VINYL CHLORIDE MONOMER

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The Dow Chemical Company
Midland, Michigan

Coatings Technical Service

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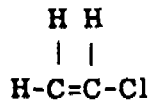
VINYL CHLORIDE MONOMER

I. INTRODUCTION

A. Name

Vinyl Chloride
Vinyl Chloride Monomer
Chloroethylene
Chloroethene

B. Structural Formula



C. General Characteristics

At room temperature pure vinyl chloride monomer is a colorless gas with a faintly sweet odor. It contains a reactable aliphatic double bond which permits it to polymerize quite readily. This monomer is mildly toxic; prolonged or repeated exposures to vapor concentrations of over 500 p.p.m. are not recommended; high concentrations cause anesthesia. The greatest hazards encountered in the use and handling of this monomer are the dangers of fire and explosion. The flash point is -78°C. (-108°F.) with explosion limits from 4% to 22% by volume in air.

Vinyl chloride monomer is sold, shipped and stored in the form of a liquid under pressure (B.P. = -13.37°C.). It ranks with styrene and butadiene monomers in commercial importance.

II. PROPERTIES

A. Physical Properties and Constants of Pure Vinyl Chloride

The following table contains the latest information available on the properties of vinyl chloride. Some properties are the results of Dow laboratories while others are calculations and/or estimations from the most reliable sources available.

1.	Molecular weight[1]*	62.501
2.	Boiling point (760 mm)[1]	-13.37°C. (+7.93°F.)
3.	Freezing point[1]	-153.79°C. (-244.82°F.)
4.	Odor (pure vinyl chloride)	Faint sweet odor
	(commercial)	Faint phenolic odor (due to inhibitor)
5.	Color	Colorless
6.	Corrosivity	Noncorrosive when dry at atmospheric temperatures. Acetylene impurities in commercial product reacts with copper.
7.	Flash point, Cleveland open cup[2]	-78°C. (-108°F.)
8.	Explosion box[2]	-78°C. (-108°F.)
9.	Explosive limits in air[2]	4 - 22% by volume
10.	Liquid density[1] -20°C.	0.98343 g./ml. (8.207 lb./gal.)
	-25°C.	0.99176 g./ml. (8.276 lb./gal.)
	-30°C.	0.99986 g./ml. (8.343 lb./gal.)

(See Density Chart Fig. 1)

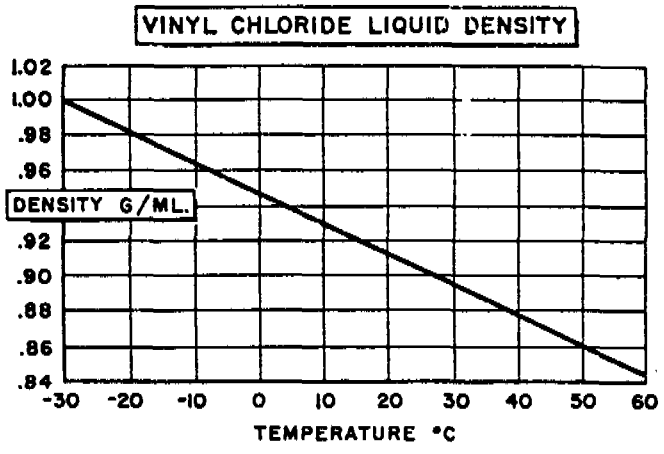


Fig. 1

*See references page 7.

11. Density change with temperature[1] (between -30°C. & -20°C.) — Approximately 0.00164 g./ml./°C.

12. Viscosity[1 & 2]

at -10°C.	0.248 centipoise
-20°C.	0.274 centipoise
-30°C.	0.303 centipoise
-40°C.	0.340 centipoise

(See Viscosity Chart Fig. 2)

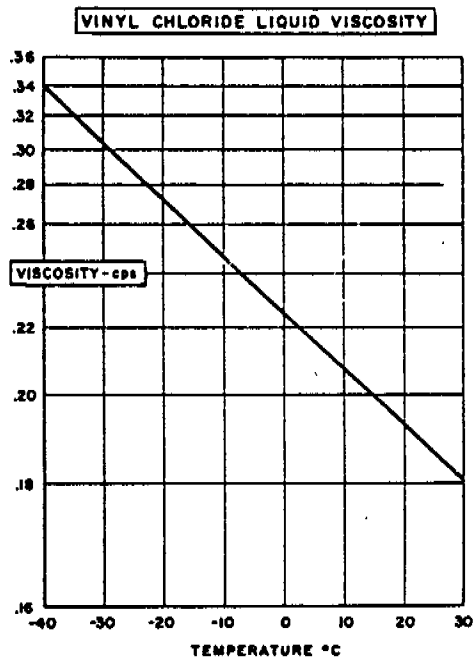


Fig. 2

. Surface Tension[1 & 2]

at -10°C.	20.88 Dyne per cm.
-20°C.	22.27 Dyne per cm.
-30°C.	23.87 Dyne per cm.

(See Surface Tension Chart Fig. 3)

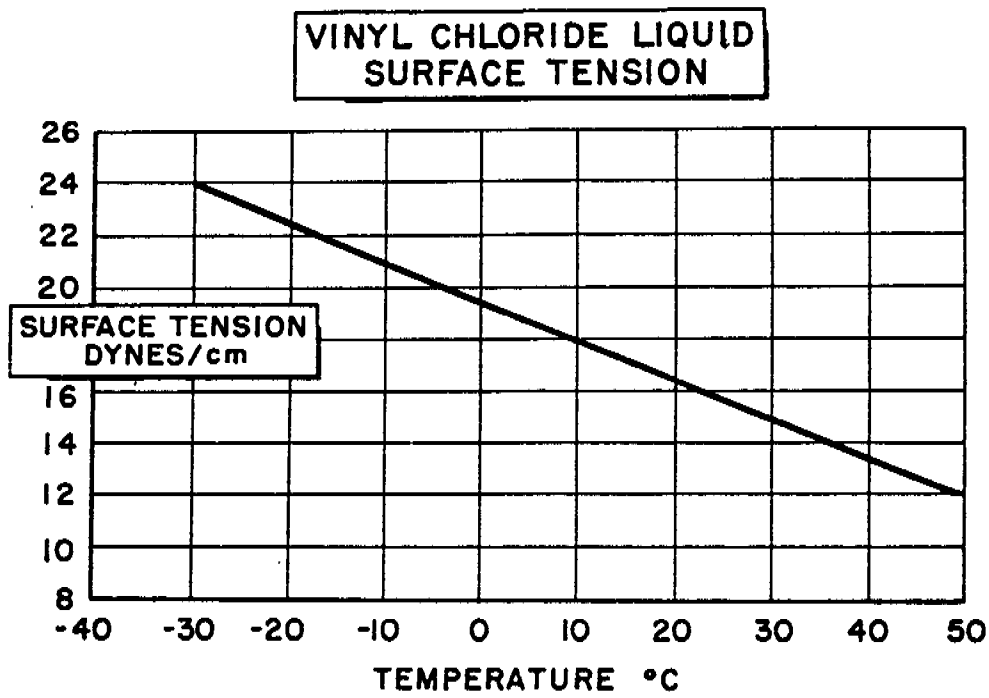


Fig. 3

14. Refractive index, D-Line[2] at 15°C. 1.398 calc'd

15. Vapor pressure[1] at 25°C. 2660 mm. Hg

-13.37°C.	760 mm.
(t_e) -15.76°C.	692.3 mm.
-55.8°C.	100 mm.
-73.9°C.	30 mm.
-87.5°C.	10 mm.
-109.4°C.	1 mm.

(See Vapor Pressure Chart Fig. 4)

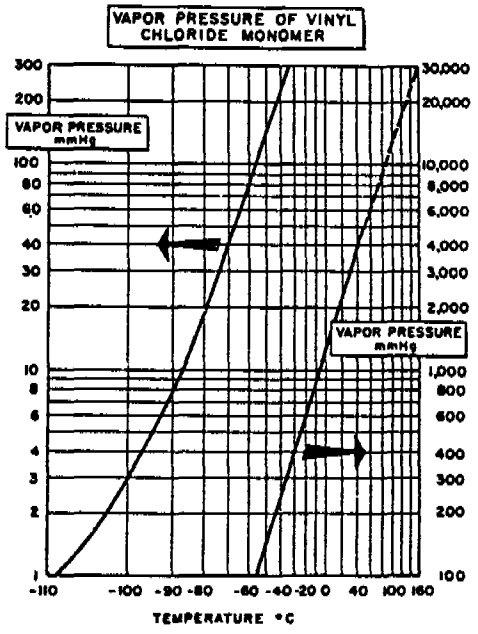


Fig. 4

16. dt/dp Change in b.p. with press[1]

at 25°C.	0.01355°C. per mm. Hg
B.P. (-13.37°C.)	0.03423°C. per mm. Hg
(t_e) -15.76°C.	0.03675°C. per mm. Hg

17. Specific heat of liquid[2] — 0.38 cal./g./°C. or B.T.U./lb./°F.

18. Specific heat of vapor Cp[2] at 25°C. — 12.83 cal./g.mol/°C. or B.T.U./lb.mol/°F.

19. Specific heat of vapor Cv[2] at 25°C. — 10.84 cal./g.mol/°C. or B.T.U./lb.mol/°F.

20. $\gamma = Cp/Cv$[2] — 1.183

21. Latent heat of vaporization* at 25°C.[1]		71.26 cal./g. (128.27 B.T.U./lb.)
	-13.37°C.	79.53 cal./g. (143.15 B.T.U./lb.)
22. Latent heat of fusion[1]		18.14 cal./g. (33.12 B.T.U./lb.)
23. Heat of formation (estimated)[2]		-120 cal./g. (-216 B.T.U./lb.)
24. Heat of polymerization (estimated)[3]		-272 cal./g. (-490 B.T.U./lb.)
25. Critical temperature, T_c[1]		156.5°C. (313.7°F.)
26. Critical pressure, P_c[1]		42000 mm. Hg (55.2 Atm.)
27. Critical volume, V_c[1]		2.70 ml./g.
28. Critical density, D_c[1]		0.370 g./ml.
29. Volumetric shrinkage upon polymerization		Approximately 35%
30. PV/RT[1]	at 156.5°C.	0.264
	25°C.	0.9178
	-13.37°C.	0.9640
	(t_e) -15.76°C.	0.9652
	-73.90°C. (30 mm. Hg)	1.000
31. Dielectric constant at frequency of 10^5 [1] and 17.2°C.		6.26

32. Solubilities. Sol. in CCl_4, ether, ethanol, and most organic solvents. Solubility of water in vinyl chloride = 0.11%.

33. t_e = Temperature at which a mole of vapor in equilibrium with the liquid occupies 22.414 liters -15.76°C.

34. Infrared absorption spectra[2] - See Figure 5.

*All heat terms are defined according to the "Lewis & Randall" nomenclature. A negative value (ΔH_f = -120 cal./g.) indicates that heat is evolved.

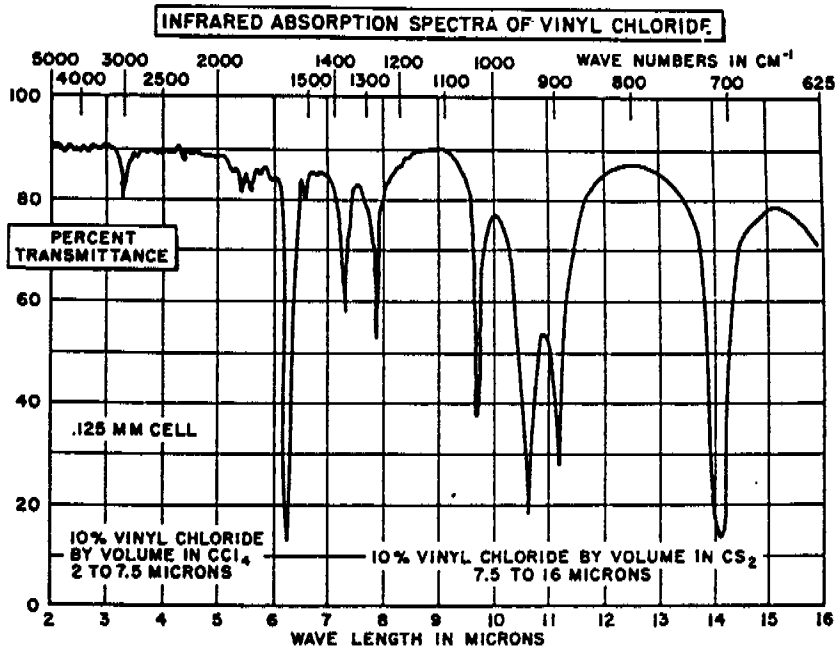


Fig. 5

35. References:

1. Dreisbach, R. R., The Dow Chemical Company, unpublished data.

2. The Dow Chemical Company, unpublished data.

3. Roberts, D. E., Journal of Research of N.B.S., volume 44, p. 221 (March, 1950)

III. HAZARDS AND THEIR CONTROL*

A. Health

The following statements on health hazards are as complete as our information permits. The precautions for safe handling and use are necessarily general in nature since detailed recommendations can be made only for the specific exposures and circumstances of each individual use.

*Proposed M.C.A. Chemical Safety Data Sheet for Vinyl Chloride Monomer.

Present toxicological information indicates that vinyl chloride exhibits a low order of toxicity, but when present in sufficiently high vapor concentrations it has an anesthetic action. Vapor concentrations in work areas should be kept below 500 p.p.m. for eight hour exposure periods. Concentrations of greater than 500 p.p.m. may cause warning symptoms of dizziness, disorientation, and disturbances of equilibrium and coordination similar to drunkenness. Vapor concentrations approaching the lower explosive limit may cause helplessness and unconsciousness on very short exposure.

Pure vinyl chloride has a weak sweet odor, while the commercial product has a faint phenolic odor due to the presence of the phenol inhibitor.

Uninhibited monomer on the skin is not absorbed, but may cause local irritation, frostbite, or freezing because of the rapid vaporization. Inhibited vinyl chloride on the skin may also cause local burns due to the presence of the phenol inhibitor. Any skin area splashed by liquid monomer should be washed with generous amounts of water. A liquid monomer splash in the eyes should be washed with water for at least 15 minutes and the patient placed in the hands of a physician. If after 15 minutes signs of tissue damage to the eyes are still apparent the washing should continue.

Clothes or bandages wet with the monomer should be removed immediately to prevent phenol burns or the refrigeration effect caused by the absorbed vinyl chloride. Contamination by inhibited monomer should always be treated in the same manner as phenol contamination.

Anyone displaying evidence of vinyl chloride intoxication should be put at rest in an uncontaminated atmosphere. If confined in an atmosphere of high concentration where escape is impossible, deep anesthesia is possible. In such an instance, the patient should be placed at bed rest, preferably with the head slightly lower than the feet. If respiration has ceased, artificial respiration should be given. In either case medical attention should be obtained immediately.

B. Fire and Explosion

Far more important than any other hazards are the dangers of fire and explosion from vinyl chloride vapor. The vapors form explosive mixtures with air in concentrations of 4% to 22% by volume at all temperatures down to -78°C. (-108°F.). Precautions must be taken to keep vinyl chloride enclosed and to eliminate all sources of ignition. Fires involving large quantities of liquid monomer are practically impossible to extinguish. Small fires may be extinguished with CO_2 or dry chemicals if properly applied.

Diking and drainage should be provided for confining and disposing of the liquid monomer in case of tank ruptures or spills. In case of storage tank fires, the fire should be confined to the drainage area, if possible, and the metal structures and surface of the tank kept as cool as possible with a water spray. A direct stream of water on burning vinyl chloride liquid intensifies the fire.

It is of paramount importance that all open flames, local hot spots, friction, spark producing equipment and static electricity be strictly avoided when handling vinyl chloride monomer.

C. Spills and Leakage

If spills or leaks occur, all sources of ignition must be removed from the area immediately and only properly protected personnel should remain in the area. Spills, unless very large, usually evaporate rapidly, but ample ventilation must be provided to prevent the accumulation of toxic or explosive mixtures. Spills and leaks must not be allowed to enter the sewer system because of the explosion hazard involved. An approved flammable gas indicator can be used in testing for vinyl chloride leaks.

Clothing and shoes contaminated with vinyl chloride spills should be removed immediately and the body washed thoroughly to remove any material which may have penetrated to the skin. Clothing and shoes should not be worn again until free of vinyl chloride and inhibitor.

At the site of leaks, the phenol inhibitor in vinyl chloride may accumulate by evaporation of monomer and reach sufficient concentration to cause local burns of the skin. In case of such accumulation of inhibitor, the area should be thoroughly hosed down with water after all traces of monomer have evaporated. In event of contact with the phenol, the person should immediately be washed with generous amounts of water and medical aid summoned.

D. Special Personal Protective Equipment

Self-contained breathing apparatus or air- or oxygen-supplied masks equipped with full face pieces and approved by the U. S. Bureau of Mines for this purpose, should be used under the following conditions:

1. In emergencies, when the vapor concentration is not definitely known.
2. When the vinyl chloride concentration is greater than 2% by volume.
3. When the oxygen content of the air may be less than 16% by volume.
4. When the exposure period is to be over 30 minutes duration.
5. In tank and equipment cleaning and repair work under conditions outlined in 1, 2, 3 and 4.

Industrial canister type masks, equipped with full face piece and approved by the U. S. Bureau of Mines, fitted with the proper canister for absorbing vinyl chloride vapor,

will afford protection against concentrations known not to exceed 2% by volume when the oxygen content of the air is greater than 16% by volume. In all other cases a self-contained breathing apparatus or air- or oxygen-supply mask should be used.

Chemical cartridge respirators approved by the U. S. Bureau of Mines may be used to avoid inhaling disagreeable but harmless concentrations of vinyl chloride vapor for short periods of time.

E. Employee Education and Training

All personnel in areas where vinyl chloride liquid or vapor may be present should be thoroughly indoctrinated. Safety in use of vinyl chloride depends in large part upon safe practices in handling the monomer. Only reliable, properly trained personnel should be given the responsibility of controlling the flow of monomer to and from cylinders, tank cars, tanks and reactors. In addition, each person in a vinyl chloride area should know the location and use of personal protective equipment, fire fighting equipment, alarms, evacuation signals, safety showers and first aid measures.

IV. TRANSPORTATION*

A. Containers

Vinyl chloride monomer is shipped in ICC approved cylinders and tank cars designed to carry liquefied gases under pressure. Some types of tank cars are ICC-106A500, ICC-106A500X, ICC-105A300 and ICC-105A300W. The usual cylinder is ICC-4B300 (without brazed seams) with a capacity of 250 pounds. All parts of valves, safety devices, tank cars, cylinders, etc., must be of a metal or other material which will not cause the formation of explosive acetylides.

Each shipping container must bear the ICC red label for a flammable compressed gas. The Manufacturing Chemists' Association recommends the following in addition to, or in combination with, any label, warnings or other statements required by statute, regulations or ordinances.

VINYL CHLORIDE

DANGER: EXTREMELY FLAMMABLE
HIGHLY VOLATILE

Keep away from heat, sparks and open flames.
Keep container closed.
Use with adequate ventilation.
Avoid prolonged breathing of vapor.

*Proposed M. C. A. Chemical Safety Data Sheet for Vinyl Chloride Monomer.

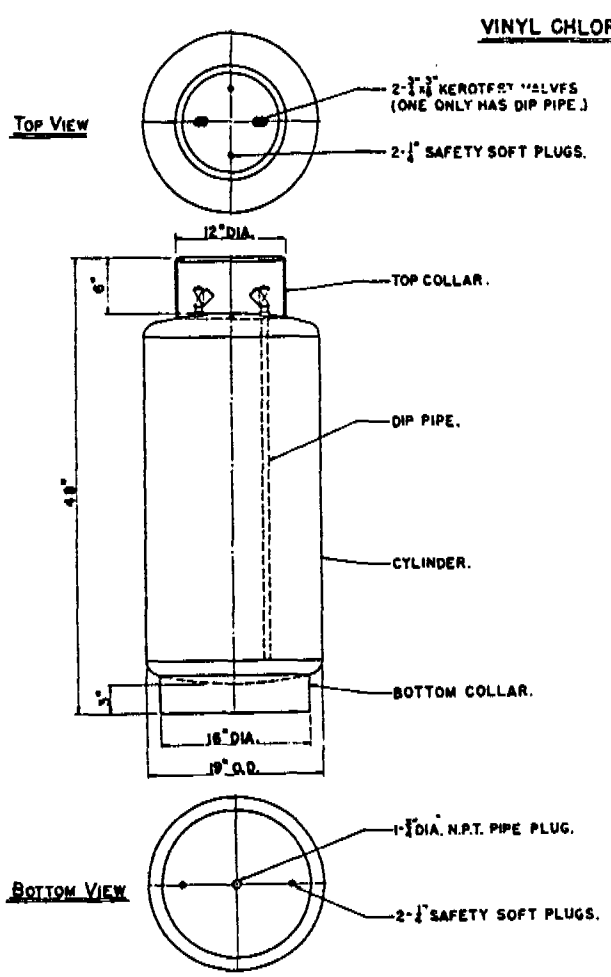
Tank cars and railroad cars carrying one or more containers of vinyl chloride must bear the ICC "DANGEROUS" placard.

B. Unloading Cylinders and Tank Cars

1. Cylinders

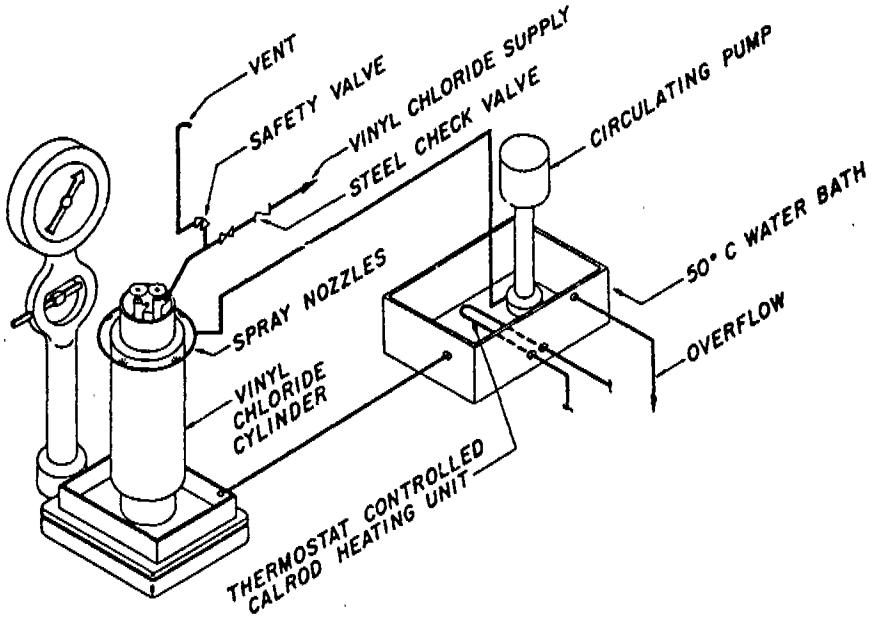
PRECAUTION! Never allow air to enter a vinyl chloride cylinder.

See Figures 6 and 7 for cylinder dimensions and a recommended unloading system.



1. CONFORMS TO ICC 48 300.
2. WORKING PRESSURE = 100 PSI.
3. TARE WT. 216 LBS.
   NET WT. 250 LBS.
   GROSS WT. 466 LBS.
   } AVG.
4. VALVES ARE "CYLINDER VALVE, ¾ x ¾, IRON, NO. 200 A 03 E" FURNISHED BY KEROTEST MFG CO., 2525 LIBERTY AVE., PITTSBURG 22, PA. (¾ NPT MALE THREAD SCREWS INTO CYLINDER; ¾ NPT FEMALE THREAD RECEIVES FITTING FOR LOADING OR UNLOADING.)
5. SOFT PLUGS, ALSO FURNISHED BY KEROTEST, ARE "TYPE T 11 S, ¼" MALE THREADS, IRON, TIN DIPPED."
6. DIP PIPE VALVE IS MARKED WITH AN X ON VALVE STEM.
7. COLOR - ALUMINUM & BLACK.

Fig. 6



VINYL CHLORIDE CYLINDER UNLOADING STATION

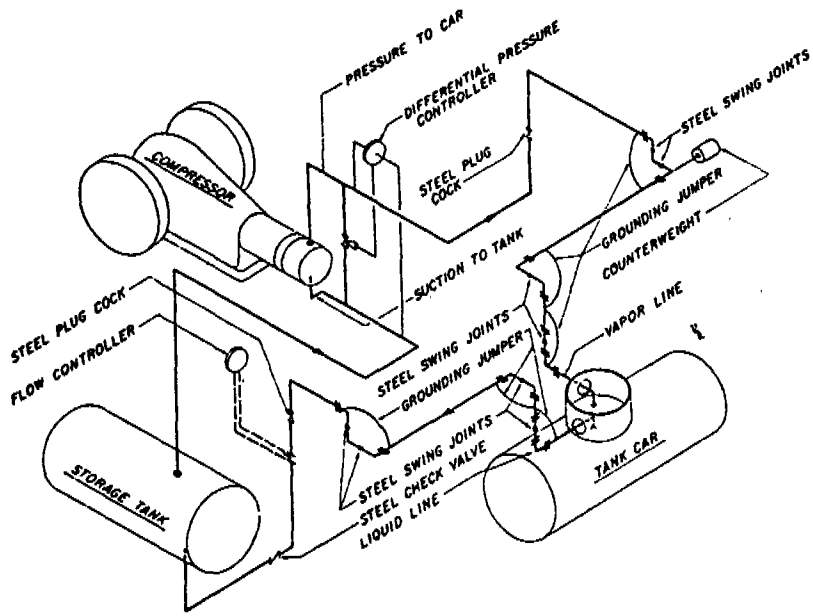
Fig. 7

Cylinders should be emptied through the dip pipe while in an upright position. A water bath heated to a maximum of 50°C. (122°F.) may be used to empty the cylinder by means of the monomer vapor pressure. Check valves must be installed in the feed lines from the cylinder to prevent reactants from entering the cylinder. When the cylinder is empty, the valves should be closed. Air should never be allowed to enter the cylinder and no attempt should ever be made to mix gases or liquids in a cylinder. Monomer inventory in a cylinder should be determined by weight only.

Cylinders must not be filled except by or with the consent of the owner, and then only in compliance with ICC regulations.

2. Tank Cars

Detailed instructions for unloading tank cars containing flammable liquids may be found in MCA Manual Sheet TC-4 or ICC regulations, Sec. 74-560 to 74-563 inclusive. A diagram of a vinyl chloride tank car unloading station is shown in Figure 8.



VINYL CHLORIDE TANK CAR UNLOADING STATION

Fig. 8

No heat should ever be applied to a tank car containing vinyl chloride monomer. An inert gas or vinyl chloride gas may be used as a pressurizing medium to empty the car. Cylinder nitrogen may be used for this purpose or larger systems may have a suction line connected from the storage tank to a compressor which discharges vinyl chloride gas to the vent connection on the tank car. The pressure on the car is not to exceed the service pressure for which the car was designed. Positive vinyl chloride or inert gas pressure should be left in the tank car. In no case should air be allowed to enter the car.

Some tank cars are equipped with excess flow check valves that close if the discharge rate is too great. If this should occur, the outlet valve must be closed until the pressure is equalized and the excess flow valve opens.

C. Safety Precautions

1. Ground all cylinders, tank cars, tanks, piping, pumps and equipment.

2. Eliminate all sources of ignition in the area.

3. All piping from cylinders or tank cars to storage or reactors should contain check valves.

4. Do not allow air to enter cylinders or tank cars.

5. Do not heat tank cars.

6. Do not heat cylinders with anything but 50°C., (122°F.) or cooler, water baths.

V. STORAGE*

A. Safety Precautions

All vinyl chloride storage areas should be selected in accordance with local codes and authorities having jurisdiction. Assistance may be obtained from such organizations as the National Board of Fire Underwriters, Factory Insurance Association, or Associated Factory Mutual Fire Insurance Companies. All electrical equipment, motors, lights and flashlights used in an area where vinyl chloride is stored or handled should conform to the National Electrical Code for Hazardous Areas. All areas where the monomer is stored should be clearly posted as a hazardous area and the burning characteristics of the liquid clearly defined for the benefit of fire departments.

B. Cylinder Storage

Cylinders containing vinyl chloride should be stored in an upright position outside of buildings in an isolated and well ventilated area. It is preferable to store cylinders in the open, but they should be protected from the direct rays of the sun and from the accumulation of dirt, water, snow or ice on valves or safety devices.

C. Tanks and Tank Farms

Figures 9 and 10 illustrate one type of storage facility recommended for vinyl chloride monomer.

*Proposed M.C.A. Chemical Safety Data Sheet for Vinyl Chloride Monomer.

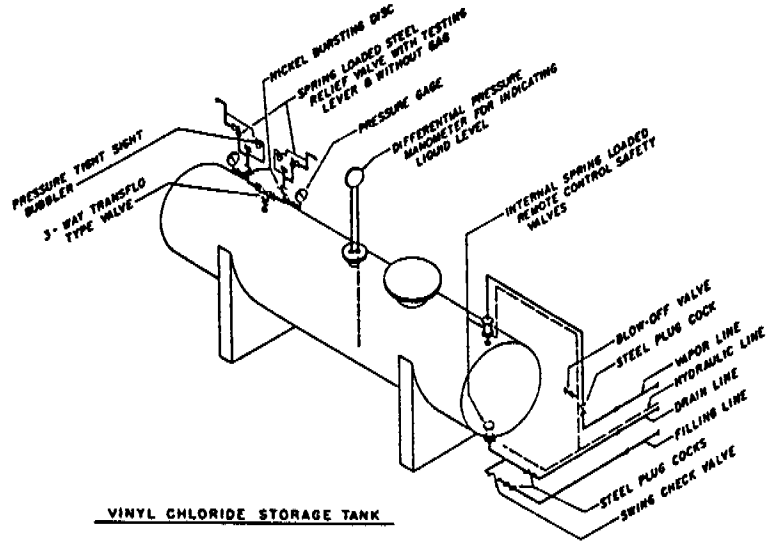
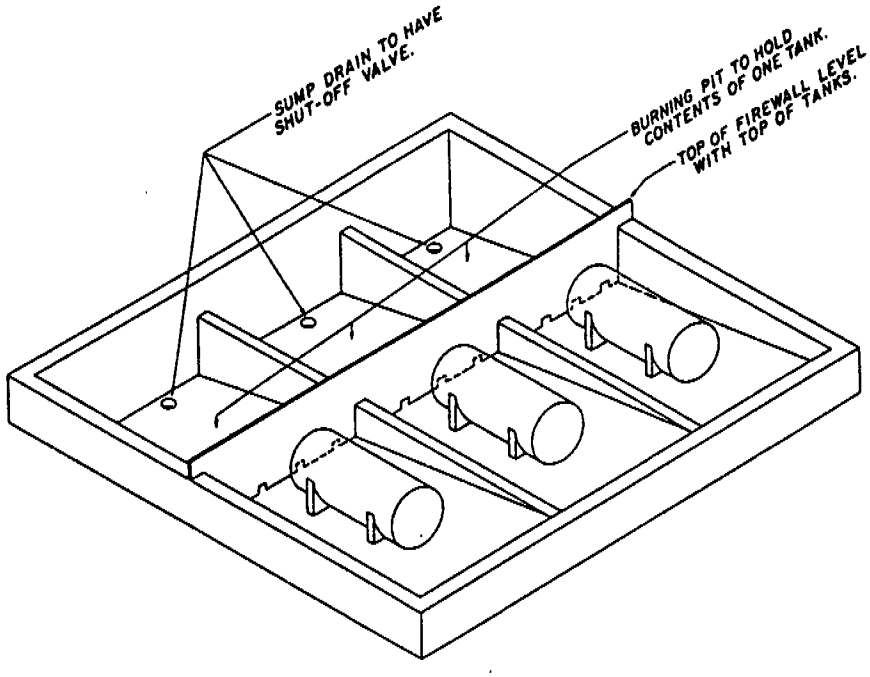


Fig. 9



VINYL CHLORIDE TANK FARM

Fig. 10

Inhibited vinyl chloride monomer may be stored at normal atmospheric temperatures in steel pressure vessels. Uninhibited monomer may be stored either under refrigeration or at normal atmospheric temperatures in the absence of air, sunlight or other catalysts for relatively short periods of time. All tanks, piping, instrument leads, relief valves and equipment in contact with the monomer should be of steel and designed to have a working pressure of at least 138 psi. No copper or copper bearing alloys should be used in the storage facilities in contact with the monomer or its vapors. Cast iron is not recommended for use in flanges or fittings.

All liquid inlet lines should enter the bottom of the tanks or extend to the bottom of the tanks to prevent the accumulation of static charges on filling. In addition all tanks and filling equipment should be grounded.

The tanks should be equipped with a combination of 138 psi. frangible disk and pressure relief valve. In case excess pressure ruptures the safety disk, the pressure relief valve will prevent the loss of the entire contents of the tank after the excess pressure has been relieved. These tanks are designed for skin temperatures up to approximately 130°F. In localities where surface temperatures may go above this valve, the tanks may be cooled with a water spray system. The tanks should not be filled to more than 90% of volume capacity. A blanket of inert gas or vinyl chloride vapor must be maintained in the tank at all times. No air should be allowed to enter the tanks at any time. Relief valve sizes may be determined by using A. S. M. E. Boiler Construction Code VA230 when the valve is designed to relieve all vapor formed without increasing the total pressure by more than 10%. Tanks may be gauged with nitrogen bubbler gauges.

Adequate diking and drainage should be provided under the tanks to confine and dispose of the liquid in case of vessel rupture. A water spray system is recommended as a method of keeping the metal tank cool in case of fire.

All outlet lines from storage tanks should contain check valves to prevent contamination of tank contents. Before a tank is put into vinyl chloride monomer service, it should be purged with an inert gas until free of air. Tanks of less than 30,000 gallons capacity are most economically constructed in the form of horizontal cylinders.

VI. INHIBITORS

A. Inhibitor Removal

Vinyl chloride, as it is shipped, contains 1000 p. p. m. phenol. Phenol is added to prevent polymerization during shipment and storage. Before the monomer will polymerize, this inhibitor must be removed.

The most convenient method of removing the phenol inhibitor is by use of a caustic wash. A diagram of an inhibitor removal system is shown in Figure 11. In this process the monomer is mixed with water and sodium hydroxide. The sodium hydroxide reacts with the phenol to form water soluble sodium phenate. The monomer and water phase are then separated by a series of decanting steps.

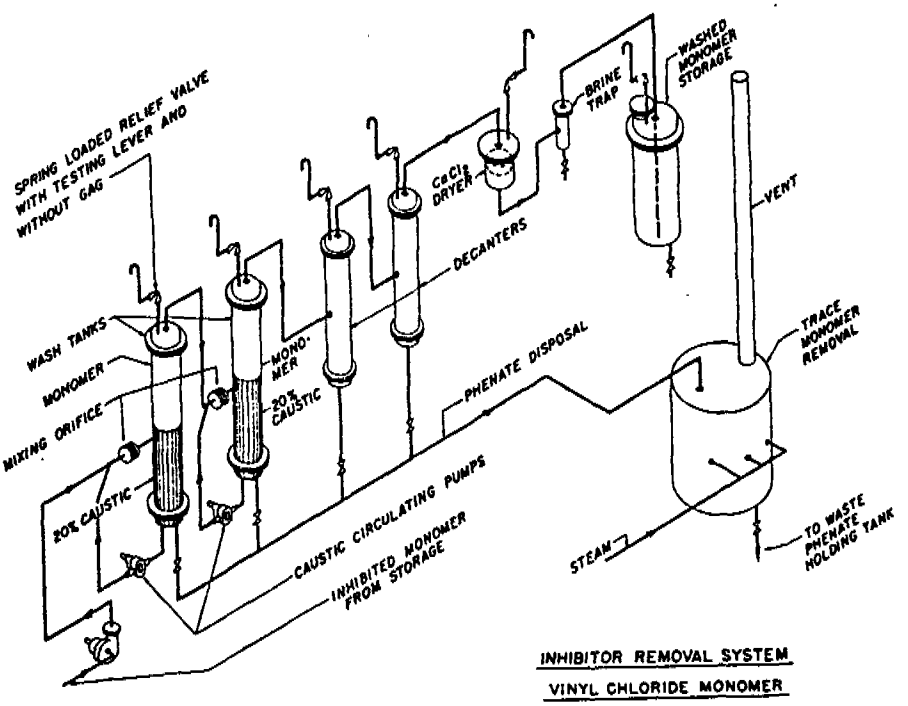


Fig. 11

B. Safety Precautions

Caustic or sodium hydroxide is a strong alkali. Whether as a solid, a dust, in solution or as a mist it has a marked corrosive effect upon living tissues. The eyes are particularly susceptible to injury. Caustic is not absorbed through the skin in toxic amounts.

Sodium phenate is highly toxic and for all practical purposes must be considered as hazardous as phenol. It is readily absorbed through the skin in toxic amounts. However, its presence in small amounts in strong caustic solution does not add significantly to the hazards of the caustic alone.

Full face shield, rubber gloves, rubber boots and rubber apron are recommended when handling caustic (solid or solutions) or mixtures of sodium phenate and caustic.

In case of contact, immediately flood the skin and/or eyes with water for at least 15 minutes and summon medical aid. Speed is important. A more detailed description of hazards and first-aid measures regarding caustic are given in the M. C. A. Chemical Safety Data Sheet SD-9. It is recommended that this bulletin be consulted for operating directives.

Expended caustic-sodium phenate mixtures should be steamed to remove any traces of vinyl chloride before they are discharged. A holding tank following the steaming step is recommended so that mixture to be wasted can be discharged or treated at a uniform rate.

VII. POLYMERIZATION

A. Monomers

In general, vinyl chloride, as are most monomers, is converted to two basically different types of polymers. The first type of reaction, called homopolymerization, occurs when N molecules of vinyl chloride react to form a "homopolymer" (Polyvinyl chloride in this case) of molecular weight N times the molecular weight of vinyl chloride monomer. The second type of reaction, called copolymerization, occurs when N molecules of vinyl chloride react with M molecules of some other monomer (X) to form a "copolymer" of molecular weight N (VCl) + M (X). A few examples of vinyl chloride copolymers follow:

1. Vinyl chloride - Vinyl acetate
2. Vinyl chloride - Vinylidene chloride
3. Vinyl chloride - Acrylonitrile
4. Vinyl chloride - Methyl acrylate
5. Vinyl chloride - Styrene
6. Vinyl chloride - Dimethyl maleate
7. Vinyl chloride - Dimethyl maleate - Diethyl maleate

B. Polymerization Catalysts

A few of the compounds that catalyze the polymerization of vinyl chloride are:

1. Benzoyl peroxide

3. Ammonium persulfate

4. Potassium persulfate

C. Polymerization Methods

Polymerization reactions may be carried out by several different methods. Some of these methods are listed below:

1. Mass Polymerization - The liquid monomer or monomers are directly polymerized to form a solid or semi-solid mass of polymer.

2. Solution Polymerization - The monomer or monomers are dissolved in a suitable solvent and polymerized. The resultant polymer may or may not be soluble in the solvent.

3. Suspension Polymerization - The monomer or monomers are suspended in water in the form of droplets and polymerized to form "beads" of polymer.

4. Emulsion Polymerization - The monomer or monomers are dispersed in water along with a suitable emulsifying agent. Polymerization results in a latex.

The most commonly employed polymerization methods are the suspension and emulsion polymerizations. Mass and solution polymerization are rarely used in industrial applications.

VIII. OPERATING EQUIPMENT

A. Effect of Monomer Upon Materials

Vinyl chloride is noncorrosive to iron and steel at normal atmospheric temperature when dry. In the presence of moisture at elevated temperatures it accelerates the corrosion of iron and steel and should be processed in equipment with a corrosion resistant lining. Glass, porcelain, Heresite or nickel linings are adequate. Vinyl chloride should not be allowed to come in contact with copper or copper bearing alloys because the small amount of acetylene in commercial monomer may form explosive acetylides with copper.

Some types of gaskets, seals, and packings that are acceptable for use with vinyl chloride are Teflon, Velumoid, lead, asbestos, carbon or their equivalents. Mechanical seals, asbestos or Teflon packings are recommended for use in pumps and rotating shafts.

B. Pressures and Vents

All equipment should be designed with due recognition of the high vapor pressure of vinyl chloride and suitable safety factors allowed. Each vessel, reactor, pipe line, pump or piece of equipment that can be sealed off by means of valves must be vented to the atmosphere or back to storage with a frangible disk and/or pressure relief valve. It is recommended that these safety devices be placed in pairs to facilitate inspection, cleaning and replacement. Figure 9 illustrates the pressure release mechanism on a storage tank. The same system may be used on other types of equipment.

Pressure relief valves and safety disks on reactors or equipment where personnel or sources of ignition may be present should be vented off through stacks to a safe area.

C. Pumps, Piping, Reactors, etc.

Steel is recommended for pipe lines, flanges, pumps, tanks, valves, etc., where atmospheric temperatures prevail. Cast iron is not recommended. At temperatures above atmospheric, especially if moisture may be involved; glass, porcelain, Heresite, or nickel linings may be necessary. Centrifugal, positive displacement and gear pumps are all acceptable for use with vinyl chloride monomer but should be equipped with mechanical seals. Plug valves are recommended for use in lines carrying monomer. They may have to be lubricated after every turn.

D. Controls and Operating Areas

Conventional process controls and recording instruments are acceptable for use with vinyl chloride, with the exception that copper or copper bearing alloys should not be allowed to come in contact with the monomer or its vapors. Instruments, controllers and control centers should be located in areas where operating personnel will not be subjected to undue hazards.

Operating areas should be well ventilated to prevent the accumulation of toxic or explosive concentrations of vapors in case of a leak or spill. Vents and stacks from safety relief valves and frangible disks should extend outside of operating areas. Personnel protective equipment, fire fighting equipment, safety showers, eye showers, medical equipment and facilities, and a warning and evacuation alarm should be quickly accessible to all personnel working in the area.

IX. WASTE DISPOSAL

Because of the volatility of vinyl chloride monomer there is usually no waste disposal problem. In case of spills and leaks, the monomer usually evaporates rapidly.

If large quantities of vinyl chloride are to be disposed of, they may be allowed to vaporize slowly in an isolated area where there is no chance of ignition or of over-exposure by personnel. Under no circumstances should monomer be allowed to enter the sewer system because of the danger of explosion.

Waste caustic and sodium phenate from the inhibitor removal system must be treated as phenol waste.

X. SOURCES OF FURTHER INFORMATION

Additional information may be obtained from the following organizations:

The Dow Chemical Company
Coatings Technical Service
Midland, Michigan

National Board of Fire Underwriters
85 John Street
New York City, N. Y.

Factory Insurance Association
175 West Jackson Boulevard
Chicago, Illinois

Associated Factory Mutual Fire Insurance Companies
184 High Street
Boston, Massachusetts

Manufacturing Chemists' Association, Inc.
246 Woodward Building
Washington 5, D. C.

Interstate Commerce Commission
Washington 25, D. C.

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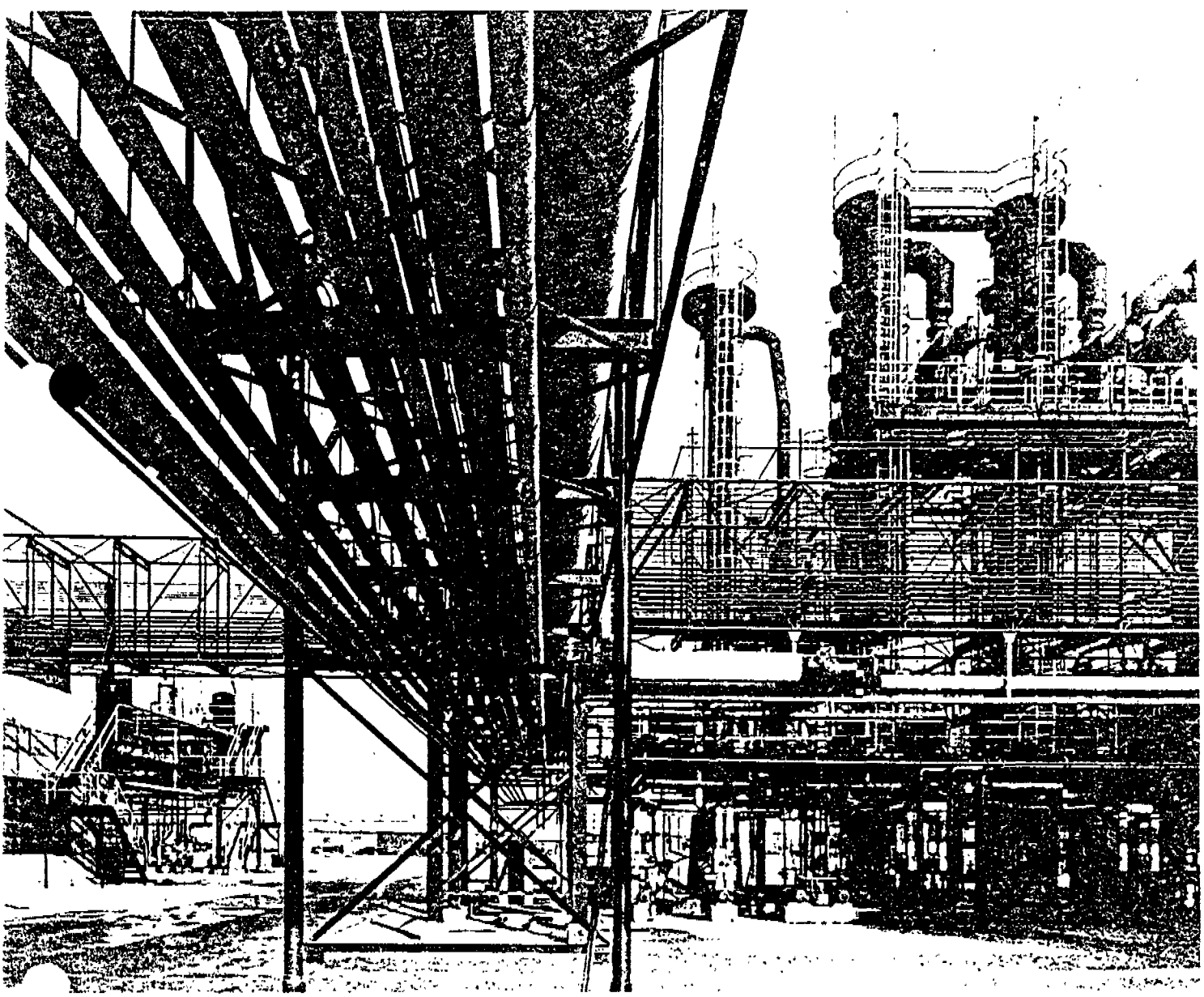
BULLETIN

VINYL CHLORIDE MONOMER

COATINGS TECHNICAL SERVICE

THE DOW CHEMICAL COMPANY
[illegible] DEPARTMENT • MIDLAND, MICHIGAN

VINYL CHLORIDE MONOMER



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