

**Low Pressure
Carbon Dioxide
Storage Units**



CO₂ Low Pressure Storage Units

The Chemetron **Low Pressure Carbon Dioxide** System carbon dioxide (CO₂) stored, mostly as a liquid, at approximately 300 psi (2070 kPa) and 0°F (-17.8°C). It is maintained at near this pressure by mechanical refrigeration. When needed, operation of the refrigeration system cools and condenses CO₂ vapor in the vapor space of the unit, thus converting it to liquid and reducing the pressure. The storage unit is very well insulated, keeping to a minimum the heat transfer to the CO₂ from the warmer ambient air of the storage location. A slight rise in storage pressure from this heat input starts the refrigeration cycle described herein.

Stored as a liquid at an ambient temperature of 70°F (21°C) carbon dioxide has a vapor pressure of approximately 850 psi (5865 kPa). Thus, high pressure cylinders are used for storage and it is designated is **High Pressure** CO₂. This brochure explains low pressure storage and describes the wide range of storage units available.

The storage of CO₂ in the “Low Pressure” state has numerous advantages over cylinder storage. The features of this storage and the resultant advantages continue over the following pages.

Advantages

Economy

Low Pressure units store liquid CO₂, to as much as 100 tons (90,900 kg) or more, in a single lightweight vessel filled to over 90% of its water capacity. In contrast, cylinders have a maximum capacity of 100 lbs. each (filled to 68% of their water capacity). This results in lower storage costs for high capacity systems.

Multiple Hazard Protection

Low Pressure Systems facilitate the design of simultaneous protection of more than one hazard from one piping system.

Multiple Discharge Capability

A second (or multiple) discharge, based on storage unit capacity, is immediately available without any switchover to the reserve.

Reserve Supply

A reserve supply is easily obtained by merely increasing the storage unit size; no complicated manifolding and valving is required. After one discharge, the reserve supply provides uninterrupted protection during the interval preceding recharge of the unit to full capacity.

Hydrostatic Testing

Low Pressure CO₂ units, constantly in service, do not require hydrostatic testing as cylinders do, i.e., before refilling if over 5 years from last test date, or after 12 years even if the cylinder has not been discharged.

Ease of Filling

Storage unit fill connections are extended to a point accessible to a transport truck, allowing the unit to be filled solely by transfer of liquid through a pump on the truck. Plant personnel need not be involved. In contrast, high pressure cylinders must be disconnected and transported to a filling plant.

The cost of CO₂ delivered as low pressure liquid is normally much less than that delivered in cylinders on a per pound (kilogram) basis.

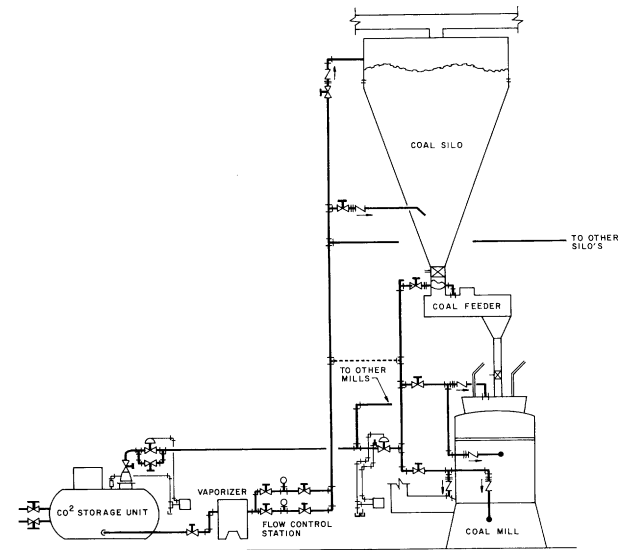
Conserves Storage Space

In most cases, Chemetron Low Pressure storage units require less floor space than equal storage in cylinders. Storage weights can also be significantly less. Low pressure storage requires approximately 1 lb (kg) of steel to store 1 lb (kg) of CO₂. The high

pressure cylinder storage ratio is approximately 2 lbs (kg) of steel to 1 lb (kg) of CO₂. To conserve plant floor space, outdoor installations are common with high pressure systems.

Monitoring CO₂ Supply

The low pressure storage unit has a liquid level gauge designed to continuously monitor the amount of CO₂ in storage.



Typical Low Pressure CO₂ Fire Suppression and Inerting System

Features

Pressure Vessel

The pressure vessel is a cylindrical steel tank of all welded construction, designed and manufactured in accordance with the A.S.M.E. Boiler & Pressure Vessel code, Section VIII, Division 1, for unfired vessels. Standard vessel design is for a working pressure of 363 psi (2503 kPa) and is tested during manufacture at a hydrostatic pressure to meet code requirements.

Storage unit vessels have also been provided to meet similar code requirements in Japan, Australia, The United Kingdom, and other countries.

Insulation

Insulation material is provided between the outer housing and the pressure vessel to reduce heat transfer to a practical minimum. The thermal insulating efficiency is such that even without refrigeration, storage pressure will not exceed the bleeder valve setting for a period of from 24 to 48 hours, depending on unit capacity.

Liquid Level and Pressure Gauges

These are located on the storage unit. They show the quantity of carbon dioxide in the unit and its vapor pressure, respectively. Liquid level gauges can be provided with optional arrangements utilizing electrical contacts to signal “low CO₂ level” or an analog output for computer monitoring of the unit contents.

Housing

The pressure vessel and its insulation are enclosed in an appropriate metal or fiberglass housing designed to shield the insulation, ensure a barrier against water vapor penetration, and protect the unit from weather when located outdoors. The refrigeration system is appropriately housed as an integral part of the complete unit.

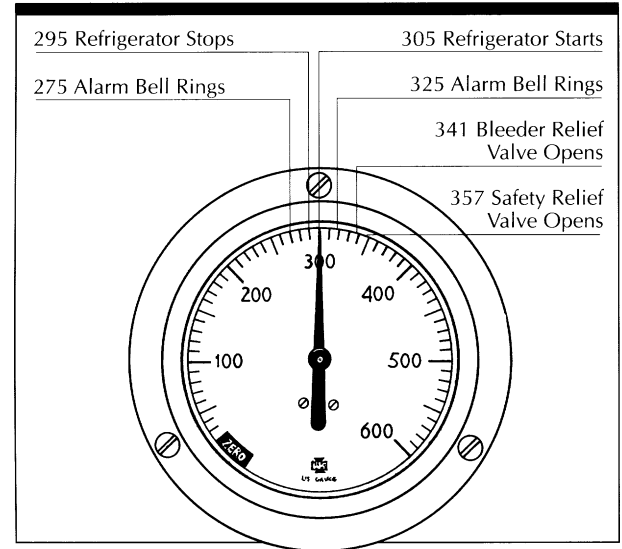
Fabrication and finishing of the unit are to high standards ensuring a long, low maintenance life. While the unit is normally painted red with a high grade enamel, other colors are available when needed or specified.

Refrigeration

Low temperature storage is maintained by a commercial grade compressor and a refrigeration coil running lengthwise through the pressure vessel near the top. During the refrigeration cycle, carbon dioxide vapor coming into contact with the coil is condensed into liquid carbon dioxide. A pressure switch starts the compressor whenever carbon dioxide pressure reaches approximately 305 psi (2103 kPa) and stops it when the pressure has been reduced to 295 psi (2034 kPa). This is the normal operating pressure range of each Chemetron storage unit.

Under emergency conditions when the mechanical refrigeration is not functioning, the unit is self-refrigerating due to the refrigeration effect of vapor released through the bleeder valve. Carbon dioxide required for this is only 6 to 20 Pounds (2.7 to 9.1 kg) per hour, depending on unit capacity.

Refrigerants used in units built from 1995 on are compatible with the requirements of the U.S. Environmental Protection Agency.

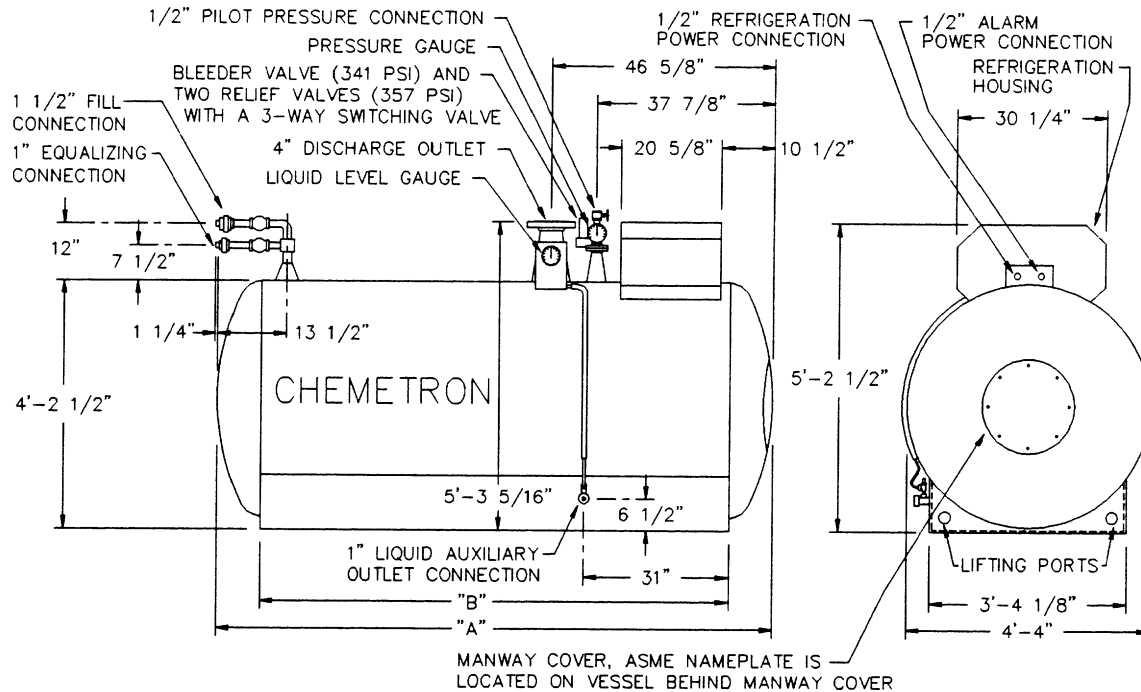


Pressure Gauge (PSI)

Standard Storage Units

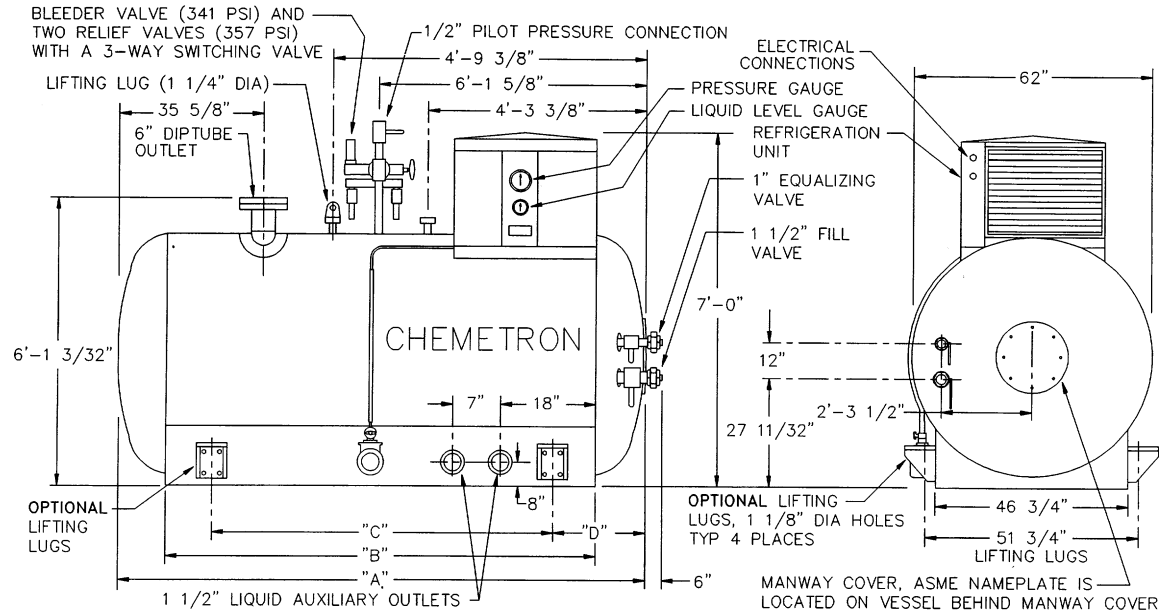
The following drawings provide dimensions, weights and important information on the standard Chemetron carbon dioxide storage units. Similar information on special units can be obtained from Chemetron Fire Systems Engineering as well as drawings with dimensions in metric units.

CHEMETRON Fire Systems™



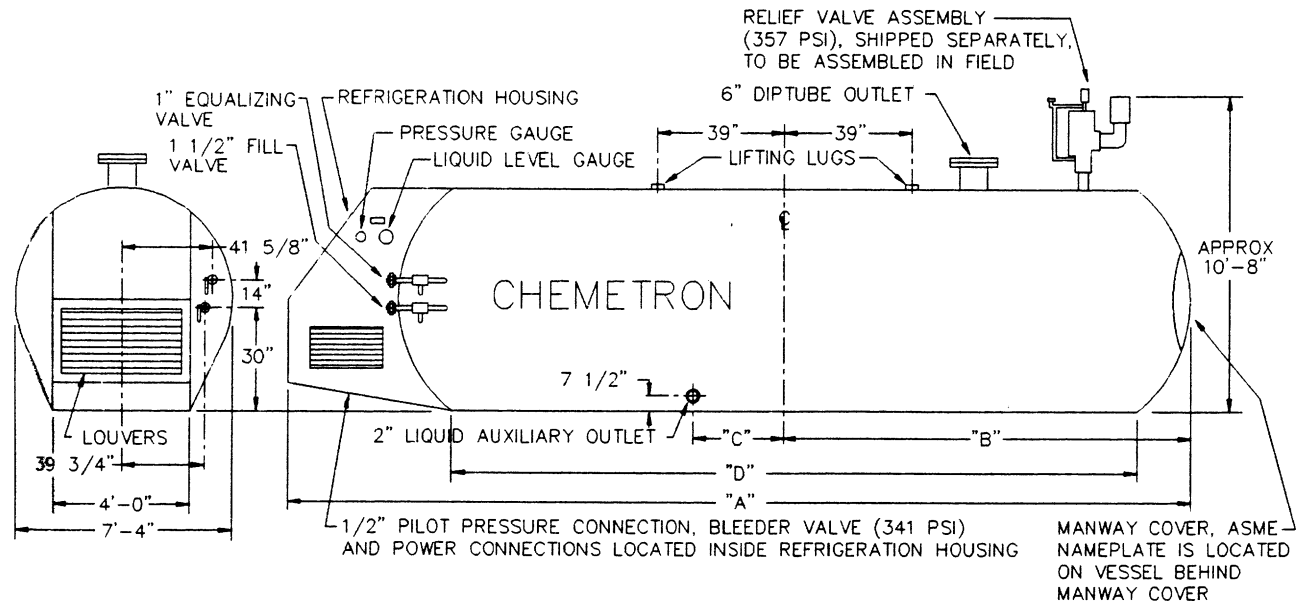
Nominal			DIMENSION		Option:	
Size (Tons)	Stock Number	Full Weight (Pounds)	"A"	"B"	Storage Tank With Lifting Lugs	Motor H.P.
1-1/4	10481064	5,215	5' 8-7/8"	4' 4"	10481076	1/2
2	10481068	7,615	8' 6-7/8"	7' 2"	10481080	1/2
2-3/4	10481072	9,965	11' 4-7/8"	10' 0"	10481084	1/2

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Nominal Size (Tons)	Stock Number	Full Weight (Pounds)	DIMENSION				Option: Storage Tank With Lifting Lugs	Motor H.P.
			"A"	"B"	"C"	"D"		
4	10481089	13,500	10' 5-1/4"	8' 8"	6' 10"	1' 4-5/8"	10481095	1
6	10481101	19,250	14' 9-1/4"	13' 0"	6' 6"	2' 9"	10481107	1
8	10481143	25,000	19' 1-1/4"	17' 4"	10' 10"	2' 9"	10481149	1-1/2
10	10481125	30,750	22' 1-1/4"	21' 4"	14' 10"	3' 7-5/8"	10481131	1-1/2

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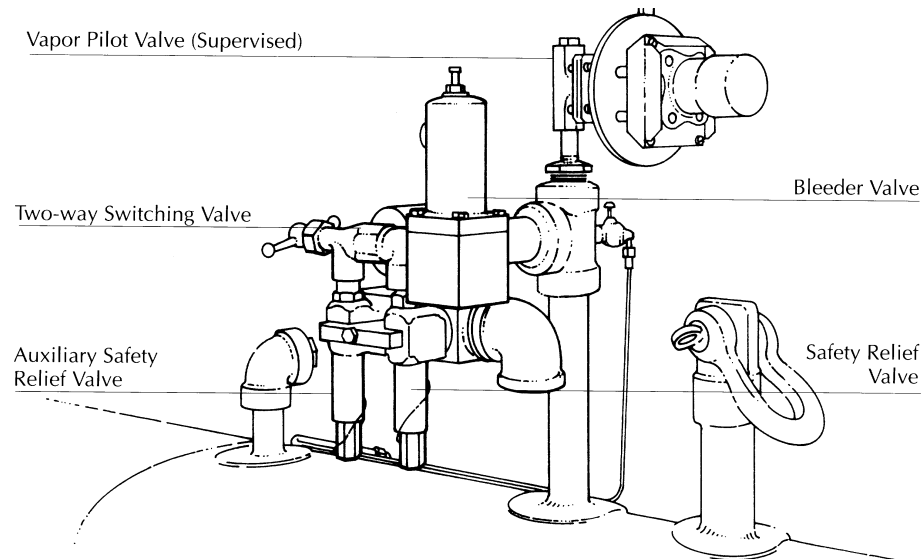
Nominal Size (Tons)	Stock Number	Full Weight (Pounds)	DIMENSION				Option: Storage Tank With Lifting Lugs	Motor H.P.
			"A"	"B"	"C"	"D"		
13	10481214	40,500	18' 0"	7' 5"	1' 5"	10' 1"	10481219	3
17	10481224	52,000	22' 0"	9' 5"	3' 4-1/2"	14' 0"	10481229	3
24	10481234	72,000	29' 0"	12' 11"	6' 10-1/2"	21' 0"	10481239	3
31	10481244	92,000	36' 0"	16' 5"	10' 4-1/2"	28' 0"	10481249	3

Safety Devices

Storage units are equipped with multiple safety devices that are engineered to provide complete protection against abnormally high tank pressures. Such pressures usually result only from power or compressor failure continuing over a period of many hours. The safety valve arrangement consists of a two-way switching valve, bleeder relief valve, and two safety relief valves. The construction of the two-way switching valve makes it impossible to shut off both safety relief valves at the same time. Its normal operating position pressurizes both the bleeder valve and one relief valve, leaving the second safety relief valve in reserve.

The bleeder valve opens to relieve pressure at 341 psi (2352 kPa). If the pressure continues to rise beyond the capacity of the bleeder valve, the safety relief valve will open at 357 psi (2462 kPa). The safety relief valve will arrest the rise in tank pressure, even with a very high outside temperature and much of the tank insulation removed.

The second safety relief valve will only be in operation during the repair or replacement of other valves. In addition to the above safety devices, an alarm will sound automatically if the pressure rises to 325 psi (2241 kPa) or falls to 275 psi (1896 kPa).



The safety valve arrangement shown is that used on smaller storage units. Larger units utilize a pilot operated safety valve that can be tested without being removed from service.

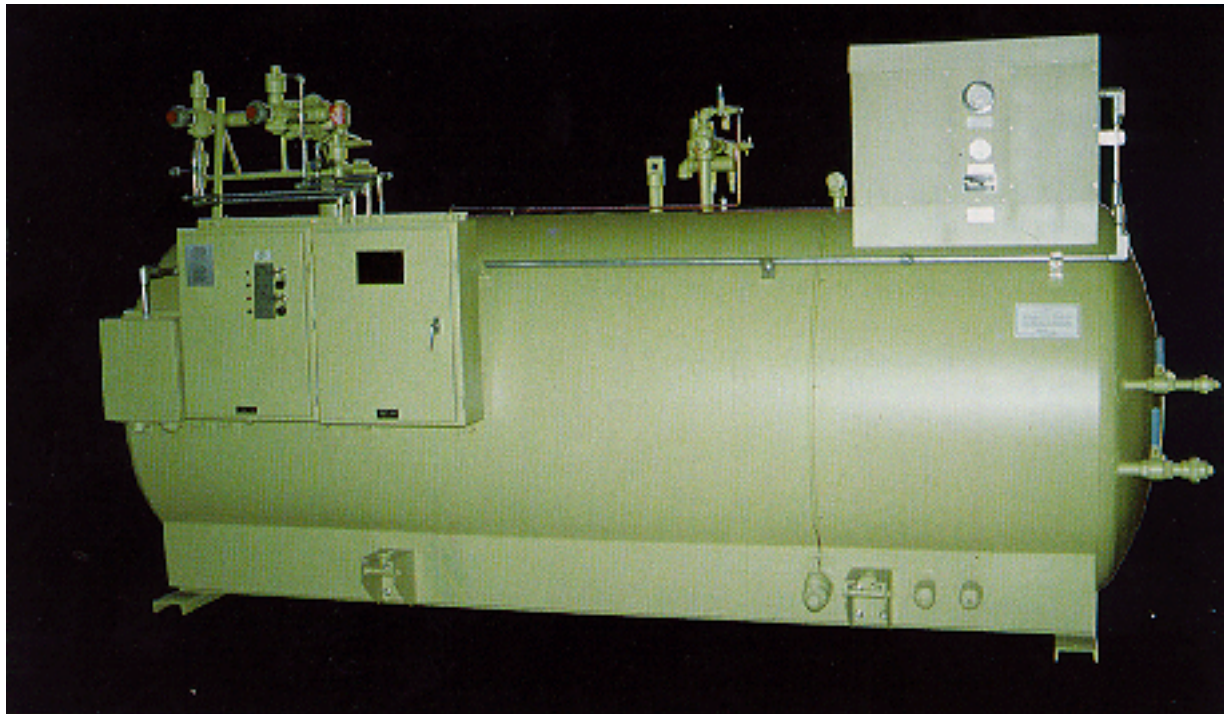
Skid Mounted Units

The factory or shop fabrication of an appropriate skid to facilitate unit handling with pre-assembly of equipment and piping offers the most efficient method of handling certain installations.

This allows pretesting of piping and equipment, reducing field testing time as well.

Chemetron Fire Systems offers such units manufactured at our plant or fabricated to our specifications by one of our partners.

Photos show typical factory fabricated skids with both mechanical equipment and electrical controls mounted on the skid.



Units designed to additional requirements of the Department of Transportation to allow them to be used in over-the-road transport of liquid CO₂ are available.

Note: This brochure illustrates the more commonly used units for Chemetron Low Pressure CO₂ Fire Extinguishing Systems. However, other variations of the standard storage units are used from time to time to meet job conditions. In addition, special purpose units are also available. Dimensions, etc. on same are available from Chemetron. These include:

- Units for Marine (Shipboard) Service
- Units with Explosion Proof Electrical Equipment
- Units for Vertical Storage
- Units meeting D.O.T. Requirements



Approvals

Chemetron Low Pressure CO₂ Storage Units are approved and/or listed by the appropriate approval agency for the application involved.

Approvals of Chemetron Storage Units have been obtained from:

- Underwriters laboratories (UL and LJLC) Factory Mutual (FM)
- U.S. Coast Guard
- American Bureau of Shipping (ABS) United Kingdom: BS 5500
- Japan: Nippon Kaiji Kyokai (NKK)
- Australia: Work Cover Authority

In addition to the Chemetron Storage Unit, a very wide range of fire system equipment built to similar high standards (ISO 9002), together with our world leading CO₂ system application technology combine to offer the very best in CO₂ fire suppression or prevention (inerting). Chemetron Fire Systems and our worldwide distributor organization are available to help with any fire suppression or inerting application.

Make Chemetron your source for fire suppression equipment

- Low pressure CO₂
- High pressure CO₂
- FM-200™
- Control panels

Chemetron Fire Systems products have been manufactured for more than fifty years and remain a vital link to the gaseous agent fire protection market.

As a leader in the fire protection industry, we have brought to market many innovative products and extinguishing system design techniques. Chemetron designs and manufactures Low Pressure Carbon Dioxide, High Pressure Carbon Dioxide, FM-200, and Water Mist fire suppression systems and electronic control panels. Chemetron Fire Systems also offers design engineering and related technical support services for a wide range of applications. Custom developed computer programs aid our designers in their design tasks, while allowing more accuracy and flexibility in your application.

Chemetron Fire Systems has established a worldwide distribution network that provides engineering, technical support, installation, commissioning, in-

spection and repair services. We are dedicated to insuring that the reputation of special hazards fire protection excellence built over the past 50 years is maintained and enhanced.

The seller makes no warranties, express or implied including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose, except as expressly stated in seller's sales contract or sales acknowledgment form.

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