

NATIONAL STEEL CORPORATION
WEIRTON STEEL COMPANY DIVISION
WEIRTON, WEST VIRGINIA

JANUARY, 1965

STANDARD DESIGN AND CONSTRUCTION SPECIFICATION FOR STEEL MILL PIPING

STANDARD MES-101

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I FABRICATION

- 1.1 All pipe, flanges and fittings shall conform to the latest ASTM standards for the service intended except where heavier wall pipe is specified in the detailed specifications or on the drawings. Sizes 3-1/2", 4-1/2", 5", 7", 9", and 11" shall not be used except where required for connections to equipment. Where standard weight pipe is specified, 10" and smaller shall be Schedule 40. 12" and larger 3/8" wall.
- 1.2 All threaded nipples up to 12" long shall be Schedule 80. All flanges are to be forged steel. Flanged fittings shall be cast steel depending on service, and screwed fittings shall be Malleable Iron or forged steel as required.
- 1.3 Welded fabrication joints shall be used throughout except where it is impractical, then flanged joints of the proper ASTM standard for the service condition may be substituted.
- 1.4 Pipe run size reduction is to be accomplished by the use of reducers only.
- 1.5 All turns or offsets required for changes in the direction of piping shall be affected by the use of fittings where possible, or if required, by bends made from the pipe. However, such bends must have a uniform radius of at least five times the pipe diameter and be free from any appreciable flattening or thinning of the pipe at any point.

- 1.6 Special care is to be taken to be sure that all pipe is positively free of any foreign matter, pipe cuttings or burns. Ream all pipe ends after threading. Lines are not to be left open at any place where any foreign matter might accidentally enter such an open pipe.
- 1.7 Any line connecting to high pressure supply through a reducing valve must be designed to conform to the high pressure standards unless properly protected by relief valves set to the lower rating.
- 1.8 Valve By-Passes
- 1.8.1 All gate valves 6" in size and larger for steam or boiler feed service designed for 300 psi or greater shall be equipped with a standard size by-pass unless otherwise specified.
- 1.8.2 Each such by-pass shall consist of a seamless steel pipe of sufficient length to prevent excessive expansion strains. Each by-pass shall have one steel bolted bonnet, outside screw and yoke, globe valve of equivalent service rating.
- 1.8.3 Pipe, valves, joints, studs etc. for by-passes on valves, shall be of the same type, material etc. and shall be suitable for the same working pressure as specified, for the corresponding size in the line in which they are to be installed. By-pass pipe shall in no case be less than Schedule 80.
- 1.8.4 Any pipe line connected to high pressure supply through a reducing valve must have a by-pass line. Filler pieces should be provided between a flanged reducing valve and the adjacent gate valves. To protect the reducing valve from dirt and scale a self-cleaning strainer equipped with a free blow-down valve should be installed ahead of the reducing valve. Relief valves

I FABRICATION (CONT'D)

should be provided on the low pressure side and the use of the heavier standard valves should be continued through to the last valve ahead of the relief valve.

1.9 All valves shall be provided with suitable flange protectors bolted in place before shipment. Protectors shall also be provided for welding ends on all valves, fittings, and pipe before shipment.

1.10 Welding Fittings

1.10.1 In welded pipe lines short turn bends shall be made by the means of welding fittings "Tube-turn or equal" unless otherwise shown or called for on the drawings.

1.10.2 Pipe bends may be used instead of fittings in certain places where space allows and if the Engineer approves. Grade A rather than Grade B shall be used for close coiling or cold bending.

1.10.3 Welding elbows are to be of the long radius type if possible and shall never have a radius less than that equal to the diameter of the pipe. Tees shall have well rounded branch outlets.

1.10.4 All welding fittings shall be fully as strong as the pipe to which they connect. Fittings shall be made to close tolerances and shall have true round machine beveled ends suitable for welding.

1.10.5 The Contractor shall consider carefully the type of welding fittings used where stress relieving of welds are required, in order that no interference will be experienced with stress relieving apparatus.

1.10.6 Welded branch connections and special welded fabricating fittings shall be carefully fitted and properly reinforced as required by the latest edition of the ASME code for pressure piping. - ASA-B31.1

I FABRICATION (CONT'D)

- 1.18 All parts shown on drawings to be finished, must be machined accurately to dimensions given. All castings or forgings are to be spot faced for heads and nuts of bolts.
- 1.19 The Contractor shall warrant the design, material, and workmanship, of all parts of the equipment that were furnished by the Contractor, to be the best of the respective kinds suitable for the purpose specified herein. If any part or parts of this equipment shall one year from date of initial operation be found to be inadequate or defective as to design, material or workmanship the Contractor shall replace same at the plant site and at no expense to the Purchaser.

2. ERECTION

- 2.1 Pipe supports and hangers are to have means for vertical adjustments and are to be designed to allow for free expansion and contraction of the pipe without causing excessive strain in the pipe or on the supports or anchors. Anchors and guides are to be such that the lines will not move in a direction other than planned in the design.
- 2.2 At the completion of the work all valves shall have packing glands and nuts properly adjusted to prevent leakage.
- 2.3 Supports, drip legs, etc. for the piping shall be located as shown on the drawings. However, the Contractor will be required to furnish any additional supports, drip legs, etc. required by field conditions or as determined by good practice during installation.
- 2.4 Suitable gaskets shall be installed on flanged joints on all lines.
- 2.5 Pipe going to equipment where dry air is required shall be equipped with separators or drip legs and filters complete with blowout.

3. TESTING (CONT'D)

- 3.1.1 The test pressure shall not be more than twice the primary service rate of any valve included in the test.
- 3.1.2 The test pressure shall not be more than one and one half the primary service rating when the pressure is under the seat of a closed globe valve.
- 3.1.3 In all cases the required test pressure shall be maintained a sufficient length of time to enable an inspection to be made of all joints and connections.
- 3.1.4 Any portion of the work failing these tests shall be repaired promptly by the Contractor at no additional cost to the Purchaser. Care should be taken to prevent damage to connected equipment.
- 3.1.5 Refer to the detailed sections of this specification for individual service tests.

4. Steam Piping

0-150 PSI, Maximum Temperature 450°F

4.1 Pipe

- 4.1.1 All sizes seamless carbon steel ASTM Specification A53 Grade "B" or ASTM A106 Grade "B" Schedule 40.
- 4.1.2 2" size and under plain end for screwed or socket weld connections.
- 4.1.3 2 1/2" size and over beveled ends for welded construction.

4.2 Gate Valves

- 4.2.1 2" size and under Crane No. 431 - 150# bronze body solid wedge disc gate valve rising stem, screwed ends.
- 4.2.2 2 1/2" size or larger - Crane #47 XR or equal - cast steel body outside screw and yoke - flanged ends

4. STEAM PIPING (CONT'D)

4.8 Gaskets

1/16" composition asbestos material.

4.9 Testing

Upon completion of pipe erection and prior to being put into service, the system shall be hydrostatically tested as outlined in Section 3 of this Specification.

5. STEAM PIPING

150 to 300 PSI, Maximum Temperature 650°F

5.1 Pipe

5.1.1 All sizes seamless carbon steel ASTM Specification A53 Grade B or A106 Grade B Schedule 80.

5.1.2 2" size or smaller - plain ends for socket weld or screwed construction.

5.1.3 2 1/2" size or larger - beveled ends for welded construction.

5.2 Gate Valves

5.2.1 2" size and smaller Crane #634E 300# bronze body, wedge disc with screwed ends or VOGT - forged steel socket weld - OS & Y #SW12111 through #SW12118 or equal.

5.2.2 2 1/2" size and larger - Crane No. 33 XR or equal. - 300# cast steel body, outside steel and yoke with flanged ends.

5.3 Globe Valves

5.3.1 2" size and smaller Crane #362P - 300# Bronze body, plug type disc with screwed ends or VOGT forged steel, socket - welded ends outside screw and yoke - Model #SW12141 through SW12148 or equal.

5.3.2 2 1/2" and larger - Crane #151XR or equal - 300# cast steel body with flanged ends.

5.4 Check valves

5. STEAM PIPING (CONT'D)

5.4.1 2" size and smaller - Crane #3694X or equal - 600# cast steel body, swing check with screwed ends.

5.4.2 2 1/2" size and larger - Crane #159X or equal - 300# cast steel body, swing check with flanged ends.

5.5 Fittings

5.5.1 2" size and smaller - 3000# forged steel socket weld - ASTM A105 Grade II

5.5.2 2 1/2" size and larger - extra strong butt weld - ASTM A234.

5.5.3 Unions - 3000# forged steel - steel to steel seats with screwed ends. ASTM A105 Grade 2 - Crane #252H or equal.

5.5.4 Branch connections - For branches 3/4" size and smaller from headers 2 1/2" in diameter and larger - weldolets are to be used. Larger branches are to be made with weld saddles. Branches the same size as the headers are to be made with the use of weld fittings.

5.5.5 Couplings - 3000# forged steel socket weld - ASTM A105 - Grade 2

5.6 Flanges - Weld neck or slip-on 300# faced and drilled - 1/16" raised face, forged steel - ASTM A181 - Grade 1.

5.7 Bolts - ASTM A193 Grade B7, Alloy steel bolt studs, threaded full length with 2 hex. nuts ASTM A194 Grade 2, heavy series. Threads to conform to ASA B1.4.

5.8 Gaskets to be of 1/16" composition asbestos materials.

5.9 Testing - Upon completion of pipe erection and prior to being put into service the system shall be hydrostatically tested as outlined in Section 3 of this Specification.

5.10 General Notes

5.10.1 All risers shall be trapped

5.10.2 Traps shall be placed every 250 feet on runs.

5. STEAM PIPING (CONT'D)

5.10.3 All end piping and low points are to be trapped.

5.10.4 All runs to slope 1/16" per foot minimum.

6. STEAM PIPING

301 to 600 PSI, Maximum Temperature 650°F

6.1 Pipe

6.1.1 All sizes seamless carbon steel ASTM Specification A106 Grade B extra strong, Schedule 80.

6.1.2 2" and under plain ends for socket weld construction.

6.1.3 2 1/2" and over - beveled ends for butt weld construction - flanged only where absolutely required.

6.2 Gate Valves

6.2.1 2" size and smaller - Crane #3611XU or equal, 600# cast steel body, wedged disc with bolted bonnet and outside screw and yoke, socket weld ends.

6.2.2 2 1/2" and larger - Crane #76 1/2 XR - 600# cast steel body with butt weld ends or Crane #76XR with flanged ends. Valve to have bolted bonnet and outside screw and yoke.

6.3 Globe Valves

6.3.1 2" size and smaller - Crane #3648XW with union bonnet, or Crane #3652XW with bolted bonnet, 600# forged steel body and socket weld connections.

6.3.2 2 1/2" size and larger - Crane #171 1/2 XR with butt weld ends or Crane #171 XR with flanged ends, 600# cast steel body, bolted ring type bonnet and plug type disc and seat.

6. STEAM PIPING (CONT'D)

6.4 Check Valves

6.4.1 2" size and smaller - Crane #3694X or equal, 600# forged steel body, swing check with bolted cap and screwed ends.

6.4.2 2 1/2" size and larger - Crane #175 1/2 X - 600# cast steel, butt welded swing check or Crane #175X flanged, swing check.

6.5 Fittings

6.5.1 2" size and smaller - 3000# forged steel, socket weld, ASTM A105 Grade 2.

6.5.2 2 1/2" size and larger, extra strong, butt welded - ASTM A234.

6.5.3 Unions

Forged steel ground joint union - 6000# WOG steel to steel seat female ends - Crane #265H or equal.

6.5.4 Branch Connections

1" size and smaller - from headers 2 1/2" in diameter and larger use extra strong ASTM A105 Grade 2 - "Weld-O-Lets" (socket type), Branches : larger than 1" size use tees and reducers.

6.5.5 Couplings - forged steel, socket weld - 3000# WOG

6.6 Flanges - Weld Neck 600# forged steel phonographic finish with raised face ASTM A105 Grade II.

6.7 Bolts - ASTM A193 - Grade B7 - alloy steel bolt studs - threaded full length with 2 hex. nuts ASTM A194 Grade 2 semi-finished heavy series - Threads to conform to ASA B1.4.

6.8 Gaskets - 1/16" composition asbestos material.

6.9 Testing - Upon completion of pipe erection and prior to being put into service the system shall be hydrostatically tested as outlined in Section 3 of this Specification.

6. STEAM PIPING (CONT'D)

6.10 General Notes

- 6.10.1 All risers must be trapped.
- 6.10.2 Traps must be placed every 250 feet on pipe runs.
- 6.10.3 All end piping and low points are to be trapped.
- 6.10.4 All pipe runs to slope 1/16" per foot minimum.

7. STEAM PIPING

Above 600 PSI, and 650°F.

- 7.1 Piping for pressures in excess of 600 PSI and/or 650°F are to be considered on an individual case basis.

8. CONDENSATE

Maximum pressure 300 PSI, Maximum Temperature 450°F.

8.1 Pipe

- 8.1.1 All sizes, seamless carbon steel ASTM A53 Grade B or A106 Grade B, Schedule 80.
- 8.1.2 2" size and smaller - plain end for socket weld or screwed construction.
- 8.1.3 2 1/2" size and larger, beveled ends for butt weld or flanged construction.

8.2 Gate Valves

- 8.2.1 2" size and smaller, Crane #634E - 300# bronze body, wedge disc with screwed ends or VOGT forged steel bolted bonnet - outside screw and yoke. #SW12111 through #SW12118 with socket weld ends.

8.3 Globe Valves

- 8.3.1 2" size and smaller, Crane #382P - 300# bronze body, plug type disc with screwed ends or VOGT forged steel outside screw and yoke #SW12141 through #SW12148 with socket weld ends.

8.4 Check Valves

- 8.4.1 2" size and smaller - Crane #3694X - 600# cast steel body, swing check with screwed ends.

8. CONDENSATE (CONT'D)

8.4.2 2 1/2" size and larger - Crane #159X, 300# cast steel body, swing check with flanged ends.

8.5 Fittings

8.5.1 2" size and smaller - 3000# forged steel - Socket weld ASTM A105 Grade 2 or 300# Malleable Iron banded type screwed.

8.5.2 2 1/2" size and larger, extra strong, butt weld - ASTM A234

8.5.3 Unions - 3000# forged steel with steel to steel seats, ASTM A105 Grade 2 - Crane #252H or equal.

8.5.4 Branch Connections - For branches 3/4" diameter and smaller from headers 2 1/2" diameter and larger - "Weld-O-Lets" are to be used - Larger branches are to be made with weld saddles. For branches the same size as headers use welded fittings.

8.5.5 Couplings - 3000# forged steel socket weld - ASTM A105 Grade 2

8.6 Flanges - Weld Neck or Slip-On 300# faced and drilled, with 1/16" raised face, forged steel ASTM A181 Grade 1.

8.7 Bolting - ASTM A193 - Grade B7 - Alloy steel bolts with two hex nuts ASTM A194 - Grade 2 semi-finished, heavy series. Threads to conform to ASA B1.4.

8.8 Gaskets - 1/16" composition asbestos material.

8.9 Testing - Upon completion of pipe erection and prior to being put into service the system shall be hydrostatically tested as outlined in Section 3 of this Specification.

9. POTABLE WATER - HOT AND COLD

Maximum Pressure 100 PSI, Maximum Temperature 160°F.

9.1 Pipe

9.1.1 Above Ground

9.1.1.1 1" size and smaller - copper water tubing ASTM B44 - Type K - hard drawn

11. FUEL OIL (CONT'D)

11.8 Gaskets - 1/16" thick oil resistant, cork fiber.

11.9 Testing - Upon completion of pipe erection and prior to being put into service the system shall be hydrostatically tested as outlined in Section 3 of this Specification.

12. GEAR DRIVE AND BEARING LUBRICATION OIL SYSTEMS

Maximum Pressure 150 PSI, Maximum Temperature 200°F.

12.1 Pipe -

All pipes shall be standard weight seamless or electric welded steel ASTM A53 or A106 Grade B and must be thoroughly pickled to remove all mill coat, paint, scale and dirt.

12.1.1 2" size and smaller to have plain ends for socket weld or screwed construction.

12.1.2 2 1/2" size and larger to have beveled ends for butt weld construction.

12.2 Gate Valves

12.2.1 2" size and smaller - 150# bronze body with solid wedge disc and rising stem. Screwed ends - Crane #431 or equal.

12.2.2 2" size and larger - 150# cast steel body with wedge disc, outside screw and yoke and bolted bonnet with flanged ends - Crane #47X or equal.

12.3 Globe Valves

12.3.1 2" size and smaller 200# bronze body - plug type disc with screwed ends - Crane #212P or equal.

12.3.2 2 1/2" size and larger - 150# cast steel body bolted bonnet, outside screw and yoke with flanged ends - Crane #143X or equal.

12.4 Check Valves

12.4.1 2" size and smaller 125# bronze body, swing check - Crane #34 or equal.

12. GEAR DRIVE AND BEARING LUBRICATION OIL SYSTEMS (CONT'D)

12.4.2 2" size and larger - 150# cast steel body with bolted cap and flanged ends - Crane #147K or equal.

12.5 Fittings

12.5.1 2" size and smaller 150# Malleable Iron, banded type, screw d, ASTM A197 or 2000# forged steel socket weld ASTM A105 Grade 2.

12.5.2 2 1/2" size and larger - Standard steel butt welding ASTM A374.

12.5.3 Unions - Ground joint type brass to iron seats - 300# Malleable Iron - Walworth #7716 or equal.

12.5.4 Branch Connections - For branch connections 2 pipe sizes or less smaller than the header diameter, from headers 2 1/2" diameter and larger use "Weld-O-Lets" welded into the header. For branches from headers 2" in diameter and smaller or branch lines less than 2 pipe sizes smaller than the header, use fittings.

12.5.5 Couplings - Couplings to be 3000# forged steel - socket weld ASTM A105 Grade 2.

12.6 Flanges -

Weld neck or Slip-On 150# - faced and drilled with 1/16" raised face - forged steel - "Tube Turn" or equal ASTM A181 Grade 1.

12.7 Bolts

ASTM A307 Grade B - Carbon steel square head machine bolts and extra heavy hexagon nuts - Dimension to ASA B18.2. Threads to be ASA B1.1 coarse type - Class 2A for bolts - Class 2B for nuts.

12.8 Gaskets

1/16" composition asbestos oil resistant material.

12.9 Traction

Use as a station of "live" operation prior to being put into service

13. HYDRAULIC OIL SYSTEMS (CONT'D)

diameter and smaller, or branch lines less than 2 pipe sizes smaller than the header, use fittings.

13.7.5 Couplings - 3000# forged steel, socket weld type.

13.8 Flanges

Flanges to be weld neck with rating and facing to match valves and equipment.

13.9 Bolts to be ASTM A193 alloy steel bolts with 2 hexagon nuts of ASTM A194 Grade 2 - semi-finished heavy series, carbon steel. Dimension to ASA B18.2. Threads to conform to ASA B1.4.

13.10 Gaskets - Gaskets to be 1/16" thick "Cranite" or equal. Type to conform with flange or equipment face.

13.11 Testing - Upon completion of pipe erection and prior to being put into service the system shall be hydrostatically tested as outlined in Section 3 of this Specification.

13.12 Descaling - Prior to being put into service the system shall be completely descaled as outlined under the Weirton Steel Standard Specification for descaling of hydraulic and lubricating oil systems.

14. COMPRESSED AIR SYSTEM

Maximum Pressure 150 PSI, Temperature Ambient

14.1 Pipe - All sizes to be standard weight seamless or electric welded ASTM A53 or A106 Grade B.

14.1.1 2" size and smaller to have plain ends for socket weld or screwed construction.

14.1.2 2 1/2" size and larger to have beveled ends for welded construction.

14.2 Gate Valves -

14.2.1 2" size and smaller to be 150# bronze body with wedge disc and rising stem, with screwed ends - Crane #431 or equal.

14. COMPRESSED AIR SYSTEM (CONT'D)

- 14.2.2 2 1/2" size and larger 125# ferrosteel body with wedge disc and outside screw and yoke with bolted bonnet and flanged ends.
Bronze seats and stem - Crane #465 1/2 or equal.

14.3 Globe Valves

- 14.3.1 2" size and smaller 150# bronze body with plug type disc and screwed ends - Crane #14 1/2P or equal.
- 14.3.2 2 1/2" size and larger - 125# Ferrosteel body with yoke bonnet and #6 Granite disc for air service. - flanged ends - Crane #359 or equal.

14.4 Check Valves

- 14.4.1 2" size and smaller to be 200# bronze body swing check with screwed ends - Crane #36 or equal.
- 14.4.2 2 1/2" size and larger 150# cast steel body with bolted cap, swing check with flanged ends - Crane #147X or equal.

14.5 Fittings

- 14.5.1 2" size and smaller 150# Malleable Iron banded type, screwed ASTM A197 or 2000# forged steel socket weld ASTM A105 Grade 2.
- 14.5.2 2 1/2" size and larger - Standard steel - butt welding fittings ASTM A234.
- 14.5.3 Unions - Ground joint type, brass to iron seats 300# Malleable Iron Walworth #7716 or equal.
- 14.5.4 Branch Connections - For branch connections 2 pipe sizes or less, smaller than the header diameter from headers 2 1/2" in diameter and larger use "Weld-O-Lets" welded into the header. For branches from headers 2" in diameter and smaller or branch lines less than 2 pipe sizes smaller than the header, use fittings.
- 14.5.5 Couplings - Couplings to be 3000# forged steel - socket weld ASTM A105 Grade 2.

14. COMPRESSED AIR SYSTEM (CONT'D)

14.6 Flanges

Weld neck or Slip-On 150# faced and drilled with 1/16" raised face, forged steel - Tube Turn or equal. ASTM A181 Grade 1.

14.7 Bolts

ASTM A307 Grade B - Carbon steel square head machine bolts and extra heavy hexagon nuts - Dimension to ASA B18.2 - Threads to be ASA B1.1 coarse type - Class 2A for bolts, Class 2B for nuts.

14.8 Gaskets

1/16" composition asbestos material.

14.9 Testing

Upon completion of pipe erection and prior to being put into service the system shall be air tested at approximately 200 psi gauge and shall show no pressure drop in the shut-off position for a period of not less than 2 hours.

14.10 Separators and filters - Pipe going to equipment where dry air is required shall be equipped with separators or drip legs and filters complete with blow-off valves.

14.11 Air filters, lubricators and regulators - All air piping to cylinders, solenoid operating valves, etc. shall be furnished with an air filter, lubricator, regulator unit as manufactured by the Watts Regulating Company or approved equal.

15. NATURAL, BLAST FURNACE, COKE OVEN AND ANNEALING ATMOSPHERE, GAS

Maximum Pressure 100 PSI.

15.1 Piping

All pipe to be standard weight seamless or electric welded steel
ASTM A53 Grade A.

15. NATURAL, BLAST FURNACE, COKE OVEN AND ANNEALING ATMOSPHERE, GAS (CONT'D)

15.1.1 2" size and smaller to have plain ends for socket weld or screwed construction.

15.1.2 2" size and larger beveled ends for butt weld construction.

15.2 Gate Valves

15.2.1 Valves or valve trim shall not include any form of brass or copper without written approval of the Engineer.

15.2.2 2" size and smaller to be lubricated plug valve semi-steel body with screwed gland, regular pattern with screwed ends. Powell Figure #2202 or equal.

15.2.3 2 1/2" to 4" to be lubricated plug valve semi-steel body with screwed gland, regular pattern, flanged ends. Powell Figure #2203 or equal.

15.2.4 4" through 12" inclusive to be lubricated plug valve semi-steel body with bolted gland, regular pattern Powell Figure #2207 or #2207G or equal.

15.2.5 14" through 36" to be eccentric action plug valve with semi-steel body NI-resist plug - Stainless bushings with Hycar resilient seal in plug - DeZurik Figure #426 or equal.

Valve to be drilled for lubrication fitting - 150# ASA flanged connections.

15.3 Globe Valves

15.3.1 2" size and smaller to be 150# all iron body and seat with screwed ends Crane #355 1/2 or equal.

15.3.2 2 1/2" size and larger 125# Ferrosteeel body iron trim with flanged ends - Crane #351 1/4 or equal.

15.4 Check Valves

15.4.1 2" size and smaller - 1000# WOG Malleable iron body, swing check with screwed ends. Crane #346 1/2 or equal.

15. NATURAL, BLAST FURNACE, COKE OVEN AND ANNEALING ATMOSPHERE, GAS (CONT'D) ✓

15.4.2 2 1/2" size and larger 125# Ferrosteeel body, swing check -
all iron construction with flanged ends - Crane #373 1/2 or equal.

15.5 Fittings

15.5.1 2" size and smaller 300# ASTM A197 Malleable iron, banded type,
screwed or 2000# forged steel socket weld ASTM A105 Grade 2.

15.5.2 2 1/2" size and larger standard steel butt welding type ASTM
A234.

15.5.3 Unions - 3000# forged steel, steel to steel seats - ASTM A105
Grade 2 - Crane #252H or equal.

15.5.4 Branch connections - For branch lines 3/4" and smaller from
headers 2 1/2" in diameter and larger use "Weld-O-Lets" welded
into the header. For branches from headers 2" in diameter
and smaller use fittings.

15.5.5 Couplings - 2000# forged steel - ASTM A105 Grade 2.

15.6 Flanges - 150# Weld Neck or Slip-On, full face, forged steel - Tube Turn
or equal ASTM A181 Grade 1.

15.7 Bolts -

ASTM A307 Grade B - carbon steel - square head machine bolts and extra
heavy hexagon nuts. Threads to be ASA B1.1 coarse type - Class 2A for
bolts, Class 2B for nuts.

15.8 Gaskets

Gaskets to be 1/16" composition asbestos material.

15.9 Testing

Upon completion of pipe erection and prior to being put into service,
the system shall be tested at approximately 10# gauge or at operating
pressure whichever is higher and shall show no pressure drop in the
shut-off position over a period of not less than 2 hours.

18. AMMONIA PIPING SYSTEM (CONT'D)

the event of leakage. The spray system shall be controlled by an automatic or manually operated valve located as near as practical to quick access from the equipment.

18.10 Coding

All vapor and liquid lines inside and outside of buildings shall be properly coded and tagged as "Ammonia Lines".

18.11 Insulation

Ammonia lines should be insulated as outlined in the standard specifications for insulation of refrigerated pipe lines.

19. RAW ACID PIPING

66° Baume' (93.19% H₂SO₄)

19.1 Pipe

All pipe size to be extra heavy - Schedule 80 - Seamless carbon steel pipe ASTM Specification A106 Grade A.

19.2 Gate Valves - All valves to be 150# - Stainless steel body with solid wedge disc, outside screw and yoke, bolted bonnet with flanged ends. Valves to have teflon packing Powell Figure #2453SG or equal.

19.3 Fittings

19.3.1 2" size and smaller to be 3000# forged steel, socket weld or screwed. ASA B16.9.

19.3.2 2 1/2" size and larger to be extra strong butt welding type "Tube Turn" or equal - ASA B16.9 -ASTM A234 Grade A.

19.3.3 Unions - 3000# WOG forged steel - Ground joint unions with steel to steel seats - Crane #252H or equal.

19.3.4 Branch Connections - All branch connections are to be made by means of fittings and proper reducers.

19.4 Flanges

19. RAW ACID PIPING

All flanges to be 300# forged steel Weld Neck - ASA B16.9 "Tube Turn" or equal.

19.5 Bolts

Bolts to be continuous threaded stud bolts ASTM Specification A193.

Threads to be standard ASA B1.4. Studs to be complete with 2 semi-finished hexagon nuts, ASTM Specification A194 Grade 1.

19.6 Gaskets

Gaskets to be 1/16" teflon ring type or 1/16" thick 97% pure, long fibre blue asbestos, full faced, John Manville or equal.

20. INDUSTRIAL SLUDGE AND WASTE PIPING

20.1 Piping

All piping to be standard weight, Schedule 40, seamless or electric weld ASTM A53 or A106 Grade B, or Cast Iron Class 150 ASA 21.6. Bell and Plain end, centrifugally cast with the bell modified to accommodate a single rubber gasket for the joint seal. To be James B Clow and Sons. Where required the pipe shall be cast iron mechanical joint type, C-N, centrifugally cast Class 150 ASA 21.6 - James B Clow and Sons or equal.

20.2 Gate Valves

To be 125# iron body with flanged ends - Crane #465 1/2 or equal.

20.3 Check Valves

To be 125# iron body, swing check with flanged ends Crane #373 or equal.

20.4 Fittings

20.4.1 2" size and smaller to be 150# Malleable iron screwed or 2000# forged steel socket weld.

20.4.2 2 1/2" size and larger to be forged steel, standard weight, welding fittings, or 150# cast steel flanged or CW mechanical joint.

25.10 Gaskets

Gaskets to be 1/16" thick Granite or equal. Type to conform with flange or equipment face.

25.11 Testing

Upon completion of pipe erection and prior to being put into service, the system shall be hydrostatically tested as outlined in Section 3 of this Specification.

25.12 Descaling

Prior to being put into service, the system shall be completely descaled as outlined under the Weirton Steel Standard Specification for descaling of hydraulic and lubricating oil systems.

26. STRIP LUBRICATION SYSTEM (PAIM OIL)

26.1 Pipe

26.1.1 All sizes to be type 304, seamless stainless steel, Schedule 40.

26.1.2 2" size and smaller to have plain ends for screwed or socket weld construction.

26.1.3 2-1/2" size and larger to have bevelled ends for butt weld construction.

26.1.4 All pipe lines to be steam traced with 1/2" carbon steel ASTM A53 Grade A pipe.

26.2 Gate Valves

26.2.1 2" size and smaller, 150# 18-8 stainless steel body with solid wedge disc, inside screw, rising stem and screwed ends. Powell Figure 1832 or equal.

26.2.2 2-1/2" size and larger, 150# stainless steel body with solid wedge disc, bolted flanged yoke bonnet, outside screw and stem, with flanged ends. Powell Figure 2453SG or 2456SG or equal.

26.7 Bolts

ASTM A193, Grade B7 alloy steel bolt studs, threaded full-length with two Hex nuts ASTM A194 Grade 2, heavy series. Threads to conform to ASA B1.4.

26.8 Gaskets

1/16" composition asbestos material.

26.9 Testing

Upon completion of pipe erection and prior to being put into service, this system shall be hydrostatically tested as outlined in Section 3 of this Specification.

27. PLUMBING SECTION

150# maximum pressure - 250° F.

27.1 Pipe - Supply Lines

27.1.1 2" and smaller to be ASTM B44 seamless copper, Type "K", hard-drawn pipe with solder joints - Solder to be 60/40 60% lead - 40% tin.

27.1.2 2-1/2" and larger to be ASTM A53, Grade "B" electric weld pipe - Schedule 40 (Standard) with bevelled ends.

27.2 Fittings

27.2.1 2" and smaller fittings to be solder joint wrought copper dimensioned to ASA B16.22.

27.2.2 2-1/2" sizes and larger to be 150# malleable iron or Schedule 40 (Standard) forged steel fittings.

27.2.3 Unions to be "NIBCO, INC." Type 633, or approved equal, except where copper piping connects to steel; dielectric unions shall then be used and a threaded steel pipe nipple.

27.2.4 Adaptors to be "NIBCO, INC." type to suit application.

27.2.5 Branch connections where copper branches occur in steel headers, use a flanged tee together with reducing flange, a threaded steel nipple and a dielectric union.

27.2.6 Where both branches and headers are steel, use welding fittings.

27.3 Bolting

- 27.3.1 ASTM A307, Grade B, carbon steel square head machine bolts, and extra heavy hexagon nuts, dimensioned to ASA B18.2. Threads shall be ASA B1.1 coarse type; Class 2A for bolts and Class 2B for nuts.

27.4 Flanges

- 27.4.1 All flanged connections shall be 150# ASA weld neck or slip-on flanges with 1/16" raised face. ASTM - A181 - GR 1.

27.5 Gate Valves

- 27.5.1 2" and smaller shall be 150# copper to copper heavy pattern gate valve, rising stem single disc - Solder joints, Chase #429 (or equal).
- 27.5.2 2-1/2" and larger shall be 150# Ferrosteeel wedge gate valves, O.S. and Y. bronze trimmed flanged ends. Crane #465-1/2" or equal.

27.6 Globe Valves

- 27.6.1 2" and smaller shall be 150# copper to copper globe valve - Solder joints - Chase #431 (or equal).
- 27.6.2 2-1/2" and larger shall be 150# Ferrosteeel body bronze trimmed Globe valve - O. S. and Y. - Flanged ends Crane #351 (or equal).

27.7 Check Valves

- 27.7.1 2" and smaller shall be 150# copper to copper swing check valve, brass seat and disc Solder Joints - Chase #426 (or equal).
- 27.7.2 2-1/2" and larger to be 150# cast steel flanged check valve with bolted bonnet. Crane #147 (or equal).

27.8 Gaskets

- 27.8.1 All gaskets shall be 1/16" composition asbestos gaskets for flanged joints.

28. PIPING INSULATION

GENERAL

All pipes shall be insulated with sectional or segmental molded materials of the type and thickness listed in Section 28.2 Table No. 1, Class A to G inclusive.

28.1 INSULATION DESIGN

- 28.1.1 The shapes and dimensions of the molded insulation shall be such as to require a minimum of cutting and fitting during installation.
- 28.1.2 The type and thickness of the insulation shall be determined by Section 28.2 Table No. 1 and the pertinent sections following Section 28.2 Table No. 1.
- 28.1.3 Before any insulation is applied a pressure test shall be made on all piping.
- 28.1.4 Where two layer pipe insulation construction is specified, the first layer of insulation shall be applied while the pipe is still cold, but before the second layer is applied and before flange or fitting insulation is put in place there should be steam in the pipe lines.
- 28.1.5 Single thickness insulation shall be applied with the pipe lines cold but no attempt shall be made to finish the work until heat has been supplied to the piping.

28.2 TABLE NO. 1

Thickness in inches for type of insulation.



TEMPERATURE OF PIPE - DEGREES FAHRENHEIT

Nominal Pipe Size	Class A	Class B	Class C	Class D	Class E		Class F		Class G	
	Hot Water 85% Mag.	212 to 266 85% Mag.	267 to 387 85% Mag.	387 to 600 85% Mag.	600 to 699 Inner Layer Hi. Temp.	Outer Layer 85% Mag.	700 to 799 Inner Layer Hi. Temp.	Outer Layer 85% Mag.	800 to 1000 Inner Layer Hi. Temp.	Outer Layer 85% Mag.
Up to 1½"	1"	1"	1"	1½"	2"	None	2"	None	2½"	None
2"	1½"	1½"	1½"	2"	1½"	1½"	1½"	1½"	1½"	1½"
2½"	1½"	1½"	1½"	2"	1½"	1½"	1½"	1½"	2"	1½"
3"	1½"	1½"	1½"	2"	1½"	1½"	1½"	1½"	2"	1½"
4"	1½"	1½"	1½"	2"	1½"	1½"	1½"	2"	2"	1½"
6"	1½"	1½"	1½"	2"Db1. Std.	1½"	1½"	1½"	2"	2"	2"
8"	1½"	1½"	1½"	2"Db1. Std.	1½"	1½"	1½"	2"	2"	2"
10"	1½"	1½"	1½"	2"Db1. Std.	1½"	1½"	1½"	2"	2"	2"
12" to 18"					1½"	2"	1½"	2½"	2"	2"
12" to 30"	2"	2"	2"	3"Db1. Layer						
12" to 30" Segmental Blocks	2"	2"	2"	3"Db1. Layer						

All steam lines insulated under this section shall be finished with a weatherproof jacket unless otherwise specified.

28.3 CLASS G

28.3.1 High Pressure and superheated steam

850# Working Steam Pressure

850°F Working Steam Temperature

28.4 COMBINATION INSULATION - SECTION 28.2 TABLE NO. 1

- 28.4.1 Inner layer shall be high temperature diatomaceous silica.
- 28.4.2 Outer layer shall be 85% magnesia
- 28.4.3 All end and side joints shall be staggered, properly pointed, and tightly fitted in the inner layer.
- 28.4.4 All end and side joints shall be staggered properly pointed and tightly fitted in the outer layer with respect to the inner layer for double layer construction.
- 28.4.5 Both layers, each inner and outer shall be securely wired with 14 gauge steel tie wire.
- 28.4.6 Three loops of tie wire, per section, each layer shall be used on piping up to 6".
- 28.4.7 Four loops of tie wire, per section, for each layer shall be used on piping 6" and over.
- 28.4.8 Tie wire shall be drawn tight enough to be imbedded in each inner and outer layer of the sections, flush with the surface of insulation, and the ends of the wires twisted firmly, bent over and beat into the surface of the insulation.
- 28.4.9 All segmental insulation shall be firmly fitted into place and all joints pointed with 85% magnesia cement.
- 28.4.10 All tie wires also to be completely covered with cement.

28.5 WEATHERPROOF JACKET

- 28.5.1 A weatherproof jacket, uncoated 32# saturated asbestos felt paper shall cover the insulation.
- 28.5.2 Allow 3" of lap at all ends and sides.
- 28.5.3 On horizontal lines the longitudinal lap shall be located at the side of the pipe with the lap turned down.

28.5 WEATHERPROOF JACKET (CONT'D)

- 28.5.4 On vertical lines the asbestos felt paper shall be lapped downward to shed water.
- 28.5.5 All end and side laps shall be secured in place with .091 aluminum tie wire on 6" maximum centers, with the ends of the wires firmly twisted and bent over.
- 28.5.6 Galvanized butter-tub staples shall be applied between each loop of tie wire for further securing the side laps.
- 28.5.7 Where adverse conditions prevail and insulated lines are subject to mechanical damage and/or over railroad crossings, the weather-proof jacket shall be omitted and the insulation finished with a 26 or 28 gauge galvanized steel sheet metal jacket.
- 28.5.8 The sheet metal shall be cut from flat galvanized steel and rolled into 3 foot long cylinders to a diameter a little under the diameter of the finished insulation to provide a snug fit around the pipe.
- 28.5.9 The "stretch out" or width of the galvanized sheet metal in the cylinder shall be sufficient to give a side lap of not less than 3 inches.
- 28.5.10 The end laps shall be equal amounts.
- 28.5.11 The galvanized sheet metal jackets shall be banded on approximately 9" centers and secured firmly with cadmium stove bolts.

28.6 FITTINGS AND FLANGES

- 28.6.1 All flanges, fittings and valves shall be insulated with the same material as used on the adjacent piping.
- 28.6.2 Pipe 4" and larger, the bodies of the flanges, fittings and valves, the entire surface up to the bonnets of the valves and flanges of

all piping shall be insulated with block insulation 1/2" thinner than the insulation of the adjacent piping.

- 28.6.3 Where double layer construction is used, the 1/2" thick reduction in thickness of the blocks shall be in the outer layer.
- 28.6.4 The insulation blocks shall be securely wired in place and a finish of asbestos cement shall then be applied over the outer surface of the blocks to make the total thickness of the insulation equal to that of the adjacent piping.
- 28.6.5 Piping insulation shall be stopped short of all flanges and beveled off to permit the removal of flange bolts where necessary.
- 28.6.6 On piping 3 1/2" and smaller in place of the cement and blocks, the entire insulation shall consist of high temperature cement on all fittings and flanges, finished with #302 asbestos cement.
- 28.6.7 For high temperature steam piping at 850°F provide removable type flange insulation covers so that covering can be removed from the flanges with a minimum of destruction to materials.
- 28.6.8 The removable type flange insulation covers shall be made of frames. Each frame shall be made of hardware wire mesh in two half-sections to which the blocks or sectional insulation are attached.
- 28.6.9 The inside and outside areas of the half-sections of flange insulation removable covers shall be finished with 85% magnesia cement.
- 28.6.10 The half-sections of flange insulation removable covers, shall extend 2" over the ends of the adjacent pipe insulation, on each side of the flange.
- 28.6.11 All ends of pipe insulation shall be stopped short and beveled as previously described.

28.6 WEATHERPROOF JACKET (CONT'D)

28.6.12 The two half-sections of flange insulation removable covers shall be held in place by bolting together in diametrically opposite positions or with galvanized steel sheet metal bands.

28.6.13 A sketch showing the type of removable flange insulation covers shall be furnished to Weirton Steel Company Engineers for approval.

28.7 CLASS D

28.7.1 900# Continuous Blowdown
225# Steam Working Pressure
500 - 550°F Steam Temperature

28.7.2 Pipe insulation shall be as listed per Section 28.2 Table No. 1
85% magnesia for respective pipe sizes and thickness of insulation.

28.7.3 In double layer construction, Section 28.4 shall be applicable except all of the insulation shall be 85% magnesia.

28.7.4 Fittings and flanges shall be same as Section 28.6..

28.8 CLASS B

28.8.1 1000# - 250°F Feedwater Piping
5# - 212°F Feedwater Piping
5# - 220°F to 250°F Exhaust Steam Piping

28.8.2 Pipe insulation shall be as listed per Section 28.2 Table No. 1
85% magnesia for respective pipe sizes and insulation thickness.

28.8.3 Fittings and flanges shall be same as Section 28.6

28.8.4 Where sectional insulations are used, a standard weight canvas jacket firmly and neatly pasted on shall be applied over the outer surface of the insulation.

28.8 CLASS B (CONT'D)

- 28.8.5 In the larger pipe sizes where segmental insulation is required, after pointing up the joints between the blocks of half sections of the outer layer with #302 asbestos cement or equal, a standard weight canvas jacket shall be applied firmly and neatly in place for finish.
- 28.8.6 The block insulation on the body of 4" or larger fittings, valves, and all flanges shall be insulated with permanent type of insulation securely wired in place with tie wire of the same size used to the adjacent pipe insulation,
- 28.8.7 On flanges the insulation shall extend 2" over the adjacent pipe insulation on each side of the flange. The space in between shall be filled with insulation and thoroughly sealed with asbestos cement of a hard finish type. The hard type finish cement shall be applied in two coats to bring the total thickness of the insulation up to that of the adjacent pipe insulation. The first coat of cement shall be allowed to thoroughly dry before the second coat is applied, and the second coat shall be trowelled to a smooth hard finish. Over the cement finish shall be applied a standard weight canvas jacket firmly and neatly pasted on.
- 28.8.8 Where insulated piping is carried in between buildings or exposed to weather, the canvas jacket shall be eliminated and a weather-proof jacket shall be substituted same as per Section 28.5.

28.9 INSULATION OF PIPING IN BENDS

- 28.9.1 All insulation joints of piping in bends shall be closed with #302 asbestos cement or equal. The finish coat of asbestos cement shall not be less than 1/4" thick applied over the entire outside

28.9 INSULATION OF PIPING IN BENDS (CONT'D)

surface of the insulation and finished smoothly before applying the canvas jacket.

28.10 EQUIPMENT INSULATION

28.10.1 Item #1 - Flash Tank 393°F to 525°F

Item #2 - Steam Purifier 500°F

Heat Exchangers

Item #3 - Feedwater Heater 278°F to 400°F

Item #4 - Rm. Water Heater 100°F to 278°F

Item #5 - Deaerators 220°F

28.10.2 Equipment shall be insulated with 85% magnesia blocks. Blocks shall be applied in staggered joint construction securely wired or banded on approximately 9" centers. Blocks shall be closely fitted in place and all joints pointed with 85% magnesia cement. When equipment is insulated cold or before being put into service, allowances shall be made for expansion to prevent excessive strain on the wires or bands securing the blocks.

28.10.3 For insulating the flash tank, purifier and the heat exchanger handling treated feedwater a 2" thick 85% magnesia block shall be applied to the shells of the equipment. The blocks shall be securely wired in place with 1/4 gauge steel tie wire. A 1" hexagonal hardware steel wire netting over which shall be applied a 1/2" thickness of #302 hard finish asbestos cement.

28.10.4 The cement shall be applied in two layers. The first layer shall consist entirely of asbestos cement. The second layer, a hard smooth finish, shall consist of four parts of asbestos and one part of Portland cement. A final finish over the outside surface of the cement shall be a standard weight canvas jacket neatly pasted on.

28.10 EQUIPMENT INSULATION (CONT'D)

- 28.10.5 For insulating the raw water heater and the deaerators the insulation shall be as specified for the flash tank, etc. except that 1 1/2" thick 85% magnesia blocks shall be used instead of the 2" thick as specified.
- 28.10.6 Equipment located outside of buildings and exposed to weather, the insulating blocks shall be 1/2" thicker than above specified. The cement finish shall be applied in two layers. The first layer shall be asbestos cement. The second layer shall be a final finish of 1/4" thick Johns-Manville Insulkote or equal.

28.11 OIL, TAR, AND BENZOL PIPING INSULATION

- 28.11.1 Steam traced, companion or two lines parallel to each other which are too close to be insulated separately shall be first wrapped with 1/4" hardware steel wire mesh and securely wired in place.
- 28.11.2 The inner layer shall be two layers of 1/4" thick corrugated asbestos paper. Each layer or sheet shall be tied at ends and center with #14 gauge steel tie wire.
- 28.11.3 The outer layer shall be two layers of 1" thick hairfelt, total 2", 10 to 12# density laid, and wire tied with #14 gauge steel wire 6" on centers.
- 28.11.4 All pipe flanges, fittings, and valves shall be insulated with the same materials as used on the adjacent piping.
- 28.11.5 Outer jacket shall be weatherproofed same as per Section 28.5.

28.12 COLD WATER PIPING INSULATION TO PREVENT SWEATING

- 28.12.1 The inner layer for pipe 2 1/2" and smaller shall be two layers of 1" thick hairfelt insulation, total 2", 10 to 12# density laid and spiral wrapped around the pipe.

28.12 COLD WATER PIPING INSULATION TO PREVENT SWEATING (CONT'D)

- 28.12.2 The outer layer for pipe 2 1/2" and smaller shall be two layers of 1" thick hairfelt insulation, Total 2", 10 to 12# density laid and broken jointed.
- 28.12.3 Pipes 3" and over shall be two layers of 1" thick hairfelt insulation, total 2", 10 to 12# density laid, broken jointed, and each inner and outer layer shall be tied with #14 gauge steel wire on 6" maximum centers.
- 28.12.4 All pipe flanges, fittings and valves shall be insulated with the same materials as used on the adjacent piping.
- 28.12.5 Outer jacket shall be weatherproofed same as per Section 28.5.

THE UNIVERSITY OF CHICAGO

PHYSICS DEPARTMENT

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