METHYL CHLORIDE HANDBOOK

Technical Information

NOVEMBER 2024

OxyChem®

Dallas-based Occidental Chemical Corporation is a leading North American manufacturer of basic chemicals, vinyls, and performance chemicals directly and through various affiliates (collectively, OxyChem). OxyChem is also America's only producer of sodium chlorite.

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As a Responsible Care® company, OxyChem's global commitment to safety and the environment goes well beyond compliance. OxyChem's Health, Environment, and Safety philosophy is a positive motivational force for our employees and helps create a strong culture for protecting human health and the environment. Our risk management programs, and methods have been, and continue to be, recognized as some of the industry's best.

OxyChem offers an effective combination of industry expertise, experience, online business tools, quality products and exceptional customer service. As a member of the Occidental Petroleum Corporation family, OxyChem represents a rich history of experience, top-notch business acumen, and sound, ethical business practices.

Contents

MANUFACTURING

Methyl Chloride, also known as chloromethane (CH3Cl), is a colorless gas that is typically transported as a pressurized liquid. It is produced in large quantities naturally through the interaction of sunlight with biomass and chlorine found in sea foam. Nonetheless, the chloromethane utilized in industrial processes is exclusively synthesized through artificial means.

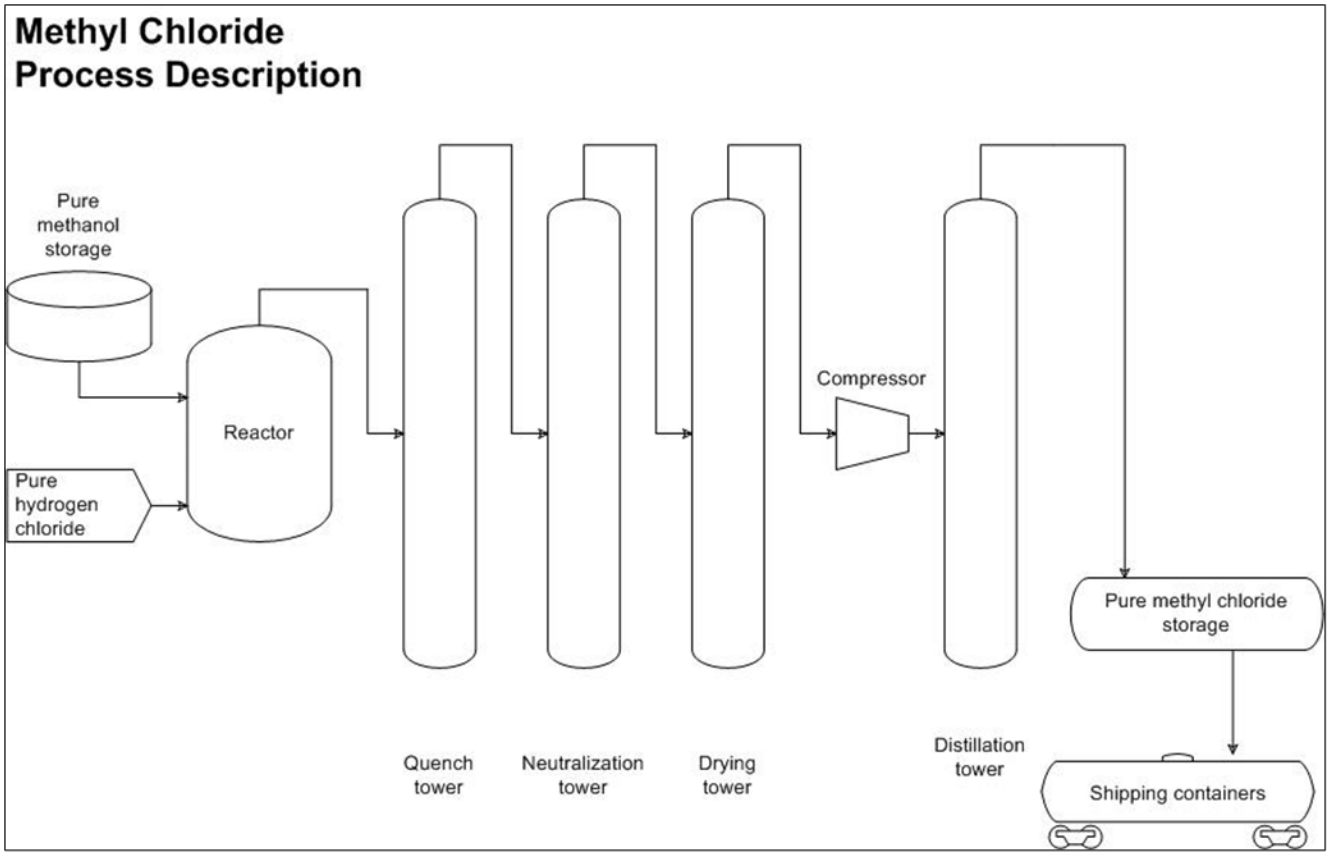
Most chloromethane is prepared by reacting methanol with hydrogen chloride, according to the chemical equation:

$$CH_3OH + HCl \rightarrow CH_3Cl + H_2O$$

OxyChem's method reacts hydrogen chloride gas through boiling methanol with a zinc chloride catalyst; another method for reaction is passing combined methanol and hydrogen chloride vapors over an alumina catalyst at 350°C.

A smaller amount of chloromethane is produced by heating a mixture of methane and chlorine to over 400°C. However, this method also results in more highly chlorinated compounds such as methylene chloride and chloroform and is usually only used when these other products are also desired.

Further reaction of chloromethane with chlorine can produce dichloromethane (methylene chloride), trichloromethane (chloroform) and tetrachloromethane (carbon tetrachloride).



METHYL CHLORIDE END USES

Technical Grade is the only grade of methyl chloride available from OxyChem. Eighty-eight percent of the methyl chloride produced in the U.S. is consumed in the manufacture of silicone fluids, elastomers, and resins. The largest volume goes into silicone fluids, which are used in a wide range of products including processing aids such as antifoaming agents, release agents, and light-duty lubricants.

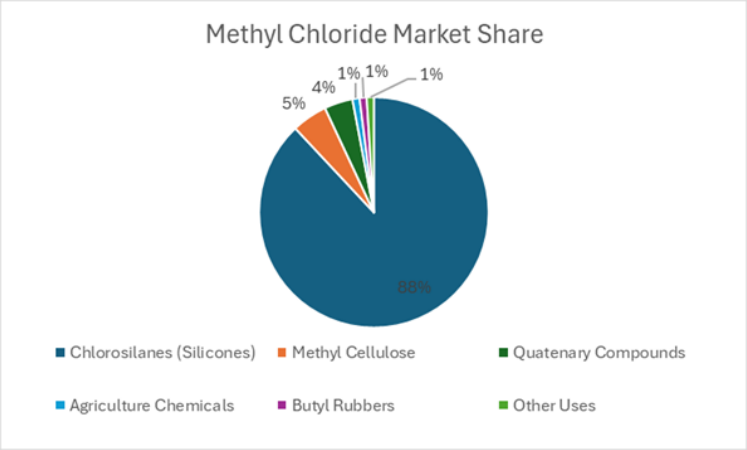
Silicone elastomers are used in the construction industry as sealants and adhesives and to a lesser degree, in automotive applications, wire and cable insulation, and medical and surgical applications. Silicone resins are used in coating, water-repellent resins, molding resins, laminating resins, and electrical insulation.

Approximately five percent of methyl chloride is used as a raw material for cellulose ethers such as methyl cellulose, hydroxyproply methylcellulose, and hydroxybutyl methylcellulose. All of these are used as thickeners and binders in pharmaceuticals, toiletries, and food products. It is also used in the manufacture of building products such as drywall joint cement formulations, cement formulations, stucco, mortars, etc.

Methyl chloride is also consumed in the production of certain quaternary ammonium compounds such as dimethyl ammonium chloride, which is an ingredient found in fabric softeners. These markets consume approximately four percent of the methyl chloride produced.

Methyl chloride is a raw material used in the production of agricultural chemicals known as herbicides. They include paraquat, monosodium methanearson, and disodium methanearsonate. This makes up approximately one percent of the methyl chloride market.

The remaining two percent goes into various uses such butyl rubbers and organomodified clays. Butyl rubbers are used in such things as inner tubes and inner liners for tires as well as caulks, sealants, and pharmaceuticals. Organomodified clays are used primarily in drilling mud in the oil and gas industry to impart lubricity and viscosity to the system.



SPECIFIICATIONS AND PRODUCT GRADES

OxyChem produces and markets Technical Grade methyl chloride at a minimum purity of 99.95% by weight. Material produced and shipped from OxyChem's Wichita, KS plant and Geismar, LA plant is Kosher certified.

OxyChem's Technical Services Department can provide more product information. Call or write:

OxyChem
Technical Services Department
6200 S. Ridge Road
Wichita, KS 67215
800-733-1165, Ext 1.
OxyChem_Tech_Service@oxy.com

SAFETY AND FIRST AID

HAZARDS

Methyl chloride is a highly flammable and hazardous chemical and should be handled with extreme care. Personnel should be properly trained in the handling of methyl chloride and should always wear the proper protective equipment when working around methyl chloride. All users should read the Safety Data Sheet (SDS) before handling methyl chloride.

Contact with liquid methyl chloride can produce frostbite. Exposure to high concentrations can irritate the eyes and produce delayed effects such as nausea, vomiting, diarrhea, headache, drowsiness, dizziness, central nervous system effects, visual disturbances, lung congestion, paralysis, convulsions, coma, and possibly death. Symptoms of overexposure may be delayed for up to 24-48 hours. Recovery from a massive exposure is slow and damage to the central nervous system, liver, kidneys, and cardiovascular system can occur. The level that is Immediately Dangerous to Life or Health is 2000 ppm.

It is recommended that employees be provided with and required to use chemical impervious clothing, gloves, boots, splash proof goggles and other appropriate protective clothing necessary to prevent any possibility of skin contact with methyl chloride gas or liquid. Material types which may be considered for this service include fire resistant clothing, Saranex®, Barricade®, Viton®, Responder®, Trellchem®, and Tychem®. To prevent frostbite, it is crucial to wear clothing that precludes skin contact with methyl chloride and use leather or cloth gloves for protection against freeze burns. While face shields can supplement the protection offered by splash-proof goggles and safety glasses, they should not be used as substitutes for these essential safety devices.

Methyl chloride is difficult to detect in air and odor cannot be relied upon as warning of concentrations that are dangerous to health. The Threshold Limit Values (TLVs) published by the American Conference of Governmental Industrial Hygienists (ACGIH) recommends a maximum eight-hour Time Weighted Average (TWA) exposure of 50 ppm and a short-term (15 minutes) exposure limit (STEL) of 100 ppm. Occupational Safety & Health Administration's (OSHA) current permissible exposure limit (PEL) as found in 29 CFR 1910.1000 Table Z-2 is 100 ppm TWA (8 hour) and a 200 ppm ceiling.

Figure 1: Personal Protective Equipment (PPE)

RESPIRATORY PROTECTION

OSHA requires that employees using respirators should be properly fitted and trained in their use per regulatory statute in 29 CFR 1910.134 .

Types of respirators for use while handling methyl chloride:
1. Escape

In areas where the unexpected release of methyl chloride vapors may lead to potentially dangerous exposure, appropriate escape respirators should be carried by or be readily accessible to each employee. The most common respirator used for this purpose is the mouthpiece respirator. This respirator contains a single cartridge with a mouthpiece and nose clip. Employees should only use this respirator when escape times are short and airborne concentrations of methyl chloride vapors are low.

Figure 2: Mouthpiece Respirator (Escape Only)

2. Air Purifying Respirators

NOTE: At this time, there is no known cartridge/canister for use in methyl chloride contaminated air at or above exposure limits for air purifying respirators.

3. Self-contained Breathing Apparatus

Self-contained breathing apparatus (SCBA) can provide respiratory protection in an oxygen-deficient environment and in situations where unknown concentrations of methyl chloride vapors are present. The SCBA can also provide protection in emergency situations.

The SCBA is an atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user (OSHA definition). A full-face mask is always used with this type of apparatus. OSHA requires that when wearing the SCBA in an Immediately Dangerous to Life and Health (IDLH) atmosphere, the SCBA be operated in the pressure demand mode and be certified by the National Institute for Occupational Safety and Health (NIOSH) for a minimum service life of thirty minutes. Escape SCBA devices are commonly used with full face pieces or hoods and, depending on the supply of air, are usually rated as 3 to 60 minute units.

Figure 4: Self-Contained Breathing Apparatus

OSHA requires that all respirators must be NIOSH approved and shall use breathing gas containers marked in accordance with the NIOSH respirator certification standard, 42 CFR part 84. For further information on regulations pertaining to respirator equipment, see 29 CFR 1910.134 and 30 CFR § 57.5005 For additional information see Department of Health & Human Services (NIOSH) Publication No. 2005-100, *NIOSH Respirator Selection Logic 2004* or Publication No. 87-116, *NIOSH Guide to Industrial Respiratory Protection*.

SAFETY PRECAUTIONS

Methyl chloride odors are reported to be not noticeable at potentially dangerous concentrations. OxyChem suggests methyl chloride users measure exposure potential in all process, storage and unloading areas. OxyChem recommends measurement by continuous sampling devices or, as a minimum, frequent sampling using accepted industrial hygiene methods and procedures. Surveys should be conducted routinely for the purpose of detecting leak sources. Portable direct-reading instruments calibrated for methyl chloride should be used for leak detection. Leaks should be identified and repaired without delay.

Measurement of actual personnel exposure to methyl chloride should be conducted on a routine basis using accepted industrial hygiene methods and procedures. Results from this sampling should be used to analyze job procedures and possible leak situations. Training plays a major role in controlling personnel exposure. All employees who handle or work around methyl chloride should be trained in proper procedures for use and handling, as well as the possible health effects of methyl chloride

A process vent system should be provided to collect all methyl chloride emissions at the source. Sources might include relief-valve or rupture-disc discharges, vessel and piping purges, and venting related to unloading operations. The exhaust from area vent fans and laboratory vent hoods should be ducted to a point well away from occupied workstations.

Safety showers and eye wash fountains should be located in the immediate work area and clearly marked. These units should be tested on a weekly basis. Portable or temporary systems are available. Every precaution should be taken to ensure that a suitable system is in place and operational before handling methyl chloride. Only trained and properly protected personnel should be allowed to enter areas where methyl chloride is present. American National Standards Institute (ANSI) Standard Z358.1 contains placement and performance criteria for emergency eyewash and shower equipment.

Tanks and pipelines containing methyl chloride should be completely emptied and checked for vapors before entering. Do not enter a confined space (which includes tanks or pits) without following proper entry procedures such as 29 CFR 1910.146.

Good housekeeping practices are important where methyl chloride is used. If a methyl chloride leak occurs, evacuate the area and eliminate all ignition sources. Response personnel should wear self-contained breathing air and protective equipment to prevent contact with vapor, liquid or hazardous decomposition products.

In all cases, explosion-proof ventilation should be provided to keep concentrations below explosive limits.

See Page 14 of this handbook for specific recommendations on spills and precautions.

FIRST AID

Eye Contact - If eyes come in contact with methyl chloride, hold the eyelids apart and flush the eye gently with a large amount of lukewarm water for at least 15 minutes, forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissues. Washing eyes within several seconds is essential to achieve maximum effectiveness. GET MEDICAL ATTENTION IMMEDIATELY.

Skin Contact - If skin comes in contact with methyl chloride, immediately wash exposed skin with plenty of water (lukewarm if available) while removing contaminated clothing, jewelry and shoes. Do not attempt to remove frozen clothing from frostbitten areas. Wash clothing and thoroughly clean shoes before reuse. Discard contaminated leather goods. GET MEDICAL ATTENTION IMMEDIATELY.

Inhalation – If methyl chloride is inhaled, remove individual to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, qualified personnel should administer oxygen. If respiration or pulse has stopped, have a trained person administer Basic Life Support (Cardio-Pulmonary Resuscitation/Automatic External Defibrillator) and CALL FOR EMERGENCY SERVICES IMMEDIATELY.

Ingestion – Not a likely route of exposure.

Traumatic Shock - Whenever injured persons are being cared for, the person administering first aid should watch for signs of traumatic shock. Traumatic shock may follow serious injury- and is a depressed condition of many body functions due to inadequate blood circulation throughout most of the body. Signs of shock are pale, moist, cool skin; shallow and irregular breathing; and weak pulse. Beads of perspiration may be noted about the lips, forehead, palms, and armpits. The patient may become nauseated.

To treat shock, keep the patient lying down and as warm and comfortable as possible. Raise the patient's feet eight to twelve inches unless there is head injury, breathing difficulty, or if the patient complains of added pain.

TOXICITY

Methyl chloride is a potent narcotic and has been used as an anesthetic agent. Exposure to less than the current occupational exposure limit (100 ppm, 8 hour TWA) was not associated with any significant impairment. Most cases of intoxication involve concentrations above 500 ppm. In most cases, exposure concentration and duration are not available. The most common consequences of excessive single or repeated exposures have been functional changes in the central nervous system. They have been described as drunkenness as from ingested ethanol (alcohol) but are much longer in persistence. The symptoms of overexposure may include a staggering gait, weakness, drowsiness, double vision, headache, apathy, anorexia, nausea, vomiting, abdominal pain, diarrhea, personality changes, spasms, tremors, loss of memory, paralysis, confusion, unconsciousness, and death. Other organ systems can be affected in persons showing marked central nervous system changes: these include the kidneys, liver, and particularly the lungs. Documentation from historical exposures indicates that pulmonary complications may arise after very significant exposures, likely due to fluid retention from renal failure. Although recovery usually appears complete, at least one case report indicates adverse effects may be permanent. The onset of elevated liver enzymes and indicators of renal impairment may be delayed.

There is inadequate evidence for the carcinogenicity of methyl chloride in animals and humans; therefore, methyl chloride is not classifiable under GHS as to its carcinogenicity.

REGULATORY

The following is a summary of regulations and sources that may pertain to Methyl Chloride.
U.S. Environmental Protection Agency:

- Clean Air Act: Methyl Chloride is included on the Clean Air Act, Section 112(b) list of Hazardous Air Pollutants. Overview by Section of CAA | Technology Transfer Network Air Technical Web site | US EPA
- Clean Air Act: Methyl Chloride is included on the Clean Air Act, Section 112(r) list of Regulated Chemicals for Accidental Release Prevention. Fact Sheet: Clean Air Act Section 112(r): Accidental Release Prevention / Risk Management Plan Rule | US EPA
- Clean Water Act: Methyl Chloride is included on the Clean Water Act, Section 126 list of Priority Pollutants. Toxic and Priority Pollutants Under the Clean Water Act | US EPA
- Comprehensive Environmental Response, Compensation, and Liability Act: Releases of Methyl Chloride in excess of the Reportable Quantity of 100 pounds must be reported. Hazardous Substance Designations and Release Notifications | US EPA
- Emergency Planning and Community Right-to-know Act: Methyl Chloride is a listed substance that is subject to reporting requirements under Section 313 of the act. These reports are often called Toxic Release Inventory (TRI) Reports. Emergency Planning and Community Right-to-Know Act (EPCRA) | US EPA
- Emergency Planning and Community Right-to-Know Act (EPCRA) | US EPA
- Resource Conservation and Recovery Act: Listed Hazardous Waste Codes in which listing is based wholly or partly on Methyl Chloride include U045, K009, K010, and K157. Resource Conservation and Recovery Act (RCRA) Laws and Regulations | US EPA

These summaries also do not address any similar state or local regulations, some of which may impose additional or different obligations from those imposed by federal regulations. All users are responsible for a complete review of the applicable regulations pertaining to their own operation.

STORAGE AND HANDLING

STORAGE & PIPING

Methyl chloride should be stored in steel pressure tanks built and tested to applicable American Society of Mechanical Engineers (ASME) code. In cold climates, storage tanks should be rated for vacuum service. Additional local code requirements must be incorporated in the construction of the storage tanks.

All openings in storage tanks must be welded or have standard bolted flanges rated for the appropriate pressure requirements. **Threaded piping and cast or ductile iron equipment should not be used in methyl chloride service.**

Pressure relief devices should be sized and tested according to ASME code. Dual relief valves should be provided to allow testing with the tank in service.

All methyl chloride storage tanks should be equipped with a high-level alarm to prevent overfilling the vessel. Filling density should be limited to no more than 90 percent of the capacity of the storage tank.

Electrical equipment and wiring used in areas where methyl chloride is processed must meet local and national electrical code requirements. In general, this equipment should meet National Fire Protection Association (NFPA) Class I, Division 2 hazardous location requirements for lighting, electric motors, instrumentation and other electric powered equipment.

Methyl chloride tanks and unloading facilities should be located away from areas containing fired heaters and other potential ignition sources. All tanks and piping must be electrically bonded and provided with static electricity and lightning protection.

Carbon steel containers and piping are suitable for handling dry methyl chloride. **Cast or ductile iron and brass or copper-bearing alloys should not be used in methyl chloride service. Aluminum and aluminum alloys must not be used in methyl chloride storage or handling systems since trimethyl aluminum is formed when methyl chloride contacts aluminum. Zinc and magnesium alloys also must be avoided in equipment or piping for methyl chloride service.**

Gasket materials in methyl chloride service should be Gylon 3504 or Durlon 9000. Other gasket materials may be acceptable, but chemical compatibility must be verified prior to use.

All piping and equipment for methyl chloride should be designed as a closed and contained system so the chemical (both liquid and vapor) is controlled at all times. Storage vessels must have both liquid and vapor piping with block valves located as close to the tank nozzles as possible.

In piping or equipment where liquid methyl chloride may be trapped between closed valves, expansion chambers should be installed.

Methyl chloride storage tanks should be located above ground in limited access areas away from occupied structures. Tanks and unloading areas should be equipped with a sprinkler, deluge monitor, or other fire suppression system per NFPA 30.6.76. Spill containment for both the storage and unloading area should be designed per API RP2218 to prevent flammable material from collecting under tanks, tank cars, trailers, or process piping per NFPA 30 22.11.13. .

MAINTENANCE OF STORAGE FACILITIES

This section covers recommended procedures for most normal maintenance on equipment and systems in methyl chloride service. Maintenance which requires non-standard procedures should not be attempted until all aspects of the work and any potential safety hazards have been addressed.

As with all work involving hazardous chemicals, personnel should be thoroughly trained in the methods, precautions and use of protective equipment required to safely perform the job.

Clearing or Decontaminating Methyl Chloride Equipment - Every job that requires opening any part of a methyl chloride system must begin with the removal of residual methyl chloride. Equipment or piping to be opened should be isolated from the rest of the process and purged with dry nitrogen. Follow recommendations outlined in NFPA 56 for fire and explosion prevention during cleaning and purging of flammable gas piping systems.

For vessels, pressure purging several times is usually most efficient. For piping, a sweep purge most quickly eliminates residual methyl chloride vapors. **Under no circumstances should compressed air be used to purge methyl chloride.** The use of air for removal of the residual methyl chloride could create a flammable situation of methyl chloride vapors in air mixture.

After residual methyl chloride vapors have been cleared, security blinds that provide isolation during maintenance work must be installed in all connections vessels or piping to be opened. If piping or equipment contains materials other than methyl chloride, clearing procedures for those materials should be carried out after the methyl chloride has been removed. Extra precautions may be necessary where methyl chloride has been absorbed into sludge, catalysts or other materials that may be present in the equipment or piping.

Steaming is not recommended for clearing residual methyl chloride. While steaming effectively removes methyl chloride, some internal corrosion could occur.

If steam is required to clear materials other than methyl chloride, the methyl chloride should be purged first. Before the equipment or piping is put back into service, it must be completely dried.

Vessel Entry - Entry into any confined space must be done in accordance with proper entry procedures as required by 29 CFR 1910.146. Vessels which have contained methyl chloride must be thoroughly purged with dry nitrogen and absolutely isolated from all other equipment and piping before entry is allowed. The vessel must be checked to make sure all residual chemicals have been removed and then ensured there is an acceptable oxygen-containing atmosphere inside the vessel before human entry. Furthermore, some method of forced ventilation throughout the vessel must be provided when working inside the vessel.

If portable lighting is required, it must be low-voltage (maximum 12 volts) or connected to a tested GFI-protected circuit. All power-driven devices (such as agitators and feeders) must be electrically locked out. Hydraulically driven devices must be fully disconnected from their fluid driving source.

Welding - Flame cutting or welding equipment in methyl chloride service should not be performed until all chemical residue is removed and purging is verified by appropriate testing devices. Standard combustible gas detectors can be used if they have been calibrated for methyl chloride.

Pumps, Receivers and Drums - Process equipment must remain isolated with security blinds until all maintenance work is complete. If equipment must be removed for maintenance, the disconnected piping must be blind flanged until work is complete, and the equipment returned to service.

During any maintenance, all parts (including gaskets, shims or other internal materials) must be checked to ensure the material is compatible with methyl chloride at the anticipated service pressures and temperatures. All equipment and piping returned to service following maintenance or inspection must be pressure tested for leaks and purged with dry nitrogen to remove moisture and oxygen. The oxygen end point for returning equipment to methyl chloride service should be less than one percent by volume.

SHIPPING

Shipping Containers - Methyl chloride is classified by DOT as a flammable gas (UN 1063). OxyChem ships methyl chloride in rail tank cars and dedicated tank trailers.

Figure 5: Typical Methyl Chloride trailer

Tank Trailers - OxyChem's dedicated methyl chloride tank trailers are designed to DOT specification MC-331 and come with either side unloading or rear unloading. Customer-furnished pumps or methyl chloride vapor compressors are required for unloading. Net weight of methyl chloride carried aboard a tank trailer is approximately 40,000 pounds.

Figure 6: Side Connections

Methyl chloride trailers are equipped with two 20-foot sections of two-inch hose with 3¼ inch brass hammer-type female fittings that can be connected to any of the trailer's vapor and liquid outlets. The hose is rated at 300 psig test pressure and 250 psig working pressure. Methyl chloride trailers are also equipped with two 250 psig pressure relief valves, a liquid excess flow valve that shuts off at a flow of 298 gallons/minute and a vapor excess flow valve that shuts off at a flow of 179 gallons/minute.

The tank trailers are also equipped with two emergency trip levers, one located at the front of the trailer and the other at the rear, which can be pulled to close the liquid outlet valve and the vapor inlet valve.

Tank Cars - OxyChem tank cars are built and insulated to DOT specification 105J300W. Tank cars are available in 25,000gallon capacities.

All connections to methyl chloride railcars are located inside the tank car protective housing (see Figure 7). These connections include two 2" liquid outlet valves and one 2" vapor valve along with a pressure relief valve, a thermowell and a sample valve. The vapor and liquid valves are equipped with 2" IPT female threaded connections. All valves are equipped with excess flow devices that shut off at a flow of 260 gallons/minute. The pressure relief valve is set to discharge at 250 psig.

In addition, OxyChem tank cars are equipped with a magnetic level gauge which operates in the top 50 percent of the tank. **According to 49 CFR 173.314, these cars can be loaded to 99% of the total water capacity of the tank car.**

UNLOADING PROCEDURES

Although methyl chloride may be unloaded from shipping containers using either a pump or a compressor, compressor unloading is recommended for most installations. Regardless of the method chosen, the shipping container and storage vessel should become a closed system to ensure no methyl chloride is released to the environment during unloading. Before unloading, all piping, including the unloading hose, must be purged and pressure tested with nitrogen to ensure there are no leaks. This nitrogen purge also removes oxygen and other contaminants in the piping. Unloading by use of nitrogen pressure is not recommended as it will introduce high nitrogen levels into the methyl chloride product.

DOT Regulations for tank car unloading (49 CFR 174.67(i)) require that throughout the entire period of unloading, and while the tank car is connected to an unloading device, the tank car must be attended by the unloader or monitored by a signaling system (video system, sensing equipment, or mechanical equipment) that is observed by a designated hazmat employee located either in the immediate area of the tank car or at a remote location within the facility, such as a control room.. If it is necessary to discontinue unloading a tank car for any reason, all valves must be tightly closed and unloading connections disconnected. This is intended to assure that the flow of methyl chloride from the tank car is carefully controlled, and the tank car can quickly be shut off should problems in unloading develop. Letters of clarification from DOT indicate that "attending" the unloading includes the flow of methyl chloride can be stopped if unloading difficulties develop.

However, there are some additional unloading requirements established for tank trailers designed to minimize the likelihood of uncontrolled product releases. These regulations (49 CFR 177.840(q)) require that an attendant remain within 25 feet of the tank trailer during the unloading operation, and have an unobstructed view of the tank trailer and delivery hose to the maximum extent practicable.

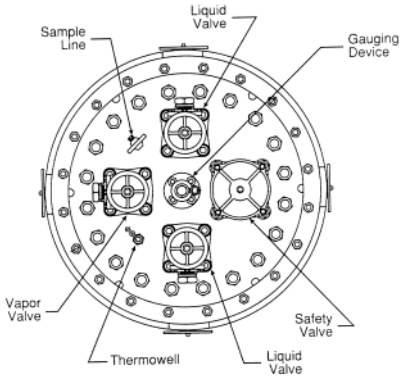


Figure 7: Typical Valve Arrangement
(Liquid valves are parallel to the length of the tank car)

Pump Unloading - Pump suction is connected to the container's liquid outlet and pump discharge is connected to the storage tank (see Figure 8). Compressor unloading is the preferred method.

The storage tank vapor space is piped back to the container vapor inlet. With the pump in operation, the vapor line equalizes pressure between the storage tank and the shipping container and allows the pump to operate at minimum discharge pressure.

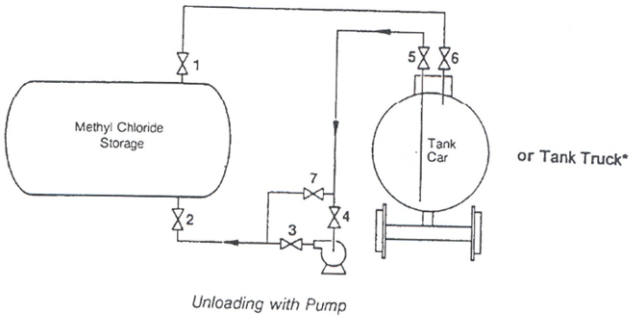


Figure 8: Pump Unloading Diagram

Step 1: **If storage pressure exceeds tank car pressure,** open valves 1 and 6 to equalize pressure.
If tank car pressure exceeds storage, open valves 5, 7 and 2. Valves 3, 4, 6 and 1 should be closed. Flow liquid until pressure equalizes.

Step 2: Open valves 1, 6, 4, 5 and 2. Close valve 7. Start pump and slowly open valve 3. Check level in storage.

Step 3: When unloading is complete, close valve 3 and stop pump. Close 1, 5, 6, 2 and 4. Valve 7 should be closed. Purge all lines with dry nitrogen to vent system. Disconnect shipping container.

Step 4: Reinstall all shipping plugs.

Note: Valves 5 and 6 are tank car valves. Only minimum valves and no instrumentation is shown.

Depending on the pump's capacity, the discharge valve may be throttled to prevent flashing of liquid in the suction line to the pump or to prevent setting the excess flow check valves. A pump will not remove vapor remaining in the shipping container. Figure 13 illustrates a more comprehensive pump unloading and transfer process and instrument drawing (P&ID), including a priming drum located adjacent to the pump.

Compressor Unloading - Using a compressor to unload a shipping container displaces the liquid going to the storage tank with methyl chloride vapor (see Figure 9). This is the preferred method of unloading. The liquid outlet of the tank car or truck is piped to the storage tank liquid inlet. Compressor suction is piped to the storage vessel's vapor outlet while the compressor discharge is connected to the shipping container's vapor inlet. A pressure differential of 10 to 15 psig is maintained during unloading. Depending on the compressor's capacity, the discharge valve may be throttled to prevent setting the excess flow check valves.

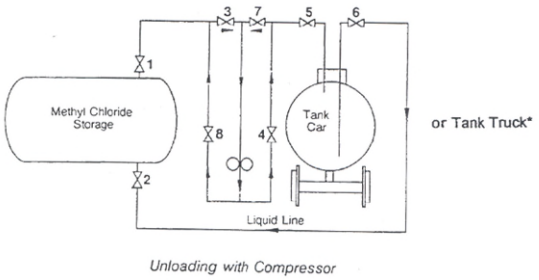


Figure 9: Compressor Unloading Diagram

Step 1: **If storage pressure exceeds tank car pressure,** open valves 1, 3, 7 and 5. Close valves 4 and 8 to equalize pressure.
If tank car pressure exceeds storage, open valves 2 and 6 to flow liquid until pressure equalizes.

Step 2: Open valves 1, 3, 4 and 5. Close valves 7 and 8. Start compressor. Open valves 2 and 6 slowly and maintain differential pressure until all liquid is transferred.

Step 3: After liquid is unloaded, close valve 2 and open valve 1, 7, 8 and 5. Close valves 3 and 4. When tank car pressure falls to 10 psig, stop compressor. Close valves 5, 6, 1, 7 and 8.

Step 4: Reinstall all shipping plugs and reverse DOT placards.

Note: Valves 5 and 6 are tank car valves. Only minimum valves and no instrumentation is shown.

After the liquid is unloaded, compressor suction is switched to the shipping container and the vapor is removed from the car or truck and piped to the storage tank. During this step, all liquid valves must be closed. Never allow pressure in the shipping container to fall below 10 psig. During unloading, emergency equipment should be readily available, and personnel trained in its use should be in attendance at all times. After unloading is complete, all valve plugs must be reinstalled and tightened, and the dome cover secured for the return trip. Figure 12 on page 16 illustrates a more

comprehensive compressor unloading and transfer facility P&ID.

SPILLS AND PRECAUTIONS

Methyl chloride is classified as a Division 2.1, flammable gas under US Department of Transportation regulations. The appropriate DOT identification number is UN1063.

Methyl chloride is generally stable when dry. In the presence of moisture, methyl chloride hydrolyzes to form corrosive hydrochloric acid. Hydrochloric acid attacks most metals and forms hydrogen gas, which is explosive.

Methyl chloride reacts with aluminum to form trimethyl aluminum, a pyrophoric material. Methyl chloride creates an explosive mixture on contact with magnesium, sodium and other alkali metals; in contact with sodium-potassium alloys, it is impact sensitive and may result in an explosion. Methyl chloride also attacks natural rubber.

At room temperature and pressure, methyl chloride is stable in contact with air. At high temperatures, decomposition occurs. Avoid contact with flames or extremely hot surfaces. When burned in air, methyl chloride forms hydrogen chloride and phosgene, both of which are extremely hazardous.

SPILLS

After evacuating the area, stop the gas flow. If a fire occurs, it should not be extinguished until the leak is isolated and stopped**. Escaping unburned methyl chloride is potentially explosive**. Once the gas flow has been stopped, dry chemical, CO_2 and water fog can be used to extinguish the fire. Water spray can be used to cool adjacent equipment, disperse vapors and absorb hazardous decomposition products.

The National Response Center (800-424-8802) must be notified of any uncontained releases to the environment in excess of the Reportable Quantity (100 lbs.). Local, state, and Federal regulations concerning the reporting of methyl chloride releases must be followed.

Facilities expecting employees to engage in emergency response must develop an emergency response plan as specified by OSHA in 29 CFR 1910.1200. Where employees are not expected to assist in handling emergencies, an emergency plan is not required. However, in this case an emergency action plan in accordance with 29 CFR 1910.38(a) is required.

TECHNICAL DATA

PRODUCT SAMPLING

All methyl chloride sampling should be done in DOT specification stainless steel pressure sampling cylinders using a closed loop system (see Figure 9). Closed loop sampling can be done almost anywhere in the system where a pressure differential exists, such as around control valves, pumps, vent systems or relief valves.

All sample cylinders should be equipped with relief valves and one end should have an internal dip tube about four (4) inches into the end of the 500 cc container. The dip tube end must be marked and positioned at the top when sampling. The dip tube prevents liquid from completely filling the bomb, which could rupture the container.

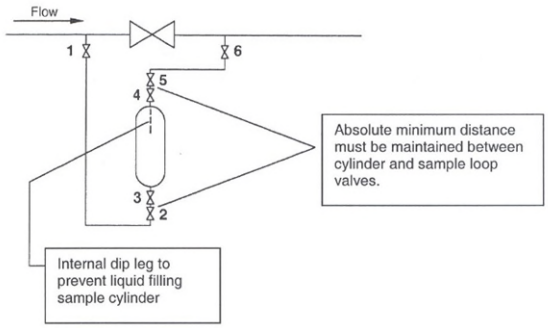


Figure 10: Typical Closed Loop Sampling

Step 1: Connect cylinder inlet and outlet.
Step 2: Open valves 1, 2, 3, 4, 5 and 6.
Step 3: After cylinder fills, continue flow to ensure representative sample from line.
Step 4: Close sample cylinder valves 3 and 4.
Step 5: Close valves 2 and 5.
Step 6: Close valves 1 and 6.
Step 7: Slowly disconnect sample cylinder.

PHYSICAL PROPERTIES

Some of the physical properties of methyl chloride are listed. Liquid density and vapor pressure curves are included in Figures 10 and 11, respectively.

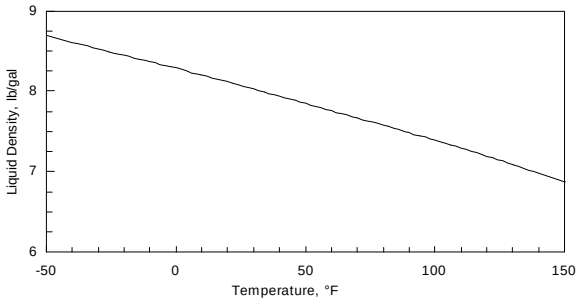


Figure 10: Methyl Chloride Liquid Density

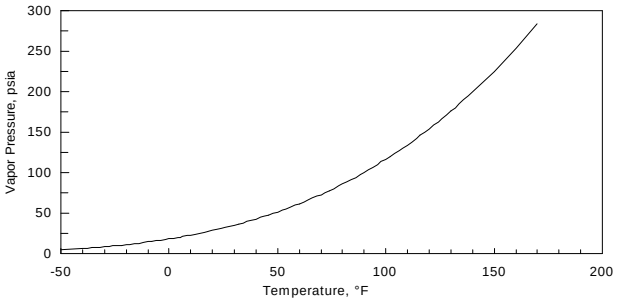


Figure 11: Methyl Chloride Saturated Vapor Pressure

Boiling Point, at 1 atm	-10.7°F
Solubility, vol. gas/vol. water	2.2 @ 68°F
Specific Gravity, 20/4°C	0.92
Vapor Density, air=1	1.8
Vapor Pressure, mm Hg	3600 @ 68°F (54.9 psig)

Sensitivity to Static Discharge: Electrostatic charges may build up during handling and may form ignitable vapor-air mixtures in storage containers. Ground equipment in accordance with industry standards and best practices such as NFPA 77 [Recommended Practices on Static Electricity (2007)] and American Petroleum Institute (API) RP Recommended Practice 2003 [Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents (2008)].

Lower Flammability Level (air): 8.1 %
Upper Flammability Level (air): 17.4 %
Flash point: -49.9 F (-45.5 C) (OC)
Autoignition Temperature: 1170 F (632.2 C)

Figure 12: Unloading and Transfer by Compressor Facility Process & Instrument Drawing

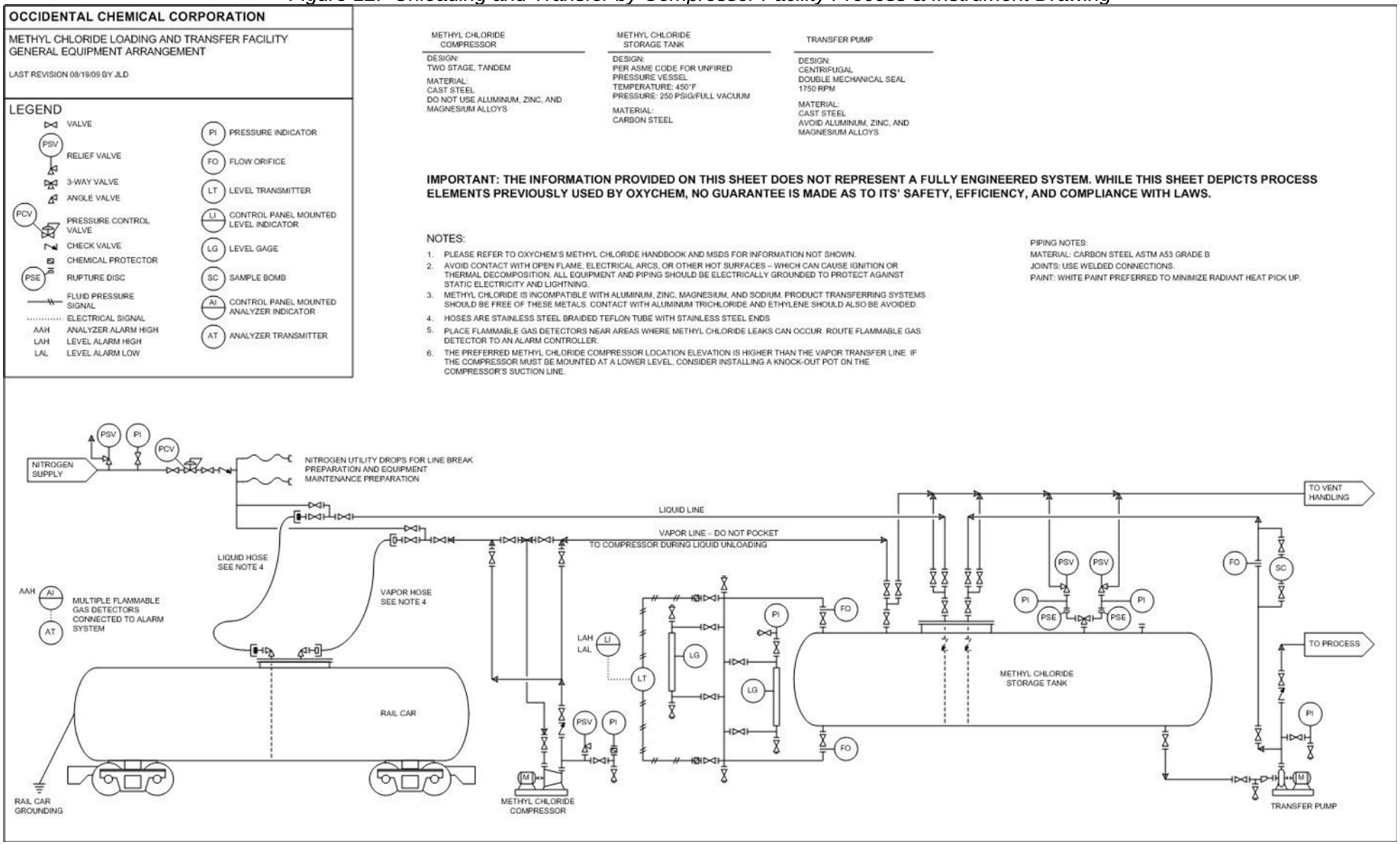


Figure 13: Unloading and Transfer by Pump Facility Process & Instrument Drawing

OCCIDENTAL CHEMICAL CORPORATION

METHYL CHLORIDE LOADING AND TRANSFER FACILITY
GENERAL EQUIPMENT ARRANGEMENT

LAST REVISION 08/19/09 BY JLD

LEGEND

- VALVE
- PSV — RELIEF VALVE
- 3-WAY VALVE
- ANGLE VALVE
- PCV — PRESSURE CONTROL VALVE
- CHECK VALVE
- CHEMICAL PROTECTOR
- PSE — RUPTURE DISC
- FLUID PRESSURE SIGNAL
- ELECTRICAL SIGNAL
- AAH — ANALYZER ALARM HIGH
- LAH — LEVEL ALARM HIGH
- LAL — LEVEL ALARM LOW
- PI — PRESSURE INDICATOR
- FO — FLOW ORIFICE
- LT — LEVEL TRANSMITTER
- LI — CONTROL PANEL MOUNTED LEVEL INDICATOR
- LG — LEVEL GAGE
- SC — SAMPLE BOMB
- AI — CONTROL PANEL MOUNTED ANALYZER INDICATOR
- AT — ANALYZER TRANSMITTER

UNLOADING PUMP

DESIGN:
SEALLESS CENTRIFUGAL
WITH DRY CUT-OFF
1750 RPM

MATERIAL:
CAST STEEL
AVOID ALUMINUM, ZINC, AND
MAGNESIUM ALLOYS

METHYL CHLORIDE STORAGE TANK

DESIGN:
PER ASME CODE FOR UNFIRED
PRESSURE VESSEL
TEMPERATURE: 450°F
PRESSURE: 250 PSIG/FULL VACUUM

MATERIAL:
CARBON STEEL

TRANSFER PUMP

DESIGN:
CENTRIFUGAL
DOUBLE MECHANICAL SEAL
1750 RPM

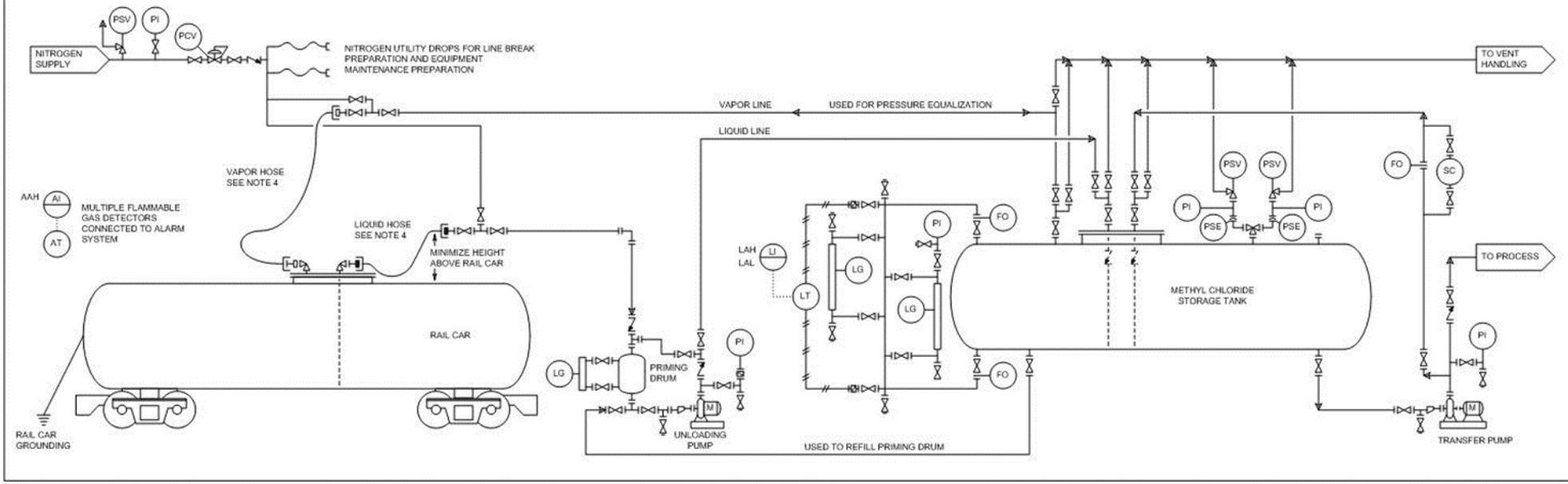
MATERIAL:
CAST STEEL
AVOID ALUMINUM, ZINC, AND
MAGNESIUM ALLOYS

IMPORTANT: THE INFORMATION PROVIDED ON THIS SHEET DOES NOT REPRESENT A FULLY ENGINEERED SYSTEM. WHILE THIS SHEET DEPICTS PROCESS ELEMENTS PREVIOUSLY USED BY OXYCHEM, NO GUARANTEE IS MADE AS TO ITS' SAFETY, EFFICIENCY, AND COMPLIANCE WITH LAWS.

NOTES:

1. PLEASE REFER TO OXYCHEM'S METHYL CHLORIDE HANDBOOK AND MSDS FOR INFORMATION NOT SHOWN.
2. AVOID CONTACT WITH OPEN FLAME, ELECTRICAL ARCS, OR OTHER HOT SURFACES – WHICH CAN CAUSE IGNITION OR THERMAL DECOMPOSITION. ALL EQUIPMENT AND PIPING SHOULD BE ELECTRICALLY GROUNDED TO PROTECT AGAINST STATIC ELECTRICITY AND LIGHTNING.
3. METHYL CHLORIDE IS INCOMPATIBLE WITH ALUMINUM, ZINC, MAGNESIUM, AND SODIUM. PRODUCT TRANSFERRING SYSTEMS SHOULD BE FREE OF THESE METALS. CONTACT WITH ALUMINUM TRICHLORIDE AND ETHYLENE SHOULD ALSO BE AVOIDED.
4. HOSES ARE STAINLESS STEEL BRAIDED TEFLON TUBE WITH STAINLESS STEEL ENDS
5. PLACE FLAMMABLE GAS DETECTORS NEAR AREAS WHERE METHYL CHLORIDE LEAKS CAN OCCUR. ROUTE FLAMMABLE GAS DETECTOR TO AN ALARM CONTROLLER.
6. THE PREFERRED METHYL CHLORIDE COMPRESSOR LOCATION ELEVATION IS HIGHER THAN THE VAPOR TRANSFER LINE. IF THE COMPRESSOR MUST BE MOUNTED AT A LOWER LEVEL, CONSIDER INSTALLING A KNOCK-OUT POT ON THE COMPRESSOR'S SUCTION LINE.

PIPING NOTES:
MATERIAL: CARBON STEEL ASTM A53 GRADE B
JOINTS: USE WELDED CONNECTIONS.
PAINT: WHITE PAINT PREFERRED TO MINIMIZE RADIANT HEAT PICK UP.



FURTHER INFORMATION

More detailed information on OxyChem methyl chloride or any specific applications is available on request through the OxyChem Technical Service Department.

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