

Section 15100
CHEMICAL PIPING

PART 1 GENERAL

1.01 SUMMARY

This Section includes chemical piping related to chemical [(chlorine gas, chlorine (GAS) solution, sodium hypochlorite (bleach), liquid ammonium sulfate (LAS), service water, and sodium hydroxide (caustic)] feed and supply systems.

1.02 MEASUREMENT AND PAYMENT

No separate payment for Work performed under this Section. Include cost of same in Contract price bid for Work of which this is a component part.

1.03 REFERENCES

This specification references the following publications in their current editions. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

- A. ASTM A53/A53M: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded, and Seamless
- B. ASTM A105/A105M: Standard Specification for Carbon Steel Forgings for Piping Applications
- C. ASTM A106/A106M: Standard Specification for Seamless Carbon Steel Pipe for High - Temperature Service
- D. ASTM A182/A182M: Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High - Temperature
- E. ASTM A216/A216M: Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding for High Temperature Service
- F. ASTM A312/A312M: Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
- G. ASTM A403/A403M: Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings
- H. ASTM D1784: Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
- I. ASTM D1785: Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

- J. ASTM D2467: Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
- K. ASTM D2665: Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
- L. ASME Boiler and Pressure Vessel Code (BPVC) Section VIII, Division 1, Rules for Construction of Pressure Vessels.
- M. ASME B16.5: Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
- N. ASME B16.11: Forged Fittings, Socket-Welding and Threaded
- O. ASME B31.3: Process Piping, ASME Code for Pressure Piping
- P. ASME B36.10M: Welded and Seamless Wrought Steel Pipe
- Q. ASME B36.19: Stainless Steel Pipe
- R. AWWA C900: PVC Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution
- S. The Chlorine Institute, Inc.:
 - 1. Pamphlet 6: Piping Systems for Dry Chlorine
 - 2. Pamphlet 94: Sodium Hydroxide Solution and Potassium Hydroxide Solution (Caustic) Storage Equipment and Piping Systems
 - 3. Pamphlet 96: Sodium Hypochlorite Manual
- T. CGA G-4.1: Cleaning Equipment for Oxygen Service
- U. ISO 9001: Quality Management Systems – Requirements

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01330 – “Submittal Procedures”
 - 1. Certified shop and working drawings
 - 2. Operating and maintenance instructions
 - 3. Shop drawings details for accessory items
 - 4. Recommendations for short and long term storage
 - 5. Sales bulletins or other general publications are not acceptable as submittals for review except where necessary to provide supplemental technical data

6. ISO 9001 certification or other quality control manual demonstrating a complete system for quality management
7. Material Certification:
 - a. Provide certification from the Manufacturer that the materials of construction specified are recommended and suitable for the service conditions specified and indicated.
 - b. If materials other than those specified are proposed based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated including an installation list of a minimum of five (5) installations in operation for a minimum of three (3) years. Provide proposed materials at no additional cost to the Owner.
 - c. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated.
8. Certified results of factory tests

1.05 RELATED REQUIREMENTS

The following related requirements are as applicable and as indicated as part of these Contract Specifications.

- A. Section 01330 – “Submittal Procedures”
- B. Section 01450 – “Contractor’s Quality Control
- C. Section 02515 – “Hydrostatic Testing of Water Lines”
- D. Section 11303 – “Chemical Analyzers”
- E. Section 13446 – “Primary Instrument Devices”
- F. Section 15140 - "Pipe Hangers, Supports, and Restraints"
- G. The piping and fittings specified herein shall meet and/or exceed the industry standards and requirements as set forth by the American Society for Testing and Materials (ASTM) and the National Sanitation Foundation (NSF). The piping and fittings shall carry the NSF seal of approval for potable water applications, from an organization accredited by ANSI.

1.06 QUALITY ASSURANCE

- A. Comply with the requirements specified in Section 01450 – "Contractor's Quality Control"
- B. Do work required by and in accordance with applicable State (Provincial) and local codes; arrange for permits, inspections and tests required by these codes.
- C. Provide components to Manufacturer's standard for service intended unless otherwise required.

1.07 SYSTEM DESCRIPTION (NOT USED)

1.08 DELIVERY, STORAGE AND HANDLING

During loading, transportation and unloading, prevent damage to pipes and coatings. Load and unload each pipe under control at all times. Under no circumstances shall a dropped pipe be used unless inspected and accepted by the Project Manager. Place skids or blocks under each pipe in the shop and securely wedge pipe during transportation to protect pipe, lining, and coating.

1.09-1.13 (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURER(S)

A. Valves (PVC)

1. Ball Valves (PVC):

- a. Hayward True Union PVC Ball Valves
- b. Chemtrol True Union PVC Ball Valves
- c. Or Approved Equal

2. Ball Check Valves (PVC):

- a. Hayward True Union PVC Ball Check Valves
- b. Chemtrol True Union PVC Ball Check Valves
- c. Or Approved Equal

3. Diaphragm Valves:

As recommended by equipment manufacturer to match equipment and system requirements

4. Basket Strainers:

As recommended by equipment manufacturer to match equipment and system requirements
 5. Solenoid Valves:
 - a. ASCO Model 8210, normally closed brass solenoid valves
 - b. Or Approved Equal
 6. Valves for chlorine gas lines under pressure (Ball, Globe, Pressure Reducing, Pressure Reducing Shut-Off and Vacuum Relief Valves):

As recommended by equipment manufacturer to match equipment and system requirements
 7. Electric Actuators (PVC Ball Valves):
 - a. Hayward Industrial Products Inc. - Model EVS
 - b. Or Approved Equal
- B. Chemical Tubing and Fittings
1. New Age Industries
 2. Nalge, Inc.
 3. Norton Company
 4. Or Approved Equal
- C. Service Water System - Hose, Hose Fittings, and Accessories
1. Hose Products
 - a. Goodyear Rubber Company
 - b. B. F. Goodrich.
 - c. Uniroyal Rubber Company
 - d. Or Approved Equal
 2. Fittings:
 - a. Dover Corporation, OPW Division
 - b. American Packing and Gasket Company

- c. Or Approved Equal

2.02 MATERIALS AND/OR EQUIPMENT

A. Valves and Strainers

1. Valve components shall be compatible to the service they are being used, with components chemically resistant to the chemical being conveyed in the piping.
2. Whip to manifold valves are standard Chlorine Institute (CI) valves
3. Whip to cylinder (container) valves are standard Chlorine Institute (CI) valves
4. Ball Valves (PVC)
 - a. PVC Body: Cell Class 12454 per ASTM D1784
 - b. Full port design through 4"
 - c. Reversible PTFE seats
 - d. Double O-Ring Seals
 - e. NST/ANSI 61 listed (2 1/2" – 4")
 - f. Actuator ready design
 - g. End Connection
 - 1) Greater than 4" shall be flanged
 - 2) 4" and below shall be threaded or flanged as shown on Drawings
 - h. Pressure Rating
 - 1) 4" and below – 235 psi at 70°F Non-Shock
 - 2) Greater than 4" – 150 psi at 70°F Non-Shock
 - i. Seals
 - 1) EPDM – Sodium Hypochlorite (Bleach) Service
 - 2) EPDM – Liquid Ammonium Sulfate (LAS) Service
 - 3) FPM – Chlorine (GAS) Solution Service
5. Ball Valves (Chlorine Gas Under Pressure)

- a. Rated no less than 300 psig (2.1 MPa) WSP.
 - b. Cast steel body, ASTM A216/A216M, Grade WCB full or reduced port, externally adjustable stem seal
 - c. Monel or Hastelloy "C" ball and stem
 - d. Glass filled Teflon seats and seals
 - e. Screwed ends
 - f. Provide design with excess pressure relief from the ball and body cavity to high pressure side when valve is closed.
 - g. Indicator showing high pressure side
6. Ball Check Valves (PVC)
- a. PVC Body: Cell Class 12454 per ASTM D1784
 - b. For horizontal or vertical installation
 - c. Square cut seat for positive sealing
 - d. Seat with minimum back pressure
 - e. O-Ring Seals
 - f. NST/ANSI 61 listed (2 ½" – 4")
 - g. End Connection
 - (1) Greater than 4" shall be flanged
 - (2) 4" and below shall be threaded or flanged as shown on Drawings
 - h. Pressure Rating
 - (1) 4" and below – 235 psi at 70°F Non-Shock
 - (2) Greater than 4" – 150 psi at 70°F Non-Shock
7. Diaphragm Valves:
- Rigid unplasticized PVC body with Teflon diaphragms for chloride service or Neoprene diaphragms in other service unless otherwise designated on Drawings. Diaphragms are to be compatible with the service
8. Solenoid Valves

- a. Body: Brass or stainless steel (as required by use)
 - b. Seals: NBR or PTFE (as required by use)
 - c. Core Tube, Core, Plugnut and Springs are stainless steel
 - d. Solenoid valves are to meet the minimum standards listed in Section 13346 - "Primary Instrument Devices."
9. Globe Valves (Chlorine Gas Under Pressure)
- a. Rated no less than 300 psig (2.1 MPa) WSP
 - b. Forged steel body, ASTM A105/A105M bolted Bonnet, OS & Y and screwed ends
 - c. Monel plug type disk and seat ring
 - d. Hastelloy "C" stem
 - e. PTFE impregnated packing
10. Pressure Reducing Valve (Chlorine Gas Under Pressure)
- a. Provide in header as indicated on Plans
 - b. Mechanically operated
 - c. Bypass manifold with manual valves
 - d. Body of high tensile cast iron
 - e. Regulating diaphragm of Hastelloy "C"
 - f. Pressure adjustment by means of adjusting screw with locknut
11. Pressure Reducing and Shut-Off Valve (Chlorine Gas Under Pressure)
- a. Furnish and install on gas outlet of each evaporator
 - b. Electrically operated
 - c. Bypass manifold with manual valves
 - d. Body of high tensile cast iron
 - e. Regulating diaphragm of Hastelloy "C"
 - f. Pressure adjustment by means of adjusting screw with locknut

- g. Shut-off valve connected through switches on evaporator and through evaporator low water temperature switches.
 - (1) Energize to open
 - (2) Close on low water temperature
- 12. Vacuum Relief Valve (Chlorine Gas Under Pressure)
 - a. To be utilized on solution discharge header line from injectors
 - b. Relieve excess vacuum resulting from negative head in solution line
- 13. Basket Strainers:
 - a. Service Conditions:
 - (1) Provide strainers suitable for the chemical service as indicated in the equipment schedules.
 - (2) Provide size and type, simplex and duplex, as indicated.
 - b. Materials:
 - (1) Body and Cover: CPVC
 - (2) Valves for duplex strainers: CPVC
 - (3) O-rings: EPDM or suitable for the service specified and indicated.
 - (4) Baskets: CPVC with 1/16-inch (1.58 mm) perforations
 - c. Covers: Threaded with hand operable vent
 - d. Body:
 - Provide with and operable drain
 - e. Provide with integral flat mounting base
 - f. Ball Valves for duplex strainers:
 - Provide a 3-way ball valve at the inlet and outlet, mechanically connected with true-union connections.
 - g. Pressure Rating: 150 psi (1,050 kPa)
 - h. End Connections: Flanged 150 psi ANSI (Class 150) standard

- i. Duplex Strainer Configuration: Provide configuration as indicated
14. Identification of Valves
- a. Each shut off or control valve, except those on equipment, shall be provided with a 1 1/2 inch minimum diameter heavy brass tag. Tags shall bear the identifying number of the valve as indicated on the Drawings and, when shown, one or more identifying letter symbols of the service line.
 - b. Numbers and letters shall be block type with 1/2 inch high numbers and 1/4 inch high letters stamped on the tags and filled with black enamel. Where necessary to operate more than one valve to control a section of piping, the numbers of the other valves shall be stamped on the tag in 1/8 inch high block numbers and letters filled with black enamel.
 - c. Attach tags to the valves by split key rings soldered so that the ring and tag cannot be removed.
 - d. Furnish a neatly typed valve directory listing each valve number and its location. Submit the directory to Project Manager for approval. After approval, deliver 6 copies to the Owner.
15. Electric Actuators (PVC Ball Valves)
- a. Provide electric-operated drive units on chemical PVC ball valves as indicated.
 - b. Drive Units:
 - (1) Provide each electric-operated drive unit complete with motor, gearing, manual over-ride, position limiting and indicating device contacts, drive coupling, integral motor controls, integral position indicator, and field-device network communication equipment.
 - (2) Enclose in NEMA 4X housing, including motor, gearing, mechanism, hand-wheel mechanism, position limiting device contacts, lubricants, heating elements, wiring and terminal facilities.
 - (3) Gearing:

Design for 100 percent overload, permanently lubricated, and effectively sealed against entrance of foreign matter.
 - (4) Manual Operators:

Provide manual operation of the actuator. Provide integral de-

clutch mechanism that instantly disengages when drive unit is energized. Prevent drive unit rotor from turning during manual operation. Provide de-clutch lever to shift unit into manual operation.

- (5) Size according to the individual valve's torque requirements with a safety factor of 1.5

c. Motors:

- (1) Provide motor specifically designed for actuator service.
 - (a) Type: Induction, UL Listed.
 - (b) Protection: Thermal switches imbedded in the motor windings.
 - (c) Operation: Reversing with cycle time 5-45 seconds.
 - (d) Operating Power: 120 volt, single-phase, 60 Hz.
- (2) Provide extended duty motors made expressly for valve control service and capable of operating the valve without overheating.
- (3) Provide permanently lubricated bearings.
- (4) Position Limiting:
 - (a) Provide devices to limit actuator operation at each end of travel.
 - (b) Provide independent adjustment provisions for each travel limit.
 - (c) Provide position limit contacts for control and indication of the actuator at each end of travel. Maintain interlocks and remote indication contact position upon loss of actuator power supply.
- (5) Provide mechanical methods to prevent moisture ingress; or provide space-heating elements rated for 120-volt AC operation and sized to prevent condensation in the motor and control compartment.
- (6) Provide terminal facilities for connection to motor leads, switches and heating elements.
- (7) Visual Position Indicators: Provide position indication

B. Pipe and Fittings

1. General:

- a. Use PVC compounds in manufacture of pipe that contain no ingredient in amount that has been demonstrated to migrate into water in quantities considered to be toxic.
- b. Pipe support to be continuous and installed to avoid sagging. Supports shall be suitable for size and location of pipeline. Refer to Section 15140 - "Pipe Hangers, Supports, and Restraints" for types of supports to be used.
- c. Thread Lubricant, when used, shall be as recommended by Manufacturer of pipe and fittings. Seal joints with Teflon tape.
- d. Pipe for drains, water or vents shall be Schedule 80, normal impact pipe made of rigid unplasticized virgin polyvinyl chloride per ASTM D2665. Fittings of same material and of solvent-weld type.

2. Liquid Ammonium Sulfate (LAS) Service

Materials and piping covered in this Section are applicable for LAS disinfection systems.

a. General:

- (1) Cold bending of pipe is NOT ACCEPTABLE
- (2) Piping passing through walls or floors of LAS storage area and LAS feed room caulked gas tight as specified for plumbing work.
- (3) Piping passing through rooms other than the chlorine storage area and feed room are to use double containment piping as called out on the Drawings.
- (4) Arrange piping at the points of application as indicated on Drawings. Sizes and capacities not specified herein are indicated on Drawings.
- (5) Terminate ammonia vent lines outdoors away from personnel access areas. Vents containing pockets or extending more than 25 feet (7.62 m) above ammonia feeder are NOT ACCEPTABLE.

b. Piping and Fittings:

- (1) Schedule 80 PVC per ASTM D1785

- (2) Schedule 80 PVC piping and fittings rated for a minimum pressure of 400 psig at 73°F
 - (3) Solvent weld all joints except those as described in Paragraph 2.02.B.2.c
 - c. Threaded joints at transitions to equipment with Teflon tape joining material
3. Sodium Hypochlorite (Bleach) and Chlorine Solution (Gas) Service

Materials and piping covered in this Section are applicable for bleach and chlorine solution (gas) disinfection systems.

a. General

- (1) Piping systems are to meet the guidelines in Chlorine Institute Pamphlet 6 and pamphlet 96
- (2) Cold bending of pipe is NOT ACCEPTABLE
- (3) Piping passing through walls or floors of chlorine storage area and chlorinator feed room are to be caulked gas tight as specified for plumbing work.
- (4) Piping passing through rooms other than the chlorine storage area and feed room are to use double containment piping as called out on the Drawings.
- (5) Arrange piping at the points of application as indicated on Drawings. Sizes and capacities not specified herein are indicated on Drawings.
- (6) Terminate chlorine vent lines outdoors away from personnel access areas. Vents containing pockets or extending more than 25 feet (7.62 m) above chlorine feeder are NOT ACCEPTABLE.

b. Piping and Fittings:

- (1) Schedule 80 PVC per ASTM D1785
- (2) Schedule 80 PVC piping and fittings rated for a minimum pressure of 400 psig at 73°F
- (3) Solvent weld all joints except those as described in Paragraph 2.02.B.3.b.4

- c. Threaded joints at transitions to equipment with Teflon tape joining material

4. Chlorine Gas Service

Materials and piping covered in this Section are applicable for chlorine gas disinfection systems.

a. General

- (1) Piping systems are to meet the guidelines in Chlorine Institute Pamphlet 6
- (2) Cold bending of pipe is NOT ACCEPTABLE
- (3) Piping passing through walls or floors of chlorine storage area and chlorinator feed room are to be caulked gas tight as specified for plumbing work.
- (4) Piping passing through rooms other than the chlorine storage area and feed room are to use double containment piping as called out on the Drawings.
- (5) Arrange piping at the points of application as indicated on Drawings. Sizes and capacities not specified herein are indicated on Drawings.
- (6) Terminate chlorine vent lines outdoors away from personnel access areas. Vents containing pockets or extending more than 25 feet (7.62 m) above chlorine feeder are NOT ACCEPTABLE.

b. Liquid chlorine and chlorine gas under pressure:

- (1) Schedule 80 seamless steel pipe per ASTM A106/A106M Grade B, seamless, per ASME B36.10
- (2) Conform to ASTM A53/A53M
- (3) Manifold at ton containers mounted on protecting angle-iron support frame.
- (4) Manufacturer's standard whips

c. Fittings and Joints

- (1) All joints less than 2" are to be threaded. Joints from 2" to 4" are to be threaded or flanged. Joints greater than 4" are to be flanged.

- (2) 3,000-lb. forged carbon steel fittings per ASTM A105/A105M, Class 3,000 forged steel threaded to meet ASME B16.11
 - (3) 300-lb. forged carbon steel flanges per ASTM A105/A105M, Class 300 forged steel raised-face or tongue and-groove, threaded to meet ASME B16.5 or Schedule 80 seamless butt weld fittings for pipe larger than 1-1/2-inch (40 mm) in size
 - (4) Unions: ASTM A105/A105M Class 3,000 forged steel lug nut unions; threaded type flanges unions with O-rings appropriate to the type of service. Ground joint unions are NOT ACCEPTABLE.
 - (5) Use Teflon tape mixture of linseed oil and white lead or mixture of linseed oil and graphite on male threads where screwed fittings required
 - (6) Flange gaskets for chlorine of lead containing 3 percent antimony
 - (7) 1/16-inch (1.6 mm) thick gaskets for pipe smaller than 2-inch (50 mm)
 - (8) 1/8-inch (3 mm) thick gaskets for pipe 2-inch (50 mm) and larger
5. Sodium Hydroxide (Caustic Soda) Service
- a. Piping systems are to meet the guidelines in Chlorine Institute Pamphlet 94, and the requirements contained in ASME B31.3.
 - b. Materials and piping covered in this Section are applicable for 0 to 25% caustic soda.
 - c. If a 50% concentration of caustic soda is to be used, it is recommended that stainless steel piping be used in lieu of PVC piping around the storage tanks and all inlet piping due to the high temperatures encountered during the mixing of the caustic soda and water.
 - d. Caustic soda at concentrations of 30% and higher have freezing points above 30 degrees Fahrenheit. 50% caustic begins to crystallize at 54 degrees Fahrenheit. Refer to Table 2.02.B.1 in the "ATTACHMENT" for caustic soda freezing points at various temperatures.
 - e. Avoid low points in the piping system. All low points should have a drain provided for clearing the line.
 - f. Piping systems should be installed to allow complete drainage.

- g. Piping systems should include a sufficient number of fittings to facilitate hydrotesting, clean-out, and maintenance.
- h. Pipe layouts should be minimized, especially outdoors where caustic solutions can freeze if insulation or heat tracing malfunctions.
- i. All caustic lines shall be insulated
- j. Provisions shall be made to utilize less than 50% caustic during winter months to minimize risk of caustic soda freezing in the pipelines.
- k. Caustic concentrations 25% or less and all outlet piping
 - (1) Pipe:
 - (a) 4" and above - AWWA C900, Grade 12454B, Type I, Grade 2
 - (b) Schedule 80 PVC per ASTM D1785
 - (2) Fittings: Schedule 80 PVC per ASTM D1785 and ASTM D2467
 - (3) Hose: PVC as specified elsewhere in this Section
 - (4) Joints: Socket Type
- l. Caustic concentrations greater than 25% - Around storage tanks and all inlet piping (2" and above)
 - (1) Stainless steel pipe and fittings shall be used for all piping systems around the storage tanks and on all inlet piping when using caustic concentrations exceeding 25%.
 - (2) Piping and fittings (2" and above):
 - (a) Piping: ASTM A312/A312M, Grade TP304 Schedule 10S Stainless Steel Seamless or Welded pipe per ASME B36.19
 - (b) Fittings (Wrought): ASTM A403/A403M Grade WP304 or WP304-W, 304 SS Seamless or Welded
 - (c) Fittings (Forged): ASTM A182/A182m Grade F304 Forged Stainless Steel
 - (d) Flanges: ASTM A182/A182M Grade F304 Class 150 Forged Stainless Steel, Raised Face Weld neck or Slip-on per ASME B16.5

- (e) PTFE Gasket with various fillers or EPDM or Non-Asbestos

C. Chemical Tubing and Fittings:

1. Provide tubing that is suitable for suction and discharge application.
2. Tubing to allow tight compression fittings for leak proof connections
3. Provide braided reinforced flexible tubing resistant to the chemical specified
4. Provide no flow restriction compression fittings when connecting pieces is required.
5. Provide transition connections as detailed on the Drawings
6. Materials:
 - a. Tube: FEP or Teflon with cross linked polyethylene backing
 - b. Reinforcement: Synthetic textile with steel helix
 - c. Cover: EPDM
7. Sizes:
 - a. 3/4-inch (19 mm) through 2 inch (50 mm): 200 psi (1,400 kPa)
 - b. 2.5 and 3 inch (65 and 75 mm): 150 psi (1,050 kPa)
 - c. 4 inch (100 mm) 125 psi (875 kPa)
 - d. 3/4 inch (19 mm) through 4 inch (100 mm): 30 in Hg (760 mm Hg) vacuum
8. Coupling:

Provide type and materials as recommended by the hose manufacturer for the service conditions specified and indicated.

D. Service Water System - Hose, Hose Fittings, and Accessories

Materials and equipment covered in this Section are applicable to water lines utilized within the site for various purposes, such as dilution water line for chemical processes and hose bibs.

1. Hose:

Rubber tube and cover; 3/4 inch diameter 2-ply water hose, 200 psi working pressure, 50 foot lengths

2. Fittings:

For each ¾ inch diameter hose, standard bronze male and female garden hose couplings; one heavy-duty bronze adjustable hose nozzle.

3. Gaskets:

Natural or Buna-N rubber

4. Hose Racks:

Heavyweight galvanized steel, semicircular wall mounted, capacity one hose length

5. Polyvinyl chloride hose shall be a clear, flexible, abrasion resistant extrusion with clear rigid reinforcement. The hose shall have a smooth bore, convoluted cover, and be suitable for use with liquid or other chemicals as required.

E. Pressure Gauges and Switches

1. Pressure Gauges

- a. Install with header type isolation valves of suitable material
- b. Diaphragm type
- c. Silver or tantalum diaphragms
- d. Fluorocarbon oil filling

2. Pressure Switches

- a. Install as indicated on Drawings
- b. Diaphragm seal to protect activating elements
- c. Normally open contacts with field adjustable closure setting
- d. Wired to alarm high gas pressure in manifold
- e. See Section 13446 – “Primary Instrument Devices” for more detailed information related to pressure switches.

2.03-2.04 (NOT USED)

PART 3 EXECUTION

3.01-3.02 (NOT USED)

3.03 INSTALLATION AND CONSTRUCTION

- A. Install all equipment and connecting piping in accordance with Manufacturer's instructions and as indicated.
- B. Prior to testing and start-up, inspect the installation to verify the system is ready for complete testing and calibration of equipment.
- C. Install pipelines parallel to building walls wherever possible. Install piping to lines and grades indicated and support. Where supports are used, provide supports as specified in Section 15140 - "Pipe Hangers, Supports, and Restraints" to prevent shifting or distortion of pipe. Provide for expansion.
- D. Slope piping toward low points and provide for draining at low points
- E. Before assembly, remove debris from inside pipes and fittings
- F. Support piping laid in trenches in trench on bed of selected backfill material which maintains desired line and grade.

3.04 REPAIR / RESTORATION

- A. Field Touch-Up Painting

After installation and acceptance testing by the Project Manager, apply touch-up paint to all scratched, abraded and damaged shop painted surfaces. Coating type and color shall match shop painting.

3.05-3.06 (NOT USED)

3.07 CLEANING

- A. All new chemical piping systems must be cleaned and dried prior to being tested and put in service. Since the chemicals conveyed in the piping can react violently with water and organic compounds such as oil, grease, solvents, alcohols, hydrocarbons and other foreign materials, procedures for cleaning the piping must focus on completely removing all residues. Once cleaning is complete, the piping must dried thoroughly before being put in service.
- B. A written procedure must be developed based on the type of chemicals being conveyed and the system being cleaned and dried. This procedure should include methods for verifying that the cleaning and drying has met the requirements established for the system being cleaned.
- C. Reference sources for developing procedures and guidelines for cleaning chemical piping systems are CGA G-4.1 and the specific Chlorine Institute pamphlet covering the chemicals being conveyed in the system.
- D. Procedures should be in compliance with all federal, state and local regulations.

- E. Manufacturer's recommendations of the cleaning product and the equipment to be cleaned should be followed when possible.
- F. Work to be done in accordance with Chlorine Institute pamphlets.
- G. Methodology:
 - 1. Clean by pulling through each length of pipe a lint-free cloth saturated with trichloroethylene or other suitable chlorinated solvent.
 - 2. Do not contact any plastic pipe or equipment with solvent.
 - 3. Hydrocarbons or alcohols are NOT ACCEPTABLE because residual solvent may react with ammonia.
 - 4. Dismantle and clean new valves and other equipment before use. If valve packing is oily or dirty, repack valves with Manufacturer's recommended packing or Teflon.
 - 5. Test valves with clean, dry 300 psi (2.1 MPa) air for seat tightness as specified hereinbefore.
- H. Chlorinated solvents can produce very serious physiological effects unless used in strictest compliance with the solvent Manufacturer's safety recommendations. Instruct workmen in the proper use, disposal and handling of these solvents.

3.08 TESTING AND INSPECTION

- A. After installation, and in presence of the Project Manager, test all pipelines for tightness in acceptable manner. Furnish suitable testing plugs or caps, all necessary pipe connections, test fluids, gages, other equipment and all labor required for these tests.
- B. Remove or valve off from lines all instrumentation and appurtenant equipment which is incapable of withstanding the test pressures.
- C. Chemicals needed for testing will be supplied by the Owner.
- D. Pressure Testing:
 - 1. Hydrostatically test all PVC liquid chemical and solution piping with water to a pressure of 100 psig (690 kPa) according to Section 02515 – "Hydrostatic Testing of Water Lines" and requirements of the applicable Chlorine Institute Pamphlet covering the chemical being conveyed in the lines.
 - 2. No leakage is allowed
 - 3. Prior to test, remove or isolate solution rotameters and any other devices or valves which may be incapable of withstanding test pressures.

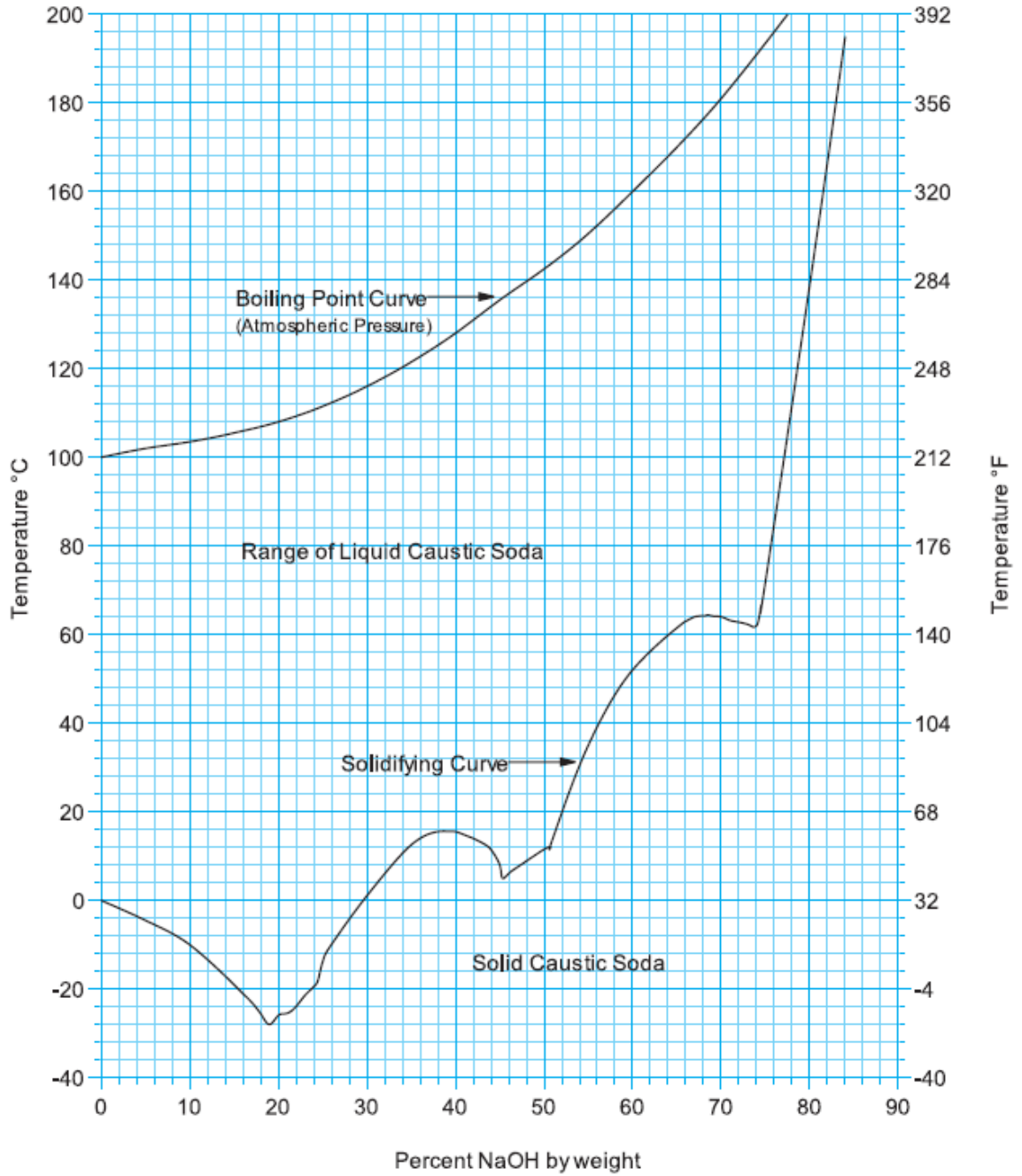
4. Piping systems shall be held at test pressure for a minimum of eight (8) hours unless otherwise noted on Drawings, Contract Documents or by the Authority's representative.
 5. After testing, all moisture absorbing gaskets and packing shall be replaced.
 6. Once testing is complete, thoroughly dry the system before testing for leaks and placing system into service. System can be dried by introduction of a dry nitrogen or dry air purge. Heating the gas being used to purge the system will aid in the drying process. See applicable Chlorine Institute pamphlets for more information.
- E. Test for chemical leaks:
1. Leak testing should occur once the piping system is completely assembled, cleaned, and dried.
 2. The purpose of testing for leaks is to ensure that all connections and components will not leak chemicals when the lines are pressurized.
 3. Testing for leaks is not a substitute for pressure testing of the system.
 4. See applicable Chlorine Institute pamphlets for more information on guidelines for leak testing of the chemicals being conveyed in the piping.
- F. Clean and repair to the satisfaction of the Project Manager, or replace all equipment or property damaged by testing procedures at no additional cost to the Owner.

3.09-3.10 (NOT USED)

ATTACHMENT

Table 2.02.B.1 – Boiling and Solidifying Temperatures of Caustic Soda Solutions

(Source: OxyChem Caustic Soda Handbook, 2009)



END OF SECTION