

FIRE SAFETY ANALYSIS

FOR

Durango Mountain Utilities, LLC

**327 South Camino Del Rio
Durango, Colorado USA 81303**

Sheol Street Location

Located at:

#72 Sheol Street

Tank Information:

1977 Trinity Industries

18,000 Gallon Above Ground

SN# 609965

MAWP 250 PSIG @ 125 degrees Fahrenheit

Overall Diameter 109.346

Overall length 491.375

Hemispherical Head Thickness; .387

Shell Thickness; .6733

Ownership:

Durango Mountain Utilities, LLC

PREPARED BY

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INTRODUCTION

Durango Mountain Utilities, LLC places the emphasis on safety first with their product control system, emergency planning, and operating procedures.

The safety of employees and customers, within the facility, neighbors, and emergency personnel, are of paramount concern.

In spite of efforts to eliminate hazards within an LP-gas facility, management realizes accidents may occur and has developed reasonable steps to control them. Conservation of the physical plant is especially important as it relates to the safety of neighbors and the protection of their property.

HAZARD CHARACTERIZATION

Until ultimately used in consuming equipment, LP-gas is stored, transported, and handled in closed containers and piping. A hazard is created whenever LP-gas is released in other than the intended manner.

- SEE APPENDIX 8.1

EMERGENCY CONTROL OBJECTIVES

The emergency control objectives consist of three operational phases:

1. Stopping the release of LP-gas.
2. Dissipating LP-gas vapors and preventing flammable gas-air mixtures from reaching potential ignition sources or entering structures.
3. Keeping fire exposed containers and equipment cool.

ROLE OF NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

The NFPA is the pre-eminent national consensus covering the fire safety of a broad range of LP-gas installations and facilities. It is widely adopted as the basis for government regulations covering employee and public safety, and is recognized by management, fire services, and insurers as establishing the basic adequacy of public safety and property conservation measures.

NFPA 58 is a standard on equipment design, fabrication, installation and human performance. **To a substantial extent, compliance with NFPA 58 2004 EDITION will result in a self-sufficient facility that poses little risk to itself or its neighbors.**

NFPA 58 and NFPA 1

FIRE SAFETY ANALYSIS

An adequate degree of emergency control is subject to widely varying circumstances specific to each facility. Because of the large number of variables, each cannot be specifically addressed in NFPA 58. Furthermore, while it is possible that a facility could be made entirely self sufficient in fire protection, it is seldom necessary or cost efficient to do so. These factors mean that judgment must be brought to bear and agreements reached with local authorities.

5.1 NO FIRE PROTECTION REQUIRED

In compliance with specific NFPA 58 provisions, there may be situations where no fire protection is needed beyond those provided at the facility. A candidate for such a decision would be a well-isolated facility.

5.2 FIRE PROTECTION REQUIRED

Unless the circumstances described in 5.1 apply, it must be recognized that a degree of exposure exists to the facility, its employees, the persons and property of neighbors and that fire protection is needed beyond what is specifically required by NFPA 58. A plant fire brigade and / or fire department could provide this fire protection.

Such a facility will undoubtedly be within an area served by one or more emergency services - e.g., public fire, police departments and ambulance services. Facility management has a right to expect assistance from these sources. Management has a duty to obtain this assistance without requiring the emergency personnel to accept undue risks. The resolution of this risk factor is a key element in the fire safety analysis process.

If we review the previously cited Emergency Control Objectives, it will be evident that a fire department is suited to accomplish objectives 2 and 3. Water, in the proper form, can disperse gas clouds, and cool containers and equipment.

It is apparent why NFPA 58 states consideration in a fire safety analysis should also be directed to the fire department's capabilities.

5.3 FIRE DEPARTMENT CAPABILITY

The most important step, in evaluating the fire department's adequacy, is to recognize that the facility management and fire department officers must communicate with each other, at all stages of the analysis. Neither should make any assumptions about the other's capability.

The answer is adequate education and training. It will be necessary, during training, to consider the particular character of the facility and the general knowledge of the fire department.

In those instances where the general knowledge is not present, the facility management should do all it can by encouraging the fire department to obtain it. If feasible, key fire department personnel should attend training that offers 'hands-on' field exercises. Facility management should also be prepared to provide training and instructional material, which includes visual aids.

5.4 ANALYSIS FACTORS

The basic appreciation for the problems has been obtained. Now the analysis can proceed on a sound basis. As noted in NFPA 58, the analysis should include the following factors:

5.4.1 Local Conditions Of Hazards Within The Container Site

Experience has shown the most frequent cause of accidents leading to leaks and fires, in a LP-gas facility, is associated with liquid transfer operations.

5.4.1-1 Bulkhead

CONCERN: 1

Product transfer points.

FINDING:

Point of transfer protection (bulkheads).

- ❑ Point of transfer bulkheads, for the unloading of transport vehicles, offer several sound engineering principles which are combined to provide the utmost in product transfer safety.
- ❑ Designed as a robust welded steel structure, this device will remain intact and protect the connected valves and piping in the event of a pull-away.
- ❑ Durango Mountain Utility's system incorporates high-rise release nipples (on the bulkhead piping offering low torque) and nipple release, before the possibility a hose rupture could occur. This will be accomplished by a wire rope cable connection between a lug near the top of these moment nipples and the pneumatic safety switch. In the remote event of a vehicle moving with the hoses still connected, this pneumatic safety switch will release the pneumatic charge to the ESV (emergency shut-off valve) which is spring loaded to the closed position.
- ❑ Included into each ESV setup is a frangible D.O.T. approved tubing that will discharge and close the valves if subjected to perforation or flame. **This tubing, in effect, becomes an extended system fusible element.**
- ❑ Further, each valve includes a 212-degree F melt point fuse link for valve release should a flame impingement incur.

CONCERN: 2

Product transfer points.

FINDING:

Vehicle fire at product transfer points (bulkheads).

Potential for a vehicle fire impinging on the LPG system is mitigated by:

- Separation, between vehicles and LPG piping and storage tanks, is 5 and 15 feet respectfully.
- Durango Mountain Utility's policy is only trained personnel drivers, with L.P. Hazmat training, will transfer product.
- All vehicles are equipped with fire extinguishers that are inspected once per year, by an outside service, and all employees receive annual training per NFPA in their use.

Bobtail trucks: One (1) 20 lb 120-B:C extinguisher on rear deck.

Transport trucks: One (1) 20 lb 120-B:C extinguisher on rear deck.

Bulkhead: One (1) 20 lb 120-B:C extinguisher mounted the Sheol street shed next to the ESV Shutdown location.

CONCERN: 3

Product transfer points.

FINDING:

Vehicle fire at product transfer points, (bulkhead).

Expanding the dynamics of the fire safety analysis, any thermal impingement of the product transfer area will be swiftly mitigated in the following manner:

- The first situation to possibly unfold is where no product is being transferred, at the time of a vehicle fire. The vehicle would be the primary source of fuel, in this situation, and thermal impact, on the transfer area and piping, is expected to be radiant absorption with little or no impact on the storage system.
- The second situation might be where fuel is being transferred at the time of a vehicle fire. Unlike the first case, valves are in the open position and fuel is flowing. Thermal impingement upon the frangible tubing that supplies opening pressure to the safety shut off valves will melt, and these valves will fail to the closed position. Thermally redundant to the frangible tubing, “solder based” handle attachments would release upon thermal impingement, and the operation shaft will rotate to the closed position. Power, for valve closure, is provided by both internal and external torsion springs. At this point, this situation would return to the one stated in the first example where the vehicle itself will be the only fuel to support combustion.

Residual fuel in the affected piping will react in the following manner:

- The vapor will heat up gradually as the piping containing it warms, but the thermal transferal to a compressible vapor does not incite a product expansion concern. Liquid propane, in exposed piping, will expand during heating. Before a dangerous hydrostatic condition can occur, redundant safety features will accommodate this expansion. The Fisher internal valves are “bubble tight” primary shut off valves that contain product in the storage tank. Their design prevents product exiting the vessel when closed, but will allow higher pressured gas or liquid to push open the valve seat and re-enter the vessel, until equilibrium is established.

- Should an isolation valve be closed in a liquid line, the pressure return properties prescribed to the internal valves will be negated. Installation of a hydrostatic relief valve, between any two-fixed positive shut off valves, in a liquid line, is required and so designed. The “start to discharge” pressures, of a hydrostatic relief valve, are between 400 PSIG and 500 PSIG (NFPA 58). Pressure drops dramatically with just a diminutive amount of liquid discharge and the relief valve will reseal and seal as the pressure drops. These relief valves insure that Durango Mountain Utility’s system stays within the pressure guidelines of NFPA piping requirements. They are designed to handle working pressure of 350 PSIG and a minimum burst pressure of 1,750 PSIG (NFPA 58 and ASME B31.1 requirements).

CONCERN: 4

Product transfer points.

FINDING:

Vehicle fire at product transfer points, (bulkheads).

- To elevate the tank temperature, from the heat of a vehicle fire that is not fueled with propane from the vessel, is very unlikely. Fuel equals fire and Durango Mountain Utility’s positive product control prevents acceleration of an incident involving a vehicle.
- To reiterate, separation between vehicles and LPG piping and storage tanks are 10 and 15 feet respectfully, 5 feet from tank to crash post, plus a 10-foot fill hose as required by Durango Mountain Utility’s operating producers thus minimizing the possibility of an engine fire impinging on the system.
- Durango Mountain Utility’s designed system further enhances safety, by the tank positioning, piping layout, and the transport and bobtail truck design. On transport trucks, engine position are 20 feet ahead of trailer openings that are parallel to the bulkhead and piping; in effect, adding another 20-foot margin of safety. On bobtails this added margin is 15 feet.
- Employee training in fire safety, product transfer, and use of safety equipment coupled with Durango Mountain Utility’s design features, assures a safe operation.
- SEE APPENDICES 8.2, 8.3

5.4.1-3 Vessel Valving

CONCERN:

Vessel valving meets or exceeds requirements of NFPA 58.

FINDING:

- All vessel valving exceeds requirements of NFPA 58.
- The designed system provides for a combination excess flow and a primary shutoff valve which positions the soft-seated sealing media within the structural envelope of the vessel. This type of combination valve is referred to as a Fisher type, C427 Internal Valve. An internal valve of this design also incorporates a breakaway annulus. It allows the valve to absorb mechanical impact and shear at a predetermined point that leaves the seating portions of the valve intact and seals in the product.
- Additionally, with the primary shut off sealing media encased within the vessel, the opportunity for thermal denigration of the valve, should it be subjected to a conflagration, will be greatly reduced.
- Internal valves are internally spring loaded to statically remain closed. Remote operation of the internal valves is accomplished pneumatically via regulated air source.
- As an excess flow valve, the internal valve will snap closed if the product flow is greater than the rated flow of the internal spring.
- The pneumatic operators (model AA9) that control the internal valves are spring loaded to the closed position. Air is transferred, from remote control stations to the valve operators, by means of a frangible D.O.T. approved tubing, which will discharge and close the valves if subjected to perforation or flame. Further, each valve operator includes a 212-degree F melt point solder fuse plug, for release, should an internal valve incur flame impingement.
- SEE APPENDICES 8.4, 8.6

5.4.1-4 Protection

CONCERN:

Protection of pumps, compressors, and motors.

FINDING:

- ❑ A multiple protection system is employed for the transfer of the product.
- ❑ The pump motor is wired for thermal overload.
- ❑ Heaters in the electrical starting circuit provide thermal backup protection.
- ❑ Pump employs a bypass valve inline for overpressure safety.
- ❑ SEE APPENDIX 5.5

5.4.1-5 Piping Design

CONCERN:

Is piping designed according to the requirements of NFPA 58?

The term piping as used in NFPA 58 includes pipe, tubing, valves, and all fittings used in the system.

FINDING:

- ❑ Above ground piping and support meets UFC requirements.
All piping meets ASTM requirements.
- ❑ The underground piping is Schedule 80 seamless pipe with extruded coating with all the weld joints primed and wrapped. A single 17# magnesium anode was installed to provide cathodic protection.
- ❑ Piping meets all local building, fire, and state codes.
- NOTE: The State of Colorado, Division of Oil and Public Safety, will review and inspect all piping. They will also inspect the total system for compliance to all state code requirements prior to system activation.
- ❑ SEE APPENDIX 8.2

5.4.1-8 Property Access

CONCERN: 1

Access by fire department apparatus and personnel - e.g., fenced gates, and roadways, to include fire flow capability.

FINDING:

- Access by fire department apparatus and personnel is provided by utilizing Sheol Street.

CONCERN: 2

Access by fire department apparatus and personnel - e.g., fenced gates, and roadways, to include fire flow capability.

FINDING:

- Three existing hydrants provide fire flow availability.
 - # 1 Hydrant is located at the stop sign on Sheol Street
 - #2 Hydrant is located at the top of the stairs adjacent the “Arrival Court”
 - #3 Hydrant is located in front of the Peregrine Point condominium phase one.
- Reference this report section 5.4.3

5.4.1-9 Emergency Shutdown Controls ESV system

CONCERN:

Are emergency shutdown controls available and do they meet or exceed requirements of NFPA 58?

FINDING:

- Emergency shutdown controls are in place and exceed requirements of NFPA 58.
- Push button Pneumatic Nitrogen controls operate **all** valves associated with the storage system. These controls are placed in strategic locations throughout the facility.
- Control #1- on the bulkhead.
- Control #2- south side of the tank, on the east side of the Sheol Street Shed.
- If any one of the above controls is activated, a total system shutdown will occur. Upon this occurrence, all valving will close; all pumps will cease to operate; and electrical power will be disconnected.
- NOTE: When a circumstance causes a loss of air pressure at any point in the system, the result will be an unrestricted valve closing and system shutdown.

5.4.1-11 LPG Tank Farm Protection

CONCERN:

Protection of LPG tank; i.e., vessel, piping, pumps, and bulkhead.

FINDING:

- Concrete barriers, exceeding the Uniform Fire Code requirements, have been installed and shall be placed and offset at prescribed distances.
- The tank is protected from over pressurization by relief valves sized to the proper tank capacity.

5.4.2 Exposure To And From Other Properties

5.4.2-1 Exposure From Other Property

CONCERN:

Exposure from other property.

FINDING:

- Location and setback from adjacent property lines and buildings of importance meet or exceed code requirements.
- South side of property location is the Sheol Street shed, and vacant land to the vehicular access to the ski lifts at the base.
- North of property is driveway access into the employee parking for Purgatory Lodge
- East side of the property is the East Rim Condominium owners association.
- These three sides pose no risk to Durango Mountain Utility's operations.

5.4.2-2 Exposure To Other Property, Evacuation Routes, Road Closures

CONCERN: 1

Exposure to other property.

FINDING:

- With Durango Mountain Utility's product control and safety shutdown systems in place, the likelihood of an uncontrolled product release is close to nonexistent; therefore, posing no special hazard to adjacent properties or personnel.
- In the unlikely event of an emergency occurring, evacuation routes for Durango Mountain Utility's facility, and its surrounding areas, are easily accessible avoiding placing personnel and neighbors in harms way.

CONCERN: 2

Evacuation routes.

FINDING:

- The ordinary route for the safe orderly evacuation of the area would be north along Sheol Street.
- In the unlikely event that Sheol Street was in accessible personnel and residents could be evacuated along the "Old Hermosa Park" Road.

CONCERN: 3

Highway closure.

FINDING:

- If events compelled the closure of US Highway 550, the following situations would prevail.
 1. Notifications of the Colorado State Patrol by the County Fire Department.
 2. Notification of Colorado Department of Transportation by the Colorado State Patrol.
- Depending on the situation, Durango Mountain Resort's site location offers several choices for the County Fire Department, the Colorado State Patrol, and the Colorado Department of Transportation, in diverting traffic around their property.
- SEE APPENDIX 8.11

5.4.3 Water Supply

One of the major points considered in this analysis is the availability, quantity, and reliability of a water supply.

Experience shows that the likelihood of a leak large enough to escape, beyond the facility boundaries, is of a lesser degree at facilities complying with the leak control provisions in NFPA 58. Ignited escaping gas that is feasible to control does not pose a severe hazard to the facility, its neighbors, or emergency personnel.

The quantity of water needed, for adequate container cooling, can be determined by the area directly contacted by flames. Considerable test work indicates approximately 0.20 to 0.25 gpm per sq. ft. of container area directly contacted by flames is needed. Based upon reports of fire exposing 18,000-gallon containers, exposure to about 1/3 of the tank area is likely. On this basis, the water needed would be from 100 gpm per container exposed to a single fire.

5.4.3-1 Quantity and Reliability

CONCERN: 1

Available water supplies.

FINDING:

Fire flow information provided by the Purgatory Metropolitan District.

- **Hydrant #1 (NW0035)** - Water flow, for this hydrant, located at the stop sign on Sheol Street. The Static pressure is 89 PSIG the flow rate is 1007 @ 75 PSIG.
 - **Hydrant #2 (NW0036)** Located at the top of the stairs adjacent the “Arrival Court”. The Static pressure is 89 PSIG the flow rate is 1552 @ 65 PSIG.
 - **Hydrant #3 (NW0027)** Located in front of the peregrine point condominiums. The Static pressure is 89 PSIG the flow rate is 2421 @ 855 PSIG.
- Summary: total water flow equals 4980 gpm, which is many times greater than the required 100 gpm.

CONCERN: 2

Quantity and reliability of water supply.

FINDING:

- Purgatory Metropolitan District supplies this area with storage tanks supplied by wells.

5.4.4 Effectiveness Of Plant Fire Brigades

This NFPA 58 term is used in the context of what plant employees can do to accomplish the emergency control objectives. At any facility, in which the storage and distribution of LP gas is the primary purpose, the employees' role reflects primarily objectives 1 and 2.

Usually the number of employees, in these facilities, is small and inadequate to accomplish objective 3.

Fire department personnel, with their equipment and techniques, must accomplish this objective.

With respect to objective 1 (stopping the release of LP gas), facility employees are in a far better position to accomplish this than the fire department or anyone else.

This is their **prime objective**.

With respect to objective 2 (preventing flammable gas-air mixtures from reaching ignition sources and entering structures), employees can shut down equipment, which constitute potential ignition sources.

This facility has a written emergency plan, which includes activities to accomplish objectives 1 and 2.

DMU currently has 24 hour Security patrol on the property and trained personnel who can address emergency response and "make safe" procedures / activities over the telephone 24/7

5.4.4-1 LP-Gas Release

CONCERN:

LP-gas release.

FINDING:

- With the automated product control system and personnel training proposed for this facility, an event causing a gas release is very unlikely. If a release did occur, Durango Mountain Utilities Operator Qualified employees have the training to minimize and curtail it.

5.4.4-2 Flammable Gas-Air Mixture

CONCERN:

Preventing flammable gas-air mixtures reaching ignition sources.

FINDING:

- At the present time, there are no plans to have an office or shop on the property thus even further reducing a gas-air mixture from reaching a source of ignition.

5.4.4-3 Written Emergency Plans And Procedures

CONCERN:

Written emergency plans and procedures.

FINDING:

Durango Mountain Utilities is using their written emergency plan that is part of their Operations and Maintenance plan.

This includes:

Durango Mountain Utilities, LLC Personnel
Mick Hinkle OQ Operations Technician
Kevin Gross OQ Operations Technician
Jim Brantley OQ Operations Technician

Mike Sims Manager
ML Sims L.P. Gas Safety Consulting, LLC

5.4.5 Fire Department Capabilities (information provided by: Deputy Fire Marshal George Surmi and Deputy Chief Clay)

Several aspects of the fire department's effectiveness have been addressed in the preceding four factors. These must also be considered in the analysis.

5.4.5-1 Response Time

Response time is very important. The shorter the response time, the more valuable and effective the response will be.

CONCERN:

Response time of the fire department for first and second alarm.

FINDING:

- ✚ Durango Fire Rescue Authority Station 15 (Career) 1st alarm 1 min / Turnout 1 min /
Travel 9.6 min / Total ETA 11.6 min
- ✚ DFRA Station 14 (Volunteer) 1st alarm 1 min / Turnout 4 min / Travel 14.6 min /
Total ETA 19.6 min.

- DFRA Station 16 (Volunteer) 1st alarm 1 min / Turnout 4 min / Travel 1.5 min /
Total ETA 6.5 min.

2A: Name of the person in the FD assisting with the data acquisition:
George Surmi. (970) 382-6025.

2B: Position of the person in the FD assisting with the data acquisition:
Deputy Fire Marshal.

3A: Date on which FD data was collected: 10/22/07, 10/25/07

3B: Name of the person collecting the data: George Surmi, Deputy Chief Alan Clay

4: Number of firefighters on duty at any time: 16

5: Average number of firefighters available for response: 20

6A: Number of firefighters qualified to FF I: 68

6B: Number of firefighters qualified to FF II: 35

7A: Number of firefighters who would respond on the first alarm to the facility: 5

7B: Number of firefighters who would respond on the first alarm and who are qualified to the operations level requirements of NFPA 472 or local requirements: 38

7C: Number of firefighters who would respond on the first alarm with specific knowledge and training on the properties of LP-Gas and LP-Gas fires: 38

8A: Number of fire apparatus that have the capability to deploy a 125 gpm hose line supplied by onboard water for at least 4 minutes, and, which are in service in the department: 16

8B: Number of fire apparatus that have the capability to deploy a 125 gpm hose line supplied by onboard water for at least 4 minutes, and, which would respond on a first alarm: 2

5.4.5-2 Effectiveness

CONCERN:

Effectiveness of the fire department.

FINDINGS:

- Number of firefighters on duty at any time: 16
- Average number of firefighters available for response: 20
- Number of firefighters qualified to FF 1: 68
- Number of firefighters qualified to FF II: 35
- Number of firefighters who would respond on the first alarm with specific knowledge and Training on the properties of LP-Gas and LP-Gas fires: 38

- Number of fire apparatus that have the capability to deploy a 125 gpm hose line supplied by onboard water for at least 4 minutes, and which are in service in the department: 16
- Number of fire apparatus that have the capability to deploy a 125 GPM hose line supplied by onboard water for at least 4 minutes, and which would respond on a first alarm: 2

5.4.6 Communications

CONCERN:

Communication delays.

FINDING:

- Telephone service lines are placed well away from the tank system; thereby, minimizing the initial exposure to a product release.
- Operators, at transfer locations, will have mobile cell phone / radio capabilities.

CONCLUSION

The most important single factor is for Durango Mountain Utilities, LLC and the Fire Department to work closely together in an atmosphere of cooperation as an on-going practice. The

personnel in all organizations are subject to change and the relationship must be sustained for the good of the facility, neighbors, fire department, and the community at large.

This analysis ranges widely to take in all aspects of design criteria, employees, facility capabilities, on and off-site conditions, water requirements, water availability, fire department capability, access and response times.

This analysis has several recommendations.

1. Cooperation and training between Durango Mountain Utility and the Fire Department must be continued.
2. On-site training and familiarization by the Fire Department on Durango Mountain Utility operations and shutdown procedures.(Training done by Paul Reed)
3. This on-site training must include the Durango Fire Rescue Authority, personnel from stations #14, #15, and #16.
4. Acceptance by the fire departments of Durango Mountain Utility's offer for training, by the Western Propane Gas Associations, at "no charge" to the department.

The above recommendations are in keeping with Durango Mountain Utilities, LLC ongoing commitment to continue to provide LP Gas to its customers in the safest possible manner going above and beyond Local, State, and Federal Code requirements.

"The 2004 edition of NFPA 58, in 3-10.2.3, changed the first consideration, in an analysis, from the **capability of the fire department and availability of water to an evaluation of the total product control system**. Paragraph 3-10.2.3, in the 2004 edition, states that the total product control system includes emergency internal and shutoff valves having remote and thermal shutoff capability and pull-away protection, and optional requirements in the new Section 3-11, are the first consideration. Valves with these features and pull-away protection significantly reduce the potential of product release."

"The 2004 edition adds even more safety requirements to control releases. For example, paragraph

3-2.10.11 (g) requires all new and existing facilities, with a single container over 4000 gal (15.1 m³), and multiple container systems, with an aggregate water capacity of more than 4000 gal (15.1 m³), to have at least one identified and easily accessible manually operated remote emergency shutoff device. This device must be located not less than 20 ft (6.1 m) nor more than 100 ft (30.5 m), in the path of egress from an emergency shutoff valve.”

Note: The above paragraphs, is information from the LP – GAS CODE HANDBOOK seventh edition 2004 which is an in-depth extension of NFPA 58 2004 edition. Durango Mountain Utilities, LLC facility and design exceeds the criteria of the above two paragraphs plus the requirements of NFPA 1.

NFPA 58 stipulates two conditions must be met; namely, a serious hazard must exist and the fire department is incapable of an effective response, before Special Protection is required.

After considerable study and evaluation, taking into account the product control system, and the Fire Department capability of an effective response, the conclusion reached is:

‘NO SERIOUS HAZARD EXISTS’

THEREFORE, NO SPECIAL PROTECTION IS REQUIRED.

APPENDICES

8.1 MATERIAL SAFETY DATA SHEET

8.2 TRANSPORT BULKHEAD - PIPE SUPPORTS – PRODUCT CONTROL

8.3 EMERGENCY SHUTOFF VALVES

- 8.4 INTERNAL VALVE
- 8.5 BY-PASS AND RELIEF VALVES
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- 8.7 STRUCTURAL DESIGN AND PIPING PLAN
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1

MATERIAL SAFETY DATA SHEET FOR ODORIZED PROPANE

1. Chemical Product and Company Identification

Product Name: Odorized Commercial Propane **Name & Address:**

Chemical Name: Propane **AmeriGas Propane, L.P.**

Chemical Family: Paraffinic Hydrocarbon **P. O. Box 965**

Formula: C₃H₈ **Valley Forge, PA. 19482**

Synonyms: Dimethylmethane, LP-Gas, Liquefied Petroleum Gas (LPG), Propane, Propyl Hydride

Transportation Emergency Number: For General Information, Call:

CHEMTREC 1-800-424-9300 1-610-337-1000, Safety Dept.

2. Composition / Information on Ingredients

INGREDIENT NAME /CAS NUMBER	PERCENTAGE	OSHA PEL	ACGIH TLV
Propane / 74-98-6	87.5 -100	Simple asphyxiant
Ethane / 74-84-0	0 - 7.0	Simple asphyxiant
Propylene / 115-07-1	0 - 5.0	Simple asphyxiant
Butanes / 106-97-8	0 - 2.5	Simple asphyxiant
Ethyl Mercaptan / 75-08-1	0 - 50 ppm	0.5 ppm

WARNING: The intensity of the chemical odorant (e.g., ethyl mercaptan) may “fade” or diminish due to chemical oxidation, adsorption or absorption. Individuals with nasal perception problems may not be able to smell the odorant. Leaking propane from

underground gas lines may lose its odor as it passes through certain soils. No odorant is effective 100% of the time. Therefore, circumstances can exist when individuals are in the presence of leaking propane and not be alerted by the smell. Contact AmeriGas

for more information about odor, propane gas detectors and other safety considerations associated with the handling, storage and use of propane.

3. Hazards Identification

EMERGENCY OVERVIEW

DANGER! Flammable liquefied gas under pressure. Keep away from heat, sparks, flame, and all other ignition sources. Vapor replaces oxygen available for breathing and may cause suffocation in confined spaces. Use only with adequate ventilation. Reliance upon detection of odor may not provide adequate warning of potentially hazardous concentrations. Vapor is heavier than air; may collect at low levels. Liquid can cause freeze burn similar to frostbite. Do not get liquid in eyes, on skin, or on clothing. Avoid SPECIAL HAZARDS* breathing vapor. Keep service valve closed when not in use.

POTENTIAL HEALTH EFFECTS INFORMATION

ROUTES OF EXPOSURE:

Inhalation: Asphyxiation. Before suffocation could occur, the lower flammability limit of propane in air would be exceeded, possibly causing both an oxygen-deficient and explosive atmosphere. Exposure to concentrations >10% may cause dizziness. Exposure to atmospheres containing 19% or less oxygen will bring about unconsciousness without warning. Lack of sufficient oxygen may cause serious injury or death.

Eye Contact: Contact with liquid can cause freezing of tissue.

Skin Contact: Contact with liquid can cause frostbite.

Skin Absorption: None.

Ingestion: Ingestion is not expected to occur in normal use. However, liquid can cause freeze burn similar to frostbite.

CHRONIC EFFECTS: None. **CARCINOGENICITY:** Propane is not listed by NTP, OSHA or IARC.

4. First Aid Measures

INHALATION: Individuals suffering from lack of oxygen should be removed to fresh air. If victim is not breathing, administer artificial respiration. If breathing is difficult, administer oxygen. Obtain immediate medical assistance.

EYE CONTACT: Gently flush eyes with lukewarm water. Obtain immediate medical assistance.

SKIN CONTACT: Remove saturated clothes, shoes and jewelry. Immerse affected area in lukewarm water not exceeding 105° F.

Keep immersed. Obtain immediate medical assistance.

4

1 0

1,000 ppm

Minimal 0

Slight 1

Moderate 2

Serious 3

Severe 4

*(Ref. NFPA 704)

HEALTH HAZARD

(Blue)

FIRE HAZARD

(Red)

REACTIVITY

(Yellow)

2

INGESTION: If swallowed, obtain immediate medical assistance.

5. Fire-Fighting Measures

FLASH POINT: -156°F (-104°C) **AUTOIGNITION:** 842°F (432°C)

IGNITION TEMPERATURE IN AIR: 920°F to 1120°F (493°C to 549°C)

FLAMMABLE LIMITS IN AIR (% by volume): Lower: 2.15% Upper: 9.6%

EXTINGUISHING MEDIA: Dry chemical, CO₂, water spray or fog for surrounding area. Do not attempt to extinguish fire until propane source is isolated.

SPECIAL FIRE-FIGHTING INSTRUCTIONS: Evacuate all unnecessary personnel from the area. Allow only properly trained and protected emergency response personnel in area. A NIOSH approved self-contained breathing apparatus may be required. If gas flow cannot be shut off, do not attempt to extinguish fire. Allow fire to burn itself out. Use high

volume water supply to cool exposed pressure containers and nearby equipment. Approach a flame-enveloped container

from the sides, never from the ends. Use extreme caution when applying water to a container that has been exposed to

heat or flame for more than a short time. For uncontrollable fires and/or when flame is impinging on container, withdraw

all personnel and evacuate vicinity immediately.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Propane is heavier than air and can collect in low areas. Flash back

along a vapor trail is possible. Pressure in a container can build up due to heat; and, container may rupture suddenly and

violently without warning if pressure relief devices fail to function properly. If flames are against the container, withdraw

immediately on hearing a rising sound, if venting increases in volume or intensity or if there is discoloration of the container due to fire. Propane released from a properly functioning relief valve on an overheated container can also become ignited.

HAZARDOUS COMBUSTION PRODUCTS: None.

6. Accidental Release Measures

IF MATERIAL IS RELEASED OR SPILLED: Evacuate the immediate area. Eliminate any possible sources of ignition

and provide maximum ventilation. Shut off source of propane, if possible. If leaking from container or valve, contact your supplier or AmeriGas immediately.

7. Handling and Storage

HANDLING PRECAUTIONS: Propane vapor is heavier than air and can collect in low areas that are without sufficient

ventilation. Conduct system checks for leaks with a leak detector or solution, never with flame. Make certain the container service valve is shut off prior to connecting or disconnecting. If container valve does not operate properly, discontinue use and contact AmeriGas. Never insert an object (e.g., wrench, screwdriver, pry bar, etc.) into pressure

relief valve or cylinder valve cap openings. Do not drop or abuse cylinders. Never strike an arc on a gas container or

make a container part of an electrical circuit. See Section 16, "OTHER INFORMATION", for additional precautions.

STORAGE PRECAUTIONS: Store in a safe, authorized location (outside, detached storage is preferred) with adequate

ventilation. Specific requirements are listed in NFPA 58, LP-GAS CODE. Isolate from heat and ignition sources. Containers should never be allowed to reach temperature exceeding 125°F (52°C). Isolate from combustible materials.

Provide separate storage locations for other compressed and flammable gases. Propane containers should be separated

from oxygen cylinders or other oxidizers by a minimum distance of 20 feet, or by a barrier of non-combustible material at

least 5 feet high having a fire rating of at least 1/2 hour. Full and empty cylinders should be segregated. Keep cylinders

in an upright position at all times so that each pressure relief valve communicates with the vapor space. Keep container

valve closed and plugged or capped when not in use. Install protective caps when cylinders are not connected for use.

Empty containers retain some residue and should be treated as if they were full.

8. Exposure Control / Personal Protection

ENGINEERING CONTROLS

Ventilation: Provide ventilation adequate to ensure propane does not reach a flammable mixture.

RESPIRATORY PROTECTION

General Use: None.

Emergency Use: If concentrations are high enough to warrant supplied-air or NIOSH self-contained breathing apparatus, then the atmosphere may be flammable (See Section 5). Appropriate precautions must be taken regarding flammability.

PROTECTIVE CLOTHING: Avoid skin contact with liquid propane because of possibility of freeze burn. Wear gloves

and protective clothing that are impervious to the product for the duration of the anticipated exposure.

EYE PROTECTION: Safety glasses, goggles or face shields are recommended when handling cylinders.

OTHER PROTECTIVE EQUIPMENT: Safety shoes are recommended when handling cylinders.

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9. Physical and Chemical Properties

BOILING POINT: @ 14.7 psia = -44° F (@1.00 atm.pressure = -42°C)

SPECIFIC GRAVITY OF VAPOR (Air = 1) at 60° F (15.56°C): 1.50

SPECIFIC GRAVITY OF LIQUID (Water = 1) at 60° F: 0.504

VAPOR PRESSURE: @ 70° F (20°C) = 127 psig; @ 105° F (45°C) = 210 psig; @ 130°F (55°C) = 287 psig

EXPANSION RATIO (From liquid to gas @ 14.7 psia): 1 to 270

SOLUBILITY IN WATER: Slight, 0.1 to 1.0%

APPEARANCE AND ODOR: A colorless and tasteless gas at normal temperature and pressure. An odorant (ethyl mercaptan) is added to provide a strong unpleasant odor. Should a propane-air mixture reach the lower limits of flammability, the ethyl mercaptan concentration will be approximately 0.5 ppm in air.

ODORANT WARNING: Odorant is added to aid in the detection of leaks. One common odorant is ethyl mercaptan, CAS

No. 75-08-1. Odorant has a foul smell. The ability of people to detect odors varies widely. Also, the odor level can be

reduced by certain chemical reactions with material in the propane system or when fugitive propane gas from underground leaks passes through certain soils. No odorant will be 100% effective in all circumstances. If the presence

of the odorant is not obvious, notify AmeriGas immediately.

10. Stability and Reactivity

STABILITY: Stable.

Conditions to Avoid: Keep away from high heat, strong oxidizing agents and sources of ignition.

REACTIVITY:

Hazardous Decomposition Products: Under fire conditions, fumes, smoke, carbon monoxide, aldehydes and other decomposition products. In most applications where there is inadequate venting to the outside air, incomplete combustion will produce carbon monoxide (a toxic gas) and potentially develop concentrations that can create a serious health hazard.

Hazardous Polymerization: Will not occur.

11. Toxicological Information

Propane is non-toxic and is a simple asphyxiant. It has slight anesthetic properties. Higher concentrations may cause dizziness.

IRRITANCY OF MATERIAL: None. **SENSITIZATION TO MATERIAL:** None

REPRODUCTIVE EFFECTS: None **MUTAGENICITY:** None

TERATOGENICITY: None **SYNERGISTIC MATERIALS:** None

12. Ecological Information

No adverse ecological effects are expected. Propane does not contain any Class I or Class II ozone-depleting chemicals

(40 CFR Part 82). Propane is not listed as a marine pollutant by DOT (49 CFR Part 171).

13. Disposal Considerations

WASTE DISPOSAL METHOD: Do not attempt to dispose of residual or unused product in the container; return it to your

supplier or contact AmeriGas for safe disposal. Residual product within a process system may be burned at a controlled

rate if a suitable burning unit is available on site, and is done in accordance with federal, state and local regulations.

14. Transport Information

DOT SHIPPING NAME: Liquefied Petroleum Gas **SHIPPING LABEL (S):** Flammable Gas

IDENTIFICATION NUMBER: UN 1075 **PLACARD (WHEN REQUIRED):** Flammable Gas

IMO SHIPPING NAME: Propane **SPECIAL SHIPPING INFORMATION:** Container must be

IMO IDENTIFICATION NUMBER: UN 1978 transported in a well-ventilated vehicle, secured, and in a **HAZARD CLASS:** 2.1 (Flammable Gas) position such that the pressure relief device is in communication **PRODUCT RQ:** None with the vapor space.

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15. Regulatory Information

The following information concerns U.S. Federal regulatory requirements potentially applicable to this product. Not all

such requirements are identified. Users of this product are responsible for their own regulatory compliance on a federal,

state [provincial] and local level.

U.S. FEDERAL REGULATIONS

Environmental Protection Agency (EPA)

Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) - 40 CFR Parts 117 and 302

Reportable Quantity (RQ): None

Superfund Amendment and Reauthorization Act (SARA)

- Sections 302/304: Relates to emergency planning on threshold planning quantities (TPQ) and release reporting based on reportable quantities (RQ) of EPA's extremely hazardous substances (40 CFR Part 355).

Extremely Hazardous Substances: None **Threshold Planning Quantity (TPQ):** None

- Sections 311/312: Relates to submission of material safety data sheets (MSDSs) and chemical inventory reporting with identification of EPA-defined hazard classes (40 CFR Part 370). The hazard classes for this product are:

IMMEDIATE: No **PRESSURE:** Yes **DELAYED:** No **REACTIVITY:** No **FLAMMABLE:** Yes

- Section 313: Relates to submission of annual reports of release of toxic chemicals that appear in 40 CFR Part 372. Propane does not require reporting under Section 313.

Toxic Substance Control Act (TSCA)

Propane is listed on the TSCA inventory.

Occupational Safety and Health Administration (OSHA)

The following 29 CFR Parts may apply to propane:

29 CFR 1910.110: *Storage and Handling of Liquefied Petroleum Gases*

29 CFR 1910.119: *Process Safety Management of Highly Hazardous Chemicals*

29 CFR 1910.1200: *Hazardous Communications*

Food and Drug Administration (FDA)

21 CFR 184.1655: Generally recognized as safe (GRAS) as a direct human food ingredient when used as a propellant, aerating agent and gas.

16. Other Information

SPECIAL PRECAUTIONS: Use piping and equipment adequately designed to withstand pressure to be encountered.

NFPA 58, LP-GAS CODE and OSHA 29 CFR 1910.10 require that all persons employed in handling LP-gases be trained

in proper handling and operating procedures, which the employer shall document. Contact your propane supplier or AmeriGas to arrange for the required training. Allow only trained and qualified persons to install and service propane

containers and systems.

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Type N550 Emergency Shutoff Valves Instruction Manual

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Failure to follow these instructions or to properly install and maintain this equipment could result in an explosion and/or fire causing property damage and personal injury or death.

Fisher equipment must be installed, operated, and maintained in accordance with federal, state, and local codes and Fisher instructions. The installation in most states must also comply with NFPA No. 58 or ANSI K61.1 standards.

Only personnel trained in the proper procedures, codes, standards, and regulations of the LP-gas or anhydrous ammonia industries should install and service this equipment.

Introduction

Scope of Manual

This instruction manual covers installation and maintenance for the Type N550 Series Emergency Shutoff Valves and Accessories.

Description

Type N550 Snappy Joe® (Figure 1) emergency shutoff valves are intended for in-line use on LP-gas or NH₃ service.

The valves may be installed on both ends of transfer hoses where the hose connects the bulk plant piping to the bobtail, transport, or tank car. They provide a quick way of shutting off gas flow in the event of a hose rupture and meet the requirements for such service when correctly installed with a remote release and proper piping support. The N550 valves are lever operated, latch-open, and quick closing valves. A fusible element in the latch melts if the temperature reaches 212°F (100°C), allowing the valve to close.

The following accessories are also covered:

Type P164B – Cable Release Assembly.

Type P327D – Remote Pneumatic Release Assembly.

Specifications

Table 1 lists specifications for the Type N550 valve which is designed for butane, propane, or NH₃ service at ambient temperatures. Contact the factory if the valve is to be used on any other service, fluid, compressed gas, or temperature condition.

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Operation

The Type N550 handle and shaft may break if the valve is forced open against the gas flow and before pressure is equalized on each side of the main valve disc.

To Open a Closed Valve:

Close a shutoff valve downstream of the N550. Pull the N550 handle counter clockwise. There will be resistance to opening as inlet pressure helps hold the valve disc closed against the seat. The initial opening force on the handle opens a pilot valve in the main valve disc, permitting pressure to build up downstream. When differential pressure across the main disc has been reduced, the N550 can be opened without further difficulty by continuing to lift the handle to the open position. When the handle is fully open (handle perpendicular to the pipe) the latch engages to hold the valve open.

Because the valve is spring closed (aided by pressure), the handle can snap down with considerable force when closing. Keep hands and fingers away from the handle as it closes.

To Close an Open Valve:

Pushing the handle down (handle parallel to the pipe) will close the valve.

From a remote location, pulling on the remote cable or exhausting pneumatic pressure from the P327D will retract the plunger allowing the N550 to close.

If emergency conditions cause the fusible element to reach a temperature of 212°F (100°C), the element, which attaches the handle to the shaft, pulls apart and allows the valve to close.

Installation

Shutoff Direction

The valves shall be installed in the fixed piping between a storage tank and the transfer hose connection at the truck or tank car loading/unloading area. They can be placed in a line used either for filling or withdrawing from the storage tank (or both). The valve shall be installed to shutoff flow from the tank towards the hose, enabling the valve to control product loss in case of a hose break.

N550 valves are spring closed (aided by pressure) and shutoff flow in one direction only. THE NAMEPLATE FLOW ARROW SHOWS FLOW DIRECTION FOR VALVE SHUTOFF. The arrow shall point to the hose connection. Improper flow direction will not shutoff flow through the line.

When installed in horizontal piping, install with the nameplate up. The valve can be installed in vertical piping with the flow arrow pointing in the desired flow direction for valve shutoff. In some cases the normal flow through the valve may be opposite the shutoff direction (like a back check valve).

Bulk Head Protection

The valve should be installed near the hose connection, but shall be positioned so that any undue strain resulting from a hose pull cannot shear the valve or its inlet piping from the storage area piping. The piping shall always be firmly supported and anchored to be sure of meeting the requirement.

One preferred method of installation is shown in Figure 2 where the pipe connection to the valve and to the hose coupling is securely anchored in a solid bulkhead.

A bobtail truck can provide enough pull on the hose connection to cause a break in the system. That break must not occur between the Type N550 and the storage tank.

TYPE NUMBER BODY SIZE PROPANE FLOW AT 2

PSIG DIFFERENTIAL

N550-10 1 1/4-in. FNPT 75GPM

N550-16 2-in. FNPT 115 GPM

N550-24 3-in. FNPT 275GPM

MAXIMUM INLET PRESSURE :400 PSI

Table 1 - Specifications

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Fusible Element Location

A fusible element that will close the N550 shall be located within five feet of the hose connection. If the N550 is placed within five feet of the hose connection, this requirement is met. If not, an additional fusible element must be provided near the hose coupling which will activate a remote release.

Remote Release Installation

In all installations a remote release shall be connected to the latch on all emergency valves at the bulk head. The remote release has to extend to a place where it can be easily reached to close the N550 valve(s) in the event that an emergency makes the valve(s) inaccessible. The remote release shall shutdown all emergency valves when activated. Remote release activation may be by cable or pneumatic hook-up.

Cable Hook-Ups

Remote release cables shall be installed so that they will close the N550 valve(s) when pulled from the farthest remote location. Cable shall operate smoothly, over pulleys and/or through conduit. Do not kink cable or run cable around sharp corners. If installed in conduit, keep water out of conduit. Frozen water, dirt or dried mud in the conduit will render the remote release inoperable.

Remote releases used on N550 valves shall not:

- (a) be made from plastic or fiber rope;**
- (b) have any kind of fusible link which could melt and prevent the cable from pulling the N550 latch.**

To provide a remote release, aircraft cable can be connected to the short looped cable on the valve and run to the remote release point over pulleys or through conduit. Adjust the cable so that minimal pull is required to close the emergency valves.

P164B Cable Installation

To connect a Fisher P164B remote release assembly, which is supplied with 50 feet of cable:

1. Run the inner cable and housing assembly to the remote release point. Leave enough slack on each end for a smooth, flowing path, without sharp bends in the cable, between the N550 latch block and remote release handle.
2. If it is necessary to cut the cable to a shorter length, pull about one foot of inner cable from the N550 latch block cable end (end with the 3/16 by 1/2 long cylindrical cast fitting, see Figure 3) from the housing.

At the remote release end (other end of inner Cable housing assembly), cut the housing and inner cable at desired length. Push the excess inner cable back through the housing so that the bare cable extends from the remote release end.

Figure 2. Typical N550 Installation Using Remote Cable Release

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3. Close the N550 valve. Handle parallel to pipe.
4. If necessary for additional working space, remove the long end of the external spring from under the latch block. **DO NOT REMOVE SPRING FROM HANDLE.**
5. Loosen the slotted screw, Figure 3, on the N550 valve's latch block until the plunger can be pulled from the latch block.
6. Disconnect the short looped cable and remove it.
7. Insert the P164B inner cable end cylindrical cast fitting through the latch block rear conical hole and connect the cylindrical cast fitting into the side slot in the plunger.
8. Replace the plunger in the latch block, oriented so the screw will enter the plunger slot. Tighten the screw.
9. The end of the cable housing and cable housing nut fit into the conical end of the latch block. Pulling the excess inner cable through the housing from the remote release end will hold the housing in the latch block.
10. Mount the remote release cylinder assembly to a suitable support at the remote release location (7/16 inch diameter mounting hole) but do not tighten the mounting nut.
11. At the remote release end, strip about 3/4 inch of vinyl cover from the cable housing end.
12. Insert the inner cable completely through the release cylinder. Screw the bare cable housing end into the remote release cylinder by rotating the cylinder. Tighten the mounting nut.
13. Pull any slack from the inner cable, just tight enough so that the latch is not activated, and cut the inner cable off 1 inch past the remote release cylinder end.
14. Insert the 1-inch bare inner cable into the remote release handle shaft. Push the remote release handle completely into the remote release cylinder. Tighten the handle set screw to secure the handle to the inner cable.

Possible hand and finger pinch point between closing N550 handle and latch block. Handle closes quickly and with extreme force. Keep hands and fingers away from handle as it closes.

15. Test the remote release and N550 operation from the most remote location. Rotate handle counter clockwise to open valve. Valve must stay open. HANDLE AND VALVE MUST QUICKLY "SNAP" CLOSED when (a) the remote release cable is pulled, and (b) handle is pushed closed from the open position.

All open N550 emergency valve(s) attached to the remote release must properly close when the release cable is pulled.

Figure 3. Type P164B Installation Schematic

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Pneumatic Hook-Up

P327D Pneumatic Release Block

Installation

If several valves are installed at the same location, remote release may be accomplished with the Type P327D pneumatic release block which replaces the cable latch block installed on the N550 valves.

To install the P327D, see Figure 4:

1. Close the N550 valve. Handle is parallel to the pipe.
2. Remove the long end of the external spring from under the latch block. **DO NOT REMOVE SPRING FROM HANDLE.**
3. Remove latch bolt(s). Older valves will have 2 bolts. **DISCARD CABLE LATCH BLOCK.**
4. Use a 5/32 Allen head wrench to screw 1/4 inch long bolt into bottom hole.
5. Tighten until bolt head seats firmly on body.
6. Place latch block on body with lower blind hole over bolt in body.
7. Install 3/4 inch long bolt through second hole and firmly tighten with 5/32 Allen head wrench.
8. Refasten long end of spring under latch block by **ROTATING 180 DEGREES CLOCKWISE.**
9. Attach the remote air source to the cylinder end with appropriate supply tubing and valving. A regulated air supply of **30 to 70 PSIG** to the P327D cylinder is required for proper operation.

Possible hand and finger pinch point between closing N550 handle and latch block. Handle closes quickly and with extreme force. Keep hands and fingers away from handle as it closes.

10. Test the remote release and N550 operation. Rotate handle counter clockwise to open valve. Valve must stay open. **HANDLE AND VALVE MUST QUICKLY "SNAP" CLOSED** when (a) air pressure is exhausted from P327D remote release, and (b) the handle is pushed closed from the open position.

All open N550 Emergency Valve(s) attached to the remote pneumatic release system must properly close when air pressure is exhausted from the system. Remote release controls must quickly exhaust pressure from the supply line to close emergency valves.

Optional Motion Release Cable

With either the cable or pneumatic remote release hook-ups, it is possible to connect an additional cable from the Type N550's operating handle to the truck along the transfer hose(s). This cable would close the valve if the hose(s) is stretched (driver does not disconnect) beyond a preselected limit. The hook-up does not affect the normal operation of the valve.

Motion Release Cable Installation

1. Connect a suitable release cable such as stainless steel aircraft cable to a standard "S" hook. Attach

the “S” hook to the N550 handle as shown in Figure 5.

2. The cable should run through the bulkhead just below and to the side of the pipe. The cable should be in line with the operating lever, refer to Figure 5.

3. Leave enough slack in the cable to allow the N550 lever to move freely but not close during normal hose movement or hook-up.

4. Run the cable along the hose. Tape or secure it to the hose. Fasten the cable securely to the “truck” end hose connection.

When the hose stretches more than the amount of slack left in the cable, the tightening cable will pull the lever down and close the N550 valve.

Figure 4. Type P327D Air Cylinder Installation

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Maintenance

Only qualified service personnel should attempt to repair these valves. Before starting any type of repair, close off the upstream valves and remove all pressure from both the inlet and outlet of the Type N550 Emergency Shutoff Valve.

At least once a month inspect and check the following things:

1. See that the remote release is properly connected, works freely, and is not worn. Operate the release to make certain it closes the valve. If the valve closes slowly, packing replacement (refer to form MCK-1155) may be required.
2. Make sure that the lever, latch, and release are working smoothly. The latch parts and lever are easily accessible for replacement or repair by removing the securing bolts.
3. Check for packing and joint leakage.

Replacing Internal Parts

Type N550 can be repaired in the field. However, due to the special fire resistant seals and assembly techniques, repairs should be done only by trained personnel.

If repair should become necessary, contact your Fisher distributor or the factory for information and assistance.

Only parts manufactured by Fisher should be used for the repair of Fisher N550 Valves. Be sure to give the complete type number of the N550 when corresponding with the factory.

N550 Valves that have been disassembled for repair must be tested for proper operation before being returned to service.

Title C407-10 Internal Valves

Type C407-10 Internal Valves

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Failure to follow these instructions or to properly install and maintain this equipment could result in an explosion and/or fire causing property damage and personal injury or death.

Fisher equipment must be installed, operated, and maintained in accordance with federal, state, and local codes and Fisher instructions. The installation in most states must also comply with NFPA No. 58, and ANSI Standard K61.1.

Only personnel trained in the proper procedures, codes, standards, and regulations of the LP-gas industry should install and service this equipment.

The internal valve must be closed except during product transfer. A line break downstream of a pump may not actuate the excess flow valve. If any break occurs in the system or if the excess flow valve closes, the system should be shut down immediately.

Introduction

Scope of Manual

This manual covers instructions for the Type C407-10 internal valves and the manual, cable, or pneumatic actuators for the valve.

Description

The C407-10 is intended as a main valve on small capacity pumping systems or in vapor return lines on trucks. It can also be used on in-line installations. Designed for propane, butane, or NH₃ at ambient temperatures, the valve can be used on other compressed gases, but the user should check with the factory to make sure the valve is suitable for the particular service.

The following accessories for the C407-10 are also covered:

Type P341 – Latch/remote release mechanism that permits remote valve closure. The valve is opened manually. A built in fusible element will release at 212°F allowing the valve to close. Factory type number with the P341 installed is C407M10.

Type P342 – Latch with bi-directional remote release mechanism that permits remote valve closure from two directions. The valve is opened manually. A built in fusible element will release at 212°F allowing the valve to close. Factory type number with the P342 installed is C407MB10.

Type P389 – Pneumatic cylinder that allows remote opening and closing of the valve. Factory type number with the P389 installed is C407A10.

Specifications

Specifications for C407-10 internal valves are in Table 1.

DOT Internal Self-Closing Stop Valve Requirement

– U.S. Department of Transportation (DOT) regulations 49 CFR§178.337-8(a)(4) require each liquid or vapor discharge outlet on cargo tanks (except for cargo tanks Figure 1. Type C407-10

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used to transport chlorine, carbon dioxide, refrigerated liquid, and certain cargo tanks certified prior to January 1, 1995) to be fitted with an internal self-closing stop valve. Fisher's "C" series internal valves comply with the internal self-closing stop valve requirement under the DOT regulations.

Installation

Mounting and Piping

The internal valves can be installed in either a half or full coupling. Excess flow spring closing flow rates vary in half and full couplings, see specifications in Table 1.

Excess flow valve closing flow rates are not the same for half and full couplings.

Verify the coupling for the desired excess flow rate.

Do not install the valve in any piping tending to restrict the valve inlet because this may prevent the excess flow valve from closing.

Do not install the valve with such extreme torque that the coupling can cut threads into the valve. This could cause valve distortion and affect the internal working parts.

Do not use TFE tape as it may cause thread galling to occur.

Use an appropriate pipe compound, on the male threads of the internal valve and pipeline. Pull the valve into the coupling hand tight, and then wrench tighten it for approximately two additional turns. Larger size valves may require an additional amount of torque to obtain a leak free connection.

Keep piping from the valve outlet to the pump full size and as short as possible with a minimum number of bends. Reduction in pipe size to suit smaller pump inlets should be made as close to the pump as possible using forged reducers (swage nipples) or venturi tapers rather than bushings. This assures minimum flow resistance and efficient pump operation.

The valves have a break off section below the inlet pipe thread which is intended to permit the lower valve body to shear off in an accident, leaving the valve seat in the tank. **The break off section is designed for container installations and will probably not provide shear protection if the valve is installed in a pipeline.**

A hydrostatic relief valve does not need to be installed adjacent to the valve since the internal valve relieves excessive line pressure into the tank.

Selectively Filling Manifolder Tanks

Fisher internal valves provide positive shut-off only in one direction, from out of the tank to downstream of the valve. The internal valves are designed to allow gas to flow into a tank when the downstream line pressure exceeds tank pressure. If you want to selectively fill one or more of the other tanks in a tank manifold system, you must place a positive shut-off valve downstream of

the internal valve, otherwise, all tanks will be filled at the same time and at about the same rate.

Excess Flow Protection

The internal valve contains an excess flow function, or “integral excess flow valve,” that will close when the flow exceeds the flow rating established by Fisher. Fisher’s integral excess flow valve installed on a bobtail truck or transport can provide protection against the discharge of hazardous materials during an unloading operation of a bobtail truck or transport in the event that a pump or piping attached directly to the internal valve is sheared off before the first valve, pump, or fitting downstream of the internal valve, provided that the cargo tank pressure produces a flow rate greater than the valve’s excess flow rating. Likewise, if the internal valve is installed on a stationary tank or in the related downstream piping system, the integral excess flow valve can provide protection against an unintentional release of hazardous materials in the event that a pump or piping attached directly to the internal valve is sheared off before the first valve, pump, or fitting downstream of the internal valve, provided that the flow of

Table 1. Specifications

BODY SIZE AND INLET: 1-1/4-inch MNPT

END CONNECTION STYLE: Outlet: 1-1/4-inch FNPT

MAXIMUM ALLOWABLE WORKING PRESSURE (MAWP): 400 PSIG (27,6 bar)

INLET PRESSURE: WOG

EXCESS FLOW SPRINGS: 30, 50, or 80 gpm in half coupling

35 or 65 gpm in full coupling

(with 50 or 80 gpm spring)

MATERIAL TEMPERATURE: -20° to 150° F (-28,9 to 65,6° C)

CAPABILITIES

BODY MATERIAL: Steel, WCB

APPROXIMATE WEIGHT: 3 lbs. (1,4 kg)

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product through the internal valve reaches the rated flow specified by Fisher.

Restrictions incorporated in the discharge system of a bobtail truck or transport or of a stationary tank (due to pumps, pipe and hose length and dimensions, branching, elbows, reductions in pipe diameter, or a number of other inline valves or fittings), low operating pressure as a result of ambient temperature, or a partially closed valve downstream from the integral excess flow valve, can restrict the rate of flow through the internal valve below the level necessary to actuate the integral excess flow valve. Therefore, DO NOT USE the excess flow function of the internal valve for the purpose of providing protection against the discharge of hazardous materials in the event of a rupture of hose or piping at a point in the discharge system downstream from the first valve, pump, or fitting downstream of the internal valve.

The internal valve is designed with an internal bleed feature for equalization of pressure. After the integral excess flow valve closes, the leakage through the bleed must be controlled or a hazard can be created. For this reason the operator must be familiar with the closure controls for the internal valves and must close the internal valve immediately after the integral excess flow valve closes.

Failure to follow this warning could result in serious personal injury or property damage from a fire or explosion.

DOT Passive Shutdown Equipment Requirement – DOT regulations 49 CFR§173.315(n)(2) require certain cargo tanks transporting propane, anhydrous ammonia and other liquefied compressed gases to be equipped with passive emergency discharge control equipment that will automatically shut off the flow of product without human intervention within 20 seconds of an unintentional release caused by complete separation of a delivery hose. The design for each passive shut-down system must be certified by a Design Certifying Engineer (DCE) and all components of the discharge system that are integral to the design must be included in the DCE certification. The DCE certification must consider any specifications of the original component manufacturer. In the case of downstream ruptures in hose or piping, a variety of operating conditions routinely encountered during an unloading operation restrict the rate of flow through the integral excess flow valve and make such a valve unsuitable to serve as the means of passive shutdown required under 49 CFR§173.315(n)(2). Such variables include restrictions incorporated in the discharge

system (due to pumps, pipe and hose length and dimensions, branching, elbows, reductions in pipe diameter, or a number of other in-line valves or fittings), low operating pressure as a result of ambient temperature, or a partially closed valve downstream from the excess flow valve. Due to the variety of conditions, in the case of a hose separation, that can restrict the rate of flow below the level necessary to activate the excess

Figure 2. Type C407-10

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Figure 3. Type C407-10 with latch and remote release

Figure 4. Type C407A-10

Type P341/P342 Latch/Remote Release (Figure 3)

Key Description

- 1 Latch
- 2 Spring
- 3 Washer
- 4 Clevis Pin
- 5 Cotter Pin
- 6 Cover Plate
- 7 Pull Ring

T20862

T13429

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flow valves, the integral excess flow function of Fisher's "C" series internal valves or "F" series excess flow valves cannot be used to satisfy the passive shut-down equipment requirement under/in

49 CFR§173.315(n)(2). Also, a Design Certifying Engineer cannot include the integral excess flow valve of a Fisher "C" series internal valve or "F" series excess flow valve as a component of the discharge system in any DCE certification under 49 CFR§173.315(n)(2).

DO NOT USE the excess flow function incorporated into Fisher "C" series internal valves or "F" series excess flow valves to satisfy the passive shutdown equipment requirement in 49 CFR§173.315(n)(2). DO NOT include the excess flow function incorporated into Fisher "C" series internal valves or "F" series excess flow valves in a DCE certification under 49 CFR§173.315(n)(2). The cargo tank manufacturer must install some other equipment that satisfies the requirement for passive shutdown capability under 49 CFR§173.315(n)(2). Failure to follow this warning could result in serious personal injury or property damage from a fire or explosion in the event of an unintentional release of product during an unloading operation.

Actuators

The remote operating control system for the valve is extremely important, and it must be installed to conform with the applicable codes. DOT MC331, for example, most generally applies for trucks.

Fisher offers both cable controls and air cylinder systems to operate the C407-10 internal valves. It may also be possible to use cable controls from other manufacturers or to fabricate a linkage mechanism. Any control system requires thermal protection (fuse links) at the valve, at the remote control point and, if

necessary, near the hose connections. The instruction manuals for Fisher Controls systems show how to install the fuse links.

The operating linkage must allow the operating lever to move from the fully closed position to within 2° of the fully open position. The linkage should not apply strong force to the lever past the fully open position or the valve could be damaged.

The internal valve's closing spring is not designed to overcome drag in the control linkage in order to close the valve. Depending upon the control system used, an external spring (such as Fisher drawing number 1K4434) or positive closing linkage may be needed. Be sure the control system is installed to prevent binding that could cause the valve to stick in the open position.

Cable Operation – The operating linkage should stroke the valve operating lever from the fully closed position to within a minimum of 1/8-inch (2°) of the full open position. Too short an operating lever stroke will result in premature excess flow valve closure. The cable control linkage can be attached through the hole in the operating lever (key 18) to provide remote valve operation. (See Figure 2.)

If C407-10 valve is installed in a pressurized tank, insure that the line pressure is

Figure 5. Operational Schematic T40426

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0 psi prior to beginning installation of P341, P342, or P389.

Remote Release – To install the Type P341 or P342 latch mechanisms, first release the downstream pressure. **Failure to do so could result in personal injury.** Remove the operating lever and take off the cover plate (key 56) by removing the cap screws (key 17). The new cover plate/latch assembly can be attached to the valve with the same cap screws. Tighten the screws to 25 to 30 inch-pounds torque.

A cable must be run from the pull ring (key 7, Figure 3) on the P341 to the release handle (Type P650 or P651 can be used) located at a remote point. The Type P342 allows two cables to be run to two remote locations.

The cable must be taut for proper operation, and the hookup may require sufficient pulleys to keep the cable away from the side of the tank. Pulling the release handle allows the manual operating lever to return to the closed position. The fusible link in the mechanism will melt if exposed to fire, allowing the valve to close.

When closing the valve manually, pull back on the cable attached to the release mechanism to permit the valve lever to close. (See Figure 3.)

Since there is strong spring force on the operating lever, avoid getting in the way of the lever as it moves to the closed position. Failure to do so could result in personal injury.

Air Operation – Type P389 cylinder actuators can be

installed on the valves to provide remote air operation. Minimum operating pressure for the cylinder is 60 psig; maximum cylinder pressure is 250 psig. To install the unit, first release the downstream pressure.

Failure to do so could result in personal injury. Remove the manual operating lever and take off the cover plate (key 56) by removing the cap screws (key 17). Place the P389 actuator on the valve and secure it with the two cap screws, tightening them to 25 to 30 inch-pounds torque. Insert the operating lever through the clevis (between the roller and the clevis pin) and attach to the valve. (See Figure 4.)

Principle of Operation

Refer to the schematic drawing, Figure 5. In view #1, the valve is held closed by both tank pressure and the valve's closing spring. There is no leakage past the resilient seats in the poppet to the valve outlet.

The valve is opened by moving the operating lever to approximately mid-point in its 70° travel (view #2). This allows the cam to place the rapid equalization portion of the valve stem in the pilot opening, permitting a larger amount of product to bleed downstream than if the operation lever were moved to the full open position. When tank and downstream pressure are nearly equal after a few seconds, the excess flow spring pushes open the main poppet (view #3) and the operating lever can be moved to the full open position.

If tank pressure is greater than the valve's outlet pressure, the main poppet will remain in the closed position.

If valve outlet piping is closed off by other valves, however, product bleeding through the pilot will increase until it nearly equals tank pressure and the main poppet opens.

Note

The main poppet will not open if valve outlet piping is not closed off so that the outlet pressure can approach tank pressure.

Once the main poppet opens, a flow greater than the valve's excess flow spring rating or a sufficient surge in flow forces the main poppet closed against the excess flow spring (view #4). The pilot valve allows a small amount of product to bleed, but much less than view #2 where the rapid equalization portion of the stem is placed in the pilot opening. When the operating lever is moved to the closed position, the valve closes completely and seals tightly (view #1).

Operation

Since the C407-10 will not open unless the downstream pressure can build-up to equal the inlet pressure, an operating sequence that assures equalization is important.

Follow these points:

1. C407s on bobtails and transports should never be open when the truck is in motion. If the control system is not interlocked to prevent this, the operator is responsible to see that the valves are closed.
2. Always open the internal valve before opening any other valves in the line or starting the pump.
3. Move the lever to the half-open position (figure 5, view #2) to equalize pressure. When the main poppet clicks open, move the operating lever fully open.

4. Open other line valves slowly to avoid sudden surges which could slug the excess flow valve shut.
5. If the excess flow valve does close, stop the pump and close the nearest downstream valve. Move the internal valve's operating lever back to the rapid equalizing position and wait for the valve to click open. Then move the operating lever fully open and slowly open the downstream valve.
6. All valves should be completely open when pumping.
(Throttling type valves could prevent the excess flow valve from closing when required.)

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7. The operator must always be aware of where the remote closure controls are located and know how to operate the controls if any emergency requires valve closure. When pumping is finished, make a habit of closing the internal valve from the remote closure point, thus checking to see that the control actually is capable of closing the valve.

8. The valve should be open when backfilling through the valve.

Troubleshooting

Internal Valve Will Not Open – This could be due to leakage downstream, engaging the pump too soon or from excessive wear in the internal valve. If excessive volume is in the downstream system, a longer time is required to equalize the pressures (tank and downstream) before the pump can be engaged. To determine if the valve pilot seat is opening, install a gauge downstream of the valve, operate the valve actuator; if pressure does not build up to the tank pressure, the valve pilot seat is not open. This test should be done with pump off. If the pilot is not opening, it may be plugged with dirt or some internal part may be broken. If by operating the lever manually it can be rotated past the fully open position, there is something wrong internally and the valve must be disassembled.

Premature Valve Closure – This can be caused from engaging the pump too soon, by an underrated excess flow valve spring, or by an improperly connected internal valve operating lever which does not fully open the valve. The trouble could also be from a valve that has its inlet port obstructed or from sudden line surges. In order to check the valve opening travel, operate the lever manually to the full travel, wait until valve opens (usually about 15 seconds), then engage the pump. If the excess flow closes, the points mentioned above should be investigated.

Internal Valve Will Not Close – The stub shaft could be binding or the stem could be bent in the valve. Before disassembling the valve, check the actuator mechanism to see that it operates freely by disconnecting it from the valve lever and cycling it several times. Also, operate the valve lever manually. If it sticks in the open position, the packing and bushings should be replaced. This should free the operating mechanism if the valve has not been damaged internally. Refer to the "Maintenance" section.

Low Flow Capacity – This could be caused by too small an internal valve, too small or long downstream piping, plugged screens, some other restriction in the downstream system, or by the bypass valve sticking in the open position. The bypass valve could also be set too low and be opening prematurely.

Maintenance

Refer to Figures 2, 3, and 4.

Do not use these internal valves if they leak, fail to work properly or have been damaged or have missing parts. Prompt repairs should be made by a properly trained serviceman. Continued use without repair can create a hazardous or

injurious situation.

A simple preventative maintenance program for the valve and its controls will eliminate a lot of potential problems.

Fisher recommends these steps be conducted once a month:

1. Regularly inspect the operating lever (key 18) to see that it operates freely and that there is no leakage around the stub shaft (key 15J). If there is leakage or sticking, the packing (key 15F, G, & H) should be replaced, see "Disassembly" section.
2. Check for tight closure of the seat discs. Any detected leakage, which is normally caused by disc wear or dirt, scale or debris embedded in the disc, requires that the internal valve be removed from service and repaired. Repair most often requires the replacement of valve discs. To check for leakage:
 - A) Close the internal valve and exhaust downstream pressure. Close the first valve downstream from the internal valve, and note any pressure buildup, using a pressure gauge, between the closed valve and the internal valve. If piping is cold allow it to warm to ambient temperature.
 - B) Refer to CFR 49 Section 180 Appendix B for Meter Creep Test Methods.
3. All operating controls should be regularly inspected and cleaned and oiled. The controls should be checked to see that they fully open—but not over-travel—the internal valve and operate freely to close the valve.
4. Standard construction internal valves must be removed if the container is to be steam cleaned. Heat can damage the valve's seats and seals.
5. Standard construction internal valves are not designed for water service. Immediately after a container is hydrostatically tested, remove all water and allow the container to thoroughly dry out.

Disassembly

Tank pressure must be released before removing the valve from the container.

Failure to do so could result in personal injury.

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Type C407-10 Internal Valves

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Numbers in parenthesis refer to key numbers in Figure 2.

To Replace Packing

1. The packing can be replaced with product in the tank by closing the operating lever (key 16) and blowing down the downstream pressure in the system.
2. Remove the two cap screws (key 17) holding the gland assembly and cover plate to the body.
3. Rotate the entire gland assembly slightly counterclockwise and turn the assembly to the left as it is pulled out of the body.
4. Unscrew the cap screw (key 15R) from the stub shaft (key 15J), and remove the operating lever and cover plate by taking out the cotter pin (key 19).
5. Pushing on the stub shaft will expose the gland parts including the spacer (key 15W) and packing (keys 15F, G & H).
6. Besides the packing, the liner bushings (keys 15B) should be replaced.
7. Reassemble in reverse order. Replace cap screw (key 15R) using 30 to 35 inch-pounds torque.
8. Make sure the operating lever can move freely after the new parts are installed. Conduct a leak test under pressure with a soap solution.

To Replace Seat Discs

1. Remove the valve from the tank and take out the gland assembly, refer to steps 2 and 3 above.
2. Holding the stem (key 2) with a 5/8-inch socket, unscrew (key 9) from the stem.
3. Place the disc holder (key 6) into a vise with a shop towel over the vise. The vise must be tightened lightly and carefully so as not to bend the disc holder. Unscrew the disc retainer (key 8) to reach the main seat disc (key 4) and the bleed seat disc (key 11).
4. Examine both seat discs and replace if necessary. To ease installation place the bleed seat disc on top of the disc retainer before screwing the disc retainer into the disc holder.
5. If the excess flow spring (key 3) is changed, replace the nameplate or stamp the body with the new type number.
6. Reassemble in reverse order using 35 to 40 inch pounds torque to install the disc retainer. Apply Loctite No. 242 or equivalent on the stem threads before installing the bleed seat (key 13).

Parts Ordering

When corresponding about this equipment, always reference the equipment type number found on the nameplate. A replacement Parts List is available for the valves. When ordering replacement parts, reference the complete 11-character part number for each needed part.

Parts List

Type C407-10 Internal Valve (Figure 2)

Key Description

- 1 Body
 - 2 Stem Assembly
 - 3 Excess Flow Spring
 - 4 Spring Seat
 - 5 Closing Spring
 - 6 Disc Holder
 - 7* Main Disc
 - 8 Disc Retainer
 - 11* Bleed Disc
 - 13 Bleed Seat (Not Shown)
 - 15 Gland Assembly (Includes all key No. 15 parts)
 - 15A Gland
 - 15B Liner Bushing
 - 15D Spring
 - 15E Washer
 - 15F* Male Adaptor
 - 15G* Packing Ring
 - 15H* Female Adaptor
 - 15J Stub Shaft
 - 15P Cam
 - 15R Cap Screw
 - 15S Washer
 - 15W Spacer
 - 16 O-Ring
 - 17 Cap Screw (2 req'd)
 - 18 Operating Lever
 - 19 Cotter Pin
 - 20 Nameplate
 - 21 Drive Screw (2 req'd)
 - 35 Guide
 - 36 Guide Bracket
 - 56 Cover Plate
 - 46 Apply Loctite No. 242
 - 51 Apply Magna-Lub G
- *Recommended spare part.

Type C402, C421, and C427

June 2005

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Type C402, C421, and C427 Internal Valves

Warning!

Failure to follow these instructions or to properly install and maintain this equipment could result in an explosion and/or fire causing property damage and personal injury or death.

Fisher equipment must be installed, operated, and maintained in accordance with federal, state, and local codes and Fisher instructions. The installation in most states must also comply with NFPA No. 58, and ANSI Standard K61.1. Only personnel trained in the proper procedures, codes, standards, and regulations of the LP-gas industry should install and service this equipment.

The internal valve must be closed except during product transfer. A line break downstream of a pump may not actuate the excess flow valve. If any break occurs in the system or if the excess flow valve closes, the system should be shut down immediately.

Introduction

Scope of Manual

This manual covers instructions for the C402, C421, and C427 threaded internal valves.

Description

The valves are typically used on the inlets and outlets of bobtail and transport trucks and on large stationary storage tanks. They can also be installed in-line. Designed for propane, butane, or NH₃ at ambient temperatures, the valves can be used on other compressed gases, but the user should check with the factory to make sure the valves are suitable for the particular service.

Specifications

Refer to Specifications for C402, C421, and C427 internal valves.

DOT Internal Self-Closing Stop Valve Requirement —

U.S. Department of Transportation (DOT) regulations 49CFR§178.337-8(a)(4) require each liquid or vapor discharge outlet on cargo tanks (except for cargo tanks used to transport chlorine, carbon dioxide, refrigerated liquid, and certain cargo tanks certified prior to January 1, 1995) to be fitted with an internal self-closing stop valve. Fisher's "C" series internal valves comply with the internal self-closing stop valve requirement under the DOT regulations.

C427
C421

Figure 1. C400 Series

Type C402, C421, and C427

Installation

Mounting and Piping

The internal valves can be installed in either a half or full coupling. Excess flow spring closing flow rates vary in half and full couplings, refer to specifications.

Excess flow valve closing flow rates are not the same for half and full couplings. Verify the coupling for the desired excess flow rate.

Do not install the valve in any piping tending to restrict the valve inlet because this may prevent the excess flow valve from closing.

Do not install the valve with such extreme torque that the coupling can cut threads into the valve. This could cause valve distortion and affect the internal working parts.

Do not use TPFPE ape as it may cause thread galling to occur.

Use an appropriate pipe compound, on the male threads of the internal valve and pipeline. Pull the valve into the coupling hand tight, and then wrench tighten it for approximately two additional turns. Larger size valves may require an additional amount of torque to obtain a leak-free connection.

Keep piping from the valve outlet to the pump full size and as short as possible with a minimum number of bends. Reduction in pipe size to suit smaller pump inlets should be made as close to the pump as possible using forged reducers (swage nipples) or venturi tapers rather than bushings. This assures minimum flow resistance and efficient pump operation.

The valves have a break off section below the inlet pipe thread which is intended to permit the lower valve body to shear off in an accident, leaving the valve seat in the tank. **The break off section is designed for container installations and will probably not provide shear protection if the valve is installed in a pipeline.**

A hydrostatic relief valve does not need to be installed adjacent to the valve since the internal valve relieves excessive line pressure into the tank.

selectively Filling Manifolder Tanks

Fisher internal valves provide positive shut-off only in one direction, from out of the tank to downstream of the valve. The internal valves are designed to allow gas to flow into a tank when the downstream line pressure exceeds tank pressure. If you want to selectively fill one or more of the other tanks in a tank manifold system, you must place a positive shut-off valve downstream of the internal valve, otherwise, all tanks will be filled at the same time and at about the same rate.

Specifications

Maximum Allowable Inlet Pressure

400 PSIG (27,6 bar) WOG

Material Temperature Capabilities

-20° to 150° F (-29 to 66° C)

Body Material

C421 and C427: Ductile Iron

C402: Cast Steel WCB

Approximate Weight

2-inch Sizes (DN 50):

C402: 15 pounds (6,8 kg)

C421: 11 pounds (5,0 kg)

C427: 9 pounds (4.1 kg)

3-inch Sizes (DN 80):

C402: 38 pounds (17,2 kg)

C421: 21 pounds (9,5 kg)

C427: 16 pounds (7,3 kg)

Body Size and End Connection Style

Inlet: 2 or 3-inch MNPT (DN 50 or 80)

Outlet: 2 or 3-inch FNPT (DN 50 or 80)

Number of Outlets

C402: 3 (side)

C421: 2 (side and straight through)

C427: 1 (straight through)

Excess Flow Springs

Half Coupling Flows: 2-inch Sizes (DN 50): 100, 150 and 250 GPM (378, 568, and 946 l/min)

3-inch Sizes (DN 80): 150, 200, 250, 400 and 500 GPM (568, 757, 946, 1514 and 1893 l/min)

Full Coupling Flows:

2-inch Sizes (DN 50): 60, 90 and 130 GPM (227, 341 and 492 l/min)

3-inch Sizes (DN 80): 100, 125, 165, 235 and 325 GPM (378, 473, 625, 890 and 1230 l/min)

caution

Type C402, C421, and C427

Actuators

The remote operating control system for the valve is extremely important, and it must be installed to conform with the applicable codes. DOT MC331, for example, most generally applies for trucks.

Fisher offers both cable controls and air cylinder systems to operate the C400 series internal valves. It may also be possible to use cable controls from other manufacturers or to fabricate a linkage mechanism.

Any control system requires thermal protection (fuse links) at the valve, at the remote control point and, if necessary, near the hose connections. The instruction manuals for Fisher Controls actuator systems show how to install the fuse links.

Installation instructions on Fisher P650, P163A, and P164A cable controls, are in Form MCK-1083. Air cylinder actuator installation is covered in Form MCK-1137. Type P340 latch/remote release instructions are on Form MCK-2048.

The operating linkage must allow the operating lever to move from the fully closed position to within 2° of the fully open position.

The linkage should not apply strong force to the lever past the fully open position or the valve could be damaged.

The internal valve's closing spring is not designed to overcome drag in the control linkage in order to close the valve. Depending upon the control system used, an external spring (such as Fisher drawing number 1K4434) or positive closing linkage may be needed. Be sure the control system is installed to prevent binding that could cause the valve to stick in the open position.

Excess Flow Operation

The internal valve contains an excess flow function, or "integral excess flow valve", that will close when the flow exceeds the flow rating established by Fisher. Fisher's integral excess flow valve installed on a bobtail truck or transport can provide protection against the discharge of hazardous materials during an unloading operation of a bobtail truck or transport in the event that a pump or piping attached directly to the internal valve is sheared off before the first valve, pump, or fitting downstream of the internal valve, provided that the cargo tank pressure produces a flow rate greater than the valve's excess flow rating.

Likewise, if the internal valve is installed on a stationary tank or in the related downstream piping system, the integral excess flow valve can provide protection against an unintentional release of hazardous materials in the event that a pump or piping attached directly to the internal valve is sheared off before the first valve, pump, or fitting downstream of the internal valve, provided that the flow of product through the internal valve reaches the rated flow specified by Fisher.

Restrictions incorporated in the discharge system of a bobtail truck or transport or of a stationary tank (due to pumps, pipe and hose length and dimensions, branching, elbows, reductions in pipe diameter, or a number of other in-line valves or fittings), low operating pressure as a result of ambient temperature, or a partially closed valve downstream from the integral excess flow valve, can restrict the rate of flow through the internal valve below the level necessary to actuate the integral excess flow valve. Therefore, DO NOT USE the excess flow function of the internal valve for the purpose of providing protection against the discharge of hazardous materials in the event of a rupture of hose or piping at a point in the discharge system downstream from the first valve, pump, or fitting downstream of the internal valve.

The internal valve is designed with an internal bleed feature for equalization of pressure. After the integral excess flow valve closes, the leakage through the bleed must be controlled or a hazard can be created. For this reason the operator must be familiar with the closure controls for the internal valve and must close the internal valve immediately after the integral excess flow valve closes.

Failure to follow this warning could result in serious personal injury or property damage from a fire or explosion.

DOT Passive Shutdown Equipment Requirement — DOT regulations 49CFR§173.315(n)(2) require certain cargo tanks transporting propane, anhydrous ammonia and other liquefied compressed gases to be equipped with passive emergency discharge control equipment that will automatically shutoff the flow of product without human intervention within 20 seconds of an unintentional release caused by complete separation of a delivery hose. The design for each passive shut-down system must be certified by a Design Certifying Engineer (DCE) and all components of the discharge system that are integral to the design must be included in the DCE certification. The DCE certification must consider any specifications of the original component manufacturer.

In the case of downstream ruptures in hose or piping, a variety of operating conditions routinely encountered during an unloading operation restrict the rate of flow through the integral excess flow valve and make such a valve unsuitable to serve as the means of passive shutdown required under 49CFR§173.315(n)(2). Such variables include restrictions

Explosion hazard!

caution Type C402, C421, and C427

incorporated in the discharge system (due to pumps, pipe and hose length and dimensions, branching, elbows, reductions in pipe diameter, or a number of other in-line valves or fittings), low operating pressure as a result of ambient temperature, or a partially closed valve downstream from the excess flow valve. Due to the variety of conditions, in the case of a hose separation, that can restrict the rate of flow below the level necessary to activate the excess flow valve, the integral excess flow function of Fisher's "C" series internal valves or "F" series excess flow valves cannot be used to satisfy the passive shut-down equipment requirement under/in 49CFR§173.315(n)(2). Also, a Design Certifying Engineer cannot include the integral excess flow valve of a Fisher "C" series internal valve or "F" series excess flow valve as a component of the discharge system in any DCE certification under 49CFR§173.315(n)(2).

DO NOT USE the excess flow function incorporated into Fisher "C" series internal valves or "F" series excess flow valves to satisfy the passive shutdown equipment requirement in 49CFR§173.315(n)(2). DO NOT include the excess flow function incorporated into Fisher "C" series internal valves or "F" series excess flow valves in a DCE certification under 49CFR§173.315(n)(2). The cargo tank manufacturer must install some other equipment that satisfies the requirement for passive shutdown capability under 49CFR§173.315(n)(2).

Failure to follow this warning could result in serious personal injury or property damage from a fire or explosion in the event of an unintentional release of product during an unloading operation.

Operation

Since the C400 series will not open unless the downstream pressure can build-up to equal the inlet pressure, an operating sequence that assures equalization is important.

Follow these points:

1. C400s on bobtails and transports should never be open when the truck is in motion. If the control system is not interlocked to prevent this, the operator is responsible to see that the valves are closed.
2. Always open the internal valve before opening any other valves in the line or starting the pump.
3. Move the lever to the half-open position (Operational Schematic, view #2) to equalize pressure. When the main poppet clicks open, move the operating lever fully open.
4. Open other line valves slowly to avoid sudden surges which could slug the excess flow valve shut.
5. If the excess flow valve does close, stop the pump and close the nearest downstream valve. Move the internal valve's operating lever back to the rapid equalizing position and wait for the valve to click open. Then move the operating lever fully open and slowly open the downstream valve.
6. All valves should be completely open when pumping. (Throttling type valves could prevent the excess flow valve from closing when required.)
7. The operator must always be aware of where the remote closure controls are located and know how to operate the controls if an emergency requires valve closure. When pumping is finished, make a habit of closing the internal valve from the remote closure point, thus checking to see that the control actually is capable of closing the valve.
8. The valve should be open when backfilling through the valve to fill the tank.

Troubleshooting

Internal Valve Will Not Open – This could be due to leakage downstream, engaging the pump too soon or from excessive wear in the internal valve. If excessive volume is in the downstream system, a longer time is required to equalize the pressures (tank and downstream) before the pump can be engaged. To determine if the valve pilot seat is opening, install a gauge downstream of the valve, operate the valve actuator; if pressure does not build up to the tank pressure, the valve pilot seat is not open. This test should be done with pump off. If the pilot is not opening, it may be plugged with dirt or some internal part may be broken. If by operating the lever manually it can be rotated past the fully open position, there is something wrong internally and the valve must be disassembled.

Premature Valve Closure – This can be caused from engaging the pump too soon, by an underrated excess flow valve spring, or by an improperly connected internal valve operating lever which does not fully open the valve. The trouble could also be from a valve that has its inlet port obstructed or from sudden line surges. In order to check the valve opening travel, operate the lever manually to the full travel, wait until valve opens (usually about 15 seconds), then engage the pump. If the excess flow closes, the points mentioned above should be investigated.

Internal Valve Will Not Close – The stub shaft could be binding or the stem could be bent in the valve. Before disassembling the valve, check the actuator mechanism to see that it operates freely by disconnecting it from the valve lever and cycling it several times. Also, operate the valve lever manually. If it sticks in the open position, the packing and bushings should be replaced. This should free the operating mechanism if the valve has not been damaged internally. Refer to the "Maintenance" section.

Low Flow Capacity – This could be caused by too small an internal valve, too small or long downstream piping, plugged screens, some other restriction in the downstream system, or by the bypass valve sticking in the open position. The bypass valve could also be set too low and be opening prematurely.

Explosion hazard!

Type C402, C421, and C427

Principle of Operation

Refer to the schematic drawing, Figure 2. In view #1, the valve is held closed by both tank pressure and the valve's closing spring. There is no leakage past the resilient seats in the poppet to the valve outlet.

The valve is opened by moving the operating lever to approximately mid-point in its 70° travel (view #2). This allows the cam to place the rapid equalization portion of the valve stem in the pilot opening, permitting a larger amount of product to bleed downstream than if the operating lever were moved to the full open position.

When tank and downstream pressure are nearly equal after a few seconds, the excess flow spring pushes open the main poppet (view #3) and the operating lever can be moved to the full open position.

If tank pressure is greater than the valve's outlet pressure, the main poppet will remain in the closed position. If valve outlet piping is closed off by other valves, however, product bleeding through the pilot will increase until it nearly equals tank pressure and the main poppet opens.

Note

The main poppet will not open if valve outlet piping is not closed off so that the outlet pressure can approach tank pressure.

Once the main poppet opens, a flow greater than the valve's excess flow spring rating or a sufficient surge in flow forces the main poppet closed against the excess flow spring (view #4). The pilot valve allows a small amount of product to bleed, but much less than view #2 where the rapid equalization portion of the stem is placed in the pilot opening. When the operating lever is moved to the closed position, the valve closes completely and seals tightly (view #1).

Maintenance

Do not use these internal valves if they leak, fail to work properly or have been damaged or have missing parts. Prompt repairs should be made by a properly trained serviceman. Continued use without repair can create a hazardous or injurious situation.

A simple preventative maintenance program for the valve and its controls will eliminate a lot of potential problems.

Fisher recommends these steps be conducted once a month. Also refer to the Department of Transportation (DOT) CFR49 Sections 180.416 and 180 Appendix A and B which specify monthly maintenance and inspections tests for cargo tank service internal valves and their actuation controls.

1. Inspect the operating lever to see that it operates freely and that there is no leakage around the retainer nut. If there is sticking or leakage, replace the packing and bushings. Refer to Replacing Packing.

2. Check for tight closure of the seat discs. Any detected leakage, which is normally caused by disc wear or dirt, scale or debris embedded in the disc, requires that the internal valve be removed from service and repaired. Repair most often requires the replacement of valve discs. To check for leakage:

a. Close the internal valve and exhaust downstream pressure. Close the first valve downstream from the internal valve, and note any pressure buildup, using a pressure gauge, between the closed valve and the internal valve. If piping is cold allow it to warm to ambient temperature.

limited bleed
limited bleed
bleed

flow

valve closed

valve open

excess flow valve closed

rapid bleed open

T80174

bleed
flow

Figure 2. Operational Schematic

caution

Type C402, C421, and C427

- b. Refer to CFR 49 Section 180 Appendix B for Meter Creep Test Methods.
3. All operating controls should be inspected and cleaned and oiled. The controls should be checked to see that they fully open—but not over-travel—the internal valve operating lever and operate freely to close the valve.
4. Standard construction internal valves must be removed if the container is to be steam cleaned. Heat can damage the valve's seats and seals.
5. Standard construction internal valves are not designed for water service. Immediately after a container is hydrostatically tested, remove all water and allow the container to thoroughly dry out.
6. Clean and inspect the integral strainer in the C402s. To remove the strainer, first evacuate the downstream piping and remove the flange bolts leaving one bolt attached to the body. Rotate the flange 180° and the retainer and screen will drop out. Clean the gasket surfaces and the gasket. Replace the gasket if necessary. Make a leak test after reassembly.

Disassembly

Tank pressure must be released before removing the valve from the container. Failure to do so could result in personal injury.

Numbers in parenthesis refer to key numbers in Figures 3, 4, and 5.

To Replace Packing

1. The packing (keys 15F, G, and H) can be replaced with product in the tank by closing the operating lever (key 18) and blowing down the downstream pressure in the system.
2. Remove the three cap screws (key 17) holding the bonnet assembly to the body.
3. Rotate the entire bonnet assembly slightly to remove it from the body.
4. Unscrew the cap screw (key 15R) from the stub shaft (key 15J), and remove the operating lever by taking out the cotter pin (key 19).
5. Unscrew the retaining nut (key 15M) from the bonnet. Pushing on the stub shaft (key 15J) will expose the bonnet parts including the packing.
6. Besides the packing, the liner bushings (keys 15B and 15K) should be replaced.
7. Reassemble in reverse order. Replace cap screw (key 15R) using 30 to 35 inch-pounds torque.
8. Make sure the operating lever can move freely after the new parts are installed. Conduct a leak test under pressure with a soap solution.

To Replace Seat Discs

1. Remove the valve from the tank.
2. Remove the cotter pin (key 14) and unscrew the hex nut (key 13).
3. Remove both disc holders (keys 6 and 12) from the stem (key 2).
4. Unscrew the three screws (key 9) holding the disc retainer (key 8) to replace the main seat disc.
5. Examine both seat discs (keys 7 and 11) and replace if necessary.
6. If the excess flow spring (key 3) is changed, replace the nameplate or stamp the body with the new type number.
7. Always replace the sealing washer (key 23).
8. Reassemble in reverse order using 15 to 20 foot-pounds torque to install the disc retainer (key 8). Apply Loctite No. 242 or equivalent on the stem threads before installing the hex nut (key 13).

Parts Ordering

When corresponding about this equipment, always reference the equipment type number found on the nameplate. A replacement Parts List is available for the valves. When ordering replacement parts, reference the complete 11-character part number for each needed part.

Warning!

Type C402, C421, and C427

Figure 3. Type C402
Figure 4. Type C427

Type C402, C421, and C427

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Parts List (Figures 3 through 5) Type C402, C421, and C427

Key Description

- 1 Body
- 2 Stem Assembly
- 3 Excess Flow Spring
- 4 Spring Seat
- 5 Shutoff Spring
- 6 Disc Holder
- 7* Lower Disc
- 8 Disc Retainer
- 9 Screw (3 required)
- 10 Disc Retainer
- 11* Upper Disc
- 12 Disc Holder
- 13 Hex Nut
- 14 Cotter Pin
- 15A Bonnet
- 15B* Liner Bushing
- 15C Washer
- 15D Spring
- 15E Washer (2 required)
- 15F* Male Packing Adaptor
- 15G* Packing (3 required)
- 15H* Female Packing Adaptor
- 15J Stub Shaft
- 15K* Liner Bushing
- 15L Rod Wiper

Key Description

- 15M Retainer Nut
- 15N Groove Pin
- 15P Cam
- 15R Cap Screw
- 15S Washer
- 16* O-Ring
- 17 Cap Screw (3 required)
- 18 Operating Lever
- 19 Cotter Pin (not shown)
- 20 Nameplate (not shown)
- 21 Drive Screw (2 required) (not shown)
- 22 Pipe Plug (not shown)
- 23* Washer
- 33 Travel Stop
- 35 Bushing
- 36 Guide

For C402 Only

- 25 Strainer
- 26* O-Ring
- 27 Bottom Flange
- 28 Lock Washer (8 required)
- 29 Cap Screw (8 required)

Figure 5. Type C421

* Recommended spare part

November 2001

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www.fisherregulators.com/lp

“H” Series Relief Valves

Warning

!

Failure to follow these instructions or to properly install and maintain this equipment could result in an explosion and/or fire causing property damage and personal injury or death.

A person should *NEVER* stand directly over or in front of, or look directly into a relief valve when the tank is pressurized. The relief valve could suddenly “pop” open blowing gas, dirt, and other debris into the person’s face and eyes.

Fisher equipment must be installed, operated, and maintained in accordance with federal, state, and local codes and Fisher instructions. In addition, in most states the installation must also comply with NFPA No. 58, NFPA 501C, DOT, and ANSIC61.1 standards.

Only personnel trained in the proper procedures, codes, standards, and regulations of the LP-gas industry should install and inspect this equipment.

Introduction

Scope of Manual

This manual covers instructions for the “H” series relief valves which can be used in various vapor and liquid applications. Most “H” series relief valves must be used on vapor service only. Use only advertised hydrostatic relief valves for liquid applications. The valves are typically installed in ASME tanks, DOT cylinders, and piping applications.

Things To Tell The Gas Customer

1. The purpose of a relief valve is to keep the tank from rupturing from excessive tank pressure by venting gas to the atmosphere until the tank pressure drops. Excessive tank pressure can be caused by the following:
 - a. Exposure to fire or radiant heat including hot summer days.
 - b. New or refilled tanks not fully purged of air.
 - c. Tank colors (other than white) increase the heat absorption of the tank raising the pressure in the tank.
 - d. Propane with “vapor pressures” out of specification, i.e., “Hot Gas.”
 - e. Overfilling the tank.
2. Do not beat, pound, or hit the relief valve with hammers or other tools or attempt to force the valve closed as this will not stop gas discharge and could damage relief valve parts or rupture the tank.
3. Call your gas dealer if the relief valve discharges gas.

Specifications

If the valve is to be for service other than LP-gas, anhydrous ammonia, or air; contact the factory to determine if the valve materials are suitable for the particular service.

Valves with brass materials must not be used on anhydrous ammonia service.

“H” Series relief valves range in size from 1/4 to 3-inch NPT inlet connections. Set pressures and flow capacities vary by size and application. Materials of construction are typically brass, steel, and stainless steel with nitrile discs. Consult your Fisher Catalog for size, set pressure and flow capacity combinations.

Underwriters Laboratories listed valves are required by most states, although some states require ASME capacity rated valves. Be sure the valve is rated

caution

H Series

and stamped to meet the requirements of the state where it will be used. The valve should also have sufficient capacity for the container size where it is used. Required relief valve capacity is a function of the container surface area. Consult NFPA #58 or other appropriate product standards.

The start-to-discharge pressure stamped on the valve must be correct for the design pressure of the container. Do not use a valve with a start-to-discharge pressure higher than the design pressure of the container.

When a valve has an inlet dip tube (such as used in motor fuel applications) or an outlet pipeaway stack (such as used in motor fuel and bulk storage applications), a restriction may result that reduces valve capacity below that stamped on the valve. In these cases, the total system capacity must be sufficient to meet the sizing requirements for the container being used.

Installation

Vapor relief valves must be installed only in the vapor space to provide relief capacity for the tank.

Installed vapor relief valves must have direct contact with the vapor space of the containers.

Hydrostatic relief valves are required on liquid lines to provide relief protection for the liquid line between 2 shutoff valves. Hydrostatic relief valves must be installed in the liquid space.

Install the valve so that flow is unobstructed. Be certain that any discharge from the valve will not impinge on the container, adjacent containers, or any source of ignition.

Each application will dictate whether discharge stacks or deflectors are required. Deflectors and adaptors are separate devices mounted to the outlet of the valve to control discharge direction. Consult the applicable standard to determine if these additional devices are required.

Coat the male threads of the valve with an Underwriters' Laboratories listed sealing compound. Do not allow excess compound to drip into the container or flow around the bottom edge of the pipe threads.

Pull the valve into the coupling hand tight, and then wrench tighten it for approximately two additional turns. Do not install the valve with such extreme torque that the coupling can cut threads into the valve.

Warning!

valve disc
gas discharges when disc lifts
orifice
TANK PRESSURE
SPRING
OPEN
CLOSED

Figure 1. Principle of Operation

H Series

This could cause valve distortion and affect the internal working parts. Larger size valves (especially if of steel construction) may require an additional amount of torque to obtain a leak free connection.

Rain caps are required on all valves. The rain cap should be kept in place; an out-of-place rain cap indicates the valve may have opened to relieve

Overpressure. Most relief valves have a drain hole in the body which must remain open at all times.

Relief valves on bobtails, transports and motor fuel applications must be protected as specified by DOT, NFPA #58, and other applicable laws, codes, and standards.

New containers must be purged to remove air from the container. Failure to properly purge may result in excessive pressure and the possibility of "popping" the relief valve when the container is filled. Follow NFPA #58 and NLPGA Pamphlet 133-80 guidelines for purging containers.

Principle of Operation

The relief valve (See Figure 1) is held close by the spring force seating the rubber valve disc against the orifice. When the tank pressure exceeds the spring force, the valve disc lifts off the orifice allowing gas to discharge through the valve to the air.

Gas discharge initially may be small producing only seepage and a light "hissing" sound. As pressure increases and gas volume discharge continues, a "popping" condition occurs with large volumes of gas discharge and a loud "hissing or roaring" sound.

When the tank pressure decreases enough, the spring force closes the valve disc back against the orifice stopping further discharge.

Maintenance and Replacement

Safety relief valves are nonreplicable valves and cannot be adjusted in the field.

Any valve that has fully opened "popped" should be tested to see if it is within the allowable start-to-discharge pressure setting. If it is not within the correct range, it must be replaced. Relief valve start-to-discharge and reseal pressures may be lower if the valve has fully opened (popped).

Some relief valve installations require periodic testing or replacement, such as those required by DOT, NFPA #58, NFPA Pamphlet 59 (LP-Gas Utility Gas Plants) and ANSI K61.1. It is recommended that all relief valves be regularly inspected for visible damage, dirt, corrosion, missing rain caps, paint inside outlet, tampering, etc. If any of the preceding is evident or questionable, the valve should be retested or replaced immediately.

The discharge side of the relief valve body must be kept free of dirt, water and other foreign matter which can damage the valve seat or "weld" some "wing style" poppets to the valve body. This can prevent the valve from opening. Replace valves when this occurs.

Relief valves are precisely set by the manufacturer for the correct start-to-discharge setting, and field repair should never be attempted. Since the disc in a relief valve is subject to normal deterioration, Fisher recommends that a relief valve not be used for longer than 15 years. (All Fisher valves carry the date of manufacture.) Earlier replacement may be required due to severe service conditions or code requirements.

Warning!

H Series

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BLACKMER DIFFERENTIAL BYPASS VALVES

960451

Page 1 of 2

PARTS LIST

505-A02

MODELS: BV1.25A, BV1.50A Section 505

DISCONTINUED MODELS BV1¼, BV1½ Effective May 2006

PARTS LIST WITH INSTALLATION AND OPERATION INSTRUCTIONS Replaces Oct 2005

PARTS LIST

Ref.

No. Description

Parts

Per

Unit

Part No.

1 Cap 1 414402

2 Adjusting Stud & Nut Assy.. ((1712 6- -1 12655 psi)j) (S1 td.) 1 **

2A Adjusting Screw ((2401 -- 4700 psi)) 1 437803

3 Locknut 1 922923

4 Cover 1 413045

6 Body -- 11 ¼½ "" ,N NPPTT 1 4030457

7 Spring Guide 422853

Spring (20 - 40 psi) 1 471415

SS Spring (20 - 40 psi) (BV 1.50A only) 2 471417

Spring (41 - 70 psi) 471420

Spring (71 - 125 psi) (Std.) 471428

8

Spring (126 - 165 psi) 1

1

471428

9 Valve 1 453042

O-Ring - Cover (Buna-N) (Std.) 701934

10

O-Ring - Cover (FKM) 2, 3

1 701921

O-Ring - Spring Guide (Buna-N) (Std.) 711917

88

O-Ring - Spring Guide (FKM) 2, 3

1 701979

* Assembly is not a saleable part; preset at factory.

1 For use with pumps rated over 125 psi differential pressure.

2 Non-U.L. Listed.

3 For MAPP Gas; to be used with stainless steel (SS) spring only.

DIMENSIONS

FLOW RATING - BV1.25A & BV1.50A

***Normal Maximum Rated Flow - GPM (LPM)**

Liquid Viscosity at 20 psi

(1.38 bar)

at 50 psi

(3.45 bar)

at 80 psi

(5.52 bar)

at 120 psi

(8.27 bar)

100 SSU (22 Cs) -

Propane, Gasoline 60 (227) 80 (303) 100 (379) 125 (473)

500 SSU (105 Cs) 50 (189) 70 (265) 90 (341) 100 (379)

1000 SSU (220 Cs) 40 (151) 60 (227) 80 (303) 90 (341)

3000 SSU (630 Cs) 30 (114) 50 (189) 70 (265) 80 (303)

5000 SSU (1050 Cs) 20 (76) 40 (151) 60 (227) 70 (265)

* This is the maximum flow that will pass through the bypass valve without an increase in pressure over the valve differential pressure setting.

1809 Century Avenue, Grand Rapids, Michigan 49503-1530, U.S.A.

Telephone: (616) 241-1611 / Fax: (616) 241-3752 Parts List 505-A02

E-Mail: blackmer@blackmer.com / Internet: www.blackmer.com Page 2 of 2

INSTALLATION AND OPERATION

NOTICE

BLACKMER BYPASS VALVES **MUST** ONLY BE INSTALLED IN LPG & NH₃ SYSTEMS THAT HAVE BEEN DESIGNED BY QUALIFIED ENGINEERING PERSONNEL AND OPERATED AND MAINTAINED BY QUALIFIED TECHNICIANS. THE SYSTEM **MUST** CONFORM TO ALL APPLICABLE LOCAL AND NATIONAL REGULATIONS AND SAFETY STANDARDS (SPECIFICALLY, LPG SYSTEMS **MUST** CONFORM TO NFPA 58). THIS MANUAL **MUST** BE KEPT WITH THE BYPASS VALVE AND BE REVIEWED **BEFORE** INSTALLATION, PUTTING INTO OPERATION OR PERFORMING ANY MAINTENANCE WORK.

Hazardous pressure
can cause personal
injury or property
damage

DO NOT ATTEMPT TO OPEN THE PUMP OR BYPASS VALVE UNTIL YOU HAVE BLED OFF THE PRESSURE. ON SYSTEMS WITH METERS, THE DIFFERENTIAL VALVE WILL KEEP LIQUID UNDER PRESSURE IN THE PUMP, METER AND PIPING EVEN WHEN THE HOSE IS EMPTIED.

INSTALLATION

On liquefied gas systems, a separate bypass valve, piped back to the supply tank, is necessary for maximum pump performance and longer pump life. The bypass valve must be installed in the correct position on the discharge side of the pump. (An arrow cast on the valve body indicates intake and discharge.) The bypass valve will automatically prevent excessive pressure resulting from accidental pump over speeding, discharge shut-off, or highly restrictive receiving systems.

In general, the bypass valve and its piping should be sized to accommodate the full flow from the pump when the pump's discharge line is closed and the pump is running at its rated maximum speed.

When installing bypass valve, it is essential that the pipe and fittings from the discharge port of the bypass valve be sized properly. Excessive backpressure resulting from friction loss in the bypass valve discharge piping will cause a higher pressure than the actual bypass valve setting.

For example, the BV125A bypass valve has a

characteristic pressure when set at 90 psi (6.21 bar) as shown on the following curve. If the friction loss through the bypass valve, discharge pipe and fittings (pipe, elbows, tees, shut-off valve, check valve, etc.) is 12 psi (.84 bar) at 50 gpm (189 lpm) flow rate, then the actual differential pressure in the system will rise under bypass conditions, as illustrated on the curve.

For more information on sizing and friction loss, refer to the Blackmer Liquefied Gas Handbook - Bulletin 500 (or Bulletin 33 for other liquids) for pipe friction tables.

On liquefied gas systems, the bypass valve discharge must be piped back to the liquid or vapor section of the supply tank never to the pump inlet. This method of piping should also be used when pumping volatile liquids from an underground tank or at high vacuum.

OPERATION

Unless otherwise specified, standard BV1.25A and BV1.50A bypass valves are factory set at 125 psi (8.62 bar) differential pressure, with a maximum attainable pressure setting of 125 psi (8.62 bar) for LP-Gas and NH₃ service, per Underwriters Laboratories. Optional spring ranges and settings, are noted in the bypass valve materials of construction sheet or parts lists.

Pressure Equipment Directive design life expectancy is 10 years.

NOTICE: At temperatures below -20° F (-28.9° C) materials have reduced impact strength. Provisions should be made to prevent tools and other objects from impacting any pressure containing components of the pumping system.

To check the pump's internal relief valve setting and the external bypass valve setting, follow these steps:

1. Install a pressure gauge equipped with a needle valve or snubber in the pump discharge gauge port. Install a pressure gauge on the tank and record the tank pressure.
2. Connect the delivery hose to the receiving tank.
3. Check all valves. The shut-off valve in the pump's discharge line and the shut-off valve in the bypass return line should be open.
4. Start pumping at the normal rate. Make sure the supply tank outlet valve is wide open and check the direction of shaft rotation to be sure it matches the direction of the arrow on the pump.
5. Check the pressure setting of the pump's internal relief valve (when applicable) with the following procedure:
First gradually close the shut-off valve in the bypass return line. Then slowly close the shut-off valve in the pump's discharge line while watching the gauge pressure on the discharge side of the pump. Record the peak differential pressure (the difference between the discharge and inlet pressure) when the internal relief valve begins to open. NOTE: It is important to read the peak pressure just before the pump relief valve opens. Once recirculation starts through the relief valve, vaporization will cause the pressure to fall quickly. For more information on the relief valve settings and adjustments, refer to the installation instructions for the specific pump.
6. After the relief valve setting has been determined, reopen the shut-off valve in the pump's discharge line and the shut-off valve in the bypass return line. Continue pumping at the normal rate.
7. To check the external bypass valve setting, gradually close the shut-off valve in the pump's discharge line and record the gauge pressure. The difference between this reading and the tank pressure (before pumping) is the external bypass valve setting. The external bypass valve must be set at least 25 psi (1.72 bar) less than the pump's internal relief valve setting. This pressure setting will ensure that the liquid does not recirculate through the relief valve, and thus cause excessive pump wear and noise.

Re open the shut-off valve in the pump's discharge line and resume normal pumping operation. Record the discharge gauge pressure. The difference between this reading and the tank pressure (before pumping) is the normal system operating pressure.

The external bypass valve setting should also be at least 15 psi (1.03 bar) higher than the normal system operating pressure. (Operating pressures nearing the bypass valve setting may mean liquid is being recirculated unnecessarily.)

If necessary, adjustment to the external bypass valve can be made by removing the valve cap and loosening the locknut.

WARNING: Do not remove the valve cap on the bypass valve until you have bled off the pressure. To increase the pressure setting, turn the adjusting stud and nut assembly (or adjusting screw) inward, or clockwise. To reduce the pressure setting, turn the adjusting stud and nut assembly (or adjusting screw) outward, or counterclockwise.

8.8 WATER FLOW TEST

**All Water flow test data is compiled into the document titled:
Purgatory Metropolitan District
Fire Hydrant Testing Summary 2009
Complete with Hydrant maps and photographs of each Hydrant
This document is provided and updated by the Purgatory Metropolitan
District, P.O. Box 251, Durango, Colorado USA 81302
Phone (970) 247-3954 / Fax (970) 385-6736
www.purgaturymetrodistrict.com**