

capco®

**INSTALLATION
GUIDE**
FOR ASBESTOS
CEMENT DISTRIBUTION
AND TRANSMISSION
PIPE

CAPCO PIPE COMPANY, INC.
Subsidiary of Asarco, Inc.
BIRMINGHAM, ALABAMA

IMPORTANT

RELIEVING AIR FROM THE PIPELINE

Before making either a pressure or leakage test, all air must be vented from the pipeline. Entrapped air cannot be successfully purged through fire hydrants. Air vents should be placed at all high spots in the piping system.

CAPCO® INSTALLATION GUIDE

FOR ASBESTOS CEMENT DISTRIBUTION
AND TRANSMISSION PIPE

WARNING

High-speed abrasive disc saws are prohibited by OSHA if not equipped with local exhaust ventilation and a hepa filter dust collection system.

IMPORTANT: Always follow instructions in "Recommended Work Practices for A/C Pipe" booklet which is furnished with each pipe order.

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SHORT FORM SPECIFICATIONS ASBESTOS-CEMENT DISTRIBUTION PIPE

ASBESTOS-CEMENT PIPE:

- A. Asbestos-cement pipe** shall be Class 150 or Class 200 CAPCO® pipe as manufactured by CAPCO Pipe Company, Inc. or equal. One PERMAFLEX® coupling shall be furnished with each standard, random, and every two short lengths of pipe. It shall consist of an asbestos-cement coupling and two solid rubber rings of uniform cross section and shall be suitable in size and design with the pipe with which it is used. The rubber ring gaskets shall consist of a vulcanized rubber compound. All pipe shall conform to AWWA C400-77.
- B. Hydrostatic Test:** Each standard, random, and short length of CAPCO® pipe shall be designed to have sufficient strength to withstand an internal hydrostatic pressure of 525 psi for Class 150 pipe and 700 psi for Class 200 pipe. Flexural and crushing strength tests shall be performed on CAPCO® pipe as required in AWWA C400-77.
- C. Chemical Requirements:** The uncombined calcium hydroxide present in CAPCO® pipe and PERMAFLEX® couplings shall not be more than 1%.
- D. Inspection:** Before shipment, each standard, random, and short length of pipe in each size and class shall be tested by the manufacturer as stated above. Pipe shall be inspected in the normal air-dry condition.

INSTALLATION GUIDE

FOR CAPCO PIPE CO., INC.
DISTRIBUTION AND
TRANSMISSION PIPE

A GENERAL

CAPCO® Distribution Pipe is manufactured in sizes from 4-inch through 24-inch in three classifications for use at 100, 150, and 200 psi. These classifications specify the permissible working pressure in psi up to which the pipe can be used.

CAPCO® Transmission Pipe is manufactured with nominal inside diameters of 6", 8", 10", 12", 14", 15", 16", 18", 20", 21", and 24".

CAPCO® Transmission Pipe is manufactured in Classes T-30, T-35, T-40, T-45, T-50, T-60, T-70, T-80, and T-90 in sizes 8-inch through 24-inch; and Classes T-40, T-45, T-50, T-60, T-70, T-80, and T-90 in sizes 6-inch through 24-inch.

CAPCO® Distribution and Transmission Pipe meet the applicable ASTM and AWWA specifications.

B INSPECT FOR DAMAGE

Shipments are loaded at CAPCO's® plants in accordance with specifications approved by the carriers and we have transportation company's receipt for each shipment acknowledging delivery to it in good order and agreeing to deliver at destination in like order. However, extremely rough handling enroute can cause pipe damage.

Check to see if the bands are intact and the load has not shifted. Make sure the wooden chocks are still in place, securely fastened to each end of the stacking board. Do not remove chains or bands until truck is positioned for unloading.

If the load has shifted, straps or braces broken, inspect the load carefully. Examine each piece of pipe and accessory as it is unloaded. Make an itemized notation of any damage on the Delivery Receipt, and have it signed by the driver. On rail shipments call the carrier's agent and note any damage on the carrier's receipt or on the inspection report supplied by the railroad and signed by the Inspector.

If damage has occurred and notation of same has been made on delivery receipt then a copy of noted delivery receipt should be mailed to Traffic Manager, CAPCO, P. O. Box 3435, Birmingham, Alabama 35255.

CHECK THE LOAD AGAINST PACKING LIST

Make a thorough check to make sure every item on the packing list is received. Any shortage must be shown on signed receipt. Check the number and footage of standard, random and short lengths of pipe, the number of standard and special couplings, adaptors and fittings. The rubber rings and lubricant are packed either in a burlap bag or carton. Check the contents. Don't throw the bag or carton from the truck or car—handle carefully.

C PREPARATIONS FOR INSTALLATION OF CAPCO® PIPE

Efficient prework saves assembly costs, simplifies laying and increases the safety and service of CAPCO® pipe.

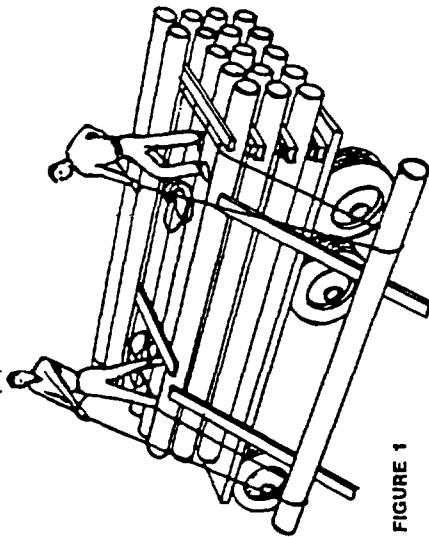


FIGURE 1

UNLOADING (See Figure 1)

Unloading of pipe up to 6" can be done manually without any mechanical help. Pipe larger than 6" in diameter is generally unloaded with skids and ropes. Two ropes should be used for lowering each pipe. Tie one end of each rope to the truck. Do not let pipe slide and do not drop it.

When using mechanical equipment for heavy pipe, use choker in center of pipe. Never insert hooks in end of pipe or coupling. Unload couplings carefully, never throw couplings from the truck.

If pipe is not immediately lined up alongside the trench, it should be stacked on level ground. Make sure that stop blocks are properly secured; timbers should be posted approximately 3 feet from pipe ends.

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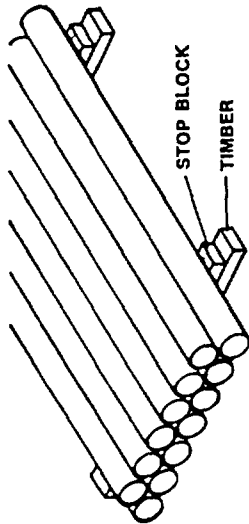


FIGURE 2

Couplings are usually delivered installed on pipe. Since direct sunlight might eventually damage the rubber rings, it is important that loose rings are not exposed to the sun for a long period of time. Store at a central point to avoid loss or pilfering. Keep away from oils or grease.

TRENCHSIDE DELIVERIES

Place pipe along side trench or trench site away from traffic. Along unopened trenches do not place pipe in path of excavating discharge. Never permit pipe unloading by one man from one end. Dropping one end of pipe while holding other end will result in breakage. Protect machined end of pipe from rocks, etc.

D TRENCHING

As a general rule, trenches should not be opened too far ahead of pipe laying. Here are some of the reasons why long stretches of opened trench should be avoided: it minimizes the possibility of flooding the trench; it reduces caving caused by ground water; it helps prevent frozen trench bottom and backfill; it reduces hazards to traffic and workmen. Due to the light weight of the pipe and the simple assembly in the field, CAPCO® pipe can generally be laid as fast as the trench is excavated.

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WIDTH OF TRENCH

A wide trench at pipe level will increase the earthload on pipe whereas a narrow trench will slow down the laying of the pipe. Normally trench width is recommended by the project engineer to suit the soil conditions. In the absence of a specific recommendation by an engineer, the width at pipe level should be the same as shown in Table I.

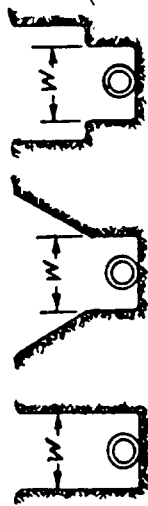


FIGURE 3

Recommended trench widths which are generally sufficient and also economical are listed in Table I.

TABLE I

Pipe diameter	Min. width of trench	Max. width of trench
4 inch	18 inch	28 inch
6 and 8 inch	20 inch	32 inch
10 and 12 inch	24 inch	36 inch
14 and 16 inch	30 inch	42 inch
18 and 20 inch	33 inch	45 inch
24 inch	36 inch	48 inch

DEPTH OF TRENCH

Like the trench width, the depth of the trench, too, has an important bearing on the cost of laying. Before excavating the trench, all factors should therefore be considered very carefully.

For pressure lines this is determined with a minimum depth of cover over the pipe to give adequate protection against frost penetration. Also, due consideration must be given to surface loads and earth loads. The project engineer usually specifies the depth of cover.

LINE OF TRENCH

The PERMAFLEX® coupling is a flexible pipe connection and allows limited deflection of pipe. The recommended maximum angles of deflection for the individual sizes are listed in Table II.

TABLE II

Pipe diameter	Recommended max. deflection
4"—12"	5°
14"—16"	4°
18"—24"	3½°

The pipe should be assembled in a normal straight line position. Deflection should be taken after assembly has been completed (see Figure 4).

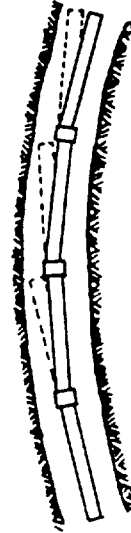


FIGURE 4

MINIMUM RADIUS OF CURVATURE FOR PIPE ON CURVES

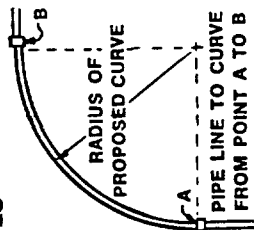
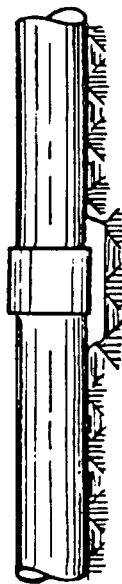
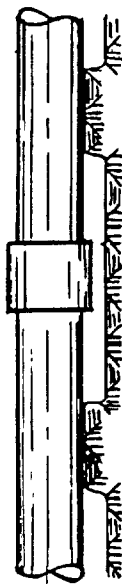


FIGURE 5



PIPE LAID ON TRENCH BOTTOM



PIPE LAID ON EARTH PADS

PIPE LAID ON EARTH PADS

Earth pads may be used to support pipe and keep couplings up off hard bottom. These pads should be made from select blackfill material, free from rocks, clay lumps, etc.

Space pads approximately 30 inches from each end of 13-foot pipe. On shorter length pipe, locate pads one-fifth of pipe length from each end. Pads should be a minimum of 12 inches wide, 2 inches high, and extend the complete width of the trench.

Place pipe on pads and check ends for alignment. Add or remove pad material as required to align pipe ends. Be sure pipe has a minimum of 2-inches clearance under unsupported area. Begin backfilling as soon as possible.

(See section "G," page 20)

TABLE III

MINIMUM RADIUS OF CURVE (FEET)	Length of Pipe (Feet)		Deflection per Coupling (Degrees)	Offset per 13' Length (Inches)
	3 1/4	6 1/2		
186.7	37.1	74.3	1°	2.7"
92.7	18.6	37.1	2°	5.4"
62.0	12.4	24.9	3°	8.1"
46.5	9.3	18.6	4°	10.9"
37.1	7.4	14.9	5°	13.6"

PIPE LAID ON TRENCH BOTTOM

Where conditions permit, the trench should be excavated to a flat bottom, cut true and even to the established grade. Where rock or other hard substances are present on the trench bottom, remove them to a depth of 6 inches deeper than the specified trench bottom and refill with well tamped earth or sand. Use a leveling board made from 2" x 4" at least 14 feet long to check for irregularities in the trench bottom. Any uneven areas in the trench bottom should be shaved off or filled in with well tamped earth. Recheck with the leveling board after filling.

E INSTALLATION OF CAPCO® PIPE

The PERMAFLEX® coupling is a self sealing pipe connection. Its sealing rings simplify the installation process. Rising water pressure also increases the compression of the rings and thus the sealing security of the coupling (see Figure 6).

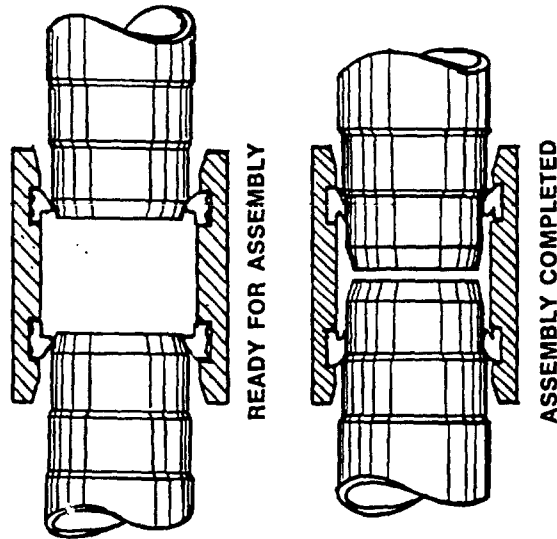


FIGURE 6

Normally CAPCO® pipe is furnished with one gasket and coupling installed. Before installing the other gasket in field make sure the gasket groove is cleaned of any earth, sand, etc. Up on insertion of gasket run fingers around entire

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inside of gasket to make sure it is firmly seated without any twisting or bulging (see Figure 7).

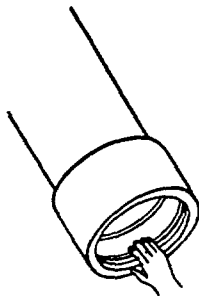


FIGURE 7

Clean coupling area of pipe. Apply lubricant over the machined end of the pipe (Figure 8) and surface of the rubber rings inside the coupling. To apply lubricant use a cloth or 2" paint brush. Use only lubricant supplied with pipe, never use grease or oils.

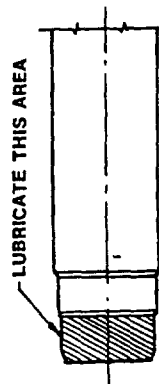


FIGURE 8

Small pipe may be handled by hand in trench and stabbed together as shown.

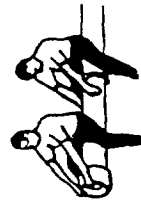


FIGURE 9

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For medium sizes use crowbar and wooden block as demonstrated in Figure 10.

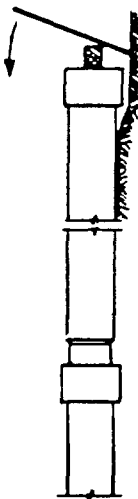


FIGURE 10

For larger sizes suspension may be used (Figure 11) so that the pipes' own weight forms a horizontal thrust component.

This saves considerable effort for the layer. A bar or pipe puller (or a combination of both) may be used to complete the assembly (Figure 12).

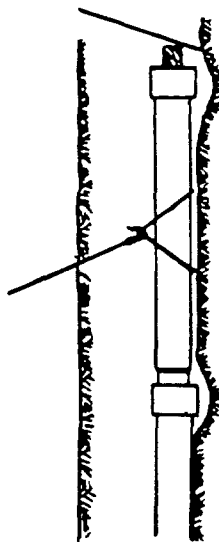


FIGURE 11

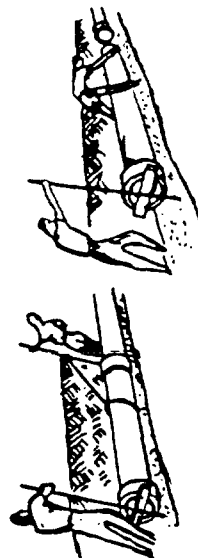


FIGURE 12

The pipe to be assembled should be aligned carefully with the mating bell into which it will be inserted, any deflection required should be taken after assembly has been completed. A short positive swing of the pipe being assembled will drive it into proper assembled position, a solid feel of assembly is attained at this time, further forcing should not be attempted. Excess forces should not be used during assembly, if a solid feel is not attained, further inspection should be made for foreign material under the gasket, misalignment of pipe, gasket not properly installed, improper lubrication, etc.

CUTTING AND MACHINING

A cutting machine such as shown in Figure 13 should be used for cutting pipe. If a fully machined pipe (MOA) is cut, the pipe bevel can be cut with rasp. Otherwise a coupling surface can be machined on the rough barrel of the pipe by using a machining tool such as shown.

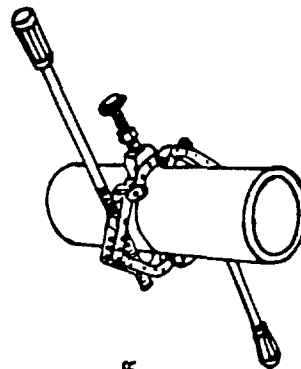


FIGURE 13
PIPE CUTTER

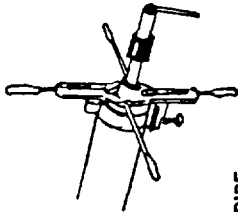


FIGURE 14
TOOL FOR MACHINING PIPE

F SERVICE CONNECTIONS

Corporation Stops

Maximum recommended sizes of corporation stops:
For 4" and 6" pipe— $\frac{3}{4}$ " Tap
For 8" and larger pipe—1" Tap

Use only a clean and sharp tapping tool. Locate tap at about 45 degree angle, tap only deep enough to allow three threads exposed when the corporation stop is inserted (make a test tap and mark drilling bar). Do not tighten corporation stop more than necessary. Do not force the drill. Use a mixture of graphite and oil to lubricate stop and tap. Always put a bend or "gooseneck" between corporation stop and service pipe to allow for vibration, settling of soil, etc.

BEND TO ABSORB VIBRATION

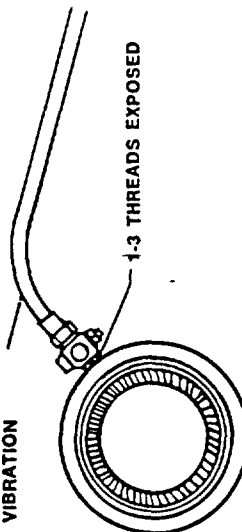


FIGURE 15
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If more than one corporation stop is used, they must be staggered at least 12" apart and not on the same center line.

Tapped Couplings, Tapping Sleeves and Service Clamps

For larger outlets tapped PERMAFLEX® Couplings, service clamps or tapping sleeves are used. Double strap service clamps should be used when the outlet is over 1 inch. The following table contains the recommended maximum outlet sizes for use with service clamps.

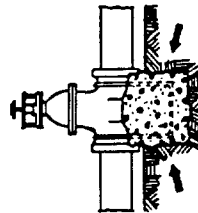
TABLE IV
Maximum Size of Outlet Recommended with Service Clamps (Inches)

Pipe Size	Outlet Size (Classes 100-150-200)	
	Single Strap	Double Strap
4"		1"
6"		1½"
8"	2"	2"
10"	2"	2"
12"	2"	2"
14"	2"	2"
16"	2"	2"
18"		3"
20"		3"
24"		3"

ANCHORAGE OF VALVES IN LINE AND THRUST BLOCKS

All tees, wyes, hydrants, caps, and valves must be thrust blocked. For example: The minimum thrust against a 6" closed valve @ 100 psi is equal to 3800 lbs.

FIGURE 16



Anchorage of Valves

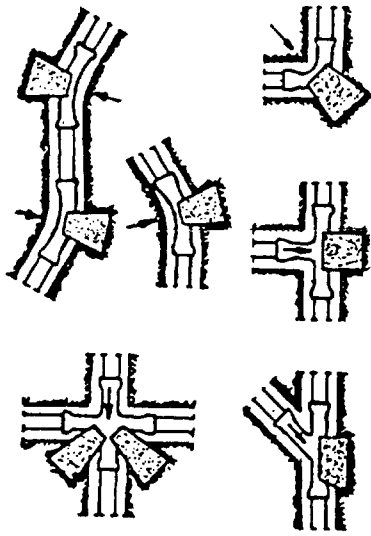


FIGURE 17

Permanent thrust blocks are generally made of concrete. Detachable blocks for pressure tests should be made of steel or wood. The size and type of thrust block depends on various factors such as: diameter of pipe, line pressure, type of fitting and kind of soil.

Table V lists the forces encountered at end closures. To calculate forces encountered at bends, tees and wyes, multiply the figure given in this table by the appropriate factor as listed following Table V.

TABLE V

Minimum Thrust at Fittings in Pounds, at One Pound Per Square Inch (1 psi) of Static Water Pressure

Pipe Size	Dead End or Tee	90° Elbow	45° Elbow	22½° Elbow
4"	18	25	14	7
6"	38	54	29	15
8"	65	92	49	25
10"	107	151	81	42
12"	152	214	116	59
14"	207	292	157	81
16"	268	378	204	105
18"	386	544	293	151
20"	478	674	363	186
24"	689	972	524	269

Factors for calculating thrust W for elbows and tees.

Elbows: 90° = 1.41 Tees = 0.70
 60° = 1.00
 45° = 0.76
 30° = 0.52
 22½° = 0.39

TABLE VI gives approximate horizontal bearing power of different soils. The thrust-block area is calculated as follows:

$$\text{Thrust-block area} = \frac{W}{F} = \frac{\text{Thrust (Table V)}}{\text{Soil bearing power (Table VI)}}$$

TABLE VI

Type of Soil	F=Horizontal bearing power in lb./sq. ft.
Sand	1000
Sand & gravel	1500
Clay & Marl	2000

Examples of Calculation

1st Example:

Thrust-block for end closure for 12" dia. line
 Test pressure: 200 P.S.I.
 Soil: Sand and gravel
 Thrust (Table V) W=30,200 P.S.I.
 Soil-bearing power (Table VI) F=1500 lb./sq. ft.
 Required thrust-block area = $\frac{W}{F} = \frac{30,200}{1500}$
 20.2 sq. ft.

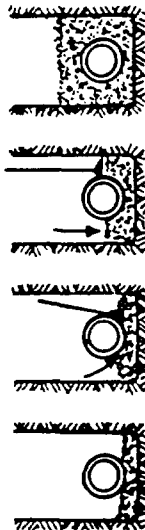
2nd Example:

Thrust-block for elbow 12" dia. 90°
 Test pressure: 250 P.S.I.
 Soil: Clay and marl
 Thrust (Table V) W=37,800 x 1.41=53,300 P.S.I.
 Soil bearing power (Table VI) F=2000 lbs.
 Required thrust-block area = $\frac{W}{F} = \frac{53,300}{2,000}$
 26.65 sq. ft.

G BACKFILLING AND TAMPING

Initial backfilling should be done as soon as possible after the pipe has been placed to protect the pipe from falling rocks, flooding and cave-ins. Provide a continuous bed by placing selected material under pipe and coupling and between the pipeline and the trench walls (Fig. 18).

FIGURE 18



1. Place soil in 4" layers
2. Tamp under pipe at both sides
3. Add another 4" layer and tamp until half way up the pipe
4. Backfill by hand 12" over the pipe

Couplings are normally exposed until the line has been tested; initial backfill should proceed until the pipe has been covered by at least 12" of well selected material.

Water tamping may be used where drainage is good.

H TESTING

Pressure tests are generally carried out at an internal pressure of 50 P.S.I. above the actual operating pressure. Individual test sections should preferably not exceed 1000 ft. in length. Couplings should be uncovered for the test so that possible leaks are readily located. Before pressure testing, all parts of the pipeline have to be backfilled to prevent movement. All thrust-blocks should be in place and completely hardened. To insure that pipeline section is well

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vented, it should be filled at the lowest point of the line and an adequate venting port should be provided at the other end.

Dry cement-asbestos pipe is hydroscopic so that lines must be filled at least 24 hours prior to testing. Prior to final testing, again make sure that all entrapped air has been removed. All valves and hydrants must be closed. The pressure test is built up by using a hand pump or a small power pump. The quantity of water measured to maintain the test pressure is usually specified by the engineer.

TABLE VII
Allowable Leakage per 100 Couplings*

Pipe Diam. in.	Average Test Pressure at Lowest Point in Line—psi							
	50	75	100	125	150	175	200	225
	Leakage—gal/hr							
4	0.71	0.87	1.00	1.12	1.23	1.32	1.42	1.51
6	1.06	1.29	1.51	1.66	1.84	1.96	2.12	2.25
8	1.42	1.72	2.00	2.24	2.45	2.64	2.84	3.00
10	1.77	2.15	2.50	2.79	3.07	3.40	3.54	3.75
12	2.12	2.58	3.00	3.35	3.68	3.96	4.24	4.52
14	2.48	3.01	3.50	3.91	4.28	4.62	4.96	5.28
15	2.66	3.23	3.75	4.19	4.59	4.95	5.31	5.69
16	2.83	3.44	4.01	4.47	4.89	5.27	5.68	6.00
18	3.18	3.87	4.52	5.02	5.52	5.93	6.37	6.75
20	3.54	4.30	5.00	5.56	6.12	6.58	7.08	7.51
21	3.73	4.54	5.24	5.88	6.40	6.92	7.42	7.86
24	4.24	5.16	6.00	6.69	7.34	7.91	8.50	9.01

*The data are based on 150 psi and represent a leakage of approximately 30 gpd per mile of pipe per inch of pipe diameter for pipe in 13-ft. lengths.

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MATERIAL SPECIFICATION

CAPCO® ASBESTOS-CEMENT DISTRIBUTION PIPE

SECTION 1—SCOPE:

1.1 General: This specification designates the requirements for CAPCO® asbestos-cement water pipe manufactured for use in supply lines and distribution systems which carry water under pressure. This specification also designates the requirements for CAPCO® asbestos-cement water pipe for use in sewer force mains which carry sewage under pressure.

SECTION 2—GENERAL REQUIREMENTS:

2.1 Sizes: CAPCO® water pipe shall be manufactured with nominal inside diameters of 4, 6, 8, 10, 12, 14, 16, 18, 20, and 24 inches.

2.2 Classes: CAPCO® water pipe shall be manufactured for use in service at maximum operating pressures of 100, 150, or 200 pounds per square inch. Pipe shall be designated as Class 100, 150, and 200, respectively, for the above maximum operating pressures.

2.3 Lengths:

2.3.1 Standard Lengths: The standard nominal length for CAPCO® water pipe shall be 13 feet. A maximum of 10 percent of the total footage of any one size and class for any one order may be furnished, at the manufacturer's option, in pipe

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I HOW TO REPAIR DAMAGED PIPE

A bolted repair clamp may be used to repair bruises or cracks in the pipe wall. If the pipe has been broken cleanly into two pieces, the ends can either be joined together with a repair clamp or replaced. If the coupling area of the pipe has been chipped or cracked more than 1/2" from the end, the damaged area has to be cut off at least 1" beyond the defect and the pipe end has to be remachined.

Scratches not over 1/16" deep and 1/2" wide can be sanded smooth so that the rubber rings will seat properly on the pipe. Deeper scratches or gouges will prevent the ring from sealing properly.

Therefore, the entire area should be cut off and the pipe end remachined.

If an undamaged pipe section must be replaced with insertion of fittings, couplings should be cut carefully to prevent damage to the machined section of pipe. Use hack saw, carpenter saw or cold chisel and hold tool parallel to pipe (see Figure 19).

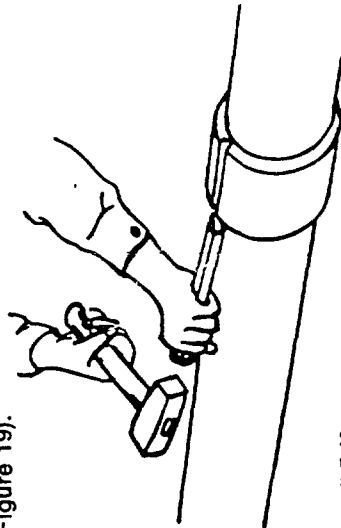


FIGURE 19

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lengths shorter than 13 feet but not less than 7 feet. These shorter lengths shall be termed random lengths.

2.3.2 Short Lengths: Short lengths furnished for use in making rigid connections to fittings or structures shall not exceed 6 feet 6 inches.

2.4 Couplings:

One PERMAFLEX® coupling shall be furnished with each standard and random length of pipe and one coupling shall be furnished with each two short lengths of pipe. It shall consist of an asbestos-cement sleeve and two solid rubber rings of uniform cross section and shall be suitable in size and design for the pipe with which it is used.

2.5 Materials:

2.5.1 Pipe and PERMAFLEX® Coupling: CAPCO® water pipe and PERMAFLEX® coupling shall be composed of an intimate mixture of portland cement, silica and asbestos fiber and shall be free from organic substances.

2.5.2 PERMAFLEX® Coupling Rubber Rings: The rubber-ring gaskets shall consist of a vulcanized rubber compound.

SECTION 3—DETAIL REQUIREMENTS:

3.1 Pipe:

3.1.1 Description: CAPCO® water pipe shall conform to the dimensions and tolerances given in the table of dimensions following. Each pipe shall be properly machined on each end so as to facilitate joining the pipe sections without damage and to provide end separation of pipes in each coupling assembly. The pipe ends shall also be compatible with the coupling so as to provide confinement of the rubber rings.

3.1.2 Hydrostatic Strength: Each standard, random and short length of CAPCO® pipe shall be designed to have sufficient strength to withstand an internal hydrostatic pressure listed under Table II when applied as specified in Section 4.2.2.

TABLE II

**A
Routine Hydrostatic Pressure, psi**

Class	Test Pressure
100	350
150	525
200	700

**B
Sampling Hydrostatic Test Pressure, psi**

Class	Test Pressure
100	400
150	600
200	800

3.1.3 Flexural Strength: Each standard length of CAPCO® pipe in sizes 4, 6, and 8 inches shall have sufficient flexural strength to withstand, without failure, the total loads listed in Table III when applied at the third points of a 12-foot span for 13-foot lengths in the manner specified in Section 4.2.3.

TABLE III
Flexural Test Loads

Nominal Diameter In.	Class 100	Class 150	Class 200
	Total Applied Load—Lb.		
4	900	1,095	1,395
6	2,100	2,775	3,675
8	3,998	5,700	7,598

3.1.4 Crushing Strength: CAPCO® pipe shall have the crushing strength indicated in Table IV when tested in accordance with ASTM 3-Edge Bearing Method as specified in Section 4.2.4.

TABLE IV
Crushing Test Loads

Nominal Diameter In.	Class 100	Class 150	Class 200
	Applied Load per Foot of Length—Lb.		
4	4,100	5,400	8,700
6	4,000	5,400	9,000
8	4,000	5,500	9,300
10	4,400	7,000	11,000
12	5,200	7,600	11,800
14	5,200	8,600	13,500
16	5,800	9,200	15,400
18	6,500	10,100	17,400
20	7,100	10,900	19,400
24	8,100	12,700	22,600

3.2 PERMAFLEX® Coupling Sleeves:

3.2.1 Description: PERMAFLEX® coupling sleeves shall conform to the dimensions and tolerances listed in table of dimensions. The inner surface of each sleeve shall be machined with gasket retaining grooves, so that when the joint

is assembled the gasket shall be compressed to form a water-tight seal.

3.2.2 Hydrostatic Strength: Each PERMAFLEX® coupling sleeve shall be designed to have sufficient strength to withstand the internal hydrostatic pressures listed in Table II when applied as specified in Section 4.3.2.

3.3 Rubber Rings:

Rubber ring gaskets shall conform to the manufacturer's standards.

3.4 Chemical Requirements:

The uncombined calcium hydroxide present in CAPCO® pipe and PERMAFLEX® coupling sleeves shall not be more than 1%. When requested on the order, this test shall be conducted in accordance with the method described in Section 4.5.

SECTION 4—INSPECTION, TESTS AND REJECTIONS:

4.1 General: All material furnished under this specification shall be inspected and tested in a normal air-dry condition prior to shipment for conformance to the requirements stated in previous sections. When required on his order, the purchaser may witness inspection and test procedures at his own expense. In lieu of this, he may request the manufacturer to submit a certificate certifying the product meets the requirements of this specification.

4.2 Pipe:

4.2.1 Inspection: Before shipment, each pipe shall be inspected by the manufacturer for conformance to the dimensions and tolerances specified in Section 3.1.1.

4.2.2 Hydrostatic Test: Before shipment, each standard, random and short length of pipe in each size and class shall be tested hydrostatic-

ally to the routine test pressures specified in Table II-A by the manufacturer.

In addition, from each lot of 300 standard lengths of a given size and class which have passed the routine test, the manufacturer shall select one section at random and test it to the sampling hydrostatic requirements listed in Table II-B and subsequently retest it to the pressure specified in Table II-A. If any pipe fails to withstand this sampling test, five additional lengths shall be selected and tested. Failure of two of these additional lengths to meet the specified requirements will necessitate rejection of the entire lot of pipe represented.

The test listed in Table II shall be conducted by placing the pipe in a hydrostatic testing machine which seals the pipe ends. All air shall be expelled and the internal pressure increased at a uniform rate of not less than 100 psi per second to the test pressures specified in Table II. The test pressures specified in Table II shall be maintained for a period of 5 seconds.

4.2.3 Flexural Test: Before shipment, each 13' standard length of pipe in sizes 4, 6, and 8 inches shall be tested in flexure by the manufacturer for compliance with the flexure strength requirements specified in Section 3.1.3. The length of pipe shall be supported on a standard flexure testing machine with supports 12-feet apart for the 13-foot lengths. The total load shall be divided equally and applied at third points of the clear span at a minimum rate of at least 500 pounds per second and shall be maintained for 5 seconds.

Each pipe so tested shall support the applicable load without evidence of cracks or other defects.

4.2.4 Crushing Test: Before shipment, crushing tests shall be conducted by the manufacturer when requested by the purchaser on his order. One specimen length of pipe shall be selected from each lot of 300 lengths of each size and

class of pipe or fraction thereof. From the specimen pipe there shall be cut one unmachined section of pipe one-foot long. This section shall be tested in crushing by the ASTM 3-Edge Bearing Method and shall not fail until the total applied load exceeds the tabular value given in Table IV for the size and class of pipe being tested. After 75 percent of the specified load is reached, the load shall be applied at a uniform rate of approximately 2000 pounds per minute.

If any specimen tested for crushing strength is less than 100 percent of the crushing load required in Section 3.1.4, one specimen cut from each of two additional pipe sections of the same lot shall be subjected to the crushing test.

The failure of one of these additional specimens to meet the crushing strength requirements of Section 3.1.4 shall be cause for rejection of the entire lot of pipe represented.

4.3 PERMAFLEX® Coupling Sleeves:

4.3.1 Inspection: Before shipment, each PERMAFLEX® coupling sleeve shall be inspected by the manufacturer for conformance with the dimensions and tolerances specified in Section 3.2.1.

4.3.2 Hydrostatic Test: Before shipment, each PERMAFLEX® coupling sleeve shall be tested hydrostatically by the manufacturer to the routine Hydrostatic Test pressures specified in Section 3.2.2 and Table II-A. In addition, from each lot of 300 couplings of a given size and class which have passed the routine test, the manufacturer shall select one at random and test it to the sampling hydrostatic requirement specified in Section 3.2.2 and Table II-B and subsequently retest it to the pressures specified in Table II-A. If any coupling fails to withstand this sampling test, five additional couplings shall be selected and tested. Failure of two of these additional couplings to meet the specified requirement will necessitate rejection of the entire lot of couplings represented. The tests listed in Table

TABLE OF DIMENSIONS—CAPCO® DISTRIBUTION PIPE AND COUPLINGS

CLASS 100

ALL CLASSES

Pipe Size	D	D ₂ D ₄	D ₃	D ₅	D ₆	*D ₇	D ₈	*D ₉	*N	Q	C	E	T
4	4.00	4.64	4.80	4.93	5.38	6.20	4.76	4.84	7.00	.92	2.40	3.90	.75
6	6.00	6.91	7.07	7.20	7.65	8.75	7.03	7.15	7.00	.92	2.40	3.90	.75
8	8.00	9.11	9.27	9.40	9.85	10.75	9.23	9.35	7.00	.92	2.40	3.90	.75
10	10.00	11.24	11.40	11.53	11.98	13.25	11.36	11.47	7.00	.92	2.40	3.90	.75
12	12.00	13.44	13.60	13.73	14.18	15.70	13.56	13.74	8.00	.92	2.90	4.40	.75
14	13.59	15.07	15.23	15.39	15.95	17.50	15.20	15.55	9.00	1.00	3.25	4.75	1.00
16	15.50	17.15	17.31	17.47	18.03	19.75	17.28	17.55	9.00	1.00	3.25	4.75	1.00
18	18.00	19.90	20.06	20.22	20.78	23.00	20.03	20.50	10.00	1.00	3.75	5.25	1.00
20	20.00	22.12	22.28	22.44	23.00	25.30	22.25	22.70	10.00	1.00	3.75	5.25	1.00
24	24.00	26.48	26.64	26.80	27.36	30.10	26.61	27.15	10.00	1.00	3.75	5.25	1.00

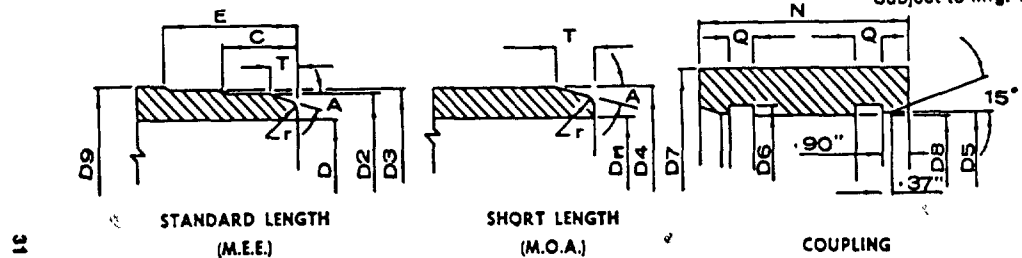
CLASS 150

Pipe Size	D	D ₂ D ₄	D ₃	D ₅	D ₆	*D ₇	D ₈	*D ₉	Length of Pipe				
4	4.00	4.81	4.97	5.10	5.55	6.50	4.93	5.00	Standard: 13' - 0" Half Lengths: 6' - 6" Quarter Lengths: 3' - 3" Standard Lengths MEE Half Lengths MEE Quarter Lengths MOA Gaskets are Marked for— Sizes & Classes				
6	5.85	6.91	7.07	7.20	7.65	9.15	7.03	7.20					
8	7.85	9.11	9.27	9.40	9.85	11.50	9.23	9.40					
10	10.00	11.66	11.82	11.95	12.40	14.50	11.78	11.92					
12	12.00	13.92	14.08	14.21	14.66	17.15	14.04	14.20					
14	14.00	16.22	16.38	16.54	17.10	19.75	16.35	16.50					
16	16.00	18.46	18.62	18.78	19.34	22.60	18.59	18.75					
18	18.00	20.94	21.10	21.26	21.82	25.12	21.07	21.30					
20	20.00	23.28	23.44	23.60	24.16	27.65	23.41	23.64					
24	24.00	27.96	28.12	28.28	28.84	32.92	28.09	28.32					

CLASS 200

Pipe Size	D	D ₂ D ₄	D ₃	D ₅	D ₆	*D ₇	D ₈	*D ₉	Tolerances				
4	4.00	4.81	4.97	5.10	5.55	6.70	4.93	5.32	Dimensions D ₂ , D ₃ , D ₄ , D ₅ , D ₆ & D ₈ 4"–12" + .03–.03 14"–24" + .04–.04 Dimensions D ₇ , D ₉ & N Subject to Manufacturer Tolerance Angle A° 15° ± 2° Length of Pipe + .00–1.0 Short Pieces + .00–0.375 Dimensions E&C + .00–.12 Dimensions Q + .01–.03 Dimension DM Subject to Mfg. Tol.				
6	5.70	6.91	7.07	7.20	7.65	9.25	7.03	7.25					
8	7.60	9.11	9.27	9.40	9.85	11.60	9.23	9.50					
10	9.63	11.66	11.82	11.95	12.40	14.60	11.78	11.95					
12	11.56	13.92	14.08	14.21	14.66	17.50	14.04	14.20					
14	13.64	16.22	16.38	16.54	17.10	20.50	16.35	16.55					
16	15.55	18.46	18.62	18.78	19.34	23.00	18.59	18.90					
18	18.00	22.18	22.34	22.50	23.06	27.73	22.31	22.54					
20	20.00	24.66	24.82	24.98	25.54	30.71	24.79	25.02					
24	24.00	29.62	29.78	29.94	30.50	36.71	29.75	29.98					

*Subject to Mfg. Tol.



It shall be conducted by placing the coupling in a hydrostatic testing device designed to subject the coupling to internal bursting pressure. The pressure shall be increased at a steady rate of at least 100 psi per second to the test pressure specified in Table II and held at the test pressure for 5 seconds.

4.4 CAPCO® Coupling Rubber Rings:

4.4.1 Inspection: Rubber ring gaskets shall be inspected by the manufacturer, before shipment, for compliance with the manufacturer's standards.

4.5 Uncombined Calcium Hydroxide Test:

Before shipment, when requested on the order, the Uncombined Calcium Hydroxide Test shall be conducted on one representative sample by the method described in this section.

SECTION 5—MARKING

5.1 Pipe: Each standard, random, and short length of pipe shall be marked with the manufacturer's trade name CAPCO®, nominal size, class, hydrostatic test pressure, date of manufacture, and a "T" to signify it was tested.

5.2 Coupling Sleeves: Each PERMAFLEX® coupling shall be marked by the manufacturer with the manufacturer's identification, the size, the class of pipe with which it shall be used, and with a "T" to signify it has been hydrostatically tested.

5.3 Rubber Rings: Each CAPCO® rubber ring shall be marked with the manufacturer's identification, the size, the year of manufacture, and the classes of pipe with which it can be used.

SECTION 6—PREPARATION FOR SHIPMENT:

6.1 General:

CAPCO® pipe and couplings shall be prepared for standard commercial shipment so as to assure acceptance by common or other carriers.

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SECTION 7—SUPPLEMENTARY DETAILS TO BE SPECIFIED BY PURCHASER:

7.1 General: When purchasing CAPCO® pipe under these specifications, the purchaser shall supplement them with the following specific requirements for each lot of pipe.

7.1.1 Laying Length: The purchaser shall state the total laying length of each size and class of pipe required.

7.2.1 Short Lengths: The purchaser shall state the total footage of short lengths which shall be required for making rigid connections to fittings and structures and for making closures as described in Section 2.3.2.

7.3 Coating of Pipe and Couplings: When the purchaser requires that the interior surface of the pipe and couplings be coated with a bituminous seal coating, he shall so state on his order. The expense for coating shall be assumed by the purchaser.

7.4 Inspection and Tests: When the purchaser wishes to witness the inspection and tests conducted by the manufacturer, he shall so state on his order so that the manufacturer can notify the purchaser in ample time. All expense incidental to this inspection shall be assumed by the purchaser.

7.4.1 Certificate of Test: When the purchaser requires a certificate of test in lieu of witnessing the inspection and test procedures, he shall so state on his order.

7.4.2 Crushing Tests: When the purchaser requires that the crushing tests be conducted on pipe, he shall so state on his order.

7.4.3 Uncombined Calcium Hydroxide Tests: When the purchaser requires that the Uncombined Calcium Hydroxide Tests be conducted, he shall so state on his order.

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MATERIAL SPECIFICATION CAPCO® ASBESTOS CEMENT TRANSMISSION PIPE

SECTION I—SCOPE:

1.1 General: This specification covers the requirements for CAPCO® Asbestos Cement Transmission Pipe intended for use in transmission systems that convey water under pressure from its source to a point of distribution. Our T-pipe is manufactured in accordance with ASTM C668 and AWWA C402 in sizes 18" through 24".

SECTION II—GENERAL REQUIREMENTS:

2.1 Size: CAPCO® T-pipe shall be manufactured with nominal inside diameters of 6", 8", 10", 12", 14", 15", 16", 18", 20", 21", and 24".

2.2 Classes: CAPCO® T-pipe shall be manufactured in Classes T-30, T-35, T-40, T-45, T-50, T-60, T-70, T-80, and T-90, in sizes 8" through 24"; and Classes T-40, T-45, T-50, T-60, T-70, T-80, and T-90, in sizes 6" through 24".

2.3 Lengths: The standard length for CAPCO® T-pipe shall be 13 feet in all classes and sizes. A maximum of 10% of the total footage of any one size or class for any one order may be furnished in random pipe lengths shorter than 13 feet but not less than 7 feet. The tolerance for the standard length of 13 feet is ± 0.00 "– 1.00 ". Random lengths are furnished in increments of 0.5 feet with a tolerance of plus or minus 1 inch.

Short lengths for use in making connections to valves, fittings, and for making closures shall not exceed 6'6". Standard one-half lengths are

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6'6" and 3'3" machined each end ± 0.00 "– 0.375 "; and one-quarter lengths 3'3" machined overall ± 0.00 "– 0.375 ". Short lengths are available for all sizes and classes of CAPCO® T-pipe.

2.4 Couplings: One CAPCO® coupling of the same composition as the pipe shall be furnished with pipe and includes as required. It shall consist of an asbestos cement sleeve and two solid rubber rings of uniform cross section and shall be suitable in size and design for the pipe with which it is used.

2.5 Gaskets: The rubber sealing gasket shall consist of a vulcanized rubber compound that meets the latest requirements of ASTM Specification D-1869.

NOTE: FOR ASSISTANCE IN PROPER T-PIPE CLASS SELECTION AND FOR AVAILABILITY, PLEASE CHECK WITH OUR SALES REPRESENTATIVES OR WRITE TO (CAPCO) ENGINEERING DEPARTMENT: CAPCO PIPE CO., INC., P. O. BOX 3435, BIRMINGHAM, ALABAMA 35255.

SECTION III—DETAIL, REQUIREMENTS, STANDARD METHODS OF TESTING

3.1 General: CAPCO® T-pipe shall be made to the manufacturer's standard dimensions and tolerances in Table I. Each pipe shall be properly machined on each end so as to facilitate joining the pipe sections without damage and to provide end separations of pipes in each coupling assembly. The pipe ends shall also be compatible with the coupling so as to provide confinement of the rubber rings.

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3.2 **Hydrostatic Proof Test:** Each standard, random or short length of pipe and couplings for pipe shall withstand without leakage a hydrostatic proof test of not less than the pressure indicated in the table below when tested in accordance with ASTM C500.

MINIMUM HYDROSTATIC PROOF TEST, PSI

ALL PIPE SIZES	PIPE CLASS								
	T30	T35	T40	T45	T50	T60	T70	T80	T90
	225	262	300	337	375	450	525	600	675

3.3 **Hydrostatic Bursting Test:** In conjunction with the minimum hydrostatic proof test, one length of pipe shall be subjected to and be able to withstand the minimum bursting pressure indicated in the table below when tested in accordance with ASTM C500 and ASTM 668.

MINIMUM HYDROSTATIC BURSTING TEST, PSI

ALL PIPE SIZES	PIPE CLASS								
	T30	T35	T40	T45	T50	T60	T70	T80	T90
	300	350	400	450	500	600	700	800	900

3.4 **Crushing Strength:** Each pipe when tested shall have sufficient strength to support not less than the loads indicated in the table below when tested in accordance with ASTM C500.

MINIMUM CRUSH STRENGTH, LBS/FT

PIPE SIZE SIZES	PIPE CLASS								
	T30	T35	T40	T45	T50	T60	T70	T80	T90
6"			2400	3200	4000	4700	5400	6700	9000
8"	2000	2400	2800	3400	4000	4800	5500	7400	9300
10"	2000	2500	3000	3500	4500	5500	7000	9000	11000
12"	2000	2500	3000	4000	5200	6400	7800	10000	12200
14"	2000	2500	3000	4000	5200	7000	8800	11000	13500
15"	2300	2800	3300	4300	5500	7400	9300	12000	14500
16"	2500	3000	3500	4500	5800	7500	9500	12400	15400
18"	2500	3000	4000	5000	6500	8500	11000	14000	18000
20"	2500	3500	4500	5500	7100	9500	12000	15000	20000
21"	2500	3500	4500	5800	7300	9700	12500	16000	21000
24"	2800	3800	5000	6200	8100	11000	15000	19000	24000

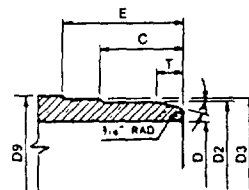
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§ 3.5 Flexure Proof Test: Each pipe in sizes 6" and 8" shall have sufficient strength to withstand without failure the total applied load indicated in the table below when tested in accordance with ASTM C500.

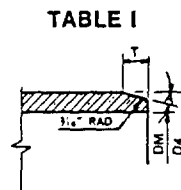
MINIMUM FLEXURAL LOADS, LBS.

PIPE SIZE INCHES	PIPE CLASS								
	T30	T35	T40	T45	T50	T60	T70	T80	T90
6"			1700	1900	2100	2400	2800	3000	3700
8"	2800	3300	3800	4300	4800	5200	5700	6600	7600

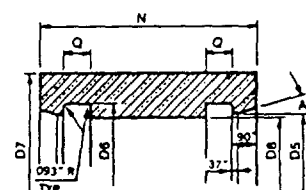
3.6 Uncombined Calcium Hydroxide Test: The uncombined calcium hydroxide in CAPCO® T-pipe and couplings shall not be greater than 1% when tested in accordance with ASTM C500.



STANDARD LENGTH (M.E.E.)



SHORT LENGTH (M.O.A.)



COUPLING

TABLE I

Pipe Size	CLASS T-30									ALL CLASSES				
	D	D ₂ D ₄	D ₃	D ₅	D ₆	*D ₇	D ₈	*D ₉	*N	Q	C	E	T	
8	8.00	8.80	8.96	9.09	9.54	10.50	8.92	9.12	7.00	.92	2.40	3.10	.75	
10	10.00	10.89	11.05	11.18	11.63	12.50	11.01	11.08	7.00	.92	2.40	3.10	.75	
12	12.00	12.99	13.15	13.28	13.73	14.70	13.11	13.10	8.00	.92	2.90	4.40	1.00	
14	14.00	15.07	15.23	15.39	15.95	17.60	15.20	15.38	9.00	1.00	3.25	4.75	1.00	
15	15.00	16.11	16.27	16.43	16.99	18.40	16.24	16.64	9.00	1.00	3.25	4.75	1.00	
16	16.00	17.15	17.31	17.47	18.03	19.31	17.28	17.58	9.00	1.00	3.25	4.75	1.00	
18	18.00	19.28	19.44	19.60	20.16	21.53	19.41	19.60	10.00	1.00	3.75	5.25	1.00	
20	20.00	21.44	21.60	21.76	22.32	23.83	21.57	21.76	10.00	1.00	3.75	5.25	1.00	
21	21.00	22.52	22.68	22.84	23.40	25.11	22.65	22.34	10.00	1.00	3.75	5.25	1.00	
24	24.00	25.76	25.92	26.08	26.64	28.43	25.89	26.08	10.00	1.00	3.75	5.25	1.00	

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CLASS T-35

Pipe Size	D	D ₂ D ₄	D ₃	D ₅	D ₆	*D ₇	D ₈	*D ₉
8	8.00	8.80	8.96	9.09	9.54	10.50	8.92	9.26
10	10.00	10.89	11.05	11.18	11.63	12.75	11.01	11.10
12	12.00	12.99	13.15	13.28	13.73	15.00	13.11	13.27
14	14.00	15.07	15.23	15.39	15.95	17.60	15.20	15.38
15	15.00	16.11	16.27	16.43	16.99	18.40	16.24	16.82
16	16.00	17.15	17.31	17.47	18.03	19.80	17.28	17.94
18	18.00	19.28	19.44	19.60	20.16	21.77	19.41	19.60
20	20.00	21.44	21.60	21.76	22.32	24.01	21.57	21.76
21	21.00	22.52	22.68	22.84	23.40	25.24	22.65	22.84
24	24.00	25.76	25.92	26.08	26.64	28.65	25.89	26.08

LENGTH OF PIPE

Standard: 13'-0"
 Half Length 6'-6"
 Quarter Length 3'-3" (M.O.A.)

TOLERANCES

Dimensions D₂, D₃, D₄, D₅, D₆
 & D₈ 6"-12" ±.03"
 14"-24" ±.04"

Dimensions D₇ +.04"
 -.00"

D₁₁ Reduced Bore
 subject to Mfg. Toler.

Dimensions C&E +.00"
 -.12"

Dimension N +.03"

Dimension Q +.03"
 -.01"

Dimension T ±.06"

Angle A=15° ± 2°

Length Of Pipe +.00"
 -1.00"

Short Pieces +.00"
 -.375"

*Subject to Mfg. Tol.

CLASS T-40

Pipe Size	D	D ₂ D ₄	D ₃	D ₅	D ₆	*D ₇	D ₈	*D ₉
6	6.00	6.69	6.85	6.99	7.43	8.18	6.82	7.06
8	8.00	8.80	8.96	9.09	9.54	10.50	8.92	9.26
10	10.00	10.89	11.05	11.18	11.63	12.75	11.01	11.21
12	12.00	12.99	13.15	13.28	13.73	15.00	13.11	13.33
14	14.00	15.07	15.23	15.39	15.95	17.60	15.20	15.56
15	15.00	16.11	16.27	16.43	16.99	18.67	16.24	16.82
16	16.00	17.15	17.31	17.47	18.03	19.80	17.28	17.94
18	18.00	19.90	20.06	20.22	20.78	23.24	20.03	20.14
20	20.00	22.12	22.28	22.44	23.00	25.66	22.25	22.38
21	21.00	23.28	23.44	23.60	24.16	26.79	23.41	23.72
24	24.00	26.48	26.64	26.80	27.36	30.40	26.61	26.82

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CLASS T-45

Pipe Size	D	D ₂ D ₄	D ₃	D ₅	D ₆	*D ₇	D ₈	*D ₉
6	6.00	6.69	6.85	6.99	7.43	8.18	6.82	7.06
8	8.00	8.80	8.96	9.09	9.54	10.67	8.92	9.36
10	10.00	11.24	11.40	11.53	11.98	13.30	11.36	11.46
12	12.00	13.44	13.60	13.73	14.18	15.55	13.56	13.70
14	14.00	15.50	15.66	15.82	16.38	18.20	15.63	15.75
15	15.00	16.68	16.84	17.00	17.56	19.51	16.81	17.05
16	16.00	17.74	17.90	18.06	18.62	20.42	17.87	17.99
18	18.00	19.90	20.06	20.22	20.78	23.62	20.03	20.14
20	20.00	22.12	22.28	22.44	23.00	26.08	22.25	22.38
21	21.00	23.28	23.44	23.60	24.16	26.93	23.41	23.72
24	24.00	26.48	26.64	26.80	27.36	30.94	26.61	26.82

CLASS T-50

Pipe Size	D	D ₂ D ₄	D ₃	D ₅	D ₆	*D ₇	D ₈	*D ₉
6	6.00	6.91	7.07	7.20	7.65	8.40	7.03	7.16
8	8.00	9.11	9.27	9.40	9.85	10.90	9.23	9.36
10	10.00	11.24	11.40	11.53	11.98	13.30	11.36	11.46
12	12.00	13.44	13.60	13.73	14.18	15.76	13.56	13.70
14	14.00	15.50	15.66	15.82	16.38	18.49	15.63	15.87
15	15.00	16.68	16.84	17.00	17.56	19.82	16.81	17.36
16	16.00	17.74	17.90	18.06	18.62	20.69	17.87	18.22
18	18.00	19.90	20.06	20.22	20.78	23.72	20.03	20.44
20	20.00	22.12	22.28	22.44	23.00	26.20	22.25	22.56
21	21.00	23.28	23.44	23.60	24.16	27.07	23.41	23.84
24	24.00	26.48	26.64	26.80	27.36	31.08	26.61	27.25

CLASS T-60

Pipe Size	D	D ₂ D ₄	D ₃	D ₅	D ₆	*D ₇	D ₈	*D ₉
6	5.85	6.91	7.07	7.20	7.65	8.76	7.03	7.12
8	7.85	9.11	9.27	9.40	9.85	11.32	9.23	9.32
10	10.00	11.66	11.82	11.95	12.40	14.36	11.78	11.85
12	12.00	13.92	14.08	14.21	14.66	17.00	14.04	14.11
14	14.00	16.22	16.38	16.54	17.10	19.80	16.35	16.41
15	15.00	17.28	17.44	17.60	18.16	21.02	17.41	17.66
16	16.00	18.46	18.62	18.78	19.34	22.28	18.59	18.65
18	18.00	20.50	20.66	20.82	21.38	24.79	20.63	20.94
20	20.00	22.83	22.99	23.15	23.71	27.49	22.96	23.26
21	21.00	23.96	24.12	24.28	24.84	28.79	24.09	24.44
24	24.00	27.42	27.58	27.74	28.30	32.47	27.55	27.96

CLASS T-70

Pipe Size	D	D ₂ D ₄	D ₃	D ₅	D ₆	*D ₇	D ₈	*D ₉
6	5.85	6.91	7.07	7.20	7.65	8.76	7.03	7.12
8	7.85	9.11	9.27	9.40	9.85	11.32	9.23	9.32
10	10.00	11.66	11.82	11.95	12.40	14.36	11.78	11.93
12	12.00	13.92	14.08	14.21	14.66	17.13	14.04	14.35
14	14.00	16.22	16.38	16.54	17.10	20.26	16.35	16.59
15	15.00	17.28	17.44	17.60	18.16	21.52	17.41	17.77
16	16.00	18.46	18.62	18.78	19.34	22.54	18.59	19.09
18	18.00	20.94	21.10	21.26	21.82	26.42	21.07	21.48
20	20.00	23.28	23.44	23.60	24.16	29.20	23.41	23.54
21	21.00	24.38	24.54	24.70	25.26	30.03	24.51	25.10
24	24.00	27.96	28.12	28.28	28.84	34.76	28.09	28.22

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CLASS T-80

Pipe Size	D	D ₂ D ₄	D ₃	D ₅	D ₆	*D ₇	D ₈	*D ₉
6	5.70	6.91	7.07	7.20	7.65	9.35	7.03	7.36
8	7.60	9.11	9.27	9.40	9.85	12.00	9.23	9.46
10	9.60	11.66	11.82	11.95	12.40	15.15	11.78	11.88
12	11.44	13.92	14.08	14.21	14.66	17.90	14.04	14.11
14	13.60	16.22	16.38	16.54	17.10	20.50	16.35	16.50
15	15.00	17.99	18.15	18.31	18.87	22.46	18.12	18.43
16	15.50	18.46	18.62	18.78	19.34	23.20	18.59	18.95
18	18.00	20.94	21.10	21.26	21.82	27.10	21.07	21.92
20	20.00	23.28	23.44	23.60	24.16	29.94	23.41	24.35
21	21.00	24.38	24.54	24.70	25.26	30.81	24.51	25.60
24	24.00	27.96	28.12	28.28	28.84	35.64	28.09	29.22

CLASS T-90

Pipe Size	D	D ₂ D ₄	D ₃	D ₅	D ₆	*D ₇	D ₈	*D ₉
6	5.70	6.91	7.07	7.20	7.65	9.35	7.03	7.36
8	7.60	9.11	9.27	9.40	9.85	12.00	9.23	9.50
10	9.60	11.66	11.82	11.95	12.40	15.15	11.78	12.34
12	11.44	13.92	14.08	14.21	14.66	17.90	14.04	14.52
14	13.60	16.22	16.38	16.54	17.10	21.06	16.35	16.92
15	15.00	17.99	18.15	18.31	18.87	23.01	18.12	18.68
16	15.50	18.46	18.62	18.78	19.34	23.47	18.59	19.52
18	18.00	22.18	22.34	22.50	23.06	28.29	22.31	22.60
20	20.00	24.66	24.82	24.98	25.54	31.41	24.79	25.16
21	21.00	25.84	26.00	26.16	26.72	33.13	25.97	26.36
24	24.00	29.62	29.78	29.94	30.50	37.65	29.75	30.16

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APPENDIX

TABLE I
SIDE THRUST ON CURVES

Outward pressure exists on all deflections from a straight line. Good soil, properly tamped, is sufficient to hold side thrust—unless soil conditions are unstable. Therefore, some anchorage must be provided on each side of the coupling. Do not thrust block the coupling.

SIDE THRUST PER 100 LBS./SQ. IN.
PRESSURE PER DEGREE OF DEFLECTION

Pipe Size—Inches	Side Thrust—Pounds
4	35
6	72
8	122
10	197
12	278
14	377
16	496
18	665
20	790
24	1150

Note: Multiply thrust by degree of deflection to obtain total side thrust.

TABLE II

VOLUME* OF WATER CONTAINED IN PIPES

Inside Diameter	Gallons Per Linear Foot of Pipe
4"	0.65
6"	1.47
8"	2.61
10"	4.06
12"	5.87
14"	8.00
16"	10.5
18"	13.2
20"	16.3
24"	23.0

* Volume = $(3.14159) (\text{Radius})^2 \text{ Length}$; 1 gallon = 231 cubic inches; 1 cubic foot = 7.4805 gallons = 1,728 cubic inches.

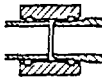
TABLE III
FOR CONVERTING FEET HEAD OF WATER
INTO PRESSURE PER SQUARE INCH

Feet Head	Pounds Per Sq. Inch	Feet Head	Pounds Per Sq. Inch	Feet Head	Pounds Per Sq. Inch	Feet Head	Pounds Per Sq. Inch
1	.43	20	8.66	75	32.48	160	69.29
2	.87	25	10.83	80	34.65	170	73.63
3	1.30	30	12.99	85	36.81	180	77.96
4	1.73	35	15.16	90	38.98	190	82.29
5	2.17	40	17.32	95	41.14	200	86.62
6	2.60	45	19.40	100	43.31	225	97.45
7	3.03	50	21.65	110	47.64	250	108.27
8	3.40	55	23.82	120	51.97	275	119.10
9	3.90	60	25.99	130	56.30	300	129.93
10	4.33	65	28.15	140	60.63	325	140.75
15	6.50	70	30.32	150	64.96	350	151.58

TABLE IV
MINIMUM SIZE CASING REQUIRED WITH PIPE
(In Inches)

PIPE SIZE	CASING SIZE (Inside Diameter)
4	10
6	12
8	16
10	18
12	20
14	24
16	26
18	32
20	35
24	40

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HOW TO CONNECT CAPCO® PIPE TO								
CAPCO	Simplex	Class "D" Poured	Mech. Joint	Cast Iron Fittings for A/C Cl. 100	Cast Iron Fittings for A/C Cl. 150/200	Cast Iron Ductile Iron & C-900 P.E.	Steel or SDR PVC 160-200	
								
4"	Class 100	Direct	PAD	No	No	No	No	No
	150	"	MOA	MOA	No	Direct	Direct	Reg. A/C coupl. w/CAPCO trans Gasket
	200	No	"	"	No	"	"	
6"	Class 100	No	MOA	MOA	Direct	Direct	No	No
	150	Direct	"	"	"	"	Direct	Reg. A/C coupl. w/CAPCO trans Gasket
	200	No	"	"	"	"	"	
8"	Class 100	No	PAD	PAD	"	Direct	No	No
	150	Direct	MOA	"	"	"	Direct	w/CAPCO trans. Reg. A/C coupl. Gasket
	200	No	MOA	PAD	"	"	"	
10"	Class 100	Direct	PAD	PAD	"	Class Adapt.	No	No
	150	"	"	"	Class Adapt.	Direct	Coupling Adapt.	Coupling Adapt.
	200	No	"	"	"	"	"	"

12"	Class 100	Direct	PAD	PAD	Direct	Class Adapt.	No	No
	150	"	"	"	Class Adapt.	Direct	Coupling Adapt.	Coupling Adapt.
	200	No	"	"	"	"	"	"
14"	Class 100	No	PAD	PAD	Direct	Class Adapt.	No	
	150	Direct	"	"	Class Adapt.	Direct		
	200	No	"	"	"	"		
16"	Class 100	No	PAD	PAD	Direct	Class Adapt.	No	
	150	Direct	"	"	Class Adapt.	Direct		
	200	No	"	"	"	"		
18"	Class 100	Direct	PAD	PAD	Direct	Class Adapt.	No	
	150	No	"	"	No	Direct		
20"	Class 100	Direct	PAD	PAD	Direct	Class Adapt.	No	
	150	No	"	"	No	Direct		
24"	Class 100	Direct	PAD	PAD	Direct	Class Adapt.	No	
	150	No	"	"	No	Direct		

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NOTE: PAD's Beveled on CI side for Butterfly Valves.

TABLE V
4' UNITS

Pipe Size	Pieces Per Unit	Weight Per Unit
4"	42	3767
6"	25	3868
8"	16	3910
10"	9	3510
12"	9	4773
8' UNITS		
14"	10	6994
16"	8	7041
18"	6	7082
20"	6	8642
24"	3	6150

TABLE VII
APPROXIMATE WEIGHTS CLASS 150 COUPLINGS

PIPE SIZE	POUNDS
4"	8
6"	12
8"	17
10"	26
12"	40
14"	53
16"	77
18"	105
20"	120
24"	158

TABLE VI
ONE CAN (1 qt.) OF PIPE LUBRICANT WILL INSTALL:

Pipe Size	Lineal Feet	Pieces	Pipe Size	Lineal Feet	Pieces
4"	598	46	14"	130	10
6"	402	31	16"	104	8
8"	324	25	18"	86	7
10"	234	18	20"	82	6
12"	194	15	24"	68	5
1 Gallon					
4"	2392	184	14"	520	40
6"	1608	124	16"	416	32
8"	1296	100	18"	344	26
10"	936	72	20"	328	25
12"	776	60	24"	272	20

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TABLE VIII
A/C TO MJ WEIGHTS

PIPE SIZE	POUNDS
8"	30
10"	50
12"	70
14"	48
16"	95
18"	110
20"	140
24"	188

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HYDROSTATIC TESTING

It is advantageous to test a pipe line in short sections with couplings and fittings exposed.

Leakage tests should be made with normal constant working pressure. The engineer will usually specify the leakage allowance and describe the methods for testing. A straight-sided vessel (55-gallon drum) that can be calibrated to gallons per inch of depth can be used as a source of water for testing. After the test limit is up, the amount of water pumped from the drum can be measured and checked with the specified leakage allowance. A meter, which has been checked for accuracy, can also be used.

If either of the above tests fail, the following check points may be helpful in locating the leak:

1. Hydrant valve held open by a piece of rag, wood or some other foreign matter. When the valve is held slightly open, line pressure will be relieved through the hydrant drain.
2. Dirt or foreign material under the coupling gasket.
3. Pipe not sufficiently covered in trench.
4. Fittings (curves and tees), as well as valves, in test section not sufficiently blocked.
5. Corporation cocks not tightly closed.
6. Air in line (no relief valve).
7. Leakage through valve at end of test section.
8. Valve leaking past gate.
9. Packing on valves and wet barrel hydrants leaking.
10. Test pump leaking. Check-valve as well as gate-valve.
11. Insufficient saturation time (a minimum of 24 hrs.).
12. Ruptured pipe—cracked, blown out.

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TABLE IX
STANDARD SIZES AND CLASSES
STANDARD PIPE LENGTH—13 FEET

CLASS 100

Nominal Pipe Size Inches	Inside Dia. Inches	Machined Outside Dia. Inches	Approx. Wt. Per Lin. Ft. Pipe & Coupling	Feet Per Ton
4	4.00	4.64	6.2	323
6	6.00	6.91	10.4	192
8	8.00	9.11	16.2	123
10	10.00	11.24	22.3	90
12	12.00	13.44	29.2	68
14	13.59	15.07	36.9	54
16	15.50	17.15	50.0	40
18	18.00	19.90	67.7	30
20	20.00	22.12	81.9	24
24	24.00	26.48	113.5	18

CLASS 150

Nominal Pipe Size Inches	Inside Dia. Inches	Machined Outside Dia. Inches	Approx. Wt. Per Lin. Ft. Pipe & Coupling	Feet Per Ton
4	4.00	4.81	6.9	290
6	5.85	6.91	11.9	168
8	7.85	9.11	18.8	106
10	10.00	11.66	30.0	67
12	12.00	13.92	40.8	49
14	14.00	16.22	53.8	37
16	16.00	18.46	67.7	30
18	18.00	20.94	90.8	23
20	20.00	23.28	110.8	18
24	24.00	27.96	157.7	13

CLASS 200

Nominal Pipe Size Inches	Inside Dia. Inches	Machined Outside Dia. Inches	Approx. Wt. Per Lin. Ft. Pipe & Coupling	Feet Per Ton
4	4.00	4.81	8.8	227
6	5.70	6.91	14.6	137
8	7.60	9.11	22.3	90
10	9.63	11.66	34.6	58
12	11.56	13.92	47.7	42
14	13.59	16.22	63.8	31
16	15.50	18.46	84.6	24
18	18.00	22.18	120.2	15
20	20.00	24.66	159.6	13
24	24.00	29.62	228.5	9

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13. Broken couplings.
14. Faulty accessory equipment — valves, fittings, hydrants, saddles, corporation cocks, relief valves.
15. Faulty test gauge.
16. Test pump suction line drawing air.

Occasionally a leak will not show on the surface due to good draining soil under the pipe. Sensitive transistorized leak detectors can be employed to locate a hard-to-find leak.

After all tests are made, all couplings, valves, and fittings left open for inspection should be covered, tamped, and final backfill completed.

WASTE DISPOSAL

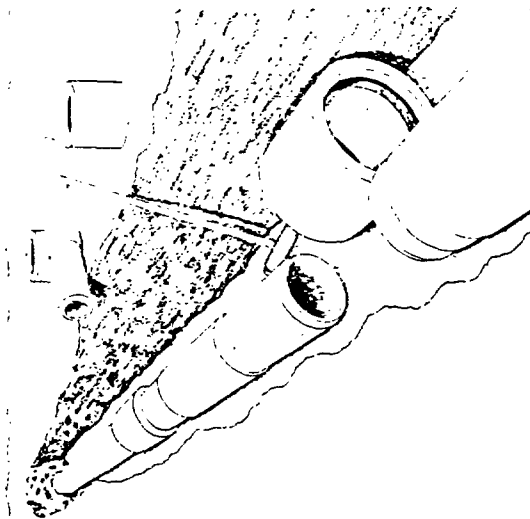
WASTE DISPOSAL: Asbestos-cement chips and cuttings from the field operations described in this booklet should be disposed of in a manner that will not contribute airborne asbestos dust to the atmosphere. Where cutting and machining operations are performed at the construction site, the chips should be placed in the trench and buried with the pipeline.

Where operations are performed at a central location such as a contractor's or distributor's yard on a more or less continuing basis, the chips and cuttings may be collected and mixed wet with cement and made into non-friable forms. These forms may be used in the trench as supports for cast iron fittings and valves, as appropriate.

Otherwise, chips and cuttings should be collected in sealed bags or closed containers impermeable to asbestos dust. *Loose material should never be dry swept.* When vacuum equipment is available, it should be used. Water or other dust suppressants should be applied in those circumstances where sweeping is unavoidable. **DO NOT BLOW WASTE MATERIAL WITH COMPRESSED AIR.**

No visible emissions to the atmosphere may result from the collection, processing, packaging, transporting or deposition of any asbestos-containing material. Wastes should be disposed at a site operated in accordance with the requirements or applicable national, state or local laws.

**TYING-IN A/C PIPE:
CLOSURE SYSTEM**



Through the use of closure lengths and closure couplings, closure distances from one inch to 13 feet can be spanned without any field cutting of A/C pipe. The practice of using these closure lengths and couplings also eliminates possible airborne asbestos fiber exposures resulting from the field cutting of A/C pipe during installation of pipe or repairs.

WARNING: HIGH-SPEED ABRASIVE DISC SAWS ARE PROHIBITED BY OSHA IF NOT EQUIPPED WITH LOCAL EXHAUST VENTILATION AND A HEPA FILTER DUST COLLECTION SYSTEM.

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**TAPPING A/C PIPE:
TAPPED COUPLING**



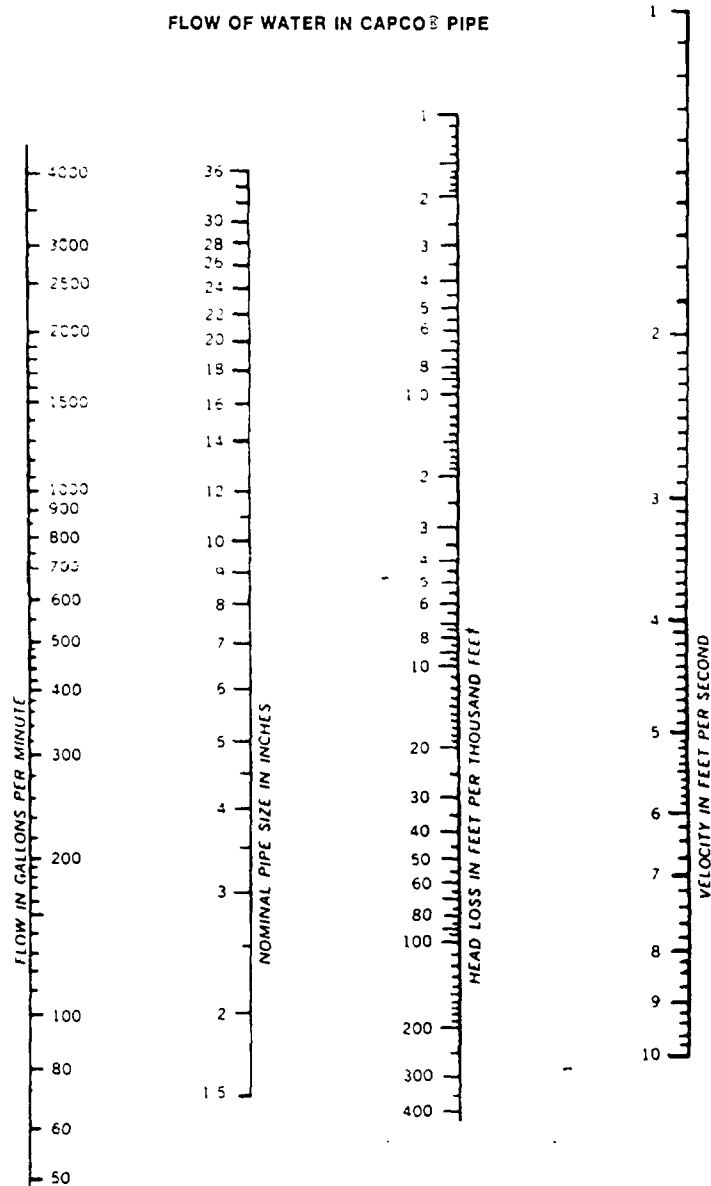
Field tapping of A/C pipe can be eliminated altogether through the use of a factory-installed, threaded brass insert coupling. Besides its factory precision, this "tapped coupling" also eliminates the possibility of A/C cuttings entering the pipeline, which can foul valves, regulators, meters, etc.

In place of a regular coupling, simply install a tapped coupling, mark the location, insert a corporation stop and continue laying A/C pipe.

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NOTES

FLOW OF WATER IN CAPCO PIPE



NOTE: Loss of head values on this chart are for coefficient of flow $C = 140$. These may be converted to head loss for other coefficients by using the following multiplying factors:

- 1.15 for $C = 130$
- 1.34 for $C = 120$
- 1.57 for $C = 110$
- 1.86 for $C = 100$
- 1 ft head = .433 P.S.I.
- 1 P.S.I. = 2.309 ft. head