1/8	7	.939	.693	98	5190	195	10380	390	20760
1 1/4	7	1.064	.890	137	6675	273	13350	545	26700
1 3/8	6	1.158	1.054	183	7905	365	15810	730	31620
1 1/2	6	1.283	1.294	219	9705	437	19410	875	38820
1 5/8	5 1/2	1.389	1.515	300	11363	600	22725	1200	45450
1 3/4	5	1.490	1.744	390	13080	775	26160	1550	52320
1 7/8	5	1.615	2.049	525	15368	1050	30735	2100	61470
2	4 1/2	1.711	2.300	563	17250	1125	34500	2250	69000

Data for Use with Alloy Steel Stud Bolts

Load in Pounds on Stud Bolts when Torque Loads Are Applied

Nominal Diameter of Stud	Number of Threads	Diameter at Root of Thread	Area at Root of Thread	Stress					
				30,000 psi		45,000 psi		60,000 psi	
Inches	Per Inch	Inches	Sq. Inch	Torque Ft. Lbs.	Compression, Lbs.	Torque Ft. Lbs.	Compression, Lbs.	Torque Ft. Lbs.	Compression, Lbs.
1/4	20	.185	.027	4	810	6	1215	8	1620
5/16	18	.240	.045	8	1350	12	2025	16	2700
3/8	16	.294	.068	12	2040	18	3060	24	4080
7/16	14	.345	.093	20	2790	30	4185	40	5580
1/2	13	.400	.126	30	3780	45	5670	60	7560
9/16	12	.454	.162	45	4860	68	7290	90	9720
5/8	11	.507	.202	60	6060	90	9090	120	12120
3/4	10	.620	.302	100	9060	150	13590	200	18120
7/8	9	.731	.419	160	12570	240	18855	320	25140
1	8	.838	.551	245	16530	368	24795	490	33060
1 1/8	8	.963	.728	355	21840	533	32760	710	43680
1 1/4	8	1.088	.929	500	27870	750	41805	1000	55740
1 3/8	8	1.213	1.155	680	34650	1020	51975	1360	69300
1 1/2	8	1.338	1.405	800	42150	1200	63225	1600	84300
1 5/8	8	1.463	1.680	1100	50400	1650	75600	2200	100800
1 3/4	8	1.588	1.980	1500	59400	2250	89100	3000	118800
1 7/8	8	1.713	2.304	2000	69120	3000	103680	4000	138240
2	8	1.838	2.652	2200	79560	3300	119340	4400	159120
2 1/4	8	2.088	3.423	3180	102690	4770	154035	6360	205380
2 1/2	8	2.338	4.292	4400	128760	6600	193140	8800	257520
2 3/4	8	2.588	5.259	5920	157770	8880	236655	11840	315540
3	8	2.838	6.324	7720	189720	11580	284580	15440	379440

Machine bolt and stud bolt sizes and additional data....pages 316 to 319

31

Design of Pipe Coils for Heat Transfer

Sample problem: 1000 gallons of hot water per hour is required. The water is to be heated from 50 to 180 F with 25 psi gauge steam in a single cylindrical steel pipe coil (Standard or Schedule 40 pipe) immersed in water. The coil is to be 3'0" center to center in diameter. The pressure drop through the coil shall not exceed 5 psi. *Determine the size of pipe from which the coil should be made and the number of turns required in the coil.*

Solution: Refer to the table on page 437 and determine properties of the steam, as follows:

$$\text{Average pressure} = \frac{25 + (25 - 5)}{2} = 22.5 \text{ psi}$$

Average specific volume = 11.24 cu ft/lb
Latent heat of steam at avg. press. = 936 Btu/lb
Temp. of 25 lb. steam = 267 F
Temp. of 20 lb. steam = 259 F (minimum allowable downstream pressure)
Fluid change in temp. = 180 F − 50 F = 130 F
Heat input to water = 130 Btu/lb.

Refer to table of physical properties of water, page 431 and determine the weight per gallon of 180 F water equals 8.098 pounds.

Determination of Q

$Q = 8.098 \times 1000 \times 130$
$Q = 1\,053\,000$ Btu/hr required

Determination of U

From the conditions given, water flows through the heat exchanger at the rate of 1000 gph, giving continuous flow. Therefore, select a U value from the column (page 386) headed "Forced Convections." The velocity of the water as it passes the coil will obviously be low and, since steel pipe is used, some rusting may be expected. The minimum value of U for forced convections, ($U = 150$) is therefore used.

Determination of T *(Use Formula 2; page 385)*

$GTD = 267 - 50 = 217$ F
$LTD = 259 - 180 = 79$ F

$$T = \frac{217 - 79}{2.3 \log \frac{217}{79}} = \frac{138}{2.3 \log 2.75}$$

$$T = \frac{138}{2.3 \times 0.4393} = 137 \text{ F}$$

Determination of A *(Use Formula 1; page 385)*

$$A = \frac{1\,053\,000}{150 \times 137} = 51.2 \text{ square feet}$$

Determination of pipe size and length of pipe

Refer to table of Pipe Data, page 346 to determine the inside diameter and external area per foot of the probable pipe sizes of Schedule 40 pipe.

Size	Inside Diameter	External Surface
1¼"	1.380"	0.435 square feet per foot
1½	1.610	0.497 square feet per foot
2"	2.067	0.622 square feet per foot

Calculate the length of pipe needed to give the required area of heating surface:

$$(1\tfrac{1}{4}") = \frac{51.2}{0.435} = 118 \text{ feet}$$

$$(1\tfrac{1}{2}") = \frac{51.2}{0.497} = 103 \text{ feet}$$

$$(2") = \frac{51.2}{0.622} = 82 \text{ feet}$$

To determine the equivalent length of the coil for purposes of determining pressure drop:

(a) calculate relative radius, r/d, by dividing radius of coil by inside diameter of pipe.
(b) determine number of full 90° bends in coil.
(c) find the total resistance, and the resistance due to the length and the bends, as determined from the upper chart on page 426.

Size	Relative Radius r/d	Resistance in Pipe Diameters			No. of 90° Bends
		Length	Bend	Total	
1¼"	13.0	20.5	16.5	37.0	50
1½	11.2	17.5	15.0	32.5	44
2	8.7	14.0	13.0	27.0	36

For equivalent length of the circular coil, in pipe diameters, use the following formula (see page 426):

$$\frac{L}{D} = R_t + (n - 1)\left(R_t + \frac{R_b}{2}\right)$$

To convert to feet of pipe, use:

$$L = \left(\frac{L}{D}\right)\left(\frac{d}{12}\right)$$ where d = inside diameter of pipe, in inches

Size	Pipe Diameters L/D	Schedule 40 Pipe L
1¼"	1446	166 feet
1½	1108	149 feet
2	745	128 feet

The amount of steam that must be condensed to provide 1,053,000 Btu/hr is:

$$\left(\frac{1\,053\,000 \text{ Btu}}{\text{hr}}\right)\left(\frac{\text{lbs}}{936 \text{ Btu}}\right) = 1125 \text{ lbs/hr}$$

For the purpose of calculating pressure drop, the average quantity of steam flowing within the coil may be assumed as 0.75×1125 which equals 844 pounds per hour. Refer to pages 434 and 435 to determine pressure drop as follows:

Size	C_1	C_2	$\bar{V}$	ΔP_{100}	ΔP
1¼"	0.0007	1408	11.24	11.1	18.4 (total)
1½	0.0007	627	11.24	4.9	7.3 (total)
2	0.0007	169	11.24	1.3	1.7 (total)

By inspection, the conditions of the problem, that is, a 5 psi maximum pressure drop, cannot be met with either 1¼ or 1½-inch pipe. Therefore, 2-inch pipe must be used.

$$\text{Total pressure drop in coil} = 1.3 \times \frac{128}{100} = 1.7 \text{ psi}$$

Number of coil loops = 36 ÷ 4 = 9

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004127

Simplified Method for Calculating Working Pressure, Stress, or Wall Thickness — cont.

Piping problems involving Sections 1 and 5 of the Code for Pressure Piping can be quickly solved by means of the tables shown on pages 388 to 390. To obtain P/S values from Table 4, it is first necessary to determine the applicable "y" value from Table 2.

Determining Pipe Wall Thickness

Material, temperature, and working pressure are known.

Divide working pressure by allowable stress to get P/S value; see Table 4 for equivalent.

What thickness of 12-inch seamless plain end pipe, 1¼% Chromium—½% Molybdenum, per ASTM Specification A 335, Grade P11, can be used for a steam line operating at 1450 psi and 950 F? The pipe is to comply with Section 1 of the Code.

From Table 3, note the allowable stress as 11,000 psi. To find the P/S value, divide the known working pressure by the allowable stress, thus:

P/S value = 1450 ÷ 11,000 = 0.132

This P/S value should be compared with those of established thicknesses of 12-inch pipe to find its equivalent or the next heavier weight. Since the given temperature is 950 F, the y value (from Table 2) is 0.5; consequently, for comparison purposes, refer to that column in Table 4.

Table 4 shows that 12-inch Schedule 120 pipe with a wall thickness of 1.000 inches has a P/S value of 0.136. Since the calculated value is 0.132, and the next lighter weight (Schedule 100) has a lower P/S value of 0.111, Schedule 120 pipe should be used.

Determining Working Pressure

Material, thickness, and temperature are known.

Multiply P/S value by allowable stress.

What is the maximum allowable working pressure at 100 F for 1-inch Schedule 40, Grade A seamless steel plain end pipe per ASTM Specification A106? The pipe is to comply with Section 1 of the Code.

Table 2 indicates that y equals 0.4; Referring to Table 4 in the column headed "y=0.4", the P/S value for the pipe considered is 0.105. The allowable stress, from Table 3, is 12,000 psi. Then:

maximum working pressure = P/S value x allowable stress
= 0.105 x 12,000 = 1260 psi

Determining Stress

Material, thickness, and working pressure are known.

Divide working pressure by P/S value.

What is the stress in 4-inch Schedule 80, Grade A seamless steel plain end pipe per ASTM Specification A 106 at a working pressure of 1000 psi at 550 F? The stress should not exceed that allowed at that temperature by Section 1 of the Code.

Table 2 indicates that y equals 0.4; Referring to Table 4 in the column headed "y=0.4", the P/S value for the pipe considered is 0.106. Divide the known working pressure by the P/S value, thus:

calculated stress = 1000 ÷ 0.106 = 9434 psi

The allowable stress (from Table 3) is 12,000 psi; since the calculated stress is less than the allowable, the pipe is suitable for the conditions.

Table 3 — Allowable Stresses (psi) for Steel Pipe from the Code for Pressure Piping

Code for Pressure Piping Section	Temp. Fahr.	Carbon Steels* Seamless Grade A (API 5L or ASTM A53 and A106)	Carbon Steels* Seamless Grade B (API 5L or ASTM A53 and A106)	Carbon Steels* Butt-Welding (API 5L or ASTM A53)	Low Alloy Steels Seamless 1¼% Cr ½% Mo (ASTM A213, A335, and A369)	Low Alloy Steels Seamless 2¼% Cr 1% Mo (ASTM A213, A335, and A369)	Stainless (Austenitic) Steels Seamless 18% Cr 8% Ni (†) Type 304	Stainless (Austenitic) Steels Seamless 18% Cr 8% Ni-Ti (‡) Type 321	Stainless (Austenitic) Steels Seamless 16% Cr 13% Ni-Mo (†) Type 316
Section 1, Power	−20°	12,000	15,000	6,750	15,000	15,000	18,750	18,750	18,750	18,750
	100	12,000	15,000	6,750	15,000	15,000	18,750	18,750	18,750	18,750
	200	12,000	15,000	6,750	15,000	15,000	16,650	17,000	18,750	18,750
	250	12,000	15,000	6,750	15,000	15,000	...	...	17,875	18,325
	300	12,000	15,000	6,750	15,000	15,000	15,000	16,000	17,000	17,900
	350	12,000	15,000	6,750	15,000	15,000	...	...	16,400	17,700
	400	12,000	15,000	6,750	15,000	15,000	13,650	15,450	15,800	17,500
	450	12,000	15,000	6,750	15,000	15,000	...	...	15,500	17,350
	500	12,000	15,000	6,750	15,000	15,000	12,500	15,100	15,200	17,200
	550	12,000	15,000	6,750	15,000	15,000	...	...	15,050	17,150
	600	12,000	15,000	6,750	15,000	15,000	11,600	14,900	14,900	17,100
	650	12,000	15,000	6,750	15,000	15,000	11,200	14,850	14,850	17,050
	700	11,650	14,350	...	15,000	15,000	10,800	14,800	14,800	17,000
	750	10,700	12,950	...	15,000	15,000	10,400	14,700	14,700	16,900
	800	9,000	10,800	...	15,000	15,000	10,000	14,550	14,550	16,750
	850	7,100	7,800	...	14,400	14,400	9,700	14,300	14,300	16,500
	900	5,000	5,000	...	13,100	13,100	9,400	14,000	14,100	16,000
	950	...	...	...	11,000	11,000	9,100	13,400	13,850	15,100
	1000	...	...	...	7,800	7,800	8,800	12,500	13,500	14,000
	1050	...	...	...	5,500	5,800	8,500	10,000	13,100	12,200
	1100	...	...	...	4,000	4,200	7,500	7,500	10,300	10,400
	1150	...	...	...	...	3,000	5,750	5,750	7,600	8,500
	1200	...	...	...	...	...	4,500	4,500	5,000	6,800
Section 5, Refrigeration	Cold	12,000	15,000	6,800	...	...	...	...	18,750	...

*May be subject to graphitization at 775 F and higher.

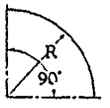
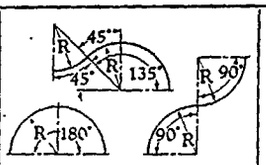
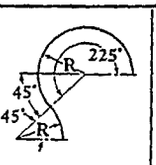
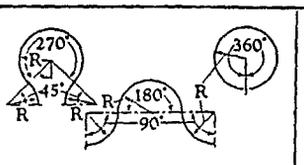
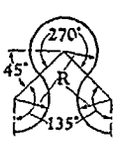
‡The values for Type 321 Steel apply also to Type 347 (18% Cr—8% Ni-Cb).

†Data is from ASME Boiler Code, Section 1. The higher stress values listed for Type 304 exceed 62½% (but not 90%) of the yield strength, use only where slightly greater deformation is permissible.

See next page for Table 4, P/S Values for Steel Pipe.

CRTX 1176

Length of Pipe in Bends

Radius of Pipe Bends						
Inches	Feet	90° Bends	180° Bends	270° Bends	360° Bends	540° Bends
1		1½"	3"	4¾"	6¼"	9½"
2		3	6¼	9½	12½	18¾
3	¼	4¾	9½	14¼	18¾	28¼
4		6¼	12½	18¾	25¼	37¾
5		7¾	15¾	23½	31½	47¼
6	½	9½	18¾	28¼	37¾	56½
7		11	22	33	44	66
8		12½	25¼	37¾	50¼	75½
9	¾	14¼	28¼	42½	56½	84¾
10		15¾	31½	47¼	62¾	94¼
11		17¼	34½	51¾	69	103¾
12	1	18¾	37¾	56½	75½	113
12.5		19¾	39¼	59	78½	117¾
14		22	44	66	88	132
15	1¼	23½	47	70¾	94¼	141¼
16		25¼	50¼	75½	100½	150¾
17.5		27½	55	82½	110	165
18	1½	28¼	56½	84¾	113	169¾
20		31½	62¾	94¼	125¾	188½
21	1¾	33	66	99	132	198
24	2	37¾	75½	113	150¾	226¼
25		39¼	78½	117¾	157	235½
30	2½	47¼	94¼	141¼	188½	282¾
32		50¼	100½	150¾	201	301½
36	3	56½	113	169½	226¼	339¼
40		62¾	125¾	188½	251¼	377
48	4	75½	150¾	226¼	301½	452½
50		78½	157	235½	314¼	471¼
56		88	176	264	351¾	527¾
60	5	94¼	188½	282¾	377	565½
64		100½	201	301½	402	603¼
70		110	220	329¾	439¾	659¾
72	6	113	226¼	339¼	452½	678½
80		125¾	251¼	377	502¾	754
84	7	132	263¾	395¾	527¾	791½
90	7½	141¼	282¾	424	565½	848¼
96	8	150¾	301½	452½	603	904¾
100		157	314¼	471¼	628¼	942½
108	9	169½	339¼	509	678½	1017¾
120	10	188½	377	565½	754	1131
132	11	207¼	414¾	622	829½	1244
144	12	226¼	452½	678½	904¾	1357¼
156	13	245	490	735¼	980¼	1470¼
168	14	263¾	527¾	791½	1055½	1583½
180	15	282¾	565½	848¼	1131	1696½
192	16	301½	603	904¾	1206¼	1809½
204	17	320½	640¾	961¼	1281¾	1922½
216	18	339¼	678½	1017¾	1357¼	2035¾
228	19	358	716¼	1074½	1432½	2148¾
240	20	377	754	1131	1508	2262

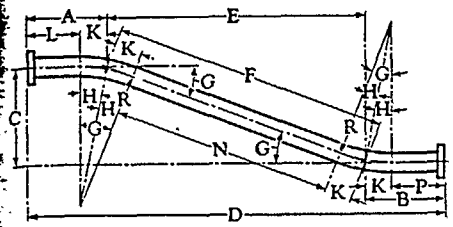
To find the length of pipe in a bend having a radius not given above, add together the length of pipe in bends whose combined radii equal the required radius.

Example: Find length of pipe in 90° bend of 5' 9" radius.
Length of pipe in 90° bend of 5' radius = 94¼"
Length of pipe in 90° bend of 9" radius = 14¼"
Then, length of pipe in 90° bend of 5' 9" radius = 108½"

Standard types of pipe bends....pages 360 and 361

Minimum recommended radii of pipe bends....page 361

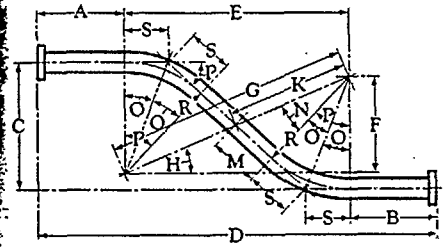
Calculation of Pipe Bends



Example No. 8—**Given A, B, C, D, R**

$E = D - A - B$
$F = \sqrt{E^2 + C^2}$
$\frac{C}{F} = \sin \angle G$

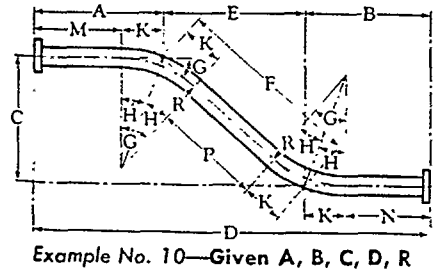
$\angle H = \frac{1}{2} \angle G$
$K = \tan \angle H \times R$
$L = A - K$
$P = B - K$
$N = F - 2K$



Example No. 9—**Given A, B, C, D, R**

$E = D - A - B$
$F = 2R - C$
$G = \sqrt{E^2 + F^2}$
$\frac{F}{E} = \tan \angle H$
$K = \frac{1}{2} G$

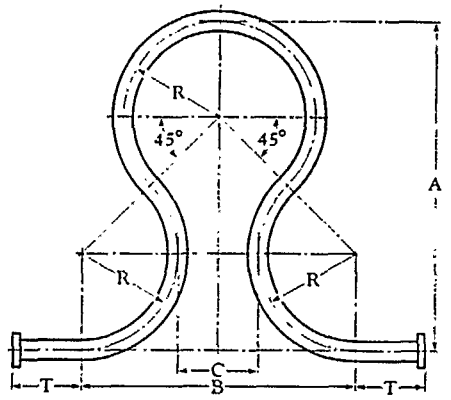
$M = \sqrt{K^2 - R^2}$
$\frac{M}{K} = \sin \angle N$
$\angle P = 90° - \angle H - \angle N$
$\angle O = \frac{1}{2} \angle P$
$S = \tan \angle O \times R$



Example No. 10—**Given A, B, C, D, R**

$E = D - A - B$
$F = \sqrt{C^2 + E^2}$
$\frac{C}{F} = \sin \angle G$

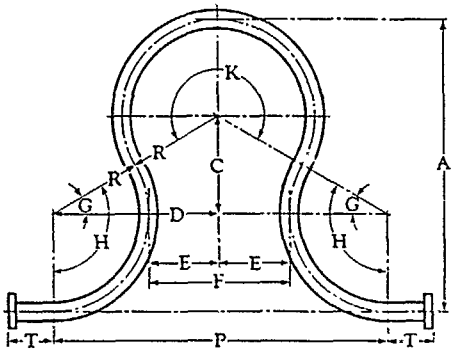
$\angle H = \frac{1}{2} \angle G$
$K = \tan \angle H \times R$
$M = A - K$
$N = B - K$
$P = F - 2K$



Example No. 11—**Given R and 45° Angles**

$A = 3.414 \times R$
$B = 2.828 \times R$
$C = 0.828 \times R$

T = Tangent
Length of pipe in bend = $9.425 \times R + 2T$

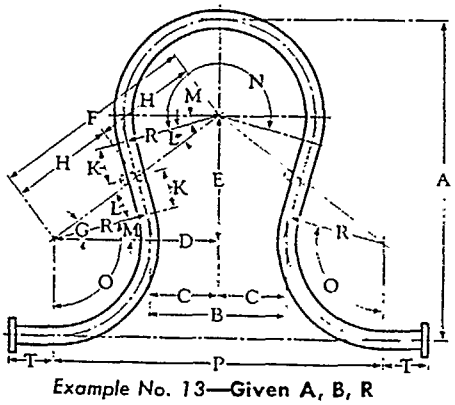


Example No. 12—**Given A, R**

$C = A - 2R$
$D = \sqrt{(2R)^2 - C^2}$

$P = 2D$
$E = D - R$
$F = 2E$

$C/2R = \sin \angle G$
$\angle H = 90° + \angle G$
$\angle K = 180° + 2 \angle G$



Example No. 13—**Given A, B, R**

$C = \frac{1}{2} B$
$D = R + C$
$E = A - 2R$
$F = \sqrt{D^2 + E^2}$

$E/F = \sin \angle G$
$H = \frac{1}{2} F$
$K = \sqrt{H^2 - R^2}$
$K/H = \sin \angle L$

$\angle M = \angle G - \angle L$
$\angle N = 180° + 2 \angle M$
$\angle O = 90° + \angle M$
$P = 2D$

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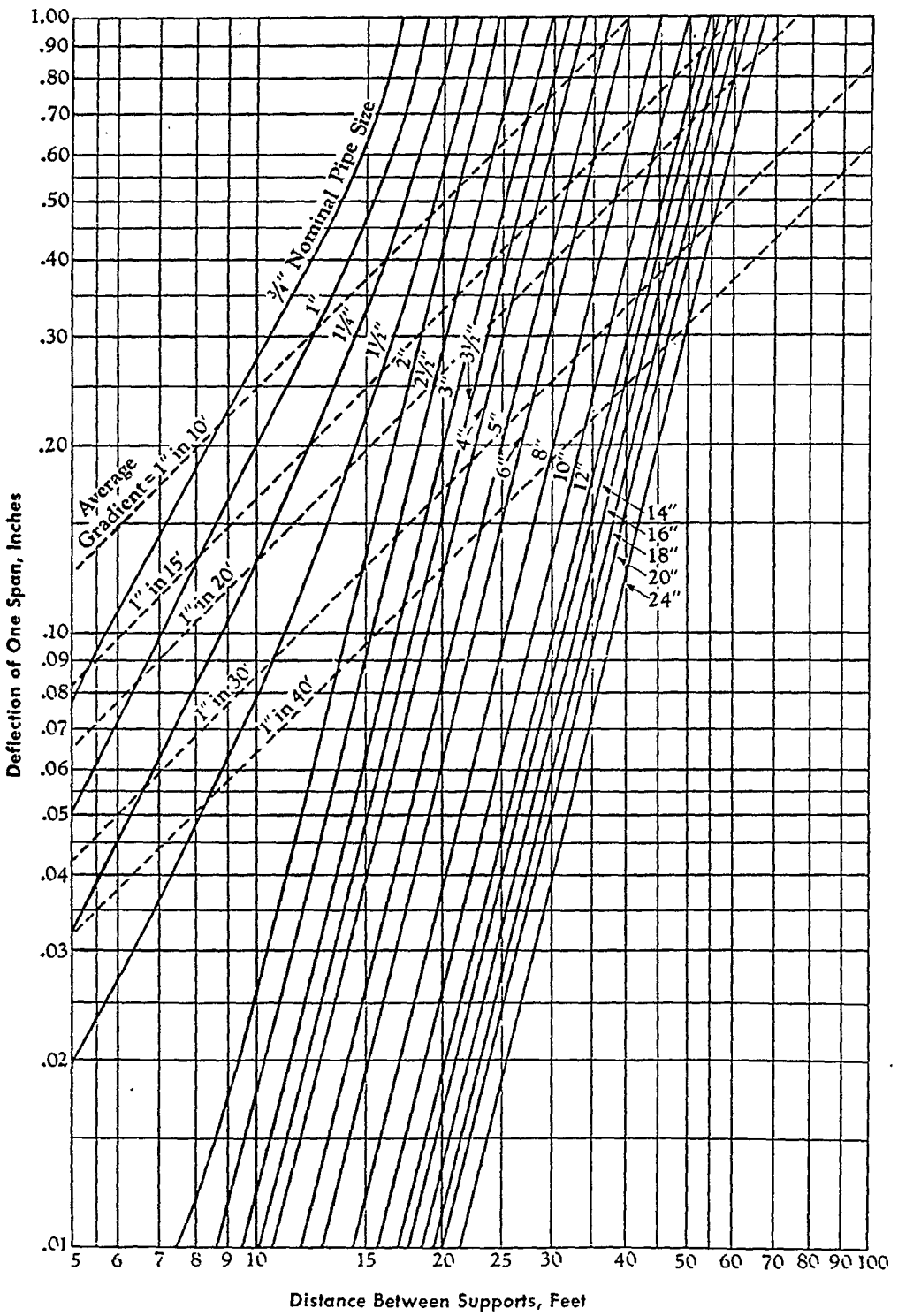
Spacing of Pipe Supports

Deflection of Horizontal Pipe Lines
(Based on Standard Pipe Filled with Water)



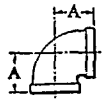
31

OC4135

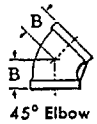
Dimensions of Bronze Screwed Fittings

C1100

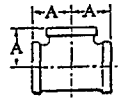
ASA 125-Pound and 250-Pound Classes



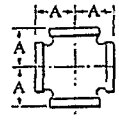
90° Elbow



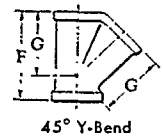
45° Elbow



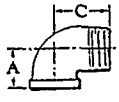
Tee



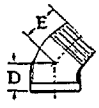
Cross



45° Y-Bend



90° Street Elbow



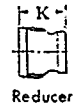
45° Street Elbow



Cap



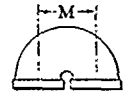
Coupling



Reducer

American Standards: The dimensions shown on this page apply to 125 and 250-pound bronze screwed fittings and were extracted from American Standards B16.15-1958 and B16.17-1949, respectively.

The 125-Pound Standard (B16.15) includes all of the fittings illustrated. The 250-Pound Standard (B16.17) includes only the 90° elbow, 45° elbow, tee, cross, and coupling.



Return Bend

ASA Dimensions, In Inches

Size	A	B	C	D	E	F	G	H	J	Reducers K		Return Bends M		Plus or minus tolerance
										1 reduction	2 or 3 reductions	Close Pattern	Open Pattern	
125-Pound Bronze														
⅛	0.54	0.42	0.92	0.42	0.78	...	...	0.49	0.80	...	...	...	...	0.03
¼	0.71	0.56	1.11	0.56	0.88	...	...	0.59	0.97	0.88	...	...	...	0.04
⅜	0.82	0.63	1.24	0.63	0.92	1.78	1.28	0.64	1.05	1.01	0.92	...	...	0.05
½	1.01	0.78	1.48	0.78	1.06	2.19	1.58	0.76	1.29	1.17	1.13	1.00	1.50	0.06
¾	1.18	0.89	1.65	0.89	1.23	2.62	1.90	0.84	1.43	1.36	1.24	1.25	2.00	0.06
1	1.43	1.06	1.98	1.06	1.40	3.18	2.33	0.99	1.68	1.56	1.49	1.50	2.50	0.07
1¼	1.69	1.22	2.24	1.22	1.64	3.85	2.83	1.10	1.86	1.77	1.65	...	3.00	0.07
1½	1.84	1.30	2.46	1.30	1.80	4.24	3.14	1.15	1.92	1.89	1.80	...	3.50	0.08
2	2.12	1.45	2.88	1.45	2.14	5.00	3.76	1.32	2.20	2.06	2.03	...	4.00	0.08
2½	2.70	1.95	...	...	...	...	...	1.70	2.88	3.25	...	...	...	0.10
3	3.08	2.17	...	...	...	...	...	1.80	3.18	3.69	3.69	...	...	0.10
4	3.79	2.61	...	...	...	...	...	2.08	3.69	4.38	...	...	...	0.12
250-Pound Bronze														
¼	0.81	0.73	...	...	...	...	...	...	1.06	...	...	...	...	0.04
⅜	0.95	0.80	...	...	...	...	...	...	1.16	...	...	...	...	0.05
½	1.12	0.88	...	...	...	...	...	...	1.34	...	...	...	...	0.06
¾	1.31	0.98	...	...	...	...	...	...	1.52	...	...	...	...	0.06
1	1.50	1.12	...	...	...	...	...	...	1.67	...	...	...	...	0.07
1¼	1.75	1.29	...	...	...	...	...	...	1.93	...	...	...	...	0.07
1½	1.94	1.43	...	...	...	...	...	...	2.15	...	...	...	...	0.08
2	2.25	1.68	...	...	...	...	...	...	2.53	...	...	...	...	0.08
2½	2.70	1.95	...	...	...	...	...	...	2.88	...	...	...	...	0.10
3	3.08	2.17	...	...	...	...	...	...	3.18	...	...	...	...	0.10
4	3.79	2.61	...	...	...	...	...	...	3.69	...	...	...	...	0.12

ASA dimensions of malleable iron screwed fittings....page 398
ASA dimensions of cast iron screwed fittings.....page 399

For Crane steel screwed and welding fittings, see Sections 24 and 25 respectively

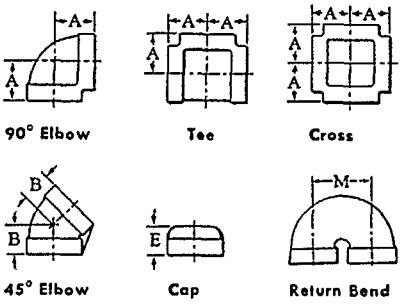
CC 4137

Dimensions of Cast Iron Screwed Fittings

ASA 125-Pound and 250-Pound Classes

ASA Dimensions, in Inches

Size	125-Pound						250-Pound		Plus or minus tolerance
	A	B	E	H	M Close	M Open	A	B	
1/4	0.81	0.73	...	...	...	...	0.94	0.81	0.04
3/8	0.95	0.80	...	...	...	...	1.06	0.88	0.05
1/2	1.12	0.88	...	1.38	1.25	1.75	1.25	1.00	0.06
3/4	1.31	0.98	...	1.50	1.50	1.88	1.44	1.13	0.06
1	1.50	1.12	...	1.70	1.75	2.50	1.63	1.31	0.07
1 1/4	1.75	1.29	...	2.13	2.25	3.00	1.94	1.50	0.07
1 1/2	1.94	1.43	...	2.25	2.50	3.50	2.13	1.69	0.08
2	2.25	1.68	...	2.32	3.25	4.50	2.50	2.00	0.08
2 1/2	2.70	1.95	1.81	2.63	3.75	5.50	2.94	2.25	0.10
3	3.08	2.17	1.91	2.88	4.50	6.50	3.38	2.50	0.10
3 1/2	3.42	2.39	2.03	3.13	...	...	3.75	2.63	0.10
4	3.79	2.61	2.22	3.38	6.00	7.50	4.13	2.81	0.12
5	4.50	3.05	2.38	3.57	...	...	4.88	3.19	0.12
6	5.13	3.46	2.63	3.81	...	...	5.63	3.50	0.14
8	6.56	4.28	2.88	5.25	...	...	7.00	4.31	0.16
0	8.08	5.16	3.50	...	...	...	8.63	5.19	0.19
2	9.50	5.97	3.88	...	...	...	10.00	6.00	0.21



ASA: Dimensions at the left are extracted from American Standard B16.4-1949 for Cast Iron Screwed Fittings.



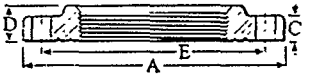
In the 250-pound class, the foregoing Standard includes only the 90° elbow, 45° elbow, tee, and cross.

Dimensions of Bronze Flanges

ASA 150-Pound and 300-Pound Classes

ASA Dimensions, in Inches

SA Class	Size	A	C	E	D	No. & dia. of bolts	Size of bolt holes
	1/2	3 1/2	5/16	2 3/8	19/32	4-1/2	5/8
	3/4	3 7/8	11/32	2 3/4	5/8	4-1/2	5/8
	1	4 1/4	3/8	3 1/8	11/16	4-1/2	5/8
	1 1/4	4 5/8	13/32	3 1/2	13/16	4-1/2	5/8
	1 1/2	5	7/16	3 7/8	7/8	4-1/2	5/8
	2	6	1/2	4 3/4	1	4-5/8	3/4
0-Pound Bronze	2 1/2	7	9/16	5 1/2	1 1/8	4-5/8	3/4
	3	7 1/2	5/8	6	1 3/16	4-5/8	3/4
	3 1/2	8 1/2	11/16	7	1 1/4	8-5/8	3/4
	4	9	11/16	7 1/2	1 5/16	8-5/8	3/4
	5	10	3/4	8 1/2	1 7/16	8-3/4	7/8
	6	11	13/16	9 1/2	1 9/16	8-3/4	7/8
	8	13 1/2	15/16	11 3/4	1 3/4	8-3/4	7/8
	10	16	1	14 1/4	1 15/16	12-7/8	1
	12	19	1 1/16	17	2 3/16	12-7/8	1
	1/2	3 3/4	1/2	2 5/8	19/32	4-1/2	5/8
	3/4	4 5/8	17/32	3 1/4	5/8	4-5/8	3/4
	1	4 7/8	19/32	3 1/2	11/16	4-5/8	3/4
	1 1/4	5 1/4	5/8	3 7/8	13/16	4-5/8	3/4
	1 1/2	6 1/8	11/16	4 1/2	7/8	4-3/4	7/8
0-Pound Bronze	2	6 1/2	3/4	5	1	8-5/8	3/4
	2 1/2	7 1/2	13/16	5 7/8	1 1/8	8-3/4	7/8
	3	8 1/4	29/32	6 5/8	1 3/16	8-3/4	7/8
	3 1/2	9	31/32	7 1/4	1 1/4	8-3/4	7/8
	4	10	1 1/16	7 7/8	1 5/16	8-3/4	7/8
	5	11	1 1/8	9 1/4	1 7/16	8-3/4	7/8
	6	12 1/2	1 3/16	10 5/8	1 9/16	12-3/4	7/8
	8	15	1 3/8	13	1 3/4	12-7/8	1



150 or 300-Pound Screwed Flange

Except for dimension "D", all dimensions shown apply to blind flanges (not illustrated) also.

American Standard: The dimensions shown at the left are extracted from American Standard B16.24-1953 covering 150 and 300-Pound Bronze Flanges and Flanged Fittings.

Flange facings: The Standard recommends that flanges be plain faced, with two concentric grooves between the port and the bolt holes.

Drilling templates: For 150 and 300-pound bronze drilling templates, see page 326.

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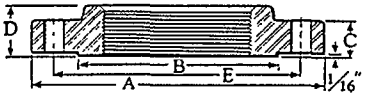
For ASA dimensions of cast iron flanges, see page 401

Dimensions of Cast Iron Flanges

ASA Class 125 and Class 250



Class 125 Screwed Flange
(plain face)



Class 250 Screwed Flange
(1/16-inch raised face)

Except for dimension "D," all dimensions shown apply to blind flanges (not illustrated) also.

ASA Dimensions, in Inches

Pressure Class	Nominal Pipe Size	A Diameter of flange	B Diameter of raised face	C Thickness of flange	D Length through hub	E Diameter of bolt circle	— No. and diameter of bolts	— Diameter of bolt holes
Class 125 Cast Iron Screwed and Blind Flanges	1	4 1/4	...	7/16	11/16	3 1/8	4-1/2	5/8
	1 1/4	4 5/8	...	1/2	13/16	3 1/2	4-1/2	5/8
	1 1/2	5	...	9/16	7/8	3 7/8	4-1/2	5/8
	2	6	...	5/8	1	4 3/4	4-5/8	3/4
	2 1/2	7	...	11/16	1 1/8	5 1/2	4-5/8	3/4
	3	7 1/2	...	3/4	1 3/16	6	4 5/8	3/4
	3 1/2	8 1/2	...	13/16	1 1/4	7	8-5/8	3/4
	4	9	...	15/16	1 5/16	7 1/2	8-5/8	3/4
	5	10	...	15/16	1 7/16	8 1/2	8-3/4	7/8
	6	11	...	1	1 9/16	9 1/2	8-3/4	7/8
	8	13 1/2	...	1 1/8	1 3/4	11 3/4	8-3/4	7/8
	10	16	...	1 3/16	1 15/16	14 1/4	12-7/8	1
	12	19	...	1 1/4	2 3/16	17	12-7/8	1
	14 OD	21	...	1 3/8	2 1/4	18 3/4	12-1	1 1/8
	16 OD	23 1/2	...	1 7/16	2 1/2	21 1/4	16-1	1 1/8
	18 OD	25	...	1 9/16	2 11/16	22 3/4	16-1 1/8	1 1/4
	20 OD	27 1/2	...	1 11/16	2 7/8	25	20-1 1/8	1 1/4
	24 OD	32	...	1 7/8	3 1/4	29 1/2	20-1 1/4	1 3/8
Class 250 Cast Iron Screwed and Blind Flanges	1	4 7/8	2 11/16	11/16	7/8	3 1/2	4-5/8	3/4
	1 1/4	5 1/4	3 1/16	3/4	1	3 7/8	4-5/8	3/4
	1 1/2	6 1/8	3 9/16	13/16	1 1/8	4 1/2	4-3/4	7/8
	2	6 1/2	4 3/16	7/8	1 1/4	5	8-5/8	3/4
	2 1/2	7 1/2	4 15/16	1	1 7/16	5 7/8	8-3/4	7/8
	3	8 1/4	5 11/16	1 1/8	1 9/16	6 5/8	8-3/4	7/8
	3 1/2	9	6 5/16	1 3/16	1 5/8	7 1/4	8-3/4	7/8
	4	10	6 15/16	1 1/4	1 3/4	7 7/8	8-3/4	7/8
	5	11	8 5/16	1 3/8	1 7/8	9 1/4	8-3/4	7/8
	6	12 1/2	9 11/16	1 7/16	1 15/16	10 5/8	12-3/4	7/8
	8	15	11 15/16	1 5/8	2 3/16	13	12-7/8	1
	10	17 1/2	14 1/16	1 7/8	2 3/8	15 1/4	16-1	1 1/8
	12	20 1/2	16 7/16	2	2 9/16	17 3/4	16-1 1/8	1 1/4
	14 OD	23	18 15/16	2 1/8	2 11/16	20 1/4	20-1 1/8	1 1/4
	16 OD	25 1/2	21 1/16	2 1/4	2 7/8	22 1/2	20-1 1/4	1 3/8
	18 OD	28	23 5/16	2 3/8	...	24 3/4	24-1 1/4	1 3/8
	20 OD	30 1/2	25 9/16	2 1/2	...	27	24-1 1/4	1 3/8
	24 OD	36	30 1/4	2 3/4	...	32	24-1 1/2	1 11/16

American Standards: The dimensions shown on this page are extracted from American Standards B16.1-1948 (Class 125) and B16b-1944 (Class 250) covering Cast Iron Flanges and Flanged Fittings

Flange facings: Class 125 flanges have a plain face. Class 250 flanges have a 1/16-inch raised face which is included in the thickness of flange dimension (C).

Drilling templates.....pages 327 and 328

Crane forged steel flanges....Section 26

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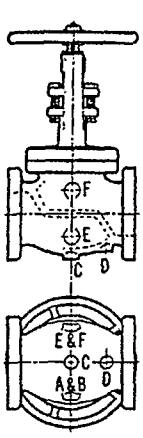
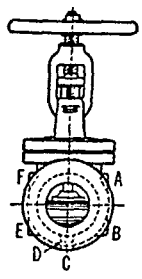
C64141

Taps and Drains for Flanged Valves

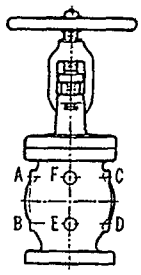
Designating Location of Tapped Holes

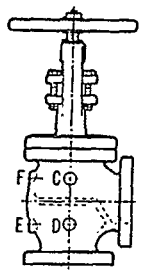


Globe Valve



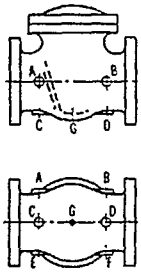
Globe Valve



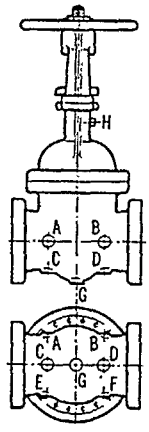


Angle Valve

These illustrations indicate a standard method used for designating the location of tapped holes on cast iron and cast steel globe, angle, check, and gate valves in all pressure classes.



Check Valve



Gate Valve

Valve bodies can be tapped without a boss for a very small drain hole; the maximum size of the hole, however, depends entirely upon the location of the tapped hole and the pressure class of the valve.

Gate valves are regularly made with bosses (except at location "G"). Globe, angle, and check valves are not regularly made with bosses but can be so furnished when orders specify.

Location of By-Passes

Gate valves: When gate valves are ordered with by-pass attached, it shall be regular practice to attach said by-pass at the side of the main valve with the stems of both valves parallel, pointing vertically upward.

The more common of the "special" attached-locations is on the center of the flow line, at the bottom of the main valve, with the stem of the by-pass valve at right angles to the main valve stem. This is designated as the "bottom attachment", or defined as "by-pass at bottom". When any other "special" attached-location or other position of the by-pass valve stem is desired, a sketch should be submitted.

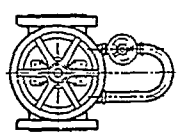
Globe valves: When globe valves are ordered with by-pass attached, it shall be regular practice to attach said by-pass at the right-hand side of the main valve, with the stems of both valves parallel, pointing vertically upward. When by-pass is "specially" required attached at the left-hand side, the designation shall be "left-hand attachment".

Right-hand side of a globe valve is the side at the right, when facing the flow-port which leads to the under side of the disc.

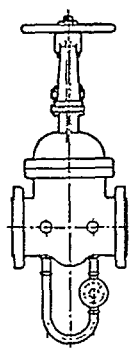
Angle valves: When angle valves are ordered with by-pass attached, it shall be regular practice to attach said by-pass at the back of the main valve, with the stems of both valves parallel, pointing verti cally upward.

When the by-pass is "specially" required attached at the right or left-hand side, the designations shall be "right-hand attachment" or "left-hand attachment". Right-hand side of an angle valve is at the right, when facing the back of the valve.

These illustrations are representative of steel valves.



Gate Valve with By-Pass on Side



Gate Valve with By-Pass at Bottom

For by-passes, see the following pages:
Steel Bolted Bonnet Wedge Gate Valves.....page 129
Iron Wedge Gate Valves.....page 282
Iron Double Disc Gate Valves.....page 282

For by-passes for steel pressure-seal bonnet gate valves, see page 174.

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CRTX 1190

Circumferences and Areas of Circles

Diameter = Circumference ÷ 3.141 592 654

Circumference = 3.141 592 654 × Diameter Area = 0.785 398 163 × Diameter²

Dia.	Circum.	Area	Dia.	Circum.	Area	Dia.	Circum.	Area	Dia.	Circum.	Area	Dia.	Circum.	Area
1/64	.04909	.00019	2	6.2832	3.1416	6	18.850	28.274	14	43.982	153.94	22	69.115	380.13
1/32	.09818	.00077	1/16	6.4795	3.3410	1/8	19.242	29.465	1/8	44.375	156.70	1/8	69.508	384.46
3/64	.14726	.00173	1/8	6.6759	3.5466	1/4	19.635	30.680	1/4	44.768	159.48	1/4	69.900	388.82
			3/16	6.8722	3.7583	3/8	20.028	31.919	3/8	45.160	162.30	3/8	70.293	393.20
1/16	.19635	.00307	1/4	7.0686	3.9761	1/2	20.420	33.183	1/2	45.553	165.13	1/2	70.686	397.61
5/64	.24544	.00479	5/16	7.2649	4.2000	5/8	20.813	34.472	5/8	45.946	167.99	5/8	71.079	402.04
3/32	.29452	.00690	3/8	7.4613	4.4301	3/4	21.206	35.785	3/4	46.338	170.87	3/4	71.471	406.49
7/64	.34361	.00940	7/16	7.6576	4.6664	7/8	21.598	37.122	7/8	46.731	173.78	7/8	71.864	410.97
1/8	.39270	.01227	1/2	7.8540	4.9087	7	21.991	38.485	15	47.124	176.71	23	72.257	415.48
9/64	.44179	.01553	9/16	8.0503	5.1572	1/8	22.384	39.871	1/8	47.517	179.67	1/8	72.649	420.00
5/32	.49087	.01917	5/8	8.2467	5.4119	1/4	22.776	41.282	1/4	47.909	182.65	1/4	73.042	424.56
11/64	.53996	.02320	11/16	8.4430	5.6727	3/8	23.169	42.718	3/8	48.302	185.66	3/8	73.435	429.13
3/16	.58905	.02761	3/4	8.6394	5.9396	1/2	23.562	44.179	1/2	48.695	188.69	1/2	73.827	433.74
13/64	.63814	.03241	13/16	8.8357	6.2126	5/8	23.955	45.664	5/8	49.087	191.75	5/8	74.220	438.36
7/32	.68722	.03758	7/8	9.0321	6.4918	3/4	24.347	47.173	3/4	49.480	194.83	3/4	74.613	443.01
15/64	.73631	.04314	15/16	9.2284	6.7771	7/8	24.740	48.707	7/8	49.873	197.93	7/8	75.006	447.69
1/4	.78540	.04909	3	9.4248	7.0686	8	25.133	50.265	16	50.265	201.06	24	75.398	452.39
17/64	.83449	.05542	1/16	9.6211	7.3662	1/8	25.525	51.849	1/8	50.658	204.22	1/8	75.791	457.11
9/32	.88357	.06213	1/8	9.8175	7.6699	1/4	25.918	53.456	1/4	51.051	207.39	1/4	76.184	461.86
19/64	.93266	.06922	3/16	10.014	7.9798	3/8	26.311	55.088	3/8	51.444	210.60	3/8	76.576	466.64
5/16	.98175	.07670	1/4	10.210	8.2958	1/2	26.704	56.745	1/2	51.836	213.82	1/2	76.969	471.44
21/64	1.03084	.08456	5/16	10.407	8.6179	5/8	27.096	58.426	5/8	52.229	217.08	5/8	77.362	476.26
11/32	1.0799	.09281	3/8	10.603	8.9462	3/4	27.489	60.132	3/4	52.622	220.35	3/4	77.754	481.11
23/64	1.1290	.10143	7/16	10.799	9.2806	7/8	27.882	61.862	7/8	53.014	223.65	7/8	78.147	485.98
3/8	1.1781	.11045	1/2	10.996	9.6211	9	28.274	63.617	17	53.407	226.98	25	78.540	490.87
25/64	1.2272	.11984	9/16	11.192	9.9678	1/8	28.667	65.397	1/8	53.800	230.33	1/8	78.933	495.79
13/32	1.2763	.12962	5/8	11.388	10.321	1/4	29.060	67.201	1/4	54.192	233.71	1/4	79.325	500.74
27/64	1.3254	.13978	11/16	11.585	10.680	3/8	29.452	69.029	3/8	54.585	237.10	3/8	79.718	505.71
7/16	1.3744	.15033	3/4	11.781	11.045	1/2	29.845	70.882	1/2	54.978	240.53	1/2	80.111	510.71
29/64	1.4235	.16126	13/16	11.977	11.416	5/8	30.238	72.760	5/8	55.371	243.98	5/8	80.503	515.72
15/32	1.4726	.17257	7/8	12.174	11.793	3/4	30.631	74.662	3/4	55.763	247.45	3/4	80.896	520.77
31/64	1.5217	.18427	15/16	12.370	12.177	7/8	31.023	76.589	7/8	56.156	250.95	7/8	81.289	525.84
1/2	1.5708	.19635	4	12.566	12.566	10	31.416	78.540	18	56.549	254.47	26	81.681	530.93
17/32	1.6690	.22166	1/16	12.763	12.962	1/8	31.809	80.516	1/8	56.941	258.02	1/8	82.074	536.05
9/16	1.7671	.24850	1/8	12.959	13.364	1/4	32.201	82.516	1/4	57.334	261.59	1/4	82.467	541.19
19/32	1.8653	.27688	3/16	13.155	13.772	3/8	32.594	84.541	3/8	57.727	265.18	3/8	82.860	546.35
5/8	1.9635	.30680	1/4	13.352	14.186	1/2	32.987	86.590	1/2	58.119	268.80	1/2	83.252	551.55
21/32	2.0617	.33824	5/16	13.548	14.607	5/8	33.379	88.664	5/8	58.512	272.45	5/8	83.645	556.76
11/16	2.1598	.37122	3/8	13.744	15.033	3/4	33.772	90.763	3/4	58.905	276.12	3/4	84.038	562.00
23/32	2.2580	.40574	7/16	13.941	15.466	7/8	34.165	92.886	7/8	59.298	279.81	7/8	84.430	567.27
3/4	2.3562	.44179	1/2	14.137	15.904	11	34.558	95.033	19	59.690	283.53	27	84.823	572.56
25/32	2.4544	.47937	9/16	14.334	16.349	1/8	34.950	97.205	1/8	60.083	287.27	1/8	85.216	577.87
13/16	2.5525	.51849	5/8	14.530	16.800	1/4	35.343	99.402	1/4	60.476	291.04	1/4	85.608	583.21
27/32	2.6507	.55914	11/16	14.726	17.257	3/8	35.736	101.62	3/8	60.868	294.83	3/8	86.001	588.57
7/8	2.7489	.60132	3/4	14.923	17.721	1/2	36.128	103.87	1/2	61.261	298.65	1/2	86.394	593.96
29/32	2.8471	.64504	13/16	15.119	18.190	5/8	36.521	106.14	5/8	61.654	302.49	5/8	86.786	599.37
15/16	2.9452	.69029	7/8	15.315	18.665	3/4	36.914	108.43	3/4	62.046	306.35	3/4	87.179	604.81
31/32	3.0434	.73708	15/16	15.512	19.147	7/8	37.306	110.75	7/8	62.439	310.24	7/8	87.572	610.27
1	3.1416	.7854	5	15.708	19.635	12	37.699	113.10	20	62.832	314.16	28	87.965	615.75
1/16	3.3379	.8866	1/16	15.904	20.129	1/8	38.092	115.47	1/8	63.225	318.10	1/8	88.357	621.26
1/8	3.5343	.9940	1/8	16.101	20.629	1/4	38.485	117.86	1/4	63.617	322.06	1/4	88.750	626.80
3/16	3.7306	1.1075	3/16	16.297	21.135	3/8	38.877	120.28	3/8	64.010	326.05	3/8	89.143	632.36
1/4	3.9270	1.2272	1/4	16.493	21.648	1/2	39.270	122.72	1/2	64.403	330.06	1/2	89.535	637.94
5/16	4.1233	1.3530	5/16	16.690	22.166	5/8	39.663	125.19	5/8	64.795	334.10	5/8	89.928	643.55
3/8	4.3197	1.4849	3/8	16.886	22.691	3/4	40.055	127.68	3/4	65.188	338.16	3/4	90.321	649.18
7/16	4.5160	1.6230	7/16	17.082	23.221	7/8	40.448	130.19	7/8	65.581	342.25	7/8	90.713	654.84
1/2	4.7124	1.7671	1/2	17.279	23.758	13	40.841	132.73	21	65.973	346.36	29	91.106	660.52
9/16	4.9087	1.9175	9/16	17.475	24.301	1/8	41.233	135.30	1/8	66.366	350.50	1/8	91.499	666.23
5/8	5.1051	2.0739	5/8	17.671	24.850	1/4	41.626	137.89	1/4	66.759	354.66	1/4	91.892	671.96
11/16	5.3014	2.2365	11/16	17.868	25.406	3/8	42.019	140.50	3/8	67.152	358.84	3/8	92.284	677.71
3/4	5.4978	2.4053	3/4	18.064	25.967	1/2	42.412	143.14	1/2	67.544	363.05	1/2	92.677	683.49
13/16	5.6941	2.5802	13/16	18.261	26.535	5/8	42.804	145.80	5/8	67.937	367.28	5/8	93.070	689.30
7/8	5.8905	2.7612	7/8	18.457	27.109	3/4	43.197	148.49	3/4	68.330	371.54	3/4	93.462	695.13
15/16	6.0868	2.9483	15/16	18.653	27.688	7/8	43.590	151.20	7/8	68.722	375.83	7/8	93.855	700.98

(continued on the two pages following)

CRTX 1192

Circumferences and Areas of Circles

Diameter = Circumference ÷ 3.141 592 654

Circumference = 3.141 592 654 × Diameter Area = 0.785 398 163 × Diameter^2

(continued from the preceding page)

Dia.	Circum.	Area	Dia.	Circum.	Area	Dia.	Circum.	Area	Dia.	Circum.	Area	Dia.	Circum.	Area
5	204.204	3318.3	72	226.195	4071.5	79	248.186	4901.7	86	270.177	5808.8	93	292.168	6792.9
1/8	204.596	3331.1	1/8	226.587	4085.7	1/8	248.579	4917.2	1/8	270.570	5825.7	1/8	292.561	6811.2
1/4	204.989	3343.9	1/4	226.980	4099.8	1/4	248.971	4932.7	1/4	270.962	5842.6	1/4	292.954	6829.5
3/8	205.382	3356.7	3/8	227.373	4114.0	3/8	249.364	4948.3	3/8	271.355	5859.6	3/8	293.346	6847.8
1/2	205.774	3369.6	1/2	227.765	4128.2	1/2	249.757	4963.9	1/2	271.748	5876.5	1/2	293.739	6866.1
5/8	206.167	3382.4	5/8	228.158	4142.5	5/8	250.149	4979.5	5/8	272.140	5893.5	5/8	294.132	6884.5
3/4	206.560	3395.3	3/4	228.551	4156.8	3/4	250.542	4995.2	3/4	272.533	5910.6	3/4	294.524	6902.9
7/8	206.952	3408.2	7/8	228.944	4171.1	7/8	250.935	5010.9	7/8	272.926	5927.6	7/8	294.917	6921.3
66	207.345	3421.2	73	229.336	4185.4	80	251.327	5026.5	87	273.319	5944.7	94	295.310	6939.8
1/8	207.738	3434.2	1/8	229.729	4199.7	1/8	251.720	5042.3	1/8	273.711	5961.8	1/8	295.702	6958.2
1/4	208.131	3447.2	1/4	230.122	4214.1	1/4	252.113	5058.0	1/4	274.104	5978.9	1/4	296.095	6976.7
3/8	208.523	3460.2	3/8	230.514	4228.5	3/8	252.506	5073.8	3/8	274.497	5996.0	3/8	296.488	6995.3
1/2	208.916	3473.2	1/2	230.907	4242.9	1/2	252.898	5089.6	1/2	274.889	6013.2	1/2	296.881	7013.8
5/8	209.309	3486.3	5/8	231.300	4257.4	5/8	253.291	5105.4	5/8	275.282	6030.4	5/8	297.273	7032.4
3/4	209.701	3499.4	3/4	231.692	4271.8	3/4	253.684	5121.2	3/4	275.675	6047.6	3/4	297.666	7051.0
7/8	210.094	3512.5	7/8	232.085	4286.3	7/8	254.076	5137.1	7/8	276.067	6064.9	7/8	298.059	7069.6
67	210.487	3525.7	74	232.478	4300.8	81	254.469	5153.0	88	276.460	6082.1	95	298.451	7088.2
1/8	210.879	3538.8	1/8	232.871	4315.4	1/8	254.862	5168.9	1/8	276.853	6099.4	1/8	298.844	7106.9
1/4	211.272	3552.0	1/4	233.263	4329.9	1/4	255.254	5184.9	1/4	277.246	6116.7	1/4	299.237	7125.6
3/8	211.665	3565.2	3/8	233.656	4344.5	3/8	255.647	5200.8	3/8	277.638	6134.1	3/8	299.629	7144.3
1/2	212.058	3578.5	1/2	234.049	4359.2	1/2	256.040	5216.8	1/2	278.031	6151.4	1/2	300.022	7163.0
5/8	212.450	3591.7	5/8	234.441	4373.8	5/8	256.433	5232.8	5/8	278.424	6168.8	5/8	300.415	7181.8
3/4	212.843	3605.0	3/4	234.834	4388.5	3/4	256.825	5248.9	3/4	278.816	6186.2	3/4	300.807	7200.6
7/8	213.236	3618.3	7/8	235.227	4403.1	7/8	257.218	5264.9	7/8	279.209	6203.7	7/8	301.200	7219.4
68	213.628	3631.7	75	235.619	4417.9	82	257.611	5281.0	89	279.602	6221.1	96	301.593	7238.2
1/8	214.021	3645.0	1/8	236.012	4432.6	1/8	258.003	5297.1	1/8	279.994	6238.6	1/8	301.986	7257.1
1/4	214.414	3658.4	1/4	236.405	4447.4	1/4	258.396	5313.3	1/4	280.387	6256.1	1/4	302.378	7276.0
3/8	214.806	3671.8	3/8	236.798	4462.2	3/8	258.789	5329.4	3/8	280.780	6273.7	3/8	302.771	7294.9
1/2	215.199	3685.3	1/2	237.190	4477.0	1/2	259.181	5345.6	1/2	281.173	6291.2	1/2	303.164	7313.8
5/8	215.592	3698.7	5/8	237.583	4491.8	5/8	259.574	5361.8	5/8	281.565	6308.8	5/8	303.556	7332.8
3/4	215.984	3712.2	3/4	237.976	4506.7	3/4	259.967	5378.1	3/4	281.958	6326.4	3/4	303.949	7351.8
7/8	216.377	3725.7	7/8	238.368	4521.5	7/8	260.359	5394.3	7/8	282.351	6344.1	7/8	304.342	7370.8
69	216.770	3739.3	76	238.761	4536.5	83	260.752	5410.6	90	282.743	6361.7	97	304.734	7389.8
1/8	217.163	3752.8	1/8	239.154	4551.4	1/8	261.145	5426.9	1/8	283.136	6379.4	1/8	305.127	7408.9
1/4	217.555	3766.4	1/4	239.546	4566.4	1/4	261.538	5443.3	1/4	283.529	6397.1	1/4	305.520	7428.0
3/8	217.948	3780.0	3/8	239.939	4581.3	3/8	261.930	5459.6	3/8	283.921	6414.9	3/8	305.913	7447.1
1/2	218.341	3793.7	1/2	240.332	4596.3	1/2	262.323	5476.0	1/2	284.314	6432.6	1/2	306.305	7466.2
5/8	218.733	3807.3	5/8	240.725	4611.4	5/8	262.716	5492.4	5/8	284.707	6450.4	5/8	306.698	7485.3
3/4	219.126	3821.0	3/4	241.117	4626.4	3/4	263.108	5508.8	3/4	285.100	6468.2	3/4	307.091	7504.5
7/8	219.519	3834.7	7/8	241.510	4641.5	7/8	263.501	5525.3	7/8	285.492	6486.0	7/8	307.483	7523.7
70	219.911	3848.5	77	241.903	4656.6	84	263.894	5541.8	91	285.885	6503.9	98	307.876	7543.0
1/8	220.304	3862.2	1/8	242.295	4671.8	1/8	264.286	5558.3	1/8	286.278	6521.8	1/8	308.269	7562.2
1/4	220.697	3876.0	1/4	242.688	4686.9	1/4	264.679	5574.8	1/4	286.670	6539.7	1/4	308.661	7581.5
3/8	221.090	3889.8	3/8	243.081	4702.1	3/8	265.072	5591.4	3/8	287.063	6557.6	3/8	309.054	7600.8
1/2	221.482	3903.6	1/2	243.473	4717.3	1/2	265.465	5607.9	1/2	287.456	6575.5	1/2	309.447	7620.1
5/8	221.875	3917.5	5/8	243.866	4732.5	5/8	265.857	5624.5	5/8	287.848	6593.5	5/8	309.840	7639.5
3/4	222.268	3931.4	3/4	244.259	4747.8	3/4	266.250	5641.2	3/4	288.241	6611.5	3/4	310.232	7658.9
7/8	222.660	3945.3	7/8	244.652	4763.1	7/8	266.643	5657.8	7/8	288.634	6629.6	7/8	310.625	7678.3
71	223.053	3959.2	78	245.044	4778.4	85	267.035	5674.5	92	289.027	6647.6	99	311.018	7697.7
1/8	223.446	3973.1	1/8	245.437	4793.7	1/8	267.428	5691.2	1/8	289.419	6665.7	1/8	311.410	7717.1
1/4	223.838	3987.1	1/4	245.830	4809.0	1/4	267.821	5707.9	1/4	289.812	6683.8	1/4	311.803	7736.6
3/8	224.231	4001.1	3/8	246.222	4824.4	3/8	268.213	5724.7	3/8	290.205	6701.9	3/8	312.196	7756.1
1/2	224.624	4015.2	1/2	246.615	4839.8	1/2	268.606	5741.5	1/2	290.597	6720.1	1/2	312.588	7775.6
5/8	225.017	4029.2	5/8	247.008	4855.2	5/8	268.999	5758.3	5/8	290.990	6738.2	5/8	312.981	7795.2
3/4	225.409	4043.3	3/4	247.400	4870.7	3/4	269.392	5775.1	3/4	291.383	6756.4	3/4	313.374	7814.8
7/8	225.802	4057.4	7/8	247.793	4886.2	7/8	269.784	5791.9	7/8	291.775	6774.7	7/8	313.767	7834.4
												100	314.159	7854.0

CRTX 1194

Natural Trigonometric Functions

↓	Sin	Cos	Tan	Cot	
22°00′	.37461	.92718	.40403	2.4751	68°00′
10	.37730	.92609	.40741	2.4545	50
20	.37999	.92499	.41081	2.4342	40
30	.38268	.92388	.41421	2.4142	30
40	.38537	.92276	.41763	2.3945	20
50	.38805	.92164	.42105	2.3750	10
23°00′	.39073	.92050	.42447	2.3559	67°00′
10	.39341	.91936	.42791	2.3369	50
20	.39608	.91822	.43136	2.3183	40
30	.39875	.91706	.43481	2.2998	30
40	.40142	.91590	.43828	2.2817	20
50	.40408	.91472	.44175	2.2637	10
24°00′	.40674	.91355	.44523	2.2460	66°00′
10	.40939	.91236	.44872	2.2286	50
20	.41204	.91116	.45222	2.2113	40
30	.41469	.90996	.45573	2.1943	30
40	.41734	.90875	.45924	2.1775	20
50	.41998	.90753	.46277	2.1609	10
25°00′	.42262	.90631	.46631	2.1445	65°00′
10	.42525	.90507	.46985	2.1283	50
20	.42788	.90383	.47341	2.1123	40
30	.43051	.90259	.47698	2.0965	30
40	.43313	.90133	.48055	2.0809	20
50	.43575	.90007	.48414	2.0655	10
26°00′	.43837	.89879	.48773	2.0503	64°00′
10	.44098	.89752	.49134	2.0353	50
20	.44359	.89623	.49495	2.0204	40
30	.44620	.89493	.49858	2.0057	30
40	.44880	.89363	.50222	1.9912	20
50	.45140	.89232	.50587	1.9768	10
27°00′	.45399	.89101	.50953	1.9626	63°00′
10	.45658	.88968	.51320	1.9486	50
20	.45917	.88835	.51688	1.9347	40
30	.46175	.88701	.52057	1.9210	30
40	.46433	.88566	.52427	1.9074	20
50	.46690	.88431	.52798	1.8940	10
28°00′	.46947	.88295	.53171	1.8807	62°00′
10	.47204	.88158	.53545	1.8676	50
20	.47460	.88020	.53920	1.8546	40
30	.47716	.87882	.54296	1.8418	30
40	.47971	.87743	.54674	1.8291	20
50	.48226	.87603	.55051	1.8165	10
29°00′	.48481	.87462	.55431	1.8041	61°00′
10	.48735	.87321	.55812	1.7917	50
20	.48989	.87178	.56194	1.7796	40
30	.49242	.87036	.56577	1.7675	30
40	.49495	.86892	.56962	1.7556	20
50	.49748	.86748	.57348	1.7438	10
30°00′	.50000	.86603	.57735	1.7321	60°00′
10	.50252	.86457	.58124	1.7205	50
20	.50503	.86310	.58513	1.7090	40
30	.50754	.86163	.58905	1.6977	30
40	.51004	.86015	.59297	1.6864	20
50	.51254	.85866	.59691	1.6753	10
31°00′	.51504	.85717	.60086	1.6643	59°00′
10	.51753	.85567	.60483	1.6534	50
20	.52002	.85416	.60881	1.6426	40
30	.52250	.85264	.61280	1.6319	30
40	.52498	.85112	.61681	1.6213	20
50	.52745	.84959	.62083	1.6107	10
32°00′	.52992	.84805	.62487	1.6003	58°00′
10	.53238	.84650	.62892	1.5900	50
20	.53484	.84495	.63299	1.5798	40
30	.53730	.84339	.63707	1.5697	30
40	.53975	.84182	.64117	1.5597	20
50	.54220	.84025	.64528	1.5497	10
33°00′	.54464	.83867	.64941	1.5399	57°00′
	Cos	Sin	Cot	Tan	↑

↓	Sin	Cos	Tan	Cot	
33°00′	.54464	.83867	.64941	1.5399	57°00′
10	.54708	.83708	.65355	1.5301	50
20	.54951	.83549	.65771	1.5204	40
30	.55194	.83389	.66189	1.5108	30
40	.55436	.83228	.66608	1.5013	20
50	.55678	.83066	.67028	1.4919	10
34°00′	.55919	.82904	.67451	1.4826	56°00′
10	.56160	.82741	.67875	1.4733	50
20	.56401	.82577	.68301	1.4641	40
30	.56641	.82413	.68728	1.4550	30
40	.56880	.82248	.69157	1.4460	20
50	.57119	.82082	.69588	1.4370	10
35°00′	.57358	.81915	.70021	1.4282	55°00′
10	.57596	.81748	.70455	1.4193	50
20	.57833	.81580	.70891	1.4106	40
30	.58070	.81412	.71329	1.4020	30
40	.58307	.81242	.71769	1.3934	20
50	.58543	.81072	.72211	1.3848	10
36°00′	.58779	.80902	.72654	1.3764	54°00′
10	.59014	.80730	.73100	1.3680	50
20	.59248	.80558	.73547	1.3597	40
30	.59482	.80386	.73996	1.3514	30
40	.59716	.80212	.74447	1.3432	20
50	.59949	.80038	.74900	1.3351	10
37°00′	.60182	.79864	.75355	1.3270	53°00′
10	.60414	.79688	.75812	1.3190	50
20	.60645	.79512	.76272	1.3111	40
30	.60876	.79335	.76733	1.3032	30
40	.61107	.79158	.77196	1.2954	20
50	.61337	.78980	.77661	1.2876	10
38°00′	.61566	.78801	.78129	1.2799	52°00′
10	.61795	.78622	.78598	1.2723	50
20	.62024	.78442	.79070	1.2647	40
30	.62251	.78261	.79544	1.2572	30
40	.62479	.78079	.80020	1.2497	20
50	.62706	.77897	.80498	1.2423	10
39°00′	.62932	.77715	.80978	1.2349	51°00′
10	.63158	.77531	.81461	1.2276	50
20	.63383	.77347	.81946	1.2203	40
30	.63608	.77162	.82434	1.2131	30
40	.63832	.76977	.82923	1.2059	20
50	.64056	.76791	.83415	1.1988	10
40°00′	.64279	.76604	.83910	1.1918	50°00′
10	.64501	.76417	.84407	1.1847	50
20	.64723	.76229	.84906	1.1778	40
30	.64945	.76041	.85408	1.1709	30
40	.65166	.75851	.85912	1.1640	20
50	.65386	.75661	.86419	1.1572	10
41°00′	.65606	.75471	.86929	1.1504	49°00′
10	.65825	.75280	.87441	1.1436	50
20	.66044	.75088	.87955	1.1369	40
30	.66262	.74896	.88473	1.1303	30
40	.66480	.74703	.88992	1.1237	20
50	.66697	.74509	.89515	1.1171	10
42°00′	.66913	.74314	.90040	1.1106	48°00′
10	.67129	.74120	.90569	1.1041	50
20	.67344	.73924	.91099	1.0977	40
30	.67559	.73728	.91633	1.0913	30
40	.67773	.73531	.92170	1.0850	20
50	.67987	.73333	.92709	1.0786	10
43°00′	.68200	.73135	.93252	1.0724	47°00′
10	.68412	.72937	.93797	1.0661	50
20	.68624	.72737	.94345	1.0599	40
30	.68835	.72537	.94896	1.0538	30
40	.69046	.72337	.95451	1.0477	20
50	.69256	.72136	.96008	1.0416	10
44°00′	.69466	.71934	.96569	1.0355	46°00′
10	.69675	.71732	.97133	1.0295	50
20	.69883	.71529	.97700	1.0236	40
30	.70091	.71325	.98270	1.0176	30
40	.70298	.71121	.98843	1.0117	20
50	.70505	.70916	.99420	1.0058	10
45°00′	.70711	.70711	1.00000	1.0000	45°00′
	Cos	Sin	Cot	Tan	↑

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Four-Place Logarithms to Base 10

N	0	1	2	3	4	5	6	7	8	9	Proportional Parts 1	2	3	4	5	6	7	8	9
4.0	6021	6031	6042	6053	6064	6075	6085	6096	6107	6117	1	2	3	4	5	6	8	9	10
4.1	6128	6138	6149	6160	6170	6180	6191	6201	6212	6222	1	2	3	4	5	6	7	8	9
4.2	6232	6243	6253	6263	6274	6284	6294	6304	6314	6325	1	2	3	4	5	6	7	8	9
4.3	6335	6345	6355	6365	6375	6385	6395	6405	6415	6425	1	2	3	4	5	6	7	8	9
4.4	6435	6444	6454	6464	6474	6484	6493	6503	6513	6522	1	2	3	4	5	6	7	8	9
4.5	6532	6542	6551	6561	6571	6580	6590	6599	6609	6618	1	2	3	4	5	6	7	8	9
4.6	6628	6637	6646	6656	6665	6675	6684	6693	6702	6712	1	2	3	4	5	6	7	7	8
4.7	6721	6730	6739	6749	6758	6767	6776	6785	6794	6803	1	2	3	4	5	5	6	7	8
4.8	6812	6821	6830	6839	6848	6857	6866	6875	6884	6893	1	2	3	4	4	5	6	7	8
4.9	6902	6911	6920	6928	6937	6946	6955	6964	6972	6981	1	2	3	4	4	5	6	7	8
5.0	6990	6998	7007	7016	7024	7033	7042	7050	7059	7067	1	2	3	3	4	5	6	7	8
5.1	7076	7084	7093	7101	7110	7118	7126	7135	7143	7152	1	2	3	3	4	5	6	7	8
5.2	7160	7168	7177	7185	7193	7202	7210	7218	7226	7235	1	2	2	3	4	5	6	7	7
5.3	7243	7251	7259	7267	7275	7284	7292	7300	7308	7316	1	2	2	3	4	5	6	6	7
5.4	7324	7332	7340	7348	7356	7364	7372	7380	7388	7396	1	2	2	3	4	5	6	6	7
5.5	7404	7412	7419	7427	7435	7443	7451	7459	7466	7474	1	2	2	3	4	5	5	6	7
5.6	7482	7490	7497	7505	7513	7520	7528	7536	7543	7551	1	2	2	3	4	5	5	6	7
5.7	7559	7566	7574	7582	7589	7597	7604	7612	7619	7627	1	2	2	3	4	5	5	6	7
5.8	7634	7642	7649	7657	7664	7672	7679	7686	7694	7701	1	1	2	3	4	4	5	6	7
5.9	7709	7716	7723	7731	7738	7745	7752	7760	7767	7774	1	1	2	3	4	4	5	6	7
6.0	7782	7789	7796	7803	7810	7818	7825	7832	7839	7846	1	1	2	3	4	4	5	6	6
6.1	7853	7860	7868	7875	7882	7889	7896	7903	7910	7917	1	1	2	3	4	4	5	6	6
6.2	7924	7931	7938	7945	7952	7959	7966	7973	7980	7987	1	1	2	3	3	4	5	6	6
6.3	7993	8000	8007	8014	8021	8028	8035	8041	8048	8055	1	1	2	3	3	4	5	5	6
6.4	8062	8069	8075	8082	8089	8096	8102	8109	8116	8122	1	1	2	3	3	4	5	5	6
6.5	8129	8136	8142	8149	8156	8162	8169	8176	8182	8189	1	1	2	3	3	4	5	5	6
6.6	8195	8202	8209	8215	8222	8228	8235	8241	8248	8254	1	1	2	3	3	4	5	5	6
6.7	8261	8267	8274	8280	8287	8293	8299	8306	8312	8319	1	1	2	3	3	4	5	5	6
6.8	8325	8331	8338	8344	8351	8357	8363	8370	8376	8382	1	1	2	3	3	4	4	5	6
6.9	8388	8395	8401	8407	8414	8420	8426	8432	8439	8445	1	1	2	2	3	4	4	5	6
7.0	8451	8457	8463	8470	8476	8482	8488	8494	8500	8506	1	1	2	2	3	4	4	5	6
7.1	8513	8519	8525	8531	8537	8543	8549	8555	8561	8567	1	1	2	2	3	4	4	5	5
7.2	8573	8579	8585	8591	8597	8603	8609	8615	8621	8627	1	1	2	2	3	4	4	5	5
7.3	8633	8639	8645	8651	8657	8663	8669	8675	8681	8686	1	1	2	2	3	4	4	5	5
7.4	8692	8698	8704	8710	8716	8722	8727	8733	8739	8745	1	1	2	2	3	4	4	5	5
7.5	8751	8756	8762	8768	8774	8779	8785	8791	8797	8802	1	1	2	2	3	3	4	5	5
7.6	8808	8814	8820	8825	8831	8837	8842	8848	8854	8859	1	1	2	2	3	3	4	5	5
7.7	8865	8871	8876	8882	8887	8893	8899	8904	8910	8915	1	1	2	2	3	3	4	4	5
7.8	8921	8927	8932	8938	8943	8949	8954	8960	8965	8971	1	1	2	2	3	3	4	4	5
7.9	8976	8982	8987	8993	8998	9004	9009	9015	9020	9025	1	1	2	2	3	3	4	4	5
8.0	9031	9036	9042	9047	9053	9058	9063	9069	9074	9079	1	1	2	2	3	3	4	4	5
8.1	9085	9090	9096	9101	9106	9112	9117	9122	9128	9133	1	1	2	2	3	3	4	4	5
8.2	9138	9143	9149	9154	9159	9165	9170	9175	9180	9186	1	1	2	2	3	3	4	4	5
8.3	9191	9196	9201	9206	9212	9217	9222	9227	9232	9238	1	1	2	2	3	3	4	4	5
8.4	9243	9248	9253	9258	9263	9269	9274	9279	9284	9289	1	1	2	2	3	3	4	4	5
8.5	9294	9299	9304	9309	9315	9320	9325	9330	9335	9340	1	1	2	2	3	3	4	4	5
8.6	9345	9350	9355	9360	9365	9370	9375	9380	9385	9390	1	1	2	2	3	3	4	4	5
8.7	9395	9400	9405	9410	9415	9420	9425	9430	9435	9440	0	1	1	2	2	3	3	4	4
8.8	9445	9450	9455	9460	9465	9469	9474	9479	9484	9489	0	1	1	2	2	3	3	4	4
8.9	9494	9499	9504	9509	9513	9518	9523	9528	9533	9538	0	1	1	2	2	3	3	4	4
9.0	9542	9547	9552	9557	9562	9566	9571	9576	9581	9586	0	1	1	2	2	3	3	4	4
9.1	9590	9595	9600	9605	9609	9614	9619	9624	9628	9633	0	1	1	2	2	3	3	4	4
9.2	9638	9643	9647	9652	9657	9661	9666	9671	9675	9680	0	1	1	2	2	3	3	4	4
9.3	9685	9689	9694	9699	9703	9708	9713	9717	9722	9727	0	1	1	2	2	3	3	4	4
9.4	9731	9736	9741	9745	9750	9754	9759	9763	9768	9773	0	1	1	2	2	3	3	4	4
9.5	9777	9782	9786	9791	9795	9800	9805	9809	9814	9818	0	1	1	2	2	3	3	4	4
9.6	9823	9827	9832	9836	9841	9845	9850	9854	9859	9863	0	1	1	2	2	3	3	4	4
9.7	9868	9872	9877	9881	9886	9890	9894	9899	9903	9908	0	1	1	2	2	3	3	4	4
9.8	9912	9917	9921	9926	9930	9934	9939	9943	9948	9952	0	1	1	2	2	3	3	4	4
9.9	9956	9961	9965	9969	9974	9978	9983	9987	9991	9996	0	1	1	2	2	3	3	3	4

N 0 1 2 3 4 5 6 7 8 9 1 2 3 4 5 6 7 8 9

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Equivalents — General

Measure

1 in. = 25.4 mm
1 in. = 2.54 cm

1 mm = 0.039 37 in.
1 mm = 0.003 28 ft
1 micron = 0.000 001 meter

1 ft = 304.8 mm
1 ft = 30.48 cm

1 sq in. = 6.4516 sq cm
1 sq cm = 0.155 sq in.
1 sq cm = 0.001 08 sq ft
1 sq ft = 929.03 sq cm

Circumference of a circle $= 2\pi r = \pi d$

Area of a circle $= \pi r^2 = \frac{\pi d^2}{4}$

Weight

1 kg = 2.205 lb
1 cu in. of water (60 F) = 0.073 551 cu in. of mercury (32 F)
1 cu in. of mercury (32 F) = 13.596 cu in. of water (60 F)
1 cu in. of mercury (32 F) = 0.4905 lb

Velocity

1 ft per sec = 0.3048 m per sec
1 m per sec = 3.2808 ft per sec

Density

1 lb per cu in. = 27.68 gram per cu cm
1 gr per cu cm = 0.03613 lb per cu in.
1 lb per cu ft = 16.0184 kg per cu m
1 kg per cu m = 0.06243 lb per cu ft

Physical Constants

Base of Natural Logarithms (e) 2.718 281 8285
Acceleration of Gravity (g) ..... 32.174 ft/sec² ..... (980.665 cm/sec²)
Pi (π) 3.141 592 6536

	Degrees Kelvin	Degrees Rankine	Degrees Centigrade	Degrees Fahrenheit
Absolute Zero	0	0	− 273.16	− 459.69
Water Freezing Point (14.696 psia)	273.16	491.69	0	32
Water Boiling Point (14.696 psia)	373.16	671.69	100	212

Heat Transfer

1 Btu per sq ft = 0.2712 gram calorie per sq cm
1 Btu per hr per sq ft per F = 4.88 kg calorie per hr per sq meter per C
1 Btu per hr per sq ft per F = 0.000 1355 gram calorie per sec per sq cm per C

1 gram calorie per sq cm = 3.687 Btu per sq ft
1 kg calorie per hr per sq meter per C = 0.205 Btu per hr per sq ft per F
1 gram calorie per sec per sq cm per C = 7380 Btu per hr per sq ft per F

Thermal Conductivity

1 Btu per sq ft per inch = 0.6892 gram calorie per sq cm per cm
1 Btu per hr per sq ft per F per inch = 0.000 3445 gram calorie per sec per sq cm per C per cm
1 Btu per hr per sq ft per F per foot = 0.004 13 gram calorie per sec per sq cm per C per cm

1 gram calorie per sq cm per cm = 1.451 Btu per sq ft per inch
1 gram calorie per sec per sq cm per C per cm = 2903 Btu per hr per sq ft per F per inch
1 gram calorie per sec per sq cm per C per cm = 242.13 Btu per hr per sq ft per F per foot

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General mathematical data . . . . pages 405 to 412

Linear Conversion

Inches to Millimeters

(1 inch = 25.4 millimeters)

In.	0	1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16
0	0.0	1.6	3.2	4.8	6.4	7.9	9.5	11.1	12.7	14.3	15.9	17.5	19.1	20.6	22.2	23.8
1	25.4	27.0	28.6	30.2	31.8	33.3	34.9	36.5	38.1	39.7	41.3	42.9	44.5	46.0	47.6	49.2
2	50.8	52.4	54.0	55.6	57.2	58.7	60.3	61.9	63.5	65.1	66.7	68.3	69.9	71.4	73.0	74.6
3	76.2	77.8	79.4	81.0	82.6	84.1	85.7	87.3	88.9	90.5	92.1	93.7	95.3	96.8	98.4	100.0
4	101.6	103.2	104.8	106.4	108.0	109.5	111.1	112.7	114.3	115.9	117.5	119.1	120.7	122.2	123.8	125.4
5	127.0	128.6	130.2	131.8	133.4	134.9	136.5	138.1	139.7	141.3	142.9	144.5	146.1	147.6	149.2	150.8
6	152.4	154.0	155.6	157.2	158.8	160.3	161.9	163.5	165.1	166.7	168.3	169.9	171.5	173.0	174.6	176.2
7	177.8	179.4	181.0	182.6	184.2	185.7	187.3	188.9	190.5	192.1	193.7	195.3	196.9	198.4	200.0	201.6
8	203.2	204.8	206.4	208.0	209.6	211.1	212.7	214.3	215.9	217.5	219.1	220.7	222.3	223.8	225.4	227.0
9	228.6	230.2	231.8	233.4	235.0	236.5	238.1	239.7	241.3	242.9	244.5	246.1	247.7	249.2	250.8	252.4
10	254.0	255.6	257.2	258.8	260.4	261.9	263.5	265.1	266.7	268.3	269.9	271.5	273.1	274.6	276.2	277.8
11	279.4	281.0	282.6	284.2	285.8	287.3	288.9	290.5	292.1	293.7	295.3	296.9	298.5	300.0	301.6	303.2
12	304.8	306.4	308.0	309.6	311.2	312.7	314.3	315.9	317.5	319.1	320.7	322.3	323.9	325.4	327.0	328.6
13	330.2	331.8	333.4	335.0	336.6	338.1	339.7	341.3	342.9	344.5	346.1	347.7	349.3	350.8	352.4	354.0
14	355.6	357.2	358.8	360.4	362.0	363.5	365.1	366.7	368.3	369.9	371.5	373.1	374.7	376.2	377.8	379.4
15	381.0	382.6	384.2	385.8	387.4	388.9	390.5	392.1	393.7	395.3	396.9	398.5	400.1	401.6	403.2	404.8
16	406.4	408.0	409.6	411.2	412.8	414.3	415.9	417.5	419.1	420.7	422.3	423.9	425.5	427.0	428.6	430.2
17	431.8	433.4	435.0	436.6	438.2	439.7	441.3	442.9	444.5	446.1	447.7	449.3	450.9	452.4	454.0	455.6
18	457.2	458.8	460.4	462.0	463.6	465.1	466.7	468.3	469.9	471.5	473.1	474.7	476.3	477.8	479.4	481.0
19	482.6	484.2	485.8	487.4	489.0	490.5	492.1	493.7	495 3	496.9	498.5	500.1	501.7	503.2	504.8	506.4
20	508.0	509.6	511.2	512.8	514.4	515.9	517.5	519.1	520.7	522.3	523.9	525.5	527.1	528.6	530.2	531.8
21	533.4	535.0	536.6	538.2	539.8	541.3	542.9	544.5	546.1	547.7	549.3	550.9	552.5	554.0	555.6	557.2
22	558.8	560.4	562.0	563.6	565.2	566.7	568.3	569.9	571.5	573.1	574.7	576.3	577.9	579.4	581.0	582.6
23	584.2	585.8	587.4	589.0	590.6	592.1	593.7	595.3	596.9	598.5	600.1	601.7	603.3	604.8	606.4	608.0
24	609.6	611.2	612.8	614.4	616.0	617.5	619.1	620.7	622.3	623.9	625.5	627.1	628.7	630.2	631.8	633.4
25	635.0	636.6	638.2	639.8	641.4	642.9	644.5	646.1	647.7	649.3	650.9	652.5	654.1	655.6	657.2	658.8
26	660.4	662.0	663.6	665.2	666.8	668.3	669.9	671.5	673.1	674.7	676.3	677.9	679.5	681.0	682.6	684.2
27	685.8	687.4	689.0	690.6	692.2	693.7	695.3	696.9	698.5	700.1	701.7	703.3	704.9	706.4	708.0	709.6
28	711.2	712.8	714.4	716.0	717.6	719.1	720.7	722.3	723.9	725.5	727.1	728.7	730.3	731.8	733.4	735.0
29	736.6	738.2	739.8	714.4	743.0	744.5	746.1	747.7	749.3	750.9	752.5	754.1	755.7	757.2	758.8	760.4
30	762.0	763.6	765.2	766.8	768.4	769.9	771.5	773.1	774.7	776.3	777.9	779.5	781.1	782.6	784.2	785.8
31	787.4	789.0	790.6	792.2	793.8	795.3	796.9	798.5	800.1	801.7	803.3	804.9	806.5	808.0	809.6	811.2
32	812.8	814.4	816.0	817.6	819.2	820.7	822.3	823.9	825.5	827.1	828.7	830.3	831.9	833.4	835.0	836.6
33	838.2	839.8	841.4	843.0	844.6	846.1	847.7	849.3	850.9	852.5	854.1	855.7	857.3	858.8	860.4	862.0
34	863.6	865.2	866.8	868.4	870.0	871.5	873.1	874.7	876.3	877.9	879.5	881.1	882.7	884.2	885.8	887.4
35	889.0	890.6	892.2	893.8	895.4	896.9	898.5	900.1	901.7	903.3	904.9	906.5	908.1	909.6	911.2	912.8
36	914.4	916.0	917.6	919.2	920.8	922.3	923.9	925.5	927.1	928.7	930.3	931.9	933.5	935.0	936.6	938.2
37	939.8	941.4	943.0	944.6	946.2	947.7	949.3	950.9	952.5	954.1	955.7	957.3	958.9	960.4	962.0	963.6
38	965.2	966.8	968.4	970.0	971.6	973.1	974.7	976.3	977.9	979.5	981.1	982.7	984.3	985.8	987.4	989.0
39	990.6	992.2	993.8	995.4	997.0	998.5	1000.1	1001.7	1003.3	1004.9	1006.5	1008.1	1009.7	1011.2	1012.8	1014.4
40	1016.0	1017.6	1019.2	1020.8	1022.4	1023.9	1025.5	1027.1	1028.7	1030.3	1031.9	1033.5	1035.1	1036.6	1038.2	1039.8
41	1041.4	1043.0	1044.6	1046.2	1047.8	1049.3	1050.9	1052.5	1054.1	1055.7	1057.3	1058.9	1060.5	1062.0	1063.6	1065.2
42	1066.8	1068.4	1070.0	1071.6	1073.2	1074.7	1076.3	1077.9	1079.5	1081.1	1082.7	1084.3	1085.9	1087.4	1089.0	1090.6
43	1092.2	1093.8	1095.4	1097.0	1098.6	1100.1	1101.7	1103.3	1104.9	1106.5	1108.1	1109.7	1111.3	1112.8	1114.4	1116.0
44	1117.6	1119.2	1120.8	1122.4	1124.0	1125.5	1127.1	1128.7	1130.3	1131.9	1133.5	1135.1	1136.7	1138.2	1139.8	1141.4
45	1143.0	1144.6	1146.2	1147.8	1149.4	1150.9	1152.5	1154.1	1155.7	1157.3	1158.9	1160.5	1162.1	1163.6	1165.2	1166.8
46	1168.4	1170.0	1171.6	1173.2	1174.8	1176.3	1177.9	1179.5	1181.1	1182.7	1184.3	1185.9	1187.5	1189.0	1190.6	1192.2
47	1193.8	1195.4	1197.0	1198.6	1200.2	1201.7	1203.3	1204.9	1206.5	1208.1	1209.7	1211.3	1212.9	1214.4	1216.0	1217.6
48	1219.2	1220.8	1222.4	1224.0	1225.6	1227.1	1228.7	1230.3	1231.9	1233.5	1235.1	1236.7	1238.3	1239.8	1241.4	1243.0
49	1244.6	1246.2	1247.8	1249.4	1251.0	1252.5	1254.1	1255.7	1257.3	1258.9	1260.5	1262.1	1263.7	1265.2	1266.8	1268.4
50	1270.0	1271.6	1273.2	1274.8	1276.4	1277.9	1279.5	1281.1	1282.7	1284.3	1285.9	1287.5	1289.1	1290.6	1292.2	1293.8

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Linear Conversion

Millimeters to Inches — cont.

Millimeters	0	1	2	3	4	5	6	7	8	9	Millimeters
400	15.75	15.79	15.83	15.87	15.91	15.94	15.98	16.02	16.06	16.10	400
410	16.14	16.18	16.22	16.26	16.30	16.34	16.38	16.42	16.46	16.50	410
420	16.54	16.57	16.61	16.65	16.69	16.73	16.77	16.81	16.85	16.89	420
430	16.93	16.97	17.01	17.05	17.09	17.13	17.17	17.20	17.24	17.28	430
440	17.32	17.36	17.40	17.44	17.48	17.52	17.56	17.60	17.64	17.68	440
450	17.72	17.76	17.80	17.83	17.87	17.91	17.95	17.99	18.03	18.07	450
460	18.11	18.15	18.19	18.23	18.27	18.31	18.35	18.39	18.43	18.46	460
470	18.50	18.54	18.58	18.62	18.66	18.70	18.74	18.78	18.82	18.86	470
480	18.90	18.94	18.98	19.02	19.06	19.09	19.13	19.17	19.21	19.25	480
490	19.29	19.33	19.37	19.41	19.45	19.49	19.53	19.57	19.61	19.65	490
500	19.69	19.72	19.76	19.80	19.84	19.88	19.92	19.96	20.00	20.04	500
510	20.08	20.12	20.16	20.20	20.24	20.28	20.31	20.35	20.39	20.43	510
520	20.47	20.51	20.55	20.59	20.63	20.67	20.71	20.75	20.79	20.83	520
530	20.87	20.91	20.94	20.98	21.02	21.06	21.10	21.14	21.18	21.22	530
540	21.26	21.30	21.34	21.38	21.42	21.46	21.50	21.54	21.58	21.61	540
550	21.65	21.69	21.73	21.77	21.81	21.85	21.89	21.93	21.97	22.01	550
560	22.05	22.09	22.13	22.17	22.20	22.24	22.28	22.32	22.36	22.40	560
570	22.44	22.48	22.52	22.56	22.60	22.64	22.68	22.72	22.76	22.80	570
580	22.83	22.87	22.91	22.95	22.99	23.03	23.07	23.11	23.15	23.19	580
590	23.23	23.27	23.31	23.35	23.39	23.43	23.46	23.50	23.54	23.58	590
600	23.62	23.66	23.70	23.74	23.78	23.82	23.86	23.90	23.94	23.98	600
610	24.02	24.06	24.09	24.13	24.17	24.21	24.25	24.29	24.33	24.37	610
620	24.41	24.45	24.49	24.53	24.57	24.61	24.65	24.68	24.72	24.76	620
630	24.80	24.84	24.88	24.92	24.96	25.00	25.04	25.08	25.12	25.16	630
640	25.20	25.24	25.28	25.31	25.35	25.39	25.43	25.47	25.51	25.55	640
650	25.59	25.63	25.67	25.71	25.75	25.79	25.83	25.87	25.91	25.94	650
660	25.98	26.02	26.06	26.10	26.14	26.18	26.22	26.26	26.30	26.34	660
670	26.38	26.42	26.46	26.50	26.54	26.57	26.61	26.65	26.69	26.73	670
680	26.77	26.81	26.85	26.89	26.93	26.97	27.01	27.05	27.09	27.13	680
690	27.17	27.20	27.24	27.28	27.32	27.36	27.40	27.44	27.48	27.52	690
700	27.56	27.60	27.64	27.68	27.72	27.76	27.80	27.83	27.87	27.91	700
710	27.95	27.99	28.03	28.07	28.11	28.15	28.19	28.23	28.27	28.31	710
720	28.35	28.39	28.43	28.46	28.50	28.54	28.58	28.62	28.66	28.70	720
730	28.74	28.78	28.82	28.86	28.90	28.94	28.98	29.02	29.06	29.09	730
740	29.13	29.17	29.21	29.25	29.29	29.33	29.37	29.41	29.45	29.49	740
750	29.53	29.57	29.61	29.65	29.68	29.72	29.76	29.80	29.84	29.88	750
760	29.92	29.96	30.00	30.04	30.08	30.12	30.16	30.20	30.24	30.28	760
770	30.31	30.35	30.39	30.43	30.47	30.51	30.55	30.59	30.63	30.67	770
780	30.71	30.75	30.79	30.83	30.87	30.91	30.94	30.98	31.02	31.06	780
790	31.10	31.14	31.18	31.22	31.26	31.30	31.34	31.38	31.42	31.46	790
800	31.50	31.54	31.57	31.61	31.65	31.69	31.73	31.77	31.81	31.85	800
810	31.89	31.93	31.97	32.01	32.05	32.09	32.13	32.17	32.20	32.24	810
820	32.28	32.32	32.36	32.40	32.44	32.48	32.52	32.56	32.60	32.64	820
830	32.68	32.72	32.76	32.80	32.83	32.87	32.91	32.95	32.99	33.03	830
840	33.07	33.11	33.15	33.19	33.23	33.27	33.31	33.35	33.39	33.43	840
850	33.46	33.50	33.54	33.58	33.62	33.66	33.70	33.74	33.78	33.82	850
860	33.86	33.90	33.94	33.98	34.02	34.06	34.09	34.13	34.17	34.21	860
870	34.25	34.29	34.33	34.37	34.41	34.45	34.49	34.53	34.57	34.61	870
880	34.65	34.68	34.72	34.76	34.80	34.84	34.88	34.92	34.96	35.00	880
890	35.04	35.08	35.12	35.16	35.20	35.24	35.28	35.31	35.35	35.39	890
900	35.43	35.47	35.51	35.55	35.59	35.63	35.67	35.71	35.75	35.79	900
910	35.83	35.87	35.91	35.94	35.98	36.02	36.06	36.10	36.14	36.18	910
920	36.22	36.26	36.30	36.34	36.38	36.42	36.46	36.50	36.54	36.57	920
930	36.61	36.65	36.69	36.73	36.77	36.81	36.85	36.89	36.93	36.97	930
940	37.01	37.05	37.09	37.13	37.17	37.20	37.24	37.28	37.32	37.36	940
950	37.40	37.44	37.48	37.52	37.56	37.60	37.64	37.68	37.72	37.76	950
960	37.80	37.83	37.87	37.91	37.95	37.99	38.03	38.07	38.11	38.15	960
970	38.19	38.23	38.27	38.31	38.35	38.39	38.43	38.46	38.50	38.54	970
980	38.58	38.62	38.66	38.70	38.74	38.78	38.82	38.86	38.90	38.94	980
990	38.98	39.02	39.06	39.09	39.13	39.17	39.21	39.25	39.29	39.33	990
1000	39.37	39.41	39.45	39.49	39.53	39.57	39.61	39.65	39.68	39.72	1000

Equivalents of Liquid Measures and Weights

Liquid Measure or Weight	U.S. Gallon	Imperial Gallon	U.S. Pint	U.S. Pound Water*	U.S. Cubic Foot	U.S. Cubic Inch	Liter	Cubic Meter
U.S. Gallon	1	0.833	8.	8.337	0.13368	231.	3.78533	0.003785
Imperial Gallon	1.2009	1	9.60752	10.	0.16054	277.42	4.54596	0.004546
U.S. Pint	0.125	0.1041	1	1.042	0.01671	28.875	0.473166	0.000473
U.S. Pound Water*	0.11995	0.1	0.9596	1	0.016035	27.708	0.45405	0.000454
U.S. Cubic Foot	7.48052	6.22888	59.8442	62.365	1	1728.	28.31702	0.028317
U.S. Cubic Inch	0.004329	0.00361	0.034632	0.03609	0.0005787	1	0.016387	0.0000164
Liter	0.2641779	0.2199756	2.113423	2.202	0.0353154	61.02509	1	0.001000
Cubic Meter	264.170	219.969	2113.34	2202.	35.31446	61023.38	999.972	1

*Water at 60 F. 1 Barrel = 42 gallons (petroleum measure)

Problem:
How many British Imperial Gallons are equivalent to 10 U.S. Gallons?

Solution:
The Imperial Gallon equivalent of 1 U.S. Gallon is 0.833. Then, 10 x 0.833 = 8.33 Imperial Gallons.

Equivalents of Pressure and Head

Pressure or Head	lb/in.²	lb/ft²	Atmospheres	kg/cm²	kg/m²	in. water (60 F)	ft water (60 F)	in. mercury (32 F)	mm mercury (32 F)
lb/in.²	1	144.	0.068046	0.070307	703.067	27.707	2.3039	2.03601	51.7148
lb/ft²	0.0069445	1	0.000473	0.000488	4.88241	0.19241	0.01603	0.014139	0.35913
Atmospheres	14.696	2116.22	1	1.0332	10332.27	407.17	33.931	29.921	760.
kg/cm²	14.2234	2048.17	0.96784	1	10000.	394.08	32.840	28.959	735.559
kg/m²	0.001422	0.204817	0.0000968	0.0001	1	0.03941	0.003284	0.002896	0.073556
in. water*	0.036092	5.1972	0.002456	0.00253	25.375	1	0.08333	0.073483	1.8665
ft water*	0.433103	62.3668	0.029471	0.03045	304.50	12.	1	0.88180	22.3980
in. mercury†	0.491157	70.7266	0.033421	0.03453	345.316	13.608	1.1340	1	25.40005
mm mercury†	0.0193368	2.78450	0.0013158	0.0013595	13.59509	0.535764	0.044647	0.03937	1

*Water at 60 F. †Mercury at 32 F.

Problem:
How many inches of mercury are equivalent to 10 inches of water?

Solution:
1 inch of water is equal to 0.073483 inch mercury. Then, 10 x 0.073483 = 0.73483 inch mercury

31

To convert from one set of units to another, locate the given unit in the left hand column, and multiply the numerical value by the factor shown horizontally to the right, under the set of units desired.

SECTION 32

Engineering Data

Flow of Fluids Through Valves, Fittings, and Pipe

The contents indexed below comprise a condensed summary of data published in Crane's Technical Paper No. 410...."Flow of Fluids Through Valves, Fittings, and Pipe".

Nomenclature.....see below

Basic Theory
Equivalent Lengths L and L/D and Resistance Coefficient K.....page 422
Relationship of L/D and K to Inside Diameter of Connecting Pipe.....page 422
Valves with Gradually Increased Ports.....page 423
Effect of End Connections.....page 423
Basis for Design of Chart for Determining L/D and K.....page 423
Laminar Flow Conditions.....page 423
Proper Sizing of Check and Foot Valves.....page 427

Nomographs, Charts, and Tables
Schedule (Thickness) of Steel Pipe Used in Obtaining Resistance of Valves and Fittings.....page 424
Representative Equivalent Lengths (in L/D) of Valves and Fittings.....page 424
Resistance Coefficient K.....page 425
Equivalent Lengths L and L/D.....page 425
Resistance of 90 Degree and Miter Bends.....page 426
Resistance in Pipe.....page 427
Friction Factors for Clean Commercial Steel and Wrought Iron Pipe....page 429
Flow of Water Through Steel Pipe.....page 432
Flow of Air Through Steel Pipe.....page 433

Simplified Flow Formula for Compressible Fluids.....pages 434 and 435

Physical Properties of Fluids
Weight Density of Air and Gases.....page 428
Viscosity of Steam, Water, and Liquid Petroleum Products.....page 430
Viscosity of Gases and Vapors.....page 431
Physical Properties of Water.....page 431
Properties of Saturated Steam.....pages 436 to 439
Properties of Superheated Steam.....pages 440 to 442

For general engineering data, see pages 381 to 420.

Nomenclature

Symbols used in "Flow of Fluids" Section 32 are defined as follows:

D = internal diameter of pipe, in feet
d = internal diameter of pipe, in inches
f = friction factor in formula $h_L = f L v^2/D\,2g$
g = acceleration of gravity = 32.2 feet per second per second
h_L = loss of static pressure head due to fluid flow, in feet of fluid
K = resistance coefficient or velocity head loss in the formula, $h_L = Kv^2/2g$
L = length of pipe, in feet
L/D = equivalent length of a resistance to flow, in pipe diameters
P = pressure, pounds per square inch gauge
P' = pressure, pounds per square inch absolute
Q = rate of flow, in gallons per minute
q'_h = rate of flow, in cubic feet per hour at standard conditions (14.7 psia and 60F), scfh
q'_m = rate of flow, in cubic feet per minute at std. conditions (14.7 psia and 60F), scfm
R_r = Reynolds number
S_g = specific gravity of a gas relative to air = the ratio of the molecular weight of the gas to that of air
t = temperature, in degrees Fahrenheit
$\overline{V}$ = specific volume of fluid, in cubic feet per pound
v = mean velocity of flow, in feet per second
W = rate of flow, in pounds per hour

Subscripts

(100)...refers to 100 feet of pipe

Greek Letters

Delta
Δ = differential between two points
Rho
ρ = weight density of fluid, lbs. per cubic foot
Mu
μ = absolute (dynamic) viscosity, in centipoise
μ_f = absolute viscosity, in pound mass per foot second or poundal seconds per sq foot

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Flow of Fluids Through Valves, Fittings, and Pipe 03106

Valves with gradually increased ports

Various types of valves are often made with reduced seats and have uniformly tapered ports. Straight-through valves such as gates and plug cocks, when so designed, are sometimes referred to as venturi valves. When the transition from seat size to port size is uniformly tapered with an angle, approximately 20 degrees or less with the center line, the flow characteristics may be determined in the same manner as for valves installed with pipe having an inside diameter other than that with which the valve was tested.

Tests have shown the effect of tapered port sections upon flow characteristics is minor compared to losses across the valve seat. This applies particularly to valves having relatively high flow resistances.

Equation 4 may be used to establish approximate resistance coefficients for reduced seat valves.

Effect of end connections

Analysis of many tests indicates there is little, if any, justification for assigning different resistance coefficients to a given valve or fitting with varying types of end connections. The difference between flanged, screwed, and welding ends in this respect has been found to be insignificant. The pressure drop due to unions, couplings, and flanged joints is, likewise, insignificant.

Basis for design of charts (on page 425) for determining equivalent length and resistance coefficient

The lower table on page 424 lists average equivalent length data expressed in pipe diameters abstracted from all available tests. It is not practical to identify all valve and fitting types with the many variations in design which may affect the flow characteristics. The data given for globe and angle valves represent actual tests on the variation of designs indicated. By using the data given in this table along with the principles presented on page 422 as a basis, reasonable equivalent length values can be estimated for any valve or fitting upon consideration of design features, such as, the relative area of seat or restricted sections to pipe diameter and the shape of the flow passage.

The right hand chart on page 425 provides a convenient means of translating the equivalent length in pipe diameters (from page 424) to equivalent length in feet of pipe, for any given size of valve or fitting. Also, the resistance coefficient K for fully turbulent flow range can be readily determined from the left hand chart on page 425 for any size, if the resistance coefficient or equivalent length for any other size of the same item has been established, either by experiment or estimate.

Limitations of charts: The value of L/D for a given type of valve or fitting is considered to be constant for flow conditions resulting in Reynolds numbers of 1000 or greater. Equivalent lengths either in pipe diameters or feet of pipe, as determined from pages 424 or 425, are therefore legitimate for all flow conditions except in the laminar flow range where the Reynolds number is less than 1000. For Reynolds numbers less than 1000, values of L/D must be determined in accordance with Equation 5 below.

On the other hand, values of K as determined from page 425, are legitimate only for flow conditions resulting in Reynolds numbers falling in the completely turbulent flow range, as defined by the friction factor on page 429. At lower flow rates, values of K vary in approximately the same manner as does the value of friction factor with Reynolds number. At the lower flow rates, the value of K as determined from page 425 should be multiplied by the ratio:

$$\frac{f \text{ (at calculated Reynolds number)}}{f \text{ (in range of complete turbulence, where } f \text{ is constant)}}$$

Laminar flow conditions

One of the problems in flow of fluids confronting engineers from time to time, for which there is very meager information, is the resistance of valves and fittings under laminar flow conditions. Flow through straight pipe is adequately covered by the basic flow equation,

$$h_L = f \frac{L}{D} \frac{v^2}{2g},$$

which is identical to Poiseuille's law for laminar flow when the equation for f in this flow range, $f = 64/R_e$, is included in the formula.

For solution of these problems, we have developed on the basis of data presented in "Principles of Chemical Engineering" by Walker, Lewis, McAdams and Gilliland, the empirical relationship between equivalent length in the laminar flow region (for $R_e <$ 1000) to that in the turbulent region, namely:

$$\left(\frac{L}{D}\right)_s = \frac{R_e}{1000}\left(\frac{L}{D}\right)_t \qquad \text{Equation 5}$$

Subscript "s" refers to the equivalent length in pipe diameters under laminar flow conditions where the Reynolds number is less than 1000.

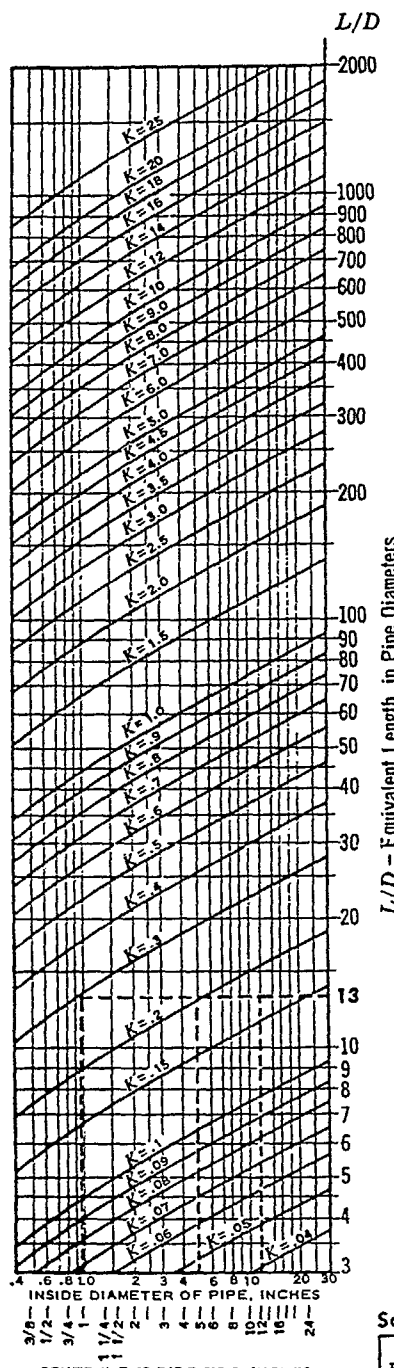
Subscript "t" refers to the equivalent length in pipe diameters determined from tests in the turbulent flow range. Representative values of equivalent length are listed on page 424.

$$R_e = 123.9 \frac{dv\rho}{\mu} = 50.6 \frac{Q\rho}{d\mu} = 6.31 \frac{W}{d\mu}$$

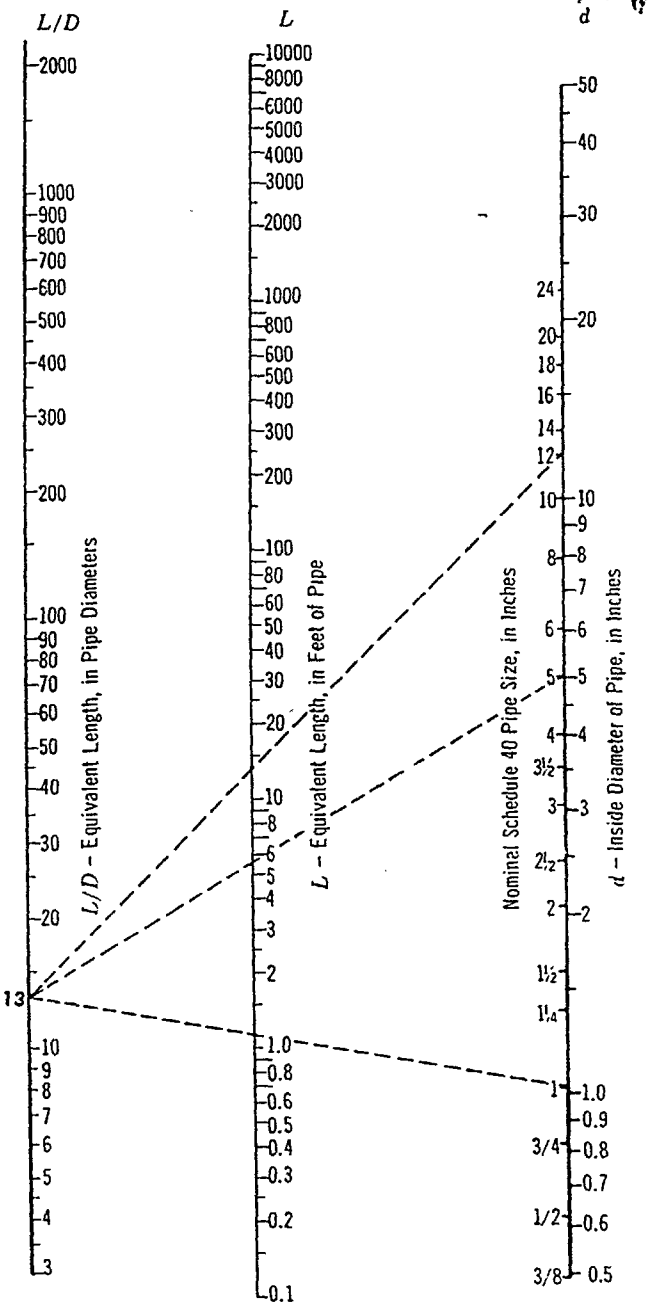
The minimum equivalent length is the length in pipe diameters of the centerline of the actual flow path through the valve or fitting. While laboratory test data supporting this method is meager, reports of field experience indicate that the results obtained agree closely with observed conditions.

For nomenclature, see page 421.

*Resistance Coefficient K



*Equivalent Lengths L and L/D



*See page 423 for limitations.

Problem

Based on the use of Schedule 40 pipe, find the equivalent length in pipe diameters (L/D), resistance factor (K), and equivalent length in feet of pipe (L) for 1, 5, and 12-inch fully opened conventional type gate valves.

Solution

To Find	Procedure (note dashed lines in charts)	Solutions for 1" valve	5" valve	12" valve
L/D	See large table facing page. . Read L/D value for conventional type gate valve, fully opened.	13	13	13
K	See chart at left. . From Sched. 40 pipe sizes (1, 5, 12") draw lines upward; from L/D value (13), draw horizontal line. Intersecting points are K values.	0.30	0.20	0.17
L	See chart above. . Connect L/D value of 13 to Sched 40 pipe sizes (1, 5, 12") on d scale. At intersecting points on center scale, read L values	1.1	5.5	13.0

Resistance in Pipe Due to Sudden Enlargements and Contractions

Sudden enlargement: The resistance coefficient K for a sudden enlargement from 6-inch Schedule 40 pipe to 12-inch Schedule 40 pipe is **0.55**, based on the 6-inch pipe size.

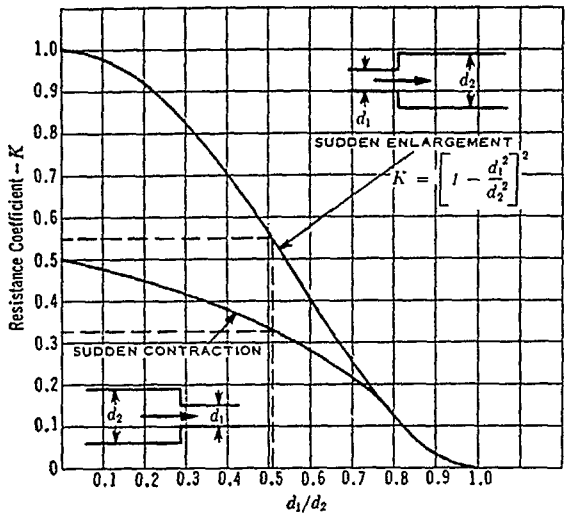
$$\frac{d_1}{d_2} = \frac{6.065}{11.938} = 0.51$$

Sudden contraction: The resistance coefficient K for a sudden contraction from 12-inch Schedule 40 pipe to 6-inch Schedule 40 pipe is **0.33**, based on the 6-inch pipe size.

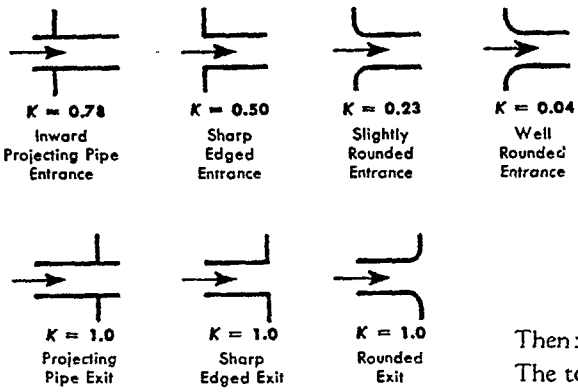
$$\frac{d_1}{d_2} = \frac{6.065}{11.938} = 0.51$$

Note: The values for the resistance coefficient K are based on velocity in the small pipe. To determine K values in terms of the greater diameter, multiply the chart values by $(d_2/d_1)^4$.

Chart is plotted from data in *Applied Fluid Mechanics* (McGraw-Hill Book Co., Inc.) by O'Brien and Hickox.



Resistance Due to Pipe Entrance and Exit



Problem: Determine the total resistance coefficient for a pipe which is one diameter long and has a sharp edged entrance and a sharp edged exit.

Solution: The resistance of pipe one diameter long is small and can be neglected ($K = f\,L/D$).

From the diagrams at the left, note:

The resistance for a sharp edged entrance = 0.5

The resistance for a sharp edged exit = 1.0

Then:

The total resistance for the pipe, $K = 0.5 + 1.0 = 1.5$

Proper Sizing of Check and Foot Valves

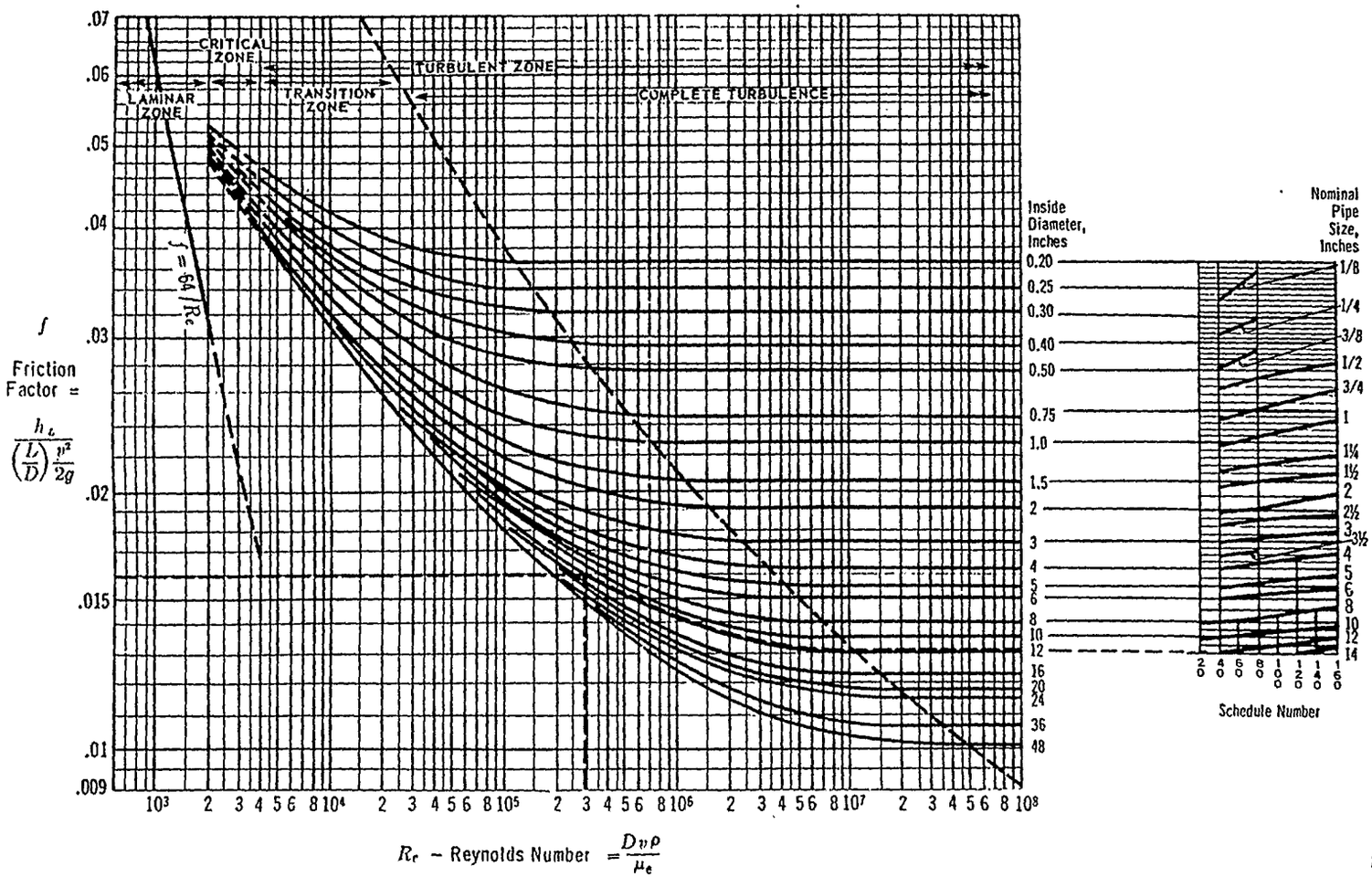
Many difficulties encountered with check valves, both lift and swing types, or with foot valves, are due to oversizing which results in noisy operation and premature wear of moving parts. Pressure drop varies somewhat for different valve designs, depending upon the relative weight and size of the disc.

An extensive study of tests conducted by Crane on check valves of all types resulted in establishment of the minimum amount of flow sufficient to lift the disc fully. It was found that the minimum flow to lift the disc varied with different types of fluids, but the measured pressure drop across the valve was constant for all fluids. As a result, minimum pressure drops required across various check and foot valves were established and are shown on page 424.

Sizing valves, based on the minimum calculated pressure drop necessary to lift the disc fully, frequently results in check and foot valves smaller in size than the line, but the actual pressure drop will be little higher, if any, than if a full size valve is used with the disc not fully open.

The losses due to sudden contraction and enlargement which will occur in such an installation, if bushings or reducing flanges are used, can be readily calculated from the data explained at the top of the page. If tapered reducers are used, the loss due to gradual contraction at the inlet to the smaller size valve is partially compensated for by the corresponding gradual enlargement on the outlet side, so that the added pressure drop due to these effects is minor.

Friction Factors for Clean Commercial Steel and Wrought Iron Pipe



For other forms of the Re equation, see page 423.

Problem: Determine the friction factor for 12-inch Schedule 40 pipe at a flow having a Reynolds number of 300,000.

Solution: The friction factor (f) equals 0.016.

Based on data extracted from *Friction Factors for Pipe Flow* by L. F. Moody, with permission of the publisher, the American Society of Mechanical Engineers, New York, N. Y.

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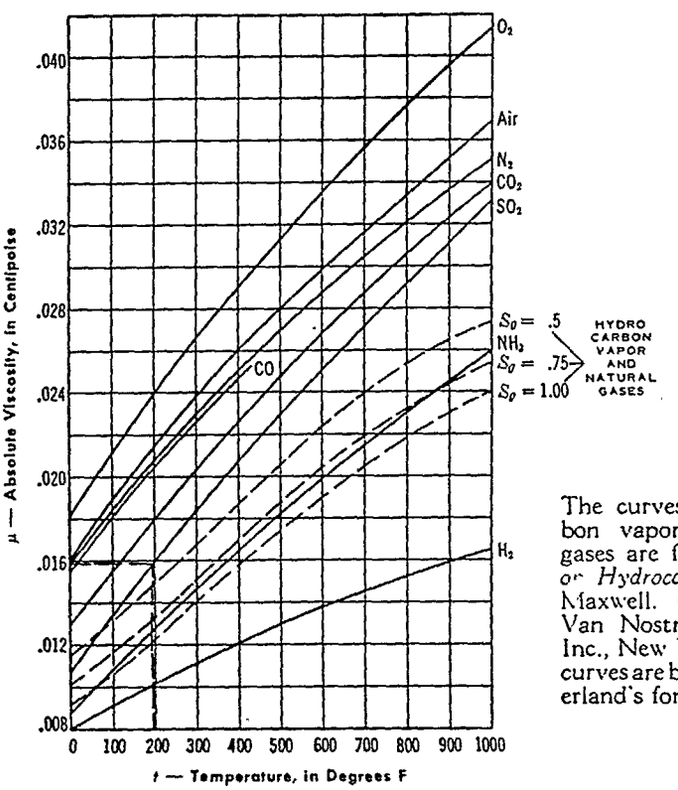
Viscosity of Gases and Vapors



The curves for hydrocarbon vapors and natural gases are from *Data Book on Hydrocarbons* by J. B. Maxwell. Courtesy of D. Van Nostrand Company, Inc., New York. All other curves are based upon Sutherland's formula.

Physical Properties of Water

Temp. of Water t Degrees Fahrenheit	Saturation Pressure P' Psia	Specific Volume $\overline{V}$ Cubic Feet Per Pound	Weight Density ρ Pounds per Cubic Foot	Weight Pounds Per Gallon	Temp. of Water t Degrees Fahrenheit	Saturation Pressure P' Psia	Specific Volume $\overline{V}$ Cubic Feet Per Pound	Weight Density ρ Pounds per Cubic Foot	Weight Pounds per Gallon
32°	0.08854	0.01602	62.42	8.345	190°	9.339	0.01657	60.35	8.068
40	0.12170	0.01602	62.42	8.345	200	11.526	0.01663	60.13	8.039
50	0.17811	0.01603	62.38	8.340	210	14.123	0.01670	59.88	8.005
60	0.2563	0.01604	62.34	8.334	212	14.696	0.01672	59.81	7.996
70	0.3631	0.01606	62.27	8.325	220	17.186	0.01677	59.63	7.972
80	0.5069	0.01608	62.19	8.314	240	24.969	0.01692	59.10	7.901
90	0.6982	0.01610	62.11	8.303	260	35.429	0.01709	58.51	7.822
100	0.9492	0.01613	62.00	8.289	280	49.203	0.01726	57.94	7.746
110	1.2748	0.01617	61.84	8.267	300	67.013	0.01745	57.31	7.662
120	1.6924	0.01620	61.73	8.253	350	134.63	0.01799	55.59	7.432
130	2.2225	0.01625	61.54	8.227	400	247.31	0.01864	53.65	7.172
140	2.8886	0.01629	61.39	8.207	450	422.6	0.0194	51.55	6.892
150	3.718	0.01634	61.20	8.182	500	680.8	0.0204	49.02	6.553
160	4.741	0.01639	61.01	8.156	550	1045.2	0.0218	45.87	6.132
170	5.992	0.01645	60.79	8.127	600	1542.9	0.0236	42.37	5.664
180	7.510	0.01651	60.57	8.098	700	3093.7	0.0369	27.10	3.623

The specific gravity of water at 60 F equals 1.00. The weight per gallon is based on 7.48 gallons per cubic foot.

All data on volume and pressure are abstracted from *Thermodynamic Properties of Steam* by J. H. Keenan and F. G. Keyes; see pages 436 to 442.

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CC4171

Flow of Air Through Schedule 40 Steel Pipe

For lengths of pipe other than 100 feet, the pressure drop is proportional to the length. Thus, for 50 feet of pipe, the pressure drop is approximately one-half the value given in the table . . . for 300 feet, three times the given value, etc.

The pressure drop is also inversely proportional to the absolute pressure and directly proportional to the absolute temperature.

Therefore, to determine the pressure drop for inlet or average pressures other than 100 psi and at temperatures other than 60 F, multiply the values given in the table by the ratio:

$$\left(\frac{100+14.7}{P+14.7}\right)\left(\frac{460+t}{520}\right)$$

where:

"P" is the inlet or average gauge pressure in pounds per square inch, and,

"t" is the temperature in degrees Fahrenheit under consideration.

The cubic feet per minute of compressed air at any pressure is inversely proportional to the absolute pressure and directly proportional to the absolute temperature.

To determine the cubic feet per minute of compressed air at any temperature and pressure other than standard conditions, multiply the value of cubic feet per minute of free air by the ratio:

$$\left(\frac{14.7}{14.7+P}\right)\left(\frac{460+t}{520}\right)$$

Calculations for Pipe Other than Schedule 40

To determine the velocity of water, or the pressure drop of water or air, through pipe other than Schedule 40, use the following formulas:

$$v_a = v_{40}\left(\frac{d_{40}}{d_a}\right)^2$$

$$\Delta P_a = \Delta P_{40}\left(\frac{d_{40}}{d_a}\right)^5$$

where:

v = velocity, feet per sec.

d = internal diameter of pipe, in inches; see pages 346 and 347.

ΔP = pressure drop, in pounds per square inch

Subscript "a" refers to the Schedule of pipe through which velocity or pressure drop is desired

Subscript "40" refers to the velocity or pressure drop through Schedule 40 pipe, as given on these facing pages

Free Air q'_m Cubic Feet Per Minute at 60 F and 14.7 psia	Compressed Air Cubic Feet Per Minute at 60 F and 100 psig	Pressure Drop of Air In Pounds per Square Inch Per 100 Feet of Schedule 40 Pipe — For Air at 100 Pounds per Square Inch Gauge Pressure and 60 F Temperature								
		1/8"	1/4"	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
1	0.128	0.361	0.083	0.018						
2	0.256	1.31	0.285	0.064	0.020					
3	0.384	3.06	0.605	0.133	0.042					
4	0.513	4.83	1.04	0.226	0.071					
5	0.641	7.45	1.58	0.343	0.106	0.027				
6	0.769	10.6	2.23	0.408	0.148	0.037				
8	1.025	18.6	3.89	0.848	0.255	0.062	0.019			
10	1.282	28.7	5.96	1.26	0.356	0.094	0.029	1 1/4"	1 1/2"	
15	1.922	...	13.0	2.73	0.834	0.201	0.062			
20	2.563	...	22.8	4.76	1.43	0.345	0.102	0.026		
25	3.204	...	35.6	7.34	2.21	0.526	0.156	0.039	0.019	
30	3.845	...	...	10.5	3.15	0.748	0.219	0.055	0.026	
35	4.486	...	...	14.2	4.24	1.00	0.293	0.073	0.035	
40	5.126	...	...	18.4	5.49	1.30	0.379	0.095	0.044	
45	5.767	...	...	23.1	6.90	1.62	0.474	0.116	0.055	2"
50	6.408			28.5	8.49	1.99	0.578	0.149	0.067	0.019
60	7.690	2 1/2"		40.7	12.2	2.85	0.819	0.200	0.094	0.027
70	8.971			...	16.5	3.83	1.10	0.270	0.126	0.036
80	10.25	0.019		...	21.4	4.96	1.43	0.350	0.162	0.046
90	11.53	0.023		...	27.0	6.25	1.80	0.437	0.203	0.058
100	12.82	0.029	3"		33.2	7.69	2.21	0.534	0.247	0.070
125	16.02	0.044			...	11.9	3.39	0.825	0.380	0.107
150	19.22	0.062	0.021		...	17.0	4.87	1.17	0.537	0.151
175	22.43	0.083	0.028		...	23.1	6.60	1.58	0.727	0.205
200	25.63	0.107	0.036	3 1/2"	...	30.0	8.54	2.05	0.937	0.264
225	28.84	0.134	0.045	0.022		37.9	10.8	2.59	1.19	0.331
250	32.04	0.164	0.055	0.027		...	13.3	3.18	1.45	0.404
275	35.24	0.191	0.066	0.032		...	16.0	3.83	1.75	0.484
300	38.45	0.232	0.078	0.037		...	19.0	4.56	2.07	0.573
325	41.65	0.270	0.090	0.043	4"	...	22.3	5.32	2.42	0.673
350	44.87	0.313	0.104	0.050		...	25.8	6.17	2.80	0.776
375	48.06	0.356	0.119	0.057	0.030	...	29.6	7.05	3.20	0.887
400	51.26	0.402	0.134	0.064	0.034	...	33.6	8.02	3.64	1.00
425	54.47	0.452	0.151	0.072	0.038	...	37.9	9.01	4.09	1.13
450	57.67	0.507	0.168	0.081	0.042	...	...	10.2	4.59	1.26
475	60.88	0.562	0.187	0.089	0.047		...	11.3	5.09	1.40
500	64.08	0.623	0.206	0.099	0.052		...	12.5	5.61	1.55
550	70.49	0.749	0.248	0.118	0.062		...	15.1	6.79	1.87
600	76.90	0.887	0.293	0.139	0.073		...	18.0	8.04	2.21
650	83.30	1.04	0.342	0.163	0.086	5"	...	21.1	9.43	2.60
700	89.71	1.19	0.395	0.188	0.099	0.032		24.3	10.9	3.00
750	96.12	1.36	0.451	0.214	0.113	0.036		27.9	12.6	3.44
800	102.5	1.55	0.513	0.244	0.127	0.041		31.8	14.2	3.90
850	108.9	1.74	0.576	0.274	0.144	0.046		35.9	16.0	4.40
900	115.3	1.95	0.642	0.305	0.160	0.051	6"	40.2	18.0	4.91
950	121.8	2.18	0.715	0.340	0.178	0.057	0.023	...	20.0	5.47
1 000	128.2	2.40	0.788	0.375	0.197	0.063	0.025	...	22.1	6.06
1 100	141.0	2.89	0.948	0.451	0.236	0.075	0.030	...	26.7	7.29
1 200	153.8	3.44	1.13	0.533	0.279	0.089	0.035	..	31.8	8.63
1 300	166.6	4.01	1.32	0.626	0.327	0.103	0.041	..	37.3	10.1
1 400	179.4	4.65	1.52	0.718	0.377	0.119	0.047			11.8
1 500	192.2	5.31	1.74	0.824	0.431	0.136	0.054			13.5
1 600	205.1	6.04	1.97	0.932	0.490	0.154	0.061	8"		15.3
1 800	230.7	7.65	2.50	1.18	0.616	0.193	0.075			19.3
2 000	256.3	9.44	3.06	1.45	0.757	0.237	0.094	0.023	10"	23.9
2 500	320.4	14.7	4.76	2.25	1.17	0.366	0.143	0.035		37.3
3 000	384.5	21.1	6.82	3.20	1.67	0.524	0.204	0.051	0.016	
3 500	448.6	28.8	9.23	4.33	2.26	0.709	0.276	0.068	0.022	
4 000	512.8	37.6	12.1	5.66	2.94	0.919	0.358	0.088	0.028	
4 500	576.9	47.6	15.3	7.16	3.69	1.16	0.450	0.111	0.035	12"
5 000	641.0	..	18.8	8.85	4.56	1.42	0.552	0.136	0.043	0.018
6 000	769.0	..	27.1	12.7	6.57	2.03	0.794	0.195	0.061	0.025
7 000	897.1	...	36.9	17.2	8.94	2.76	1.07	0.262	0.082	0.034
8 000	1025	..		22.5	11.7	3.59	1.39	0.339	0.107	0.044
9 000	1153	...		28.5	14.9	4.54	1.76	0.427	0.134	0.055
10 000	1282			35.2	18.4	5.60	2.16	0.526	0.164	0.067
11 000	1410			...	22.2	6.78	2.62	0.633	0.197	0.081
12 000	1538	...		..	26.4	8.07	3.09	0.753	0.234	0.096
13 000	1666	..		..	31.0	9.47	3.63	0.884	0.273	0.112
14 000	1794	...		..	36.0	11.0	4.21	1.02	0.316	0.129
15 000	1922	...				12.6	4.84	1.17	0.364	0.148
16 000	2051	..			..	14.3	5.50	1.33	0.411	0.167
18 000	2307	...			..	18.2	6.96	1.68	0.520	0.213
20 000	2563	..				22.4	8.60	2.01	0.642	0.260
22 000	2820					27.1	10.4	2.50	0.771	0.314
24 000	3076					32.3	12.4	2.97	0.915	0.371
26 000	3332	..				37.9	14.5	3.49	1.12	0.435
28 000	3588						16.9	4.04	1.25	0.505
30 000	3845						19.3	4.64	1.42	0.520

CRTX 1220

Simplified Flow Formula for Compressible Fluids

Pipe or Valve Pressure Drop, Rate of Flow, and Size

Values of C_2

Nominal Pipe Size Inches	Schedule Number	Value of C_2	Nominal Pipe Size Inches	Schedule Number	Value of C_2	Nominal Pipe Size Inches	Schedule Number	Value of C_2
⅛	40 s	7 920 000.	5	40 s	1.59	16	10	0.004 63
	80 x	26 200 000.		80 x	2.04		20	0.004 21
				120	2.69		30 s	0.005 04
¼	40 s	1 590 000.		160	3.59		40 x	0.005 49
	80 x	4 290 000.		... xx	4.93		60	0.006 12
⅜	40 s	319 000.	6	40 s	0.610		80	0.007 00
	80 x	718 000.		80 x	0.798		100	0.008 04
				120	1.015		120	0.009 26
½	40 s	93 500.		160	1.376		140	0.010 99
	80 x	186 100.		... xx	1.861		160	0.012 44
	160	4 300 000.						
	... xx	11 180 000.	8	20	0.133			
				30	0.135	18	10	0.002 47
				40 s	0.146		20	0.002 56
¾	40 s	21 200.		60	0.163		.. s	0.002 66
	80 x	36 900.		80 x	0.185		30	0.002 76
	160	100 100.					.. x	0.002 87
	... xx	627 000.		100	0.211		40	0.002 98
				120	0.252			
1	40 s	5 950.		140	0.289		60	0.003 35
	80 x	9 640.		... xx	0.317		80	0.003 76
	160	22 500.		160	0.333		100	0.004 35
	... xx	114 100.					120	0.005 04
			10	20	0.039 7		140	0.005 73
1¼	40 s	1 408.		30	0.042 1		160	0.006 69
	80 x	2 110.		40 s	0.044 7			
	160	3 490.		60 x	0.051 4			
	... xx	13 640.		80	0.056 9	20	10	0.001 41
							20 s	0.001 50
				100	0.066 1		30 x	0.001 61
1½	40 s	627.		120	0.075 3		40	0.001 69
	80 x	904.		140	0.090 5		60	0.001 91
	160	1 656.		160	0.105 2			
	... xx	4 630.					80	0.002 17
			12	20	0.015 7		100	0.002 51
2	40 s	169.		30	0.016 8		120	0.002 87
	80 x	236.		... s	0.017 5		140	0.003 35
	160	488.		40	0.018 0		160	0.003 85
	... xx	899.		... x	0.019 5			
				60	0.020 6			
2½	40 s	66.7				24	10	0.000 534
	80 x	91.8		80	0.023 1		20 s	0.000 565
	160	146.3		100	0.026 7		. x	0.000 597
	... xx	380.0		120	0.031 0		30	0.000 614
				140	0.035 0		40	0.000 651
				160	0.042 3		60	0.000 741
3	40 s	21.4						
	80 x	28.7	14	10	0.009 49		80	0.000 835
	160	48.3		20	0.009 96		100	0.000 972
	... xx	96.6		30 s	0.010 46		120	0.001 119
				40	0.010 99		140	0.001 274
3½	40 s	10.0		... x	0.011 55		160	0.001 478
	80 x	13.2		60	0.012 44			
4	40 s	5.17		80	0.014 16			
	80 x	6.75		100	0.016 57			
	120	8.94		120	0.018 98			
	160	11.80		140	0.021 8			
	... xx	18.59		160	0.025 2			

Note
The letters s, x, and xx in the columns of Schedule Numbers indicate Standard, Extra Strong, and Double Extra Strong pipe respectively

Example 3

Given: An 85 psig saturated steam line with 20,000 pounds per hour flow is permitted a maximum pressure drop of 10 psi per 100 feet of pipe.

Find: The smallest size of Schedule 40 pipe suitable.

Solution: $\Delta P_{100} = 10$ $\quad \overline{V} = 4.5$ ..... page 437

$C_1 = 0.4$ $\quad C_2 = 10 \div (0.4 \times 4.5) = 5.56$

Reference to the table of C_2 values above shows that the 4-inch size is the smallest Schedule 40 pipe having a C_2 value less than 5.56

The actual pressure drop per 100 feet of 4-inch Schedule 40 pipe is:

$$\Delta P_{100} = 0.4 \times 5.17 \times 4.5 = 9.3$$

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004175

Properties of Saturated Steam — continued

Pressure Lbs. per Sq. In. Absolute P'	Pressure Lbs. per Sq. In. Gage P	Temperature t Degrees F	Heat of the Liquid Btu/lb.	Latent Heat of Evaporation Btu/lb.	Total Heat of Steam h_g Btu/lb.	Specific Volume $\overline{V}$ Cu. ft. per lb.
35.0	20.3	259.28	227.91	939.2	1167.1	11.898
36.0	21.3	260.95	229.60	938.0	1167.6	11.588
37.0	22.3	262.57	231.26	936.9	1168.2	11.294
38.0	23.3	264.16	232.89	935.8	1168.7	11.015
39.0	24.3	265.72	234.48	934.7	1169.2	10.750
40.0	25.3	267.25	236.03	933.7	1169.7	10.498
41.0	26.3	268.74	237.55	932.6	1170.2	10.258
42.0	27.3	270.21	239.04	931.6	1170.7	10.029
43.0	28.3	271.64	240.51	930.6	1171.1	9.810
44.0	29.3	273.05	241.95	929.6	1171.6	9.601
45.0	30.3	274.44	243.36	928.6	1172.0	9.401
46.0	31.3	275.80	244.75	927.7	1172.4	9.209
47.0	32.3	277.13	246.12	926.7	1172.9	9.025
48.0	33.3	278.45	247.47	925.8	1173.3	8.848
49.0	34.3	279.74	248.79	924.9	1173.7	8.678
50.0	35.3	281.01	250.09	924.0	1174.1	8.515
51.0	36.3	282.26	251.37	923.0	1174.4	8.359
52.0	37.3	283.49	252.63	922.2	1174.8	8.208
53.0	38.3	284.70	253.87	921.3	1175.2	8.062
54.0	39.3	285.90	255.09	920.5	1175.6	7.922
55.0	40.3	287.07	256.30	919.6	1175.9	7.787
56.0	41.3	288.23	257.50	918.8	1176.3	7.656
57.0	42.3	289.37	258.67	917.9	1176.6	7.529
58.0	43.3	290.50	259.82	917.1	1176.9	7.407
59.0	44.3	291.61	260.96	916.3	1177.3	7.289
60.0	45.3	292.71	262.09	915.5	1177.6	7.175
61.0	46.3	293.79	263.20	914.7	1177.9	7.064
62.0	47.3	294.85	264.30	913.9	1178.2	6.957
63.0	48.3	295.90	265.38	913.1	1178.5	6.853
64.0	49.3	296.94	266.45	912.3	1178.8	6.752
65.0	50.3	297.97	267.50	911.6	1179.1	6.655
66.0	51.3	298.99	268.55	910.8	1179.4	6.560
67.0	52.3	299.99	269.58	910.1	1179.7	6.468
68.0	53.3	300.98	270.60	909.4	1180.0	6.378
69.0	54.3	301.96	271.61	908.7	1180.3	6.291
70.0	55.3	302.92	272.61	907.9	1180.6	6.206
71.0	56.3	303.88	273.60	907.2	1180.8	6.124
72.0	57.3	304.83	274.57	906.5	1181.1	6.044
73.0	58.3	305.76	275.54	905.8	1181.3	5.966
74.0	59.3	306.68	276.49	905.1	1181.6	5.890
75.0	60.3	307.60	277.43	904.5	1181.9	5.816
76.0	61.3	308.50	278.37	903.7	1182.1	5.743
77.0	62.3	309.40	279.30	903.1	1182.4	5.673
78.0	63.3	310.29	280.21	902.4	1182.6	5.604
79.0	64.3	311.16	281.12	901.7	1182.8	5.537
80.0	65.3	312.03	282.02	901.1	1183.1	5.472
81.0	66.3	312.89	282.91	900.4	1183.3	5.408
82.0	67.3	313.74	283.79	899.7	1183.5	5.346
83.0	68.3	314.59	284.66	899.1	1183.8	5.285
84.0	69.3	315.42	285.53	898.5	1184.0	5.226
85.0	70.3	316.25	286.39	897.8	1184.2	5.168
86.0	71.3	317.07	287.24	897.2	1184.4	5.111
87.0	72.3	317.88	288.08	896.5	1184.6	5.055
88.0	73.3	318.68	288.91	895.9	1184.8	5.001
89.0	74.3	319.48	289.74	895.3	1185.1	4.948
90.0	75.3	320.27	290.56	894.7	1185.3	4.896
91.0	76.3	321.06	291.38	894.1	1185.5	4.845
92.0	77.3	321.83	292.18	893.5	1185.7	4.796
93.0	78.3	322.60	292.98	892.9	1185.9	4.747
94.0	79.3	323.36	293.78	892.3	1186.1	4.699
95.0	80.3	324.12	294.56	891.7	1186.2	4.652
96.0	81.3	324.87	295.34	891.1	1186.4	4.606
97.0	82.3	325.61	296.12	890.5	1186.6	4.561
98.0	83.3	326.35	296.89	889.9	1186.8	4.517
99.0	84.3	327.08	297.65	889.4	1187.0	4.474
100.0	85.3	327.81	298.40	888.8	1187.2	4.432
101.0	86.3	328.53	299.15	888.2	1187.4	4.391
102.0	87.3	329.25	299.90	887.6	1187.5	4.350
103.0	88.3	329.96	300.64	887.1	1187.7	4.310
104.0	89.3	330.66	301.37	886.5	1187.9	4.271
105.0	90.3	331.36	302.10	886.0	1188.1	4.232
106.0	91.3	332.05	302.82	885.4	1188.2	4.194
107.0	92.3	332.74	303.54	884.9	1188.4	4.157
108.0	93.3	333.42	304.26	884.3	1188.6	4.120
109.0	94.3	334.10	304.97	883.7	1188.7	4.084

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Properties of Saturated Steam — concluded

Pressure Lbs. Per Sq. In. Absolute P′	Pressure Lbs. Per Sq. In. Gage P	Temperature t Degrees F	Heat of the Liquid Btu/lb.	Latent Heat of Evaporation Btu/lb.	Total Heat of Steam h_g Btu/lb.	Specific Volume $\overline{V}$ Cu. ft. per lb.
250.0	235.3	400.95	376.00	825.1	1201.1	1.8438
255.0	240.3	402.70	377.89	823.4	1201.3	1.8086
260.0	245.3	404.42	379.76	821.8	1201.5	1.7748
265.0	250.3	406.11	381.60	820.1	1201.7	1.7422
270.0	255.3	407.78	383.42	818.5	1201.9	1.7107
275.0	260.3	409.43	385.21	816.9	1202.1	1.6804
280.0	265.3	411.05	386.98	815.3	1202.3	1.6511
285.0	270.3	412.65	388.73	813.7	1202.4	1.6228
290.0	275.3	414.23	390.46	812.1	1202.6	1.5954
295.0	280.3	415.79	392.16	810.5	1202.7	1.5689
300.0	285.3	417.33	393.84	809.0	1202.8	1.5433
320.0	305.3	423.29	400.39	803.0	1203.4	1.4485
340.0	325.3	428.97	406.66	797.1	1203.7	1.3645
360.0	345.3	434.40	412.67	791.4	1204.1	1.2895
380.0	365.3	439.60	418.45	785.8	1204.3	1.2222
400.0	385.3	444.59	424.0	780.5	1204.5	1.1613
420.0	405.3	449.39	429.4	775.2	1204.6	1.1061
440.0	425.3	454.02	434.6	770.0	1204.6	1.0556
460.0	445.3	458.50	439.7	764.9	1204.6	1.0094
480.0	465.3	462.82	444.6	759.9	1204.5	0.9670
500.0	485.3	467.01	449.4	755.0	1204.4	0.9278
520.0	505.3	471.07	454.1	750.1	1204.2	0.8915
540.0	525.3	475.01	458.6	745.4	1204.0	0.8578
560.0	545.3	478.85	463.0	740.8	1203.8	0.8265
580.0	565.3	482.58	467.4	736.1	1203.5	0.7973
600.0	585.3	486.21	471.6	731.6	1203.2	0.7698
620.0	605.3	489.75	475.7	727.2	1202.9	0.7440
640.0	625.3	493.21	479.8	722.7	1202.5	0.7198
660.0	645.3	496.58	483.8	718.3	1202.1	0.6971
680.0	665.3	499.88	487.7	714.0	1201.7	0.6757
700.0	685.3	503.10	491.5	709.7	1201.2	0.6554
720.0	705.3	506.25	495.3	705.4	1200.7	0.6362
740.0	725.3	509.34	499.0	701.2	1200.2	0.6180
760.0	745.3	512.36	502.6	697.1	1199.7	0.6007
780.0	765.3	515.33	506.2	692.9	1199.1	0.5843
800.0	785.3	518.23	509.7	688.9	1198.6	0.5687
820.0	805.3	521.08	513.2	684.8	1198.0	0.5538
840.0	825.3	523.88	516.6	680.8	1197.4	0.5396
860.0	845.3	526.63	520.0	676.8	1196.8	0.5260
880.0	865.3	529.33	523.3	672.8	1196.1	0.5130
900.0	885.3	531.98	526.6	668.8	1195.4	0.5006
920.0	905.3	534.59	529.8	664.9	1194.7	0.4886
940.0	925.3	537.16	533.0	661.0	1194.0	0.4772
960.0	945.3	539.68	536.2	657.1	1193.3	0.4663
980.0	965.3	542.17	539.3	653.3	1192.6	0.4557
1000.0	985.3	544.61	542.4	649.4	1191.8	0.4456
1050.0	1035.3	550.57	550.0	639.9	1189.9	0.4218
1100.0	1085.3	556.31	557.4	630.4	1187.8	0.4001
1150.0	1135.3	561.86	564.6	621.0	1185.6	0.3802
1200.0	1185.3	567.22	571.7	611.7	1183.4	0.3619
1250.0	1235.3	572.42	578.6	602.4	1181.0	0.3450
1300.0	1285.3	577.46	585.4	593.2	1178.6	0.3293
1350.0	1335.3	582.35	592.1	584.0	1176.1	0.3148
1400.0	1385.3	587.10	598.7	574.7	1173.4	0.3012
1450.0	1435.3	591.73	605.2	565.5	1170.7	0.2884
1500.0	1485.3	596.23	611.6	556.3	1167.9	0.2765
1600.0	1585.3	604.90	624.1	538.0	1162.1	0.2548
1700.0	1685.3	613.15	636.3	519.6	1155.9	0.2354
1800.0	1785.3	621.03	648.3	501.1	1149.4	0.2179
1900.0	1885.3	628.58	660.1	482.4	1142.4	0.2021
2000.0	1985.3	635.82	671.7	463.4	1135.1	0.1878
2100.0	2085.3	642.77	683.3	444.1	1127.4	0.1746
2200.0	2185.3	649.46	694.8	424.4	1119.2	0.1625
2300.0	2285.3	655.91	706.5	403.9	1110.4	0.1513
2400.0	2385.3	662.12	718.4	382.7	1101.1	0.1407
2500.0	2485.3	668.13	730.6	360.5	1091.1	0.1307
2600.0	2585.3	673.94	743.0	337.2	1080.2	0.1213
2700.0	2685.3	679.55	756.2	312.1	1068.3	0.1123
2800.0	2785.3	684.99	770.1	284.7	1054.8	0.1035
2900.0	2885.3	690.26	785.4	253.6	1039.0	0.0947
3000.0	2985.3	695.36	802.5	217.8	1020.3	0.0858
3100.0	3085.3	700.31	825.0	168.1	993.1	0.0753
3200.0	3185.3	705.11	872.4	62.0	934.4	0.0580
3206.2	3191.5	705.40	902.7	0.0	902.7	0.0503

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004179

Properties of Superheated Steam — continued

$\overline{V}$ = specific volume, cubic feet per pound
h_g = total heat of steam, Btu per pound

Pressure Lbs. per Sq. In.		Sat. Temp.		Total Temperature — Degrees Fahrenheit (t)										
Abs. P'	Gage P	t		500°	540°	600°	640°	660°	700°	740°	800°	900°	1000°	1200°
380.0	365.3	439.60	$\overline{V}$	1.3616	1.4444	1.5605	1.6345	1.6707	1.7419	1.8118	1.9149	2.083	2.249	2.575
			h_g	1247.7	1273.1	1308.5	1331.0	1342.0	1363.8	1385.3	1417.3	1470.1	1523.0	1630.0
400.0	385.3	444.59	$\overline{V}$	1.2851	1.3652	1.4770	1.5480	1.5827	1.6508	1.7177	1.8161	1.9767	2.134	2.445
			h_g	1245.1	1271.0	1306.9	1329.6	1340.8	1362.7	1384.3	1416.4	1469.4	1522.4	1629.6
420.0	405.3	449.39	$\overline{V}$	1.2158	1.2935	1.4014	1.4697	1.5030	1.5684	1.6324	1.7267	1.8802	2.031	2.327
			h_g	1242.5	1268.9	1305.3	1328.3	1339.5	1361.6	1383.3	1415.5	1468.7	1521.9	1629.2
440.0	425.3	454.02	$\overline{V}$	1.1526	1.2282	1.3327	1.3984	1.4306	1.4934	1.5549	1.6454	1.7925	1.9368	2.220
			h_g	1239.8	1266.7	1303.6	1326.9	1338.2	1360.4	1382.3	1414.7	1468.1	1521.3	1628.8
460.0	445.3	458.50	$\overline{V}$	1.0948	1.1685	1.2698	1.3334	1.3644	1.4250	1.4842	1.5711	1.7124	1.8508	2.122
			h_g	1237.0	1264.5	1302.0	1325.4	1336.9	1359.3	1381.3	1413.8	1467.4	1520.7	1628.4
480.0	465.3	462.82	$\overline{V}$	1.0417	1.1138	1.2122	1.2737	1.3038	1.3622	1.4193	1.5031	1.6390	1.7720	2.033
			h_g	1234.2	1262.3	1300.3	1324.0	1335.6	1358.2	1380.3	1412.9	1466.7	1520.2	1628.0
500.0	485.3	467.01	$\overline{V}$	0.9927	1.0633	1.1591	1.2188	1.2478	1.3044	1.3596	1.4405	1.5715	1.6996	1.9504
			h_g	1231.3	1260.0	1298.6	1322.6	1334.2	1357.0	1379.3	1412.1	1466.0	1519.6	1627.6
520.0	505.3	471.07	$\overline{V}$	0.9473	1.0166	1.1101	1.1681	1.1962	1.2511	1.3045	1.3826	1.5091	1.6326	1.8743
			h_g	1228.3	1257.7	1296.9	1321.1	1332.9	1355.8	1378.2	1411.2	1465.3	1519.0	1627.2
540.0	525.3	475.01	$\overline{V}$	0.9052	0.9733	1.0646	1.1211	1.1485	1.2017	1.2535	1.3291	1.4514	1.5707	1.8039
			h_g	1225.3	1255.4	1295.2	1319.7	1331.5	1354.6	1377.2	1410.3	1464.6	1518.5	1626.8
560.0	545.3	478.85	$\overline{V}$	0.8659	0.9330	1.0224	1.0775	1.1041	1.1558	1.2060	1.2794	1.3978	1.5132	1.7385
			h_g	1222.2	1253.0	1293.4	1318.2	1330.2	1353.5	1376.1	1409.4	1463.9	1517.9	1626.4
580.0	565.3	482.58	$\overline{V}$	0.8291	0.8954	0.9830	1.0368	1.0627	1.1131	1.1619	1.2331	1.3479	1.4596	1.6776
			h_g	1219.0	1250.5	1291.7	1316.7	1328.8	1352.3	1375.1	1408.6	1463.2	1517.3	1626.0
600.0	585.3	486.21	$\overline{V}$	0.7947	0.8602	0.9463	0.9988	1.0241	1.0732	1.1207	1.1899	1.3013	1.4096	1.6208
			h_g	1215.7	1248.1	1289.9	1315.2	1327.4	1351.1	1374.0	1407.7	1462.5	1516.7	1625.5
620.0	605.3	489.75	$\overline{V}$	0.7624	0.8272	0.9118	0.9633	0.9880	1.0358	1.0821	1.1494	1.2577	1.3628	1.5676
			h_g	1212.4	1245.5	1288.1	1313.7	1326.0	1349.9	1373.0	1406.8	1461.8	1516.2	1625.1
640.0	625.3	493.21	$\overline{V}$	0.7319	0.7962	0.8795	0.9299	0.9541	1.0008	1.0459	1.1115	1.2168	1.3190	1.5178
			h_g	1209.0	1243.0	1286.2	1312.2	1324.6	1348.6	1371.9	1405.9	1461.1	1515.6	1624.7
660.0	645.3	496.58	$\overline{V}$	0.7032	0.7670	0.8491	0.8985	0.9222	0.9679	1.0119	1.0759	1.1784	1.2778	1.4709
			h_g	1205.4	1240.4	1284.4	1310.6	1323.2	1347.4	1370.8	1405.0	1460.4	1515.0	1624.3
680.0	665.3	499.88	$\overline{V}$	0.6759	0.7395	0.8205	0.8690	0.8922	0.9369	0.9800	1.0424	1.1423	1.2390	1.4269
			h_g	1201.8	1237.7	1282.5	1309.1	1321.7	1346.2	1369.8	1404.1	1459.7	1514.5	1623.9
700.0	685.3	503.10	$\overline{V}$	...	0.7134	0.7934	0.8411	0.8639	0.9077	0.9498	1.0108	1.1082	1.2024	1.3853
			h_g	...	1235.0	1280.6	1307.5	1320.3	1345.0	1368.7	1403.2	1459.0	1513.9	1623.5
750.0	735.3	510.86	$\overline{V}$	...	0.6540	0.7319	0.7778	0.7996	0.8414	0.8813	0.9391	1.0310	1.1196	1.2912
			h_g	...	1227.9	1275.7	1303.5	1316.6	1341.8	1366.0	1400.9	1457.2	1512.4	1622.4
800.0	785.3	518.23	$\overline{V}$	...	0.6015	0.6779	0.7223	0.7433	0.7833	0.8215	0.8763	0.9633	1.0470	1.2088
			h_g	...	1220.5	1270.7	1299.4	1312.9	1338.6	1363.2	1398.6	1455.4	1511.0	1621.4
850.0	835.3	525.26	$\overline{V}$	...	0.5546	0.6301	0.6732	0.6934	0.7320	0.7685	0.8209	0.9037	0.9830	1.1360
			h_g	...	1212.7	1265.5	1295.2	1309.0	1335.4	1360.4	1396.3	1453.6	1509.5	1620.4
900.0	885.3	531.98	$\overline{V}$	...	0.5124	0.5873	0.6294	0.6491	0.6863	0.7215	0.7716	0.8506	0.9262	1.0714
			h_g	...	1204.4	1260.1	1290.9	1305.1	1332.1	1357.5	1393.9	1451.8	1508.1	1619.3
950.0	935.3	538.42	$\overline{V}$	...	0.4740	0.5489	0.5901	0.6092	0.6453	0.6793	0.7275	0.8031	0.8753	1.0136
			h_g	...	1195.5	1254.6	1286.4	1301.1	1328.7	1354.7	1391.6	1450.0	1506.6	1618.3
1000.0	985.3	544.61	$\overline{V}$	...	...	0.5140	0.5546	0.5733	0.6084	0.6413	0.6878	0.7604	0.8294	0.9615
			h_g	...	...	1248.8	1281.9	1297.0	1325.3	1351.7	1389.2	1448.2	1505.1	1617.3

(continued on the next page)

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Abbreviations Used in This Catalog

AAR.....Association of American Railroads
Abs.....Absolute
AISI.....American Iron and Steel Institute
API.....American Petroleum Institute
ASA.....American Standards Association
ASME.....American Society of Mechanical Engineers
ASTM.....American Society for Testing Materials
AWWA.....American Water Works Association

Blk.....Black
Btu.....British Thermal Unit

C or Cent.....Centigrade degrees
Ctr. to Ctr....Center to center
cfm.....Cubic feet per minute
Chr.....Chromium
Cm.....Centimeter
Cos.....Cosine
Cot.....Cotangent
Cu.....Cubic
CU.....Symbol (or marking) indicating product has been approved by the Underwriters' Laboratories, Inc.

Deg.....Degrees
Dia.....Diameter

F or Fahr.....Fahrenheit degrees
F & D.....Faced and drilled
FD & SF.....Faced, drilled, and spot faced
Flgd.....Flanged
FM.....Symbol (or marking) indicating product has been approved by the Factory Mutual Laboratories

Galv.....Galvanized
gpm.....Gallons per minute

Hg.....Symbol for Hydrargyrum (mercury)
hp.....Horsepower
HPT.....Hose pipe thread

I.D.....Inside diameter
imp. gal.....Imperial gallon
IPS.....Iron pipe size

kg.....Kilograms
km.....Kilometers

lbs.....Pounds
log.....Logarithm (common)
LP.....Liquid Petroleum

Max.....Maximum
Min.....Minimum
MSS.....Manufacturers Standardization Society of the Valve and Fittings Industry

NEMA.....National Electrical Manufacturers' Association
N.F.P.A.....National Fire Protection Association
NPSC.....Symbol indicating American Standard Straight Pipe Thread in pipe couplings
NPSL.....Symbol indicating American Standard Straight Pipe Thread for locknuts and locknut pipe threads
NPSM.....Symbol indicating American Standard Straight Pipe Thread for mechanical joints
NPT.....Symbol indicating American Standard Taper Pipe Thread
N-RS.....Non-Rising Stem

O.D.....Outside diameter
OS & Y.....Outside Screw and Yoke

P.D.....Used in conjunction with threads to indicate "Pitch Diameter"
psi.....Pounds per square inch
psia.....Pounds per square inch, absolute
psig.....Pounds per square inch, gauge

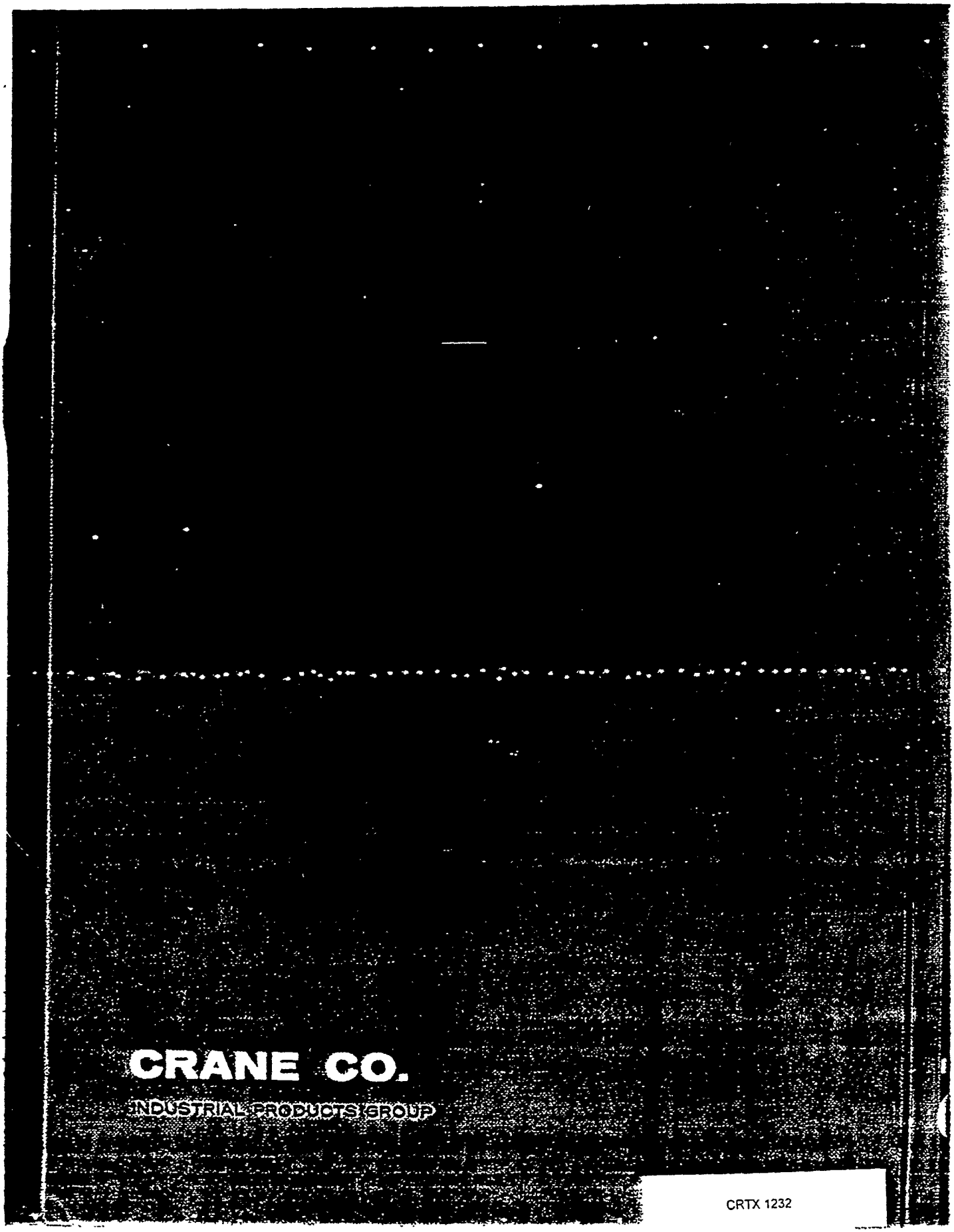
Red.....Reducing
rpm.....Revolutions per minute

S.A.E.....Society of Automotive Engineers
Sat.....Saturated
Sched.....Schedule
Sin.....Sine
Scrd.....Screwed
SP.....When used in conjunction with references to "MSS", is the abbreviation for "Standard Practice".... thus.... MSS 150 Lb Corrosion Resistant Cast Flanged Valve Standard No. SP-42-1955
SWP.....When used in conjunction with working pressure ratings, indicates "steam working pressure"

T & G.....Tongue and Groove
Tan.....Tangent
Temp.....Temperature

Symbols used to designate type of service for which product is recommended; these are frequently combined, like "WOG", and also appear as part of the marking on products:

G signifies Gas
L signifies Liquid
O signifies Oil
S signifies Steam
W signifies Water



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004182

Crane Handy Memo Page

Use this page to make a personal quick-reference listing to frequently used products, data, etc.

Product

Product Description	Product Catalog No.	Catalog Section	Catalog Page

Reference Data

Description of Data	Catalog Section	Catalog Page

Distributor and Crane Sales Representative

Company	Name of Representative	Address	Telephone No.

004180

Properties of Superheated Steam — concluded

$\overline{V}$ = specific volume, cubic feet per pound
h_g = total heat of steam, Btu per pound

Pressure Lbs. per Sq. In. Abs. P'	Pressure Lbs. per Sq. In. Gage P	Sat. Temp. t		Total Temperature — Degrees Fahrenheit (t) 660°	700°	740°	760°	780°	800°	860°	900°	1000°	1100°	1200°
1100.0	1085.3	556.31	$\overline{V}$	0.5110	0.5445	0.5755	0.5904	0.6049	0.6191	0.6601	0.6866	0.7503	0.8117	0.8716
			h_g	1288.5	1318.3	1345.8	1358.9	1371.7	1384.3	1420.8	1444.5	1502.2	1558.8	1615.2
1200.0	1185.3	567.22	$\overline{V}$	0.4586	0.4909	0.5206	0.5347	0.5484	0.5617	0.6003	0.6250	0.6843	0.7412	0.7967
			h_g	1279.6	1311.0	1339.6	1353.2	1366.4	1379.3	1416.7	1440.7	1499.2	1556.4	1613.1
1300.0	1285.3	577.46	$\overline{V}$	0.4139	0.4454	0.4739	0.4874	0.5004	0.5131	0.5496	0.5728	0.6284	0.6816	0.7333
			h_g	1270.2	1303.4	1333.3	1347.3	1361.0	1374.3	1412.5	1437.0	1496.2	1553.9	1611.0
1400.0	1385.3	587.10	$\overline{V}$	0.3753	0.4062	0.4338	0.4468	0.4593	0.4714	0.5061	0.5281	0.5805	0.6305	0.6789
			h_g	1260.3	1295.5	1326.7	1341.3	1355.4	1369.1	1408.2	1433.1	1493.2	1551.4	1608.9
1500.0	1485.3	596.23	$\overline{V}$	0.3413	0.3719	0.3989	0.4114	0.4235	0.4352	0.4684	0.4893	0.5390	0.5862	0.6318
			h_g	1249.8	1287.2	1320.0	1335.2	1349.7	1363.8	1403.9	1429.3	1490.1	1548.9	1606.8
1600.0	1585.3	604.90	$\overline{V}$	0.3112	0.3417	0.3682	0.3804	0.3921	0.4034	0.4353	0.4553	0.5027	0.5474	0.5906
			h_g	1238.7	1278.7	1313.0	1328.8	1343.9	1358.4	1399.5	1425.3	1487.0	1546.4	1604.6
1700.0	1685.3	613.15	$\overline{V}$	0.2842	0.3148	0.3410	0.3529	0.3643	0.3753	0.4061	0.4253	0.4706	0.5132	0.5542
			h_g	1226.8	1269.7	1305.8	1322.3	1337.9	1352.9	1395.0	1421.4	1484.0	1543.8	1602.5
1800.0	1785.3	621.03	$\overline{V}$	0.2597	0.2907	0.3166	0.3284	0.3395	0.3502	0.3801	0.3986	0.4421	0.4828	0.5218
			h_g	1214.0	1260.3	1298.4	1315.5	1331.8	1347.2	1390.4	1417.4	1480.8	1541.3	1600.4
1900.0	1885.3	628.58	$\overline{V}$	0.2371	0.2688	0.2947	0.3063	0.3173	0.3277	0.3568	0.3747	0.4165	0.4556	0.4929
			h_g	1200.2	1250.4	1290.6	1308.6	1325.4	1341.5	1385.8	1413.3	1477.7	1538.8	1598.2
2000.0	1985.3	635.82	$\overline{V}$	0.2161	0.2489	0.2748	0.2863	0.2972	0.3074	0.3358	0.3532	0.3935	0.4311	0.4668
			h_g	1184.9	1240.0	1282.6	1301.4	1319.0	1335.5	1381.2	1409.2	1474.5	1536.2	1596.1
2100.0	2085.3	642.77	$\overline{V}$	0.1962	0.2306	0.2567	0.2682	0.2789	0.2890	0.3167	0.3337	0.3727	0.4089	0.4433
			h_g	1167.7	1229.0	1274.3	1294.0	1312.3	1329.5	1376.4	1405.0	1471.4	1533.6	1593.9
2200.0	2185.3	649.46	$\overline{V}$	0.1768	0.2135	0.2400	0.2514	0.2621	0.2721	0.2994	0.3159	0.3538	0.3887	0.4218
			h_g	1147.8	1217.4	1265.7	1286.3	1305.4	1323.3	1371.5	1400.8	1468.2	1531.1	1591.8
2300.0	2285.3	655.91	$\overline{V}$	0.1575	0.1978	0.2247	0.2362	0.2468	0.2567	0.2835	0.2997	0.3365	0.3703	0.4023
			h_g	1123.8	1204.9	1256.7	1278.4	1298.4	1316.9	1366.6	1396.5	1464.9	1528.5	1589.6
2400.0	2385.3	662.12	$\overline{V}$	...	0.1828	0.2105	0.2221	0.2327	0.2425	0.2689	0.2848	0.3207	0.3534	0.3843
			h_g	...	1191.5	1247.3	1270.2	1291.1	1310.3	1361.6	1392.2	1461.7	1525.9	1587.4
2500.0	2485.3	668.13	$\overline{V}$	...	0.1686	0.1973	0.2090	0.2196	0.2294	0.2555	0.2710	0.3061	0.3379	0.3678
			h_g	...	1176.8	1237.6	1261.8	1283.6	1303.6	1356.5	1387.8	1458.4	1523.2	1585.3
2600.0	2585.3	673.94	$\overline{V}$	...	0.1549	0.1849	0.1967	0.2074	0.2172	0.2431	0.2584	0.2926	0.3236	0.3526
			h_g	...	1160.6	1227.3	1252.9	1275.8	1296.8	1351.4	1383.4	1455.1	1520.6	1583.1
2700.0	2685.3	679.55	$\overline{V}$	...	0.1415	0.1732	0.1853	0.1960	0.2059	0.2315	0.2466	0.2801	0.3103	0.3385
			h_g	...	1142.5	1216.5	1243.8	1267.9	1289.7	1346.1	1378.9	1451.8	1518.0	1580.9
2800.0	2785.3	684.99	$\overline{V}$	...	0.1281	0.1622	0.1745	0.1854	0.1953	0.2208	0.2356	0.2685	0.2979	0.3254
			h_g	...	1121.4	1205.1	1234.2	1259.6	1282.4	1340.8	1374.3	1448.5	1515.4	1578.7
2900.0	2885.3	690.26	$\overline{V}$	...	0.1143	0.1517	0.1644	0.1754	0.1853	0.2108	0.2254	0.2577	0.2864	0.3132
			h_g	...	1095.9	1193.0	1224.3	1251.1	1274.9	1335.3	1369.7	1445.1	1512.7	1576.5
3000.0	2985.3	695.36	$\overline{V}$	...	0.0984	0.1416	0.1548	0.1660	0.1760	0.2014	0.2159	0.2476	0.2757	0.3018
			h_g	...	1060.7	1180.1	1213.8	1242.2	1267.2	1329.7	1365.0	1441.8	1510.0	1574.3
3100.0	3085.3	700.31	$\overline{V}$	...	...	0.1320	0.1456	0.1571	0.1672	0.1926	0.2070	0.2382	0.2657	0.2911
			h_g	...	...	1166.2	1202.9	1233.0	1259.3	1324.1	1360.3	1438.4	1507.4	1572.1
3200.0	3185.3	705.11	$\overline{V}$	...	...	0.1226	0.1369	0.1486	0.1589	0.1843	0.1986	0.2293	0.2563	0.2811
			h_g	...	...	1151.1	1191.4	1223.5	1251.1	1318.3	1355.5	1434.9	1504.7	1569.9
3206.2	3191.5	705.40	$\overline{V}$	...	...	0.1220	0.1363	0.1480	0.1583	0.1838	0.1981	0.2288	0.2557	0.2806
			h_g	...	...	1150.2	1190.6	1222.9	1250.5	1317.9	1355.2	1434.7	1504.5	1569.8

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Properties of Superheated Steam*

$\overline{V}$ = specific volume, cubic feet per pound
h_g = total heat of steam, Btu per pound

Pressure Lbs. per Sq. In. Abs. P'	Pressure Lbs. per Sq. In. Gage P	Sat. Temp. t		Total Temperature — Degrees Fahrenheit (t) 360°	400°	440°	480°	500°	600°	700°	800°	900°	1000°	1200°
14.696	0.0	212.00	$\overline{V}$	33.03	34.68	36.32	37.96	38.78	42.86	46.94	51.00	55.07	59.13	67.25
			h_g	1221.1	1239.9	1258.8	1277.6	1287.1	1334.8	1383.2	1432.3	1482.3	1533.1	1637.5
20.0	5.3	227.96	$\overline{V}$	24.21	25.43	26.65	27.86	28.46	31.47	34.47	37.46	40.45	43.44	49.41
			h_g	1220.3	1239.2	1258.2	1277.1	1286.6	1334.4	1382.9	1432.1	1482.1	1533.0	1637.4
30.0	15.3	250.33	$\overline{V}$	16.072	16.897	17.714	18.528	18.933	20.95	22.96	24.96	26.95	28.95	32.93
			h_g	1218.6	1237.9	1257.0	1276.2	1285.7	1333.8	1382.4	1431.7	1481.8	1532.7	1637.2
40.0	25.3	267.25	$\overline{V}$	12.001	12.628	13.247	13.862	14.168	15.688	17.198	18.702	20.20	21.70	24.69
			h_g	1216.9	1236.5	1255.9	1275.2	1284.8	1333.1	1381.9	1431.3	1481.4	1532.4	1637.0
50.0	35.3	281.01	$\overline{V}$	9.557	10.065	10.567	11.062	11.309	12.532	13.744	14.950	16.152	17.352	19.747
			h_g	1215.2	1235.1	1254.7	1274.2	1283.9	1332.5	1381.4	1430.9	1481.1	1532.1	1636.8
60.0	45.3	292.71	$\overline{V}$	7.927	8.357	8.779	9.196	9.403	10.427	11.441	12.449	13.452	14.454	16.451
			h_g	1213.4	1233.6	1253.5	1273.2	1283.0	1331.8	1380.9	1430.5	1480.8	1531.9	1636.6
70.0	55.3	302.92	$\overline{V}$	6.762	7.136	7.502	7.863	8.041	8.924	9.796	10.662	11.524	12.383	14.097
			h_g	1211.5	1232.1	1252.3	1272.2	1282.0	1331.1	1380.4	1430.1	1480.5	1531.6	1636.3
80.0	65.3	312.03	$\overline{V}$	5.888	6.220	6.544	6.862	7.020	7.797	8.562	9.322	10.077	10.830	12.332
			h_g	1209.7	1230.7	1251.1	1271.1	1281.1	1330.5	1379.9	1429.7	1480.1	1531.3	1636.2
90.0	75.3	320.27	$\overline{V}$	5.208	5.508	5.799	6.084	6.225	6.920	7.603	8.279	8.952	9.623	10.959
			h_g	1207.7	1229.1	1249.8	1270.1	1280.1	1329.8	1379.4	1429.3	1479.8	1531.0	1635.9
100.0	85.3	327.81	$\overline{V}$	4.663	4.937	5.202	5.462	5.589	6.218	6.835	7.446	8.052	8.656	9.860
			h_g	1205.7	1227.6	1248.6	1269.0	1279.1	1329.1	1378.9	1428.9	1479.5	1530.8	1635.7
120.0	105.3	341.25	$\overline{V}$	3.844	4.081	4.307	4.527	4.636	5.165	5.683	6.195	6.702	7.207	8.212
			h_g	1201.6	1224.4	1246.0	1266.9	1277.2	1327.7	1377.8	1428.1	1478.8	1530.2	1635.3
140.0	125.3	353.02	$\overline{V}$	3.258	3.468	3.667	3.860	3.954	4.413	4.861	5.301	5.738	6.172	7.035
			h_g	1197.3	1221.1	1243.3	1264.7	1275.2	1326.4	1376.8	1427.3	1478.2	1529.7	1634.9
160.0	145.3	363.53	$\overline{V}$	...	3.008	3.187	3.359	3.443	3.849	4.244	4.631	5.015	5.396	6.152
			h_g	...	1217.6	1240.6	1262.4	1273.1	1325.0	1375.7	1426.4	1477.5	1529.1	1634.5
180.0	165.3	373.06	$\overline{V}$	...	2.649	2.813	2.969	3.044	3.411	3.764	4.110	4.452	4.792	5.466
			h_g	...	1214.0	1237.8	1260.2	1271.0	1323.5	1374.7	1425.6	1476.8	1528.6	1634.1
200.0	185.3	381.79	$\overline{V}$	...	2.361	2.513	2.656	2.726	3.060	3.380	3.693	4.002	4.309	4.917
			h_g	...	1210.3	1234.9	1257.8	1268.9	1322.1	1373.6	1424.8	1476.2	1528.0	1633.7
220.0	205.3	389.86	$\overline{V}$	...	2.125	2.267	2.400	2.465	2.772	3.066	3.352	3.634	3.913	4.467
			h_g	...	1206.5	1231.9	1255.4	1266.7	1320.7	1372.6	1424.0	1475.5	1527.5	1633.3
240.0	225.3	397.37	$\overline{V}$	...	1.9276	2.062	2.187	2.247	2.533	2.804	3.068	3.327	3.584	4.093
			h_g	...	1202.5	1228.8	1253.0	1264.5	1319.2	1371.5	1423.2	1474.8	1526.9	1632.9
260.0	245.3	404.42	$\overline{V}$	...	...	1.8882	2.006	2.063	2.330	2.582	2.827	3.067	3.305	3.776
			h_g	...	...	1225.7	1250.5	1262.3	1317.7	1370.4	1422.3	1474.2	1526.3	1632.5
280.0	265.3	411.05	$\overline{V}$	...	. .	1.7388	1.8512	1.9047	2.156	2.392	2.621	2.845	3.066	3.504
			h_g	...	...	1222.4	1247.9	1260.0	1316.2	1369.4	1421.5	1473.5	1525.8	1632.1
300.0	285.3	417.33	$\overline{V}$	...	...	1.6090	1.7165	1.7675	2.005	2.227	2.442	2.652	2.859	3.269
			h_g	...	...	1219.1	1245.3	1257.6	1314.7	1368.3	1420.6	1472.8	1525.2	1631.7
320.0	305.3	423.29	$\overline{V}$	...	...	1.4950	1.5985	1.6472	1.8734	2.083	2.285	2.483	2.678	3.063
			h_g	...	...	1215.6	1242.6	1255.2	1313.2	1367.2	1419.8	1472.1	1524.7	1631.3
340.0	325.3	428.97	$\overline{V}$	...	...	1.3941	1.4941	1.5410	1.7569	1.9562	2.147	2.334	2.518	2.881
			h_g	...	...	1212.1	1239.9	1252.8	1311.6	1366.1	1419.0	1471.5	1524.1	1630.9
360.0	345.3	434.40	$\overline{V}$	.	...	1.3041	1.4012	1.4464	1.6533	1.8431	2.025	2.202	2.376	2.719
			h_g	.	. .	1208.4	1237.1	1250.3	1310.1	1365.0	1418.1	1470.8	1523.5	1630.5

* Abstracted from Thermodynamic Properties of Steam by J. H. Keenan and F. G. Keyes, 1936 Edition, by permission of the publishers, John Wiley & Sons, Inc.

(continued on the next two pages)

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Properties of Saturated Steam — continued

Pressure Lbs. Per Sq. In. Absolute P'	Pressure Lbs. Per Sq. In. Gage P	Temperature t Degrees F	Heat of the Liquid Btu/lb.	Latent Heat of Evaporation Btu/lb.	Total Heat of Steam h_g Btu/lb.	Specific Volume $\overline{V}$ Cu. ft. per lb.
110.0	95.3	334.77	305.66	883.2	1188.9	4.049
111.0	96.3	335.44	306.37	882.6	1189.0	4.015
112.0	97.3	336.11	307.06	882.1	1189.2	3.981
113.0	98.3	336.77	307.75	881.6	1189.4	3.947
114.0	99.3	337.42	308.43	881.1	1189.5	3.914
115.0	100.3	338.07	309.11	880.6	1189.7	3.882
116.0	101.3	338.72	309.79	880.0	1189.8	3.850
117.0	102.3	339.36	310.46	879.5	1190.0	3.819
118.0	103.3	339.99	311.12	879.0	1190.1	3.788
119.0	104.3	340.62	311.78	878.4	1190.2	3.758
120.0	105.3	341.25	312.44	877.9	1190.4	3.728
121.0	106.3	341.88	313.10	877.4	1190.5	3.699
122.0	107.3	342.50	313.75	876.9	1190.7	3.670
123.0	108.3	343.11	314.40	876.4	1190.8	3.642
124.0	109.3	343.72	315.04	875.9	1190.9	3.614
125.0	110.3	344.33	315.68	875.4	1191.1	3.587
126.0	111.3	344.94	316.31	874.9	1191.2	3.560
127.0	112.3	345.54	316.94	874.4	1191.3	3.533
128.0	113.3	346.13	317.57	873.9	1191.5	3.507
129.0	114.3	346.73	318.19	873.4	1191.6	3.481
130.0	115.3	347.32	318.81	872.9	1191.7	3.455
131.0	116.3	347.90	319.43	872.5	1191.9	3.430
132.0	117.3	348.48	320.04	872.0	1192.0	3.405
133.0	118.3	349.06	320.65	871.5	1192.1	3.381
134.0	119.3	349.64	321.25	871.0	1192.2	3.357
135.0	120.3	350.21	321.85	870.6	1192.4	3.333
136.0	121.3	350.78	322.45	870.1	1192.5	3.310
137.0	122.3	351.35	323.05	869.6	1192.6	3.287
138.0	123.3	351.91	323.64	869.1	1192.7	3.264
139.0	124.3	352.47	324.23	868.7	1192.9	3.242
140.0	125.3	353.02	324.82	868.2	1193.0	3.220
141.0	126.3	353.57	325.40	867.7	1193.1	3.198
142.0	127.3	354.12	325.98	867.2	1193.2	3.177
143.0	128.3	354.67	326.56	866.7	1193.3	3.155
144.0	129.3	355.21	327.13	866.3	1193.4	3.134
145.0	130.3	355.76	327.70	865.8	1193.5	3.114
146.0	131.3	356.29	328.27	865.3	1193.6	3.094
147.0	132.3	356.83	328.83	864.9	1193.8	3.074
148.0	133.3	357.36	329.39	864.5	1193.9	3.054
149.0	134.3	357.89	329.95	864.0	1194.0	3.034
150.0	135.3	358.42	330.51	863.6	1194.1	3.015
152.0	137.3	359.46	331.61	862.7	1194.3	2.977
154.0	139.3	360.49	332.70	861.8	1194.5	2.940
156.0	141.3	361.52	333.79	860.9	1194.7	2.904
158.0	143.3	362.53	334.86	860.0	1194.9	2.869
160.0	145.3	363.53	335.93	859.2	1195.1	2.834
162.0	147.3	364.53	336.98	858.3	1195.3	2.801
164.0	149.3	365.51	338.02	857.5	1195.5	2.768
166.0	151.3	366.48	339.05	856.6	1195.7	2.736
168.0	153.3	367.45	340.07	855.7	1195.8	2.705
170.0	155.3	368.41	341.09	854.9	1196.0	2.675
172.0	157.3	369.35	342.10	854.1	1196.2	2.645
174.0	159.3	370.29	343.10	853.3	1196.4	2.616
176.0	161.3	371.22	344.09	852.4	1196.5	2.587
178.0	163.3	372.14	345.06	851.6	1196.7	2.559
180.0	165.3	373.06	346.03	850.8	1196.9	2.532
182.0	167.3	373.96	347.00	850.0	1197.0	2.505
184.0	169.3	374.86	347.96	849.2	1197.2	2.479
186.0	171.3	375.75	348.92	848.4	1197.3	2.454
188.0	173.3	376.64	349.86	847.6	1197.5	2.429
190.0	175.3	377.51	350.79	846.8	1197.6	2.404
192.0	177.3	378.38	351.72	846.1	1197.8	2.380
194.0	179.3	379.24	352.64	845.3	1197.9	2.356
196.0	181.3	380.10	353.55	844.5	1198.1	2.333
198.0	183.3	380.95	354.46	843.7	1198.2	2.310
200.0	185.3	381.79	355.36	843.0	1198.4	2.288
205.0	190.3	383.86	357.58	841.1	1198.7	2.234
210.0	195.3	385.90	359.77	839.2	1199.0	2.183
215.0	200.3	387.89	361.91	837.4	1199.3	2.134
220.0	205.3	389.86	364.02	835.6	1199.6	2.087
225.0	210.3	391.79	366.09	833.8	1199.9	2.0422
230.0	215.3	393.68	368.13	832.0	1200.1	1.9992
235.0	220.3	395.54	370.14	830.3	1200.4	1.9579
240.0	225.3	397.37	372.12	828.5	1200.6	1.9183
245.0	230.3	399.18	374.08	826.8	1200.9	1.8803

004174

Properties of Saturated Steam*

Absolute Pressure		Vacuum Inches of Hg	Temperature	Heat of the Liquid	Latent Heat of Evaporation	Total Heat of Steam	Specific Volume
Lbs. per Sq. In. P'	Inches of Hg		t Degrees F	Btu/lb.	Btu/lb.	h_g Btu/lb.	$\overline{V}$ Cu. ft. per lb.
0.20	0.41	29.51	53.14	21.21	1063.8	1085.0	1526.0
0.25	0.51	29.41	59.30	27.36	1060.3	1087.7	1235.3
0.30	0.61	29.31	64.47	32.52	1057.4	1090.0	1039.5
0.35	0.71	29.21	68.93	36.97	1054.9	1091.9	898.5
0.40	0.81	29.11	72.86	40.89	1052.7	1093.6	791.9
0.45	0.92	29.00	76.38	44.41	1050.7	1095.1	708.5
0.50	1.02	28.90	79.58	47.60	1048.8	1096.4	641.4
0.60	1.22	28.70	85.21	53.21	1045.7	1098.9	540.0
0.70	1.43	28.49	90.08	58.07	1042.9	1101.0	466.9
0.80	1.63	28.29	94.38	62.36	1040.4	1102.8	411.7
0.90	1.83	28.09	98.24	66.21	1038.3	1104.5	368.4
1.0	2.04	27.88	101.74	69.70	1036.3	1106.0	333.6
1.2	2.44	27.48	107.92	75.87	1032.7	1108.6	280.9
1.4	2.85	27.07	113.26	81.20	1029.6	1110.8	243.0
1.6	3.26	26.66	117.99	85.91	1026.9	1112.8	214.3
1.8	3.66	26.26	122.23	90.14	1024.5	1114.6	191.8
2.0	4.07	25.85	126.08	93.99	1022.2	1116.2	173.73
2.2	4.48	25.44	129.62	97.52	1020.2	1117.7	158.85
2.4	4.89	25.03	132.89	100.79	1018.3	1119.1	146.38
2.6	5.29	24.63	135.94	103.83	1016.5	1120.3	135.78
2.8	5.70	24.22	138.79	106.68	1014.8	1121.5	126.65
3.0	6.11	23.81	141.48	109.37	1013.2	1122.6	118.71
3.5	7.13	22.79	147.57	115.46	1009.6	1125.1	102.72
4.0	8.14	21.78	152.97	120.86	1006.4	1127.3	90.63
4.5	9.16	20.76	157.83	125.71	1003.6	1129.3	81.16
5.0	10.18	19.74	162.24	130.13	1001.0	1131.1	73.52
5.5	11.20	18.72	166.30	134.19	998.5	1132.7	67.24
6.0	12.22	17.70	170.06	137.96	996.2	1134.2	61.98
6.5	13.23	16.69	173.56	141.47	994.1	1135.6	57.50
7.0	14.25	15.67	176.85	144.76	992.1	1136.9	53.64
7.5	15.27	14.65	179.94	147.86	990.2	1138.1	50.29
8.0	16.29	13.63	182.86	150.79	988.5	1139.3	47.34
8.5	17.31	12.61	185.64	153.57	986.8	1140.4	44.73
9.0	18.32	11.60	188.28	156.22	985.2	1141.4	42.40
9.5	19.34	10.58	190.80	158.75	983.6	1142.3	40.31
10.0	20.36	9.56	193.21	161.17	982.1	1143.3	38.42
11.0	22.40	7.52	197.75	165.73	979.3	1145.0	35.14
12.0	24.43	5.49	201.96	169.96	976.6	1146.6	32.40
13.0	26.47	3.45	205.88	173.91	974.2	1148.1	30.06
14.0	28.50	1.42	209.56	177.61	971.9	1149.5	28.04

Pressure Lbs. per Sq. In.		Temperature	Heat of the Liquid	Latent Heat of Evaporation	Total Heat of Steam	Specific Volume
Absolute P'	Gage P	t Degrees F	Btu/lb.	Btu/lb.	h_g Btu/lb.	$\overline{V}$ Cu. ft. per lb.
14.696	0.0	212.00	180.07	970.3	1150.4	26.80
15.0	0.3	213.03	181.11	969.7	1150.8	26.29
16.0	1.3	216.32	184.42	967.6	1152.0	24.75
17.0	2.3	219.44	187.56	965.5	1153.1	23.39
18.0	3.3	222.41	190.56	963.6	1154.2	22.17
19.0	4.3	225.24	193.42	961.9	1155.3	21.08
20.0	5.3	227.96	196.16	960.1	1156.3	20.089
21.0	6.3	230.57	198.79	958.4	1157.2	19.192
22.0	7.3	233.07	201.33	956.8	1158.1	18.375
23.0	8.3	235.49	203.78	955.2	1159.0	17.627
24.0	9.3	237.82	206.14	953.7	1159.8	16.938
25.0	10.3	240.07	208.42	952.1	1160.6	16.303
26.0	11.3	242.25	210.62	950.7	1161.3	15.715
27.0	12.3	244.36	212.75	949.3	1162.0	15.170
28.0	13.3	246.41	214.83	947.9	1162.7	14.663
29.0	14.3	248.40	216.86	946.5	1163.4	14.189
30.0	15.3	250.33	218.82	945.3	1164.1	13.746
31.0	16.3	252.22	220.73	944.0	1164.7	13.330
32.0	17.3	254.05	222.59	942.8	1165.4	12.940
33.0	18.3	255.84	224.41	941.6	1166.0	12.572
34.0	19.3	257.58	226.18	940.3	1166.5	12.226

* Abstracted from Thermodynamic Properties of Steam by J. H. Keenan and F. G. Keyes, 1936 Edition, by permission of the publishers, John Wiley & Sons, Inc.

(continued on the next three pages)

CRTX 1223

Simplified Flow Formula for Compressible Fluids

Pipe or Valve Pressure Drop, Rate of Flow, and Size

The simplified flow formula was developed from the Darcy formula and employs friction factors for the fully turbulent flow range; see page 429.

$$\Delta P_{100} = C_1 C_2 \overline{V} \qquad C_1 = \frac{\Delta P_{100}}{C_2 \overline{V}} \qquad C_2 = \frac{\Delta P_{100}}{C_1 \overline{V}}$$

$$\Delta P_{100} = \frac{C_1 C_2}{\rho} \qquad C_1 = \frac{\Delta P_{100} \rho}{C_2} \qquad C_2 = \frac{\Delta P_{100} \rho}{C_1}$$

ΔP_{100} = pressure drop per 100 feet of pipe, in pounds per sq. inch
C_1 = discharge factor, from chart at the right
C_2 = size factor, from table on the facing page
$\overline{V}$ = specific volume, in cubic feet per pound
(for steam, see pages 436 to 442)
ρ = weight density, in pounds per cubic foot
(for air or gas, see page 428)

Limitations of Simplified Flow Formula

1. Flow rates through throttled or reduced seat valves may be restricted by sonic velocity at the seat; the formula is not applicable for this condition of flow.

2. The formula is accurate for the fully turbulent flow range indicated by the friction factor diagram, and also provides a good approximation for most normal flow conditions.

3. When pressure drop is less than 10 percent of the inlet gauge pressure, use $\overline{V}$ or ρ based on either inlet or outlet conditions.

4. When pressure drop is greater than 10 percent but less than 40 percent of the inlet gauge pressure, use the average of $\overline{V}$ or ρ based on inlet and outlet conditions.

5. When pressure drop is greater than 40 percent of the inlet gauge pressure, divide the pipe into shorter sections and use $\overline{V}$ or ρ based on an average of the inlet and outlet conditions of the shorter pipe section.

Converting Flow Rates

To convert flow rates given in pounds per hour (W), to standard cubic feet per hour (q'_h) or to standard cubic feet per minute (q'_m), use the following formulas:

$$q'_h = \frac{W}{0.0764\ S_g} \qquad q'_m = \frac{W}{4.58\ S_g}$$

Example 1

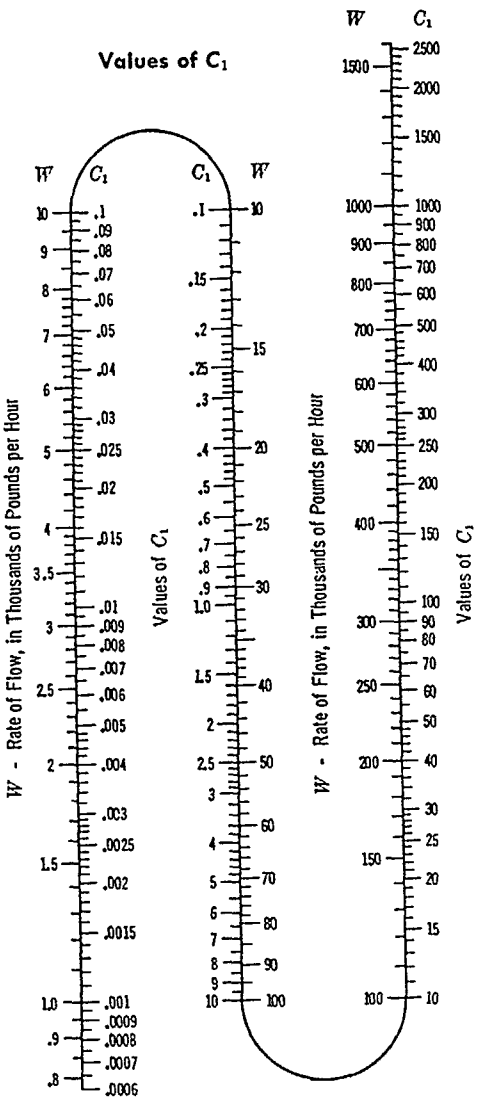
Given: Steam at 345 psig and 500 F flows through an 8-inch 300-pound steel plug type seat angle valve at a rate of 240,000 pounds per hour.

Find: The pressure drop through the valve.

Solution: Referring to the tables on page 424, note that resistance of the given valve is based on Schedule 80 pipe and its equivalent length in pipe diameters is 145.

I.D. of 8-inch Schedule 80 pipe = 7.625 ....page 346
Equivalent length of valve in feet of Schedule 80 pipe = 92 feet ....page 425
Calculate the pressure drop per 100 feet of pipe:
C_1 = 57 .....from this page
C_2 = 0.185 .....from facing page
$\overline{V}$ = 1.45 .....page 440

ΔP_{100} = 57 x 0.185 x 1.45 = 15.3
Pressure drop through valve = 15.3 (92/100) = 14.1 psi



Example 2

Given: The pressure drop is 5 psi with 100 psig air at 90 F flowing through 100 feet of 4-inch Schedule 40 pipe.

Find: The flow rate in standard cubic feet per minute (scfm).

Solution: ΔP_{100} = 5.0
C_2 = 5.17
ρ = 0.564 .....from page 428

C_1 = (5.0 x 0.564) ÷ 5.17 = 0.545
W = 23 000

$$q'_m = \frac{W}{4.58\ S_g} = \frac{23\,000}{4.58 \times 1.0} = 5022 \text{ scfm}$$

Nomenclature .....see page 421
Example on "determining pipe size" ....see next page

CRTX 1221

004170

Flow of Water Through Schedule 40 Steel Pipe

Discharge		Pressure Drop per 100 feet and Velocity in Schedule 40 Pipe for Water at 60 F															
		Velocity	Press. Drop	Velocity	Press. Drop	Velocity	Press. Drop	Velocity	Press. Drop	Velocity	Press. Drop	Velocity	Press. Drop	Velocity	Press. Drop	Velocity	Press. Drop
Gallons per Minute	Cubic Ft. per Second	Feet per Second	Lbs. per Sq. In	Feet per Second	Lbs. per Sq. In.	Feet per Second	Lbs. per Sq. In.	Feet per Second	Lbs. per Sq In	Feet per Second	Lbs. per Sq In.	Feet per Second	Lbs. per Sq. In.	Feet per Second	Lbs. per Sq. In.	Feet per Second	Lbs per Sq In.
		1/8"		1/4"		3/8"		1/2"									
.2	0.000446	1.13	1.86	0.616	0.359					3/4"							
.3	0.000668	1.69	4.22	0.924	0.903	0.504	0.159	0.317	0.061								
.4	0.000891	2.26	6.98	1.23	1.61	0.672	0.345	0.422	0.086								
.5	0.00111	2.82	10.5	1.54	2.39	0.840	0.539	0.528	0.167	0.301	0.033						
.6	0.00134	3.39	14.7	1.85	3.29	1.01	0.751	0.633	0.240	0.361	0.041						
.8	0.00178	4.52	25.0	2.46	5.44	1.34	1.25	0.844	0.408	0.481	0.102	1"		1¼"			
1	0.00223	5.65	37.2	3.08	8.28	1.68	1.85	1.06	0.600	0.602	0.155	0.371	0.048			1½"	
2	0.00446	11.29	134.4	6.16	30.1	3.36	6.58	2.11	2.10	1.20	0.526	0.743	0.164	0.429	0.044		
3	0.00668			9.25	64.1	5.04	13.9	3.17	4.33	1.81	1.09	1.114	0.336	0.644	0.090	0.473	0.043
4	0.00891			12.33	111.2	6.72	23.9	4.22	7.42	2.41	1.83	1.49	0.565	0.858	0.150	0.630	0.071
5	0.01114	2"				8.40	36.7	5.28	11.2	3.01	2.75	1.86	0.835	1.073	0.223	0 788	0.104
6	0.01337	0.574	0.044	2½"		10.08	51.9	6.33	15.8	3.61	3.84	2.23	1.17	1.29	0.309	0.946	0.145
8	0.01782	0.765	0.073			13.44	91.1	8.45	27.7	4.81	6.60	2.97	1.99	1.72	0.518	1.26	0.241
10	0.02228	0.956	0.108	0.670	0.046			10.56	42.4	6.02	9.99	3.71	2.99	2.15	0.774	1.58	0.361
15	0.03342	1.43	0.224	1.01	0.094	3"				9.03	21.6	5.57	6.36	3.22	1.63	2.37	0.755
20	0.04456	1.91	0.375	1.34	0.158	0.868	0.056	3½"		12.03	37.8	7.43	10.9	4.29	2.78	3.16	1.28
25	0.05570	2.39	0.561	1.68	0.234	1.09	0.083	0.812	0.041	4"		9.28	16.7	5.37	4.22	3.94	1.93
30	0.06684	2.87	0.786	2.01	0.327	1.30	0.114	0.974	0.056			11.14	23.8	6.44	5.92	4.73	2.72
35	0.07798	3.35	1.05	2.35	0.436	1.52	0.151	1.14	0.704	0.882	0.041	12.99	32.2	7.51	7.90	5.52	3.64
40	0.08912	3.83	1.35	2.68	0.556	1.74	0.192	1.30	0.095	1.01	0.052	14.85	41.5	8.59	10.24	6.30	4.65
45	0.1003	4.30	1.67	3.02	0.668	1.95	0.239	1.46	0.117	1.13	0.064			9.67	12.80	7.09	5.85
50	0.1114	4.78	2.03	3.35	0.839	2.17	0.288	1.62	0.142	1.26	0.076	5"		10.74	15.66	7.88	7.15
60	0.1337	5.74	2.87	4.02	1.18	2.60	0.406	1.95	0.204	1.51	0.107			12.89	22.2	9.47	10.21
70	0.1560	6.70	3.84	4.69	1.59	3.04	0.540	2.27	0.261	1.76	0.143	1.12	0.047			11.05	13.71
80	0.1782	7.65	4.97	5.36	2.03	3.47	0.687	2.60	0.334	2.02	0.180	1.28	0.060			12.62	17.59
90	0.2005	8.60	6.20	6.03	2.53	3.91	0.861	2.92	0.416	2.27	0.224	1.44	0.074	6"		14.20	22.0
100	0.2228	9.56	7.59	6.70	3.09	4.34	1.05	3.25	0.509	2.52	0.272	1.60	0.090	1.11	0.036	15.78	26.9
125	0.2785	11.97	11.76	8.38	4.71	5.43	1.61	4.06	0.769	3.15	0.415	2.01	0.135	1.39	0.055	19.72	41.4
150	0.3342	14.36	16.70	10.05	6.69	6.51	2.24	4.87	1.08	3.78	0.580	2.41	0.190	1.67	0.077		
175	0.3899	16.75	22.3	11.73	8.97	7.60	3.00	5.68	1.44	4.41	0.774	2.81	0.253	1.94	0.102		
200	0.4456	19.14	28.8	13.42	11.68	8.68	3.87	6.49	1.85	5.04	0.985	3.21	0.323	2.22	0.130	8"	
225	0.5013	...	...	15.09	14.63	9.77	4.83	7.30	2.32	5.67	1.23	3.61	0.401	2.50	0.162	1.44	0.043
250	0.557	...	...	...	...	10.85	5.93	8.12	2.84	6.30	1.46	4.01	0.495	2.78	0.195	1.60	0.051
275	0.6127	...	...	...	...	11.94	7.14	8.93	3.40	6.93	1.79	4.41	0.583	3.05	0.234	1.76	0.061
300	0.6684	...	...	...	...	13.00	8.36	9.74	4.02	7.56	2.11	4.81	0.683	3.33	0.275	1.92	0.072
325	0.7241	...	...	...	...	14.12	9.89	10.53	4.09	8.19	2.47	5.21	0.797	3.61	0.320	2.08	0.083
350	0.7798			...	...	...	...	11.36	5.41	8.82	2.84	5.62	0.919	3.89	0.367	2.24	0.095
375	0.8355			...	...	...	...	12.17	6.18	9.45	3.25	6.02	1.05	4.16	0.416	2 40	0.108
400	0.8912			...	...	...	...	12 98	7.03	10 08	3.68	6.42	1.19	4.44	0.471	2.56	0.121
425	0.9469			...	...	...	...	13.80	7.89	10.71	4.12	6.82	1.33	4.72	0.529	2.73	0.136
450	1.003	10"		...	...	...	...	14.61	8.80	11.34	4.60	7.22	1.48	5.00	0.590	2.89	0.151
475	1.059	1.93	0.054			...	...	...	...	11.97	5.12	7.62	1.64	5.27	0.653	3.04	0.166
500	1.114	2.03	0.059			...	...	...	...	12.60	5.65	8.02	1.81	5.55	0.720	3.21	0.182
550	1.225	2.24	0.071			...	...	...	...	13.85	6.79	8.82	2.17	6.11	0.861	3.53	0.219
600	1.337	2.44	0.083			...	...	...	...	15.12	8.04	9.63	2.55	6.66	1.02	3.85	0.258
650	1.448	2.64	0.097	12"		...	...	...	...	...	...	10.43	2.98	7.22	1.18	4.17	0.301
700	1.560	2.85	0.112	2.01	0.047							11.23	3.43	7.78	1.35	4.49	0.343
750	1.671	3.05	0.127	2.15	0.054	14"		...	...	...	...	12.03	3.92	8.33	1.55	4.81	0.392
800	1.782	3.25	0.143	2.29	0.061			...	...	...	...	12.83	4.43	8.88	1.75	5.13	0.443
850	1.894	3.46	0.160	2.44	0.068	2 02	0.042	...	...	...	...	13.64	5.00	9.44	1.96	5.45	0.497
900	2.005	3.66	0.179	2.58	0.075	2.13	0.047	...	...	...	...	14.44	5.58	9.99	2.18	5.77	0.554
950	2.117	3.86	0.198	2.72	0.083	2.25	0.052					15.24	6.21	10.55	2.42	6.09	0.613
1 000	2.228	4.07	0.218	2.87	0.091	2.37	0.057	16"				16.04	6.84	11.10	2.68	6.41	0.675
1 100	2.451	4 48	0.260	3.15	0.110	2.61	0.068					17.65	8.23	12.22	3.22	7.05	0.807
1 200	2.674	4.88	0.306	3.44	0.128	2.85	0.080	2.18	0.042					13.33	3.81	7.70	0.948
1 300	2.896	5.29	0.355	3.73	0.150	3.08	0.093	2.36	0.048					14.43	4.45	8.33	1.11
1 400	3.119	5 70	0.409	4.01	0.171	3.32	0.107	2.54	0.055					15.55	5.13	8.98	1.28
1 500	3.342	6.10	0.466	4.30	0.195	3.56	0.122	2.72	0.063	18"				16.66	5.85	9.62	1.46
1 600	3.565	6.51	0.527	4.59	0.219	3.79	0.138	2.90	0.071					17.77	6.61	10 26	1.65
1 800	4.010	7.32	0.663	5.16	0.276	4.27	0.172	3.27	0.088	2.58	0.050			19 99	8.37	11.54	2.08
2 000	4.456	8.14	0.808	5.73	0.339	4.74	0.209	3.63	0.107	2.87	0.060	20"		22.21	10.3	12.82	2.55
2 500	5.570	10.17	1.24	7.17	0.515	5.93	0.321	4.54	0.163	3.59	0.091					16 03	3.94
3 000	6.684	12.20	1.76	8.60	0.731	7.11	0.451	5 45	0.232	4 30	0.129	3.46	0.075	24"		19.24	5.59
3 500	7.798	14.24	2.38	10 03	0.982	8.30	0.607	6.35	0.312	5.02	0.173	4.04	0.101			22 44	7.56
4 000	8.912	16.27	3.08	11 47	1.27	9 48	0.787	7.26	0.401	5.74	0.222	4.62	0.129	3.19	0.052	25 65	9.80
4 500	10.03	18.31	3.87	12.90	1.60	10.67	0.990	8.17	0.503	6.46	0.280	5.20	0.162	3.59	0.065	28.87	12.2
5 000	11.14	20.35	4.71	14 33	1.95	11 85	1.21	9.08	0.617	7 17	0.340	5.77	0.199	3.99	0.079	...	...
6 000	13.37	24.41	6.74	17.20	2.77	14.23	1.71	10.89	0.877	8 61	0.483	6 93	0.280	4 79	0.111	...	...
7 000	15.60	28.49	9.11	20.07	3.74	16 60	2.31	12.71	1.18	10 04	0.652	8.08	0.376	5 59	0.150	...	...
8 000	17.82	...	...	22 93	4.84	18 96	2.99	14.52	1.51	11 47	0.839	9.23	0.488	6.38	0.192	...	...
9 000	20.05	...	...	25.79	6.09	21.34	3.76	16.34	1.90	12.91	1.05	10.39	0.608	7.18	0.242	...	...
10 000	22.28	...	...	28.66	7.46	23.71	4.61	18.15	2.34	14.34	1.28	11.54	0.739	7.98	0.294	...	...
12 000	26.74	...	...	34.40	10.7	28.45	6.59	21.79	3.33	17.21	1.83	13.85	1.06	9.58	0.416	...	...
14 000	31.19	...	...	...	...	33.19	8.89	25 42	4.49	20 08	2.45	16.16	1.43	11.17	0.562	...	...
16 000	35.65	...	...	...	...	...	...	29 05	5.83	22.95	3.18	18.47	1.85	12.77	0.723	...	...
18 000	40.10	...	...	...	...	...	...	32.68	7.31	25.82	4.03	20.77	2.32	14 36	0.907	...	...
20 000	44.56	...	...	...	...	...	...	36.31	9.03	28 69	4.93	23.08	2.86	15.96	1.12	...	...

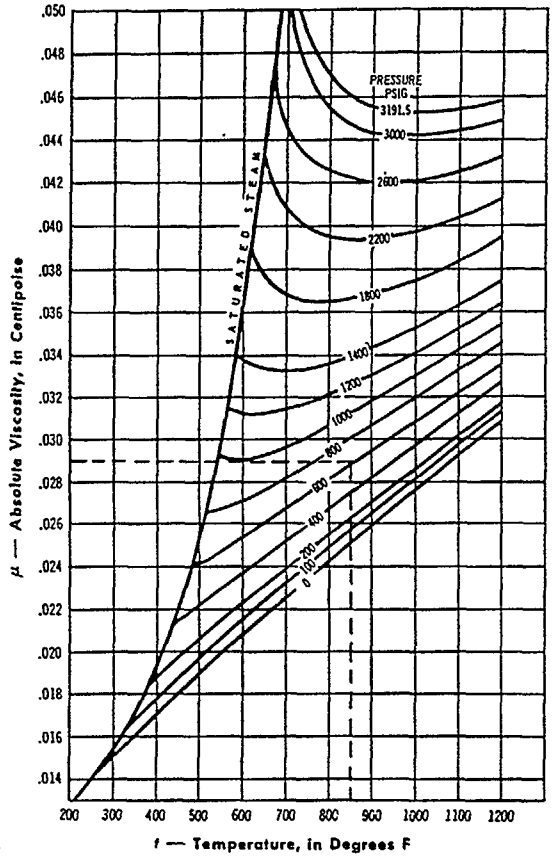
For pipe lengths other than 100 feet, the pressure drop is proportional to the length Thus, for 50 feet of pipe, the pressure drop is approximately one-half the value given in the table . . . for 300 feet, three times the given value, etc.

Velocity is a function of the cross sectional flow area; thus, it is constant for a given flow rate and is independent of pipe length

For calculations for pipe other than Schedule 40, see explanation on next page.

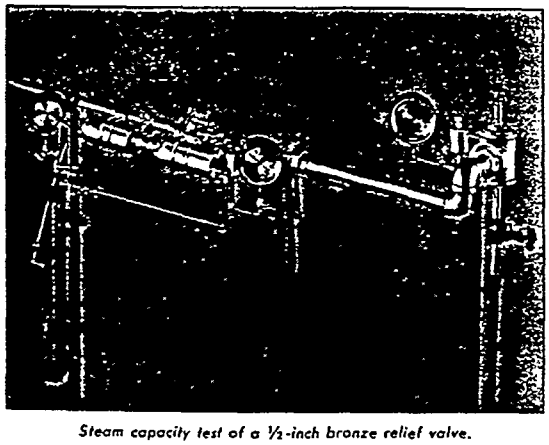
CRTX 1219

Viscosity of Steam



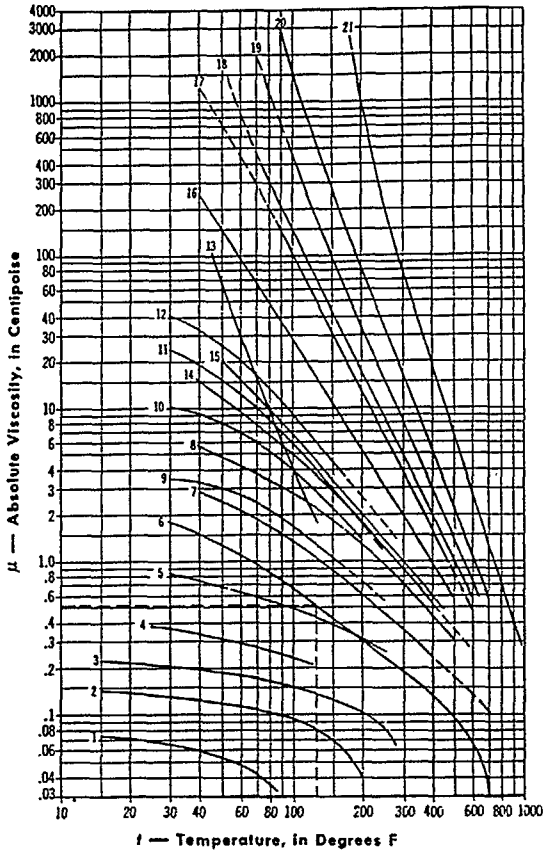
Example: The viscosity of steam at 600 psig, 850 Fahrenheit, is 0.029 centipoise.

Reference: Data adapted from Philip J. Potter's *Steam Power Plants*, Copyright 1949, courtesy of The Ronald Press Company.



Steam capacity test of a ½-inch bronze relief valve.

Viscosity of Water and Liquid Petroleum Products



1. Ethane (C_2H_6)
2. Propane (C_3H_8)
3. Butane (C_4H_{10})
4. Natural Gasoline
5. Gasoline
6. Water
7. Kerosene
8. Distillate
9. 48 Deg. API Crude
10. 40 Deg. API Crude
11. 35.6 Deg. API Crude
12. 32.6 Deg. API Crude
13. Salt Creek Crude
14. Fuel 3 (Max.)
15. Fuel 5 (Min.)
16. SAE 10 Lube (100 V.I.)
17. SAE 30 Lube (100 V.I.)
18. Fuel 5 (Max.) or 6 (Min.)
19. SAE 70 Lube (100 V.I.)
20. Bunker C Fuel (Max.) and M.C. Residuum
21. Asphalt

Example: The viscosity of water at 125 Fahrenheit is 0.52 centipoise (Curve No. 6).

References: Curves 1, 2, and 3 are taken from *Flow Measurement with Orifice Meters* by R. F. Stearns, R. M. Jackson, R. R. Johnson, and C. A Larson; courtesy of D. Van Nostrand Company, Inc., New York, 1951.

Curve 6 is taken from E. C. Bingham and R. F. Jackson, *Bureau of Standards Bulletin No. 14*, pages 58 to 86 (S.P. 298, August, 1916) (1919).

All remaining curves reproduced by permission of the Oil and Gas Journal.

CRTX 1217

Weight Density of Air and Gases

004166

Weight Density of Air*

Air Temp. Deg F.	Weight Density of Air, in Pounds per Cubic Foot For Gauge Pressures Indicated (Based on an atmospheric pressure of 14.696 and a molecular weight of 28.97)													
	0 psi	5 psi	10 psi	20 psi	30 psi	40 psi	50 psi	60 psi	70 psi	80 psi	90 psi	100 psi	110 psi	120 psi
30°	.0811	.1087	.1363	.1915	.247	.302	.357	.412	.467	.522	.578	.633	.688	.743
40	.0795	.1065	.1335	.1876	.242	.295	.350	.404	.458	.512	.566	.620	.674	.728
50	.0782	.1048	.1314	.1846	.238	.291	.344	.397	.451	.504	.557	.610	.663	.717
60	.0764	.1024	.1284	.1804	.232	.284	.336	.388	.440	.492	.544	.596	.648	.700
70	.0750	.1005	.1260	.1770	.228	.279	.330	.381	.432	.483	.534	.585	.636	.687
80	.0736	.0986	.1236	.1737	.224	.274	.324	.374	.424	.474	.524	.574	.624	.674
90	.0722	.0968	.1214	.1705	.220	.269	.318	.367	.416	.465	.515	.564	.613	.662
100	.0709	.0951	.1192	.1675	.216	.264	.312	.361	.409	.457	.505	.554	.602	.650
110	.0697	.0934	.1171	.1645	.212	.259	.307	.354	.402	.449	.497	.544	.591	.639
120	.0685	.0918	.1151	.1617	.208	.255	.302	.348	.395	.441	.488	.535	.581	.628
130	.0673	.0902	.1131	.1590	.205	.251	.296	.342	.388	.434	.480	.525	.571	.617
140	.0662	.0887	.1113	.1563	.201	.246	.291	.337	.382	.427	.472	.517	.562	.607
150	.0651	.0873	.1094	.1537	.1981	.242	.287	.331	.375	.420	.464	.508	.553	.597
175	.0626	.0834	.1051	.1477	.1903	.233	.275	.318	.361	.403	.446	.488	.531	.573
200	.0602	.0807	.1011	.1421	.1831	.224	.265	.306	.347	.388	.429	.470	.511	.552
225	.0580	.0777	.0974	.1369	.1764	.216	.255	.295	.334	.374	.413	.453	.492	.531
250	.0559	.0750	.0940	.1321	.1702	.208	.246	.284	.322	.361	.399	.437	.475	.513
275	.0540	.0724	.0908	.1276	.1644	.201	.238	.275	.311	.348	.385	.422	.459	.495
300	.0523	.0700	.0878	.1234	.1590	.1945	.230	.266	.301	.337	.372	.408	.443	.479
350	.0490	.0657	.0824	.1158	.1491	.1825	.216	.249	.283	.316	.349	.383	.416	.449
400	.0462	.0619	.0776	.1090	.1405	.1719	.203	.235	.266	.298	.329	.360	.392	.423
450	.0436	.0585	.0733	.1030	.1327	.1624	.1921	.222	.252	.281	.311	.341	.370	.400
500	.0414	.0555	.0695	.0977	.1258	.1540	.1821	.210	.238	.267	.295	.323	.351	.379
550	.0393	.0527	.0661	.0928	.1196	.1464	.1731	.1999	.227	.253	.280	.307	.334	.360
600	.0375	.0502	.0630	.0885	.1140	.1395	.1649	.1904	.216	.241	.267	.292	.318	.343
	130 psi	140 psi	150 psi	175 psi	200 psi	250 psi	300 psi	400 psi	500 psi	600 psi	700 psi	800 psi	900 psi	1000 psi
30°	.798	.853	.909	1.047	1.185	1.460	1.736	2.29	2.84	3.39	3.94	4.49	5.05	5.60
40	.782	.836	.890	1.026	1.161	1.431	1.702	2.24	2.78	3.32	3.86	4.40	4.95	5.49
50	.770	.823	.876	1.009	1.142	1.408	1.674	2.21	2.74	3.27	3.80	4.33	4.87	5.40
60	.752	.804	.856	.986	1.116	1.376	1.636	2.16	2.68	3.20	3.72	4.24	4.76	5.28
70	.738	.789	.840	.968	1.095	1.350	1.605	2.12	2.63	3.14	3.65	4.16	4.67	5.18
80	.724	.774	.824	.950	1.075	1.325	1.575	2.08	2.58	3.08	3.58	4.08	4.58	5.08
90	.711	.760	.809	.932	1.055	1.301	1.547	2.04	2.53	3.02	3.51	4.00	4.50	4.99
100	.698	.747	.795	.916	1.036	1.278	1.519	2.00	2.48	2.97	3.45	3.93	4.42	4.90
110	.686	.734	.781	.900	1.018	1.255	1.492	1.967	2.44	2.92	3.39	3.86	4.34	4.81
120	.674	.721	.768	.884	1.001	1.234	1.467	1.933	2.40	2.86	3.33	3.80	4.26	4.73
130	.663	.709	.755	.869	.984	1.213	1.442	1.900	2.36	2.82	3.27	3.73	4.19	4.65
140	.652	.697	.742	.855	.967	1.193	1.418	1.868	2.32	2.77	3.22	3.67	4.12	4.57
150	.641	.686	.730	.841	.951	1.173	1.395	1.838	2.28	2.72	3.17	3.61	4.05	4.50
175	.616	.659	.701	.807	.914	1.127	1.340	1.765	2.19	2.62	3.04	3.47	3.89	4.32
200	.593	.634	.675	.777	.879	1.084	1.289	1.698	2.11	2.52	2.93	3.34	3.75	4.16
225	.571	.610	.650	.749	.847	1.044	1.242	1.636	2.03	2.43	2.82	3.21	3.61	4.00
250	.551	.589	.627	.722	.817	1.088	1.198	1.579	1.959	2.34	2.72	3.10	3.48	3.86
275	.532	.569	.606	.698	.790	.973	1.157	1.525	1.893	2.26	2.63	3.00	3.36	3.73
300	.515	.550	.586	.675	.764	.941	1.119	1.475	1.830	2.19	2.54	2.90	3.25	3.61
350	.483	.516	.550	.633	.716	.883	1.050	1.384	1.717	2.05	2.38	2.72	3.05	3.39
400	.455	.486	.518	.596	.675	.832	.989	1.303	1.618	1.932	2.25	2.56	2.87	3.19
450	.430	.459	.489	.563	.638	.786	.934	1.232	1.529	1.826	2.12	2.42	2.72	3.01
500	.407	.436	.464	.534	.604	.745	.886	1.167	1.449	1.731	2.01	2.29	2.58	2.86
550	.387	.414	.441	.508	.575	.708	.842	1.110	1.377	1.645	1.912	2.18	2.45	2.72
600	.369	.394	.420	.484	.547	.675	.802	1.057	1.312	1.567	1.822	2.08	2.33	2.59

Interpolate for values at intermediate pressures or temperatures.

Air: Values in the table were calculated using the perfect gas law. Correction for supercompressibility, the deviation from the perfect gas law, would be less than three percent and has not been applied.

*Gases other than air: The weight density of gases other than air can be determined by multiplying the density listed for air by the specific gravity (S_g) of the gas relative to air.

CRTX 1215

004164

Resistance of Bends

Resistance of 90 Degree Bends

The chart at the right shows the resistance of 90 degree bends to the flow of fluids in terms of equivalent lengths of straight pipe.

Resistance of bends greater than 90 degrees is found using the formula:

$$\frac{L}{D} = R_t + (n-1)\left(R_t + \frac{R_b}{2}\right)$$

n = total number of 90° bends in coil
R_t = total resistance due to one 90° bend, in L/D
R_t = resistance due to length of one 90° bend, in L/D
R_b = bend resistance due to one 90° bend, in L/D

Problem: Determine the equivalent lengths in pipe diameters of a 90 degree bend and a 270 degree bend having a relative radius of 12.

Solution: Referring to the "Total Resistance" curve, the equivalent length for a 90 degree bend is 34.5 pipe diameters.

The equivalent length of a 270 degree bend is:

$L/D = 34.5 + (3-1)\,[18.7 + (15.8 \div 2)]$
$L/D = 87.7$ pipe diameters

Note: This loss is less than the sum of losses through three 90 degree bends separated by tangents.

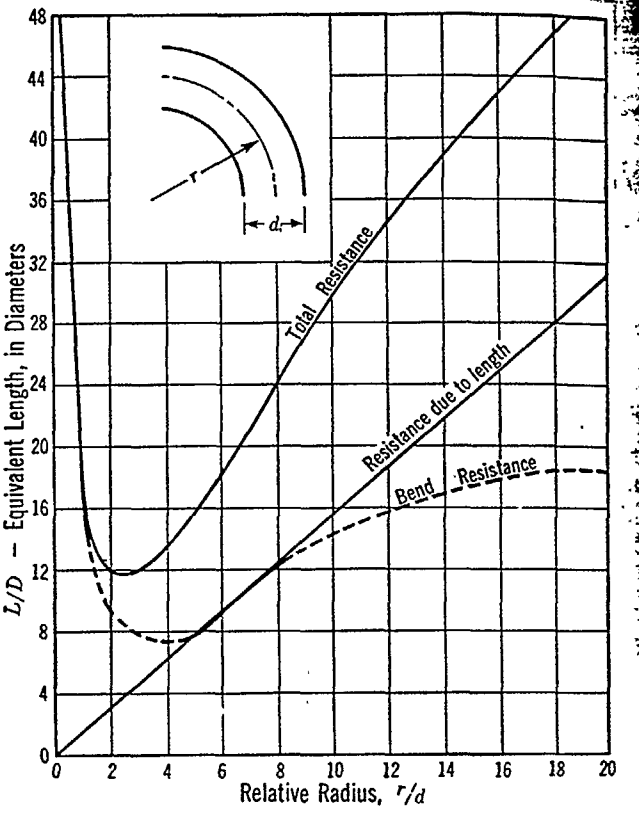


Chart for Resistance of 90 Degree Bends

From *Pressure Losses for Fluid Flow in 90 Degree Pipe Bends* by K. H. Beij. Courtesy of Journal of Research of National Bureau of Standards, Vol. 21, July, 1938.

Resistance of Miter Bends

The chart at the lower right shows the resistance of miter bends to the flow of fluids. The chart is based on data published by the American Society of Mechanical Engineers (ASME).

Problem: Determine the equivalent length in pipe diameters of a 40 degree miter bend.

Solution: Referring to the "Total Resistance" curve in the chart, the equivalent length is 12 pipe diameters.

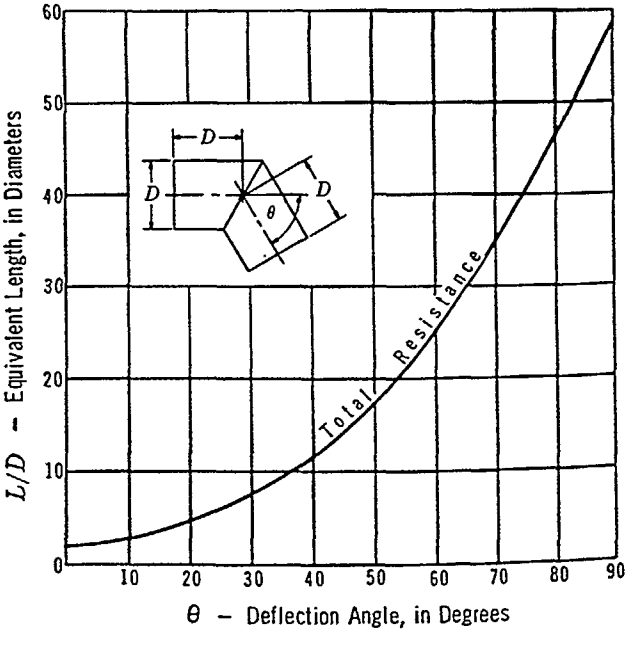


Chart for Resistance of Miter Bends

From H. Kirchbach's *Loss of Energy in Miter Bends;* Transactions of the Munich Hydraulic Institute, Bulletin No. 3, American Society of Mechanical Engineers, New York, 1935

CRTX 1213

Schedule (Thickness) of Steel Pipe Used in Obtaining Resistance Of Valves and Fittings of Various Pressure Classes by Test*

Valve or Fitting ASA Pressure Classification (Steam Rating)		Schedule No. of Pipe (Thickness)
250-Pound and Lower		Schedule 40
300-Pound to 600-Pound		Schedule 80
900-Pound		Schedule 120
1500-Pound		Schedule 160
2500-Pound	Sizes ½ to 6-inch	xx (Double Extra Strong)
	Sizes 8-inch and larger	Schedule 160

*These schedule numbers have been arbitrarily selected only for the purpose of identifying the various pressure classes of valves and fittings with specific pipe dimensions for the interpretation of flow test data; they should not be construed as a recommendation for installation purposes.

Representative Equivalent Length† in Pipe Diameters (*L/D*) Of Various Valves and Fittings

Description of Product				Equivalent Length In Pipe Diameters (*L/D*)
Globe Valves	Conventional	With no obstruction in flat, bevel, or plug type seat	Fully open	340
		With wing or pin guided disc	Fully open	450
	Y-Pattern	(No obstruction in flat, bevel, or plug type seat)		
		– With stem 60 degrees from run of pipe line	Fully open	175
		– With stem 45 degrees from run of pipe line	Fully open	145
Angle Valves	Conventional	With no obstruction in flat, bevel, or plug type seat	Fully open	145
		With wing or pin guided disc	Fully open	200
Gate Valves	Conventional Wedge Disc, Double Disc, or Plug Disc		Fully open	13
			Three-quarters open	35
			One-half open	160
			One-quarter open	900
	Pulp Stock		Fully open	17
			Three-quarters open	50
			One-half open	260
			One-quarter open	1200
	Conduit Pipe Line		Fully open	3**
Check Valves	Conventional Swing		0.5†...Fully open	135
	Clearway Swing		0.5†...Fully open	50
	Globe Lift or Stop		2.0†...Fully open	Same as Globe
	Angle Lift or Stop		2.0†...Fully open	Same as Angle
	In-Line Ball	2.5 vertical and 0.25 horizontal	†...Fully open	150
Foot Valves with Strainer		With poppet lift-type disc	0.3†...Fully open	420
		With leather-hinged disc	0.4†...Fully open	75
Butterfly Valves (6-inch and larger)			Fully open	20
Cocks	Straight-Through	Rectangular plug port area equal to 100% of pipe area	Fully open	18
	Three-Way	Rectangular plug port area equal to 80% of pipe area (fully open)	Flow straight through	44
			Flow through branch	140
Fittings	90 Degree Standard Elbow			30
	45 Degree Standard Elbow			16
	90 Degree Long Radius Elbow			20
	90 Degree Street Elbow			50
	45 Degree Street Elbow			26
	Square Corner Elbow			57
	Standard Tee	With flow through run		20
		With flow through branch		60
	Close Pattern Return Bend			50
Pipe	90 Degree Pipe Bends			see page 426
	Miter Bends			see page 426
	Sudden Enlargements and Contractions			see page 427
	Entrance and Exit Losses			see page 427

**Exact equivalent length is equal to the length between flange faces or welding ends.

†Minimum calculated pressure drop (psi) across valve to provide sufficient flow to lift disc fully

‡For limitations and effect of end connections, see page 423.

For resistance factor "K" and equivalent length in feet of pipe, see page 425.

004160 Flow of Fluids Through Valves, Fittings, and Pipe

Equivalent length L or L/D and resistance coefficient K

The numerous types of valves and fittings and the great variety of service conditions make it virtually impossible to obtain test data on every size and type of valve and fitting used today. For this reason, it is desirable to find a means of utilizing the limited test data which are available. Several methods of accomplishing this have been devised; the most commonly used are the "equivalent length" and "resistance coefficient methods."

The resistance coefficient K in the equation

$$h_L = K \frac{v^2}{2g} \qquad \text{Equation 1}$$

is defined as the number of velocity heads lost due to a valve or fitting. The same head loss in straight pipe is expressed by the Darcy equation:

$$h_L = \left(f \frac{L}{D}\right) \frac{v^2}{2g} \qquad \text{Equation 2}$$

It follows that,

$$K = \left(f \frac{L}{D}\right) \qquad \text{Equation 3}$$

The length of pipe in feet, L, or the ratio L/D in pipe diameters is the equivalent length of straight pipe which will cause the same pressure drop as a valve under the same flow conditions.

The resistance coefficient, K, would theoretically be a constant for all sizes of a given design or line of valves and fittings if all sizes were geometrically similar. Geometric similarity is seldom, if ever, achieved because the design of valves and fittings is dictated by manufacturing economies, standards, structural strength, and other considerations. For geometric similarity, relative roughness of surfaces would also have to be similar.

An extensive study of Crane and various other sources of test data revealed that the resistance coefficient K had a definite tendency to vary with sizes of valves, in much the same manner as friction factor varies with sizes of pipe. It is probably coincidence that the effect of geometric dissimilarity between different sizes of the same lines of valves or fittings upon the resistance coefficient, K, is similar to that of relative roughness or size of pipe, upon friction factor. The study of test data also indicated that the equivalent length L/D tends toward being constant for the various sizes of a given line of valves or fittings.

In the flow range of complete turbulence as defined by the Friction Factor Chart shown on page 429, both K and L/D are, of course, constant for a given size. In the transition zone, where f for pipe increases with decreasing Reynolds numbers, it is assumed that the value of L/D is constant and that K varies in the same manner as friction factor. Limited tests have shown that this is not an exact relationship and that it may vary for different types of valves and fittings; however, since the tendency is in this direction, it is believed to provide more accurate solutions than would the assumption that K is constant for all Reynolds numbers.

Relationship of equivalent length L/D and resistance coefficient K to the inside diameter of connecting pipe

Tests have shown that the pressure drop due to a given valve or fitting does not change when the product is installed with pipe of the same nominal size but of different thickness. Small variations in entrance and exit losses caused by mating the valve ends to variable pipe thicknesses, within reasonable limits, are insignificant. Since the pressure drop is a function of the square of the velocity, and velocity is a function of the square of the internal diameter, it follows that the equivalent length of a given valve or fitting, expressed in terms of the pipe to which it is connected, varies as the fourth power of the internal diameter of the pipe.

For example, if the equivalent length of a ½-inch valve is determined by test to be 100 pipe diameters of Schedule 80 pipe, its equivalent length will be 169 diameters of Schedule 40 pipe, since the ratio of the inside diameters of the two pipes to the fourth power is 1.69. This ratio, of course, varies with the different sizes and thicknesses of pipes.

In view of this condition, the Crane Engineering Laboratories have established the practice of making all flow tests with pipe having internal diameters normally used with the particular valve or fitting. For this purpose, pipe normally used with the various pressure classes of valves and fittings have been arbitrarily established in accordance with the table shown at the top of page 424.

Computation of pressure drop using equivalent length coefficient data established on the basis of this table should be made using pipe dimensions shown on pages 346 and 347; for installation conditions not in agreement with the table, the equivalent length in pipe diameters should be multiplied by the ratio of diameters to the fourth power.

$$\left(\frac{L}{D}\right)_a = \left(\frac{L}{D}\right)_b \left(\frac{d_a}{d_b}\right)^4 \qquad \text{Equation 4}$$

where, subscript "a" defines the equivalent lengths with reference to the internal diameter of the pipe in which the valve will be installed,

and subscript "b" defines the known equivalent lengths and the internal diameters of the pipe for which these equivalent lengths were established.

This procedure of obtaining equivalent length data with respect to pipe of various internal diameters corrects a significant variable that has often been neglected in translating test data and makes possible a more accurate prediction of the flow characteristics of untested valves and fittings by comparison of detail dimensions and shapes with tested items.

Resistance coefficient K can be calculated for the pipe in which the valve will be installed by employing the formula

$$K = f\left(\frac{L}{D}\right)_a$$

Friction factor f will be based on flow in the pipe in which the valve will be installed.

Temperature Conversion

064158

—459.4° to 0°			1° to 60°			61° to 290°			300° to 890°			900° to 3000°		
C	C / F	F	C	C / F	F	C	C / F	F	C	C / F	F	C	C / F	F
−273	−459.4		−17.2	1	33.8	16.1	61	141.8	149	300	572	482	900	1652
−268	−450		−16.7	2	35.6	16.7	62	143.6	154	310	590	488	910	1670
−262	−440		−16.1	3	37.4	17.2	63	145.4	160	320	608	493	920	1688
−257	−430		−15.6	4	39.2	17.8	64	147.2	166	330	626	499	930	1706
−251	−420		−15.0	5	41.0	18.3	65	149.0	171	340	644	504	940	1724
−246	−410		−14.4	6	42.8	18.9	66	150.8	177	350	662	510	950	1742
−240	−400		−13.9	7	44.6	19.4	67	152.6	182	360	680	516	960	1760
−234	−390		−13.3	8	46.4	20.0	68	154.4	188	370	698	521	970	1778
−229	−380		−12.8	9	48.2	20.6	69	156.2	193	380	716	527	980	1796
−223	−370		−12.2	10	50.0	21.1	70	158.0	199	390	734	532	990	1814
−218	−360		−11.7	11	51.8	21.7	71	159.8	204	400	752	538	1000	1832
−212	−350		−11.1	12	53.6	22.2	72	161.6	210	410	770	549	1020	1868
−207	−340		−10.6	13	55.4	22.8	73	163.4	216	420	788	560	1040	1904
−201	−330		−10.0	14	57.2	23.3	74	165.2	221	430	806	571	1060	1940
−196	−320		− 9.4	15	59.0	23.9	75	167.0	227	440	824	582	1080	1976
−190	−310		− 8.9	16	60.8	24.4	76	168.8	232	450	842	593	1100	2012
−184	−300		− 8.3	17	62.6	25.0	77	170.6	238	460	860	604	1120	2048
−179	−290		− 7.8	18	64.4	25.6	78	172.4	243	470	878	616	1140	2084
−173	−280		− 7.2	19	66.2	26.1	79	174.2	249	480	896	627	1160	2120
−169	−273	−459.4	− 6.7	20	68.0	26.7	80	176.0	254	490	914	638	1180	2156
−168	−270	−454	− 6.1	21	69.8	27.2	81	177.8	260	500	932	649	1200	2192
−162	−260	−436	− 5.6	22	71.6	27.8	82	179.6	266	510	950	660	1220	2228
−157	−250	−418	− 5.0	23	73.4	28.3	83	181.4	271	520	968	671	1240	2264
−151	−240	−400	− 4.4	24	75.2	28.9	84	183.2	277	530	986	682	1260	2300
−146	−230	−382	− 3.9	25	77.0	29.4	85	185.0	282	540	1004	693	1280	2336
−140	−220	−364	− 3.3	26	78.8	30.0	86	186.8	288	550	1022	704	1300	2372
−134	−210	−346	− 2.8	27	80.6	30.6	87	188.6	293	560	1040	732	1350	2462
−129	−200	−328	− 2.2	28	82.4	31.1	88	190.4	299	570	1058	760	1400	2552
−123	−190	−310	− 1.7	29	84.2	31.7	89	192.2	304	580	1076	788	1450	2642
−118	−180	−292	− 1.1	30	86.0	32.2	90	194.0	310	590	1094	816	1500	2732
−112	−170	−274	− 0.6	31	87.8	32.8	91	195.8	316	600	1112	843	1550	2822
−107	−160	−256	0.0	32	89.6	33.3	92	197.6	321	610	1130	871	1600	2912
−101	−150	−238	0.6	33	91.4	33.9	93	199.4	327	620	1148	899	1650	3002
− 96	−140	−220	1.1	34	93.2	34.4	94	201.2	332	630	1166	927	1700	3092
− 90	−130	−202	1.7	35	95.0	35.0	95	203.0	338	640	1184	954	1750	3182
− 84	−120	−184	2.2	36	96.8	35.6	96	204.8	343	650	1202	982	1800	3272
− 79	−110	−166	2.8	37	98.6	36.1	97	206.6	349	660	1220	1010	1850	3362
− 73	−100	−148	3.3	38	100.4	36.7	98	208.4	354	670	1238	1038	1900	3452
− 68	− 90	−130	3.9	39	102.2	37.2	99	210.2	360	680	1256	1066	1950	3542
− 62	− 80	−112	4.4	40	104.0	37.8	100	212.0	366	690	1274	1093	2000	3632
− 57	− 70	− 94	5.0	41	105.8	43	110	230	371	700	1292	1121	2050	3722
− 51	− 60	− 76	5.6	42	107.6	49	120	248	377	710	1310	1149	2100	3812
− 46	− 50	− 58	6.1	43	109.4	54	130	266	382	720	1328	1177	2150	3902
− 40	− 40	− 40	6.7	44	111.2	60	140	284	388	730	1346	1204	2200	3992
− 34	− 30	− 22	7.2	45	113.0	66	150	302	393	740	1364	1232	2250	4082
− 29	− 20	− 4	7.8	46	114.8	71	160	320	399	750	1382	1260	2300	4172
− 23	− 10	14	8.3	47	116.6	77	170	338	404	760	1400	1288	2350	4262
− 17.8	0	32	8.9	48	118.4	82	180	356	410	770	1418	1316	2400	4352
			9.4	49	120.2	88	190	374	416	780	1436	1343	2450	4442
			10.0	50	122.0	93	200	392	421	790	1454	1371	2500	4532
			10.6	51	123.8	99	210	410	427	800	1472	1399	2550	4622
			11.1	52	125.6	100	212	413.6	432	810	1490	1427	2600	4712
			11.7	53	127.4	104	220	428	438	820	1508	1454	2650	4802
			12.2	54	129.2	110	230	446	443	830	1526	1482	2700	4892
			12.8	55	131.0	116	240	464	449	840	1544	1510	2750	4982
			13.3	56	132.8	121	250	482	454	850	1562	1538	2800	5072
			13.9	57	134.6	127	260	500	460	860	1580	1566	2850	5162
			14.4	58	136.4	132	270	518	466	870	1598	1593	2900	5252
			15.0	59	138.2	138	280	536	471	880	1616	1621	2950	5342
			15.6	60	140.0	143	290	554	477	890	1634	1649	3000	5432

Locate temperature in middle column. If in degrees Centigrade, read Fahrenheit equivalent in right hand column; if in degrees Fahrenheit, read Centigrade equivalent in left hand column.

Abstracted from "Bethlehem Alloy Steels" (Albert Sauveur type of table. Values revised). Courtesy Bethlehem Steel Company.

CRTX 1207

004156

Weight Conversion

Pounds to Kilograms

(1 pound = 0.4536 kilogram)

Pounds	0	1	2	3	4	5	6	7	8	9
0	0.00	0.45	0.91	1.36	1.81	2.27	2.72	3.18	3.63	4.08
10	4.54	4.99	5.44	5.90	6.35	6.80	7.26	7.71	8.16	8.62
20	9.07	9.53	9.98	10.43	10.89	11.34	11.79	12.25	12.70	13.15
30	13.61	14.06	14.52	14.97	15.42	15.88	16.33	16.78	17.24	17.69
40	18.14	18.60	19.05	19.50	19.96	20.41	20.87	21.32	21.77	22.23
50	22.68	23.13	23.59	24.04	24.49	24.95	25.40	25.86	26.31	26.76
60	27.22	27.67	28.12	28.58	29.03	29.48	29.94	30.39	30.84	31.30
70	31.75	32.21	32.66	33.11	33.57	34.02	34.47	34.93	35.38	35.83
80	36.29	36.74	37.20	37.65	38.10	38.56	39.01	39.46	39.92	40.37
90	40.82	41.28	41.73	42.18	42.64	43.09	43.55	44.00	44.45	44.91

Kilograms to Pounds

(1 kilogram = 2.2046 pounds)

Kilograms	0	1	2	3	4	5	6	7	8	9
0	0.00	2.20	4.41	6.61	8.82	11.02	13.23	15.43	17.64	19.84
10	22.05	24.25	26.46	28.66	30.86	33.07	35.27	37.48	39.68	41.89
20	44.09	46.30	48.50	50.71	52.91	55.12	57.32	59.52	61.73	63.93
30	66.14	68.34	70.55	72.75	74.96	77.16	79.37	81.57	83.77	85.98
40	88.18	90.39	92.59	94.80	97.00	99.21	101.41	103.62	105.82	108.03
50	110.23	112.43	114.64	116.84	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.09	143.30	145.50	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.75	171.96	174.16
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.00	196.21
90	198.41	200.62	202.82	205.03	207.23	209.44	211.64	213.85	216.05	218.26

Pressure Conversion

Pounds per Square Inch to Kilograms per Square Centimeter

(1 pound per square inch = 0.0703066 kilogram per square centimeter)

1 to 30		31 to 60		61 to 90		91 to 200		205 to 400		410 to 700		710 to 1000		1010 to 1500	
Lbs. per Sq. Inch	Kg. per Sq. Cm.	Lbs. per Sq. Inch	Kg. per Sq. Cm.	Lbs. per Sq. Inch	Kg. per Sq. Cm.	Lbs. per Sq. Inch	Kg. per Sq. Cm.	Lbs. per Sq. Inch	Kg. per Sq. Cm.	Lbs. per Sq. Inch	Kg. per Sq. Cm.	Lbs. per Sq. Inch	Kg. per Sq. Cm.	Lbs. per Sq. Inch	Kg. per Sq. Cm.
1	.07	31	2.18	61	4.29	91	6.40	205	14.41	410	28.83	710	49.92	1010	71.01
2	.14	32	2.25	62	4.36	92	6.47	210	14.76	420	29.53	720	50.62	1020	71.71
3	.21	33	2.32	63	4.43	93	6.54	215	15.12	430	30.23	730	51.32	1030	72.42
4	.28	34	2.39	64	4.50	94	6.61	220	15.47	440	30.93	740	52.03	1040	73.12
5	.35	35	2.46	65	4.57	95	6.68	225	15.82	450	31.64	750	52.73	1050	73.82
6	.42	36	2.53	66	4.64	96	6.75	230	16.17	460	32.34	760	53.43	1060	74.52
7	.49	37	2.60	67	4.71	97	6.82	235	16.52	470	33.04	770	54.14	1070	75.23
8	.56	38	2.67	68	4.78	98	6.89	240	16.87	480	33.75	780	54.84	1080	75.93
9	.63	39	2.74	69	4.85	99	6.96	245	17.23	490	34.45	790	55.54	1090	76.63
10	.70	40	2.81	70	4.92	100	7.03	250	17.58	500	35.15	800	56.25	1100	77.34
11	.77	41	2.88	71	4.99	105	7.38	255	17.93	510	35.86	810	56.95	1120	78.74
12	.84	42	2.95	72	5.06	110	7.73	260	18.28	520	36.56	820	57.65	1140	80.15
13	.91	43	3.02	73	5.13	115	8.09	265	18.63	530	37.26	830	58.35	1160	81.56
14	.98	44	3.09	74	5.20	120	8.44	270	18.98	540	37.97	840	59.06	1180	82.96
15	1.05	45	3.16	75	5.27	125	8.79	275	19.33	550	38.67	850	59.76	1200	84.37
16	1.12	46	3.23	76	5.34	130	9.14	280	19.69	560	39.37	860	60.46	1220	85.77
17	1.20	47	3.30	77	5.41	135	9.49	285	20.04	570	40.07	870	61.17	1240	87.18
18	1.27	48	3.37	78	5.48	140	9.84	290	20.39	580	40.78	880	61.87	1260	88.59
19	1.34	49	3.45	79	5.55	145	10.19	295	20.74	590	41.48	890	62.57	1280	89.99
20	1.41	50	3.52	80	5.62	150	10.55	300	21.09	600	42.18	900	63.28	1300	91.40
21	1.48	51	3.59	81	5.69	155	10.90	310	21.80	610	42.89	910	63.98	1320	92.80
22	1.55	52	3.66	82	5.77	160	11.25	320	22.50	620	43.59	920	64.68	1340	94.21
23	1.62	53	3.73	83	5.84	165	11.60	330	23.20	630	44.29	930	65.39	1360	95.62
24	1.69	54	3.80	84	5.91	170	11.95	340	23.90	640	45.00	940	66.09	1380	97.02
25	1.76	55	3.87	85	5.98	175	12.30	350	24.61	650	45.70	950	66.79	1400	98.43
26	1.83	56	3.94	86	6.05	180	12.66	360	25.31	660	46.40	960	67.49	1420	99.84
27	1.90	57	4.01	87	6.12	185	13.01	370	26.01	670	47.11	970	68.20	1440	101.24
28	1.97	58	4.08	88	6.19	190	13.36	380	26.72	680	47.81	980	68.90	1460	102.65
29	2.04	59	4.15	89	6.26	195	13.71	390	27.42	690	48.51	990	69.60	1480	104.05
30	2.11	60	4.22	90	6.33	200	14.06	400	28.12	700	49.21	1000	70.31	1500	105.46

OC4154

Linear Conversion

Decimals of an Inch to Millimeters

(0.10 inch = 2.54 millimeters)

Inches	0.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	Inches
0.00	0.00	0.25	0.51	0.76	1.02	1.27	1.52	1.78	2.03	2.29	0.00
.10	2.54	2.79	3.05	3.30	3.56	3.81	4.06	4.32	4.57	4.83	.10
.20	5.08	5.33	5.59	5.84	6.10	6.35	6.60	6.86	7.11	7.37	.20
.30	7.62	7.87	8.13	8.38	8.64	8.89	9.14	9.40	9.65	9.91	.30
.40	10.16	10.41	10.67	10.92	11.18	11.43	11.68	11.94	12.19	12.45	.40
.50	12.70	12.95	13.21	13.46	13.72	13.97	14.22	14.48	14.73	14.99	.50
.60	15.24	15.49	15.75	16.00	16.26	16.51	16.76	17.02	17.27	17.53	.60
.70	17.78	18.03	18.29	18.54	18.80	19.05	19.30	19.56	19.81	20.07	.70
.80	20.32	20.57	20.83	21.08	21.34	21.59	21.84	22.10	22.35	22.61	.80
.90	22.86	23.11	23.37	23.62	23.88	24.13	24.38	24.64	24.89	25.15	.90

Millimeters to Inches

(1 millimeter = 0.03937 inch)

Millimeters	0	1	2	3	4	5	6	7	8	9	Millimeters
0	0.00	0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354	0
10	0.39	0.43	0.47	0.51	0.55	0.59	0.63	0.67	0.71	0.75	10
20	0.79	0.83	0.87	0.91	0.94	0.98	1.02	1.06	1.10	1.14	20
30	1.18	1.22	1.26	1.30	1.34	1.38	1.42	1.46	1.50	1.54	30
40	1.57	1.61	1.65	1.69	1.73	1.77	1.81	1.85	1.89	1.93	40
50	1.97	2.01	2.05	2.09	2.13	2.17	2.20	2.24	2.28	2.32	50
60	2.36	2.40	2.44	2.48	2.52	2.56	2.60	2.64	2.68	2.72	60
70	2.76	2.80	2.83	2.87	2.91	2.95	2.99	3.03	3.07	3.11	70
80	3.15	3.19	3.23	3.27	3.31	3.35	3.39	3.43	3.46	3.50	80
90	3.54	3.58	3.62	3.66	3.70	3.74	3.78	3.82	3.86	3.90	90
100	3.94	3.98	4.02	4.06	4.09	4.13	4.17	4.21	4.25	4.29	100
110	4.33	4.37	4.41	4.45	4.49	4.53	4.57	4.61	4.65	4.69	110
120	4.72	4.76	4.80	4.84	4.88	4.92	4.96	5.00	5.04	5.08	120
130	5.12	5.16	5.20	5.24	5.28	5.31	5.35	5.39	5.43	5.47	130
140	5.51	5.55	5.59	5.63	5.67	5.71	5.75	5.79	5.83	5.87	140
150	5.91	5.94	5.98	6.02	6.06	6.10	6.14	6.18	6.22	6.26	150
160	6.30	6.34	6.38	6.42	6.46	6.50	6.54	6.57	6.61	6.65	160
170	6.69	6.73	6.77	6.81	6.85	6.89	6.93	6.97	7.01	7.05	170
180	7.09	7.13	7.17	7.20	7.24	7.28	7.32	7.36	7.40	7.44	180
190	7.48	7.52	7.56	7.60	7.64	7.68	7.72	7.76	7.80	7.83	190
200	7.87	7.91	7.95	7.99	8.03	8.07	8.11	8.15	8.19	8.23	200
210	8.27	8.31	8.35	8.39	8.43	8.46	8.50	8.54	8.58	8.62	210
220	8.66	8.70	8.74	8.78	8.82	8.86	8.90	8.94	8.98	9.02	220
230	9.06	9.09	9.13	9.17	9.21	9.25	9.29	9.33	9.37	9.41	230
240	9.45	9.49	9.53	9.57	9.61	9.65	9.69	.9.72	9.76	9.80	240
250	9.84	9.88	9.92	9.96	10.00	10.04	10.08	10.12	10.16	10.20	250
260	10.24	10.28	10.31	10.35	10.39	10.43	10.47	10.51	10.55	10.59	260
270	10.63	10.67	10.71	10.75	10.79	10.83	10.87	10.91	10.94	10.98	270
280	11.02	11.06	11.10	11.14	11.18	11.22	11.26	11.30	11.34	11.38	280
290	11.42	11.46	11.50	11.54	11.57	11.61	11.65	11.69	11.73	11.77	290
300	11.81	11.85	11.89	11.93	11.97	12.01	12.05	12.09	12.13	12.17	300
310	12.20	12.24	12.28	12.32	12.36	12.40	12.44	12.48	12.52	12.56	310
320	12.60	12.64	12.68	12.72	12.76	12.80	12.83	12.87	12.91	12.95	320
330	12.99	13.03	13.07	13.11	13.15	13.19	13.23	13.27	13.31	13.35	330
340	13.39	13.43	13.46	13.50	13.54	13.58	13.62	13.66	13.70	13.74	340
350	13.78	13.82	13.86	13.90	13.94	13.98	14.02	14.06	14.09	14.13	350
360	14.17	14.21	14.25	14.29	14.33	14.37	14.41	14.45	14.49	14.53	360
370	14.57	14.61	14.65	14.69	14.72	14.76	14.80	14.84	14.88	14.92	370
380	14.96	15.00	15.04	15.08	15.12	15.16	15.20	15.24	15.28	15.31	380
390	15.35	15.39	15.43	15.47	15.51	15.55	15.59	15.63	15.67	15.71	390

(continued on next page)

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Linear Conversion

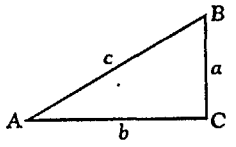
Fractions of an Inch To Decimals of an Inch and to Millimeters

Fraction	Decimal	Millimeter
1/64	.015625	0.39688
1/32	.03125	0.79375
3/64	.046875	1.19063
1/16	.0625	1.58750
5/64	.078125	1.98438
3/32	.09375	2.38125
7/64	.109375	2.77813
1/8	.125	3.17501
9/64	.140625	3.57188
5/32	.15625	3.96876
11/64	.171875	4.36563
3/16	.1875	4.76251
13/64	.203125	5.15939
7/32	.21875	5.55626
15/64	.234375	5.95314
1/4	.25	6.35001
17/64	.265625	6.74689
9/32	.28125	7.14376
19/64	.296875	7.54064
5/16	.3125	7.93752
21/64	.328125	8.33439
11/32	.34375	8.73127
23/64	.359375	9.12814
3/8	.375	9.52502
25/64	.390625	9.92189
13/32	.40625	10.31877
27/64	.421875	10.71565
7/16	.4375	11.11252
29/64	.453125	11.50940
15/32	.46875	11.90627
31/64	.484375	12.30315
1/2	.5	12.70002
33/64	.515625	13.09690
17/32	.53125	13.49378
35/64	.546875	13.89065
9/16	.5625	14.28753
37/64	.578125	14.68440
19/32	.59375	15.08128
39/64	.609375	15.47816
5/8	.625	15.87503
41/64	.640625	16.27191
21/32	.65625	16.66878
43/64	.671875	17.06566
11/16	.6875	17.46253
45/64	.703125	17.85941
23/32	.71875	18.25629
47/64	.734375	18.65316
3/4	.75	19.05004
49/64	.765625	19.44691
25/32	.78125	19.84379
51/64	.796875	20.24066
13/16	.8125	20.63754
53/64	.828125	21.03442
27/32	.84375	21.43129
55/64	.859375	21.82817
7/8	.875	22.22504
57/64	.890625	22.62192
29/32	.90625	23.01880
59/64	.921875	23.41567
15/16	.9375	23.81255
61/64	.953125	24.20942
31/32	.96875	24.60630
63/64	.984375	25.00317
1	1.0	25.40005

CRTX 1201

Mensuration of Plane Figures

Right Triangle



Angles $A + B = 90°$

$\sin A = \frac{a}{c}$

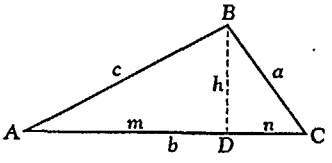
$\cos A = \frac{b}{c}$

$\tan A = \frac{a}{b}$

$a^2 + b^2 = c^2$

Area $= \frac{1}{2}ab$

Oblique Triangle



$\overline{AB} = c$ $\quad \overline{BC} = a$

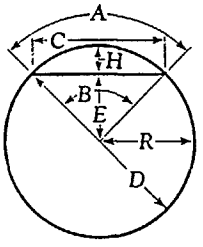
$\overline{AC} = b$ $\quad \overline{BD} = h$

$\overline{AD} = m$ $\quad \overline{DC} = n$

A, B and C are angles

Given	Required	Formulas
A,B,a	C,b,c	$C = 180° - A - B$; $b = \frac{a \sin B}{\sin A}$; $c = \frac{a \sin C}{\sin A}$
b,c,A	B,C,a	$\cos B = \frac{c^2 + a^2 - b^2}{2ac}$; $\cos C = \frac{a^2 + b^2 - c^2}{2ab}$ $a^2 = b^2 + c^2 - 2bc \cos A$; $h = c \sin A$ $m = c \cos A$; $n = b - m$; $a^2 = h^2 + n^2$
a,c,A	B,C,b	$\sin C = \sin A \times \frac{c}{a}$; $B = 180° - A - C$ $b = a\frac{\sin B}{\sin A}$ Note: In some cases, two values for B, C and b are possible.
a,b,c	A	$\sin \frac{A}{2} = \sqrt{\frac{(s-b)(s-c)}{b \times c}}$ $\quad \cos \frac{A}{2} = \sqrt{\frac{s(s-a)}{b \times c}}$ $\tan \frac{A}{2} = \sqrt{\frac{(s-b)(s-c)}{s(s-a)}}$ $\quad s = \frac{1}{2}(a+b+c)$
a,b,c	m,n	$m = \frac{c^2 + b^2 - a^2}{2b}$; $n = \frac{a^2 + b^2 - c^2}{2b}$

Circle



B = Angle in Degrees
A = Length of Arc

Circumference $= \pi D = 2\pi R$
Area $= \pi R^2$

$A = \frac{\pi RB}{180}$

$C = 2\sqrt{2HR - H^2} = 2R \sin \frac{B}{2}$

$H = R - \frac{1}{2}\sqrt{4R^2 - C^2} = 2R \sin^2 \frac{B}{4}$

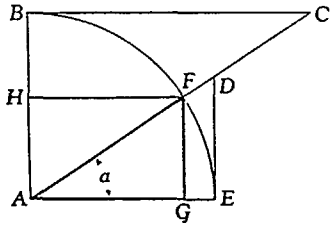
$E = R - H$

Area of Sector $= \frac{1}{2}RA$

Area of Segment $= \frac{1}{2}RA - \frac{1}{2}EC$

Trigonometric Formulas

$\sin^2 a + \cos^2 a = 1$ $\quad \tan a = \frac{\sin a}{\cos a}$ $\quad \sec^2 a - \tan^2 a = 1$



Radius $AE = 1$

$FG = \sin a$ $\quad BC = \cot a$

$AG = \cos a$ $\quad AD = \sec a$

$DE = \tan a$ $\quad AC = \csc a$

$\sin a$		$\sqrt{1 - \cos^2 a}$	$\frac{\tan a}{\sqrt{1 + \tan^2 a}}$	$\frac{1}{\sqrt{1 + \cot^2 a}}$
$\cos a$	$\sqrt{1 - \sin^2 a}$		$\frac{1}{\sqrt{1 + \tan^2 a}}$	$\frac{\cot a}{\sqrt{1 + \cot^2 a}}$
$\tan a$	$\frac{\sin a}{\sqrt{1 - \sin^2 a}}$	$\frac{\sqrt{1 - \cos^2 a}}{\cos a}$		$\frac{1}{\cot a}$
$\cot a$	$\frac{\sqrt{1 - \sin^2 a}}{\sin a}$	$\frac{\cos a}{\sqrt{1 - \cos^2 a}}$	$\frac{1}{\tan a}$	

Four-Place Logarithms to Base 10

The logarithms to base 10 of numbers between 1 and 10, correct to four places, are given in the tables shown on this and the following page.

If the decimal point in the number is moved n places to the right (or left), the value of n (or $-n$) is added to the logarithm, thus:

log 3.14 = 0.4969
log 314. = 0.4969 + 2 or 2.4969
log .0314 = 0.4969 − 2, which may be written $\bar{2}$.4969 or 8.4969 − 10

If the given number has more than four significant figures, it should be reduced to four figures, since those beyond four figures will not affect the result in four-place computations.

The logarithm of a number having four significant figures must be interpolated by adding to the logarithm of the three figure number, the amount under the fourth figure, as read in the proportional parts section of the table.

Thus, the logarithm of 3.1416 is found as follows:

a. Reduce the number to four significant figures: 3.142
b. The log of 3.14 is .4969
c. The value of the proportional part under 2 (the fourth figure) is 3
d. Then, the log 3.142 = 0.4969 + .0003 or 0.4972

Natural logarithms: Many calculations make use of natural logarithms (Base $e = 2.7183$). To convert base 10 (common) logarithms to natural logarithms, multiply the value for the former by 2.30258.

Natural logarithms are also called Hyperbolic or Naperian logarithms.

$$\log ab = \log a + \log b \qquad \log a^n = n \log a$$

$$\log \frac{a}{b} = \log a - \log b \qquad \log \sqrt[n]{a} = \frac{\log a}{n}$$

N	0	1	2	3	4	5	6	7	8	9	Proportional Parts 1	2	3	4	5	6	7	8	9
1.0	0000	0043	0086	0128	0170	0212	0253	0294	0334	0374	4	8	12	17	21	25	29	33	37
1.1	0414	0453	0492	0531	0569	0607	0645	0682	0719	0755	4	8	11	15	19	23	26	30	34
1.2	0792	0828	0864	0899	0934	0969	1004	1038	1072	1106	3	7	10	14	17	21	24	28	31
1.3	1139	1173	1206	1239	1271	1303	1335	1367	1399	1430	3	6	10	13	16	19	23	26	29
1.4	1461	1492	1523	1553	1584	1614	1644	1673	1703	1732	3	6	9	12	15	18	21	24	27
1.5	1761	1790	1818	1847	1875	1903	1931	1959	1987	2014	3	6	8	11	14	17	20	22	25
1.6	2041	2068	2095	2122	2148	2175	2201	2227	2253	2279	3	5	8	11	13	16	18	21	24
1.7	2304	2330	2355	2380	2405	2430	2455	2480	2504	2529	2	5	7	10	12	15	17	20	22
1.8	2553	2577	2601	2625	2648	2672	2695	2718	2742	2765	2	5	7	9	12	14	16	19	21
1.9	2788	2810	2833	2856	2878	2900	2923	2945	2967	2989	2	4	7	9	11	13	16	18	20
2.0	3010	3032	3054	3075	3096	3118	3139	3160	3181	3201	2	4	6	8	11	13	15	17	19
2.1	3222	3243	3263	3284	3304	3324	3345	3365	3385	3404	2	4	6	8	10	12	14	16	18
2.2	3424	3444	3464	3483	3502	3522	3541	3560	3579	3598	2	4	6	8	10	12	14	15	17
2.3	3617	3636	3655	3674	3692	3711	3729	3747	3766	3784	2	4	6	7	9	11	13	15	17
2.4	3802	3820	3838	3856	3874	3892	3909	3927	3945	3962	2	4	5	7	9	11	12	14	16
2.5	3979	3997	4014	4031	4048	4065	4082	4099	4116	4133	2	3	5	7	9	10	12	14	15
2.6	4150	4166	4183	4200	4216	4232	4249	4265	4281	4298	2	3	5	7	8	10	11	13	15
2.7	4314	4330	4346	4362	4378	4393	4409	4425	4440	4456	2	3	5	6	8	9	11	13	14
2.8	4472	4487	4502	4518	4533	4548	4564	4579	4594	4609	2	3	5	6	8	9	11	12	14
2.9	4624	4639	4654	4669	4683	4698	4713	4728	4742	4757	1	3	4	6	7	9	10	12	13
3.0	4771	4786	4800	4814	4829	4843	4857	4871	4886	4900	1	3	4	6	7	9	10	11	13
3.1	4914	4928	4942	4955	4969	4983	4997	5011	5024	5038	1	3	4	6	7	8	10	11	12
3.2	5051	5065	5079	5092	5105	5119	5132	5145	5159	5172	1	3	4	5	7	8	9	11	12
3.3	5185	5198	5211	5224	5237	5250	5263	5276	5289	5302	1	3	4	5	6	8	9	10	12
3.4	5315	5328	5340	5353	5366	5378	5391	5403	5416	5428	1	3	4	5	6	8	9	10	11
3.5	5441	5453	5465	5478	5490	5502	5514	5527	5539	5551	1	2	4	5	6	7	9	10	11
3.6	5563	5575	5587	5599	5611	5623	5635	5647	5658	5670	1	2	4	5	6	7	8	10	11
3.7	5682	5694	5705	5717	5729	5740	5752	5763	5775	5786	1	2	3	5	6	7	8	9	10
3.8	5798	5809	5821	5832	5843	5855	5866	5877	5888	5899	1	2	3	5	6	7	8	9	10
3.9	5911	5922	5933	5944	5955	5966	5977	5988	5999	6010	1	2	3	4	5	7	8	9	10

N	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9

Natural Trigonometric Functions

↓	Sin	Cos	Tan	Cot	
0°00′	.00000	1.00000	.00000	∞	90°00′
10	.00291	1.00000	.00291	343.774	50
20	.00582	.99998	.00582	171.885	40
30	.00873	.99996	.00873	114.589	30
40	.01164	.99993	.01164	85.940	20
50	.01454	.99989	.01455	68.750	10
1°00′	.01745	.99985	.01746	57.290	89°00′
10	.02036	.99979	.02036	49.104	50
20	.02327	.99973	.02328	42.964	40
30	.02618	.99966	.02619	38.188	30
40	.02908	.99958	.02910	34.368	20
50	.03199	.99949	.03201	31.242	10
2°00′	.03490	.99939	.03492	28.636	88°00′
10	.03781	.99929	.03783	26.432	50
20	.04071	.99917	.04075	24.542	40
30	.04362	.99905	.04366	22.904	30
40	.04653	.99892	.04658	21.470	20
50	.04943	.99878	.04949	20.206	10
3°00′	.05234	.99863	.05241	19.081	87°00′
10	.05524	.99847	.05533	18.075	50
20	.05814	.99831	.05824	17.169	40
30	.06105	.99813	.06116	16.350	30
40	.06395	.99795	.06408	15.605	20
50	.06685	.99776	.06700	14.924	10
4°00′	.06976	.99756	.06993	14.301	86°00′
10	.07266	.99736	.07285	13.727	50
20	.07556	.99714	.07578	13.197	40
30	.07846	.99692	.07870	12.706	30
40	.08136	.99668	.08163	12.251	20
50	.08426	.99644	.08456	11.826	10
5°00′	.08716	.99619	.08749	11.430	85°00′
10	.09005	.99594	.09042	11.059	50
20	.09295	.99567	.09335	10.712	40
30	.09585	.99540	.09629	10.385	30
40	.09874	.99511	.09923	10.078	20
50	.10164	.99482	.10216	9.788	10
6°00′	.10453	.99452	.10510	9.514	84°00′
10	.10742	.99421	.10805	9.255	50
20	.11031	.99390	.11099	9.010	40
30	.11320	.99357	.11394	8.777	30
40	.11609	.99324	.11688	8.556	20
50	.11898	.99290	.11983	8.345	10
7°00′	.12187	.99255	.12278	8.144	83°00′
10	.12476	.99219	.12574	7.953	50
20	.12764	.99182	.12869	7.770	40
30	.13053	.99144	.13165	7.596	30
40	.13341	.99106	.13461	7.429	20
50	.13629	.99067	.13758	7.269	10
8°00′	.13917	.99027	.14054	7.115	82°00′
10	.14205	.98986	.14351	6.968	50
20	.14493	.98944	.14648	6.827	40
30	.14781	.98902	.14945	6.691	30
40	.15069	.98858	.15243	6.561	20
50	.15356	.98814	.15540	6.435	10
9°00′	.15643	.98769	.15838	6.314	81°00′
10	.15931	.98723	.16137	6.197	50
20	.16218	.98676	.16435	6.084	40
30	.16505	.98629	.16734	5.976	30
40	.16792	.98580	.17033	5.871	20
50	.17078	.98531	.17333	5.769	10
10°00′	.17365	.98481	.17633	5.671	80°00′
10	.17651	.98430	.17933	5.576	50
20	.17937	.98378	.18233	5.485	40
30	.18224	.98325	.18534	5.396	30
40	.18509	.98272	.18835	5.309	20
50	.18795	.98218	.19136	5.226	10
11°00′	.19081	.98163	.19438	5.1446	79°00′
	Cos	Sin	Cot	Tan	↑

↓	Sin	Cos	Tan	Cot	
11°00′	.19081	.98163	.19438	5.1446	79°00′
10	.19366	.98107	.19740	5.0658	50
20	.19652	.98050	.20042	4.9894	40
30	.19937	.97992	.20345	4.9152	30
40	.20222	.97934	.20648	4.8430	20
50	.20507	.97875	.20952	4.7729	10
12°00′	.20791	.97815	.21256	4.7046	78°00′
10	.21076	.97754	.21560	4.6383	50
20	.21360	.97692	.21864	4.5736	40
30	.21644	.97630	.22169	4.5107	30
40	.21928	.97566	.22475	4.4494	20
50	.22212	.97502	.22781	4.3897	10
13°00′	.22495	.97437	.23087	4.3315	77°00′
10	.22778	.97371	.23393	4.2747	50
20	.23062	.97304	.23700	4.2193	40
30	.23345	.97237	.24008	4.1653	30
40	.23627	.97169	.24316	4.1126	20
50	.23910	.97100	.24624	4.0611	10
14°00′	.24192	.97030	.24933	4.0108	76°00′
10	.24474	.96959	.25242	3.9617	50
20	.24756	.96887	.25552	3.9136	40
30	.25038	.96815	.25862	3.8667	30
40	.25320	.96742	.26172	3.8208	20
50	.25601	.96667	.26483	3.7760	10
15°00′	.25882	.96593	.26795	3.7321	75°00′
10	.26163	.96517	.27107	3.6891	50
20	.26443	.96440	.27419	3.6471	40
30	.26724	.96363	.27732	3.6059	30
40	.27004	.96285	.28046	3.5656	20
50	.27284	.96206	.28360	3.5261	10
16°00′	.27564	.96126	.28675	3.4874	74°00′
10	.27843	.96046	.28990	3.4495	50
20	.28123	.95964	.29305	3.4124	40
30	.28402	.95882	.29621	3.3759	30
40	.28680	.95799	.29938	3.3402	20
50	.28959	.95715	.30255	3.3052	10
17°00′	.29237	.95630	.30573	3.2709	73°00′
10	.29515	.95545	.30891	3.2371	50
20	.29793	.95459	.31210	3.2041	40
30	.30071	.95372	.31530	3.1716	30
40	.30348	.95284	.31850	3.1397	20
50	.30625	.95195	.32171	3.1084	10
18°00′	.30902	.95106	.32492	3.0777	72°00′
10	.31178	.95015	.32814	3.0475	50
20	.31454	.94924	.33136	3.0178	40
30	.31730	.94832	.33460	2.9887	30
40	.32006	.94740	.33783	2.9600	20
50	.32282	.94646	.34108	2.9319	10
19°00′	.32557	.94552	.34433	2.9042	71°00′
10	.32832	.94457	.34758	2.8770	50
20	.33106	.94361	.35085	2.8502	40
30	.33381	.94264	.35412	2.8239	30
40	.33655	.94167	.35740	2.7980	20
50	.33929	.94068	.36068	2.7725	10
20°00′	.34202	.93969	.36397	2.7475	70°00′
10	.34475	.93869	.36727	2.7228	50
20	.34748	.93769	.37057	2.6985	40
30	.35021	.93667	.37388	2.6746	30
40	.35293	.93565	.37720	2.6511	20
50	.35565	.93462	.38053	2.6279	10
21°00′	.35837	.93358	.38386	2.6051	69°00′
10	.36108	.93253	.38721	2.5826	50
20	.36379	.93148	.39055	2.5605	40
30	.36650	.93042	.39391	2.5387	30
40	.36921	.92935	.39727	2.5172	20
50	.37191	.92827	.40065	2.4960	10
22°00′	.37461	.92718	.40403	2.4751	68°00′
	Cos	Sin	Cot	Tan	↑

CRTX 1195

Circumferences and Areas of Circles

044144

Diameter = Circumference ÷ 3.141 592 654

Circumference = 3.141 592 654 × Diameter Area = 0.785 398 163 × Diameter²

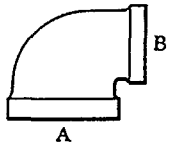
(continued from the preceding page)

Dia.	Circum.	Area	Dia.	Circum.	Area	Dia.	Circum.	Area	Dia.	Circum.	Area	Dia.	Circum.	Area
30	94.248	706.86	37	116.239	1075.2	44	138.230	1520.5	51	160.221	2042.8	58	182.212	2642.1
1/8	94.640	712.76	1/8	116.632	1082.5	1/8	138.623	1529.2	1/8	160.614	2052.8	1/8	182.605	2653.5
1/4	95.033	718.69	1/4	117.024	1089.8	1/4	139.015	1537.9	1/4	161.007	2062.9	1/4	182.998	2664.9
3/8	95.426	724.64	3/8	117.417	1097.1	3/8	139.408	1546.6	3/8	161.399	2073.0	3/8	183.390	2676.4
1/2	95.819	730.62	1/2	117.810	1104.5	1/2	139.801	1555.3	1/2	161.792	2083.1	1/2	183.783	2687.8
5/8	96.211	736.62	5/8	118.202	1111.8	5/8	140.194	1564.0	5/8	162.185	2093.2	5/8	184.176	2699.3
3/4	96.604	742.64	3/4	118.596	1119.2	3/4	140.586	1572.8	3/4	162.577	2103.3	3/4	184.569	2710.9
7/8	96.997	748.69	7/8	118.988	1126.7	7/8	140.979	1581.6	7/8	162.970	2113.5	7/8	184.961	2722.4
31	97.389	754.77	38	119.381	1134.1	45	141.372	1590.4	52	163.363	2123.7	59	185.354	2734.0
1/8	97.782	760.87	1/8	119.773	1141.6	1/8	141.764	1599.3	1/8	163.756	2133.9	1/8	185.747	2745.6
1/4	98.175	766.99	1/4	120.166	1149.1	1/4	142.157	1608.2	1/4	164.148	2144.2	1/4	186.139	2757.2
3/8	98.567	773.14	3/8	120.559	1156.6	3/8	142.550	1617.0	3/8	164.541	2154.5	3/8	186.532	2768.8
1/2	98.960	779.31	1/2	120.951	1164.2	1/2	142.942	1626.0	1/2	164.934	2164.8	1/2	186.925	2780.5
5/8	99.353	785.51	5/8	121.344	1171.7	5/8	143.335	1634.9	5/8	165.326	2175.1	5/8	187.317	2792.2
3/4	99.746	791.73	3/4	121.737	1179.3	3/4	143.728	1643.9	3/4	165.719	2185.4	3/4	187.710	2803.9
7/8	100.138	797.98	7/8	122.129	1186.9	7/8	144.121	1652.9	7/8	166.112	2195.8	7/8	188.103	2815.7
32	100.531	804.25	39	122.522	1194.6	46	144.513	1661.9	53	166.504	2206.2	60	188.496	2827.4
1/8	100.924	810.54	1/8	122.915	1202.3	1/8	144.906	1670.9	1/8	166.897	2216.6	1/8	188.888	2839.2
1/4	101.316	816.86	1/4	123.308	1210.0	1/4	145.299	1680.0	1/4	167.290	2227.0	1/4	189.281	2851.0
3/8	101.709	823.21	3/8	123.700	1217.7	3/8	145.691	1689.1	3/8	167.683	2237.5	3/8	189.674	2862.9
1/2	102.102	829.58	1/2	124.093	1225.4	1/2	146.084	1698.2	1/2	168.075	2248.0	1/2	190.066	2874.8
5/8	102.494	835.97	5/8	124.486	1233.2	5/8	146.477	1707.4	5/8	168.468	2258.5	5/8	190.459	2886.6
3/4	102.887	842.39	3/4	124.878	1241.0	3/4	146.869	1716.5	3/4	168.861	2269.1	3/4	190.852	2898.6
7/8	103.280	848.83	7/8	125.271	1248.8	7/8	147.262	1725.7	7/8	169.253	2279.6	7/8	191.244	2910.5
33	103.673	855.30	40	125.664	1256.6	47	147.655	1734.9	54	169.646	2290.2	61	191.637	2922.5
1/8	104.065	861.79	1/8	126.056	1264.5	1/8	148.048	1744.2	1/8	170.039	2300.8	1/8	192.030	2934.5
1/4	104.458	868.31	1/4	126.449	1272.4	1/4	148.440	1753.5	1/4	170.431	2311.5	1/4	192.423	2946.5
3/8	104.851	874.85	3/8	126.842	1280.3	3/8	148.833	1762.7	3/8	170.824	2322.1	3/8	192.815	2958.5
1/2	105.243	881.41	1/2	127.235	1288.2	1/2	149.226	1772.1	1/2	171.217	2332.8	1/2	193.208	2970.6
5/8	105.636	888.00	5/8	177.627	1296.2	5/8	149.618	1781.4	5/8	171.609	2343.5	5/8	193.601	2982.7
3/4	106.029	894.62	3/4	128.020	1304.2	3/4	150.011	1790.8	3/4	172.002	2354.3	3/4	193.993	2994.8
7/8	106.421	901.26	7/8	128.413	1312.2	7/8	150.404	1800.1	7/8	172.395	2365.0	7/8	194.386	3006.9
34	106.814	907.92	41	128.805	1320.3	48	150.796	1809.6	55	172.788	2375.8	62	194.779	3019.1
1/8	107.207	914.61	1/8	129.198	1328.3	1/8	151.189	1819.0	1/8	173.180	2386.6	1/8	195.171	3031.3
1/4	107.600	921.32	1/4	129.591	1336.4	1/4	151.582	1828.5	1/4	173.573	2397.5	1/4	195.564	3043.5
3/8	107.992	928.06	3/8	129.983	1344.5	3/8	151.975	1837.9	3/8	173.966	2408.3	3/8	195.957	3055.7
1/2	108.385	934.82	1/2	130.376	1352.7	1/2	152.367	1847.5	1/2	174.358	2419.2	1/2	196.350	3068.0
5/8	108.778	941.61	5/8	130.769	1360.8	5/8	152.760	1857.0	5/8	174.751	2430.1	5/8	196.742	3080.3
3/4	109.170	948.42	3/4	131.161	1369.0	3/4	153.153	1866.5	3/4	175.144	2441.1	3/4	197.135	3092.6
7/8	109.563	955.25	7/8	131.554	1377.2	7/8	153.545	1876.1	7/8	175.536	2452.0	7/8	197.528	3104.9
35	109.956	962.11	42	131.947	1385.4	49	153.938	1885.7	56	175.929	2463.0	63	197.920	3117.2
1/8	110.348	969.00	1/8	132.340	1393.7	1/8	154.331	1895.4	1/8	176.322	2474.0	1/8	198.313	3129.6
1/4	110.741	975.91	1/4	132.732	1402.0	1/4	154.723	1905.0	1/4	176.715	2485.0	1/4	198.706	3142.0
3/8	111.134	982.84	3/8	133.125	1410.3	3/8	155.116	1914.7	3/8	177.107	2496.1	3/8	199.098	3154.5
1/2	111.527	989.80	1/2	133.518	1418.6	1/2	155.509	1924.4	1/2	177.500	2507.2	1/2	199.491	3166.9
5/8	111.919	996.78	5/8	133.910	1427.0	5/8	155.902	1934.2	5/8	177.893	2518.3	5/8	199.884	3179.4
3/4	112.312	1003.8	3/4	134.303	1435.4	3/4	156.294	1943.9	3/4	178.285	2529.4	3/4	200.277	3191.9
7/8	112.705	1010.8	7/8	134.696	1443.8	7/8	156.687	1953.7	7/8	178.678	2540.6	7/8	200.669	3204.4
36	113.097	1017.9	43	135.088	1452.2	50	157.080	1963.5	57	179.071	2551.8	64	201.062	3217.0
1/8	113.490	1025.0	1/8	135.481	1460.7	1/8	157.472	1973.3	1/8	179.463	2563.0	1/8	201.455	3229.6
1/4	113.883	1032.1	1/4	135.874	1469.1	1/4	157.865	1983.2	1/4	179.856	2574.2	1/4	201.847	3242.2
3/8	114.275	1039.2	3/8	136.267	1477.6	3/8	158.258	1993.1	3/8	180.249	2585.4	3/8	202.240	3254.8
1/2	114.668	1046.3	1/2	136.659	1486.2	1/2	158.650	2003.0	1/2	180.642	2596.7	1/2	202.633	3267.5
5/8	115.061	1053.5	5/8	137.052	1494.7	5/8	159.043	2012.9	5/8	181.034	2608.0	5/8	203.025	3280.1
3/4	115.454	1060.7	3/4	137.445	1503.3	3/4	159.436	2022.8	3/4	181.427	2619.4	3/4	203.418	3292.8
7/8	115.846	1068.0	7/8	137.837	1511.9	7/8	159.829	2032.8	7/8	181.820	2630.7	7/8	203.811	3305.6

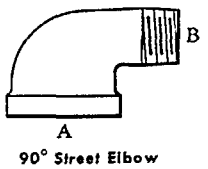
CRTX 1193

How to Read Reducing Fittings

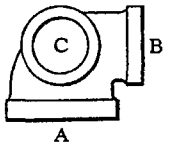
Elbows



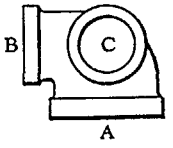
90° Elbow
Reducing



90° Street Elbow
Reducing on male end

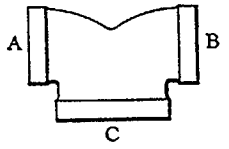


Right Hand



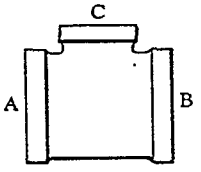
Left Hand

Side Outlet 90° Elbow
Reducing on two Outlets

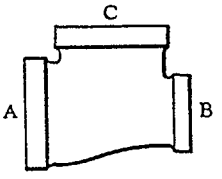


Double Branch Elbow
Reducing on both ends of Run

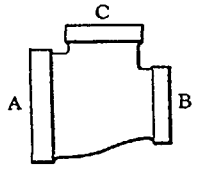
Tees



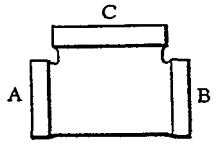
Tee
With Outlet reduced



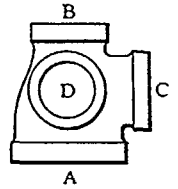
Tee
With one end of Run reduced



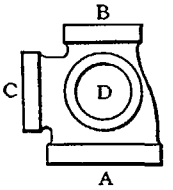
Tee
With one end of Run and Outlet reduced



Tee
Bull head type—Both ends of Run reduced



Right Hand



Left Hand

Side Outlet Tees
With one end of Run and Outlets reduced

To assist the user in "reading" reducing fittings, a variety of types most commonly required for piping systems are illustrated on this page. In these illustrations, each opening of the fitting is identified with a letter which indicates the sequence to be followed in reading the size of the fitting.

In designating the outlets of reducing fittings, the openings should be read in the order indicated by the sequence of the letters "A", "B", "C", and "D". On side outlet reducing fittings, the size of the side outlet is named last.

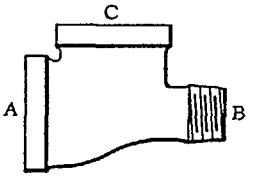
For example: A Cross having one end of the run and one outlet reduced is designated as:

A B C D
2½ x 1¼ x 2½ x 1½

Simply name the largest opening first and then name the other openings in the order indicated.

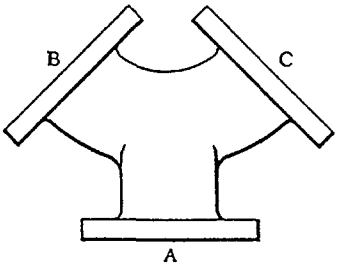
Note: Although all but one of the illustrations are of screwed fittings, the same rules apply to the "reading" of reducing flanged, welding, solder-joint, and other types of fittings.

Service Tee

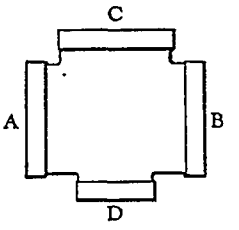


Service Tee
Reducing on male end only

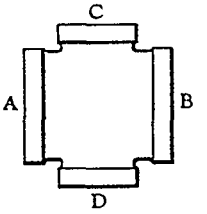
True "Y"



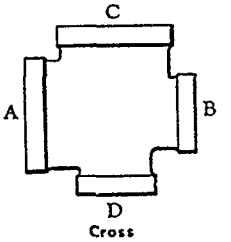
Crosses



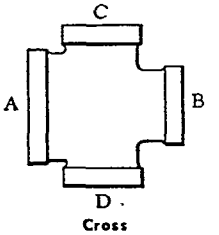
Cross
Reducing on one Outlet only



Cross
Reducing on both Outlets

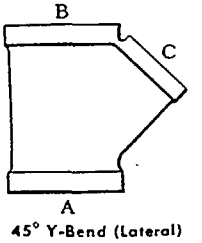


Cross
Reducing on one end of Run and on one Outlet



Cross
Reducing on one end of Run and on both Outlets

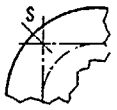
45° Y-Bend



45° Y-Bend (Lateral)
Reducing on Outlet only

Taps and Drains for Flanged Fittings

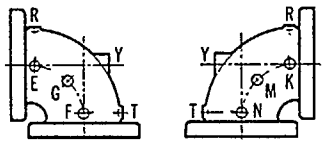
Designating Location of Tapped Holes



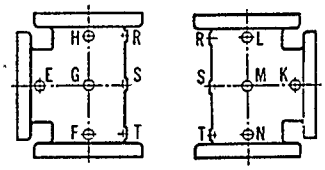
90° Elbow

The illustrations on this page indicate a standard method used for designating the location of tapped holes on ferrous flanged fittings in all pressure classes.

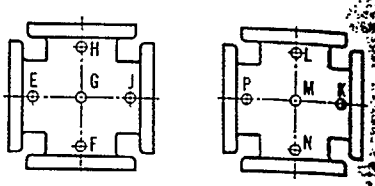
When a tapped connection is required at the heel of an elbow without a boss (at location S), the tapping should be done at right angles to the point of tangency of the radius or sweep of the fitting. This shall be standard practice, and where the tapping is required parallel to the run (at locations V and Y), the fitting shall be furnished with a boss.



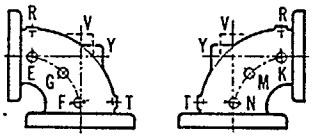
90° Elbow
Straight Size



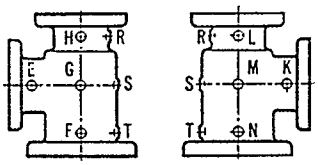
Tee
Straight Size



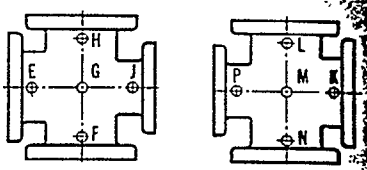
Cross
Straight Size



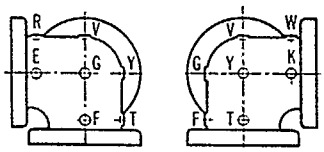
90° Elbow
Reducing Size



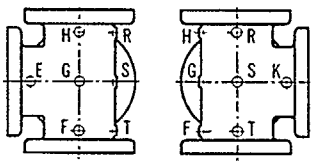
Tee
Reducing Size



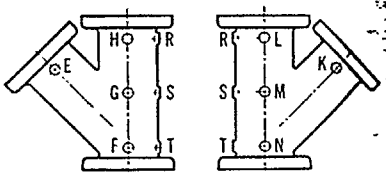
Cross
Reducing Size



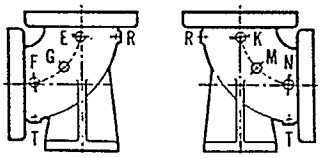
Side Outlet Elbow
Straight Size



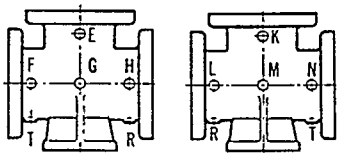
Side Outlet Tee
Straight Size



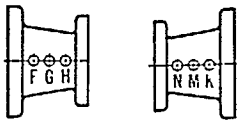
45° Lateral
Straight Size



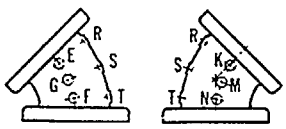
90° Base Elbow



Base Tee
Straight Size

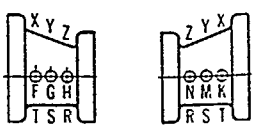


Reducer



45° Elbow

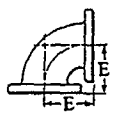
How to read sizes of reducing fittings, see page 404.



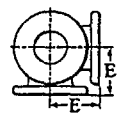
Eccentric Reducer

Dimensions of Cast Iron Flanged Fittings

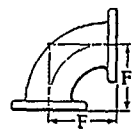
ASA Class 125 and Class 250



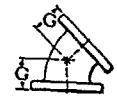
90° Elbow



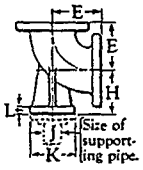
Side Outlet Elbow



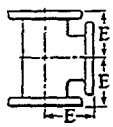
90° Long Radius Elbow



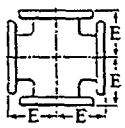
45° Elbow



90° Base Elbow



Tee



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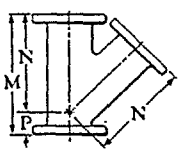
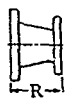


45° Lateral



Taper Reducer



Eccentric Reducer

For drilling templates, see pages 327 and 328

ASA Dimensions, in Inches

Size	90° Elbows, Tee, or Cross		45° Elbow	90° Base Elbow					45° Lateral			Reducer
	E	F	G	E	H	J	K	L	M	N	P	R
Class 125 Cast Iron												
1	3½	5	1¾	3½	3½	¾	3½	7/16	7½	5¾	1¾	...
1¼	3¾	5½	2	3¾	3⅝	¾	3½	7/16	8	6¼	1¾	...
1½	4	6	2¼	4	3¾	1	4¼	7/16	9	7	2	...
2	4½	6½	2½	4½	4⅛	1¼	4⅝	½	10½	8	2½	5
2½	5	7	3	5	4½	1¼	4⅝	½	12	9½	2½	5½
3	5½	7¾	3	5½	4⅞	1½	5	9/16	13	10	3	6
3½	6	8½	3½	6	5¼	1½	5	9/16	14½	11½	3	6½
4	6½	9	4	6½	5½	2	6	⅝	15	12	3	7
5	7½	10¼	4½	7½	6¼	2½	7	11/16	17	13½	3½	8
6	8	11½	5	8	7	2½	7	11/16	18	14½	3½	9
8	9	14	5½	9	8⅜	4	9	15/16	22	17½	4½	11
10	11	16½	6½	11	9¾	4	9	15/16	25½	20½	5	12
12	12	19	7½	12	11¼	6	11	1	30	24½	5½	14
14 OD	14	21½	7½	14	12½	6	11	1	33	27	6	16
16 OD	15	24	8	15	13¾	6	11	1	36½	30	6½	18
18 OD	16½	26½	8½	16½	.15	8	13½	1⅛	39	32	7	19
20 OD	18	29	9½	18	16	8	13½	1⅛	43	35	8	20
24 OD	22	34	11	22	18½	8	13½	1⅛	49½	40½	9	24
Class 250 Cast Iron												
2	5	6½	3	5	4½	1¼	5¼	¾	...	...	...	5
2½	5½	7	3½	5½	4¾	1¼	5¼	¾	...	...	...	5½
3	6	7¾	3½	6	5¼	1½	6⅛	13/16	...	...	...	6
3½	6½	8½	4	6½	5⅝	1½	6⅛	13/16	...	...	...	6½
4	7	9	4½	7	6	2	6½	⅞	...	...	...	7
5	8	10¼	5	8	6¾	2½	7½	1	...	...	...	8
6	8½	11½	5½	8½	7½	2½	7½	1	...	...	...	9
8	10	14	6	10	9	4	10	1¼	...	...	...	11
10	11½	16½	7	11½	10½	4	10	1¼	...	...	...	12
12	13	19	8	13	12	6	12½	17/16	...	...	...	14
14 OD	15	21½	8½	15	13½	6	12½	17/16	...	...	...	16
16 OD	16½	24	9½	16½	14¾	6	12½	17/16	...			18
18 OD	18	26½	10	18	16¼	8	15	1⅝	...			19
20 OD	19½	29	10½	19½	17⅞	8	15	1⅝	...	...		20
24 OD	22½	34	12	22½	20¾	10	17½	1⅞	...			24

ASA: These dimensions are extracted from American Standards B16.1-1948 (Class 125) and B16b-1944 (Class 250) for Cast Iron Flanged Fittings; B16b does not include the side outlet elbow, cross, 45° lateral, or eccentric reducer.

Facings: Class 125 fittings have a plain face on the end flanges; Class 250 fittings have a 1/16-inch raised face which is included in the dimensions listed.

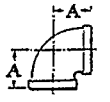
Dimensions of reducing sizes: Reducing sizes of all 90° elbow types, except the base elbow, have the same center-to-face as the straight size type corresponding to the size of the larger opening

Reducing tees, crosses, and laterals, in sizes 16-inch and smaller, also have the same center-to-face dimensions as the straight size type corresponding to the size of the largest opening

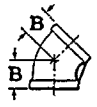
CRTX 1187

Dimensions of Malleable Iron Screwed Fittings

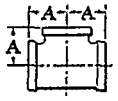
ASA 150-Pound and 300-Pound Classes



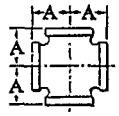
90° Elbow



45° Elbow



Tee



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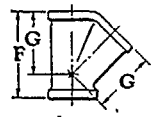
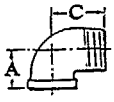
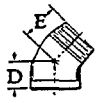


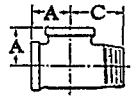
45° Y-Bend



90° Street Elbow



45° Street Elbow



Service Tee



Coupling

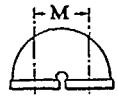


Reducer



Cap

American Standards: These dimensions are extracted from American Standards B16.3-1951 (150-pound) and B16.19-1951 (300-pound) for malleable iron screwed fittings. The 150-pound Standard includes all fittings illustrated; the 300-pound Standard includes all except the 45° Y-bend and the service tee.



Return Bend

ASA Dimensions, In Inches

Size	A	B	C	D	E	F	G	H	J	K	Return Bends M			Plus or minus tolerance
											Close Pattern	Medium Pattern	Open Pattern	
150-Pound Malleable Iron														
⅛	0.69	...	1.00	...	...	...	...	0.53	0.96	...	...	...	...	0.03
¼	0.81	0.73	1.19	0.73	0.94	...	...	0.63	1.06	1.00	...	...	...	0.04
⅜	0.95	0.80	1.44	0.80	1.03	1.93	1.43	0.74	1.16	1.13	...	...	...	0.05
½	1.12	0.88	1.63	0.88	1.15	2.32	1.71	0.87	1.34	1.25	1.00	1.25	1.50	0.06
¾	1.31	0.98	1.89	0.98	1.29	2.77	2.05	0.97	1.52	1.44	1.25	1.50	2.00	0.06
1	1.50	1.12	2.14	1.12	1.47	3.28	2.43	1.16	1.67	1.69	1.50	1.88	2.50	0.07
1¼	1.75	1.29	2.45	1.29	1.71	3.94	2.92	1.28	1.93	2.06	1.75	2.25	3.00	0.07
1½	1.94	1.43	2.69	1.43	1.88	4.38	3.28	1.33	2.15	2.31	2.19	2.50	3.50	0.08
2	2.25	1.68	3.26	1.68	2.22	5.17	3.93	1.45	2.53	2.81	2.63	3.00	4.00	0.08
2½	2.70	1.95	3.86	1.95	2.57	6.25	4.73	1.70	2.88	3.25	...	...	4.50	0.10
3	3.08	2.17	4.51	2.17	3.00	7.26	5.55	1.80	3.18	3.69	...	...	5.00	0.10
3½	3.42	2.39	...	...	...	...	...	1.90	...	...	...	...	...	0.10
4	3.79	2.61	5.69	2.61	3.70	8.98	6.97	2.08	3.69	4.38	...	...	6.00	0.12
5	4.50	3.05	6.86	...	...	...	...	2.32	...	...	...	...	...	0.12
6	5.13	3.46	8.03	...	...	...	...	2.55	...	...	...	...	...	0.14
300-Pound Malleable Iron														
¼	0.94	0.81	1.44	...	...	...	...	0.78	1.38	..	...	...	...	0.04
⅜	1.06	0.88	1.63	...	...	...	.	0.83	1.63	1.44	..	...	...	0.05
½	1.25	1.00	2.00	1.00	1.38	.	...	0.98	1.88	1.69	. .	. .	...	0.06
¾	1.44	1.13	2.19	1.13	1.56	...	...	1.08	2.13	1.75	. .	...	...	0.06
1	1.63	1.31	2.56	1.31	1.81	...	. .	1.26	2.38	2.00	1.75	2.50	3.00	0.07
1¼	1.94	1.50	2.88	1.50	2.13	. .	...	1.38	2.88	2.38	2.25	2.50	3.00	0.07
1½	2.13	1.69	3.13	1.69	2.31	...	...	1.43	2.88	2.69	3.00	3.50	6.00	0.08
2	2.50	2.00	3.69	2.00	2.69	...	...	1.68	3.63	3.19	4.00	6.00	8.00	0.08
2½	2.94	2.25	4.50	...	...	...	...	2.06	4.13	3.69	...	...	...	0.10
3	3.38	2.50	5.13	..		.	.	2.17	4.13	4.06	.	...	...	0.10

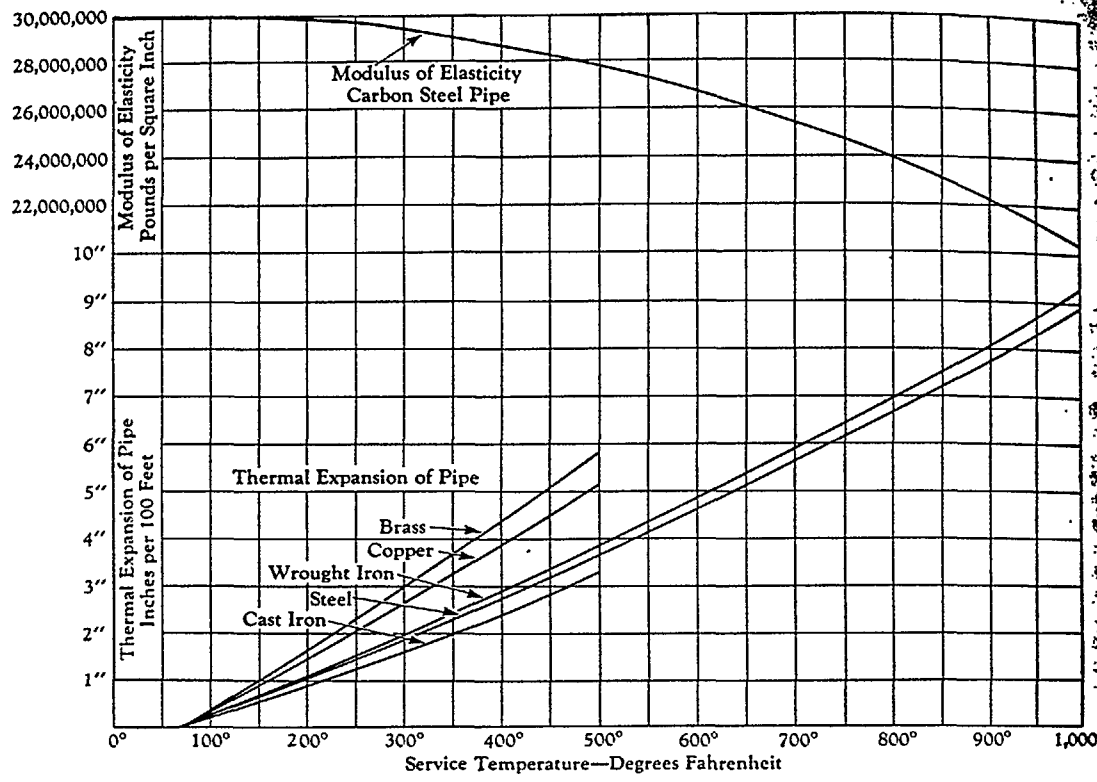
The ASA Standard includes service tees only in sizes ¼ to 2-inch, and 4-inch, of the 125-pound class

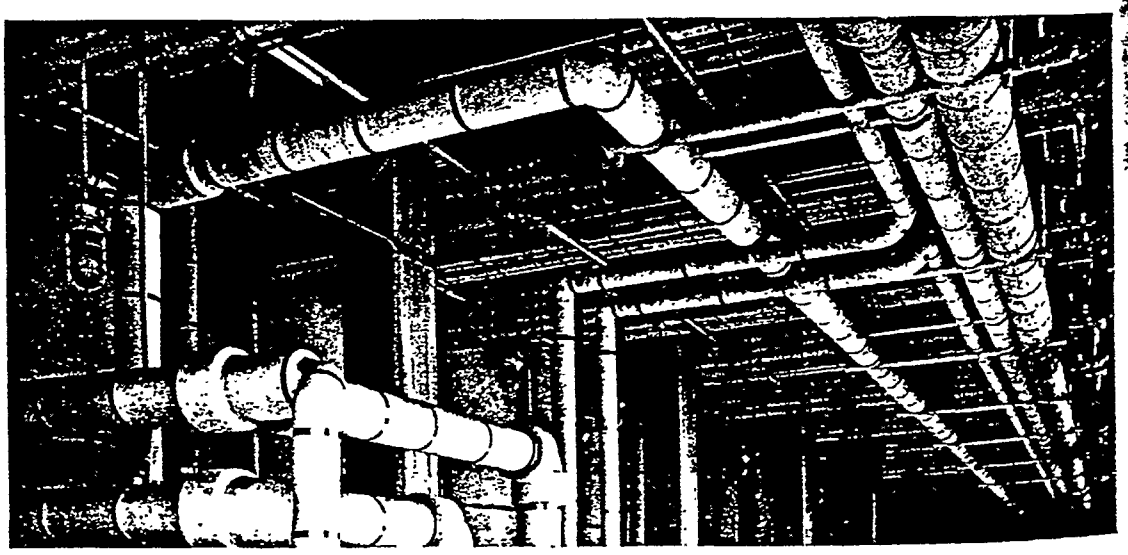
ASA dimensions of bronze screwed fittings.....page 397
ASA dimensions of cast iron screwed fittings....page 399

For Crane steel screwed and welding fittings, see Sections 24 and 25 respectively.

004134

Thermal Expansion and Modulus of Elasticity of Pipe





31

Pipe, pipe data, and thread information.....Section 29
Commercial Wrought Steel Pipe Data....pages 346 and 347

Calculating Working Pressure Stress, or Wall Thickness....pages 388 to 390
Length of Pipe in Bends and calculations of pipe bends....pages 391 to 393

CRTX 1183

Spacing of Pipe Supports

For chart on deflection of horizontal pipe lines, see next page.

When a horizontal pipe line is supported at intermediate points, sagging of the pipe occurs between these supports, the amount of sag being dependent upon the weight of the pipe, fluid, insulation, and valves or fittings which may be included in the line. If the pipe line is installed with no downward pitch, pockets will be formed in each span in which case condensation may collect if the line is transporting steam. In order to eliminate these pockets, the line must be pitched downward so that the outlet of each span is lower than the maximum sag.

Crane has conducted tests to determine the deflection of horizontal standard pipe lines filled with water, in pipe sizes ¾" to 4" inclusive, the results of which have indicated that for pipes larger than 2" and with supports having center to center dimensions greater than 10 feet, the resultant deflection is less than that determined by the use of the formula for a uniformly loaded pipe fixed at both ends. For pipe sizes 2" and smaller, the test deflection was in excess of that determined by the formula for pipe having fixed ends and approached, for the shorter spans, the deflection as determined by the use of the formula for pipe lines having unrestrained ends.

Page 395 gives the deflection of horizontal standard pipe lines filled with water, for varying spans, based upon the results obtained from tests for sizes 2" and smaller, and upon the formula for fixed ends for the larger sizes of pipe. The deflection values given on the chart are twice those obtained from test or calculation, to compensate for any variables including weight of insulation, etc.

The formula given below indicates the vertical distance that the span must be pitched so that the outlet is lower than the maximum sag of the pipe.

$$h = \frac{144\, S^2 y}{36\, S^2 - y^2}$$

where:

h = Difference in elevation of span ends, inches
S = Length of one span, feet
y = Deflection of one span, inches

By eliminating the inconsequential term "$-y^2$" from the denominator, the formula reduces to:

$$h = 4\, y$$

The pitch of pipe spans, called the Average Gradient, is a ratio between the drop in elevation and the length of the span. This is expressed as so many inches in a certain number of feet.

$$\text{Average Gradient} = \frac{4\, y}{S}$$

The dotted lines as shown on the chart on the opposite page are plotted from the above formula and indicate average gradients of 1" in 10', 1" in 15', 1" in 20', 1" in 30', and 1" in 40'.

Example: What is the maximum distance between supports for a 4" Standard pipe line assuming a pitch or average gradient of 1" in 30 feet?

Using the chart on the opposite page, find the point where the diagonal dotted line for an average gradient of 1" in 30 feet intersects the diagonal solid line for 4" pipe. From this point, proceed downward to the bottom line where the maximum span is noted to be approximately 22 feet.

Code for Pressure Piping: The Code for Pressure Piping, ASA B 31.1, makes the following statements relative to installations within the scope of the Code:

"605 (g) Supports shall be spaced so as to prevent excessive sag, bending and shear stresses in the piping, with special consideration given to those piping sections where flanges, valves, etc., impose concentrated loads. Where calculations are not made, suggested maximum spacing of hangers or supports for carbon steel piping operating at 750° F and lower are given in Table 21a (*see the table below*). "Where greater distance between supports, concentrated loads, higher temperatures, or vibration considerations are involved, special consideration should be given to effects of bending and shear stresses."

"623 (b) The design and spacing of supports shall be checked to assure that the sum of the longitudinal stresses due to weight, pressure, and other sustained external loading does not exceed the allowable stress (S value) in the hot condition."

Suggested Maximum Spacing Between Pipe Supports For Straight Runs of Standard Wall and Heavier Pipe (At Maximum Operating Temperature of 750 F)

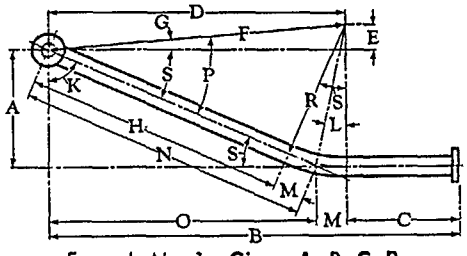
Nominal Pipe Size Inches	Maximum Span Feet	Nominal Pipe Size Inches	Maximum Span Feet
1	7	8	19
1½	9	10	22
2	10	12	23
2½	11	14	25
3	12	16	27
3½	13	18	28
4	14	20	30
5	16	24	32
6	17	..	.

Notes: The values in the table do not apply where there are concentrated loads between supports such as flanges, valves, etc.

Spacing is based on a combined bending and shear stress of 1500 psi when pipe is filled with water and the pitch of the line is such that a sag of 0.1 inch between supports is permissible.

Calculation of Pipe Bends

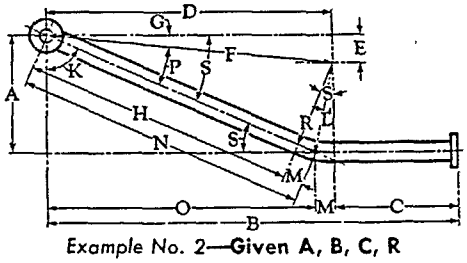
064130



Example No. 1—**Given A, B, C, R**

$D = B - C$
$E = R - A$
$F = \sqrt{D^2 + E^2}$
$\frac{E}{F} = \sin \angle G$
$H = \sqrt{F^2 - R^2}$

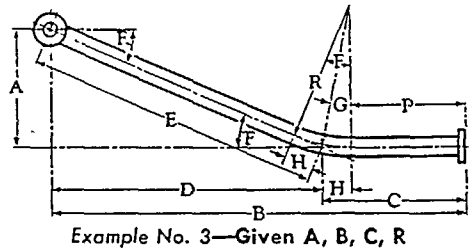
$\frac{R}{F} = \sin \angle P$
$\angle S = \angle P - \angle G$
$\angle K = 90° - \angle S$
$\angle L = \frac{1}{2} \angle S$
$M = \tan \angle L \times R$
$N = H + M$
$O = B - C - M$



Example No. 2—**Given A, B, C, R**

$D = B - C$
$E = A - R$
$F = \sqrt{D^2 + E^2}$
$\frac{E}{F} = \sin \angle G$
$H = \sqrt{F^2 - R^2}$

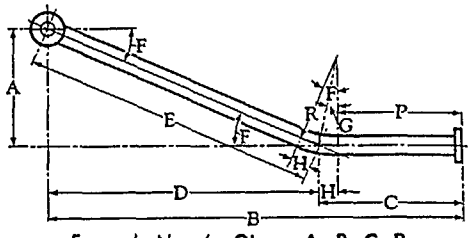
$\frac{R}{F} = \sin \angle P$
$\angle S = \angle P + \angle G$
$\angle K = 90° - \angle S$
$\angle L = \frac{1}{2} \angle S$
$M = \tan \angle L \times R$
$N = H + M$
$O = B - C - M$



Example No. 3—**Given A, B, C, R**

$D = B - C$
$E = \sqrt{A^2 + D^2}$
$\frac{A}{E} = \sin \angle F$

$\angle G = \frac{1}{2} \angle F$
$H = \tan \angle G \times R$
$P = C - H$

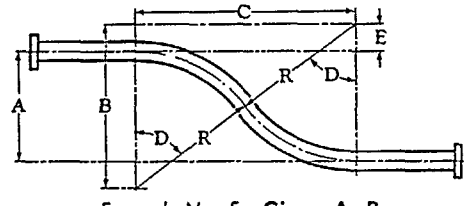


Example No. 4—**Given A, B, C, R**

$D = B - C$
$E = \sqrt{A^2 + D^2}$

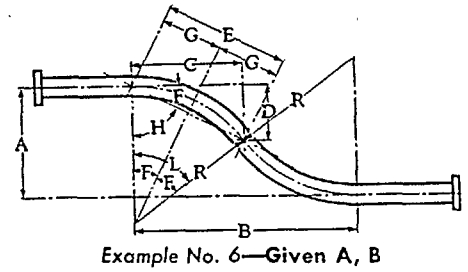
$\frac{A}{E} = \sin \angle F$
$\angle G = \frac{1}{2} \angle F$

$H = \tan \angle G \times R$
$P = C - H$



Example No. 5—**Given A, R**

$B = 2R - A$ $\quad C = \sqrt{(2R)^2 - B^2}$ $\quad \frac{C}{2R} = \sin \angle D$

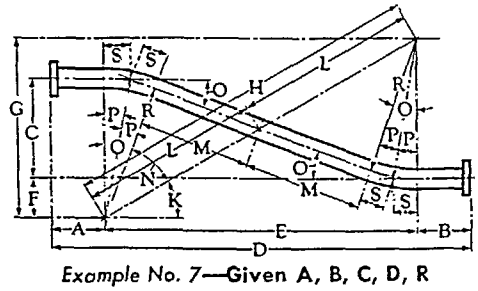


Example No. 6—**Given A, B**

$C = \frac{1}{2} B$
$D = \frac{1}{2} A$
$E = \sqrt{C^2 + D^2}$

$\frac{D}{E} = \sin \angle F$
$G = \frac{1}{2} E$

$\angle H = 90° - \angle F$
$R = \frac{A^2 + B^2}{4A}$
$L = 2F$



Example No. 7—**Given A, B, C, D, R**

$E = D - A - B$
$F = R - C$
$G = R + F$
$H = \sqrt{E^2 + G^2}$

$G/H = \sin \angle K$
$L = \frac{1}{2} H$
$M = \sqrt{L^2 - R^2}$

$M/L = \sin \angle N$
$\angle O = 90° - \angle K - \angle N$
$\angle P = \frac{1}{2} \angle O$
$S = \tan \angle P \times R$

Simplified Method for Calculating Working Pressure, Stress or Wall Thickness — cont.

QB4128

Table 4 — P/S Values (coefficients) for Steel Pipe Based on the Code for Pressure Piping, Sections 1 and 5

To obtain P/S Values for plain end pipe, it is first necessary to determine the applicable "y" value from Table 2, page 388.

Nominal Pipe Size	O. D. of Pipe	[1]Nominal Wall Thickness	P/S Values: Plain End Pipe[2] y = 0.4	y = 0.5	y = 0.7	Threaded Pipe[3] y = 0.4
Inches	Inches	Inches				
1/8	0.405	.068 (40) s	.048	.048	.048	.048
		.095 (80) x	.175	.178	.185	.175
1/4	0.540	.065 (10)	.026	.026	.026	...
		.088 (40) s	.104	.105	.108	.104
		.119 (80) x	.218	.223	.233	.218
3/8	0.675	.065 (10)	.020	.021	.021	...
		.091 (40) s	.091	.092	.094	.091
		.126 (80) x	.192	.196	.204	.192
1/2	0.840	.083 (10)	.055	.055	.056	...
		.109 (40) s	.113	.114	.117	.095
		.147 (80) x	.202	.206	.215	.183
		.187 (160)	.303	.313	.334	.282
		.294 xx	.615	.655	.754	.589
3/4	1.050	.065 (5)	.013	.013	.013	...
		.083 (10)	.044	.044	.044	...
		.113 (40) s	.097	.098	.100	.082
		.154 (80) x	.173	.176	.182	.157
		.218 (160)	.300	.310	.330	.283
		.308 xx	.502	.529	.591	.482
1	1.315	.065 (5)	.011	.011	.011	...
		.109 (10)	.071	.072	.072	...
		.133 (40) s	.105	.106	.109	.073
		.179 (80) x	.173	.176	.183	.140
		.250 (160)	.286	.294	.313	.249
		.358 xx	.477	.501	.556	.435
1 1/4	1.660	.109 (10)	.037	.037	.038	...
		.140 (40) s	.071	.072	.073	.065
		.191 (80) x	.129	.131	.135	.123
		.250 (160)	.200	.204	.213	.194
		.382 xx	.373	.387	.420	.365
1 1/2	1.900	.109 (10)	.032	.032	.033	...
		.145 (40) s	.067	.067	.068	.062
		.200 (80) x	.121	.123	.126	.116
		.281 (160)	.206	.210	.220	.200
		.400 xx	.341	.353	.380	.335
2	2.375	.109 (10)	.026	.026	.026	...
		.154 (40) s	.060	.060	.061	.056
		.218 (80) x	.111	.112	.114	.106
		.343 (160)	.215	.220	.230	.210
		.436 xx	.298	.308	.328	.293
2 1/2	2.875	.083 (5)	.005	.005	.005	...
		.120 (10)	.028	.028	.028	...
		.203 (40) s	.081	.082	.083	.055
		.276 (80) x	.129	.131	.134	.102
		.375 (160)	.198	.202	.210	.169
		.552 xx	.329	.340	.365	.298
3	3.500	.083 (5)	.004	.004	.004	...
		.120 (10)	.023	.023	.023	...
		.216 (40) s	.073	.074	.075	.052
		.300 (80) x	.118	.120	.122	.096
		.437 (160)	.196	.200	.208	.172
		.600 xx	.294	.299	.318	.269
3 1/2	4.000	.083 (5)	.004	.004	.004	...
		.120 (10)	.020	.020	.020	...
		.226 (40) s	.068	.069	.070	.050
		.318 (80) x	.111	.113	.115	.092
4	4.500	.083 (5)	.003	.003	.003	...
		.120 (10)	.018	.018	.018	...
		.237 (40) s	.065	.065	.066	.049
		.337 (80) x	.106	.108	.110	.090
		.438 (120)	.150	.152	.157	.132
		.531 (160)	.191	.195	.203	.173
		.674 xx	.257	.264	.279	.238
5	5.563	.109 (5)	.011	.011	.011	...
		.134 (10)	.019	.019	.019	...
		.258 (40) s	.059	.060	.060	.046
		.375 (80) x	.098	.099	.101	.085
		.500 (120)	.142	.144	.148	.128
		.625 (160)	.186	.190	.197	.172
		.750 xx	.232	.238	.250	.217
6	6.625	.109 (5)	.009	.009	.009	...
		.134 (10)	.016	.016	.016	...
		.280 (40) s	.056	.056	.056	.045
		.432 (80) x	.098	.099	.101	.087
		.562 (120)	.136	.138	.142	.124
		.718 (160)	.182	.186	.193	.170
		.864 xx	.228	.233	.244	.215
8	8.625	.109 (5)	.007	.007	.007	...
		.148 (10)	.015	.015	.015	...
		.250 (20)	.036	.036	.037	.028
		.277 (30)	.042	.042	.042	.033
		.322 (40) s	.051	.052	.052	.043
		.406 (60)	.069	.070	.071	.061
		.500 (80) x	.090	.090	.092	.081
		.593 (100)	.110	.111	.114	.101
		.718 (120)	.138	.140	.144	.129
		.812 (140)	.159	.162	.167	.150
		.875 xx	.174	.177	.183	.165
		.906 (160	.181	.184	.191	.172
10	10.75	.134 (5)	.010	.010	.010	...
		.165 (10)	.015	.015	.015	...
		.250 (20)	.029	.029	.029	.022
		.279	.034	.034	.034	.027
		.307 (30)	.038	.039	.039	.032
		.365 (40) s	.048	.048	.049	.041
		.500 (60) x	.071	.072	.073	.064
		.593 (80)	.087	.088	.090	.080
		.718 (100)	.109	.111	.113	.102
		.843 (120)	.132	.134	.137	.125
		1.000 (140)	.160	.163	.168	.153
		1.125 (160)	.184	.187	.194	.176
12	12.75	.156 (5)	.012	.012	.013	...
		.180 (10)	.015	.015	.015	...
		.250 (20)	.024	.024	.024	.019
		.330 (30)	.036	.036	.036	.030
		.375 s	.042	.042	.042	.036
		.406 (40)	.046	.047	.047	.041
		.500 x	.060	.060	.061	.054
		.562 (60)	.069	.069	.070	.063
		.687 (80)	.087	.088	.089	.081
		.843 (100)	.110	.111	.114	.104
		1.000 (120)	.134	.136	.140	.128
		1.125 (140)	.153	.155	.160	.147
		1.312 (160)	.182	.186	.193	.176
14	14.00	.250 (10)	.022	.022	.022	.017
		.312 (20)	.030	.030	.030	.025
		.375 (30) s	.038	.038	.039	.033
		.438 (40)	.046	.046	.047	.041
		.500 x	.054	.055	.055	.049
		.593 (60)	.067	.067	.068	.061
		.750 (80)	.087	.088	.090	.082
		.937 (100)	.113	.114	.117	.107
		1.093 (120)	.134	.136	.140	.129
		1.250 (140)	.156	.159	.164	.151
		1.406 (160)	.178	.182	.188	.173
16	16.00	.250 10)	.019	.019	.019	.015
		.312 (20)	.026	.026	.026	.022
		.375 (30) s	.033	.033	.034	.029
		.500 (40) x	.047	.048	.048	.043
		.656 (60)	.065	.066	.067	.061
		.843 (80)	.087	.088	.089	.082
		1.031 (100)	.109	.110	.113	.104
		1.218 (120)	.132	.133	.137	.127
		1.438 (140)	.159	.161	.166	.154
		1.593 (160)	.178	.181	.188	.173
18	18.00	.250 (10)	.017	.017	.017	.013
		.312 (20)	.023	.023	.024	.019
		.375 s	.030	.030	.030	.026
		.438 (30)	.036	.036	.036	.032
		.500 x	.042	.042	.043	.038
		.562 (40)	.048	.049	.049	.044
		.750 (60)	.067	.068	.069	.063
		.937 (80)	.087	.088	.089	.083
		1.156 (100)	.110	.111	.114	.106
		1.375 (120)	.133	.135	.139	.129
		1.562 (140)	.154	.156	.161	.149
		1.781 (160)	.178	.181	.188	.173
20	20.00	.250 (10)	.016	.016	.016	.013
		.375 (20) s	.027	.027	.027	.023
		.500 (30) x	.038	.038	.038	.034
		.593 (40)	.046	.046	.047	.043
		.812 (60)	.066	.067	.068	.063
		1.031 (80)	.087	.087	.089	.083
		1.281 (100)	.110	.112	.114	.106
		1.500 (120)	.131	.133	.137	.127
		1.750 (140)	.156	.158	.163	.152
		1.968 (160)	.178	.181	.187	.173
24	24.00	.250 (10)	.013	.013	.013	.010
		.375 (20) s	.022	.022	.022	.019
		.500 x	.031	.032	.032	.028
		.562 (30)	.036	.036	.036	.033
		.687 (40)	.046	.046	.046	.042
		.968 (60)	.067	.067	.068	.064
		1.218 (80)	.086	.087	.089	.083
		1.531 (100)	.111	.112	.115	.108
		1.812 (120)	.134	.135	.139	.130
		2.062 (140)	.154	.156	.161	.151
		2.343 (160)	.177	.180	.187	.174

Explanation of P/S values....page 388

[1]Figures in parentheses indicate ASA B-36 Schedule Numbers. The letters s, x, and xx, indicate Standard, Extra Strong, and Double Extra Strong pipe, respectively

[2]When y is an intermediate value, the P S value may be determined by means of interpolation

[3]For limitations of threaded ends, refer to the Code for Pressure Piping, ASA B 31.1.

CRTX 1177

Calculating Working Pressure, Stress, or Wall Thickness

Welded and Seamless Steel Pipe — Based on the Code for Pressure Piping

Among designers today, the generally accepted practice in computing thickness of pipe for a given service condition is to use formulas provided by the Code for Pressure Piping, the ASME Boiler and Pressure Vessel Code, or other applicable codes. Of these, the Code for Pressure Piping (American Standard B31.1) serves the widest general purpose and covers the following:

Section 1.....Power Piping
Section 2.....Industrial and Gas Piping
Section 3.....Petroleum Refinery Piping
Section 4.....Oil Transportation Piping
Section 5.....Refrigeration Piping
Section 6.....Chemical Industry Process Piping
Section 8.....Gas Transmission and Distribution Piping

Each Section presents minimum safety requirements for design, manufacture, and erection of the piping system indicated and includes a formula for calculating required pipe wall thickness. The procedure for Section 1 is summarized below for those concerned with power piping and district heating piping. The procedure applies to Section 5 also.

Pipe Design Formula

For Sections 1 and 5 of the Code

Sections 1 and 5 of the Code for Pressure Piping include the following formula for determining pipe wall thickness:

$$t_m = \frac{PD}{2S + 2yP} + c$$

where:

*t_m = required pipe wall thickness.....in inches
t = nominal pipe wall thickness.....in inches
P = maximum internal service pressure.....in psig
D = outside diameter of pipe.....in inches
S = allowable stress in material.....in psi
c = allowance for threading, mechanical strength, and for corrosion.....in inches; for values, see Table 1
y = coefficient.....for values, see Table 2

*Since all pipe furnished by the mill is subject to a 12½ per cent variation in wall thickness, the thickness t_m should be multiplied by 8/7 to obtain the nominal wall thickness.

The value of P shall not be taken at less than allowed by the various Sections of the Code.

Values of c and y, as expressed in the Code, follow:

Table 1—"c" Values for Steel Pipe

Section in Code	Nominal Pipe Size, Inches	"c" Values, in Inches: For Plain End Steel Pipe	"c" Values, in Inches: For Threaded Steel Pipe†
1 or 5	⅛ to ⅜	0.05	0.05
	½ and ¾	0.05	0.0571
	1	0.05	0.0696
	1¼ to 2	0.065	0.0696
	Larger than 2	0.065	0.1000

†Values are for American Standard Pipe Threads for nominal pipe sizes of ½-inch and larger.

Table 2—"y" Values (Coefficients) at Degrees F

Section in Code	Type of Steel	Up to 900°	950°	1000°	1050°	1100°	1150° & over
1 or 5	Ferritic	0.4	0.5	0.7	0.7	0.7	0.7
	Austenitic	0.4	0.4	0.4	0.4	0.5	0.7

Interpolate for "y" values at intermediate temperatures.

Simplified Method for Calculating Working Pressure, Stress, or Wall Thickness

For Sections 1 and 5 of the Code

Although the formula given above enables the determination of pipe wall thickness, its extensive use for practical purposes involves many laborious calculations. By establishing the ratio of the working pressure to the allowable stress as a coefficient, Crane engineers have developed an exceedingly easy, simple, and accurate method, based on the Code for Pressure Piping, for figuring not only wall thickness but also the stress in the pipe or the working pressure of the pipe. For typical problems, see page 389.

Coefficients for calculating; P/S values: The coefficients for calculating, which are the values of the ratio of the working pressure to allowable stress (P/S) are shown in Table 4, page 390. This table covers various thicknesses and sizes of steel pipe, and includes all scheduled pipe shown in the American Standard for Wrought-Iron and Wrought-Steel Pipe (ASA B36.10) as well as other thicknesses which are at present commercially available.

The table has been based upon the design formula given in the Code for Pressure Piping, the formula being rearranged in the following manner in order to calculate these values:

$$P/S = \frac{2\,(0.875t - c)}{D - 2y\,(0.875t - c)}$$

Allowable stress for pipe: Each Section of the Code tabulates the allowable stress, S, for piping materials at various temperatures. Table 3, page 389, shows allowable stresses applying to Sections 1 and 5 for several grades of steel pipe.

Calculated pressure-temperature ratings: For the convenience of users, Crane engineers have also calculated the actual pressure-temperature ratings for Standard and Extra Strong Grade B Seamless Steel Pipe for the Power Piping Section of the Code for Pressure Piping; see page 305.

064124 Design of Pipe Coils for Heat Transfer

The following practical hints and recommendations are presented to aid the designer of pipe coils for heat transfer.

1. "Overdesign" rather than "underdesign". It is a simple matter to cut down the conductivity of a pipe coil but more difficult to increase it.

2. Have adequate means for removal of condensate.

3. Remove entrapped gases from liquids.

4. It is important that pressure drop be considered in designing a pipe coil, to determine the limitations on length of a given pipe size. If excessively long lines are used, they may not be capable of transmitting the required quantity of fluid at the available initial pressure. Keeping this limitation in mind, it is desirable to use fluid velocities as high as possible, so that the resistance to heat transfer due to the film is lowered.

Data for calculating the pressure drop in water lines is given on page 432, air lines on page 433, and compressible fluid lines on pages 434 and 435.

In a coil using smooth pipe bends, for purposes of calculating pressure drop on the basis of the chart on page 426 showing the resistance of 90° bends, the actual pipe length should be converted to an equivalent pipe length. If other fittings such as return bends or elbows are used, the equivalent length may be based on data shown on page 424.

For steam condensing in a pipe coil, the quantity of steam passing through the coil varies from total input at the inlet to zero pounds per hour at the outlet, and the amount of condensate varies from zero pounds per hour at the inlet to total weight per hour at the outlet. Obviously, the total pressure drop in the coil will be equal to the sum of the losses due to the flow of the steam and the [illegible]. However, due to the high ratio of the specific volumes of the two fluids, the percentage of pipe cross section that is occupied by the water is negligible and the pressure drop due to the flow of condensate may therefore be neglected in the calculation of practical problems. The pressure drop due to the flow of steam will be high near the inlet, and will decrease approximately as the square of the velocity as the steam passes through the coil. From this relationship, combined with the effect of increased specific volume of the steam due to pressure drop, it can be shown that the average velocity of the steam in the coil is approximately three-fourths of the maximum or initial velocity, and for the purpose of calculating pressure drop, the same ratio may be used to determine the average quantity of steam flowing within the coil.

5. Give careful consideration to the installation of those accessories which are necessary adjuncts to the successful use of pipe coils, such as pressure and temperature indicators and regulators, safety and relief valves, traps, vent valves, and sediment separators.

6. The shape and dimensions of the vessel determine the dimensional limits and design of the pipe coil which is to be installed. The illustrations of pipe coils given on pages 376 to 379 will aid in the selection of the most applicable design.

The sample problem on the page following shows the procedure for determining the pipe size and linear feet of pipe required in a pipe coil containing steam at a given pressure and specified allowable pressure drop, to raise the temperature of a given quantity of water per unit of time a specified amount.

(Continued on the next page)

Ordinary Ranges of U*[1]

Over-all Coefficients, U, Expressed in Btu per Hour per Square Foot per Degree F

(See preceding page for explanation—"Determination of U")

Fluid Giving Up Heat	Fluid Receiving Heat	State of Controlling Resistance: Free Convections U	State of Controlling Resistance: Forced Convections U	Typical Fluid	Typical Apparatus
Liquid	Liquid	25-60	150-300	Water	Liquid Heat Exchangers, etc.
		5-10	20-50	Oil	
	Gas	1-3	2-10	Water to Air	Hot Water Radiators, Cooling Tower Surfaces
	Boiling Liquid	20-60	50-150	Water	Brine Coolers
		5-20	25-60	Oil	
Gas	Liquid	1-3	2-10	Air to Water	Air Coolers, Economizers
	Gas	0.6-2	2-6	Gas to Steam	Steam Superheaters
	Boiling Liquid	1-3	2-10	Gas to Boiling Water	Steam Boilers
Condensing Vapor	Liquid	50-200	150-800	Steam to Water	Condensers, Feed Water Heaters
		10-30	20-60	Steam to Oil	
	Gas	1-2	2-10	Steam to Air	Steam Pipes in Air, Air Heaters
	Boiling Liquid	300-800		Steam to Water	Vacuum Evaporators
		50-150		Steam to Oil	

*Under special conditions higher or lower values may be realized

[1] W. H. McAdams, "Heat Transmission" (McGraw-Hill Book Co., Inc.) from data given by A. P. Colburn (Copyright 1942).

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384 4122

Assembly and Maintenance of Flanged Joints

When a flanged joint is assembled, each of the component parts is subjected to tensile or compressive stresses of varying magnitude. Under service conditions, especially where high temperatures are involved, a change in the magnitude of these stresses occurs and a lowering of the bolt stress results.

To compensate for this reduction in bolt stress, the following recommendations are made with regard to the assembly and maintenance of flanged joints.

Assembly: Initial bolt stresses to be applied in the assembly of flanged joints should afford a reasonable factor of safety with reference to the yield point of the bolting material. And yet the initial bolt stress must be high enough to insure a tight joint.

An extensive survey of field erected flanged joints has indicated that the following initial stresses are usually applied when *alloy steel* stud bolts are pulled up manually. Experience has shown that these stresses are satisfactory for American Standard Steel Flanges and will comply with the requirements as set forth in the preceding paragraph.

Table 1

Size of Alloy Steel Stud Bolt (Note 1)	Average Stress Applied Manually, Lbs. per Sq. Inch (Note 2)	Approximate Torque to Obtain Stress, Ft. Lbs. (Note 3)	Elongation in Inches, per Inch of Effective Length (Note 4)
¾	52,000	175	.00173
⅞	48,000	255	.00160
1	45,000	370	.00150
1⅛	42,500	500	.00142
1¼	40,000	665	.00133
1⅜	38,000	860	.00127
1½	36,500	975	.00122
1⅝	35,000	1285	.00117
1¾	34,000	1700	.00113
1⅞	33,000	2200	.00110
2	32,000	2350	.00107

[1]Sizes 1-inch and smaller are coarse thread series. Sizes 1⅛-inch and larger are 8-pitch thread series.

[2]Average stress applied by maintenance men in assembly, using a lever and wrench or by sledging.

[3]Based upon threads being well-lubricated (Crane Anti-Seize Thread Compound or equal, see page 324)

[4]Based on a modulus of elasticity of 30,000,000. The effective length of the stud bolt equals the distance from the center of one nut to the center of the other.

The values given in Table 1 have been graduated according to size—but, if it is possible to apply higher torques, it is recommended that the initial bolt stress be approximately 45,000 pounds per square inch. This is higher than ASME Code design stresses; however, the stresses in the Code reflect capacity to sustain stress after relaxation, rather than initial stress.

ASME Code stresses apply after the flanged joint has been in service long enough to permit the bolt stresses to relax from their initial or assembly value to an approximate state of stability, which may be assumed to be equal to the allowable bolt stress for which the joint was designed.

The initial bolt stress can be applied by either of two methods: (1) By pulling up the well-lubricated[3] stud bolts with the proper torque, or (2) by pulling up the stud bolts to produce the elongation necessary for the desired bolt stress. When the second method is used the total desired elongation of the stud bolt should be ascertained by multiplying the value given in the table for elongation in inches per inch by the effective length (distance from center of one nut to center of the other). Figures 1 and 2. respectively, show the design of an instrument which can be used in measuring stud bolt elongation and the preparation of the ends of a stud bolt for accurate measurement.

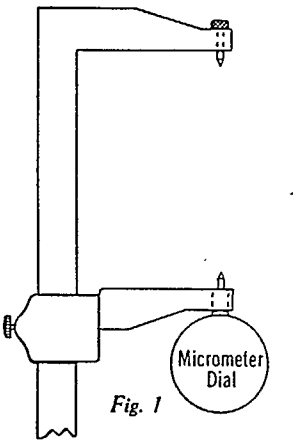


Fig. 1

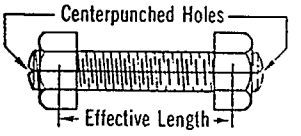


Fig. 2

Maintenance: ***When should stud bolts be pulled up after being in service?*** It is recommended that the bolting in all flanged joints installed on temperatures above 500 F be pulled up after the first shutdown. On high temperature service where creep may be expected to occur, it is recommended that the bolting be pulled up at least once during the first 200 hours of service, regardless of whether the line has been shut down or not. Bolt stress should be checked periodically during the life of the installation

How should the bolt elongation be checked and the stud bolts pulled up? As a general rule, it is only necessary to check the elongation in two or three diametrically opposite stud bolts, using the average of the values obtained as the elongation for the remainder. If the bolt elongation is to be determined while the joint is in service, one bolt should be checked and pulled up before another is loosened. Measurements should be taken immediately after releasing the load before the bolt temperature decreases. The following procedure should be used in checking bolt elongation:

(a) Determine the length of the bolt in the assembled joint
(b) Release the load on the bolt by loosening the nut re-measure the length.
(c) Subtract second reading from first
(d) Divide this value by the effective length of the bolt (Effective length equals distance from center of one nut to center of the other)

If the residual elongation or stress is found on the first check to be less than 75% of the values given in Table 1, the bolts should be pulled up so that the final elongation approximates the figures shown.

Crane Bolting

004120



Machine Bolt
Square Head
With Hexagon Nut



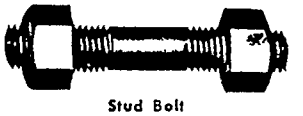
Stud
Threaded Oversize on One End
Other End Threaded for Nut

Definitions

A bolt is threaded on one end only, the other end being upset into the form of a head.

A stud is threaded on both ends, one end being oversize in diameter to fit tightly (wrench fit) in a tapped hole, the other being to the standard diameter for a nut assembly.

A stud bolt is threaded to the standard diameter, either on both ends or full length, for nut assembly on each end.



Stud Bolt
Threaded on Both Ends
With Two Hexagon Nuts



Stud Bolt
Threaded Entire Length
With Two Hexagon Nuts

Materials and Specifications

Crane furnishes machine bolts, studs, stud bolts, and nuts as follows:

Machine Bolts for use at temperatures up to 500 F are made from steel complying with ASTM Specification A 307, Grade B. This steel has a minimum tensile strength of 55,000 pounds per square inch.

The bolts have Regular Square heads in accordance with American Standard ASA B18.2.

All machine bolts are threaded in accordance with American Standard ASA B1.1 Coarse Thread Series, Class 2A fit.

Nuts regularly furnished with machine bolts are steel conforming to ASTM Specification A 307.

Nuts are made to American Standard ASA B18.2 Heavy Hexagon dimensions.

All nuts are tapped in accordance with American Standard ASA B1.1 Coarse Thread Series, Class 2B fit.

Studs and Stud Bolts for use at temperatures up to 500 F are made from cold rolled steel complying with ASTM Specification A 108, Open Hearth free-cutting grade.

Cold rolled steel studs (nut ends only) and stud bolts are threaded in accordance with American Standard ASA B1.1 Coarse Thread Series, Class 2A fit.

Nuts regularly furnished with cold rolled steel studs and stud bolts are cold formed steel conforming to ASTM Specification A 307.

Nuts are made to American Standard ASA B18.2 Heavy Semi-Finished Hexagon dimensions.

All nuts are tapped in accordance with American Standard ASA B1.1 Coarse Thread Series, Class 2B fit.

Alloy Steel Studs and Stud Bolts are made of Crane Triplex or Templex Steel. Crane Triplex Steel complies with the requirements of ASTM Specification A 193, Grade B7 bolting. Crane Templex Steel complies with the requirements of ASTM Specification A 193, Grade B14 bolting.

Crane Triplex Steel has been used with uniformly satisfactory results in thousands of steel valve and fitting installations, many of which—particularly in oil refineries—have been operating under extreme pressures and temperatures. Templex Steel, another Crane development in bolting materials, is superior to Triplex Steel in creep resistance; on temperatures over 850 F, especially where joints are made up for permanent, long-time service, as in steam power plants, Crane Templex Steel will be found ideal.

Physical Properties	Minimum	Crane Triplex average	Crane Templex average
Tensile strength.....psi	125,000	134,000	145,000
Yield point.....psi	105,000	116,000	118,000
Elongation in 2 inches...per cent	16	20	20
Reduction of area.....per cent	50	57	57
Brinell hardness number..(range)	260–320	270–300	285–320

Crane Alloy Steel Studs (nut ends only) and Stud Bolts (entire length) are threaded in accordance with American Standard ASA B1.1 . . . . Coarse Thread Series on sizes 1-inch and smaller and 8-Pitch Thread Series on sizes 1⅛-inch and larger, Class 2A fit

Nuts regularly furnished with alloy steel studs and stud bolts are hot forged, medium carbon steel, oil quenched, conforming to ASTM Specification A 194, Grade 2H.

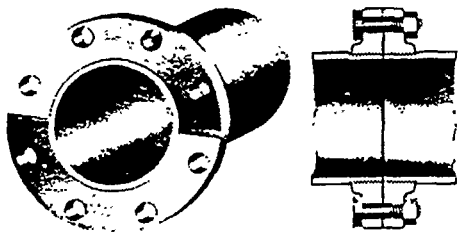
Nuts are made to American Standard ASA B18.2 Heavy Semi-Finished Hexagon dimensions.

All nuts are tapped in accordance with American Standard ASA B1.1 . . . . Coarse Thread Series on sizes 1-inch and smaller and 8-Pitch Thread Series on sizes 1⅛-inch and larger, Class 2B fit.

NOTE: EXCEPT FOR THIS PAGE, ALL OF SECTION 30 IS DELETED FROM THIS REPRINT OF THE NO. 60 CATALOG. SEE EXPLANATION ON PRECEDING PAGE.

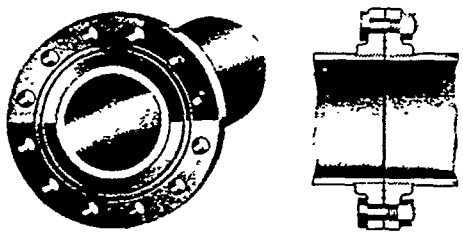
004118

Flange Facings and Finishes

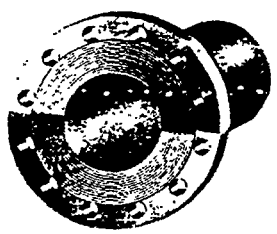


Plain Face — Smooth or Spiral Serrated Finish
(smooth finish illustrated)

Regular Crane practice on iron flanged product of the 25 and 125-pound pressure classes and on all stainless steel flanged product. Iron is furnished with a smooth finish; stainless steel, with a spiral serrated finish.

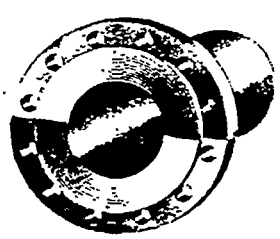


Plain Face — Smooth Finish, V-Grooved
Regular Crane practice on all bronze flanged product.



1/16-Inch High Raised Face
Concentric or Spiral Serrated Finish
(concentric serrations illustrated)

Regular Crane practice on 250-pound iron and 150 and 300-pound steel flanged product. Iron has a concentric serrated finish; steel, at the factory's option, a concentric or spiral serrated finish.



¼-Inch High Male Face
Concentric Serrated Finish

Regular Crane practice on steel flanged product of 400-pound and higher pressure classes.

Crane Fabricated Piping includes a variety of facings and finishes for flanged joints.

"*Facing*" refers to the type of face that is machined on flanges or lap joints. It should not be confused with "*finish*", which refers to the kind of finish applied to the actual contact surface of the face. For example, the facing of a flange machined with a ¼-inch high projection is commonly known as a ¼-inch high male face, but the finish on the contact surface of the male projection can be either *smooth* or *serrated*.

TYPES OF FINISHES ON FLANGE FACINGS

Smooth finish: An even, smoothly machined surface.

Smooth finish, V-grooved: An even, smoothly machined surface with two V-shaped concentric grooves between the port and the bolt holes.

Concentric serrated finish: Accomplished by means of a round-nosed or form tool which cuts concentric grooves . . . . about 16 serrations per inch on iron flanged product . . . . and about 32 serrations per inch on steel flanged product.

Spiral serrated finish: Accomplished by means of a round-nosed tool which cuts a continuous spiral groove . . . . about 32 serrations per inch on flanged product 12-inch and smaller . . . . and about 21 per inch on sizes 14-inch and larger.

CRANE STANDARD PRACTICE

Facings and finishes regularly furnished on Crane flanged product follow. Facings and finishes other than indicated can be furnished when specified; information on request.

Bronze: Regularly plain faced, with a smooth finish, V-grooved. Full face gaskets should always be used when assembling bronze joints; metallic gaskets are not recommended.

Iron—including Ferrosteel and High Tensile Iron: Iron flanged product of the 25-pound and 125-pound pressure classes are regularly furnished plain faced, with a smooth finish.

Iron flanged product of the 250-pound pressure class have a 1/16-inch high raised face, with a serrated (concentric) finish.

Steel: Steel flanged product of the 150 and 300-pound classes have a 1/16-inch high raised face, with a serrated finish (concentric or spiral serrations, at factory's option). Steel flanged product of 400-pound and higher classes have a ¼-inch high large male face, with a serrated (concentric) finish.

When any steel flanged product is ordered with a flat face . . . or with the raised face removed . . . the flat face will have a serrated (spiral) finish.

Stainless steel: Stainless steel flanged products are regularly furnished plain faced, with a serrated (spiral) finish.

BOLTING FLANGES OF DISSIMILAR METALS — Also see page 318

Raised faces should be removed from iron and steel flanges before they are bolted against bronze flanges.

Steel flanges of the 150-pound class may be bolted to iron valves, fittings, etc., having Class 125 cast iron integral flanges or screwed companion flanges providing the 1/16-inch raised face is removed. When using a ring gasket extending to the inner edge of the bolt holes, the bolting shall be of carbon steel equivalent to ASTM A 307, Grade B without heat-treatment other than stress relief. When using a full face gasket, the bolting may be heat-treated carbon steel (ASTM A 261) or alloy steel (ASTM A 193).

Steel flanges of the 300-pound class may be bolted to iron valves, fittings, etc., having Class 250 cast iron integral flanges or screwed companion flanges Removal of the 1/16-inch raised face is not mandatory; however, good practice indicates its removal. In either case, bolting shall be of carbon steel equivalent to ASTM A 307, Grade B, without heat-treatment other than stress relief

Templates for drilling . . . . . pages 326 to 331 *Dimensions of special facings . . . . pages 332 to 335*

Volume per Lineal Foot of Pipe

004116

Nominal Pipe Size Inches	Schedule No.	Wall Thickness Inches	Inside Diameter of Pipe		Pipe Volume Per Lineal Foot		
			Inches	Feet	Cubic Feet	U.S. Gallons	Barrels (*)
4	40	0.237	4.026	0.3355	0.0884	0.6613	0.01575
5	40	0.258	5.047	0.4206	0.1390	1.0398	0.02476
6	40	0.280	6.065	0.5054	0.2006	1.5006	0.03573
8	20	0.250	8.125	0.6771	0.3601	2.6937	0.06414
	30	0.277	8.071	0.6726	0.3553	2.6578	0.06328
	40	0.322	7.981	0.6651	0.3474	2.5987	0.06188
10	20	0.250	10.250	0.8542	0.5731	4.2871	0.10208
	Standard	0.279	10.192	0.8493	0.5666	4.2384	0.10092
	30	0.307	10.136	0.8447	0.5603	4.1913	0.09979
	40	0.365	10.020	0.8350	0.5475	4.0956	0.09753
12	20	0.250	12.250	1.0208	0.8185	6.1228	0.14578
	30	0.330	12.090	1.0075	0.7972	5.9635	0.14199
	Standard	0.375	12.000	1.0000	0.7854	5.8752	0.13989
	40	0.406	11.938	0.9965	0.7773	5.8146	0.13845
14	10	0.250	13.500	1.1250	0.994	7.4356	0.17704
	20	0.312	13.376	1.1147	0.9758	7.3095	0.17404
	30	0.375	13.250	1.1042	0.9575	7.1626	0.17054
	40	0.437	13.126	1.0937	0.9394	7.0272	0.16732
16	10	0.250	15.500	1.2917	1.310	9.7995	0.23333
	20	0.312	15.376	1.2813	1.290	9.6498	0.22976
	30	0.375	15.250	1.2708	1.268	9.4853	0.22584
	40	0.500	15.000	1.2500	1.2272	9.1801	0.21858
18	10	0.250	17.500	1.4583	1.670	12.4924	0.29744
	20	0.312	17.376	1.4480	1.647	12.3204	0.29335
	Standard	0.375	17.250	1.4375	1.623	12.1409	0.28907
	30	0.437	17.126	1.4272	1.599	11.9613	0.28480
	Ex. Strong	0.500	17.000	1.4167	1.5763	11.7915	0.28076
	40	0.562	16.876	1.4063	1.5533	11.6197	0.27666
20	10	0.250	19.500	1.6250	2.074	15.5146	0.36940
	...	0.312	19.376	1.6147	2.0478	15.3186	0.36474
	20	0.375	19.250	1.6042	2.021	15.1181	0.35996
	30	0.500	19.000	1.5833	1.969	14.7291	0.35070
24	10	0.250	23.500	1.958	3.012	22.5313	0.53647
	...	0.312	23.376	1.9480	2.9805	22.2956	0.53086
	20	0.375	23.250	1.9375	2.948	22.0525	0.52507
	Ex. Strong	0.500	23.000	1.9167	2.8853	21.5835	0.51390
26	...	0.250	25.500	2.1250	3.5466	26.5303	0.63169
	...	0.312	25.376	2.1147	3.5123	26.2738	0.62558
	Standard	0.375	25.250	2.1042	3.4774	26.0127	0.61937
	Ex. Strong	0.500	25.000	2.0833	3.4087	25.499	0.60713
30	...	0.250	29.500	2.4583	4.7463	35.505	0.84537
	10	0.312	29.376	2.4480	4.707	35.2107	0.83837
		0.375	29.250	2.4375	4.6664	34.907	0.83114
		0.500	29.000	2.4167	4.5871	34.314	0.81702
36		0.250	35.500	2.9583	6.8734	51.416	1.22421
		0.312	35.376	2.9480	6.8257	51.060	1.21574
		0.375	35.250	2.9375	6.7771	50.696	1.20707
		0.500	35.000	2.9167	6.6815	49.981	1.19005

*Based on one barrel equaling 42 gallons (petroleum measure)

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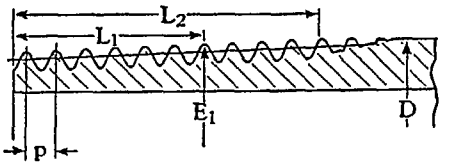
Cast steel pipe-line gate valves.....pages 131 to 133
Cast steel pipe-line swing check valves.....page 155
Commercial wrought steel pipe data....pages 346 and 347

CRTX 1165

British Standard Taper Pipe Threads

Whitworth 55° Form of Thread

Total Taper ¾-inch per Foot



This information is taken from the British Engineering Standards Association Report No. 21-1938.

Dimensions, in Inches

Pipe Size Nominal Bore	D Approximate outside diameter of pipe	E_1 Pitch diameter at end of internal thread	L_1 Normal engagement by hand between external and internal threads	L_2 Length of effective thread	p Pitch of threads	Depth of threads	Number of threads Per Inch
1/8	13/32	0.3601	0.1563	0.2545	0.03571	0.0229	28
1/4	17/32	0.4843	0.2367	0.3814	0.05263	0.0337	19
3/8	11/16	0.6223	0.2500	0.3947	0.05263	0.0337	19
1/2	27/32	0.7793	0.3214	0.5178	0.07143	0.0457	14
3/4	1 1/16	0.9953	0.3750	0.5714	0.07143	0.0457	14
1	1 11/32	1.2508	0.4091	0.6591	0.09091	0.0582	11
1 1/4	1 11/16	1.5918	0.5000	0.7500	0.09091	0.0582	11
1 1/2	1 29/32	1.8238	0.5000	0.7500	0.09091	0.0582	11
2	2 3/8	2.2888	0.6250	0.9204	0.09091	0.0582	11
2 1/2	3	2.9018	0.6875	1.0511	0.09091	0.0582	11
3	3 1/2	3.4018	0.8125	1.1761	0.09091	0.0582	11
3 1/2	4	3.8918	0.8750	1.2386	0.09091	0.0582	11
4	4 1/2	4.3918	1.0000	1.4091	0.09091	0.0582	11
5	5 1/2	5.3918	1.1250	1.5795	0.09091	0.0582	11
6	6 1/2	6.3918	1.1250	1.5795	0.09091	0.0582	11
7	7 1/2	7.3860	1.3750	1.9250	0.10000	0.0640	10
8	8 1/2	8.3860	1.5000	2.0500	0.10000	0.0640	10
9	9 1/2	9.3860	1.5000	2.0500	0.10000	0.0640	10
10	10 1/2	10.3860	1.6250	2.1750	0.10000	0.0640	10
11	11 1/2	11.3700	1.6250	2.3125	0.1250	0.0800	8
12	12 1/2	12.3700	1.6250	2.3125	0.1250	0.0800	8

Normal Engagement

Between Male and Female Threads to Make Tight Joints

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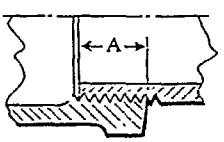
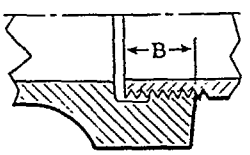


American Standard and API Line Pipe Threads



Shoulder Type Drainage Fitting Threads

*Dimension B: Dimension B indicates the use of American Standard Taper Male Thread with shoulder type drainage fittings. The external thread, however, should not be threaded small to gauge nor more than one turn large

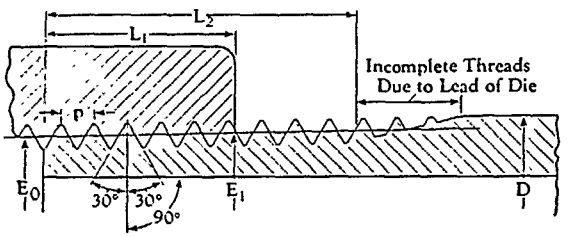
Dimensions, in Inches

Dimensions given do not allow for variations in topping or threading

Size	A	B*	Size	A	B*
1/8	1/4		3	1	15/16
1/4	3/8		3 1/2	1 1/16	1
3/8	3/8		4	1 1/8	1 1/16
1/2	1/2		5	1 1/4	1 3/16
3/4	9/16		6	1 5/16	1 1/4
1	11/16	9/16	8	1 7/16	1 3/8
1 1/4	11/16	5/8	10	1 5/8	1 9/16
1 1/2	11/16	5/8	12	1 3/4	1 11/16
2	3/4	5/8	14		1 7/8
2 1/2	15/16	7/8			

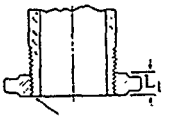
Information on threaded pipe joints....page 353

American Standard Taper Pipe Threads (NPT)

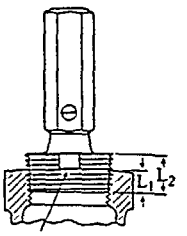


$E_0 = D - (0.050D + 1.1)p$
$E_1 = E_0 + 0.0625\ L_1$
$L_2 = (0.80D + 6.8)p$

p = Pitch
Depth of thread = $0.80p$
Total Taper ¾-inch per Foot



Tolerance on Product
One turn large or small from notch on plug gauge or face of ring gauge.



Notch flush with face of fitting. If chamfered, notch flush with bottom of chamfer

Dimensions, in Inches

Nominal pipe size	D Outside diameter of pipe	E_0 Pitch diameter at end of external thread	E_1† Pitch diameter at end of internal thread	L_1¶ Normal engagement by hand between external and internal threads	L_2§ Length of effective thread	p Pitch of thread	Depth of thread	Number of threads Per Inch
⅛	0.405	0.36351	0.37476	0.180	0.2639	0.03704	0.02963	27
¼	0.540	0.47739	0.48989	0.200	0.4018	0.05556	0.04444	18
⅜	0.675	0.61201	0.62701	0.240	0.4078	0.05556	0.04444	18
½	0.840	0.75843	0.77843	0.320	0.5337	0.07143	0.05714	14
¾	1.050	0.96768	0.98887	0.339	0.5457	0.07143	0.05714	14
1	1.315	1.21363	1.23863	0.400	0.6828	0.08696	0.06957	11½
1¼	1.660	1.55713	1.58338	0.420	0.7068	0.08696	0.06957	11½
1½	1.900	1.79609	1.82234	0.420	0.7235	0.08696	0.06957	11½
2	2.375	2.26902	2.29627	0.436	0.7565	0.08696	0.06957	11½
2½	2.875	2.71953	2.76216	0.682	1.1375	0.12500	0.10000	8
3	3.500	3.34062	3.38850	0.766	1.2000	0.12500	0.10000	8
3½	4.000	3.83750	3.88881	0.821	1.2500	0.12500	0.10000	8
4	4.500	4.33438	4.38712	0.844	1.3000	0.12500	0.10000	8
5	5.563	5.39073	5.44929	0.937	1.4063	0.12500	0.10000	8
6	6.625	6.44609	6.50597	0.958	1.5125	0.12500	0.10000	8
8	8.625	8.43359	8.50003	1.063	1.7125	0.12500	0.10000	8
10	10.750	10.54531	10.62094	1.210	1.9250	0.12500	0.10000	8
12	12.750	12.53281	12.61781	1.360	2.1250	0.12500	0.10000	8
14 O.D.	14.000	13.77500	13.87262	1.562	2.2500	0.12500	0.10000	8
16 O.D.	16.000	15.76250	15.87575	1.812	2.4500	0.12500	0.10000	8
18 O.D.	18.000	17.75000	17.87500	2.000	2.6500	0.12500	0.10000	8
20 O.D.	20.000	19.73750	19.87031	2.125	2.8500	0.12500	0.10000	8
24 O.D.	24.000	23.71250	23.86094	2.375	3.2500	0.12500	0.10000	8

†Also pitch diameter at gauging notch.
§Also length of plug gauge
¶Also length of ring gauge, and length from gauging notch to small end of plug gauge

The above information taken from the American Standard for Pipe Threads, ASA—B2 1-1945.

Wrought Iron and Steel Pipe

Comparison of Wall Thicknesses

Nominal Size	Outside Diameter	Nominal Wall Thickness, Inches					
		Standard		Extra Strong		Double Extra Strong	
Inches	Inches	Iron	Steel	Iron	Steel	Iron	Steel
¼	.540	.090	.088	.122	.119	...	...
⅜	.675	.093	.091	.129	.126	...	...
½	.840	.111	.109	.151	.147	.307	.294
¾	1.050	.115	.113	.157	.154	.318	.308
1	1.315	.136	.133	.183	.179	.369	.358
1¼	1.660	.143	.140	.195	.191	.393	.382
1½	1.900	.148	.145	.204	.200	.411	.400
2	2.375	.158	.154	.223	.218	.447	.436
2½	2.875	.208	.203	.282	.276	.567	.552
3	3.500	.221	.216	.306	.300	.615	.600
3½	4.000	.231	.226	.325	.318	.651	.636
4	4.500	.242	.237	.344	.337	.690	.674
4½*	5.000	.252	...	.363	...	.727	...
5	5.563	.263	.258	.383	.375	.768	.750
6	6.625	.286	.280	.441	.432	.884	.864
7*	7.625	.307	...	.510	...	.895	...
8	8.625	.283	.277	...	...	...	...
		.329	.322	.510	.500	.895	.875
9*	9.625	.349	...	.510	...		
10	10.750	.284	.279	...	...		
		.313	.307	...	...		
		.372	.365	.510	.500		
11*	11.750	.383	...	.510	...		
12	12.750	.336	.330	...	...		
		.383	.375	.510	.500		

Wrought Iron Pipe

Bundling Schedule

Butt-Welded Pipe	Pipe Size	Lengths per Bundle	Approx. Avg. Per Bundle	
	Inches		Feet	Pounds
Standard	¼	24	430	183
	⅜	18	320	187
	½	12	240	204
	¾	7	140	160
	1	5	100	170
	1¼	3	60	138
	1½	3	60	166
Extra Strong	¼	24	480	247
	⅜	18	340	251
	½	12	250	278
	¾	7	145	215
	1	5	100	221
	1¼	3	60	186
	1½	3	60	224
Double Extra Strong	½	12	130	223
	¾	7	95	232
	1	5	60	220
	1¼	3	60	313

For steel bundling, see pages 340 and 341.

Inside diameter and weights: To determine the inside diameter of wrought iron pipe, subtract twice the wall thickness from the outside diameter.

Weights of welded wrought iron pipe are the same, size for size, as those for steel pipe; see pages 340 and 341.

*Wrought iron pipe in these sizes are furnished to order.

Red Brass and Copper Pipe

Nominal Dimensions, in Inches, and Weights

Size (IPS)	Outside Diameter	Regular				Extra Strong			
		Inside Diameter	Wall Thickness	Lbs. per Foot		Inside Diameter	Wall Thickness	Lbs. per Foot	
				Brass	Copper			Brass	Copper
⅛	.405	.281	.062	.253	.259	.205	.100	.363	.371
¼	.540	.376	.082	.447	.457	.294	.123	.611	.625
⅜	.675	.495	.090	.627	.641	.421	.127	.829	.847
½	.840	.626	.107	.934	.955	.542	.149	1.23	1.25
¾	1.050	.822	.114	1.27	1.30	.736	.157	1.67	1.71
1	1.315	1.063	.126	1.78	1.82	.951	.182	2.46	2.51
1¼	1.660	1.368	.146	2.63	2.69	1.272	.194	3.39	3.46
1½	1.900	1.600	.150	3.13	3.20	1.494	.203	4.10	4.19
2	2.375	2.063	.156	4.12	4.22	1.933	.221	5.67	5.80
2½	2.875	2.501	.187	5.99	6.12	2.315	.280	8.66	8.85
3	3.500	3.062	.219	8.56	8.75	2.892	.304	11.6	11.8
3½	4.000	3.500	.250	11.2	11.4	3.358	.321	14.1	14.4
4	4.500	4.000	.250	12.7	12.9	3.818	.341	16.9	17.3
5	5.562	5.062	.250	15.8	16.2	4.812	.375	23.2	23.7
6	6.625	6.125	.250	19.0	19.4	5.751	.437	32.2	32.9
8	8.625	8.001	.312	30.9	31.6	7.625	.500	48.4	49.5
10	10.750	10.020	.365	45.2	46.2	9.750	.500	61.1	62.4
12	12.750	12.000	.375	55.3	56.5	...	...	..	.

General practice: Brass and copper pipe are regularly furnished with plain ends and in 12-foot lengths.

When ordering, specify the size, brass or copper, and regular or extra strong.

On special order: Special surface finishes, threaded ends, and cut lengths can be furnished when specified.

Weights: Actual weights may vary slightly from theoretical weights listed in the table.

Gauge tubing: Brass or copper seamless tubing (⅛ to 10-inch nominal or O.D. size) are available in any gauge.

Copper tube: For Types K, L, and M copper tube, see next page.

Prices: Prices on request

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Commercial Wrought Steel Pipe Data

Note 1: The letters "s", "x", and "xx" in the column of Schedule Numbers indicate Standard, Extra Strong, and Double Extra Strong Pipe, respectively.

Note 2: The values shown in square feet for the Transverse Internal Area also represent the volume in cubic feet per foot of pipe length.

Nominal Pipe Size	Outside Diameter (D)	Schedule No.	Wall Thickness (t)	Inside Diameter (d)	Area of Metal (a)	Transverse Internal Area		Moment of Inertia (I)	Weight of Pipe	Weight of Water	External Surface	Section Modulus
		See Note 1				Square Inches	*See Note 2* Square Feet	Inches to 4th Power	Pounds per foot	Pounds per foot of pipe	Sq. Ft. per foot of pipe	$(2\frac{I}{D})$
Inches	Inches		Inches	Inches	Square Inches							
1/8	0.405	40s	.068	.269	.0720	.0568	.00040	.00106	.244	.025	.106	.00523
		80x	.095	.215	.0925	.0364	.00025	.00122	.314	.016	.106	.00602
1/4	0.540	40s	.088	.364	.1250	.1041	.00072	.00331	.424	.045	.141	.01227
		80x	.119	.302	.1574	.0716	.00050	.00377	.535	.031	.141	.01395
3/8	0.675	40s	.091	.493	.1670	.1910	.00133	.00729	.567	.083	.178	.02160
		80x	.126	.423	.2173	.1405	.00098	.00862	.738	.061	.178	.02554
1/2	0.840	40s	.109	.622	.2503	.3040	.00211	.01709	.850	.132	.220	.04069
		80x	.147	.546	.3200	.2340	.00163	.02008	1.087	.102	.220	.04780
		160	.187	.466	.3836	.1706	.00118	.02212	1.300	.074	.220	.05267
		...xx	.294	.252	.5043	.050	.00035	.02424	1.714	.022	.220	.05772
3/4	1.050	40s	.113	.824	.3326	.5330	.00371	.03704	1.130	.231	.275	.07055
		80x	.154	.742	.4335	.4330	.00300	.04479	1.473	.188	.275	.08531
		160	.218	.614	.5698	.2961	.00206	.05269	1.940	.128	.275	.10036
		...xx	.308	.434	.7180	.148	.00103	.05792	2.440	.064	.275	.11032
1	1.315	40s	.133	1.049	.4939	.8640	.00600	.08734	1.678	.375	.344	.1328
		80x	.179	.957	.6388	.7190	.00499	.1056	2.171	.312	.344	.1606
		160	.250	.815	.8365	.5217	.00362	.1251	2.840	.230	.344	.1903
		...xx	.358	.599	1.0760	.282	.00196	.1405	3.659	.122	.344	.2136
1 1/4	1.660	40s	.140	1.380	.6685	1.495	.01040	.1947	2.272	.649	.435	.2346
		80x	.191	1.278	.8815	1.283	.00891	.2418	2.996	.555	.435	.2913
		160	.250	1.160	1.1070	1.057	.00734	.2839	3.764	.458	.435	.3421
		...xx	.382	.896	1.534	.630	.00438	.3411	5.214	.273	.435	.4110
1 1/2	1.900	40s	.145	1.610	.7995	2.036	.01414	.3099	2.717	.882	.497	.3262
		80x	.200	1.500	1.068	1.767	.01225	.3912	3.631	.765	.497	.4118
		160	.281	1.338	1.429	1.406	.00976	.4824	4.862	.608	.497	.5078
		...xx	.400	1.100	1.885	.950	.00660	.5678	6.408	.42	.497	.5977
2	2.375	40s	.154	2.067	1.075	3.355	.02330	.6657	3.652	1.45	.622	.5606
		80x	.218	1.939	1.477	2.953	.02050	.8679	5.022	1.28	.622	.7309
		160	.343	1.689	2.190	2.241	.01556	1.162	7.440	.97	.622	.979
		...xx	.436	1.503	2.656	1.774	.01232	1.311	9.029	.77	.622	1.104
2 1/2	2.875	40s	.203	2.469	1.704	4.788	.03322	1.530	5.79	2.07	.753	1.064
		80x	.276	2.323	2.254	4.238	.02942	1.924	7.66	1.87	.753	1.339
		160	.375	2.125	2.945	3.546	.02463	2.353	10.01	1.54	.753	1.638
		...xx	.552	1.771	4.028	2.464	.01710	2.871	13.70	1.07	.753	1.997
3	3.500	40s	.216	3.068	2.228	7.393	.05130	3.017	7.58	3.20	.916	1.724
		80x	.300	2.900	3.016	6.605	.04587	3.894	10.25	2.86	.916	2.225
		160	.438	2.624	4.205	5.408	.03755	5.032	14.32	2.35	.916	2.876
		...xx	.600	2.300	5.466	4.155	.02885	5.993	18.58	1.80	.916	3.424
3 1/2	4.000	40s	.226	3.548	2.680	9.886	.06870	4.788	9.11	4.29	1.047	2.394
		80x	.318	3.364	3.678	8.888	.06170	6.280	12.51	3.84	1.047	3.140
4	4.500	40s	.237	4.026	3.174	12.73	.08840	7.233	10.79	5.50	1.178	3.214
		80x	.337	3.826	4.407	11.50	.07986	9.610	14.98	4.98	1.178	4.271
		120	.438	3.624	5.595	10.31	.0716	11.65	19.00	4.47	1.178	5.178
		160	.531	3.438	6.621	9.28	.0645	13.27	22.51	4.02	1.178	5.898
		...xx	.674	3.152	8.101	7.80	.0542	15.28	27.54	3.38	1.178	6.791
5	5.563	40s	.258	5.047	4.300	20.01	.1390	15.16	14.62	8.67	1.456	5.451
		80x	.375	4.813	6.112	18.19	.1263	20.67	20.78	7.88	1.456	7.431
		120	.500	4.563	7.953	16.35	.1136	25.73	27.10	7.09	1.456	9.250
		160	.625	4.313	9.696	14.61	.1015	30.03	32.96	6.33	1.456	10.796
		...xx	.750	4.063	11.340	12.97	.0901	33.63	38.55	5.61	1.456	12.090
6	6.625	40s	.280	6.065	5.581	28.89	.2006	28.14	18.97	12.51	1.734	8.50
		80x	.432	5.761	8.405	26.07	.1810	40.49	28.57	11.29	1.734	12.22
		120	.562	5.501	10.70	23.77	.1650	49.61	36.40	10.30	1.734	14.98
		160	.718	5.189	13.32	21.15	.1469	58.97	45.30	9.16	1.734	17.81
		...xx	.864	4.897	15.64	18.84	.1308	66.33	53.16	8.16	1.734	20.02
8	8.625	20	.250	8.125	6.57	51.85	.3601	57.72	22.36	22.47	2.258	13.39
		30	.277	8.071	7.26	51.16	.3553	63.35	24.70	22.17	2.258	14.69
		40s	.322	7.981	8.40	50.03	.3474	72.49	28.55	21.70	2.258	16.81
		60	.406	7.813	10.48	47.94	.3329	88.73	35.64	20.77	2.258	20.58
		80x	.500	7.625	12.76	45.66	.3171	105.7	43.39	19.78	2.258	24.51
		100	.593	7.439	14.96	43.46	.3018	121.3	50.87	18.83	2.258	28.14
		120	.718	7.189	17.84	40.59	.2819	140.5	60.63	17.59	2.258	32.58
		140	.812	7.001	19.93	38.50	.2673	153.7	67.76	16.68	2.258	35.65
		...xx	.875	6.875	21.30	37.12	.2578	162.0	72.42	16.10	2.258	37.56
		160	.906	6.813	21.97	36.46	.2532	165.9	74.69	15.80	2.258	38.48

For volume per lineal foot of pipe, see page 354

CRTX 1157

Water Well Reamed and Drifted Pipe

Black and Galvanized

Dimensions, Weights, and Hydrostatic Test Pressures

Nominal Size	ASA Sched. No.	Diameters		Wall Thickness	Weight per Foot		Number of Threads Per Inch	Test Pressure		Couplings		
		Outside	Inside		Threads & Coupling	Plain End		Butt-Weld	Seamless Grade A	O. D.	Length	Weight Each
Inches		Inches	Inches	Inches	Pounds	Pounds		Psi	Psi	Inches	Inches	Pounds
1	40	1.315	1.049	.133	1.70	1.68	11½	700	...	1.576	2¾	.52
1¼	40	1.660	1.380	.140	2.30	2.27	11½	800	...	1.900	2¾	.60
1½	40	1.900	1.610	.145	2.75	2.72	11½	800	...	2.200	2¾	.84
2	40	2.375	2.067	.154	3.75	3.65	11½	800	1000	2.750	3⅜	1.58
2½	40	2.875	2.469	.203	5.90	5.79	8	800	1000	3.250	3 15/16	2.32
3	40	3.500	3.068	.216	7.70	7.58	8	800	1000	4.000	4 1/16	3.80
3½	40	4.000	3.548	.226	9.25	9.11	8	1200	1200	4.625	4 3/16	5.53
4	40	4.500	4.026	.237	11.00	10.79	8	1200	1200	5.200	4 5/16	7.14
5	40	5.563	5.047	.258	15.00	14.62	8	...	1200	6.296	4½	9.57
6	40	6.625	6.065	.280	19.45	18.97	8	...	1200	7.390	4 11/16	12.32
8	40	8.625	7.981	.322	29.35	28.55	8	...	1200	9.625	5 1/16	22.35
10	40	10.750	10.020	.365	41.85	40.48	8	...	1000	11.750	5 9/16	30.61
12	...	12.750	12.000	.375	51.15	49.56	8	...	1000	14.000	5 15/16	47.96

General practice: Unless otherwise ordered, pipe will be furnished threaded and coupled and, in sizes 4-inch and smaller, will be butt-welded.

The pipe is made especially for use in water wells and may be driven. Ends are reamed and the inside is drifted to insure proper inside clearance.

Finish: Black pipe is regularly furnished. Galvanized pipe is available at an added charge.

Couplings: All sizes are regularly furnished with taper tapped recessed couplings.

Threads: The taper of threads is ¾-inch per foot, measured on the diameter for all sizes.

Lengths: Random lengths, ranging from 16 to 22 feet, are regularly furnished. Special short lengths are available, when specified, at an added charge.

Weights: Weights listed for threaded and coupled pipe are nominal. Those for plain end pipe are calculated. Permissible variation is not more than 5 per cent above or below.

The weight per foot of pipe with threads and couplings is based on a length of 20 feet, including the coupling, but shipping lengths of small sizes will usually average less than 20 feet.

Prices: Prices will be furnished on request.

Linear Expansion in Pipe Lines

Temp. Deg Fahr.	Inches per 100 Feet				Temp. Deg. Fahr.	Inches per 100 Feet				Temp. Deg. Fahr.	Inches per 100 Feet	
	Steel	Wrought Iron	Brass	Copper		Steel	Wrought Iron	Brass	Copper		Steel	Wrought Iron
0°	0	0	0	0	340°	2.76	2.87	4.30	3.95	680°	5.965	6.20
20	.15	.155	.25	.25	360	2.935	3.05	4.58	4.15	700	6.17	6.42
40	.30	.31	.45	.45	380	3.11	3.235	4.85	4.40	720	6.375	6.625
60	.455	.475	.67	.65	400	3.29	3.43	5.14	4.64	740	6.58	6.835
80	.61	.63	.92	.87	420	3.465	3.62	5.45	4.89	760	6.79	7.05
100	.77	.80	1.17	1.10	440	3.65	3.805	5.73	5.15	780	6.99	7.275
120	.915	.96	1.41	1.35	460	3.835	4.00	5.96	5.37	800	7.21	7.49
140	1.075	1.13	1.69	1.57	480	4.02	4.19	6.25	5.64	820	7.415	7.73
160	1.235	1.29	1.91	1.77	500	4.21	4.39	6.55	5.88	840	7.63	7.93
180	1.40	1.46	2.15	2.00	520	4.39	4.58	...	...	860	7.84	8.145
200	1.57	1.64	2.43	2.25	540	4.59	4.78	...	...	880	8.055	8.37
220	1.73	1.81	2.71	2.52	560	4.78	4.975	...	..	900	8.28	8.60
240	1.89	1.98	2.97	2.74	580	4.975	5.175	...	...	920	8.495	8.82
260	2.065	2.16	3.22	2.95	600	5.17	5.38	...	..	940	8.72	9.05
280	2.23	2.335	3.47	3.17	620	5.365	5.58	...	..	960	8.945	9.28
300	2.41	2.52	3.76	3.42	640	5.565	5.785	..		980	9.17	9.52
320	2.59	2.70	4.07	3.70	660	5.765	5.99	..		1000	9.40	9.75

To find the expansion in any length of pipe obtain the difference in increased length at minimum and maximum temperatures. Divide this result by 100 to obtain the increase in length per foot, multiply this value by the length of the line in feet.

General Notes....page 338 *Pipe Specifications....page 339* *Pipe Tolerances....page 339*

CRTX 1155

API Threaded Line Pipe

Black and Galvanized

Dimensions, Weights, and Hydrostatic Test Pressures

Nominal Size	ASA Sched. No.	Diameter		Wall Thickness	Weight per Foot		Number of Threads per Inch	Test Pressure, Psi			Couplings		
		Outside	Inside		Threads & Coupling	Plain End		Butt-Weld	Seamless		O. D.	Length	Weight Each
									Grade A	Grade B			
Inches		Inches	Inches	Inches	Pounds	Pounds					Inches	Inches	Pounds
1/8	40	.405	.269	.068	.25	.24	27	700	...	...	.563	1 1/16	.04
1/4	40	.540	.364	.088	.43	.42	18	700	...	...	.719	1 5/8	.09
3/8	40	.675	.493	.091	.57	.57	18	700	...	...	.875	1 5/8	.13
1/2	40	.840	.622	.109	.86	.85	14	700	...	...	1.063	2 1/8	.24
3/4	40	1.050	.824	.113	1.14	1.13	14	700	...	...	1.313	2 1/8	.34
1	40	1.315	1.049	.133	1.70	1.68	11 1/2	700	...	...	1.576	2 5/8	.54
1 1/4	40	1.660	1.380	.140	2.30	2.27	11 1/2	800	...	...	2.054	2 3/4	1.03
1 1/2	40	1.900	1.610	.145	2.75	2.72	11 1/2	800	...	...	2.200	2 3/4	.90
2	40	2.375	2.067	.154	3.75	3.65	11 1/2	800	1000	1100	2.875	2 7/8	1.86
2 1/2	40	2.875	2.469	.203	5.90	5.79	8	800	1000	1100	3.375	4 1/8	3.27
3	40	3.500	3.068	.216	7.70	7.58	8	800	1000	1100	4.000	4 1/4	4.09
3 1/2	40	4.000	3.548	.226	9.25	9.11	8	1200	1200	1300	4.625	4 3/8	5.92
4	40	4.500	4.026	.237	11.00	10.79	8	1200	1200	1300	5.200	4 1/2	7.59
5	40	5.563	5.047	.258	15.00	14.62	8	...	1200	1300	6.296	4 5/8	9.98
6	40	6.625	6.065	.280	19.45	18.97	8	...	1200	1300	7.390	4 7/8	12.92
8*	30	8.625	8.071	.277	25.55	24.70	8	...	1200	1300	9.625	5 1/4	23.18
	40	8.625	7.981	.322	29.35	28.55	8	...	1300	1600	9.625	5 1/4	23.18
10*	...	10.750	10.192	.279	32.75	31.20	8	...	1000	1200	11.750	5 3/4	31.55
	30	10.750	10.136	.307	35.75	34.24	8	...	1000	1200	11.750	5 3/4	31.55
	40	10.750	10.020	.365	41.85	40.48	8	...	1200	1400	11.750	5 3/4	31.55
12*	30	12.750	12.090	.330	45.45	43.77	8	...	1000	1200	14.000	6 1/8	49.27
	...	12.750	12.000	.375	51.15	49.56	8	...	1100	1200	14.000	6 1/8	49.27

*API Line Pipe in sizes 8, 10, and 12-inch is made in more than one weight. Orders must specify the weight desired.

General practice: Unless otherwise ordered, API Line Pipe will be furnished with threads and couplings.

Plain end or threaded only pipe can be furnished when specified.

29 Sizes 4-inch and smaller will be furnished butt-welded, unless otherwise ordered.

Lengths: Random lengths are regularly furnished. Cut lengths are available, when specified, at an added charge.

Finish: Black pipe is regularly furnished. Galvanized pipe is available, when specified, at an added charge

Couplings: All sizes are regularly furnished with taper tapped recessed couplings.

Threads: The taper of threads is 3/4-inch per foot, measured on the diameter for all sizes.

Weights: Weights listed for threaded and coupled pipe are nominal; those for plain end pipe are calculated. Permissible variation is not more than 10 per cent above or 3 1/2 per cent below; however, the carload weight shall not be more than 1 3/4 per cent under the calculated weight.

For pipe tolerances, see page 339.

Prices: Prices are furnished on request.

Standard Pipe

Black and Galvanized

Dimensions, Weights, and Hydrostatic Test Pressures

Nominal Size	ASA Sched. No.	Diameter		Wall Thickness	Weight per Foot		Number of Threads per Inch	Test Pressure, Psi			Couplings		
		Outside	Inside		Threads & Coupling	Plain End		Butt-weld	Seamless		O. D.	Length	Weight Each
									Grade A	Grade B			
Inches		Inches	Inches	Inches	Pounds	Pounds					Inches	Inches	Pounds
1/8	40	.405	.269	.068	.24	.24	27	700	700	700	.563	13/16	.03
1/4	40	.540	.364	.088	.42	.42	18	700	700	700	.719	13/16	.07
3/8	40	.675	.493	.091	.57	.57	18	700	700	700	.875	13/16	.09
1/2	40	.840	.622	.109	.85	.85	14	700	700	700	1.063	19/16	.17
3/4	40	1.050	.824	.113	1.13	1.13	14	700	700	700	1.313	1 5/8	.26
1	40	1.315	1.049	.133	1.68	1.68	11 1/2	700	700	700	1.576	2	.40
1 1/4	40	1.660	1.380	.140	2.28	2.27	11 1/2	800	1000	1100	1.900	2 1/16	.48
1 1/2	40	1.900	1.610	.145	2.73	2.72	11 1/2	800	1000	1100	2.200	2 1/16	.67
2	40	2.375	2.067	.154	3.68	3.65	11 1/2	800	1000	1100	2.750	2 1/8	1.05
2 1/2	40	2.875	2.469	.203	5.82	5.79	8	800	1000	1100	3.250	3 1/8	2.09
3	40	3.500	3.068	.216	7.62	7.58	8	800	1000	1100	4.000	3 1/4	3.35
3 1/2	40	4.000	3.548	.226	9.20	9.11	8	1200	1200	1300	4.625	3 3/8	4.82
4	40	4.500	4.026	.237	10.89	10.79	8	1200	1200	1300	5.000	3 1/2	4.61
5	40	5.563	5.047	.258	14.81	14.62	8	...	1200	1300	6.296	3 3/4	8.52
6	40	6.625	6.065	.280	19.18	18.97	8	...	1200	1300	7.390	4	11.27
8*	30	8.625	8.071	.277	25.55	24.70	8	...	1200	1300	9.625	5 1/4	23.18
	40	8.625	7.981	.322	29.35	28.55	8	...	1300	1600	9.625	5 1/4	23.18
10*	...	10.750	10.192	.279	32.75	31.20	8	...	1000	1200	11.750	5 3/4	31.55
	30	10.750	10.136	.307	35.75	34.24	8	...	1000	1200	11.750	5 3/4	31.55
	40	10.750	10.020	.365	41.85	40.48	8	...	1200	1400	11.750	5 3/4	31.55
12*	30	12.750	12.090	.330	45.45	43.77	8	...	1000	1200	14.000	6 1/8	49.27
	...	12.750	12.000	.375	51.15	49.56	8	...	1100	1200	14.000	6 1/8	49.27

General practice: Unless otherwise ordered, Standard steel pipe will be furnished with threads and couplings (Line Pipe will be furnished on sizes 8, 10, and 12-inch; see second paragraph of asterisked note at right).

*Standard Steel Pipe in sizes 8, 10, and 12-inch is made in more than one weight. Orders must specify the weight desired

Standard Steel Pipe with threads and coupling in sizes 8, 10, and 12-inch is designated as Line Pipe. Coupling data for these sizes are taken from the regular listing of Line Pipe on page 342 and are repeated in the table above (in light face type) for convenience.

When Standard pipe in any size up to 12-inch is desired with plain ends or threaded only, orders must definitely specify.

Sizes 4-inch and smaller will be furnished butt-welded, unless otherwise specified.

Lengths: Random lengths are regularly furnished. Cut lengths are furnished, when specified, at an added charge.

Finish: Black pipe is regularly furnished. Galvanized pipe is furnished, when specified, at an added charge.

29 **Couplings:** Couplings generally are straight tapped for pipe 2-inch and smaller and taper tapped for pipe 2 1/2-inch and larger. They are screwed on the pipe sufficiently tight so that removal requires a wrench. This is termed "handling tight".

Threads: The taper of threads is 3/4-inch per foot, measured on the diameter for all sizes.

Weights: Weights listed for threaded and coupled pipe are nominal: those for plain end pipe are calculated. Permissible variation is not more than 5 per cent above or 5 per cent below; see page 330 for pipe tolerances.

Prices: Prices are furnished on request.

Bundling Schedule For Standard Steel Pipe

Nominal Size	Lengths per Bundle	Approximate Average per Bundle	
		Feet	Pounds
Inches			
1/8	30	630	151
1/4	24	504	212
3/8	18	378	215
1/2	12	252	214
3/4	7	147	166
1	5	105	176
1 1/4	3	63	144
1 1/2	3	63	172

Order butt-welded pipe in sizes up to 1 1/2-inch by bundles . . . . and in sizes 2 to 4-inch by lengths, using 21 feet as an average length.

Order seamless or electric-welded pipe by lengths, using 20 feet as an average length.

General Notes.....page 338
Pipe Specifications....page 339
Comparison of wall thicknesses of wrought iron and steel pipe.....page 348
Bundling schedule for wrought iron pipe.....page 348

Wrought Steel and Wrought Iron Pipe

General Notes

Wrought steel seamless, butt-welded, and electric-welded pipe . . . . wrought iron butt-welded and lap-welded pipe

WEIGHTS

All weights for steel pipe are figured on the basis of one cubic inch of steel weighing 0.2833 pound. Weights for wrought iron pipe are figured on the basis of one cubic inch of iron weighing 0.2777 pound.

All data presented on pages 340 to 347 inclusive apply to steel pipe. Because of the difference in the basic weight of steel and iron, wall thicknesses for wrought iron pipe are approximately 2 per cent heavier than similar sizes of steel pipe with a corresponding reduction in inside diameter. Outside diameter dimensions and weights per foot of wrought iron pipe are the same as those shown for steel pipe of corresponding sizes.

The outside diameter of any size of pipe is the same for all weights. Variations in weight or wall thickness affect only the inside diameter.

DIAMETERS

Pipe 12-inch and smaller is known by its nominal inside diameter. The term "nominal" refers to a named or given dimension as distinguished from the actual or real dimension.

Pipe 14-inch and larger is known by its outside diameter.

ORDERING

When ordering pipe 12-inch and smaller, designate the weight desired . . . such as Standard, Extra Strong, or Double Extra Strong.

When ordering pipe 14-inch O.D. and larger, designate the wall thickness desired . . . such as $\frac{5}{16}$-inch, $\frac{3}{8}$-inch, $\frac{1}{2}$-inch, etc.

On orders calling for commercial sizes of pipe which are finished with threads and couplings, in sizes $\frac{1}{8}$ to 12-inch inclusive, and where orders specify quantity in lineal feet, it is understood that random lengths fitted with threads both ends and coupling one end will be shipped; and the measurement is charged from end to end . . . that is, over-all, including the coupling.

If cut lengths of any sizes are ordered, instructions must appear on the face of the order as to whether plain ends, beveled ends, threads only, or threads and couplings are required. The pipe is then cut to the length specified for plain end and threads only; if cut lengths with threads and couplings are specified, the practice is the same with the exception that the couplings are charged separately whether they are shipped loose or screwed on the pipe.

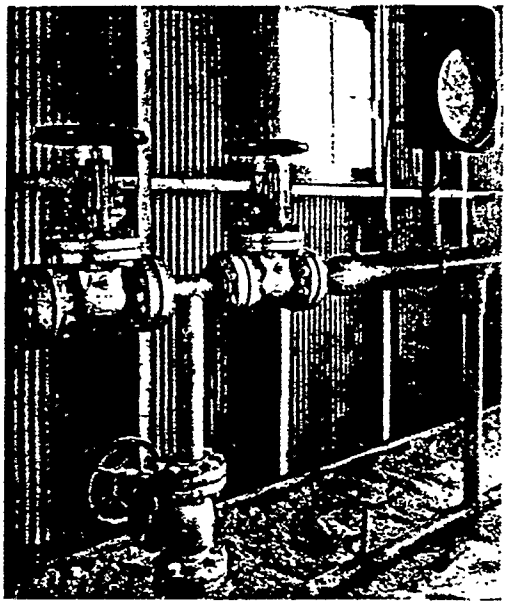
THREADS

All threads, unless otherwise noted, are in accordance with the American (Briggs') Standard.

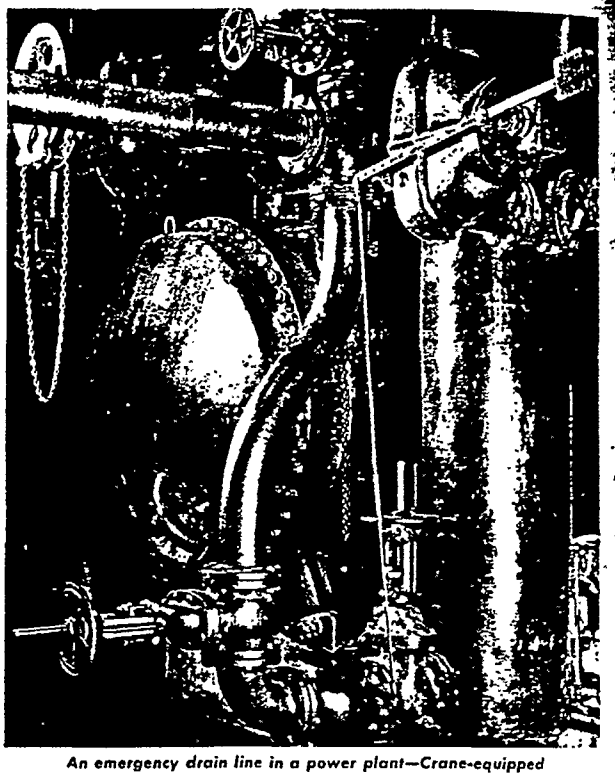
CRTX 1149

V04888

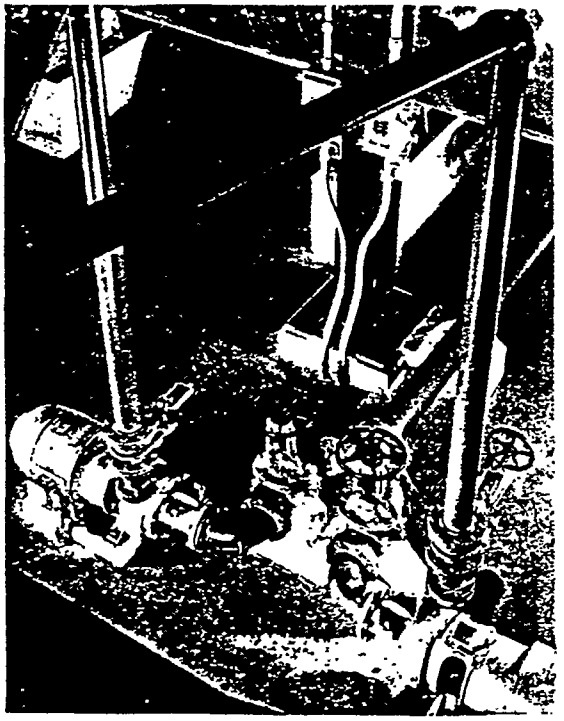
The best in piping equipment, always—from Crane



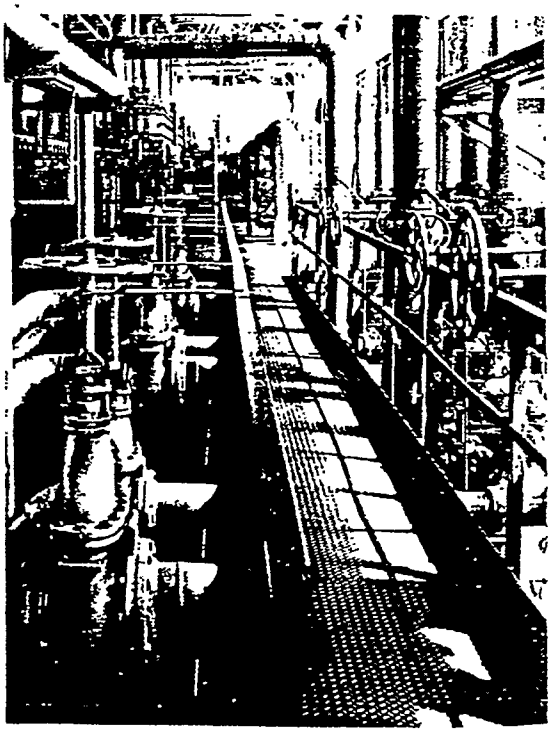
A refractory plant utilizes Crane products



An emergency drain line in a power plant—Crane-equipped



Crane cast iron valves installed in the mash transfer lines of a distillery

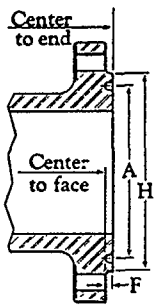


Crane products in a natural gas installation; extension stems on valves facilitate operation

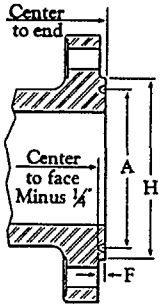
28

Ring Joint Facing and Rings

American Standard — Dimensions, in Inches

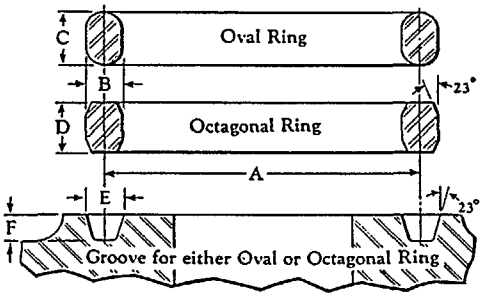


150 and 300-Pound

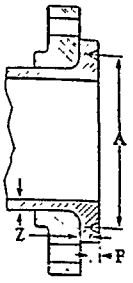


400, 600, 900, 1500, and 2500-Pound

For Valves, Fittings, and Flanges

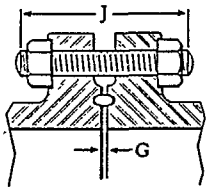


Oval rings fit grooves having either a flat or round bottom; octagonal rings only fit grooves having a flat bottom.



("Z" represents pipe thickness.)

Cranelap Joints



"G" is approximate clearance with stud bolts tight.

Assembled Ring Joint

*Dimension "J" does not apply to Cranelap Joints; see "Stud bolt lengths" on next page.

†Caution: 3-inch 300 and 600-Pound Cranelap Ring Joints use Ring No. R 30, having a pitch diameter of 4⅝ inches. When 3-inch 300 or 600-Pound ring joint valves, fittings, or flanges are to be bolted to Cranelap joints, orders must specify; they will be machined special.

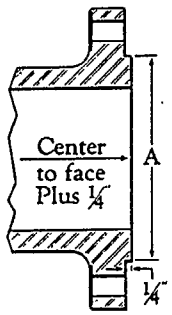
Class	Size	Ring No.	A	B	C	D	E	F	G	H	*J	Stud Bolts No.	Stud Bolts Dia.
150 Pound	1	R 15	1⅞	5/16	9/16	½	11/32	¼	5/32	2½	3	4	½
	1¼	R 17	2¼	9/16	9/16	½	11/32	¼	5/32	2⅞	3	4	½
	1½	R 19	2 9/16	5/16	9/16	½	11/32	¼	5/32	3¼	3¼	4	½
	2	R 22	3¼	5/16	9/16	½	11/32	¼	5/32	4	3½	4	5/8
	2½	R 25	4	5/16	9/16	½	11/32	¼	5/32	4¾	3¾	4	5/8
	3	R 29	4½	5/16	9/16	½	11/32	¼	5/32	5¼	4	4	5/8
	3½	R 33	5 3/16	5/16	9/16	½	11/32	¼	5/32	6 1/16	4	8	5/8
	4	R 36	5⅞	5/16	9/16	½	11/32	¼	5/32	6¾	4	8	5/8
	5	R 40	6¾	5/16	9/16	½	11/32	¼	5/32	7⅝	4¼	8	¾
	6	R 43	7⅝	5/16	9/16	½	11/32	¼	5/32	8⅝	4¼	8	¾
	8	R 48	9¾	5/16	9/16	½	11/32	¼	5/32	10¾	4½	8	¾
	10	R 52	12	5/16	9/16	½	11/32	¼	5/32	13	5	12	⅞
	12	R 56	15	5/16	9/16	½	11/32	¼	5/32	16	5	12	⅞
	14	R 59	15⅝	5/16	9/16	½	11/32	¼	⅛	16¾	5½	12	1
	16	R 64	17⅞	5/16	9/16	½	11/32	¼	⅛	19	5¾	16	1
	18	R 68	20⅜	5/16	9/16	½	11/32	¼	⅛	21½	6¼	16	1⅛
	20	R 72	22	5/16	9/16	½	11/32	¼	⅛	23½	6½	20	1⅛
	24	R 76	26½	5/16	9/16	½	11/32	¼	⅛	28	7¼	20	1¼

Class	Size	Ring No.	A	B	C	D	E	F	G 300 Lb.	G 400 Lb.	G 600 Lb.	H	*J 300 Lb.	*J 400 Lb.	*J 600 Lb.	No. of Stud Bolts 300 Lb.	No. of Stud Bolts 400 Lb.	No. of Stud Bolts 600 Lb.	Dia. of Stud Bolts 300 Lb.	Dia. of Stud Bolts 400 Lb.	Dia. of Stud Bolts 600 Lb.
†300, 400, and †600 Pound	½	R 11	1 11/32	¼	7/16	3/8	9/32	7/32	⅛	...	⅛	2	3	....	3	4	...	4	½	....	½
	¾	R 13	1 11/16	5/16	9/16	½	11/32	¼	5/32	...	5/32	2½	3¼	...	3¼	4	...	4	5/8	....	5/8
	1	R 16	2	5/16	9/16	½	11/32	¼	5/32	...	5/32	2¾	3½	...	3½	4	...	4	5/8	....	5/8
	1¼	R 18	2⅜	5/16	9/16	½	11/32	¼	5/32	...	5/32	3⅛	3½	...	3¾	4	...	4	5/8	....	5/8
	1½	R 20	2 11/16	5/16	9/16	½	11/32	¼	5/32	...	5/32	3 9/16	4	...	4	4	...	4	¾	....	¾
	2	R 23	3¼	7/16	11/16	5/8	15/32	5/16	7/32	...	3/16	4¼	4	...	4¼	8	...	8	5/8	....	5/8
	2½	R 26	4	7/16	11/16	5/8	15/32	5/16	7/32	...	3/16	5	4½	...	4¾	8	...	8	¾	....	¾
	†3	†R 31	†4⅞	7/16	11/16	5/8	15/32	5/16	7/32	...	3/16	5¾	4¾	...	5	8	...	8	¾	....	¾
	3½	R 34	5 3/16	7/16	11/16	5/8	15/32	5/16	7/32	...	3/16	6¼	5	...	5½	8	...	8	¾	....	⅞
	4	R 37	5⅞	7/16	11/16	5/8	15/32	5/16	7/32	7/32	3/16	6⅞	5	5½	5¾	8	8	8	¾	⅞	⅞
	5	R 41	7⅛	7/16	11/16	5/8	15/32	5/16	7/32	7/32	3/16	8¼	5¼	5¾	6½	8	8	8	¾	⅞	1
	6	R 45	8 5/16	7/16	11/16	5/8	15/32	5/16	7/32	7/32	3/16	9½	5½	6	6¾	12	12	12	¾	⅞	1
	8	R 49	10⅝	7/16	11/16	5/8	15/32	5/16	7/32	7/32	3/16	11⅞	6	6¾	7¾	12	12	12	⅞	1	1⅛
	10	R 53	12¾	7/16	11/16	5/8	15/32	5/16	7/32	7/32	3/16	14	6¾	7½	8½	16	16	16	1	1⅛	1¼
	12	R 57	15	7/16	11/16	5/8	15/32	5/16	7/32	7/32	3/16	16¼	7¼	8	8¾	16	16	20	1⅛	1¼	1¼
	14	R 61	16½	7/16	11/16	5/8	15/32	5/16	7/32	7/32	3/16	18	7½	8¼	9¼	20	20	20	1⅛	1¼	1⅜
	16	R 65	18½	7/16	11/16	5/8	15/32	5/16	7/32	7/32	3/16	20	8	8¾	10	20	20	20	1¼	1⅜	1½
	18	R 69	21	7/16	11/16	5/8	15/32	5/16	7/32	7/32	3/16	22⅝	8¼	9	10¾	24	24	20	1¼	1⅜	1⅝
	20	R 73	23	½	¾	11/16	17/32	3/8	7/32	7/32	3/16	25	8¾	9¾	11½	24	24	24	1¼	1½	1⅝
	24	R 77	27¼	5/8	⅞	13/16	21/32	7/16	¼	¼	7/32	29½	10	11	13¼	24	24	24	1½	1¾	1⅞

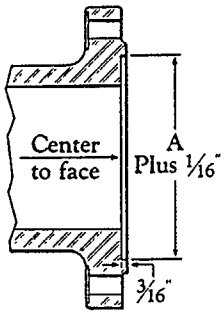
28

Male, Female, Tongue, and Groove Flange Facings

For 300-Pound Steel



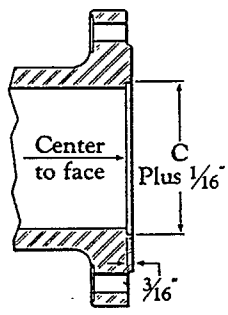
Large Male



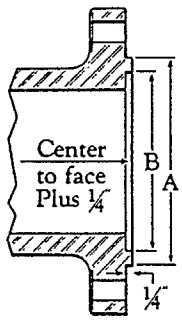
Large Female



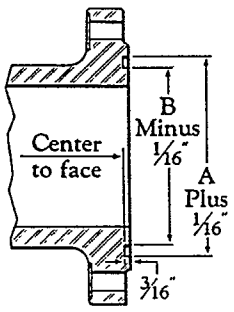
*Small Male



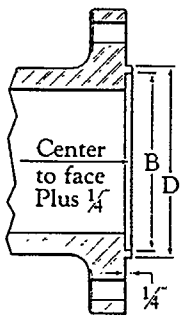
*Small Female



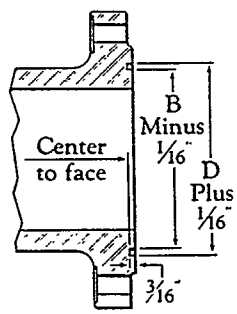
Large Tongue



Large Groove



Small Tongue



Small Groove

Dimensions, in Inches

Class	Size	A	B	C	D
300-Pound Steel	½	1⅜	1	23/32	1⅜
	¾	111/16	15/16	15/16	111/16
	1	2	1½	13/16	1⅞
	1¼	2½	1⅞	1½	2¼
	1½	2⅞	2⅛	1¾	2½
	2	3⅝	2⅞	2¼	3¼
	2½	4⅛	3⅜	211/16	3¾
	3	5	4¼	35/16	4⅝
	3½	5½	4¾	313/16	5⅛
	4	63/16	53/16	45/16	511/16
	5	75/16	65/16	5⅜	613/16
	6	8½	7½	6⅜	8
	8	10⅝	9⅜	8⅜	10
	10	12¾	11¼	10½	12
	12	15	13½	12½	14¼
	14	16¼	14¾	13¾	15½
	16	18½	16¾	15¾	17⅝
	18	21	19¼	17¾	20⅛
	20	23	21	19¾	22
	24	27¼	25¼	23¾	26¼

Prices on Request

Dimensions above conform to the American Standard for Steel Pipe Flanges and Flanged Fittings B16.5-1957.

All of the types of facings can be applied to flanged products in the 300-pound steel class, conforming to the American Steel Flange Standard, B16.5-1957.

Center to face: The illustrations show how regular valve or fitting center to face dimensions are affected by these special facings. Note that the male or tongue facing increases the regular center to face ¼-inch; the female or groove facing does not alter the regular center to face.

Regular facing and finish: Steel flanged valves and flanges of the 300-pound class are regularly furnished with a 1/16-inch raised face.

The 1/16-inch raised faces and ¼-inch male faces are regularly furnished with a serrated finish. Female, tongue, and groove faces are regularly furnished with a smooth finish.

***Small male and female:** Small male and female facing, when used with steel screwed flanges, makes the joint directly on the end of the pipe. In these cases the pipe must be thick enough to provide a bearing surface of ample width to prevent crushing of the gasket.

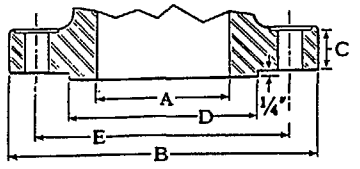
If a pipe end is to be used as a mating member in a joint, orders should specify the inside diameter of the pipe. In some instances, it may be necessary to lag up the port diameter of valves and fittings to match the I.D. of the pipe, in which case special prices will apply.

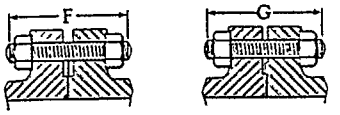
Gaskets: Gaskets for male and female and for tongue and groove joints should cover the bottom of the recess with minimum clearances, allowing for the plus or minus tolerance of 0.016 inch (1/64") which is permitted by the American Standard on the inside and outside diameters of facings.

Dimensions of ring joint facing....pages 334 and 335
Facings on Cranelap Joints....pages 365 and 366
Templates for drilling....page 329

28

Templates for Drilling
400, 600, and 900-Pound Steel Standards





Male to Male Flanged Joint — Male to Female Flanged Joint

Stud Bolt Length "G" also applies for Tongue to Groove Flanged Joint

American Standard: The 400, 600, and 900-pound flange dimensions, drilling templates, and stud bolt lengths shown in the table at the right conform, respectively, to the American Standard for 400, 600, and 900-Pound Steel Pipe Flanges and Flanged Fittings, B16.5-1957.

Facing: Unless otherwise ordered, 400, 600, and 900-pound steel flanged valves and companion flanges are regularly furnished with 1/4-inch high large male facing.

The thickness of flange dimension (dimension "C") does not include the 1/4-inch high large male face.

Bolt holes: Bolt holes are drilled 1/8-inch larger than the diameter of the bolt. Drilling templates are in multiples of four, so that valves or fittings may be turned to face in any quarter when being installed. Bolt holes are drilled to straddle the center line unless otherwise ordered.

Spot facing: The bolt holes are spot faced.

Stud bolt lengths: The stud bolt lengths apply for flanged joints other than Cranelap, made up of combinations of valves, fittings, or companion flanges with male, female, tongue, or groove faces. Male or tongue faces are 1/4-inch high; female or groove faces are 3/16-inch deep.

Dimensions, in Inches

Class	Size	A†	B	C	D	E	Stud Bolts No.	Stud Bolts Dia.	F	G
400 Pound Steel	4	4	10	1 3/8	6 3/16	7 7/8	8	7/8	5 1/4	5
	5	5	11	1 1/2	7 5/16	9 1/4	8	7/8	5 1/2	5 1/4
	6	6	12 1/2	1 5/8	8 1/2	10 5/8	12	7/8	5 3/4	5 1/2
	8	8	15	1 7/8	10 5/8	13	12	1	6 1/2	6 1/4
	10	10	17 1/2	2 1/8	12 3/4	15 1/4	16	1 1/8	7 1/4	7
	12	12	20 1/2	2 1/4	15	17 3/4	16	1 1/4	7 3/4	7 1/2
	14	13 1/8	23	2 3/8	16 1/4	20 1/4	20	1 1/4	8	7 3/4
	16	15	25 1/2	2 1/2	18 1/2	22 1/2	20	1 3/8	8 1/2	8 1/4
	18	17	28	2 5/8	21	24 3/4	24	1 3/8	8 3/4	8 1/2
	20	18 7/8	30 1/2	2 3/4	23	27	24	1 1/2	9 1/2	9 1/4
	24	22 5/8	36	3	27 1/4	32	24	1 3/4	10 1/2	10 1/4
600 Pound Steel	1/2	1/2	3 3/4	9/16	1 3/8	2 5/8	4	1/2	3	2 3/4
	3/4	3/4	4 5/8	5/8	1 11/16	3 1/4	4	5/8	3 1/4	3
	1	1	4 7/8	11/16	2	3 1/2	4	5/8	3 1/2	3 1/4
	1 1/4	1 1/4	5 1/4	13/16	2 1/2	3 7/8	4	5/8	3 3/4	3 1/2
	1 1/2	1 1/2	6 1/8	7/8	2 7/8	4 1/2	4	3/4	4	3 3/4
	2	2	6 1/2	1	3 5/8	5	8	5/8	4	3 3/4
	2 1/2	2 1/2	7 1/2	1 1/8	4 1/8	5 7/8	8	3/4	4 1/2	4 1/4
	3	3	8 1/4	1 1/4	5	6 5/8	8	3/4	4 3/4	4 1/2
	3 1/2	3 1/2	9	1 3/8	5 1/2	7 1/4	8	7/8	5 1/4	5
	4	4	10 3/4	1 1/2	6 3/16	8 1/2	8	7/8	5 1/2	5 1/4
	5	5	13	1 3/4	7 5/16	10 1/2	8	1	6 1/4	6
	6	6	14	1 7/8	8 1/2	11 1/2	12	1	6 1/2	6 1/4
	8	7 7/8	16 1/2	2 3/16	10 5/8	13 3/4	12	1 1/8	7 1/2	7 1/4
	10	9 3/4	20	2 1/2	12 3/4	17	16	1 1/4	8 1/4	8
	12	11 3/4	22	2 5/8	15	19 1/4	20	1 1/4	8 1/2	8 1/4
	14	12 7/8	23 3/4	2 3/4	16 1/4	20 3/4	20	1 3/8	9	8 3/4
	16	14 3/4	27	3	18 1/2	23 3/4	20	1 1/2	9 3/4	9 1/2
	18	16 1/2	29 1/4	3 1/4	21	25 3/4	20	1 5/8	10 1/2	10 1/4
	20	18 1/4	32	3 1/2	23	28 1/2	24	1 5/8	11 1/4	11
	24	22	37	4	27 1/4	33	24	1 7/8	12 3/4	12 1/2
900 Pound Steel	3	2 7/8	9 1/2	1 1/2	5	7 1/2	8	7/8	5 1/2	5 1/4
	4	3 7/8	11 1/2	1 3/4	6 3/16	9 1/4	8	1 1/8	6 1/2	6 1/4
	5	4 3/4	13 3/4	2	7 5/16	11	8	1 1/4	7 1/4	7
	6	5 3/4	15	2 3/16	8 1/2	12 1/2	12	1 1/8	7 1/2	7 1/4
	8	7 1/2	18 1/2	2 1/2	10 5/8	15 1/2	12	1 3/8	8 1/2	8 1/4
	10	9 3/8	21 1/2	2 3/4	12 3/4	18 1/2	16	1 3/8	9	8 3/4
	12	11 1/8	24	3 1/8	15	21	20	1 3/8	9 3/4	9 1/2
	14	12 1/4	25 1/4	3 3/8	16 1/4	22	20	1 1/2	10 1/2	10 1/4
	16	14	27 3/4	3 1/2	18 1/2	24 1/4	20	1 5/8	11	10 3/4
	18	15 3/4	31	4	21	27	20	1 7/8	12 3/4	12 1/2
	20	17 1/2	33 3/4	4 1/4	23	29 1/2	20	2	13 1/2	13 1/4
	24	21	41	5 1/2	27 1/4	35 1/2	20	2 1/2	17	16 3/4

†Dimension "A" applies to valves or fittings.

For flanged joints made up of Cranelaps or for Cranelaps in combination with valves, fittings, or companion flanges, new stud bolt lengths must be established in the following manner:

Stud Bolt Lengths for Cranelap Joints (based on length "G" for stud bolts)

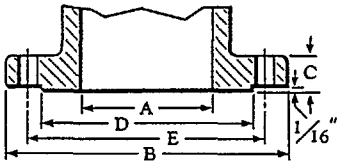
Cranelap to Cranelap.....Deduct 1/4-inch and add thickness of both laps
Cranelap to 1/4-inch male.....Add thickness of one lap
Cranelap to female.....Deduct 1/4-inch and add thickness of one lap*
Cranelap to female Cranelap.....Deduct 1/4-inch and add thickness of both laps*
Tongue or groove Cranelaps.....Add thickness of each lap

*The Cranelap serving as the male must have a minimum lap thickness of 1/4-inch.

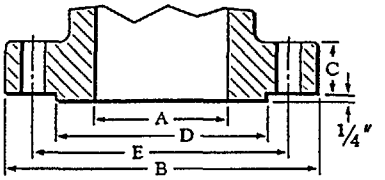
Description of stud bolts.....page 317
Bolting on companion flanges....page 325
Special facings.....pages 333 to 335
Length of stud bolts for ring joints....pages 334 and 335

Templates for Drilling

250-Pound and 800-Pound Hydraulic Cast Iron



250-Pound Cast Iron



800-Pound Hydraulic Cast Iron

250-Pound Cast Iron: The 250-pound templates for drilling conform to the American Standard for Cast Iron Pipe Flanges and Flanged Fittings, Class 250 (B16b-1944).

These templates apply also to 500-Pound W.O.G. Ferrosteel Double Disc Gate Valves.

The flanges have a 1/16-inch raised face. The thickness of flange dimension (dimension "C") includes the 1/16-inch raised face.

In sizes 24-inch and smaller, except for the diameter of the raised face (dimension "D"), these templates are the same as for the 300-Pound Steel American Standard.

800-Pound Hydraulic Cast Iron: The 800-Pound Hydraulic templates for drilling conform to the American Standard for Cast Iron Pipe Flanges and Flanged Fittings for a maximum non-shock hydraulic working pressure of 800 psi at ordinary air temperatures (B16b1-1931).

Except for flange thickness and length of bolts, these templates are the same as for the 600-Pound Steel American Standard.

Bolt holes: For bolts smaller than 1¾-inch diameter, bolt holes are drilled 1/8-inch larger than the diameter of the bolt. For bolts 1¾-inch diameter and larger, bolt holes are drilled 1/4-inch larger than the diameter of the bolt.

Drilling templates are in multiples of four, so that valves or fittings may be turned to face in any quarter when being installed. Bolt holes straddle the center line unless otherwise ordered.

Spot facing: Bolt holes are not regularly spot faced

Dimensions, in Inches

Class	Size	A Valve or fitting	B	C	D	E	No. of bolts	Dia. of bolts	Length of bolts *See Note X*	Length of stud bolts with 2 nuts *See Note X*
250 Pound Cast Iron	1	1	4 7/8	11/16	2 11/16	3 1/2	4	5/8	2 1/2	...
	1 1/4	1 1/4	5 1/4	3/4	3 1/16	3 7/8	4	5/8	2 1/2	...
	1 1/2	1 1/2	6 1/8	13/16	3 9/16	4 1/2	4	3/4	2 3/4	...
	2	2	6 1/2	7/8	4 3/16	5	8	5/8	2 3/4	...
	2 1/2	2 1/2	7 1/2	1	4 15/16	5 7/8	8	3/4	3 1/4	...
	3	3	8 1/4	1 1/8	5 11/16	6 5/8	8	3/4	3 1/2	...
	3 1/2	3 1/2	9	1 3/16	6 5/16	7 1/4	8	3/4	3 1/2	...
	4	4	10	1 1/4	6 15/16	7 7/8	8	3/4	3 3/4	...
	5	5	11	1 3/8	8 5/16	9 1/4	8	3/4	4	...
	6	6	12 1/2	1 7/16	9 11/16	10 5/8	12	3/4	4	...
	8	8	15	1 5/8	11 15/16	13	12	7/8	4 1/2	...
	10	10	17 1/2	1 7/8	14 1/16	15 1/4	16	1	5 1/4	...
	12	12	20 1/2	2	16 7/16	17 3/4	16	1 1/8	5 1/2	...
	14	13 1/4	23	2 1/8	18 15/16	20 1/4	20	1 1/8	6	...
	16	15 1/4	25 1/2	2 1/4	21 1/16	22 1/2	20	1 1/4	6 1/4	...
	18	17	28	2 3/8	23 5/16	24 3/4	24	1 1/4	6 1/2	...
	20	19	30 1/2	2 1/2	25 9/16	27	24	1 1/4	6 3/4	...
	24	23	36	2 3/4	30 1/4	32	24	1 1/2	7 3/4	9 1/2
	30	29	43	3	37 3/16	39 1/4	28	1 3/4	8 1/2	10 1/2
	36	34 1/2	50	3 3/8	43 11/16	46	32	2	9 1/2	11 3/4
	42	40 1/4	57	3 11/16	50 7/16	52 3/4	36	2	10 1/4	12 1/2
	48	46	65	4	58 7/16	60 3/4	40	2	10 3/4	13

Class	Size	A Valve or fitting	B	C	D	E	No. of bolts	Dia. of bolts	Length of bolts *See Note Y*	Length of bolts *See Note Z*
800 Pound Hydraulic Cast Iron	2	2	6 1/2	1 1/4	3 5/8	5	8	5/8	3 3/4	3 1/2
	2 1/2	2 1/2	7 1/2	1 3/8	4 1/8	5 7/8	8	3/4	4 1/4	4
	3	3	8 1/4	1 1/2	5	6 5/8	8	3/4	4 1/2	4 1/4
For sizes not listed, use 600-Pound Steel material.	3 1/2	3 1/2	9	1 5/8	5 1/2	7 1/4	8	7/8	5	4 3/4
	4	4	10 3/4	1 7/8	6 3/16	8 1/2	8	7/8	5 1/2	5 1/4
	5	5	13	2 1/8	7 5/16	10 1/2	8	1	6	5 3/4
	6	6	14	2 1/4	8 1/2	11 1/2	12	1	6 1/4	6
	8	7 7/8	16 1/2	2 1/2	10 5/8	13 3/4	12	1 1/8	7	6 3/4
	10	9 3/4	20	2 7/8	12 3/4	17	16	1 1/4	7 3/4	7 1/2
	12	11 3/4	22	3	15	19 1/4	20	1 1/4	8	7 3/4

Length of Bolts or Stud Bolts

Note X — 1/16" raised face to 1/16" raised face valve, fitting, or companion flange.

Note Y — 1/4" male to 1/4" male valve, fitting, or companion flange

Note Z — 1/4" large male to 3/16" large female valve, fitting, or companion flange. 1/4" tongue to 3/16" groove valve, fitting, or companion flange.

Templates for Drilling

Bronze and Corrosion-Resistant Standards

150-Pound Standards: The 150-pound templates for drilling and flange dimensions shown in the table at the right conform to the American Standard for 150-Pound Bronze Flanges and Flanged Fittings (ASA B16.24-1953).

The 150-pound templates for drilling and flange dimensions also conform to the MSS 150-Pound Corrosion Resistant Cast Flanged Valve Standard No. SP-42-1957. The MSS Standard does not include sizes 3½ and 5-inch.

The flange diameter, bolt circle, and number and diameter of bolts for the foregoing Standards are the same as for the Class 125 Cast Iron and 150-Pound Steel American Standards, size for size, but the thickness and facing of the flanges are different.

300-Pound Standard: The 300-pound templates for drilling and flange dimensions shown in the table at the right conform to the American Standard for 300-Pound Bronze Flanges and Flanged Fittings (ASA B16.24-1953), size for size.

The flange diameter, bolt circle, and number and diameter of bolts for the foregoing Standard are the same as for the Class 250 Cast Iron and 300-Pound Steel American Standards, but the thickness and facing of the flanges are different.

Dimensions, in Inches

Size	Diameter of flange	Thickness of Flange		Diameter of bolt circle	Number of bolts	Diameter of bolts	Length of bolts	Length of stud bolts with 2 nuts
		Bronze	Corrosion Resistant					
150-Pound Bronze ASA or Corrosion-Resistant MSS Standards								
½	3½	5/16	3/8	2⅜	4	½	1¼	1⅞
¾	3⅞	11/32	13/32	2¾	4	½	1½	1⅞
1	4¼	3/8	7/16	3⅛	4	½	1½	2
1¼	4⅝	13/32	½	3½	4	½	1½	2
1½	5	7/16	9/16	3⅞	4	½	1½	2⅛
2	6	½	5/8	4¾	4	5/8	1¾	2½
2½	7	9/16	5/8	5½	4	5/8	2	2⅝
3	7½	5/8	5/8	6	4	5/8	2	2¾
*3½	8½	11/16	...	7	8	5/8	2¼	2⅞
4	9	11/16	11/16	7½	8	5/8	2¼	2⅞
*5	10	¾	...	8½	8	¾	2½	3¼
6	11	13/16	13/16	9½	8	¾	2½	3⅜
8	13½	15/16	15/16	11¾	8	¾	2¾	3⅝
10	16	1	1	14¼	12	⅞	3¼	4⅛
12	19	1 1/16	1 1/16	17	12	⅞	3¼	4¼
300-Pound Bronze ASA Standard								
½	3¾	½	...	2⅝	4	½	1¾	2¼
¾	4⅝	17/32	...	3¼	4	5/8	2	2½
1	4⅞	19/32	...	3½	4	5/8	2	2⅝
1¼	5¼	5/8	...	3⅞	4	5/8	2	2¾
1½	6⅛	11/16	...	4½	4	¾	2¼	3⅛
2	6½	¾	...	5	8	5/8	2¼	3
2½	7½	13/16	...	5⅞	8	¾	2½	3⅜
3	8¼	29/32	...	6⅝	8	¾	2¾	3½
3½	9	31/32	...	7¼	8	¾	3	3⅝
4	10	1 1/16	...	7⅞	8	¾	3	3⅞
5	11	1⅛	...	9¼	8	¾	3¼	4
6	12½	1 3/16	...	10⅝	12	¾	3¼	4⅛
8	15	1⅜	...	13	12	⅞	3¾	4¾

*The MSS Corrosion-Resistant Cast Flanged Valve Standard, No. SP-42-1957, does not include sizes 3½ and 5-inch

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Facings: The flange faces of 150 and 300-pound bronze flanged products are regularly furnished plain faced, with two V-shaped concentric grooves between the port and the bolt holes.

The flange faces of 150-pound corrosion-resistant flanged products are regularly furnished plain faced, with a serrated finish.

Diameter of port: The diameter of the port on all 150 and 300-pound flanged valves is the same as the pipe size (nominal).

Bolt holes: Bolt holes are drilled ⅛-inch larger than the diameter of the bolt.

The bolt holes are in multiples of four, so that valves or fittings can be turned to face in any quarter when being installed. The holes are drilled to straddle the center line unless otherwise ordered.

Spot facing: The bolt holes in Crane bronze and corrosion-resistant flanged products are not regularly spot faced.

Gaskets: Full face gaskets should be used. For dimensions and description, see page 321.

When bronze or corrosion-resistant flanged material is bolted to iron or steel flanges which normally have a raised face, the raised face should be removed to provide a full face bearing for the gasket.

Bronze or corrosion-resistant flanged material should not be bolted to Cranelap flanged pipe joints

Bolting flanges of dissimilar metals....page 318

Gaskets....page 321