CHLORINE PLANT OPERATIONS SEMINAR PROCEEDINGS

26th Meeting

Fairmont Hotel

New Orleans, Louisiana

February 1983

CHLORINE INSTITUTE PAMPHLET

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REPORT ON JOINT CI-BITC
JUNE 1982 LONDON MEETING

Group A: Bulk Chlorine Transport
An Overview of European Practice
by R.M. Burrell, C-I-L Inc., Montreal, Que.

Group B: Review of Joint Meeting -
Chlorine Storage of Liquid Chlorine
by Thomas Liederbach, Eltech Corp., Chardon, O.

Presented at the Chlorine Institute's
26th Plant Operations Seminar
New Orleans, Louisiana, February 2, 1983

THE CHLORINE INSTITUTE, INC.

- PROCEEDINGS -

TWENTY-SIXTH CHLORINE PLANT OPERATIONS SEMINAR

New Orleans, Louisiana
February 2, 1983

John Fonner, Presiding

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London, June 1982
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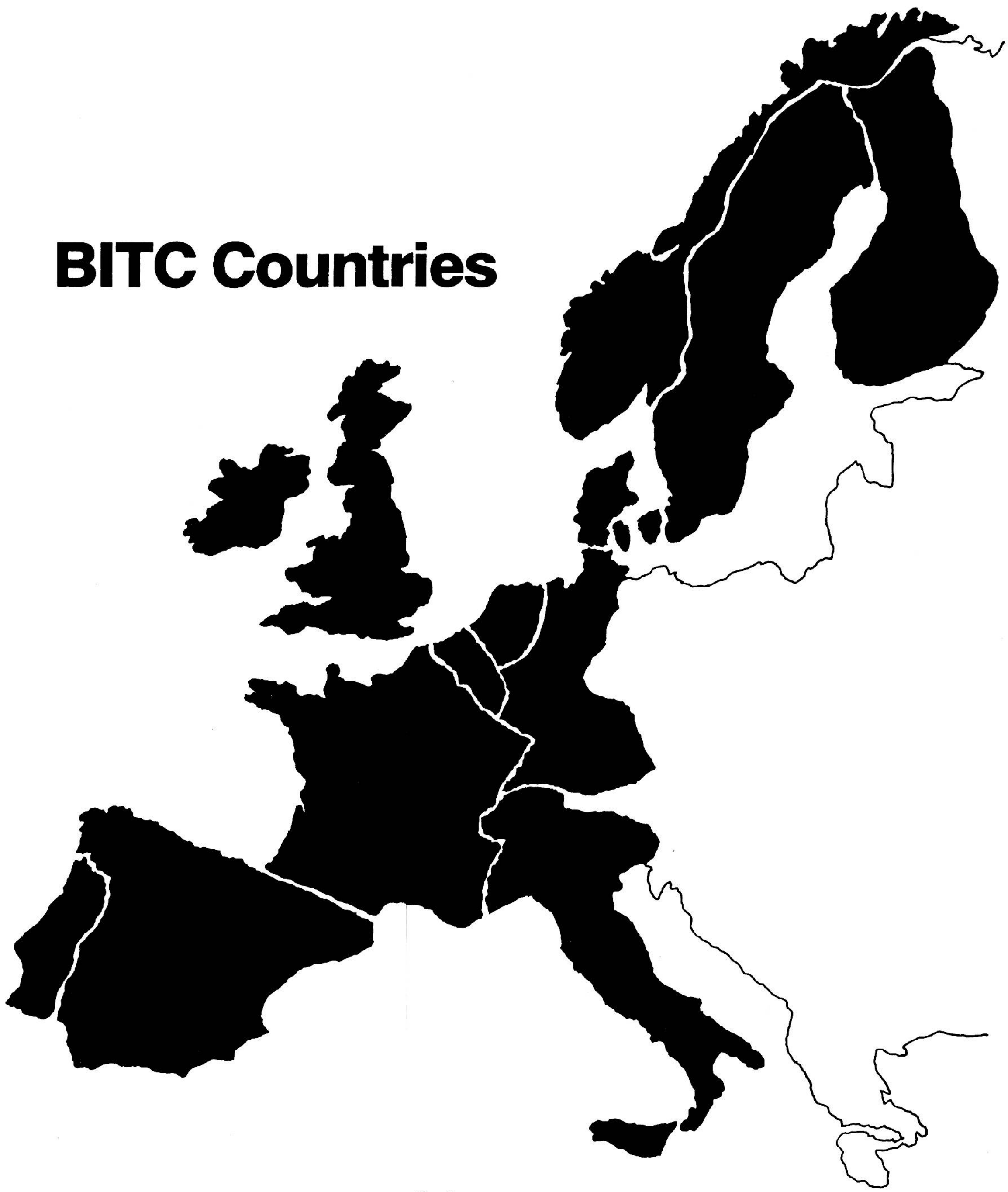


BITC Countries

Report on the Joint Chlorine Institute/BITC Meeting London, June 1982

Group A: Bulk Chlorine Transport - An Overview of European Practice

Presented by R. M. Burrell, C-I-L Inc., Montreal Canada

Introduction:

Just as North American chlorine producers and packagers have a Trade Association, the Chlorine Institute, which has a strong influence on the way chlorine is handled, so producers from 12 West European countries work through the BITC (Bureau International Technique Chlore) to develop high standards of safety in chlorine production, handling and use in Europe. In these two parallel organizations, there are groups whose prime concern is with the details of storage and shipping of chlorine. In the Institute this is the Storage and Transport Committee (the STC) formerly the CCS&S, and in the BITC it's the GEST, roughly, the Storage and Transport Study Group. Some members of the BITC and this group are well known to the Institute, through their participation as Institute Overseas members as past meetings.

It has been recognized for years that there are significant differences between practices in Europe and North America, and it was felt that a meeting between knowledgeable personnel from each group, to explore the practices and discuss the philosophies and reasons for the differences, would be of value and interest. After a number of years of discussion, this sharing of ideas finally took place in the form of a one day Joint Meeting in London on June 2, 1982, in conjunction with the Society of Chemical Industry's third seminar on Chloralkali Technology. I was privileged to be one of the Chlorine Institute's representatives, and Tom Leiderbach and I will give you a brief outline of some key points.

The meeting was held in two simultaneous study groups, the one which I will describe dealing with bulk chlorine transport, and the other, which Tom will review, with chlorine storage and handling. Following these two separate sessions, the entire group assembled for a review session and general discussion. The working sessions were preceded, the night before, by a superb dinner hosted by member companies of the BITC.

There were 16 BITC delegates at the London meeting, representing 8 countries and 12 companies, plus a staff member. The Institute's delegation of 10 included representatives from seven companies with three members of the Institute staff.

Perhaps a word or two of description of the scope of the BITC would be useful, to put later remarks into perspective. The BITC has membership from the principal 12 countries of Western Europe, with an area of approximately 1.2 million square miles, and a population of some 325 million. Chlorine production capacity in these countries is about 12 million short tonnes per year. For comparison purposes, the Active Membership of the Chlorine Institute covers the United States and Canada with an area of about 5 million square miles (counting only the developed parts of Canada) and a population of about 250 million. Chlorine productive capacity in Canada and the U.S. is about 16 million short tonnes.

Like the Chlorine Institute, the BITC/GEST is a highly competent, highly responsible and highly respected technical organization, with a major influence on the actions of its members. The BITC works within a complex framework of national and international regulations and agreements, and has started comparatively recently working toward standardization of bulk transport containers. They have issued a number of publications of recommendations and " Codes of Good Practice", and have established detailed criteria for determining acceptability of equipment and procedures which, although often significantly different from North American practice, are highly competent and well worth studying.

Chlorine Transport:

Although a lower proportion of the total chlorine produced in Europe is transported by road and rail than in America, movements of chlorine in 1981 exceeded 1.8 million tons, of which 82% was by rail, the balance by road. This table shows the breakdown, with approximate North American statistics for comparison. Road shipments are much more common in Europe, as is the practice of customer chlorine storage tanks, although the split varies widely from country to country, with road shipments being discouraged in some areas. In West Germany, Belgium and Holland there are none, in France and Scandinavia road movement is less than 25% of the total, somewhat more in Italy and 50% in the U.K., while in Spain and Portugal 95% moves by road. There are some 200 road tankers in use in the BITC countries, compared to perhaps 90 in the U.S. and Canada. Significant quantities are also moved by ISO containers by road or rail.

European rail tankers are smaller than North American, the largest being about 60 tonnes' capacity, limited by national and international regulations on total gross weight, and weight per axle. The tanks are 7'6" diameter x 39' long. At present, tank car designs are less standard than in America, the efforts toward standardization having started comparatively recently. The next table shows a breakdown of the fleet; you will note that of some 2600 European cars, 1600 are the maximum permitted size, about 60 tonne size, the rest being about 20 tonnes' capacity. An approximate North American split is shown for comparison. There are approximately 3 times as many tank cars in America.

Tank Cars:

European tank car and tank truck tanks, or barrels, are designed according to international and national regulations with additional constraints imposed by the producers to increase safety allowances. Under GEST recommendations, minimum design temperature is -40°C., and design pressure is based on a test pressure of 22 kg/cm2, or about 313 psi. Head thickness is not to be less than cylinder wall thickness, and steel is to be non-alloyed fine grain steel, with 100% examination of welds.

Head shields are not required, except in Finland, where the railways are largely single track, and a tank rupture occurred in a wreck several decades ago. The coupler or buffer design being entirely different, shelf couplers aren't fitted, but in the U.K. and Finland override beams are installed on some cars to prevent the buffers from riding up and striking the tank head in a collision.

Tank car hydrostatic retest is required every four years, and for road tankers, three years, the difference being a function of when the regulations were passed rather than a difference in philosophy. On rail tankers, one manhole only is recommended, on the upper section of the tank, similar to American practice, the manway opening being 500 mm, or 19.7" in diameter. Road tankers are less standardized. On the continent, the tank car arrangement is usually used. In some countries, including the U.K., some road tankers have the fittings in a dished well in the tank head.

In the U.K., most road tankers are now surrounded with a crash shield made of motorway crash barriers.

Valves on the tank car manway cover plate are protected in a contoured dome housing, which appears to be somewhat lighter than in America, and which lifts on a hinge to expose the manway plate and valves completely. The manway itself is protected by a steel skirt.

The standard European tank car varies from the North American car with which we are familiar in three important ways:

First, European tank cars are not insulated, and the practice of insulation is strongly opposed, because of the perceived risk of undetected corrosion below the insulation leading to tank failure, due to moisture below the insulation. They place little value on the additional mechanical protection provided by the jacketted insulation, possibly because of the excellent safety records of European railways.

Safety relief devices are not fitted on any European chlorine transport tanks, except ISO containers for carriage by sea in accordance with IMCO regulations. The use of safety valves is strongly opposed, and the reasons for this and arguments against safety valves are set out in a detailed closely reasoned BITC publication. Basically, the BITC believes that safety valves on transport tanks present a more serious hazard than they eliminate, due to possible uncontrolled leaks and releases, and they believe the purposes of safety valves can be better achieved in other ways, such as extremely strict control of inspection, loading and unloading procedures, and equipment. I recommend a reading of the BITC memorandum, or a discussion with a dedicated European tank car specialist, to stimulate your thought processes and shake up your complacency with long accepted standards. It is interesting to note that there were some 20 safety valve leaks in North America recorded in the Chlorep reports for 1976 to 1981. None were in derailments, one was due to overfilling and one due to overpadding by a customer.

The third major difference is in the arrangement of fittings on the manway cover, and the type and design of valves. The standard manway design for both tank cars and tank trucks has only three angle valves, two liquid on the lateral axis, and one gas on the longitudinal axis. About 80% of tank cars, and all new ones, meet these standards, although some U.K. cars have a different arrangement, with four valves.

The BITC standard requires that the angle valve assembly provide rapid closure, a tight seal in use, and a safe seal in the event of failure of the valve body.

To achieve these requirements, rising ball excess flow valves are not used. Instead, internal "security" valves, also called "safety plugs" are fitted below every angle valve, bolted independently with a tongue and groove flange into a 4" opening in the manway cover. These are spring loaded to close automatically and are opened by means of a pneumatically operated stem in the external "main" valve, which is bolted on directly above it. The internal valve can be closed remotely through the pneumatic operator, or closes automatically if the upper valve is displaced, as in a wreck. The eduction pipes are threaded into these internal valves, then spot welded in place. They can be removed from the car through the 4" opening in the dome, with the internal valve.

There are several designs of internal and external valves, all with a flanged outlet. All are interchangeable, and fit the standard manway cover design. The Ermeto valve is shown in these pictures, but other valves used extensively are the Gestra, and the Phonix. There is some preference by country, and national approval is required. The external valves are bolted through the flange of the internal valve, to the manway cover. Under the GEST standard, there must be a bellows seal on the moving stem which operates the internal valve.

Completely pneumatically operated assemblies have the balls or plugs of both the internal and external valve operated by movement of the same stem.

In every valve design, provision is made for manual operation of the stem, in case compressed air is not available, by a mechanical device to push down the stem and so open the internal valve, usually using a wrench. These are all designed for remote closure using a cord to release the manual actuator, permitting the spring loading to close the valve.

Manual rather than pneumatic operation of the main external valve is an optional design, and for this, a packed gland is standard. These valves are typically operated with a wrench, but some designs have a built-on handwheel. Almost all valves have built-in security devices, to protect the end of the stem and secure any manual operating devices when not in use. The valves are typically about 12" high, but GESTRA makes a low form valve, about 8" high, with a handwheel fitted on the side. GEST doesn't have an emergency kit, and it is not believed to be required, because all problems with the external valve can be handled promptly, and from a distance, by closing the internal valve. On some designs, a shear point has been designed into the body of the external valve.

The preferred materials are PTFE for the balls, plugs, discs and seats; Hastelloy C for the stem bellows; and stainless steel for other wetted internals. Monel is also sometimes used for seats, discs or stems. Materials of different hardness are used for the plug and seat.

With no excess flow valve, maximum flow through one valve is typically in excess of 20 tonnes per hour. The larger valve volume requires a longer time to degas when disconnecting. Proven life of the valves to date exceeds 10 years, with a two year overhaul being common. Valve assemblies cost $1200-$1600 depending on design. One large company has its valve maintenance overhauls carried out by the manufacturers, at a cost of about $800 per valve.

Procedures for preventing chlorine escape in loading and unloading operations are also very thorough, to avoid or minimize chlorine escape. All flexible unloading connections must be equipped at both the tank car and the process end with remote operating rapid closing shutoff valves, to stop escape in case of failure. This care and attention to detail, coupled with very high standards of railroad safety, have led to an enviable record of chlorine transport safety, with virtually no recordable chlorine escapes in transport in the last thirty years.

February 2, 1983

	BITC	Chlorine Institute (U.S.A. and Canada)
Countries	12	2
Area (mm sq. miles)	1.2	5+
Population (mm)	325	260
Chlorine Capacity (mm short tons/yr)	12	16

Chlorine Movements (thousand tons per year)

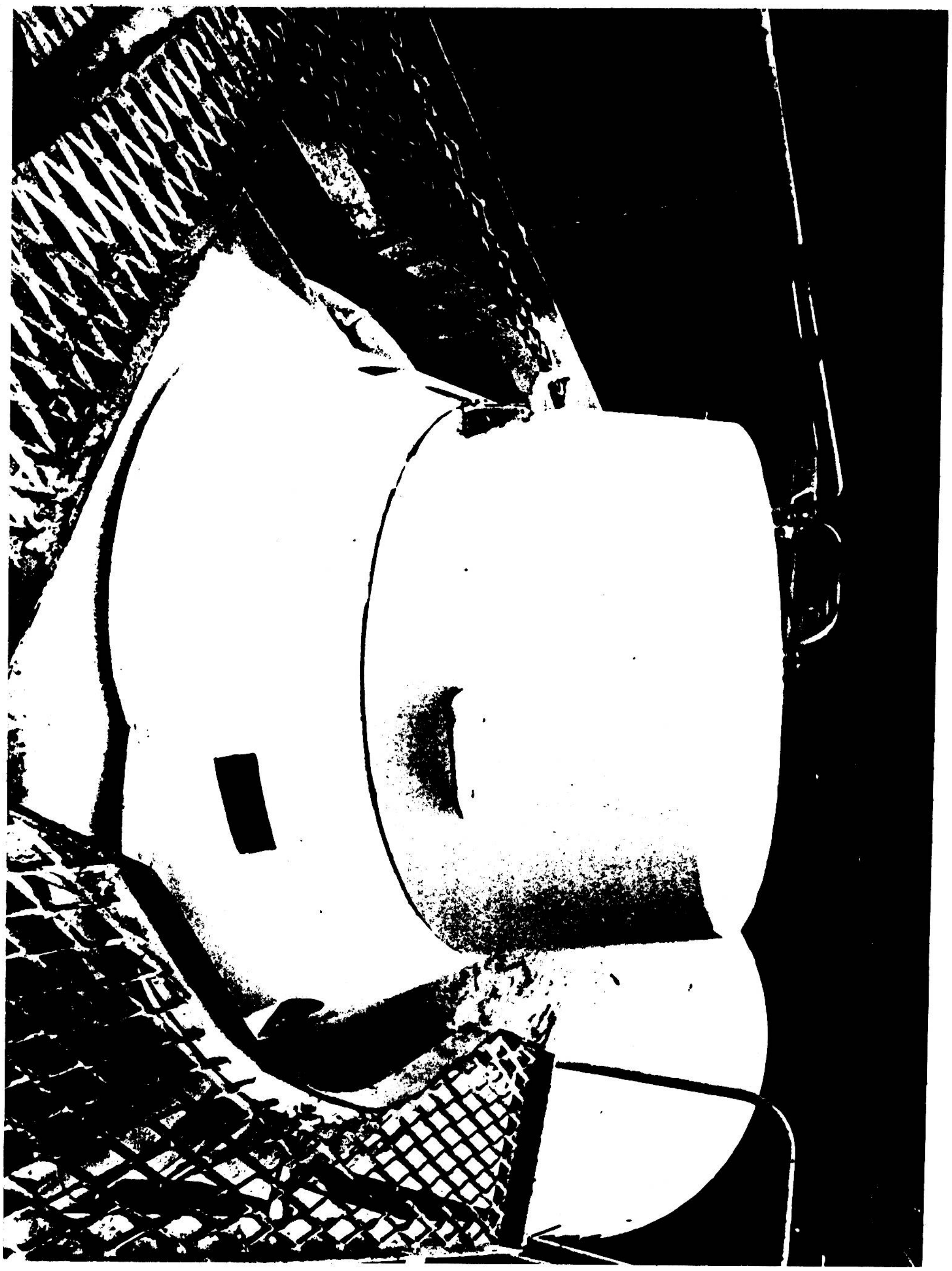
	BITC	CI
In Tank Cars	1500	3060
In Road Tankers	500	40
Total	2000	3100

Tank Car Population

		BITC		CI
Total Tank Cars		2,600		8,600
Split by Size			85/90 ton	4,200
	55/60 tonne	1,540	55 ton	3,900
	18/20 tonne	1,060	30/16 ton	570
Total Capacity, tons		128,000		595,000
Total Chlorine Moved, tons		1,500,000		3,060,000
Road Tankers		200		90

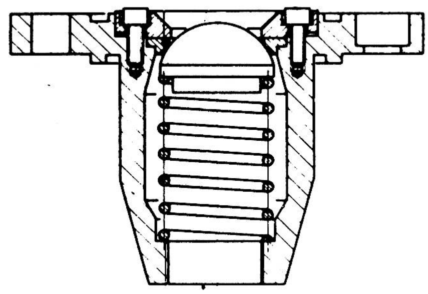
Differences in European Tank Car Design

1. Not Insulated
2. No Safety Relief Device
3. Manway Arrangement and Valve Design
   - No excess flow valve
   - Internal shutoff valve
   - Provision for remote closure

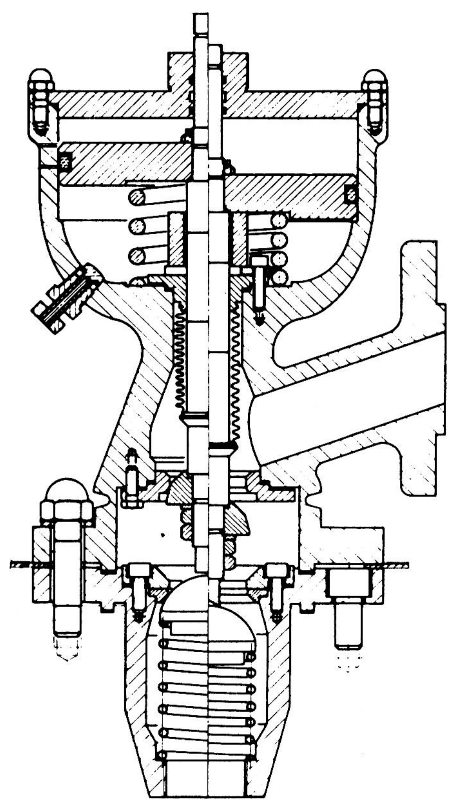



Liquid chlorine valve (red)
Device for manual opening and remote closure
Compressed air connection for pneumatic opening and closure
Gas phase valve (yellow)

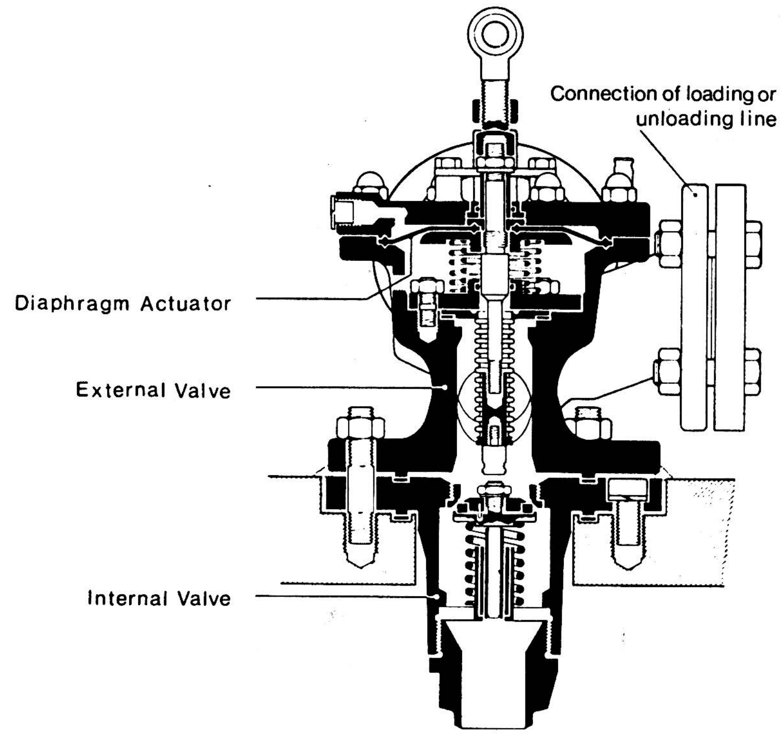
Ermeto Internal Tank Car Valve



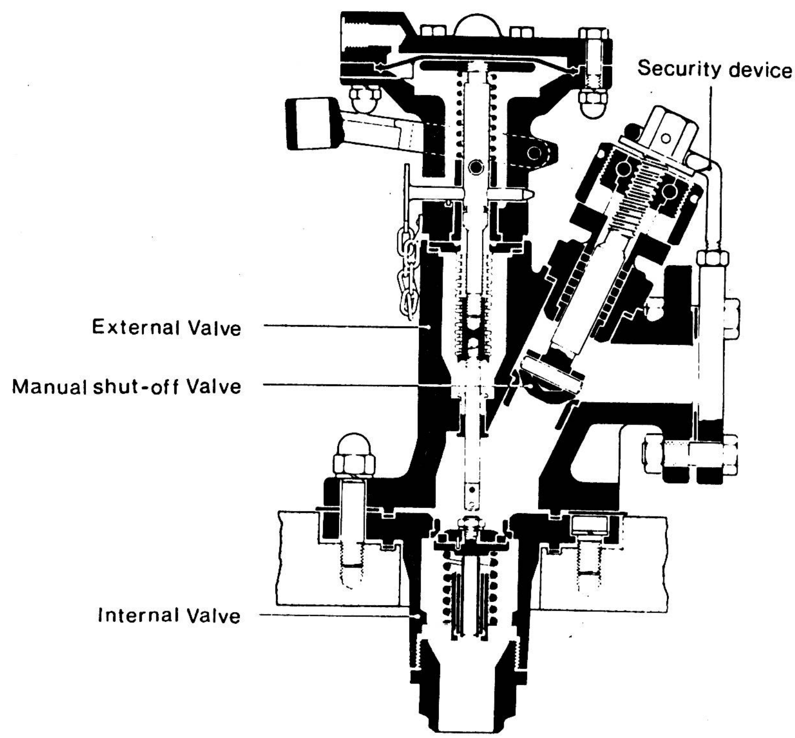
Ermeto Fully Pneumatic Internal and External Tank Car Valve



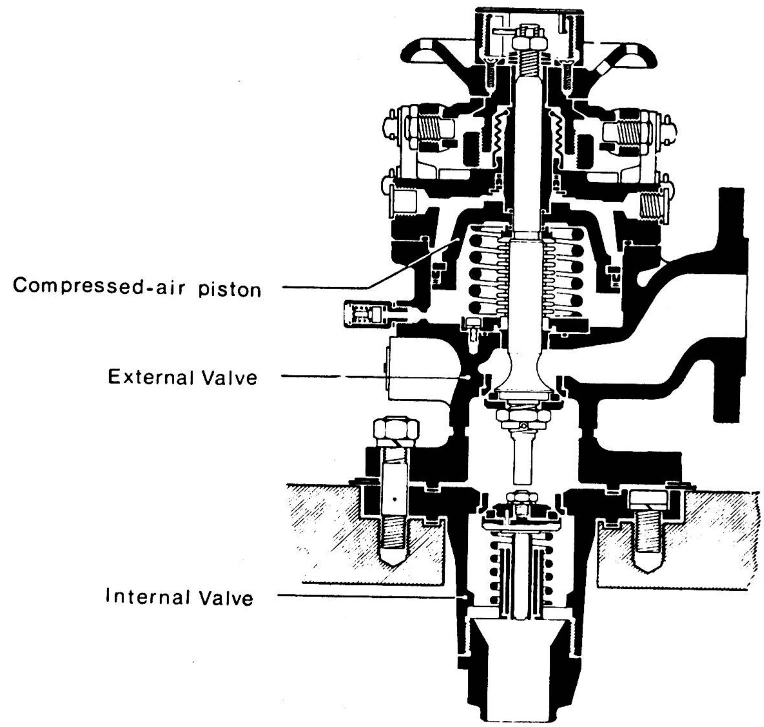
GESTRA Low Form Manual Tank Car Valve



GESTRA Manual Tank Car Valve



GESTRA Fully Pneumatic Internal and External Tank Car Valve



REVIEW OF JOINT MEETING
CHLORINE STORAGE AND TRANSPORT GROUPS
THE CHLORINE INSTITUTE
AND
THE BUREAU INTERNATIONAL TECHNIQUE CHLORE

A joint meeting of the Chlorine Storage and Transport Groups of the Chlorine Institute and its European counterpart, the Bureau International Technique Chlore (BITC) was held in London in June 1982 to discuss and compare policies and practices.

The meeting was divided into two working sub-groups, one dealing with chlorine loading and transport, and the other with chlorine storage handling practices at the plant site. In the second group, an exchange of system design and operating philosophies took place by presentation of technical papers and review of appropriate publications of the BITC and the Chlorine Institute.

There were, of course, many areas of common concern, and the exchange in these areas served to reinforce measures taken in the past. But also areas of divergence in technology did surface creating an atmosphere of dialogue and reconsideration of alternate proposals.

The technical papers presented were as follows:

CHLORINE PIPELINES

Chlorine Institute	Bob Odle, Vulcan
BITC	John Shaw, ICI

NON-REFRIGERATED (PRESSURE) STORAGE OF LIQUID CHLORINE

Chlorine Institute	Tom Liederbach, ELTECH
BITC	Dr. E. Zelfel, Hoechst

REFRIGERATED (AMBIENT PRESSURE) STORAGE OF LIQUID CHLORINE

Chlorine Institute	Manfred Pruess, Dow
	Larry Casteel, Olin
BITC	Dr. R. Strasser, Wacker Chemie

VALVES FOR LIQUID CHLORINE SERVICE

BITC	Roger Papp, PCUK

PUMPING OF LIQUID CHLORINE

Chlorine Institute	Bob Moore, Stauffer Chemical

The following is a quick review of the viewpoints stated by these nine speakers. A report including all of the papers presented during this working session will be available through the Chlorine Institute and the BITC.