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LORIDE MONOMER

Standard Trademark

(Inside Front Cover)

VINYL CHLORIDE MONOMER

D Bartlett

R&S 100930

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VINYL CHLORIDE MONOMER

I. INTRODUCTION

A. Name

Vinyl Chloride
Vinyl Chloride Monomer
Chloroethylene
Chloroethene

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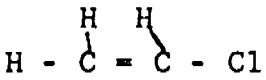
B. Structural Formula



C. General Characteristics

Pure vinyl chloride monomer at normal ambient temperatures and pressures is a colorless gas having a faintly sweet odor. Vinyl chloride is mildly toxic; prolonged or repeated exposures to vapor concentrations of over 500 ppm. are not recommended; high concentrations cause anesthesia.

Vinyl chloride monomer is sold, shipped and stored in the form of a liquid under pressure (Boiling Point = -13.80°C). The flash point is -108.4°F (-78°C) with explosive limits of 3.6% to 26.4% by volume in air. The greatest hazards in the handling of this monomer are the dangers of fire and explosion.

-more-

D. Monomer Stability

Pure vinyl chloride monomer is chemically quite stable. It does not form peroxides readily by autoxidation and the free radical homopolymerization of pure vinyl chloride is not thermally initiated.

E. Available Grades

The stability of pure vinyl chloride to autoxidation and thermally initiated free radical homopolymerization permits uninhibited vinyl chloride to be produced, stored and handled safely and satisfactorily.

The Dow Chemical Company supplies both phenol inhibited and uninhibited vinyl chloride monomer on a commercial basis.

Grade	Phenol Content	
	Typical	Specification
Inhibited	25 ppm	100 ppm - Max. 25 ppm - Min.
Uninhibited	0 ppm	2 ppm - Max.

The availability of uninhibited vinyl chloride monomer from The Dow Chemical Company relieves the customer of the necessity and expense of installing, operating and maintaining phenol removal equipment.

II. PHYSICAL PROPERTIES AND CONSTANTS OF PURE VINYL CHLORIDE

The following table contains the latest information available on the properties of vinyl chloride. Some of these properties were determined by Dow while others are calculations, estimations or determinations from the most reliable sources available.

PROPERTIES & CONSTANTS OF PURE VINYL CHLORIDE

	Property	Ref*	
1.	Molecular Weight	(1)	62.501
2.	Boiling Point at 760 mm, °C	(2)	-13.80
3.	Melting Point, °C	(3)	-153.69
4.	Odor, uninhibited inhibited	(4)	Faint, sweet odor Faint phenolic odor due to inhibitor
5.	Color	(4)	Colorless
6.	Corrosivity	(4)	Non corrosive at normal ambient temperatures when dry. In contact with water at elevated temperatures it accelerates corrosion of iron and steel.
7.	Flash Point, Cleveland Open Cup, -78°C	(1)	
8.	Explosive Limits, Vol. % in air	(5)	3.6 - 26.4
9.	Liquid Density, g/ml at	(6) (3)	
	100°C		0.746
	25°C		0.9013
	-20°C		0.9834
	-25°C		0.9918
	-30°C		0.9999

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See Density Chart Figure #1
See Pounds/gal chart Figure #2

	Property	Ref*	
10.	Density Change with Temperature (between -30°C and -20°C) g/ml/°C	(3)	0.00164 (approx.)
11.	Liquid Viscosity, cps at	(3)	
	100°C		0.100
	25°C		0.185
	-10°C		0.248
	-20°C		0.274
	-30°C		0.303
	-40°C		0.340

See Viscosity Chart Figure #3

12.	Vapor Viscosity, cps	(7)	
	100°C		0.0138
	25°C		0.0108
13.	Surface Tension, dynes/cm	(3)	
	100°C		5.4
	25°C		16.0
14.	Refractive Index, D line,	(8)	
	25°C		1.3642
15.	Vapor Pressure, mm Hg	(2)	
	100°C		16,617
	25°C		2,943
	0°C		1,293
	-25°C		470
	-50°C		130
	-75°C		24.4
	-100°C		2.5

See Vapor Pressure Chart Figure #4

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Property	Ref*	
16. Change in Boiling Point with Pressure, dt/dP °C/mm hg	(3)	
25°C		0.01355
-13.37°C		0.03423
17. Heat Capacity (Liquid), Cp, cal/mole/deg	(3)	
100°C		26.25
25°C		20.56
18. Heat Capacity (Vapor), Cp, cal/mole/deg	(9)	
100°C		14.88
25°C		12.82
Latent Heat of Vaporization, Δ Hv, cal/mole	(3)	
100°C		3310
25°C		4710
-13.8°C		5250
20. Latent Heat of Fusion, Δ Hm, cal/mole	(3)	1172
21. Heat of Formation, Δ Hf, 298°K, kcal/mole	(3) (10)	8.480
22. Free Energy of Formation, Δ Ff 298°K, kcal/mole	(3)	12.386
23. Heat of Polymerization, Δ Hp., kcal/mole	(3)	-25.3 ± 0.5
24. Critical Temperature, t_c, °C	(11)	147
25. Critical Pressure, P_c, atmospheres	(11)	56

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	Property	Ref*	
26.	Critical Volume, v_c, cc/mole	(11)	179
27.	Critical Compressibility (PV/RT), Z	(11)	0.29
28.	Volumetric Shrinkage upon Polymerization, approximate, %	(3)	35
29.	Dielectric Constant at Frequency of,	(3)	
	10^5 and 17.2°C		6.26
	10^5 and -21°C		7.05
30.	Dissipation Factor at Frequency of,	(3)	0.0011
	10^5 and -21°C		
1.	Solubility - Soluble in CCl_4, ether, ethanol and most organic solvents		
32.	Solubility of water in Vinyl Chloride, %	(1)	0.11

* References see Page No. 26

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III. HAZARDS AND THEIR CONTROL (3,4)*

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.

When present in sufficiently high vapor concentrations, vinyl chloride has an anesthetic action. The present Threshold Limit Value (TLV) recommended by the American Conference of Governmental Industrial Hygenists for repeated 7-8 hr. daily exposures is 500 ppm. However, there are indications that on the basis of more recent data this level may be lowered. Concentrations of greater than 500 p.p.m. may cause warning symptoms of dizziness, disorientation, and disturbances of equilibrium and coodination similar to drunkenness. Vapor concentrations approaching the lower explosive limit may cause helplessness and unconsciousness on very short exposure.

Pure uninhibited vinyl chloride has a weak sweet odor, while the inhibited grade 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

* References see page 26.

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 eye are still apparent the washing should be continued.

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 Hazards

Vinyl chloride should always be handled with full recognition of its volatility and its flammability. In general, precautions should be taken both to keep the material enclosed and to eliminate all sources of ignition. In small laboratory operations, where vinyl chloride vapors may escape, reliance must be placed upon the elimination of sources of ignition and the provision of sufficient ventilation to keep escaping vapors at non-flammable levels. Vinyl chloride vapors

can form flammable mixtures with air at all temperatures above -78°C.

Fires involving large quantities of liquid are difficult to extinguish since vinyl chloride is not miscible with water and is lighter than water (will float on top of water). Most small fires can be extinguished with carbon dioxide or dry chemical agents if properly applied. Adequate fire extinguishing equipment of carbon dioxide or dry chemical type, fixed or portable, should be provided. Water spray can be used for the control of fires and the protection of equipment and vessels involved. Diking and drainage should be provided for confining and disposing of the liquid in case of tank rupture or spills. Precautions should be taken to guard against vinyl chloride entering general sewer systems (See E.).

In event of a fire no unauthorized person should be permitted to enter an unventilated area until the space has been thoroughly sprayed with water to remove gases such as hydrogen chloride, phosgene, carbon monoxide, etc. generated from the fire.

C. Explosion Hazards

Vinyl chloride is a gas at normal atmospheric temperature and pressure. The gas will burn very readily in proper mixtures of air or oxygen. The explosive limits are: lower 3.6%, upper 26.4% by volume in air. An explosion hazard can

exist when drawing samples or venting to the atmosphere.

[redacted]

handling this material.

D. Polymerization Hazards

Pure vinyl chloride monomer is quite stable (see I D, Monomer Reactivity) and offers essentially no hazard from autocatalytic polymerization when stored properly. The essential requirements for the safe storage and prevention of polymerization are to store the monomer in the absence of air (oxygen) and moisture and to prevent contamination with free radical initiators or other catalytic impurities.

E. Spills & 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 if present. Disposal of the contaminated shoes is recommended if the spilled monomer was phenol inhibited.

Equipment leaks involving the inhibited monomer can create a special hazard as phenol could accumulate by evaporation at the site of the leak in sufficient quantities that it could cause local burns of the skin on contact. 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.

F. 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 repirators 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.

G. 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 pers nal protective equipment, fire fighting equipment, alarms, eva-

signals, safety showers and first aid measures.

IV. TRANSPORATION (3,4)*

A. Containers

Vinyl chloride monomer is shipped in ICC approved cylinders and tank cars designed to carry liquefied gases under pressure. The types of tank cars currently used by DOW are ICC-105A340W, and ICC-105A300W. The usual cylinders are ICC-4B300 or ICC-4B240 (without brazed seams) with a capacity of ~~either~~ 200 ~~or 300~~ 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 copper acetylides or aluminum chlor alkyls.

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.

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* References see page 26.

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 5 and 6 for cylinder dimensions and a recommended unloading system.

(Insert Figure 5)

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.

(Insert Figure #6)

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 7.

(Insert Figure 7)

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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 use of a forewarding pump in conjunction with the compressor is recommended to expedite the unloading of the "jumbo" tank cars (20 and 31,000 gals. capacity) now being used for vinyl chloride.

Steel centrifugal pumps with mechanical seals are recommended for this use. The pump should be located as close to the tank car as possible in order to minimize pressure drop. 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.

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V. STORAGE (4)*

A. Safety Precautions

All vinyl chloride storage areas should be selected in accordance with local codes and authorities having jurisdiction.

* References see page 26.

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

(Insert figures #8 and #9)

Vinyl chloride monomer may be stored at normal atmospheric temperatures in steel pressure vessels. The monomer must be protected from contact with moisture, air, sunlight, and other initiators, to prevent quality degradation during storage. 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, aluminum or aluminum 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 pressure relief valve) 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 value, 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

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maintained in the tank at all times. No air should be allowed to enter the tanks at any time. Relief valves specifications should conform to the requirements of the American Society of Mechanical Engineers Unfired Pressure Vessel Code and may be sized in accordance with Volume 1 "Flammable Liquids," of the National Fire Codes published by the National Fire Protection Association. 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 50,000 gallons or less capacity are ordinarily constructed in the form of horizontal cylinders. Above 50,000 gallons, a Hortonsphere or other special shape should be considered.

VI. INHIBITORS

A. Inhibitor Removal

Inhibited vinyl chloride, as it is shipped, contains 25-100 p.p.m. phenol. The inhibitor is usually removed before the monomer is polymerized.

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 10. 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.

(Insert Figure 10.)

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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. MCA Safety Data Sheet SD-4 and Dow Chemical Company Technical Data Bulletin Form No. 125-152 should be consulted for additional information on hazards and their control when handling phenol.

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. OPERATING EQUIPMENT

A. Effect of Monomer Upon Materials

Dry vinyl chloride is noncorrosive to iron and ~~still~~ steel at

copper acetylides and vinyl chloride could react directly with aluminum to form explosive aluminum chlor alkyls.

Some types of gaskets, seals, and packings that are acceptable for use with vinyl chloride are Teflon, 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 8 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, baked phenolic 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. Teflon lined steel ball valves or plugcocks are recommended for vinyl chloride use. Lubricated valves are unsatisfactory as they 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 aluminum and their alloys should never 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 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.

VIII. 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. Detailed information on disposal of phenol wastes from monomer purification is available from Plastics Development and Service, The Dow Chemical Company, Midland, Michigan.

IX. SOURCES OF FURTHER INFORMATION

Additional information may be obtained from the following organizations:

The Dow Chemical Company
Plastics Development & Service
Midland, Michigan

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

Factory Insurance Association
175 West Jackson Boulevard
Chicago, Illinois

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

Manufacturing Chemists' Association, Inc.
1825 Connecticut Avenue, N. W.
Washington 9, D. C.

Interstate Commerce Commission
Washington, D. C. 20423

Vinyl and Related Polymers
by Calvin E. Schildknecht
John Wiley & Sons, Inc. (1952)

National Fire Protection Association
60 Batterymarch Street
Boston, Massachusetts 02110

REFERENCES

(1) R. R. Dreisbach; American Chemical Society Advances in Chemistry Series No. 22 (1959)

(2) R. A. McDonald, S. A. Shrader, D. R. Stull; J. Chem. Eng. Data 4, 311 (1959)
Antoine Equation for calculating vapor pressures of vinyl chloride.
Log. Pmm = 6.85978-892.23/(238.04+t) (t=°C)

(3) Unpublished Data The Dow Chemical Company

(4) M. C. A. Chemical Safety Data Sheet SD-56 (1954); Properties and Essential Information for Safe Handling and Use of Vinyl Chloride.

(5) T. Numano, T. Kitagawa; Kogyo, Kagaku Zasshi 65, 182-4 (1962)

) M. C. A. Res. Proj.; Selected Values of Properties of Chemical Compounds, June 20, 1956

(7) P. Zaloudik; Chem. Prumysl 12, 81-3 (1962)

(8) A. W. Francis; J. Chem. Eng. Data 5, 534-5 (1960)

(9) K. A. Kobe, R. H. Harrison; Petroleum Refiner 30 No. 11,151 (1951)

(10) Average from
J. R. Lachner, E. Emery, E. Bohmfalk, J. D. Park; J. Phys. Chem. 60, 492-5 (1956) and
J. R. Lachner, H. B. Gottlieb, J. D. Park; Trans. Faraday Soc. 58, 2348-51 (1962)

(11) Calculated by Lydersen's Method; A. L. Lydersen; U. of Wisconsin. Eng. Exp. Station Report No. 3, April 1955.

(sales offices)

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Plastics Department The Dow Chemical Company Midland, Michigan 48640

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THE DOW CHEMICAL COMPANY

MIDLAND
August 2, 1966

Sales

36-B-11/751

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Executive Research
566 Building

Vinyl Chloride Monomer 170-233

The aforementioned bulletin has been routed as indicated on the attached routing sheets. Please send us a letter of approval.

Thanks.

Dexter Bartlett

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Plastics Section
Public Relations Department
433 Building
Phone: 6-3077

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