Chlorine Piping and Cleaning Information (Nitrogen Purging)

Chlorine Gas and Liquid Pressure Piping:

As recommended by the Chlorine Institute's pamphlet 6 "Piping Systems for Dry Chlorine", all pressurized piping should be seamless carbon steel, grade B, Schedule 80, type S, ASTM A-106. All fittings shall be 3000 pound forged carbon steel ASTM A-105. All pressure piping threads should be wrapped with Teflon tape or sealed with a mixture of litharge and glycerin. Note that applying a mixture of litharge and glycerin will create a permanent joint not allowing for easy disassembly of the threaded pipe joints.

Chlorine pressure vent piping (from the vents of pressure reducing valves and pressure relief valves) should be constructed of the same materials mentioned above. Vent piping should terminate in a safe, unoccupied, outside area and these vent lines should never be manifolded together. Slope the vent piping downward toward the outside end so that moisture will not build up in the line and place an insect screen on the outside end of the vent piping to prevent unwanted entry of insects.

Chlorine Gas vacuum piping:

Vacuum lines for chlorine gas service usually are constructed of polyethylene tubing, PVC piping (Schedule 80 PVC), or any other appropriate material recommended in the Chlorine Institute's pamphlet 6 "Piping Systems for Dry Chlorine". Hydro Instruments provides a tubing and piping sizing guide to aid in selection. If polyethylene tubing is used, it should be inspected regularly for cracking and replaced at least once every two years. Wherever possible, PVC piping joints should be socket glued rather than threaded because threaded joints are much more likely to crack. All threaded joints should be wrapped with Teflon tape. Care should also be taken not to over tighten plastic joints and crack the material.

Chlorine vent piping (from the vent ports of vacuum regulators and vacuum line control valves) should be constructed from the same materials listed in the paragraph above. Vent piping should terminate outside in a safe unoccupied area and these vent lines should never be manifolded together. Slope the vent piping downward toward the outside end so that moisture will not build up in the line and place and insect screen on the outside end of the vent piping to prevent unwanted entry of insects.

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Cleaning, Drying and purging of Chlorine Pressure Piping

Before any assembly or operation of chlorine gas is performed, all piping, valves, fittings, etc. should be inspected to remove all oils, moisture or any other contaminates. Chlorine will support combustion of hydrocarbon materials and will corrode pipes in the presence of moisture (even ambient humidity). Thus once inspected and assembled the pipes must be thoroughly cleaned and dried before any chlorine gas is passed through the system. Although the best method can be site specific, cleaning the pipeline with hot stream is the most common method for removing unwanted contaminants although there are other methods available. Steam should be introduced through the highest point in the piping and all pipe ends and drip legs should be open to allow condensate and other materials to drip out. If steam is not available, other options include aqueous cleaning with an appropriate solvent of each manifold component prior to assembly (though extra measures must be taken to remove moisture afterward) and abrasive cleaning using sand or dry ice. A detailed cleaning and assembly plan should be laid out and strictly followed.

Drying the pipes usually follows the completion of steam cleaning. While the pipe is still hot, connect a dry air, nitrogen gas, or other inert gas feed line to the pipe to be cleaned. If using high pressure gases such as nitrogen, pressure reducing and relief valves must be installed to control the pressure to about 150 PSI (10 bar) and ensure that higher pressures cannot enter the manifold because higher pressures could damage rupture discs, pressure gauges, vacuum regulators, etc… (see figure 1). If using air, the air should have a dew point of -40 ˚F (-40 ˚C) or below, and should be blown through the pipes until the discharging air is also at -40 ˚F or below.

Pressure Testing after Purging the Piping

After the lines have been dried and purged of contaminants, then they should be pressure tested with the nitrogen or dry air to approximately 100 to 150 PSI (7 – 10 bar) and the air or nitrogen supply should then be sealed off from the piping system. Mark the pressure gauges at this time and wait for 24 hours to ensure that the pressure gauge readings have not dropped. If there has been any pressure loss, then this indicates that there are one or more leaks in the piping system. Search for the leaks at joints using soapy water. The gas leaking out should create visible bubbles at the leaking joint(s). After finding and correcting all leaks, then repeat the leak test for another 24 hours. Once approved, run the ejector(s) to clear the lines of nitrogen, close the chlorine ball valve and remove the pressure testing assembly. Cap the manifold with and pressurized chlorine appropriate material (3000 lb. forged carbon steel, ASTM A-105 cap).

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Chlorine Gas Leak Testing

After the pressure testing has been successful, run the ejector to clear the nitrogen from the lines and close the chlorine ball valve (keep the ball valve closed from this point to prevent air from entering the manifold). Remove the nitrogen test assembly and cap the chlorine manifold with a material appropriate for pressurized chlorine use (3000 lb., ASTM A-105 forged carbon steel cap). The system is ready to introduce chlorine gas and start operation. Be sure not to allow air to enter the piping system during the process of switching over from nitrogen/air to chlorine gas supply. Also, ensure that the system ejector (or other vacuum source) is operational prior to opening any chlorine container valves. With the ejectors off, open one chlorine container valve (about a 1/4 turn is sufficient) briefly until the pressure rises to around 45 PSI (3 bar) and then close the chlorine container valve. Use a plastic squeeze bottle partially filled with household ammonia to check the piping system joints for leaks. Direct the ammonia fumes (not liquid) toward each joint. If leaks are present, the leaking chlorine gas contacting ammonia fumes will create a visible white vapor that looks like smoke. See equipment instruction manuals and changing chlorine containers bulletins for further information on this subject. If leaks are found, then use the ejector(s) to evacuate all chlorine from the piping system immediately and then address the leaking joint. After the piping system has been checked and no leaks have been found, then the chlorine container valves can be opened and the chlorine gas feed system can be put into operation.

For more information on chlorine piping and cleaning refer to the Chlorine Institutes "Chlorine Manual" and "Piping Systems for Dry Chlorine".

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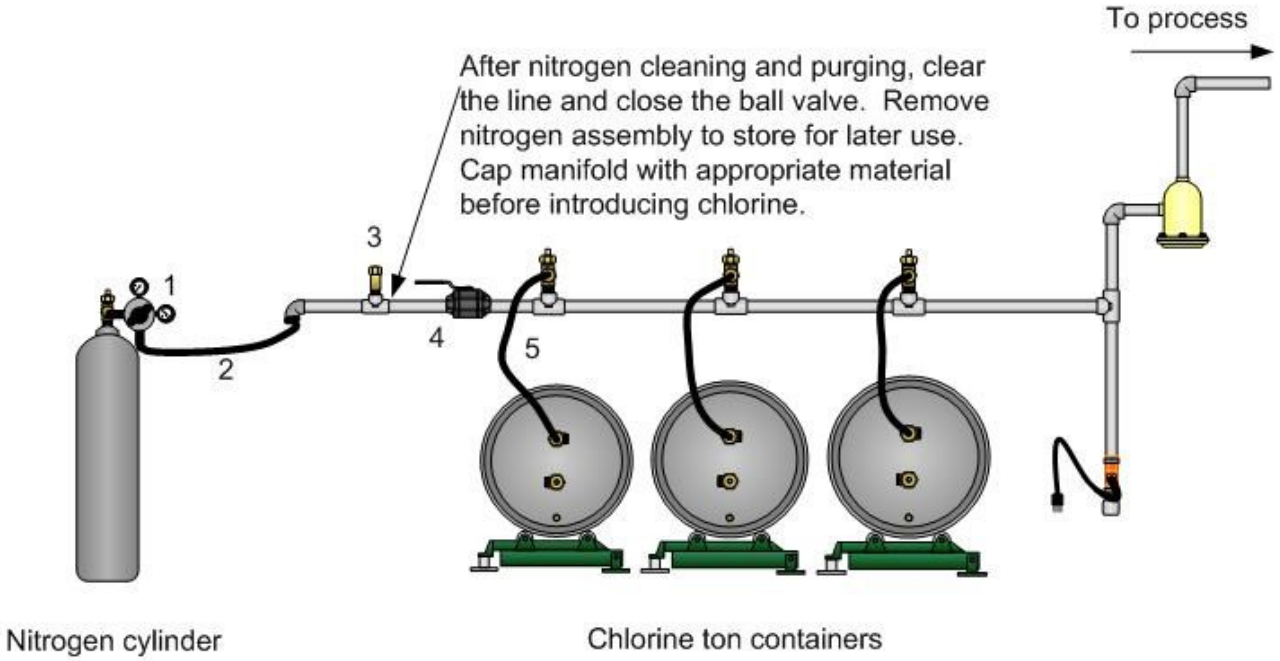
Figure 1. Nitrogen purge line

NOTE: This design should not be construed as an approval for Nitrogen gas drying/purging piping. Only after proper engineering consideration may this design be used as a reference.



1. Nitrogen gas pressure regulator
2. Nitrogen gas flexible connector and appropriate fittings
3. Pressure relief valve (set at 150 PSI)
4. Chlorine service ball valve
5. Chlorine gas flexible connector

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