OPERATIONS & MAINTENANCE HANDBOOK

for

LP-GAS BULK STORAGE FACILITIES

PROPANE education & research COUNCIL

PROPANE EXCEPTIONAL ENERGY®

NPGA National PROPANE GAS Association

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ACKNOWLEDGMENTS

This project to develop an *Operations and Maintenance Handbook for LP-Gas Bulk Storage Facilities* was undertaken to help marketers comply with new requirements for bulk plant and industrial plant LP-Gas systems that were added in the 2001 edition of NFPA 58 (The LP-Gas Code) and remain in the 2004 edition. These new requirements include mandating written procedures for safely conducting activities associated with operations and maintenance, as well as a provision that equipment owners and operators ensure that the procedures are updated, if necessary, whenever a major change occurs and prior to startup of a changed system.

The project was funded by the Propane Education & Research Council (PERC), with the National Propane Gas Association (NPGA) providing technical and regulatory oversight for the duration of the project. Wolf Safety Group, LLC (Chesterbrook, PA) was the principal contractor. As with any project, open communications, a team approach with clear definition of roles and responsibilities, and individual accountability were critical to successfully achieving the objectives.

Much of the reference materials for this handbook are from the Certified Employee Training Program (CETP), originally developed by NPGA. Materials, schematics and photographs from CETP Books 1.0 – 4.2 have been incorporated into the handbook where appropriate.

Gary Wolf, founder and owner of Wolf Safety Group, was the principal author of the handbook. Christian Branchi and Gordon Eldridge of Trans-Tech Energy (Rocky Mount, NC) provided significant technical input and support, and played key roles in the development of the handbook's format and content. Stuart Flatow, Vice President of Safety and Training for PERC, provided overall project management oversight. Sue Spear, Manager of Education and Training at NPGA, served as technical and regulatory manager for the project. Bruce Swiecicki, NPGA's Senior Technical Advisor, was the primary reviewer for regulatory requirements.

NPGA and PERC both provided valuable input and content review through their safety-related advisory committees, namely NPGA's Education, Training and Safety Committee (ETS) and PERC's Safety and Training Advisory Committee (STAC). The input and contributions from many of these committee members added significant value to the handbook. ETS formed an "O&M Subcommittee" to provide a forum for review and comment during the development of the handbook. Members of this subcommittee included Ed Anderson (ETS Associates), Gary Bourne (CHS), Ken Christensen (Crystal Flash Energy), David Hyslop (Hydratane of Athens), Ray Kazakewich (RegO Products ECII), Ken Kraft (Missouri Valley Propane), Larry Miller (Sharp Energy) and Elbert Stillwagon (HR Weaver). STAC members who significantly contributed to handbook's development included Cliff Slisz (Ferrellgas), Mike Walters (AmeriGas), Walter Cressman (Cress Gas), Thomas Petru (RR Commission of Texas), and Russ Rupp (Suburban Propane). All these gentlemen offered their time to thoroughly review each section of the handbook and provide valuable input.

A special note of appreciation from the author goes to Mike Merrill of Suburban Propane. Mike was the Chairman of the ETS O&M Subcommittee and a driving force on this project, leading consensus building with industry personnel and keeping the project team focused on maximizing the value of the handbook for the end users. He continually offered constructive comments throughout the project and contributed a significant amount of his personal time in reviewing the revisions of the handbook sections.

Last but certainly not least, we offer a special "thank you" to all the employers in the propane industry who have supported this project by providing encouragement to and time for the aforementioned volunteers to contribute to this handbook.

USER FEEDBACK RESPONSE FORM

GIVE US YOUR OPINIONS REGARDING THIS HANDBOOK

Mail to: Propane Education & Research Council
1140 Connecticut Avenue, NW
Suite 1075
Washington, DC 20036

Attention: Courtney Gendron

Email to: Courtney.Gendron@propanecouncil.org

Internet: www.PropaneSafety.com

We would like to know what you think about this Handbook. Please provide feedback using this form. If you find an error in the text, make a copy of the page(s), circle the error, write in your suggested revision and submit the copy with this form.

You can also complete the form on line at www.PropaneSafety.com. The web site will include up-to-date information on user feedback and corrections to the text.

INSTRUCTIONS:

Please read the following statements and check the appropriate response. If you disagree with the statement, please provide comments.

The material included in the *Handbook* will be useful in assisting my organization to meet the requirements of Chapter 14 of NFPA 58 – 2004.

❑ Agree ❑ Disagree

_____

_____

My organization plans to use the material in this *Handbook* to develop our Operations and Maintenance Manual.

❑ Agree ❑ Disagree

_____

_____

The information in this *Handbook* is understandable and easy to use.

❑ Agree ❑ Disagree

_____

_____

NAME: _____ **POSITION:** _____

ADDRESS: _____

_____

EMAIL: _____ **PHONE #:** _____

PROPANE EDUCATION & RESEARCH COUNCIL

INDUSTRY FEEDBACK FORM

PERC Program Operations & Maintenance Manual

Print date February 2007 **Page Number** **Item Number**

Action Requested

☐ **New Text** ☐ **Revised Text** ☐ **Graphic** ☐ **Other**

Action and Reason for Proposed Action

Include proposed updated text or graphic, and supporting information.

Subject _____

Note: The subject should clearly and accurately express the main idea of your suggestion.
For Example: Updated Distance Requirements.

Reference or similar piece _____

Note: Type in details that reference and support your suggestion.
For Example: A document or book information (title, pages number, publication date and publisher), a website address, or a federal organization name and regulation number.

Method of submitting reference material

☐ **Fax** ☐ **E-mail** ☐ **Regular Mail** ☐ **Other**

Note: If you are unable to type or print your reference details that reference and support your suggestion, please choose a method. You may support your suggestion with additional documents and materials. Propane Education & Research Council encourages you to fax, mail or e-mail additional supporting materials.

Contact Information:

Name: _____

Company:

Address: _____

City, State, Zip: _____

Phone: _____

Email: _____

You will receive a response, once the Industry Feedback Form is received. If you do not receive a response within an appropriate time, please contact PERC at (202) 452-8975.

Operations & Maintenance Handbook for LP-Gas Bulk Storage Facilities

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Background and Purpose

New requirements related to the operations and maintenance of bulk plant and industrial plant LP-Gas systems were introduced in the 2001 Edition of NFPA 58, *Liquefied Petroleum Gas Code* (Code) and expanded in the 2004 Edition. Specifically, in Chapter 14 of the 2004 Edition, the requirements summarily include:

- Operating procedure manuals for all such facilities.
- Written procedures describing actions for operating personnel to take in the event of a release of LP-Gas in the facility.
- Maintenance manuals for all equipment at these facilities.
- Maintenance programs, including record keeping, for plant fire protection equipment.

These requirements also include a provision that equipment owners and operators must ensure that the procedures are updated "… whenever a major change occurs that affects the operation of a system and prior to its startup."

It is anticipated that each LP-Gas retailer will eventually be required to meet these NFPA 58 requirements at each bulk plant. Refer to the definition of "Bulk Plant " in Chapter 3 of NFPA 58 and to Annex A of the Code for further explanatory material. In addition, customer industrial plants that meet the definition of "Bulk Plant" will need to prepare these procedures and manuals. Therefore, PERC provided project funds and Wolf Safety Group was retained to develop a "tool" that contains a standardized approach and format for LP-Gas retailers and large industrial (commercial) customers to readily use in order to meet these requirements.

This *Operations and Maintenance Handbook for LP-Gas Bulk Storage Facilities* is both a template and foundation document that allows owners and operators of LP-Gas bulk plants to easily establish and have available in a common location the necessary site information, procedures, manuals and charts used by and for:

- Plant personnel (employees and contractors) as ready reference for support and guidance in emergency situations, plant operations (including startup and shutdown), and maintenance activities.
- Record keeping associated with the required inspection and maintenance activities.
- The authority having jurisdiction to verify the continuing safety of the LP-Gas facility.

In summary, this handbook is intended to provide owners and operators of these facilities the guidance and basic information to meet the intent and the requirements of Chapter 14 of NFPA 58-2004.

LP-Gas terminal operations (i.e., refrigerated storage, marine, pipeline and rail) are typically mandated to meet the requirements of the OSHA Process Safety Management (PSM) regulation under 29 CFR 1910.119. Therefore, this handbook does **not** address

the details of those requirements.

Also, LP-Gas distribution systems that operate under the jurisdiction of the Office of Pipeline Safety (OPS) are **not** addressed in detail within this handbook.

While this handbook is not intended to be a training manual, every effort has been made to be consistent with the procedural, technical and instructional information provided in the 2nd Edition of the *Certified Employee Training Program* (CETP). Additionally, this handbook does not intend to introduce, by reference or suggested best practice, new practices that should be considered additions to the regulatory agenda.

Scope of Handbook

Following this first introductory section, the handbook is divided into eight other sections.

Section 2, "*General Facility Information,*" provides the template for itemizing critical emergency contact information for use by facility personnel, and with emergency responders and any authority having jurisdiction. **The information in this section should be completed by the owner or operator of the facility and updated when relevant changes occur.**

Section 3, "*Emergency Procedures Plan,*" gives owners and operators assistance regarding actions, procedures and documentation required by the Code in dealing with an unintentional release of LP-Gas in the facility.

Section 4, "*General Operations & Safety Requirements,*" provides guidance, procedures and charts for achieving compliance related to the **general** bulk plant/facility operating and safety requirements in NFPA 58-2004.

Section 5, "*Plant Operations Procedures,*" gives owners, operators and plant personnel a "menu" of detailed operating procedures for bulk plant facilities and large volume vapor distribution systems, including startup, normal operations and shutdown.

Section 6, "*General Maintenance and Inspection Requirements,*" offers the information necessary to comply with the general requirements for maintaining the mechanical integrity of the facility. Sample charts are provided to meet the record keeping requirements.

Section 7, "*Maintenance and Checklist Procedure,*" provides a bulk storage facility maintenance and inspection checklist detailing many maintenance and inspection steps that must be conducted in typical bulk storage and large volume vapor distribution systems. This checklist is generally organized by LP-Gas system components. Additionally, an appendix is included in this section that provides technical assistance for completing the checklist reviews.

Section 8, "*Maintenance of Fire Protection Equipment,*" gives guidance for complying with requirements associated with maintaining fire protection equipment, and charts for recording the necessary information related to maintenance and inspection activities.

Section 9, "*Manufacturers' Equipment Information*," has been intentionally left blank in the original copy of the handbook provided to you. It is intended to be a "bookmark" location for retaining/filing manufacturer's literature related to the detailed maintenance, inspection and repair information (including instructions and procedures) specific to your LP-Gas bulk plant or industrial/commercial system.

Additionally, Appendix A, "*References,*" has been provided which lists the documents that are referenced throughout this handbook. These references provide further detailed information or work procedure instructions, reference data or training information in order to meet the intent and requirements of the Code.

Using This Handbook

The ultimate purpose of this handbook is to be a functional document for each LP-Gas storage facility and serve (in a combined role) as your facility's operations, maintenance and emergency procedures manuals, consistent with the requirements of Chapter 14 of NFPA 58-2004.

Not all the information and materials contained in this handbook apply to each facility. Also, it is possible that special situations or operations not encountered in a typical LP-Gas storage facility might arise at any given site. Every effort has been made to address the numerous scenarios that can occur in a bulk plant or large storage facility. However, unique situations might not be included in this handbook. Therefore, each section should be thoroughly reviewed by the owners and operators to include all applicable data, information and procedural steps. Materials that are not applicable to your particular facility can be removed.

At the beginning of each handbook section, the purpose and objective(s) of that section are provided so that the readers, whether owners/operators or field personnel, can understand the intent of the section and the scope of the regulatory subject that is being addressed. Each section then has specific instructions regarding how to use its content in order to achieve compliance with that regulatory requirement.

By nature of the subject matter, the sections differ in their respective approaches in addressing each specific regulatory topic. For example, Section 5 on *Plant Operations Procedures* should be considered as a "template" for the operations conducted at your facility. Additions or deletions to these procedures might be necessary in order to accurately reflect local operations and conditions. Section 7 provides a checklist and guidance information for performing and documenting maintenance and inspection activities required by the Code. Again, not all subparts will necessarily be applicable; so those portions of the checklist can be removed; other items might need to be added under special circumstances.

Again, it is important to read the information at the beginning of each section so that the information contained can be used most efficiently and effectively, especially for use by plant/field personnel.

Accessibility and Review

When the information and procedures are developed into your facility's operating, maintenance and emergency procedures manual(s), these procedures and manual(s) **must all be available at the facility to which they apply and accessible to all employees and users**, including any authority having jurisdiction. Per NFPA 58-2004, maintenance manuals for normally unattended facilities are allowed to be stored at a location where they are accessible for maintenance personnel serving the unattended location.

The procedures should be reviewed with all appropriate employees and users who are expected to carry out the relevant job functions at the time when the procedures are initially developed and again when changes to the procedures occur.

Keep in mind that NFPA 58-2004 requires that all applicable **procedures must be updated whenever a change occurs** that effects the operations, maintenance or emergency response activities of the facility.

Type of Facility: ***LP-Gas Bulk Storage Plant***

Company Name:

Facility Name (if different):

Street Address:

City, State, Zip Code:

Facility Telephone Number:

Company Headquarters (city, state):

Original Date of Manual:

Revision Number and Date:

MANAGEMENT CONTACT INFORMATION

Authorized/Responsible Facility Representative:

Title/Position of Representative:

Representative's Emergency Contact Telephone Number(s):

- ❑
- ❑

LOCAL EMERGENCY RESPONDER CONTACT INFORMATION

Fire Department (name):

- ❑ **Telephone Number**:

Emergency Medical Responders (name):

- ❑ **Telephone Number**:

Hospital/ Emergency Medical Facility (name):

- ❑ **Telephone Number**:

Police Telephone Numbers

- ❑ **State**:
- ❑ **Local**:

LP-Gas Inspection Agency (name):

- ❑ **Telephone Number**:

Coast Guard Telephone Number (if applicable):

Section Purpose and Objectives

This section of the Operations & Maintenance Handbook is intended to assist owners or operators of bulk plants and industrial plants in meeting the emergency procedures requirements of NFPA 58-2004 for an unintentional LP-Gas release. Emergency procedures in the broader sense of employee exposure or the reasonable possibility for employee exposure to safety or health hazards is an OSHA jurisdictional requirement which may or may not apply to a specific LP-Gas system.

General Fire Protection Requirements

Fire protection must be provided for bulk plants and industrial plants. Fire protection can include fire prevention, fire detection and/or fire suppression.

General fire protection and response requirements for LP-Gas facilities are detailed in NFPA 58-2004 (§6.23), and include the following considerations:

Planning

- Must be coordinated with local emergency response agencies.
- Must consider the safety of emergency personnel, workers and the public.

Protection of Containers

- A written Fire Safety Analysis (FSA)* must be developed to evaluate the total product control system and to specify the modes of fire protection installed.
- This FSA must be submitted to the authority having jurisdiction and local emergency responders.
- The FSA must be updated when there are changes in the storage capacity or the transfer system.

** The FSA is a self-conducted audit of the safety features of a propane installation and an assessment of the means to minimize the potential for inadvertent propane releases from storage containers and during transfer operations. The assessment also includes an evaluation of the capabilities of local emergency response agencies as well an analysis of potential hazard exposures from the installation to the neighborhood and from the surrounding to the LP-gas facility.*

For guidance on conducting a FSA, go to www.NPGA.org and click on the "Fire Safety Analysis Manual" link where, at no cost, you can obtain the necessary forms and a step-by-step method for completing a written fire safety analysis, as explained in the 2001 and 2004 editions of NFPA 58. A FAQ sheet and other useful information about the manual are also available via the link. FSA materials may also be downloaded from PERC's Safety and Training Website at www.propanesafety.com by registering at no cost and clicking on "Regulatory Compliance." If desired, a bound paper copy of the FSA manual can be purchased online through the Propane Education & Research Council at www.propanecatalog.com.

Emergency procedures based on equipment at the facility will be described further in this section and within the system operating procedures in Sections 4 and 5.

Each owner or operator should check for other emergency planning requirements established by various regulatory agencies such as OSHA (Emergency Action Plan) and USDOT (Security Plan).

When is it an Emergency?

It is an emergency when:

- An occurrence results in or is likely to result in an unintentional or uncontrolled release of a hazardous material.
- There is a potential safety or health hazard, such as a fire, explosion or chemical exposure hazard.

Employees must be immediately evacuated from the danger area when an emergency occurs, and employees are not permitted to assist in handling the emergency, unless they have received specialized training as detailed in the company's Emergency Response Plan (ERP).

When is it *NOT* an Emergency?

Even though there may have been an incidental release of a hazardous material, it is not considered an emergency when:

- An intentional release is produced during normal operations.
- There is no potential safety or health hazard (no potential fire, explosion or chemical exposure hazard). Because this determination may be difficult to make, companies may choose a policy of evacuation any time there is a spill or leak, regardless of the size of the spill or leak

Contact Information

By completing Section 2 of this handbook, basic facility data and contact information is documented and available for emergency response and support agencies. If there are special circumstances that require additional information about the facility or require contact information specific to or necessary for other first responders in an emergency, also include that information in Section 2.

Material Safety Data Sheet (MSDS)

A Material Safety Data Sheet (MSDS) is defined as "written or printed material concerning a hazardous chemical that is prepared in accordance with OSHA's Hazard Communication Standard." The purpose of the MSDS is to provide information about chemical hazards. Each MSDS may look a bit different, but they must all provide the following information:

1) Product and Company Identification (product information)
2) Composition/Information on Ingredients (hazardous ingredients)
3) Hazards Identification (toxicology and health information)
4) First Aid and Emergency Procedures
5) Fire-fighting Measures
6) Accidental Release Measures (leak response procedures)
7) Handling and Storage
8) Exposure Controls and Personal Protection
9) Physical and Chemical Properties (characteristics)
10) Stability and Reactivity

Additional sections that can apply (as appropriate) include:

11) Toxicological Information
12) Ecological Information
13) Disposal Considerations
14) Transport Information
15) Regulatory Information
16) Other Information

Know the location of the MSDS for LP-Gas used at your company. A sample MSDS for propane is included in Appendix 3.1 at the end of this section.

Emergency Equipment Location

A site map (or site plan) that identifies the location of fire protection systems and emergency equipment should be developed, and include the following information:

- Indication of direction "north"
- Off-site references (e.g., adjacent roads)
- Property lines
- Fence lines
- Gates for vehicles and personnel
- Buildings and structures, identified by name and general function
- Bulk storage tanks
  - Identification of each tank on site

- Capacity designation for each tank (maximum capacity in water gallons)
- Identification of tanks equipped with internal valves

➢ Loading and unloading facilities (including rail car, if applicable)
➢ Site electrical system controls (i.e., switch gear, main panel, breaker box)
➢ Emergency Shutoff Valves (location of valve and remote control device)
➢ Fire monitoring, detection and suppression equipment, such as
- Monitors and hydrants
- Sprinkler Systems
- Extinguishers
- Other sources of water for emergency response

For reference, see Appendix 3.2 at the end of this section for a sample site map.

Emergency Equipment Description

All individual components and each type of fire protection and emergency equipment that exist on site should be identified on the Site Map and listed in the following table for reference.

Equipment Description	Available (Yes/No)	Total # on Site
Emergency Shutoff Valve		
Remote Emergency Shutoff Valve Device		
Container Internal Valve		
Fire Extinguisher		
Fire Hydrant/Monitor		
Fire Water Sprinkler Systems		
Main Electrical Panel		
Emergency Site Egress (Gates) Points		
Other (describe):		

Emergency Equipment Availability

While it is important that an emergency procedures plan is documented, is clear and understandable, and is accessible for use in emergency situations, the plan can only be executed successfully if emergency equipment and controls are available and functional at all

times. Particularly, emergency equipment and controls must be conspicuously marked and installed in locations specified by the Code for accessibility in emergency situations.

Specific requirements regarding inspection and maintenance of emergency equipment are discussed in Sections 7 and 8.

Emergency Escape Procedures and Routes

The site map and plan clearly defines emergency escape routes, assembly points and shelter areas to be used. An employee(s) must also be designated to take a head count of all workers after evacuation and inform emergency responders of any missing personnel.

Always plan two ways out!

Fire Extinguishers

Each bulk plant must have at least one approved portable fire extinguisher that has a minimum capacity of **18 pounds** (8.2 kg) of dry chemical with a B:C rating. NFPA codes do not specify a placement point (e.g., distance from the point of transfer or path of egress).

However, for bulk plants that have storage locations where the aggregate quantity of LP-Gas stored in cylinders awaiting use, resale or exchange is in excess of 720 lb (327 kg), the required fire extinguisher must be located no more than **50 feet** (15 m) from the storage location.

Fire extinguisher training must be provided upon hiring and annually thereafter for any employee who will be expected to use portable fire extinguishers to respond to small stage fires. Only these trained employees are authorized to use the portable fire extinguishers in an emergency.

All other employees in the fire area must immediately evacuate the affected work area when they hear the fire alarm. Employees who are trained to evacuate do not need to be trained on fire extinguisher use.

Emergency Shutoff Devices

NFPA 58 requires that emergency shutoff valves be installed at transfer points such that the temperature-sensitive element for the valve is no more than **5 feet** from the nearest end of the hose or swivel-type piping connection to the line in which the valve is installed.

Container openings meeting the retrofit requirements for thermal activation of the emergency shutdown system (effective July 1, 2011) must have the temperature sensitive element

located as follows:

- For internal valves, no more than **5 feet** from the internal valve.
- For emergency shutoff valves, as close as practical to the positive shutoff valve/excess flow valve combination on the container.

Refer to §5.7.7.2 of NFPA 58-2004 for more detailed information and requirements.

Specifically for thermally activated remote emergency shutoff devices and/or for redundant fail-safe product control systems associated with underground and mounded ASME containers, they must be:

- Identified by a sign that is readable from the point of transfer and incorporates the words "Propane – Container Liquid Valve Emergency Shutoff" in block letters of not less than 2 inches in height and on a background that contrasts in color to the letters; and
- Located not less than **25 feet** or more than **100 feet** in the path of egress from the emergency shutoff valve.

If an LP-Gas dispensing device or station is on the site, a labeled and accessible electrical switch or circuit breaker must be installed to shut off the electrical power in case of an emergency and located within **20 – 100 feet** from the dispenser itself.

Emergency Equipment Access

NFPA 58 requires that bulk plants have roadways and other appropriate means of access for emergency response equipment (e.g., fire fighting vehicles and equipment) for the situation where outside emergency response assistance is required.

Medical First Aid

For those facilities transferring LP-Gas between marine vessels and shore facilities, medical first aid equipment must be available at the shore facility.

APPENDIX 3.1

MATERIAL SAFETY DATA SHEET (MSDS) FOR ODORIZED PROPANE *(SAMPLE ONLY)*

1. Chemical Product and Company Identification

Product Name: Odorized Propane

Chemical Name: Propane

Chemical Family: Paraffinic Hydrocarbon

Formula: C3H8

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

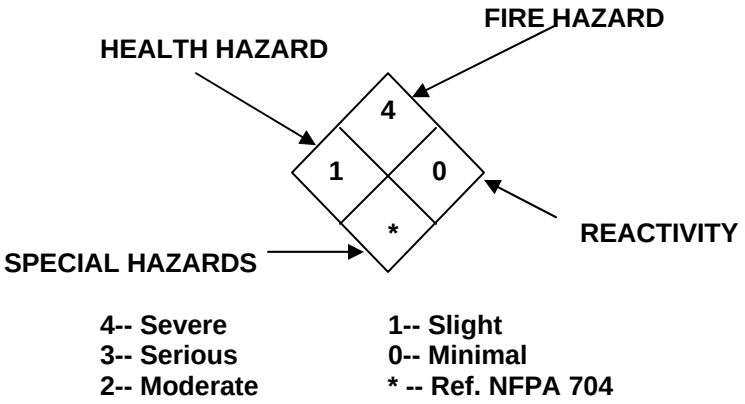
Name & Address:	Transportation Emergency Number:	Emergency Number: For Routine Info, Call:

2. Composition/Information on Ingredients

Ingredient Name /CAS Number	Percentage	OSHA PEL	ACGIH TLV
Propane/74-98-6	87.5-100	1,000 ppm	Simple asphyxiant
Ethane/74-84-0	0-5.0		Simple asphyxiant
Propylene/115-07-1	0-10.0		Simple asphyxiant
Butanes/various	0-2.5		Simple asphyxiant
Ethyl Mercaptan/75-08-1	16-25ppm	0.5 ppm	0.5 ppm

3. Hazards Identification

A. *EMERGENCY OVERVIEW*



4-- Severe **1-- Slight**
3-- Serious **0-- Minimal**
2-- Moderate *** -- Ref. NFPA 704**

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

B. *POTENTIAL HEALTH EFFECTS INFORMATION*

ROUTES OF EXPOSURE:

Inhalation: Asphyxiant. It should be noted that 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 8%-10% or less oxygen will bring about unconsciousness without warning, and so quickly that the individuals cannot help or protect themselves. 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: Liquid can cause freeze burn similar to frostbite. Ingestion not expected to occur in normal use.

CHRONIC EFFECTS: None

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: None

OTHER EFFECTS OF OVEREXPOSURE: None

CARCINOGENICITY: Propane is not listed by NTP, OSHA or IARC.

4. First Aid Measures

INHALATION: Persons 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 prompt medical attention.

EYE CONTACT: Contact with liquid can cause freezing of tissue. Gently flush eyes with lukewarm water. Obtain medical attention immediately.

SKIN CONTACT: Contact with liquid can cause frostbite. Remove saturated clothes, shoes and jewelry. Immerse affected
area in lukewarm water not exceeding 105. F. Keep immersed. Get prompt medical attention.

INGESTION: If swallowed, get immediate medical attention.

NOTES TO PHYSICIAN: None.

5. Fire-Fighting Measures

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

IGNITION TEMPERATURE IN AIR: 920-1120° F

FLAMMABLE LIMITS IN AIR BY VOLUME: Lower: 2.15% Upper: 9.6%

EXTINGUISHING MEDIA: Dry chemical, CO_2, water spray or fog for surrounding area. Do not extinguish fire until propane source is shut off.

SPECIAL FIRE-FIGHTING INSTRUCTIONS: Evacuate personnel from danger area. Immediately cool container with water spray from maximum distance, taking care not to extinguish flames. If flames are accidentally extinguished, explosive re-ignition may occur. Where water is abundant and immediate, the fire should be allowed to burn while the container and area are cooled and the flow of propane is shut off. Where water is scarce, compare the risk of allowing the area to continue to heat from the fire and the alternative of extinguishing the fire without shutting off the propane flow, which may allow for the propane to accumulate and re-ignite explosively.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Propane is easily ignited. It is heavier than air; therefore, it can collect in low areas where an ignition source can be present. Pressure in a container can build up due to heat and container may rupture if pressure relief devices should fail to function. Propane released from a properly functioning relief valve on an overheated container can also become ignited.

HAZARDOUS COMBUSTION PRODUCTS: None.

6. Accidental Release Measures

STEPS TO BE TAKEN 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.

7. Handling and Storage

HANDLING PRECAUTIONS: Propane vapor is heavier than air and can collect in low areas that are without sufficient ventilation. Leak-check system 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 supplier. 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 "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, *Standard for the Storage and Handling of Liquefied Petroleum Gases.* 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. Store cylinders in upright position, or with pressure relief valve in vapor space. Do not drop or abuse cylinders. 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 Controls/Personal Protection

ENGINEERING CONTROLS

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

RESPIRATORY PROTECTION (SPECIFY TYPE)

General Use: None.

Emergency Use: If concentrations are high enough to warrant supplied-air or 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 which are impervious to the product for the duration of the anticipated exposure.

EYE PROTECTION: Safety glasses are recommended when handling cylinders.

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

9. Physical and Chemical Properties

BOILING POINT: @ 14.7 psia = -44° F

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

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

VAPOR PRESSURE: @ 70° F = 127 psig
@ 105° F = 210 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) has been 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, CASNo.75-08-01. Odorant has a foul smell. The ability of people to detect odors varies widely. Also, certain chemical reactions with material in the propane system, or fugitive propane gas from underground leaks passing through certain soils, can reduce the odor level. No odorant will be 100% effective in all circumstances. If odorant appears to be weak, notify propane supplier 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. When used as an engine fuel, incomplete combustion can cause carbon monoxide, a toxic gas.

Hazardous polymerization: Will not occur.

11. Toxicological Information

Propane is non-toxic and is a simple asphyxiant, however, it does have slight anesthetic properties and higher concentrations may cause dizziness.

IRRITANCY OF MATERIAL: None

SENSITIZATION TO MATERIAL: None

REPRODUCTIVE EFFECTS: None

SYNERGISTIC MATERIALS: None

TERATOGENICITY: None

MUTAGENICITY: 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 to supplier for safe disposal. Residual product within process system may be burned at a controlled rate, if a suitable burning unit (flare stack) is available on site. This shall be done in accordance with federal, state and local regulations.

14. Transport Information

DOT SHIPPING NAME: Liquefied Petroleum Gas

HAZARD CLASS: 2.1 (Flammable Gas)

IDENTIFICATION NUMBER: UN 1075

PRODUCT RQ: None

SHIPPING LABEL(S): Flammable gas

IMO SHIPPING NAME: Propane

PLACARD (WHEN REQUIRED): Flammable gas

IMO IDENTIFICATION NUMBER: UN 1978

SPECIAL SHIPPING INFORMATION: Container should be transported in a secure, upright position in a well-ventilated vehicle.

15. Regulatory Information

The following information concerns selected 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

EPA Environmental Protection Agency

CERCLA Comprehensive Environmental Response, Compensation and Liability Act of 1980
(40 CFR Parts 117 and 302)
Reportable Quantity (RQ): None

SARA Superfund Amendment and Reauthorization Act
*SECTION 302/304: Requires 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: Require 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: Requires submission of annual reports of release of toxic chemicals that appear in 40 CFR Part 372. Propane does not require reporting under Section 313.

40 CFR PART 68 Risk Management for Chemical Accidental Release

TSCA Toxic Substance Control Act
Propane is listed on the TSCA inventory.

OSHA Occupational Safety and Health Administration

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

FDA Food and Drug Administration

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 *Standard for the Storage and Handling of Liquefied Petroleum Gases* 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 to arrange for the required training. Allow only trained and qualified persons to install and service propane containers and systems.

WARNING: Be aware that with odorized propane the intensity of ethyl mercaptan stench (its odor) may fade due to chemical oxidation (in the presence of rust, air or moisture), adsorption or absorption. Some people have nasal perception problems and may not be able to smell the ethyl mercaptan stench. Leaking propane from underground gas lines may lose its odor as it passes through certain soils. While ethyl mercaptan may not impart the warning of the presence of propane in every instance, it is generally effective in a majority of situations. Familiarize yourself, your employees and customers with this warning, and other facts associated with the so-called "odor-fade" phenomenon. If you do not already know all the facts, contact your propane supplier for more information about odor, electronic gas alarms and other safety considerations associated with the handling, storage and use of propane.

ISSUE INFORMATION

Issue Date:_____

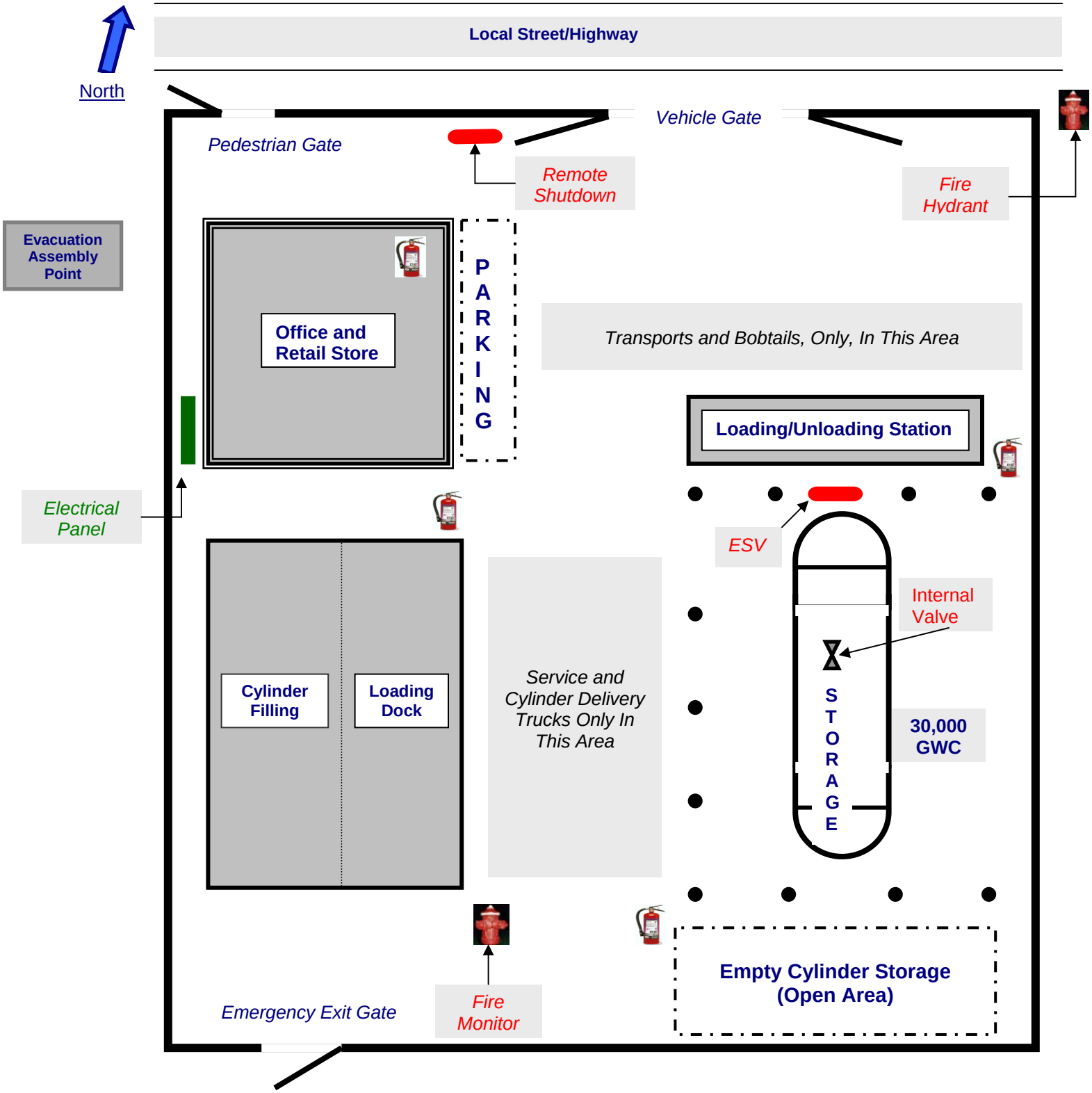
This material safety data sheet and the information it contains is offered to you in good faith as accurate. This Supplier does not manufacture this product but is a supplier of the product independently manufactured by others. Much of the information contained in this data sheet was received from sources outside our Company. To the best of our knowledge this information is accurate, but this Supplier does not guarantee its accuracy or completeness. Health and safety precautions in this data sheet may not be adequate for all individuals and/or situations. It is the user's obligation to evaluate and use this product safely, comply with all applicable laws and regulations and to assume the risks involved in the use of this product.

NO WARRANTY OR MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSES, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OF COMPLETENESS OF THIS INFORMATION, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE.

Legend: Fire Extinguisher =

Appendix 3.2
Sample Site Plan*

**Example only. Each facility should develop its own site plan.*



Section Purpose and Objectives

NFPA 58-2004 requires that general operating procedures be prepared and maintained for each facility in a common location or locations (§14.2.1.5, 14.2.2.2, and their sub-referenced paragraphs). Owners and managers of LP-Gas bulk or industrial plant systems must ensure that the operating procedures are updated, as appropriate, whenever a major change occurs and prior to the startup of a changed system.

This section provides guidance for achieving compliance with those referenced requirements related to general bulk plant/facility operating procedures and safety requirements, exclusive of emergency procedures that have already been addressed in Section 3 of this handbook. Guidance specific to startup, operation and shutdown of the transfer system and equipment are addressed in Section 5.

Site Accessibility

Except where business activities dictate, customers and the general public must be restricted from areas where LP-Gas is stored, transferred and handled.

Site Signage and Markings

Signs and other forms of markings within the site or on the equipment should provide appropriate warnings and sufficient information for personnel onsite to work safely and perform duties consistent with procedures and work practices.

Control of Combustible Materials and Ignition Sources

Referring to Figure 4.1, basic fire prevention concepts demonstrate that the elimination of any leg of the “fire triangle” will eliminate the possibility of combustion occurring.

Figure 4.1

Therefore, the control of combustible materials and ignition sources is critical to the operating safety of any LP-Gas facility.

Combustible Materials

Weeds, long dry grass, wooden materials (e.g., limbs, planks, pallets) and paper products are all examples of combustible materials (i.e., "fuel") that need to be controlled and kept at a sufficient distance from LP-Gas storage containers in order to reduce the potential of a fire that could occur adjacent to the equipment. All these and similar combustible materials must be maintained or stored such that they are no closer than **10 feet** to the container. Additionally, where single containers (constructed as portable containers) are used for temporary storage, they must not only be placed on level and firm surfaces but they also must be kept clear of combustible materials (as defined in this paragraph) for a minimum distance of **10 feet**.

Ignition Sources

Smoking

Another significant fire prevention measure is the control of ignition sources. First and foremost, smoking prohibitions for each site must be established. As minimum requirements, no person, whether that person is an employee, contractor or site visitor, can be allowed to use or carry lighted smoking materials under the following situations:

- When he or she is on or within **25 feet** of a vehicle that contains LP-Gas, liquid or vapor.
- When he or she is at any point of liquid transfer.
- When delivering to or connecting to containers.

Further smoking restrictions or prohibitions may be established by the owner or operator of the site.

Open Flames & Other Ignition Sources – Continuous Control

Open flames and other ignition sources (such as non-explosion proof electrical equipment and vehicles) must be controlled on an on-going basis for general fire prevention purposes. Specific control measures that must be implemented include:

- Prohibiting open flames and all other sources of ignition in pump houses, cylinder filling rooms and other locations where the presence of LP-Gas vapors is likely.
- Prohibiting the installation in pump houses or cylinder filling rooms of:
  (a) Direct-fired vaporizers, or
  (b) Indirect-fired vaporizers that are attached or installed adjacent to gas-fired heat sources.

- Prohibiting open flames, cutting or welding tools, sparking hand tools, portable electric tools (including two-way radios and cell phones) and non-explosion proof electrical equipment within the classified electrical areas per Table 6.20.2.2 in NFPA 58-2004.

- Installing all fixed electrical equipment and wiring within a classified area specified in Table 6.20.2.2 to be consistent with the requirements of NFPA 70, *National Electric Code*.

While open flames and other ignition sources are not prohibited in site locations where LP-Gas equipment has been purged of all liquid and vapor, appropriate measures should be taken to ensure that these locations remain gas-free.

Open Flames and Other Ignition Sources – Transfer Operations

Sources of ignition must be eliminated during all LP-Gas transfer operations, including the periods when connections and disconnections are being made and while LP-Gas is being vented to the atmosphere. During transfer operations the following specific precautions must be taken:

- Internal combustion engines that are within **15 feet** of the point of transfer must be shut down, except for:

  (a) Engines of LP-Gas cargo tank vehicles constructed and operated in compliance with Chapter 9 of NFPA 58-2004, when these engines are being used to operate transfer pumps or compressors on the vehicles themselves in order to load containers that are not located at a stationary installation (*Note: This is not a typical bulk plant scenario.*); or

  (b) Engines in buildings as covered by Section 11.12 of NFPA 58-2004 (i.e., Industrial and Forklift Trucks Powered by LP-Gas).

- Smoking or the use of open flames, sparking hand tools, portable electric tools (including two-way radios and cell phones), non-explosion proof electrical equipment or any other equipment that has the energy to ignite LP-Gas must be prohibited within **25 feet** of the point of transfer.

- Metal cutting, grinding, oxygen-fuel gas cutting, brazing, welding, soldering or welding (i.e., any "hot work" procedures) must be prohibited within **35 feet** of the point of transfer. Furthermore, if any of these procedures have been performed within this zone of 35 feet prior to the transfer operation, the affected materials must be cooled to a temperature below the ignition temperature of LP-Gas (i.e., less than 900ºF) before starting the transfer.

- For those facilities where LP-Gas is dispensed into a vehicle container for the purpose of using the LP-Gas as a fuel source (e.g., a recreational vehicle or a

propane-fueled vehicle), all ignition sources associated with the vehicles must be turned off. Control measures include shutting down the engines of the vehicle being fueled and those waiting to be fueled, and also extinguishing pilot lights and shutting off other ignition sources within recreational vehicles, for example.

Facility Ignition Sources

Survey your facility and list the ignition sources in the data box, below. Insert an additional sheet, if necessary.

Table 4.1 – Ignition Sources

TYPE/NATURE OF IGNITION SOURCE	*LOCATION OF IGNITION SOURCE*	*CONTROLS OR CORRECTIVE ACTION*

Containers – General Requirements

ASME Containers (Pressure Vessels)

In general, stationary containers used for LP-Gas bulk plant storage must be designed, fabricated, tested and marked in accordance with the requirements of the ASME *Boiler and Pressure Vessel Code*, Section VIII or the API –ASME code if constructed prior to July 1, 1961. The agency having jurisdictional authority (usually, that associated with "boilers") should be contacted for specific requirements related to compliance and continued service use. The NFPA *LP-Gas Code Handbook* (2004 Edition) provides additional background information, guidance and reference material.

ASME Container Data

For your record keeping, insert information from the data plates (nameplates) on the ASME storage containers at your facility into Table 4.2. For additional ASME storage containers, add another table and insert the appropriate information.

Table 4.2 – ASME Container Data

	CONTAINER #1	*CONTAINER #2*	*CONTAINER #3*	*CONTAINER #4*
Service (UG, AG)				
Manufacturer's Name & Address				
Manufacturer's Serial Number				
National Board Number				
Water Capacity (lbs. or gal.)				
MAWP (psi)				
Surface Area (sq. ft.)				
Year Built				
Shell Thickness (in.)				
Head Thickness (in.)				
Overall Length (ft.-in.)				
Outside Diameter (ft.-in.)				
Head Design				
Min. Design Metal Temp. @ MAWP				
Type of Construction				
Degree of Radiography				

Liquid and Vapor Openings

The requirements for internal valves and other valve/line closure components for liquid and vapor openings (both inlet and withdrawal) on ASME containers over 4,000 gallons are defined in §5.7.7.2 of NFPA 58. Alternate provisions for underground and mounded tanks of 2,001 gallon through 30,000 gallon water capacity are further provided in §6.24 of NFPA 58.

Portable Cylinders

These containers are designed, fabricated, tested and marked in accordance with the U.S. Department of Transportation (DOT). This handbook is not intended to reiterate the DOT requirements with respect to these aspects of the regulations. For details, refer to Title 49, *Code of Federal Regulations*, "Transportation". Again, the NFPA *LP-Gas Code Handbook* (2004 Edition) provides additional background information, guidance and reference material on these containers, also.

Site Storage

A number of considerations must be taken into account when storing portable cylinders in a bulk plant. These include:

- Locating them in a place that minimizes their exposure to excessive temperatures, physical or mechanical damage and tampering.
- Positioning any cylinder that has a nominal LP-Gas capacity greater than 1 lb. (0.45 kg) such that the pressure relief valve is in direct contact with the vapor space of the cylinder.
- When storing LP-Gas cylinders inside buildings (in accordance with Section 8.3 of NFPA 58-2004), they cannot be located near any areas of egress (e.g., exits, entrances, and walkways). Also, when determining the maximum quantity of LP-Gas that can be stored indoors, each cylinder stored indoors must be considered to be a full cylinder.
- Cylinders cannot be stored on the roof of any building or structure.

Temporary Stationary Storage

In situations where a portable container is being used for temporary stationary storage in a bulk plant, it must be placed on a firm flat surface (e.g., concrete pad, pavement or firm earth) while in use as such.

Labeling

ASME Containers (> 2000 gallon water capacity)

The representative inlet and outlet lines for both the liquid and vapor spaces must be labeled as such. While not required, color coding of the associated piping and valves can be used as an identification aid in addition to labeling.

Connections for gauges and pressure relief devices are not required to be labeled.

Portable Cylinders

When LP-Gas cylinders are to be stored or used at the same sites with other compressed gases, each cylinder must be labeled to identify their individual and respective contents. The labeling should be consistent with the requirements of ANSI/CGA C-7, *Guide to the Preparation of Precautionary Labeling and Marking of Compressed Gas Containers*.

Container Filling

Overfilling Prevention Devices (OPD)

NFPA 58 requires that cylinders with LP-Gas capacities of 4# through 40# be equipped with an OPD and a fixed maximum liquid level gauge, and that no cylinder in this capacity range can be filled if it is not equipped with both of these devices unless specifically exempted from the requirement.

Those cylinders in the 4 - 40# capacity range that are exempt from having a listed OPD installed include:

- Cylinders used in industrial truck service.
- Cylinders identified and used for industrial welding and cutting gases.
- Cylinders manufactured prior to October 1, 1998, and designed for use in the horizontal position and where an overfilling prevention device is not available.

Liquid Level Gauges

Every container that is designed to be filled on a volumetric basis must be equipped with a **fixed maximum liquid level gauge** in order to indicate the maximum fill level for the service in which the container is to be filled or used.

For bulk plants or specific points of transfer that are designated as a "low emission transfer" locations (i.e., to meet environmental regulatory requirements or to take advantage of reduced installation distances), fixed maximum liquid level gauges cannot be used to determine the maximum filling limit. Therefore, the maximum permitted filling limit must be determined by weight or other approved means.

Where **variable liquid level gauges** are also used for filling containers (usually large capacity storage vessels), these devices must meet the following requirements to facilitate reading the gauges:

- The gauges must show the maximum liquid level (in metric units or percent capacity of the container) when installed in containers greater than 2000 gallon water capacity; and
- Markings must indicate the maximum liquid level at liquid temperatures from 20ºF to 130ºF and in increments not greater than 20ºF; and
- The system nameplate and/or the gauge must have markings indicating the various liquid levels from empty to full; and
- Dials of rotary gauges or magnetic float gauges must indicate whether they are for cylindrical containers or spheres, and if the service is aboveground or underground; and
- Dials of gauges for aboveground (only) containers that have a water capacity of more than 1200 gallons must be marked to note this fact.

General Requirements for LP-Gas Transfer Operations

Personnel

The individual(s) performing the LP-Gas transfer operations, filling or evacuating, must be properly trained (qualified) in LP-Gas handling procedures, procedures relevant and specific to the transfer operations, and emergency response procedures. Additionally, NFPA 58 requires that refresher training be provided **every three (3) years**, and that the training be documented.

During the transfer operation, from the time of original connection through the final disconnect, at least one qualified person must be in attendance. "In attendance" means that the individual must have line of sight of the transfer operation and be in a position to physically take action if required during the operation.

These persons are also responsible to ensure that the equipment and containers used in the transfer operations are designed for the type of LP-Gas that is being filled into the receiving container.

Furthermore, when these individuals observe non-compliant situations or conditions with respect to containers and their appurtenances, the container owner and user must be notified **in writing**.

Prohibitions

Compressed air, oxygen or any oxidizing gases cannot be injected into containers for the purpose of transferring LP-Gas liquid. These gases can create a flammable gas mixture within the container.

Similarly, when evacuating containers, no liquids or gases other than LP-Gas may be injected into the containers.

Ammonia Contamination

Brass fittings are commonly used in LP-Gas service. Ammonia will damage these brass system components by a corrosion phenomenon commonly called “season cracking” (a form of stress corrosion cracking), potentially resulting in unanticipated and premature failure.

Therefore, it is important that stored LP-Gas is essentially free of ammonia. The gas must be tested for ammonia and must contain quantities less than what will turn red litmus paper to blue. Furthermore, when a transportation or storage system is being converted from ammonia service to LP-Gas, it must be tested for ammonia contamination at the time of the initial fill.

Section Purpose and Objectives

NFPA 58-2004 requires that bulk plants and industrial plants have operating procedures that are documented and readily available (§14.2.1, 14.2.2 and 13.4.4). This section provides guideline operating procedures for bulk plant facilities and large volume storage systems, including startup, normal operation and shutdown.

Scope and Application of Section

While operating procedures are typically similar at LP-Gas bulk storage facilities, the equipment can vary in size (e.g., storage capacity), design, layout, equipment complexity or function (e.g., rail unloading facilities, cylinder filling operations, on-site commercial dispensers).

This handbook section should be considered to be a “template” for the operations conducted at any specific LP-Gas bulk storage facility, and additions or deletions to these procedures could be necessary. Therefore, owners or site management and supervisors should consider site-specific features and conditions that need to be included, modified or deleted in the information in this section in order to accurately reflect local operations and conditions. With these changes, operators, technicians, drivers and other site personnel can use this document as the operating procedures required by NFPA 58-2004.

Operating procedures for large-volume storage and vapor distribution systems at customer locations are also addressed in this section.

Although NFPA 58-2004 references the need for documented operating requirements with respect to refrigerated storage, marine and pipeline LP-Gas systems, these systems (which can vary significantly in design and complexity) come under the authority of other jurisdictions which have very specific and detailed requirements within EPA’s Risk Management Plan, OSHA’s Process Safety Management and US DOT’s Office of Pipeline Safety. Therefore, these systems are not addressed in this handbook.

Content of Section

The chart below is a guide for operators to easily identify which sections are appropriate for their specific applications. Applicable CETP modules are included in the table for easy reference to further instructional information and materials.

Topic	CETP Ref.	Handbook Sect. 5 Pages	Check, If Applicable
5.1 - Basic Bulk Plant			
5.1.1 - Bulk Storage Container	3.4.1	2 - 3	
5.1.2 - Loading a CTMV (Bobtail/Transport) Using a Plant Pump	2.2.4 & 2.3.3	3 - 7	
5.1.3 - Loading a CTMV (Bobtail/Transport) Using a Plant Vapor Compressor	2.2.5 & 2.3.4	7 - 11	
5.1.4 - Unloading a CTMV (Bobtail/Transport)	3.5.11	12 - 15	
5.1.5 - Unloading a Railcar	3.6	16 - 25	
5.1.6 - Preparing & Transporting DOT Cylinders	2.4	26 - 33	
5.1.7 - Preparing & Transporting ASME Containers	2.5	34 - 42	
5.1.8 - Evacuating LP-Gas from Containers	3.1.5 & 3.2.2	42 - 57	
5.1.9 - Purging Containers	3.2.3	57 - 60	
5.1.10 - Dispensing LP-Gas in a Bulk Plant	3.3	61 - 69	
5.2 - Vapor Distribution Systems	-	70 - 71	

5.1 Bulk Plant Operating Procedures

5.1.1 Bulk Storage Containers

Startup

1. Before beginning any operation ensure the transfer equipment is in good condition, the bulk storage container is safe to be filled, and the surrounding area is free from hazards that may constitute a source of ignition.

2. Ensure that all the appropriate manual valves (i.e., globe, angle, or ball) are open on the bulk storage containers.

3. If the container has manually operated internal valves, ensure that the emergency shutdown system is operational and that internal valves are opened.

    a. Pneumatically operated systems – ensure that there is adequate pressure (typically, 30-70 psig) and that the system is leak free.

    b. Cable operated systems – ensure that all cables are operational

Operation

1. Now the system is operational and is ready to:

    a. Fill a Cargo Tank Motor Vehicle (CTMV), more commonly referred to as a "**bobtail**" or "**transport**" – see subsections 5.1.2 and 5.1.3

    b. Unload a CTMV (bobtail or transport) – see subsection 5.1.4

    c. Unload a Railcar – see subsection 5.1.5

    d. Fill Containers/Cylinders – see subsections 5.1.6 and 5.1.7

    e. Evacuate Cylinders – see subsection 5.1.8

Shutdown

1. Ensure that all the appropriate manual valves (i.e., globe, angle, or ball) are closed on the bulk storage containers.

2. If the container has remotely operated internal valves, ensure that these valves are closed by releasing the pressure in emergency shutdown system or by pulling the cable for the system.

5.1.2 Loading a Cargo Tank Motor Vehicle (CTMV) Using a Plant Pump

Before the filling operation, the person loading the CTMV (bobtail or transport) should review the bulk plant layout and operating procedures.

Startup

1. Before moving the vehicle to the loading bulkhead, check for any obstacles that might create an unsafe condition.

2. Remove the chock blocks from the wheels and store them temporarily on the vehicle.

3. Check the PTO to ensure it is disengaged.

4. After starting the engine, ensure all instrumentation indicates normal operation.

5. Position the CTMV at the loading bulkhead in a way that maximizes the shearing effect of the hoses and piping should a pull-away occur. The fill connection on the cargo tank should be at least 10 feet from the nearest bulk storage container.

6. Engage the parking brake and turn off the engine.

7. Place chock blocks in front and behind a rear wheel to prevent movement.

Operation

1. After positioning the vehicle at the loading bulkhead, set and/or determine the liquid level gauges on the CTMV**.**

   [Note: The specific gravity for propane is assumed to be 0.508 when more accurate information is not available. However, if the temperature is unknown, the float gauge cannot be used to determine the set point. Consequently, the maximum permitted filling level of the cargo tank cannot be determined. Therefore, the fixed maximum liquid level gauge must be used to determine the maximum filling level.]

2. Before making the connection, make sure all sources of ignition within 25 feet of the transfer point are removed, consistent with the requirements in Section 4 of this handbook.

3. Put on Personal Protective Equipment per company policy.

4. Carefully check the liquid and vapor transfer hose assemblies.

5. Observe Emergency Shutoff equipment and pull-a-way protection. If any defect is found, discontinue the loading operation, notify your supervisor and do not resume loading until the defect has been eliminated. If another loading bulkhead is available, move to it after notifying your supervisor and ensuring that a warning notice is placed on the defective hose.

6. Ensure the liquid fill and vapor equalizing valves on the CTMV are closed. Remove the dust covers from the ACME connectors and inspect them for damage and wear. If necessary, replace any defective O-ring or flat gasket.

7. Ensure the liquid and vapor hose-end valves are closed. In accordance with company policy, operate the ESVs at the loading bulkhead to be sure they are functioning properly.

SAFETY	If the ESVs do not operate properly, do not connect the transfer hoses.

8. Connect the liquid plant hose-end valve to the fill valve on the CTMV. Carry it in the palm of your hand, pointed away from your body. Tighten the plant hose-end valve into the filler valve of the CTMV.

9. Once the hose end connector is hand-tight, turn the connector to “wrench tight” using a spanner wrench.

10. Slightly open the liquid hose end valve and check for leakage. If leakage exists, close the hose end valve and disconnect the ACME adapter after the

connection has bled down and is de-pressurized. Examine the condition of the O-ring or flat gasket in the filler adapter and replace as needed.

11. Examine the ACME threads on the hose end adapter and the CTMV filler connection. If either is excessively worn so that the connection leaks with a new O-ring or gasket, replace the worn fitting or adapter before proceeding.

12. Connect the vapor equalizing hose between the storage container and the CTMV. Follow the procedures used when connecting the plant liquid transfer hose.

13. DOT regulations and NFPA 58 require that LP-Gas be odorized when it is delivered to a bulk plant. These requirements also state that the presence of the odorant be determined at the time of delivery by sniff-testing or other means, and that the results be documented. Though it is not a regulatory requirement, propane marketers may also perform sniff tests when filling cargo tanks. Should a sniff test be performed during cargo tank loading, the following procedure can be used:

    - Vent a small quantity of liquid through a #54 vent (or a bleeder valve).
    - Close the vent and sniff immediately after the liquid vaporizes. .
    - If you can smell propane odorant, record your sniff test on your loading ticket, daily routing report, or other company form and proceed with the loading operation.

SAFETY	If you cannot smell propane odorant, do not load the CTMV. Contact your supervisor immediately after disconnecting and securing the transfer hoses in their storage racks. Further loading should be discontinued from the storage tank until the odorization problem is resolved.

14. During the transfer operation, a qualified person must be present at the transfer point to identify emergencies, monitor the condition of the transfer system and remain in attendance during the transfer period.

15. If applicable, insert a ticket in the plant meter and reset the register to zero.

16. Ensure all liquid and vapor valves are fully open in the transfer piping between the plant storage containers and the bulkhead.

17. Verify that all line valves are in their correct open or closed positions for liquid transfer from the bulk storage tank(s) to the CTMV.

18. Start the plant transfer pump. Listen for any unusual pump noise.

19. Check the venting of vapor at the fixed maximum liquid level gauge or correctly set the rotary gauge frequently to ensure that the vent is not blocked

by frozen moisture from the air.

20. Be alert for signs of erratic pump operation. If a leak or fire develops, perform emergency shutdown actions consistent with the emergency plans in Section 3 of this handbook.

SAFETY	If for any reason the transfer operation is interrupted, or the attendant must leave the area, the pump must be shutdown and transfer hoses disconnected. Do not leave transfer hoses connected to a CTMV if a qualified person is not in attendance.

21. If operations are normal, continue the transfer process until a steady white mist fog is first emitted from the liquid level gauge vent valve, then immediately shut down the pump, close the ESVs, the hose end valves and CTMV liquid and vapor fill valves.

Shutdown

1. Bleed down the gas trapped between the cargo tank filler valve and the transfer hose end valve and disconnect the liquid hose from the truck fill valve.

2. Bleed down the gas trapped between the cargo tank vapor return valve and the vapor equaling hose end valve and disconnect the vapor hose from the vapor equalizing valve on the truck.

3. Replace the dust caps on the truck fill and vapor equalizing valves.

4. Replace the dust caps on the liquid and vapor hose-end valves. Store the hoses as required.

5. If applicable, operate the reset lever on the plant meter so that it stamps the loading ticket.

6. Fill out any company inventory forms and process them as required.

7. Before removing the chock blocks, walk around the CTMV and check for any obstacles that may be in its path. When determined to be clear, remove the chock blocks and store them on the vehicle.

8. Move the vehicle only after it has been determined the path is clear and any discharge of propane has dissipated.

5.1.3 Loading a Cargo Tank Motor Vehicle (CTMV) Using a Plant Compressor

Before the filling operation, the person performing the filling operation should review bulk plant layout and operating procedures.

Startup

1. Position the CTMV at the loading bulkhead with the fill connection on the cargo tank at least 10 feet from the nearest storage container.

2. Set the vehicle parking brake.

3. Shut down the engine.

4. Place chock blocks in front and behind a rear wheel to prevent movement of the vehicle.

5. Examine the plant piping and flow control valves. Determine how vapor will move from the bulk storage tank(s) to the suction side of the compressor and on to the cargo tank. Figure 5.1.3a illustrates typical bulk plant compressor connections, while Figure 5.1.3b illustrates the compressor 4-way valve positions for loading, unloading and vapor recovery. The chart below the illustrations gives the typical operating status of valves for the bulk plant connections illustrated for loading the cargo tank.

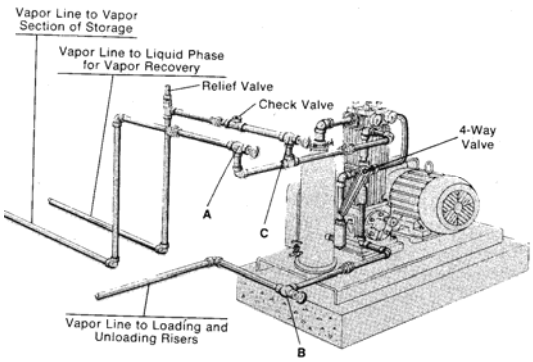


Figure 5.1.3a.
Compressor and Bulk Plant Connections

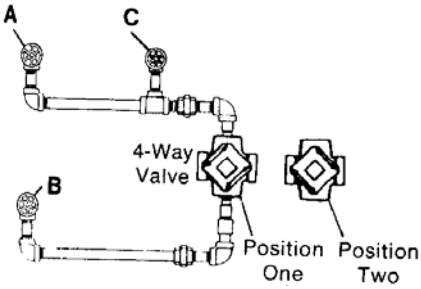


Figure 5.1.3b
4-Way Valve Positions

Operation of Valves for Cargo Tank Loading

4-Way Valve	Valve A	Valve B	Valve C
Position Two	Open	Open	Close

Operation

1. Set and/or determine the liquid level gauges on the CTMV**.**

   [Note: The specific gravity for propane is assumed to be 0.508 when more accurate information is not available. However, if the temperature is unknown, the float gauge cannot be used to determine the set point. Consequently, the maximum permitted filling level of the cargo tank cannot be determined. Therefore, the fixed maximum liquid level gauge must be used to determine the maximum filling level.]

2. Before making the connection, make sure all sources of ignition within 25 feet are removed, consistent with the requirements in Section 4 of this handbook.

3. Put on Personal Protective Equipment per company policy.

4. Carefully inspect the liquid and vapor transfer hose assemblies.

5. Observe Emergency Shutoff valves and Pull-a-way protection. If any defect is found, discontinue the loading operation, notify your supervisor and do not resume loading until the defect has been eliminated. If another loading bulkhead is available, move to it after notifying your supervisor and ensuring that a warning notice is placed on the defective hose.

6. Ensure the fill and vapor equalizing valves on the cargo tank are closed. Remove the dust covers from the valve connectors. Inspect the valve connectors for damage and wear; and if necessary, replace any defective O-ring or flat gasket.

7. Ensure the liquid and vapor hose-end valves are closed. Operate the emergency shutdown valves (ESVs) at the loading bulkhead to be sure they are functioning properly.

SAFETY	If the ESVs do not operate properly, do not connect the transfer hoses.

8. Connect the liquid plant hose-end valve to the fill valve on the cargo tank. Carry it in the palm of your hand pointed away from your body. Tighten the plant hose-end valve into the filler valve of the transport by gently moving the hose-end valve up and down while turning the ACME connector.
9. Once the connector is hand-tight, turn the connector to being “wrench tight” using a spanner wrench.
10. Slightly open the liquid hose end valve and check for leakage. If leakage exists, close the hose end valve and disconnect the ACME adapter after the connection has bled down and is de-pressurized. Examine the condition of the O-ring or flat gasket in the cargo tank filler adapter and replace as needed.

11. Examine the ACME threads on the hose end adapter and the transport filler connection. If either is excessively worn so the connection leaks with a new O-ring or gasket, replace the worn fitting or adapter before proceeding with the loading operation.

12. Connect the vapor equalizing hose between the storage container and the CTMV. Follow the procedures used when connecting the plant liquid transfer hose with the exception of the use of the spanner wrench.

13. DOT regulations and NFPA 58 require that LP-Gas be odorized when it is delivered to a bulk plant. These requirements also state that the presence of the odorant be determined at the time of delivery by sniff-testing or other means, and that the results be documented. Though it is not a regulatory requirement, propane marketers may also perform sniff tests when filling cargo tanks. Should a sniff test be performed during cargo tank loading, the following procedure can be used:

    - Vent a small quantity of liquid through a #54 vent (or a bleeder valve).
    - Close the vent and sniff immediately after the liquid vaporizes.
    - If you can smell propane odorant, record your sniff test on your loading ticket, daily routing report, or other company form and proceed with the loading operation.

SAFETY	If you cannot smell propane odorant, do not load the CTMV. Contact your supervisor immediately after disconnecting and securing the transfer hoses in their storage racks. Further loading should be discontinued from the storage tank until the odorization problem is resolved.

14. Inspect the compressor and check the crankcase oil level in the sight glass or by using the dipstick.

15. Open the vent on the compressor's liquid trap to verify that liquid is not present in the vapor hose and suction line. Liquid may severely damage the compressor and ultimately produce leaks at the head gasket or oil sump.

16. Verify the 4-way valve is in the proper position for loading the CTMV and check all in-line valves and bulk tank valves for their proper open or closed position.

17. Ensure that all shutoff valves are open in the liquid transfer, vapor suction and vapor discharge hoses.

18. Start the compressor in accordance with manufacturer's instructions. Check the pressure gauges for excessively high exhaust or excessively low intake pressure. If either occurs, stop the compressor and correct the problem

before continuing. Check the sight glass or flow indicator to make sure liquid is flowing through the system.

19. During the transfer operation, a qualified person must be present at the transfer point to identify emergencies, monitor the condition of the transfer system and remain in attendance during the transfer period.

20. Verify the proper filling set for the cargo tank, using the thermometer reading and the liquid level gauge index.

21. Monitor the cargo tank filling and stop the compressor when the proper liquid level is reached, or if any abnormal operating condition is noticed.

Shutdown

1. Close all valves in the transfer hoses.

2. Close all valves in both the suction and discharge vapor piping circuits. Close the ESV(s) at the transfer bulkhead and the appropriate liquid and vapor valves in the bulk storage tank(s), if applicable.

3. Bleed down the gas trapped between the cargo tank filler valve and the liquid transfer hose end valve.

4. Disconnect the liquid hose from the CTMV fill valve.

5. Bleed down the gas trapped between the vapor return valve and the vapor equalizing hose end valve.

6. Disconnect the vapor hose from the vapor equalizing valve on the transport.

7. Replace the dust caps on the fill and vapor equalizing valves.

8. Replace the dust caps on the liquid and vapor hose-end valves.

9. Store the hoses as required.

10. If applicable, operate the reset lever on the plant meter so that it stamps the loading ticket.

11. Fill out any company inventory forms and process them as required.

12. Before removing the chock blocks, walk around the CTMV and check for any obstacles that may be in its path. When determined to be clear, remove the chock blocks and store them on the vehicle.

13. Move the truck only after it has been determined the path is clear and any discharge of propane has dissipated.

SAFETY	If for any reason the transfer operation is interrupted, or the attendant must leave the area, the compressor must be shutdown and transfer hoses disconnected as noted in the above steps. Do not leave transfer hoses connected to a CTMV if a qualified person is not in attendance.

5.1.4 Unloading a Cargo Tank Motor Vehicle

Procedures for liquid transfer operations at LP-Gas bulk storage tanks from transports are based on common industry practices, manufacturer's instructions, and provisions listed in NFPA 58-2004 and U.S. DOT cargo tank unloading regulations. Furthermore, the major steps in the unloading procedures will vary according to the emergency discharge system used on the CTMV.

These procedures are designed to be as universal as possible and are to be used as a guide only and do not replace company policies or federal, state or local codes. Be sure to check company policy and state and local codes before beginning the unloading operation. Before the unloading operation, you should review bulk plant layout and operating procedures. Make sure you are familiar with the bulk plant equipment, piping functions, and company operating procedures.

US Department of Transportation Requirements

U.S. Department of Transportation requirements for drivers and operators unloading cargo tank motor vehicles (CTMV) are set out in several sections of the Code of Federal Regulations. The principal requirements can be found in the following references:

- Unloading Attendance Requirements – 49 CFR 177.834
- CTMV Safety Check – 49 CFR 177.840(m)
- Unloading Procedures* – 49 CFR 177.840 (q)
- Emergency Discharge Control – 49 CFR 178.337-11, 173.315(n)

  ** for cargo tanks with capacities larger than 3500 water gallons, and cargo tanks in other than metered delivery service*

US DOT unloading rules include:

1. A qualified person must be in attendance at all times during unloading.

2. A person is "qualified" if he or she has been made aware of the nature of the hazardous material which is to be loaded or unloaded, has been instructed on the procedures to be followed in emergencies, is authorized to move the cargo tank, and has the means to do so.

3. The qualified person attending the unloading operation must be awake and remain within **25 feet** of the cargo tank when the CTMV internal self-closing stop valve is open.

4. The qualified person attending the unloading operation must have an unobstructed view of the cargo tank and delivery hose to the maximum

extent practicable, except during short periods when it is necessary to activate controls or monitor the receiving container.

New transport cargo tanks placed into service after July 1, 2001, must be equipped with either a passive emergency shutdown system or, if the transport is used in metered delivery service, a remote (radio frequency) shutdown system with a query feature for unloading operations lasting more than 5 minutes. Cargo tanks that are used in **both** metered **and** non-metered service must have **both** types of emergency shutdown systems.

Startup

1. Inspect the transfer area, before giving the driver the signal to enter the plant area.

2. Spot the CTMV (most commonly, a "transport") and guide it into position at the unloading bulkhead. To prevent unnecessary wear on the PTO (power take-off) drive shaft and the pump during unloading, the centerlines of the tractor and trailer should coincide.

3. Set the brakes and turn off all electrical devices.

4. Set the chock blocks at the front and back of one of the tractor drive wheels.

5. If applicable, check with company policy for procedures to follow if a water or ammonia test is required.

Operation

1. Determine the maximum amount of LP-Gas to be transferred to the plant storage tanks. In most cases, a transport will arrive only when there is enough room in the plant storage tank(s) for the entire load of LP-Gas. To avoid accidentally overfilling the storage tank(s), calculate the maximum amount of LP-Gas that can be added safely.

2. Review and follow company procedures for checking the operation of the ESVs and pull-a-way protection installed in the plant. If the ESVs will not operate properly, do not continue the transfer operation. Notify the bulk plant's manager or supervisor.

3. Check the manual shutoff valves on the transport liquid and vapor connections to be sure they are fully closed. Slowly remove the dust caps.

4. Remove the dust caps from the connectors on the transfer hoses. Check the connectors to be sure they are clean. Check the O-rings on the valve connectors to be sure they are in good condition. If necessary, clean the connectors with a rag and replace worn, flattened, or damaged O-rings before making connections to be transport.

5. Conduct a visual inspection of delivery hose deployed during each unloading operation. Rejection criteria include exposed reinforcement, permanently deformed wire braid reinforcement, soft spots, bulging, loose outer covering, damaged couplings, and loose/missing/corroded bolts.

6. Connect hoses between the transport and the bulkhead. When using ACME connectors, spin on the connectors until they are hand-tight. While tightening the connectors, move the hose or hose end valve up and down slightly to prevent the threads from seizing. When each connection is hand-tight, tighten it to "wrench tight" with a hook spanner. Never bang on the connector with the dust cap, a hammer, or other device.

7. Check each connection for leaks by isolating it from the system and charging it with LP-Gas. If any connection leaks, close all valves and retighten the connection. If the leak persists, examine the condition of connection o-rings or gaskets, and replace them if they are defective.

SAFETY	Do not transfer liquid if leaking LP-Gas is present.

8. Verify that the LP-Gas being delivered to the bulk plant is odorized by conducting a sniff test or other means, and document the results.

9. When all valves are fully open, start the pump by engaging the PTO. Listen carefully for sounds of erratic pump behavior and check the sight gauge or flow indicator to be sure liquid is flowing through the system.
[Note: If an excess-flow valve slugs shut, stop the pump; then, reopen the excess-flow valve by equalizing pressure across the valve before continuing.]

10. Unload the transport tank. Remember that a qualified person must be present during the entire transfer operation to handle emergencies and monitor the condition of the transfer system. Monitor the liquid level gauges in the plant storage tanks carefully during the operation. If possible, equalize pressure between the transport and the plant storage tank.

11. When a tank reaches its maximum permitted filling level, stop the pump and adjust the valves in the plant piping to route the remainder of the load to another tank.

Shutdown

1. When the plant storage tank reaches its maximum permitted filling level or the transport tank is empty, stop the pump and immediately close all liquid and vapor lines involved in the transfer operation.

2. Bleed down and disconnect the hoses. Store them away as necessary.

SAFETY	**Caution**: Never disconnect any hose until the LP-Gas trapped in the connection has been safely bled off. This should be done through either the bleeder valve on the hose-end valve or a pipe-away adaptor in the transport or bulkhead connections.

3. Replace all caps on hose-end valves and on transport and plant liquid and vapor connections.

4. Complete the plant unloading form, any necessary accounting forms, and the return bill of lading.

5. Check to be sure that all bulkhead or transport hoses have been disconnected and securely stored and that all valves are tightly closed and capped.

6. Before removing the chock blocks, walk around the CTMV and check for any obstacles that may be in its path. When determined to be clear, remove the chock blocks and store them on the vehicle.

7. Move the truck only after it has been determined the path is clear and any discharge of LP-Gas has dissipated.

5.1.5 Unloading a LP-Gas Railcar Using the Plant Compressor

Procedures for liquid transfer operations at LP-Gas bulk storage tanks from a railcar are based on common industry practices, manufacturer's instructions, and provisions listed in NFPA 58-2004 and U.S. DOT regulations. These procedures are designed to be as universal as possible and are to be used as a guide only and do not replace company, federal, state or local codes. Check company policy and state and local codes before beginning the unloading operation.

Before the unloading operation, you should review bulk plant layout and operating procedures. Make sure you are familiar with the bulk plant equipment, piping functions, and company operating procedures.

US Department of Transportation Requirements

DOT regulations require employers to train and test every employee directly involved in the transportation of hazardous materials, including personnel who inspect, load or unload pressurized railcars used in LP-gas transportation.

Some specific regulations that are relevant include:

- Qualifications, Maintenance, and Use of Railcars - 49 CFR 173.31
- Training and Security Plans - 49 CFR 172, Subparts H and I
- Carriage By Rail - 49 CFR Part 174, Subparts A, B and C
- Specifications for Railcars - 49 CFR 179.7
- Quality Assurance Program - 49 CFR 179.7
- Requirements for Inspection and Test of Specification - 49 CFR 180.509

Other regulations or standards adopted by reference that may apply include:

- Association of American Railroads, *Manual of Standards and Recommended Practices, Section C, Part III, Specifications for Tank Cars (M-1002)*
- Association of American Railroads, *Field Manual of the Interchange Rules, (#70, 88, 89, and 90)*
- Canadian General Standards Board, CAN/CGSB 43.147-2005, *Construction, Modification, Qualification, Maintenance and Selection and Use of Means of Containment for the Handling, Offering for Transport, or Transporting of Dangerous Goods by Rail*

Startup

1. Check to ensure that the following conditions exist:

   - Railcar wheels are chocked.
   - Railcar brakes are set.
   - Derailer is set to the derailing position.
   - Railcar and spur entrance(s) are flagged (including Blue and White "**STOP - TANK CAR CONNECTED**" sign).

2. Climb the unloading riser and lower the platform to gain access to the dome and tank car openings.

3. Be sure the platform is properly seated and secured before crossing over to the tank car. Exercise caution when climbing or working on the riser, especially in wet or icy weather.

4. Before opening the dome, be sure that all sources of ignition have been removed from the area as outlined in Section 4. Also, avoid creating sparks when opening or working in the dome.

SAFETY	**Caution:** If one of the fittings is leaking, the dome might be filled with LP-Gas vapor.

5. Put on Personal Protective Equipment.

6. Inspect the rail car for:

   - Shipping name of product -2 sides
   - Reporting markings – 4 sides
   - Tank Car Classification – 2 sides
   - Safety valves and tank test information – 2 sides
   - Placarding – 4 sides
   - All valves closed
   - All valves plugged and wrench tight
   - Valves free of corrosion
   - Bolts and nuts present and secure
   - Protective valve housing secure
   - No corrosion or damage on relief valve.

7. If the inspection reveals an unsafe condition that cannot be corrected, notify the bulk plant manager or supervisor. In most cases, a “bad order” tag must be filled out to notify the shipper of the problem.

8. Rail Car contents must be verified with Shipping Paper before making hose connections.

9. Gauge the contents of the railcar by using the slip tube gauge. First, open the bleeder valve at the top of the gauge and raise or lower the tube until a white plume of mist vents out of the bleeder orifice indicating that the slip tube is in contact with liquid LP-Gas. A series of graduated markings on the slip tube indicates the distance in inches and feet from the top of the tank to the surface of the liquid, also known as the "outage" of the railcar.

SAFETY	The slip tube is always under high pressure and can cause serious injuries if it springs up quickly or unexpectedly. Therefore, always exercise caution when working around the slip tube gauge by standing to the side of the slip tube gauge before releasing the brake or safety catch.

10. Once the outage of the railcar is read, convert the outage to gallons by using the outage table (sometimes called a “strapping chart”) furnished by the shipper or railcar manufacturer.

WARNING	Even a relatively small error in reading the slip tube gauge can make a large difference in calculating the number of gallons in the tank. Therefore, it is important to measure the railcar outage at least twice to be sure of getting an accurate reading.

11. Determine the maximum amount of LP-Gas that can be transferred to the plant bulk storage tanks. To avoid accidentally overfilling the tank, calculate the maximum amount of LP-Gas that can be safely added.
    Even if the plant has more than one storage tank, determine how much LP-Gas can be safely added to each tank. If a single tank will not hold the entire load, use calculations to distribute the load and notify the bulk plant manager or supervisor.

    Gauge the contents of the plant storage tank with the rotary or float gauge installed in the tank head. Record the reading on the company form or on a worksheet.

    If there is more LP-Gas in the railcar than the plant tank(s) will hold safely, notify the bulk plant manager or supervisor.

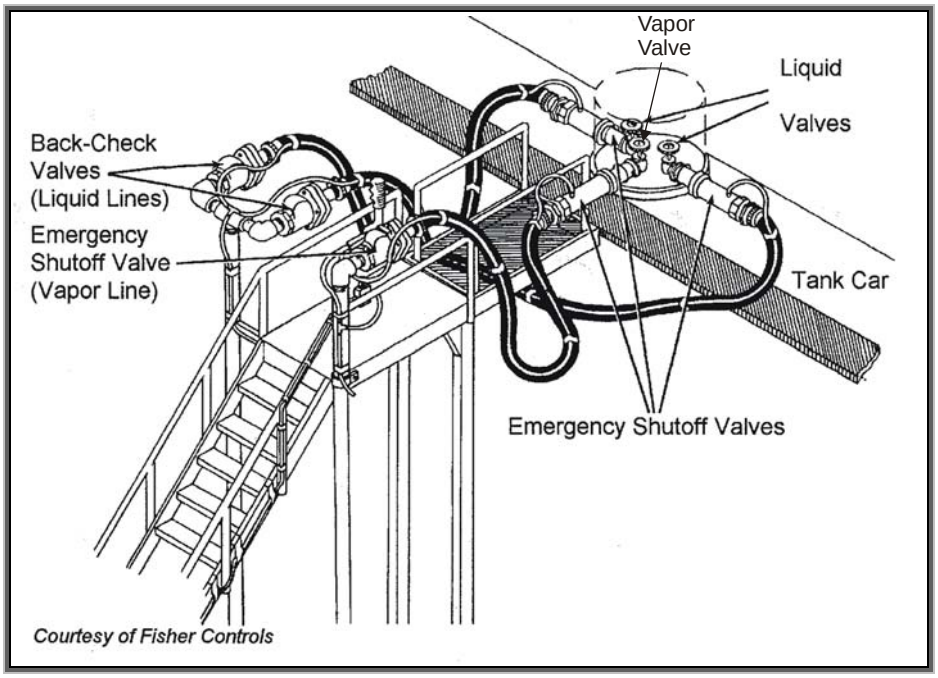


Figure 5.1.5a – Typical Railcar Riser with ESVs

12. Before connecting the liquid and vapor transfer hoses between the railcar and the unloading riser, check the manual shutoff valves on the railcar liquid and vapor connections to make sure they are fully closed. Then, carefully remove the plugs.

SAFETY	LP-Gas may vent around the plug threads for a short time. Wear heavy vinyl safety gloves throughout the operation. Keep face and other parts of the body away from the valve opening. If LP-Gas continues to vent around the plug threads, the manual shutoff valve may be faulty. Retighten the plug and notify the bulk plant manager or supervisor.

13. Install the ESVs in the liquid and vapor valves. It may be necessary to install stubs (schedule 80 pipe nipples) before installing the ESVs. Thread the ESVs into the valve opening until they are hand tight. Then, tighten them with the appropriate wrench until they are securely seated. Once installed, open the ESVs in accordance with company procedures.

14. Remove the dust caps from the connectors on the riser hoses. Check the connectors to be sure they are clean. Check the O-rings on the ESV or unloading stub to be sure they are in good condition. If necessary, clean the connectors with a rag and replace worn, flattened, or damaged O-rings.

15. Connect the hoses to the railcar stubs or ESVs (whichever is applicable) by spinning on the ACME connectors until they are hand tight. As the

connectors are tightened, move the hose or hose-end valve up and down slightly to prevent the thread from seizing. When each connection is hand tight, tighten it an additional 1/8 turn with a hook spanner.

16. Check the ESVs at the riser by opening and closing them according to plant test procedures. Be sure the remote operators are working properly and that all fusible links are intact. If the ESVs will not operate properly, do not continue the transfer operation. If possible, correct the problem. Otherwise, notify the bulk plant manager or supervisor.

17. Check each connection for leaks by opening and closing the manual shutoff valve at the railcar to charge the connection with LP-Gas.

18. If using ESVs instead of unloading stubs, open the ESV to charge and test the hose connection. If there are any connection leaks, close all valves and retighten the connection. If the leak continues, notify the bulk plant manager or supervisor.

Operation

A qualified person must be present at all times during the entire transfer operation to monitor the condition of the transfer system and to handle emergencies. Otherwise, the operation must be shut down and hoses disconnected.

If a release or fire develops at any time during the operation, close all ESVs immediately and stop the compressor. Refer to Section 3 of this handbook and company procedures to handle the situation.

Be alert for signs of erratic compressor operation. If a problem develops, shut down the operation and correct it before continuing.

1. Open the vapor valves at the railcar riser. Then, open all valves in the liquid line, starting at the manual shutoff valves on the railcar and working toward the plant storage tank(s). Allow as much liquid as possible to drift between the two tanks. Open the remaining valves in the vapor line. Open all valves slowly to prevent the excess-flow valves from slugging.

2. Check to be sure the four-way valve and the plant valves have been set so that the compressor will remove vapor from the plant storage tank and discharge it into the railcar. Figures 5.1.5b and 5.1.5c illustrate the compressor 4-way valve and piping positions for unloading in a *typical* bulk plant. Plant piping might vary. Verify the proper valve positions and operating procedures for each bulk plant.

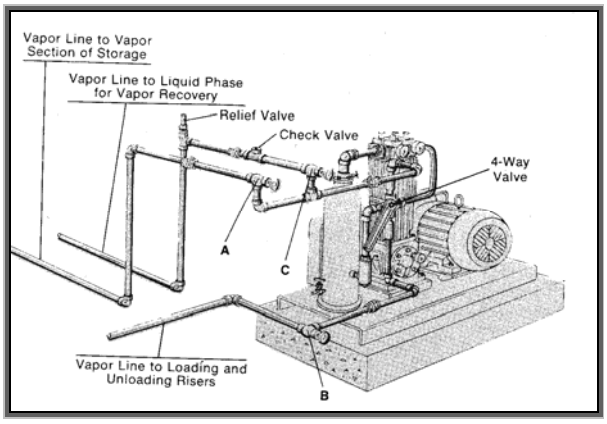


Figure 5.1.5b
Compressor & Bulk Plant Connections and Valves

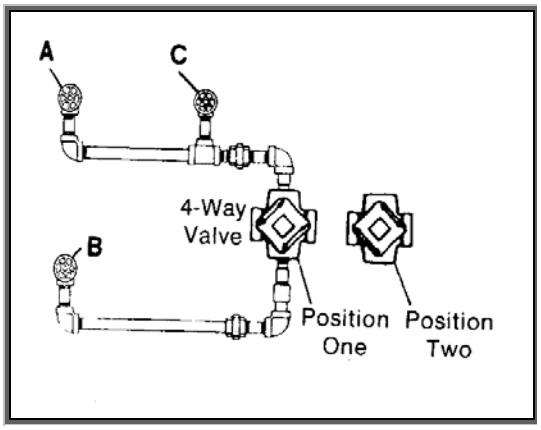


Figure 5.1.5c

4-Way Valve Positions

Operation of Valves for Cargo Tank Unloading

4-Way Valve	Valve A	Valve B	Valve C
Position One	Open	Open	Close

3. Open the vent on the compressor's liquid trap to verify that liquid is not present in the vapor hose and suction line. Liquid may severely damage the compressor and ultimately produce leaks at the head gasket or oil sump.

4. Start the compressor and check the pressure gauges for excessively high exhaust or excessively low intake pressure. If either occurs, stop the compressor and correct the problem before continuing. Check the sight glass or flow indicator to make sure liquid is flowing through the system.

5. When the plant storage tank reaches its maximum permitted filling level or the railcar is empty, close all valves in the liquid line and stop the compressor.

6. Reverse the four-way valve and adjust the plant piping manifold so the compressor will withdraw vapor from the railcar and force it through the liquid space of the plant storage tank (refer to Figures 5.1.5b and 5.1.5c). Restart the compressor and check the pressure gauges for excessively high discharge or excessively low intake pressure. If either occurs, shut down the compressor and correct the problem before continuing.

Operation of Valves for Cargo Tank Vapor Recovery

4-Way Valve	Valve A	Valve B	Valve C
Position Two	Close	Open	Open

Shutdown

1. At the end of the vapor recovery operation, close all valves in the vapor line and shut down the compressor.

   [Note: Some plants shut down the compressor when the discharge pressure rises to four times the intake pressure. Others stop vapor recovery operations when the intake pressure drops to 50 psi in the summer or 30 psi in the winter. Under some conditions plants will also shut down their compressors, if the intake pressure drops less than 10 psi during 15 minutes of operations. Check with your supervisor for the proper guidelines to follow.]

2. To ensure that the railcar is totally unloaded, open the sample valve. If liquid escapes, it might not be fully unloaded. Resume unloading operations until the railcar is totally un-loaded.

3. Close all railcar discharge valves, ESVs, and transfer hose-end valves.

4. Vent the LP-Gas trapped between valves, stubs and hose couplings. When the connections are fully de-pressurized, disconnect the transfer hoses.

5. Remove the railcar unloading nipples (or “stubs”) that are screwed into the railcar valve outlets.

6. Replace all railcar valves openings and tighten as appropriate.

7. Replace and secure all covers over fittings.

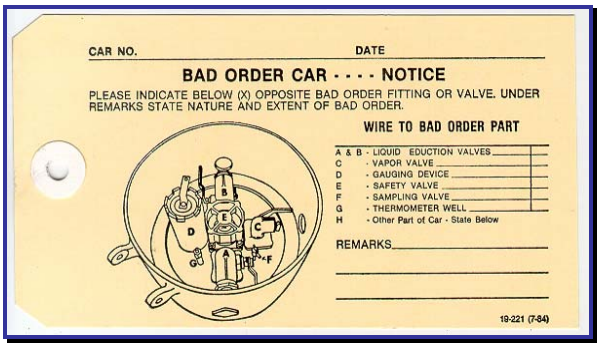
8. Check to be sure there is no liquid left in the railcar by partially opening the sampling valve.

9. Bleed down and disconnect the hoses at the riser. Never disconnect any hose until the LP-Gas trapped in the connection has been safely bled off.

10. Replace all dust caps and store the hoses.

11. Remove the unloading stubs or ESVs from the railcar, and replace the plugs in the liquid and vapor valve openings.

12. If any railcar defects were found during the unloading operation, complete a “Bad Order Tag” (see Figure 5.1.5d) and attach it to one of the sampling valves.


CAR NO. DATE

BAD ORDER CAR - - - - NOTICE

PLEASE INDICATE BELOW (X) OPPOSITE BAD ORDER FITTING OR VALVE. UNDER REMARKS STATE NATURE AND EXTENT OF BAD ORDER.

WIRE TO BAD ORDER PART

A & B - LIQUID EDUCTION VALVES
C - VAPOR VALVE
D - GAUGING DEVICE
E - SAFETY VALVE
F - SAMPLING VALVE
G - THERMOMETER WELL
H - Other Part of Car - State Below

REMARKS

19-221 (7-84)

Figure 5.1.5d - "Bad Order Tag"

13. Lower the dome cover and secure it appropriately.

14. Stow all transfer hoses and fittings and raise the unloading riser platform to its stored position.

15. Remove and store the warning signs, chock blocks and reset the derail from the derailing position.

SAFETY	Do not release the hand brake on the railcar. This will be done by railroad personnel when the railcar is picked up.

16. Prior to releasing for return shipment verify the following:
    - Shipping name of product – 2 sides
    - Reporting markings – 4 sides
    - Tank Car Classification – 2 sides
    - Safety valve and tank test information -2 sides
    - Placarding – 4 sides
    - All valves closed
    - All valves plugged and wrench tight
    - Empty Tank Car Return Billing instructions completed
    - Valves free of corrosion
    - Bolts and nuts present and secure
    - Protective valve housing secure
    - No corrosion or damage visible on relief valve.

17. Take an extra look around the railcar and unloading site to make sure everything is safe and secure.

SAFETY	**CAUTION:** Whether loaded or unloaded, a railcar is hazardous. Unless it has been thoroughly purged and cleaned, all safety and hazardous materials handling regulations must be observed.

18. Complete a Railcar Return Instructions Form and deliver the form to the rail carrier representative (see sample form in Figure 5.1.5e). This form must be prepared, signed and presented to the rail carrier representative for their signature before the railcar is released.

SAFETY	The LP-Gas marketer should use reasonable care to provide a safe and secure environment for the railcar, from the time the railcar return form is used to notify the railroad company agent that the car is ready to be picked up until the time it is actually removed from the siding.

TANK CAR RETURN INSTRUCTIONS

ORIGINAL

DATE 1-15-02

CAR/CARS
INITIAL NUMBER

MBLOX 93372

Loaded at Gas Producing Company

On 1-15-02
To Consignee Propane Heat, Inc
Railroad Agent NS-ATLA/CSXT
Forward To GAS PRODUCING COMPANY
DESMOND, MS
Routing Via CSXT-ATLA-NS

DATES

Notified of Arrival
Received on Switch
Finished Unloading
Removed from Switch

DESCRIPTION:
RESIDUE, LAST CONTAINED

(FLAMMABLE GAS),
PLACARDED FLAMMABLE GAS
STCC CODE
CONTAINS OIL

For help in chemical
Emergencies involving spill,
Leak, fire, or exposure, call
800-424-9300 Day or Night

EXEMPTION: DOT - E 7616

INSTRUCTIONS:
WHEN TANK CAR IS UNLOADED, CLOSE DISCHARGE VALVES AND REPLACE PLUGS IN TANK CAR VALVE OPENINGS, LOWER DOME COVER AND SECURE WITH PIN. APPLY PROPER PLACARDS. IMMEDIATELY AFTER UNLOADING THE ABOVE CAR/CARS, SIGN, DATE AND DELIVER (DO NOT MAIL) THESE INSTRUCTIONS TO THE RAILROAD AGENT FOR SIGNATURE. FURNISH ALL INFORMATION WHICH IS IMPORTANT FOR OUR RECORDS. INFORMATION SHOULD BE ACCURATE.

SHIPPER OF CAR

Signed
Per
Date

RAILROAD AGENT'S ACKNOWLEDGEMENT

Signed
Per
Date

REMARKS: If any part of tank or appliances are in bad order, describe the nature of the Defect. State cause if possible.

Figure 5.1.5e - Sample Railcar Return Instructions Form

5.1.6 Preparation and Transportation of DOT Cylinders

This section provides general guidance for the preparation of cylinders being shipped from a bulk plant. For complete details and procedures that fully describe the associated regulatory requirements, refer to 49 CFR 173, the Compressed Gas Association publication CGA-6, *Standard for Visual Inspection of Steel Compressed Gas Cylinders*, 1993, and ANSI/CGA C-6.3, *Guidelines for Visual Inspection and Requalification of Low Pressure Aluminum Compressed Gas Cylinders*, 1991.

Cylinder Inspection

Prior to filling cylinders at the bulk plant, cylinders that have been in service must be inspected to determine their fitness for continued service. Specifically, DOT regulations stipulate that no individual is allowed to fill a cylinder that is overdue for periodic requalification with a hazardous material and then offer it for transportation.

Before each filling of a cylinder, the individual filling the cylinder must visually inspect the outside of the cylinder. A cylinder that has any of the following characteristics cannot be filled and offered for transportation:

- A crack or leak.
- Bulging.
- A defective valve.
- A leaking or defective pressure relief device.
- Evidence of physical abuse.
- Fire or heat damage.
- Detrimental rusting or corrosion.

Requalification of Cylinders

Any cylinder that is due for requalification cannot be refilled and offered for transportation until it is requalified using methods prescribed by DOT. In jurisdictions that have adopted NFPA 58-2001 (without exceptions or modifications to §2.2.1.5), there is no distinction between cylinders that are transported in commerce and those that are not with respect to the cylinder requalification requirement. Beginning with the 2004 edition, cylinders that are in stationary service and filled on-site are permitted to undergo a visual inspection (§5.2.3.1) instead of requalification.

Specific to requalification requirements, all cylinders received at a bulk plant must be checked for:

- Requalification Due Date

  Three requalification methods are used to verify DOT cylinder fitness for continued service. The method used determines when the cylinder is next due for requalification.

Requalification date markings consist of numbers designating the month and year of the last requalification, followed by a letter or blank to signify the requalification method used (see Table 5.1.6a).

Letter After Year Stamp	Requalification Method	Next Requalification Due (years)
None	Volumetric Expansion Test	12
S	Proof Pressure Test	7
E	External Visual Inspection (CGA Inspection Method)	5

Table 5.1.6a - DOT Cylinder Requalification Periods

For example, a DOT cylinder marked 10 01E is due for requalification before or during October 2006. The cylinder may require requalification before its due dates if it is damaged or subjected to physical abuse, excessive corrosion or heat. Cylinders that have been exposed to fire must be immediately removed from service.

As of May 31, 2004, a Requalification Identification Number also appears with the Requalification Date. The RIN will be either a 4 character or 7 character RIN consisting of letters and numbers.

- The 4 character RIN will have a letter and a number above the Requalification Date and 2 numbers under the Requalification Date, as shown below.

A1

5 04 x

3 2

Where:
"5" is the month of requalification;
"A123" is the RIN;
"04" is the year of requalification (2004);
"X" represents the symbols described in paragraphs (f)(2) through (f)(7) of 49 CFR 180.213.
{Note: Characters not to scale in size.}

- The 7 character RIN will appear as a letter and 6 numbers all appearing either over, under or before the Requalification Date (see examples below).

V100001
0504 E *-or-*

0504 E
V100001 *-or-*

V100001 0504 E

Where:"V10001" is the RIN; "0504" i
the month and year of requalificatio
"E" represents external visual
inspection.

- Components to Check for Continued Service

  - Proper cylinder valve protection
  - Filler valves and weather caps
  - Valve hand-wheels
  - Valve stem leaks
  - Relief valves
  - Quick-closing couplings on motor fuel cylinders
  - Fixed maximum liquid level gauge
  - Float gauges
  - Foot rings and welds
  - Evidence of ammonia contamination
  - Any abnormal conditions reported by the customer

If valve or fitting replacement is necessary, or requalification is required, the cylinder should be moved to a designated area for that purpose.

Only facilities with a Requalification Identification Number issued by Federal Motor Carrier Safety Administration are allowed to perform a DOT specification cylinder requalification. Check with your supervisor.

Safety Considerations for Storing and Processing DOT Cylinders

Cylinders should be arranged so that any cylinder can be accessed in the event of a service valve or other leak. Proper valve protection should be maintained at all times. Also, cylinders should be stored so that cylinder relief valve discharges are not directed at the service valves of adjacent cylinders in order to limit the extent of damage and the hazards to persons and property in the event of a relief valve discharge and fire.

Checking for Proper Cylinder Labeling

Cylinders that contain LP-Gas should be labeled to indicate their contents in compliance with DOT hazardous material transportation regulations (see Figure

5.1.6a). Cylinders may be checked for proper labeling as part of the inspection process.

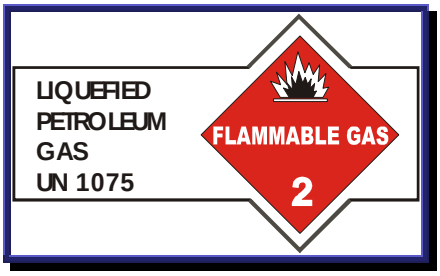


Figure 5.1.6a – DOT Label

New Cylinder Inspection

When new DOT cylinders arrive, they should be inspected to ensure that they are not damaged and are acceptable for LP-Gas service. Important items to check are:

- DOT and NFPA 58 required markings
- Proper DOT Specification and Service Pressure (minimum 240 psig)
- Tare Weight
- Water Capacity
- Manufacturer Name or Mark and Serial Number
- Manufacturer Test Date
- Relief Valve Start-to-Discharge Pressure (375 psig)
- Customer Information Labels
- Proper Valve Protection (neck ring or cap)
- Proper Foot Ring Attachment
- Motor Fuel Cylinders
    - Relief Valve Weather Cap
    - Proper Relief Valve Discharge Orientation (away from the industrial truck operator)
    - Weather Cap on Filler Valve
    - Quick-Closing Coupling on Service Valve
- Stationary Cylinders
    - Relief Valve Weather Cap
    - Weather Cap on Filler Valve

Purging New Cylinders of Air

Before liquid LP-Gas is introduced into new cylinders, it is necessary to purge them of air and moisture. Some cylinder manufacturers pre-purge new cylinders (including vacuum purging) before they are shipped. Refer to subsection 5.1.8 of this handbook for further information.

Preparing and Loading LP-Gas Cylinders on the Delivery Vehicle

When delivering LP-Gas cylinders to residential or industrial customers, the driver is responsible for the delivery vehicle and for transporting cylinders safely and efficiently. Cylinders and their valves and fittings must be leak-free before being loaded onto vehicles. Various kinds of equipment are designed and used to lift the cylinders on and off the delivery vehicle, and to secure them while being transported. Regular inspection and maintenance of the delivery vehicle, its equipment, and the cargo is also required.

Protecting the Cylinder Valves and Fittings

The transportation of cylinders must include protection against physical damage to the cylinder valves and fittings while in transit.

For cylinders manufactured after October 1, 2007, a cylinder must have its valves protected by one of the following methods:

- By equipping the cylinder with securely attached metal caps of sufficient strength to protect valves from damage during transportation; or
- By constructing the cylinder so that the valve is recessed into the cylinder or otherwise protected (e.g., valve collars) to the extent that it will not be subjected to impact damage when the container is dropped onto a flat surface.

Additionally, cylinders of 45-pound LP-Gas capacity or less must have a plug, cap or an approved quick closing coupling in place on or in the service valve (such as the backcheck in valves equipped with a listed overfilling protection device) when the cylinder is not connected for use.

Loading and Securing the Cylinder Cargo

Cylinders must be transported in a suitable rack or frame or on a flat surface, and fastened securely in a position to minimize the possibility of movement, tipping, or physical damage related to each other or to the supporting structure while in transit.

Figure 5.1.6b – Vertically Secured Cylinders

Figure 5.1.6c – Horizontally Secured Cylinders (Relief Valve at Top)

LP-Gas cylinders should be loaded so that an even weight distribution is achieved and maintained. A load distribution that places most of the weight on the front and rear axles with both side-to-side and front to back distribution is ideal. An unbalanced load is extremely dangerous due to the possibility of overturning the truck or causing poor handling due to insufficient ground contact.

Additionally, cylinders of 2½ pound water capacity or more must be positioned so that each cylinder's pressure relief valve is in direct communication with the vapor space at all times. The cylinders must be secured in this position by binders or straps.

Checking the Cylinder Delivery Vehicle for Placarding

The vehicle must be properly placarded before leaving the bulk plant. DOT regulations require any vehicle transporting more than 1,000 pounds of LP-Gas, including the weight of the cylinders, be placarded on the front, rear, and on both sides. Placards must indicate the hazard class name and hazard class number. For LP-Gas (propane), these are:

- **FLAMMABLE GAS** (indicated by red color and flame symbol),
- Hazard Class or Division - 2 or 2.1, and
- 1075 (for LP-Gas).

Verifying Shipping Papers and Emergency Instructions

If permanent shipping papers are used, the date and number of cylinders loaded at the beginning of the delivery route must be recorded on the permanent shipping paper, typically with a wax pencil marker (see Figure 5.1.6d on next page).

If single-trip shipping papers are used, they should be completed according to company procedures.

HAZARDOUS MATERIAL (CYLINDER DELIVERY VEHICLE)

SHIPPING PAPER

LIQUEFIED PETROLEUM GAS
2.1 (Flammable Gas)
UN 1075
Product Propane (Non-Corrosive)
Date: _____

1075
2.1

Number of Cylinders Loaded: _____
EMERGENCY CONTACT: 1-XXX-XXX-XXXX

GUIDE GASES-FLAMMABLE NORTH AMERICAN EMERGENCY RESPONSE GUIDE 1996
115 (INCLUDING REFRIGERATED LIQUIDS)

POTENTIAL HAZARDS

FIRE OR EXPLOSION

- **EXTREMELY FLAMMABLE.**
- Will be easily ignited by heat, sparks, or flames.
- Will form explosive mixtures with air.
- Vapors form liquefied gas are initially heavier than air and spread along ground.
- Vapors may travel to source of ignition and flash back.
- Containers may explode when heated.
- Ruptured cylinders may rocket.

HEALTH

- Vapors may cause dizziness or asphyxiation without warning.
- Some may be irritating if inhaled at high concentrations.
- Contact with gas or liquid may cause burns, severe injury and/or frostbite.
- Fire may produce irritating and /or toxic gases.

PUBLIC SAFETY

- **CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover. (CHEMTREC® 1-800-424-9300)**
- Isolate spill or leak area immediately for at least 50 to 100 meters (160 to 330 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Keep out of low areas.

PROTECTIVE CLOTHING

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Structural firefighters' protective clothing will only provide limited protection.
- Always wear thermal protective clothing when handling refrigerated/cyrogenic liquids.

EVACUATION

Large Spill

- Consider initial downwind evacuation for at least 800 meters (½ mile).

Fire

- If tank, rail car or tank truck is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions.

EMERGENCY RESPONSE INSTRUCTIONS ON BACK OF PAGE

Front Side

EMERGENCY RESPONSE

FIRE

- **DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED.**

Small Fires

- Dry chemical or CO_2.

Large Fires

- Water Spray or fog.
- Move containers form fire area if you can do so without risk.

Fire involving Tanks

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Do not direct water at source of leak or safety devices; icing may occur.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- ALWAYS stay away from the ends of tanks.
- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

SPILL OR LEAK

- ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area.)
- All equipment used when handling the product must be grounded.
- Do not touch or walk through spilled material.
- Stop leak if you can do so without risk.
- If possible, turn containers so that gas escapes rather than liquid.
- Use water spray to reduce vapors or divert vapor cloud drift.
- Do not direct water at spill or source of leak.
- Prevent spreading of vapors through sewers, ventilation systems and confined areas.
- Isolate area until gas has dispersed.

CAUTION: When in contact with refrigerated/cryogenic liquids, many materials become brittle and are likely to break without warning.

FIRST AID

- Move victim to fresh air.
- Call emergency medical care.
- Apply artificial respiration if victim is not breathing.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- Clothing frozen to skin should be thawed before being removed.
- In case of contact with liquefied gas, thaw frosted parts with lukewarm water.
- Keep victim warm and quiet.
- Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

Reverse Side

Figure 5.1.6d - Shipping Paper for Cylinder Delivery Vehicles

5.1.7 Preparation and Transportation of ASME Containers

5.1.7.1 Tank Inspection and Preparation at Bulk Plant

The following items (as a minimum) should be checked on each tank transported from the bulk plant to a customer location:

- Check for leaks at all tank welds and fittings.

  On a typical aboveground (AG), underground (UG), or aboveground/underground (AG/UG) ASME tank there are at least 19 welds. In addition, threaded fittings installed in the tank represent at least 11 additional places where leaks could occur. Each of these welds and threaded connections should be checked for leakage with the tank pressurized, using a suitable leak detection solution or leak detection device.

Figure 5.1.7a - Checking for Leaks on AG/UG Tank

- Verify that any tank over 125 gallons water capacity contains 5% or less LP-Gas in liquid form.

  If more than 5% liquid is present in a tank larger than 125 water gallons capacity, the excess liquid must be evacuated before the tank can be transported on public roadways.

Figure 5.1.7b - Liquid Level < 5%

- Check the condition of the tank coating to be sure that it is proper for the tank installation, whether it is for underground or aboveground service.

  The protective coatings used on both types of tank installations are important to maintaining structural integrity and protecting the container from loss of wall thickness due to corrosion. The coating for underground tanks is an integral part of the tank's corrosion protection system. If the protective coating of a tank is damaged, the tank coating should be repaired or another tank selected for installation. Coating touch-up materials should be transported with the tank to make any needed final repairs to tank coatings at the installation site.

- Check the condition of each tank valve and fitting.

  Check to ensure that weather caps are in place on filler valves, relief valves, and the vapor equalizing valve. Verify that the metal plug is in place and sealed on the liquid withdrawal valve. If the tank is a new tank and not vacuum-sealed by the manufacturer, be sure that the container is properly purged of air before it is transported to the customer location. Older tanks that have been open to the atmosphere must be purged as well (see subsection 5.1.9 of this handbook).

Relief Valve

Filler Valve

Vapor Equalizing Valve

Liquid Withdrawal Valve

Figure 5.1.7c – Proper Installation of Weather Caps

- Verify that the tank is properly marked and labeled for transportation.

  ASME data plate markings or ASME certification stampings in the tank head or shell must be legible.

Figure 5.1.7d – Underground Tank Data Plate

- Check the condition of the tank's lifting lugs and supports.

After the condition of the ASME tank has been determined to be satisfactory, the tank and any required installation materials should be readied for loading. Secure installation items, such as masonry foundation blocks, since they are also considered cargo that must be secured as any other cargo transported under DOT regulations.

5.1.7.2 Loading of ASME Containers to be Transported

Coordination of ASME tank loading and unloading is essential to avoid personnel injury or equipment damage.

Planning and Safety Review

When two or more people are involved in any task, efficiency and safety are dependent on planning and clear communications. Handling and setting tanks requires a coordinated effort. Before the tank is lifted, transported, and placed in its new location, pre-job planning that includes everyone who will be involved should be conducted and should address the following:

- A detailed tank loading or unloading plan along with a description for each person's responsibilities in the operation.
- Assignments for equipment operators and the means used for communicating and coordinating each step of the job. Details, such as who will act as spotter for the crane operator and the meaning of hand signals or other means of communication that will be used, should be established.
- The locations of trucks and other equipment being used to ensure that crane lifts, swings, and other movements are completed safely.
- A "Walk-Through" at the installation site by drivers and equipment operating personnel before trucks or cranes are brought onto the site. Special care should be given to ensuring proper support for vehicles, avoiding buried structures and overhangs, and slopes or terrain hazards that could lead to truck or crane overturn.
- Safe working procedures, Personal Protective Equipment and any special tank handling requirements, with emphasis on prohibiting personnel from beneath a tank during lifts, swings, or positioning.

Truck-Mounted Crane Operations

When LP-Gas company employees use company-owned truck-mounted cranes to load, unload, and install tanks, they are responsible for all the phases of these operations. OSHA regulations regarding truck-crane operations are found in 29 CFR 1910.180.

Operating the Truck-Mounted Crane

Truck-crane operators should read and follow the manufacturer's instructions for inspecting, maintaining and operating the crane.

After the pre-job planning session, the crane truck should be located on level ground so that the ASME tank can be lifted and positioned within safe working limits of the crane. The vehicle parking brakes should be set, and chock blocks placed in front of and behind the vehicle's rear wheels. The crane outriggers should be fully extended and locked into position. Outriggers should be adjusted to level the crane structure in accordance with manufacturer's operating instructions. Crane outriggers (where provided by the manufacturer) are used to prevent damage to the truck chassis and maintain stability.

Safety Inspections

Before lifting the tank, the crane should be inspected thoroughly. If the tank contains more than 5% liquid, the tank's lifting lugs or "eyes" should not be used. Instead a "basket lift" should be made using slings or chains with adequate load ratings.

OSHA regulations regarding slings are found in 29 CFR 1910.184. Also OSHA publication 3072, *Sling Safety*, provides additional guidance.

Lifting Operations

After inspecting the sling(s), the crane operator must determine how the tank will be lifted, how the sling(s) will be arranged, and if additional slings or other equipment is needed for the load. The slings being used should have load ratings well in excess of the weight of the tank and its contents.

In summary, consistently applying knowledge of crane and lifting equipment fundamentals, performing thorough inspections, coordinating communications, conducting pre-job planning, verifying that lifting equipment is properly maintained, and observing all necessary precautions will help protect employees from injury while protecting tanks, equipment, and customer property from damage.

5.1.7.3 DOT Regulations Pertaining to Transporting ASME Containers

The primary regulatory requirements for transporting ASME tanks are found in 49 CFR 173.315(j). To highlight these requirements for awareness purposes, ASME containers used for LP-Gas Service and for permanent installation on consumer premises may be shipped by private motor carrier only under the following conditions:

- Each container must be constructed in compliance with the requirements of the ASME Code and must be marked to indicate compliance (data plate or data specification stamping) in the manner specified by the respective code.

- Each container must be equipped with safety devices in compliance with the requirements as specified in the NFPA 58-2004.

  The containers must be braced or otherwise secured on the vehicle as to prevent relative motion while in transit. Valves or other fittings shall be adequately protected against injury during transportation.

WARNING	**Containers can not be shipped when charged with LP-Gas to more than 5 percent of their water capacity.** The only exception is that containers of less than 125 gallons water capacity may be shipped when charged with LP-Gas in compliance with DOT filling density.

Load Inspection Rules for Tanks and Cargo in Transit

The DOT regulatory reference for checking the security of loads on commercial vehicles is found in 49 CFR 392.9. These regulations prohibit a driver from operating a commercial motor vehicle unless the cargo is properly distributed and secured in compliance with DOT requirements. Of most importance, the driver must:

- Inspect the cargo and the devices used to secure the cargo within the first 50 miles after beginning a trip, and make necessary adjustments; and

- Re-examine the cargo and devices that secure the load, making necessary adjustments whenever:

  - The driver has a change of duty status; or

  - The commercial motor vehicle has been driven for 3 hours; or

  - The commercial motor vehicle has been driven for 150 miles.

Requirements for Transporting Bulk Containers

Tanks used to store LP-Gas are called "bulk packagings" or "containers" under U.S. Department of Transportation regulations when they are transported. They can be classified as two primary bulk container types according to their design and function:

- ASME tanks, which are designed for storage of LP-Gas and are permanently installed at bulk plants or customer locations. As mentioned previously, ASME tanks with water capacities over 125 gallons cannot be transported when filled with liquid LP-Gas to more than 5% of their water capacity.

- DOT specification portable tanks and intermodal tanks are designed to be transported filled to their maximum permitted filling density. These tanks have structural protection for valves and fittings not required for ASME storage tanks.

When any of these bulk containers are transported containing LP-Gas, they must be labeled and shipping papers and emergency instructions must be carried in the vehicle. If the gross weight of the tank plus the LP-Gas is greater than 1,001 pounds, the vehicle must be placarded. DOT regulations for securing the load and protection against shifting and falling cargo also apply.

When an ASME tank larger than 120 gallons water capacity containing LP-Gas (gross weight approximately 665 pounds), or two or more 120 gallon ASME tanks are transported, the vehicle must be placarded on the front, back and both sides.

Flammable gas shipping labels must be applied to each side of ASME tanks of less than 1,000 gallons water capacity containing LP-Gas (see Figure 5.1.7e). The use of the flammable gas label is authorized by an exception to container placarding requirements in 49 CFR 172.514. If flammable gas labels are not used, placards must be attached to each side of the tank.

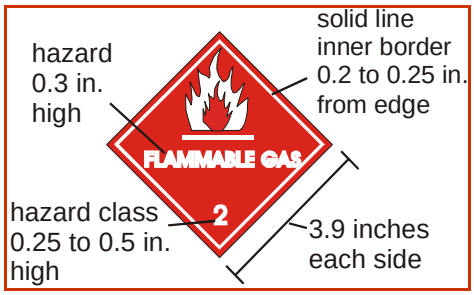


Figure 5.1.7e - Flammable Gas DOT Label

Tanks with 1,000 water gallon capacities or larger must be labeled or placarded on each side and both ends. Placards only should be used on tanks larger than 5,000 gallons because the exception authorizing the use of flammable gas labels does not apply (see Figure 5.1.7.f)

Figure 5.1.7f - LP-Gas Placard

To comply with DOT regulations (per 49 CFR 392 & 393), ASME tanks should be secured with at least 2 cargo straps and binders (or chains and binders) having sufficient working load limit ratings for the tank(s) being transported (see Figure 5.1.7g).

Additional cargo straps or chains should be used for each additional 10-foot length of tanks longer than a typical 1,000 gallon ASME tank or where two restraints do not meet minimum working load requirements for heavier loads.

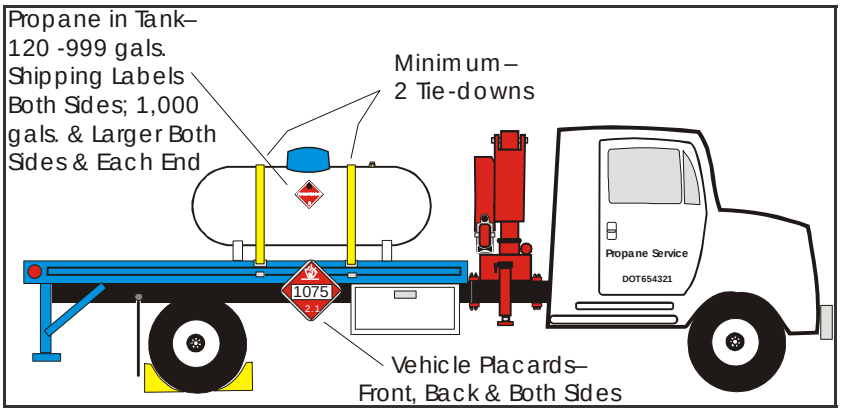


Figure 5.1.7g - Labeling, Placarding, and Cargo Restraints

If an ASME tank has a valve installed in a bottom opening that could be damaged during transit, the tank should be secured on suitable cargo blocking or timbers to provide adequate clearance between the vehicle bed and the valve. Cargo restraints should be arranged to ensure that all valves are protected during transit. If the dome of the tank cannot be adequately secured during transportation, it should be removed and secured in a toolbox or other location, but not carried unsecured in the vehicle cab.

DOT regulations prohibit the display of hazardous material placards if the vehicle is not transporting cargo containing hazardous materials. Therefore, vehicle placards must be removed or covered during the return trip after ASME tanks are delivered.

5.1.8 Evacuation of Containers

A full understanding of the operation of the liquid evacuation process is essential in order to safely remove the liquid propane from containers and reduce the potential for safety incidents associated with the following hazards:

- Exposure to liquid propane can result in freezing of the skin.
- Exposure to flammable gas and other materials at high pressure.
- Potential ignition of flammable gas.
- Utilize Personal Protective Equipment

The area around the evacuation operations must be maintained free of any ignition sources. For example, operating internal combustion engines should be at least 15 feet away from the point of transfer. Additionally, smoking, open flame, portable electric tools and extension lights should not be permitted within 25 feet of the transfer point.

Proper Personal Protective Equipment (PPE) should be worn when evacuating cylinders. Check your company policy for the specific PPE required for the operation.

5.1.8.1 DOT Cylinders

Evacuation by Gravity Transfer

Propane liquid can be removed from portable and exchange DOT cylinders by gravity transfer. Larger cylinders, especially exchange cylinders that do not have neck rings to protect the service valve, should be secured in a cylinder inverter.

To transfer the liquid out of the cylinder:

- Invert the cylinder in an elevated position above a receiving container approved for storage of LP-Gas.
- Connect the two containers with a high-pressure LP-Gas hose assembly.
- Open the service valve on the container to be evacuated and the fill valve on the receiving container to allow the liquid to drain into the receiving container (see Figure 5.1.8a).

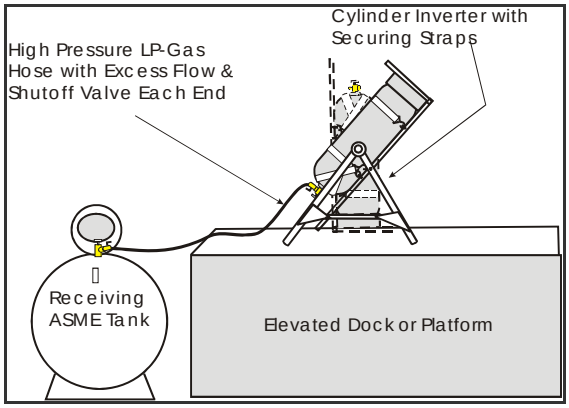


Figure 5.1.8a - Evacuation by Gravity Transfer

When evacuating liquid from stationary DOT cylinders, inverters must be rated for the load of the cylinder and the product within it.

Evacuation Using a Compressor

Bulk plant operators frequently use a compressor system for evacuating cylinders. One of the most common methods used is the scavenging system, which consist of a small scavenging tank, a stationary or portable compressor, and the bulk plant storage tank. See Figure 5.1.8b for a typical scavenging system.

When this system is used to evacuate a container, the following process is typically used:

- The vapor lines that connect the compressor to the two tanks are opened and the liquid line is closed.
- When the compressor is turned on, it pulls vapor out of the scavenging tank into the bulk storage tank.
- As a result, the pressure in the scavenging tank is reduced.
- This creates a difference in pressure between the scavenging tank and the cylinder being evacuated, causing the liquid in the cylinder to flow to the scavenging tank.
- When the scavenging tank is at the maximum permitted filling level, the compressor is turned off and all valves are closed.
- The vapor lines connecting the bulk tank and scavenging tank to the compressor are reversed.
- When the compressor is started again, the compressor pulls vapor from the bulk tank and forces it into the scavenging tank.

- The higher pressure now in the scavenging tank forces the liquid in the scavenger tank into the plant storage tank, emptying the scavenger tank so it can be used again to evacuate other containers.

Cylinders designed for **liquid service** (liquid service valve with dip tube) are very easily emptied using a scavenger tank. The following is a typical procedure:

- A LP-Gas liquid hose, with a shutoff valve on each end, is connected between the cylinder and the scavenger tank.
- When the compressor is turned on, the higher pressure in the cylinder will force liquid to flow up the dip tube in the cylinder and into the scavenger tank.
- When the liquid level in the cylinder reaches the bottom of the dip tube, liquid can no longer be removed.

If the cylinder must be totally evacuated, the remaining contents must be flared or carefully vented.

Cylinders designed for **vapor service** are not as easy to evacuate. Since a vapor service valve does not utilize a dip tube, the cylinder must be inverted (i.e., bottom side up) so liquid can be withdrawn through the vapor service valve (see Figure 5.1.8b).

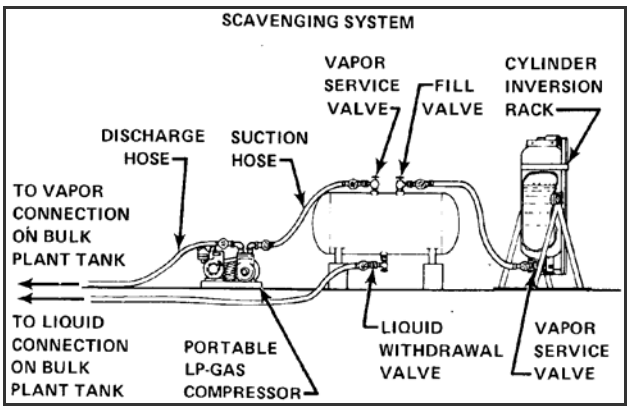


Figure 5.1.8b - Evacuating Vapor Service Cylinders

An inversion rack, also called an evacuation rack, is used to support the cylinder (see Figure 5.1.8c). Once inverted, a liquid transfer hose is connected between the service valve on the cylinder and the scavenger tank, creating liquid flow to the tank.

Figure 5.1.8c – Cylinder Inverter

If the cylinder is evacuated of liquid propane **for the purpose of comparing its weight to the manufacturer's stamped tare weight** as part of requalification, draining the liquid is all that is required. It can remain pressurized with vapor for the purposes of tare weight comparison and requalification.

If the cylinder must be de-pressurized in preparation for valve or fitting replacement, the vapor must be reduced to near atmospheric pressure which might require the flaring of vapor.

Conducting Vapor Flaring Operations

Flaring is the process of burning LP-gas removed from storage containers in a controlled and safe manner. Although venting may be the simplest way to evacuate a container, it is not the safest means and not permitted in some areas. Because of these restrictions, most LP-Gas marketers evacuate tanks and cylinders by flaring or burning off most of the LP-Gas in a burner.

Figure 5.1.8d – Propane Burning from Flare Tower

Many marketers remove most of the LP-Gas liquid by pump or compressor, thus reducing the length of time of the flaring operation. Once the majority of the liquid has been removed, the remaining LP-Gas is usually flared.

The following procedure provides guidance for flaring LP-Gas from cylinders and ASME tanks with water capacity <2,000 gallons. Check company policies and state and local codes for any additional requirements on flaring the container. Training information and instructional details associated with flaring operations are provided in *CETP Module 2.4.4*.

WARNING	In certain areas, local fire codes or company policies require you to contact the local fire department and notify them that the container is to be flared.

1. Evacuate as much LP-Gas from the container as possible.

2. Select the proper site for flaring the LP-Gas. If a designated area for flaring does not exist, select a site with your supervisor that meets the company and code requirements.

3. Select the necessary equipment for flaring the remaining LP-Gas in the container. Again, if equipment has not been designated for flaring operations, check with your supervisor to select and assemble the equipment.

4. Lay out and assemble the flaring equipment, including all the necessary hoses, fittings, supports and burner to flare the remaining LP-Gas in the container.

5. Before opening the container and burner assembly valves and prior to igniting the burner, pressure test the flaring assembly. Do not ignite the flaring burner until you are sure that the supply is gastight.

6. Flare the remaining LP-Gas in the container.

   - Place the fire extinguisher next to the burner support.

   - Inform your supervisor, as well as the other employees at the location, that the container is about to be flared.

   - Following manufacturer's instructions, ignite the burner.

SAFETY	If an accidental fire develops during the flaring operation, immediately close all shutoff valves (including the container service valve) to extinguish the fire.

7. Observe the pressure gauge on the service valve or purging adaptor. When the pressure drops below 15 psig, temporarily shut down the burner and allow the pressures in the tank or cylinder to increase.

WARNING	Because of the high demand of the burner, the container may refrigerate during the flaring operation. If a frost line develops on the cylinder, temporarily shut down the burner and allow the pressure in the container to increase.

8. When the vapor pressure no longer increases (above 15 psig), flare the remaining vapor until the burner extinguishes.

9. While wearing appropriate PPE, bleed down and disconnect the flaring equipment. If applicable, disassemble and store the equipment.

SAFETY	Flaring operations should never be left unattended. Qualified personnel should continuously monitor flaring equipment and conditions. If qualified personnel must leave the flaring operation for any reason, the operation should be shut down and the valve(s) on the container being flared should be closed.

5.1.8.2 ASME Containers

Normally, LP-Gas is evacuated from ASME containers at the customers' locations. However, there are various circumstances where an ASME container must be evacuated in the bulk plant.

When transferring LP-Gas from a stationary ASME LP-Gas storage container to a CTMV cargo tank, the following safety precautions can serve as a guideline:

- All hoses used in the evacuation procedure must be designed, listed and marked for use with liquid propane (1750 psig bursting pressure, and 350 psig working pressure).

- All sources of ignition must be controlled as noted in Section 4 of this handbook.

- At least one recently inspected fire extinguisher, having a minimum capacity of 18-lb. dry chemical with a B:C rating, must be within easy reach during the entire operation.

- A qualified individual must be present at the operation during the entire evacuation procedure.

- Proper PPE should be worn per company policy.

Equipment for Evacuating the ASME Container

CTMV Pump or Portable Compressor

If a CTMV pump is used, the liquid transfer hose must be as short as possible, but no longer than 50 feet. If the CTMV cannot be positioned any closer than 50 feet, a small portable compressor should be used.

WARNING	Because of the limited capacity of the transfer and withdrawal valves, the vehicle pump can "starve" for liquid propane and become damaged.

If a portable compressor is not available, consider moving the ASME tank to a different location on the site, closer to the CTMV.

When an ASME tank containing more than 5% liquid is lifted, the tank's lifting lugs should not be used. Instead, suitable lifting slings that have sufficient weight-bearing capacity ratings should be used to lift the tank.

Liquid Transfer Hose

The liquid transfer hose connected between the two tanks should have the following features (see Figure 5.1.8e):

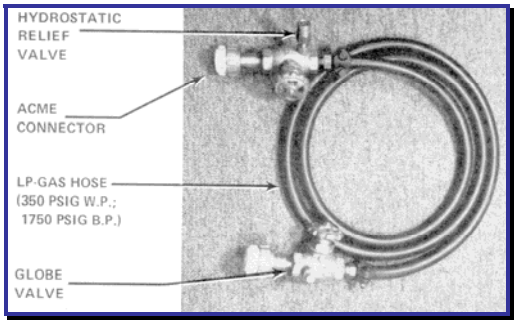


Figure 5.1.8e - Liquid Transfer Hose

- It should be listed and approved for liquid propane gas service (350 psig operating pressure, 1750 psig burst pressure).

- The length should be as short as possible and at least 3/4" (preferably 1") in diameter.
- Manual shutoff valves such as snap-action globe valves, hand wheel-operated globe valves, or ball valves should be installed on both ends of the hose.
- A hydrostatic relief valve should be installed in the liquid assembly to prevent the hose from rupturing if liquid propane is trapped between the two shut-off valves.
- Fittings must be selected that will connect the liquid supply line to the two tanks.
- All threaded connections in the liquid line, except POL and ACME threads, should be sealed with thread sealing compound.

Vapor Hoses

If a CTMV pump is used, a vapor equalizing hose must be connected between the stationary ASME tank and the cargo tank, balancing the vapor pressure between the two. During the evacuation, occasionally check for vapor flow to ensure that the ASME tank's excess flow feature in the vapor equalizing valve does not slug.

If a compressor is used, two vapor hoses are needed. Attach one to the bulk truck (suction line) and the other to the stationary ASME tank (discharge line). Follow the instructions of the compressor manufacturer and your supervisor to locate or assemble vapor lines.

Adapters

If the ASME container being evacuated is not equipped with a vapor equalizing valve, a purging adapter must be installed in the vapor service valve outlet (see example in Figure 5.1.8f).

Figure 5.1.8f - Purging Adapter (POL to Male ACME)

Liquid propane in an ASME container can be removed either through a top or bottom opening. ASME containers built prior to 1961 can be evacuated through the filler valve in the top of the tank since they have dip tubes installed which extend to the bottom of the tank to evacuate liquid through the filler valve. However, a special unloading adapter is needed to operate the filler valve. When the adapter is installed on a filler valve, the moving operator stem pushes open the back checks in the filler valve so the liquid can be removed from the container.

There are several types of unloading adapters available each with its own operating procedure. Read the manufacturer's instructions that accompany the adapter used.

WARNING	Anyone using an unloading adapter to evacuate a container through a filler valve must have a thorough working knowledge of the liquid withdrawal adapter and its effect on the double back check feature of the filler valve. These adapters are not intended to be, nor should they be used as, a permanent means of dispensing liquid for any purpose.

Actuated Liquid Withdrawal Excess Flow Valves

All tanks built after 1963 are spray-filled and should be equipped with a separate actuated liquid withdrawal excess flow valve to evacuate liquid from the tank (Figure 5.1.8g). As long as the valve remains closed, it acts as a back check and prevents any gas from escaping into the atmosphere. Once the valve is opened, the valve disc can move up and down freely on the operator stem, automatically changing it to an excess overflow valve.

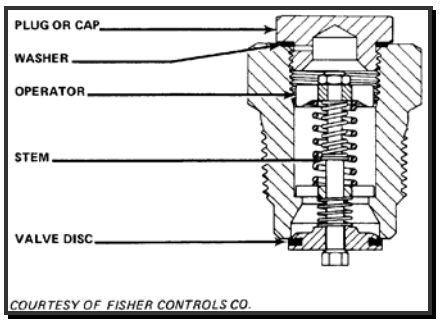


Figure 5.1.8g
Actuated Liquid Withdrawal Excess Flow (Evacuation) Valve

These withdrawal valves may be installed in the bottom, top, or side depending on the internal construction of the tank.

WARNING	In some cases, a damaged seat could allow an excessive amount of liquid to be discharged when the closing cap is loosened. If a significant amount of liquid continues to be blown from under the closing cap for more than 30 seconds, it is unlikely that the internal seat will prevent a dangerous amount of gas from escaping. *If in doubt, do not remove the closing cap, especially in a congested or populated area.*

A transfer valve with a machined adapter (Figure 5.1.8h) must be used to evacuate a tank through a liquid evacuation valve. When the transfer valve and adapter are screwed into the evacuation valve, the machined adapter forces the operator shaft down and moves the valve disc off of its seat.

Install a transfer valve with a 3/4" NPT inlet and a 1 3/4" ACME hose connector in the outlet. Use the machined adapter supplied by the evacuation valve manufacturer.

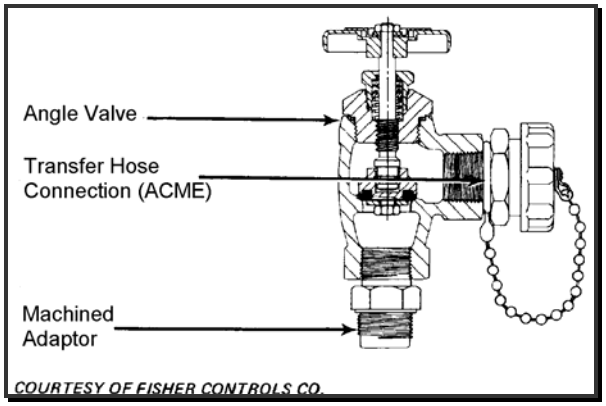


Figure 5.1.8h - Transfer Valve with Machined Adapter

WARNING	Read and strictly follow manufacturer instructions for the installation, use and removal of evacuation transfer valves. Observe all warnings and precautions. If you do not have experience evacuating containers, ask your supervisor for assistance.

Procedure for Evacuating the ASME Container

The following procedures for evacuating LP-Gas from a stationary ASME tank are designed as a guide when using a CTMV or portable compressor. These procedures are based on common industry practice and provisions in NFPA 58-2004. Check your company procedures and state and local codes for any other requirements that apply.

Information outlining features of liquid withdrawal valves, unloading adapters and installation methods is provided in the Supplemental Information Section of *CETP Module 3.1.5*. Always read and follow manufacturers' instructions for use. Use the adapters specified by manufacturers and wear personal protective equipment while evacuating LP-Gas containers.

On most LP-gas containers larger than 125 water gallon capacity and manufactured prior to July 1, 1961, a liquid withdrawal (evacuation) internal dip tube was attached to the bottom of the filler valve by the manufacturer and extended to the bottom of the container. Since 1961, container manufacturers have installed a separate valve, called an actuated liquid withdrawal excess flow valve, for liquid evacuation of domestic containers.

SAFETY

LP-Gas should never be vented into the atmosphere through these valves except as required during installation and removal of the transfer valve.

The LP-Gas evacuated from stationary containers is normally transferred into the bulk delivery vehicle cargo tank. In some cases, an empty LP-Gas storage container of the same capacity is used when a tank change out is done.

The evacuation process may use either a pump or compressor to transfer LP-Gas liquid from one tank to another. Some CTMVs are equipped with an external inlet to the pump called the auxiliary inlet, which may be used for evacuation.

Regardless of the equipment used, since evacuation requires the transfer of both LP-Gas liquid and vapor, all procedures and safety precautions should be fully understood and applied. The procedures described below are limited to the following tanks, equipment and conditions:

- Stationary ASME tanks with water capacities between 125 gallons and 1,000 gallons.
- Liquid being withdrawn through a liquid withdrawal valve with a transfer valve installed.
- The tank being used to receive the liquid from the stationary tank being evacuated is a bulk delivery vehicle cargo tank.
- A portable propane compressor or the bulk delivery vehicle pump is being used to evacuate the liquid in the stationary tank.

1. Determine the quantity of LP-Gas to be transferred. Check to see that the liquid level in the cargo tank is low enough to handle the amount of LP-Gas to be evacuated from the ASME tank without overfilling the cargo tank.

2. Position the bulk delivery vehicle to receive LP-Gas.

    - Position the compressor between the delivery vehicle and the stationary tank being evacuated.

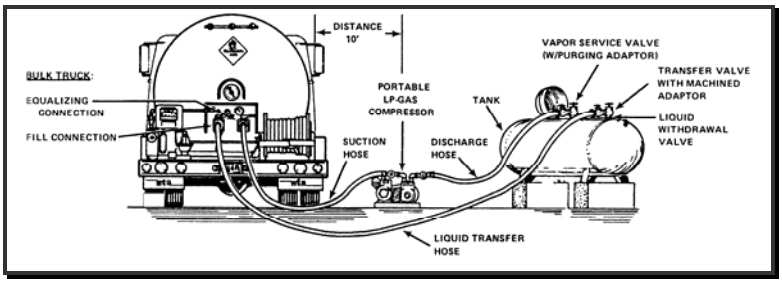


Figure 5.1.8i
Evacuating ASME Tank Using a Portable Compressor

- The delivery vehicle should be approximately 10 feet from the suction side of the compressor. The maximum distance between the compressor and the two tanks will depend on the length of the vapor hose.

3. Connect a transfer valve to the inlet of the withdrawal valve on the stationary tank.

   - Screw a machined unloading adapter into the inlet of the transfer valve.

WARNING	When removing the plug or cap from the liquid withdrawal valve, be sure only the plug is loosened and removed. If an excessive volume of LP-Gas leaks from the valve, reinstall the plug and follow manufacturer's instructions.

   - Install the transfer valve according to manufacturer's instructions.

   - Once installed, close the transfer valve.

4. Close all valves in the liquid transfer line.

5. Lay out the liquid transfer hose between the stationary tank and the cargo tank.

6. Connect one end of the liquid transfer hose to the outlet of the transfer valve and the other end to the fill connection located on the cargo tank of the delivery vehicle.

7. Connect the vapor hoses between the compressor and tanks. Connect the discharge hose between the discharge side of the compressor and the vapor equalizing valve (or purging adapter) on the stationary tank.

- Connect the suction hose between the suction side of the compressor and the equalizing connection on the cargo tank of the delivery vehicle (see Figure 5.1.8i).

8. Pressure test the vapor and liquid hoses.

    - Slowly open one valve at a time, starting with the transfer valve in the stationary tank, to pressure test the liquid supply line.

    - Check all connections downstream to the next closed valve for leakage once a valve is opened.

    - Slowly open each valve downstream one at a time after each section of line is considered tight.

    - Close all valves in the line and make repairs if any leaks are detected.

9. Transfer as much liquid as possible from the stationary ASME LP-Gas tank to the cargo tank. Follow the compressor manufacturer instructions. Typically, portable compressors are run only for short time periods of one or two minutes to create a pressure differential between the two tanks.

10. Bleed down and disconnect all hoses**.**

    - Bleed down and disconnect the fitting of the liquid transfer hose connected to the closed transfer valve.

    - Bleed down and disconnect the liquid transfer hose connection at the bulk LP-Gas delivery vehicle pump-off adapter or fill connection.

    - Fully open the transfer valve and allow LP-Gas to flow through until the excess-flow check valve "slugs" shut.

WARNING	If the excess flow valve does not “slug shut, immediately close the transfer valve. Do not remove the transfer valve until the pressure in the tank has been reduced to 0 psig.

11. Once the pressure has been reduced, the withdrawal valve must be serviced before the ASME tank is returned to service.

5.1.9 Purging of Containers

The following procedures apply to new containers designed and used for storing LP-Gas (propane) at capacities up to and including 2,000 gallons water capacity, including both ASME and DOT containers. Only personnel who have been properly trained and qualified in the procedures related to container vapor purging and methanol injection should perform the tasks outlined in this section.

SAFETY

All personnel handling LP-Gas and methanol should read and understand the Material Safety Data Sheets (MSDS) for each material prior to handling. Personal Protective Equipment should be used per the MSDS.

Purpose

Because air, moisture and other contaminants might be present in new containers (or in some circumstances used containers), it is essential that these be removed before filling a container and placing it into service. Purging a container with LP-Gas is required because air and moisture can cause corrosion (commonly called “rusting”) to occur on the inside surface of the container. When that occurs, the effectiveness of the ethyl mercaptan odorant in the LP-Gas can be significantly reduced and result in “odorant fade”, a hazardous situation. Because methanol attaches itself to water molecules and keeps moisture (water) from freezing when the LP-Gas vaporizes, methanol may need to be added to storage containers to act as a drying agent.

Purging LP-Gas Containers with LP-Gas (Propane) Vapor

ASME tanks and DOT cylinders are usually purged of air at the bulk plant using LP-Gas vapor regulated to 15 psig. Note that purging may sometimes be done through an electrically grounded purging stack (see Figure 5.1.9a).

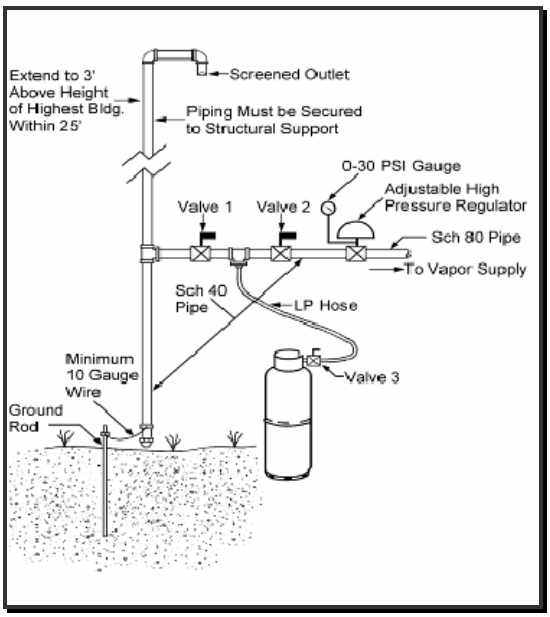


Figure 5.1.9a – Container Purging Stack

To purge a container:

1. Open the service valve to bleed any air from the tank.
2. Attach the vapor hose end valve to the service valve with the appropriate adapter.
3. Pressurize the container with LP-Gas vapor to 15 psig.
4. Close the valve on the vapor hose and bleed off the vapor using the adapter on the filler valve.
5. Repeat this process 5 times.

A final vapor charge of 15 psig should be retained in the container before filling with liquid LP-Gas.

Moisture Removal Using Methanol Injection

Vacuum Purged Containers

Some marketers pre-treat new ASME tanks for moisture by adding a small quantity of methanol. Recently, some tank manufacturers have made this process easier by evacuating air from new tanks and then sealing the tank valves with a vacuum inside (Figure 5.1.9b).

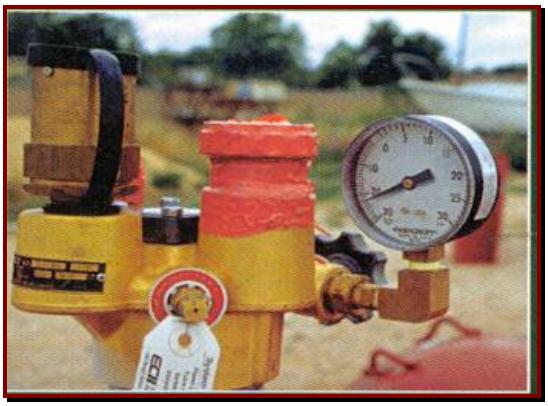


Figure 5.1.9b – New Vacuum Purged Container

The negative pressure (less than atmospheric pressure) shown on the gauge in the above photograph indicates that the tank is leak-free and that methanol can be introduced into the tank by suction.

In order to avoid air entering the tank during the methanol transfer, the hose in the methanol container must extend to the bottom of the container and the service valve on the tank should be closed before the methanol level gets to the level of the hose opening.

After the methanol is transferred into the tank, the tank is pressurized with LP-Gas vapor (see Figure 5.1.9c). All valves should be closed after the tank is pressurized. The manufacturer's applied shrink-wrap plastic should then be removed from the tank valves to indicate that the tank is pressurized with LP-Gas.

Figure 5.1.9c - Pressurizing New Vacuum Purged ASME Tank with Propane Vapor

Injecting Methanol into Pressurized Containers

Methanol can be injected into containers by using a short length of LP-Gas hose with a female ACME connector installed on the container filler valve, while a male ACME connector on the other end is secured to the bulk truck delivery hose end valve adapter. LP-Gas in the delivery hose forces the methanol into the container when the hose end valve is opened

The procedure is as follows:

1. Inspect the short hose that will be used to inject the methanol and be sure it is free of defects that would require it to be removed from service.

2. Pull the CTMV (bobtail/transport) delivery hose end to the receiving tank and place it within arms reach of the filler valve.

3. Attach the female ACME adapter of the short hose to the filler valve of the receiving container and tighten to seal the connection.

4. Fill the short hose section with methanol, holding the hose end up and being careful not to spill or splash the methanol.

5. Attach the male ACME adapter to the delivery hose end valve adapter and seal it to ensure methanol and LP-Gas will not leak out under pressure when the delivery hose end valve is opened.

6. Slowly open the delivery hose end valve. If there is not sufficient LP-Gas pressure in the hose to open the receiving container filler valve, use the CTMV pump to transfer a few gallons of LP-Gas into the receiving container.

7. Close the hose end valve and partially loosen the short hose section from the container filler valve, allowing the LP-Gas to vent until and the hose is de-pressurized.

8. Remove the short hose section from the filler valve and the delivery hose end valve.

9. Inspect the short hose section and the portion of the delivery hose deployed for the transfer.

10. Properly stow and secure the hoses and the methanol container.

5.1.10 Dispensing LP-Gas

While the dispensing equipment at a LP-Gas bulk plant will vary in size and design (e.g., storage capacity, integrated with the bulk storage tank versus stand-alone, manual versus automatic shut-off devices), the basic procedures to follow are typically the same. Prior to any operation, one should review and be familiar with the dispensing equipment, piping functions, and company operating procedures. Detailed information is provided in *CETP Module 3.3 and in PERC's "Dispensing Propane [Safely]" training materials*.

The following procedures apply to dispensing (filling) DOT cylinders and vehicle mounted ASME containers. Only personnel who have been properly trained and qualified in the procedures related to dispensing LP-Gas should perform the tasks outlined in this section. All personnel handling LP-Gas should read and understand the Material Safety Data Sheets (MSDS) for each material prior to handling.

Filling DOT Cylinders

Operating a dispenser to fill DOT cylinders with LP-Gas requires the operator to know the regulations that apply and the characteristics of manual or automatic filling equipment.

Regulatory and Code Requirements for Cylinder Filling

Three of the most critical US DOT regulatory requirements related to cylinder filling are as follows:

- Before filling each cylinder, the person filling the cylinder must visually inspect the outside of the cylinder.
- The weight of LP-Gas filled into the cylinder must be checked, after disconnecting the cylinder from the filling line, by the use of an accurate scale
- No cylinder may be filled and offered for transportation in commerce unless that cylinder has been requalified and marked in accordance with DOT requirements. A cylinder passing requalification by the external visual inspection must be marked in accordance with DOT requirements.

Additionally, NFPA 58-2004 requires that cylinders must be continued in service and transported in compliance with DOT regulations, and that any cylinder that is due for requalification must not be refilled until it is requalified using requalification methods prescribed in the DOT regulations. Some state jurisdictional authorities have not adopted the 2001 edition of NFPA 58 (where this requirement was first adopted), while others may have adopted the Code with exceptions or modifications to this requirement. If you are not sure of state or local jurisdictional requirements for requalification of cylinders not transported in commerce, ask your supervisor to clarify what your company's procedures and policies require.

NFPA 58-2004 also requires that portable cylinders (cylinders of less than 200 pounds water capacity that are subject to DOT jurisdiction) must be filled by weight using a platform scale.

Operating a Dispenser

Startup

1. Inspect all dispenser equipment prior to LP-Gas transfer to ensure that the equipment and supplies needed are in safe and proper working order.
2. Conduct pre-fill inspections on the DOT cylinders, as described in Section 5.1.6 of this handbook. Further details are provided in *CETP Module 3.3.3*.

   Please keep in mind that Overfilling Prevention Devices (OPDs)

are required by NFPA 58 (starting with the 1998 Edition) for vertical cylinders with 4# - 40 # LP-Gas capacity. In jurisdictions that have adopted this or more recent editions of NFPA 58 without modification or exceptions to the OPD requirements, these cylinders due for requalification must be equipped with OPDs before they are refilled. OPDs are not required for cylinders used for industrial welding gas service, for motor fuel service, or for horizontally mounted cylinders.

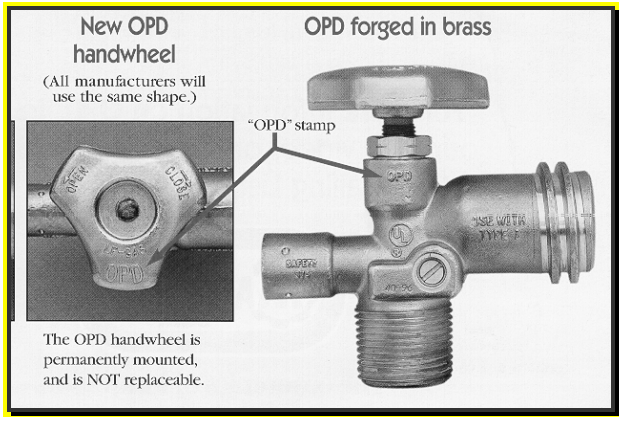


Figure 5.1.10a – Identifying Characteristics of an OPD

WARNING	OPDs are intended to be a secondary means to protect against overfilling of cylinders. The primary method to prevent overfilling is filling by weight on a scale or using the fixed maximum liquid level gauge.

If you install an OPD as a retrofit to an existing cylinder, be certain it has the proper fixed liquid level gauge and is the correct OPD for the cylinder that is being requalified.

1. Prior to filling any cylinder, ensure that ignition sources are controlled, as described in Section 4 of this handbook.

2. To ensure the cylinder is properly filled, the scales must be "zeroed" periodically.

Operation

Manual shutdown dispensers rely on the operator to determine when the maximum permitted filling limit for a cylinder is reached and to stop the flow of liquid into the cylinder by manually closing one or more valves. The operator must be in attendance to

closely observe the platform scale balance beam, close the hose end valve immediately after the balance beam rises, and then shut down the liquid transfer pump.

Automatic shutdown dispensers follow the operating procedures outlined in the previous section covering hydraulic, electric, and pneumatic systems. Be sure to perform each required step listed for manual dispensers that applies, and comply with the manufacturer's operating instructions. Typically where multiple filling stations are operated, the pump by-pass circuit is designed to allow high capacity bypassing so that the pump is not shut down until all cylinders are filled.

Regardless of whether the dispensing equipment is manually operated or if it uses automatic shutdown systems, the operator must set the platform scale for the proper filling weight.

1. Place the empty cylinder on the platform scale and set the balance beam scale to the proper filling weight of the cylinder.

2. Determine and set the proper filling weight by adding:

	Marked Cylinder Tare Weight
+	Marked Cylinder Water Capacity **x** 0.42
+	Weight of dispenser hose, end valve, & adapters
Total **=** Scale Filling Weight Setting	

3. Open the liquid outlet valve on the storage/supply tank and any valves in the by-pass return line.

4. Connect the dispensing hose to the cylinder fill valve. Verify that the proper hose-end valve adapter has been installed

5. Open the service valve on the cylinder as applicable.

6. Start the pump.

7. Slowly open the hose end valve.

8. Close the hose end valve as soon as the scale beam or indicator tips.

9. Close the cylinder valve.

10. Shut off the pump.

11. Disconnect the dispensing hose.

12. Check the weight of filled cylinder after filling connector has been disconnected. If overfilled, bleed off excess LP-Gas in a safe location.

13. Check the cylinder valves, especially the relief valve for leaks.

14. Valve outlets on cylinders of 45-lbs. LP-Gas capacity or less must be either plugged or equipped with a quick closing or quick connect coupling. Plugs are not required and should not be used for OPDs; however, it is recommended to use a dust cap to prevent any debris from entering the valve.

15. If required, apply DOT shipping label or cylinder warning label.

    [Note: *Cylinders that are less than 200 lb water capacity and not subject to DOT jurisdiction, such as non-commercial customers transporting their own cylinders, can be filled volumetrically. Refer to you company's policy and check with your supervisor before filling a cylinder by the volumetric method.*]

Shut-down

1. After the cylinder filling operation is completed, or at any time the dispensing station is unattended, shut off the pump and close the valves at the storage tank.

2. Disconnect and store the hose(s) on a rack inside a fence-protected area, inside a dispenser cabinet, or secured to a supporting structure inside the filling room. At locations that are not weather protected, install a dust cap or plug in the hose-filling adapter.

3. Secure the installation against tampering.

Filling Vehicle-Mounted ASME Tanks

In order to safely and efficiently fill vehicle-mounted ASME tanks, operators must be familiar with each of the basic parts of the dispensing system, the features of ASME tanks, and the filling procedures.

Various types of valves may be used to control the flow of product through a dispenser. It is important to understand how each valve functions and how to open and close them. As a safeguard against overfilling containers, hose end valves must be quick closing types.

Startup

1. In order for the meter to operate and pump propane into an ASME tank, the motor/mobile fuel filling hose end valve must be connected to the ASME tank filler valve and valves V1, V2, V3 and V6 (shown in Figure 5.1.10b) must be in the open position.

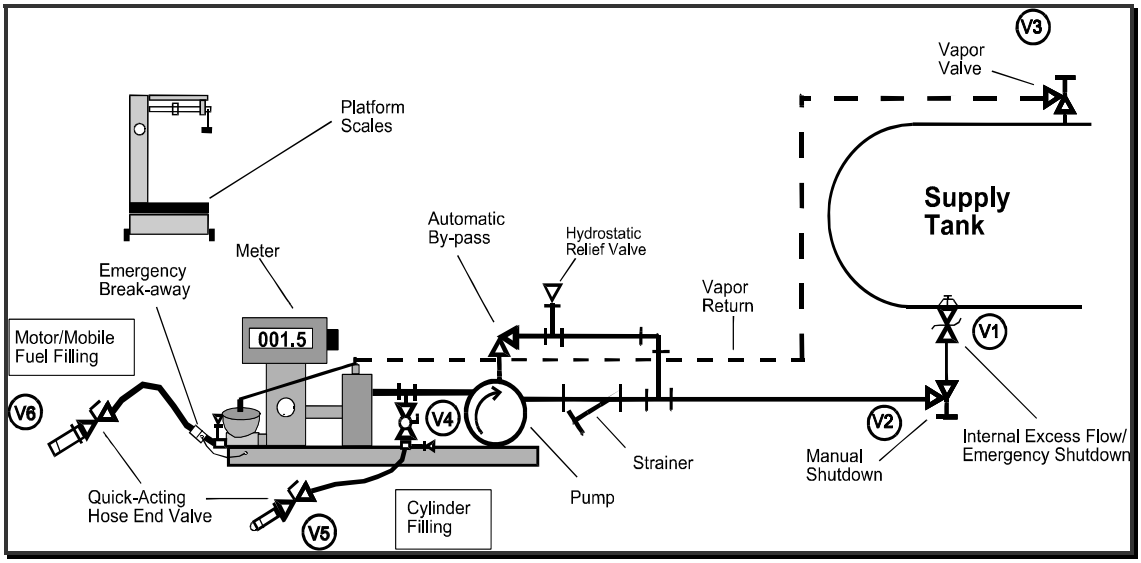


Figure 5.1.10b - Typical Propane Dispenser
(operating valves shown as numbered)

Most dispenser operators will open the vapor valve (V3) during the start up inspection and leave it open as long as they remain in attendance. If you have difficulty filling a motor or mobile fuel tank, always check to be sure the vapor valve is open.

2. Inspect the dispenser prior to propane transfer to ensure that the equipment and supplies needed are in safe and proper working order.

3. Ensure that the propane decal (Figure 5.1.10c) is correctly displayed on vehicles equipped with motor and/or mobile fuel tanks. Location requirements are:

   - For motor fuel tank equipped vehicles, on the rear of the vehicle near the bumper.

   - For vehicles equipped with mobile fuel tanks or concealed DOT cylinders, on or near the access panel door or fender skirt.

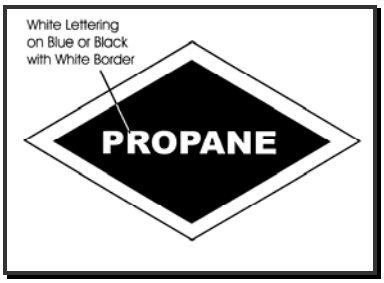


Figure 5.1.10c - Propane Diamond Decal

4. Conduct a pre-fill inspection on the vehicle's ASME tank.

   Unless an ASME tank has a legible ASME data plate, fuel cannot be transferred into the tank**.** It must contain the following information:

   - The service for which the container is designed
   - *Name and address of the manufacturer
   - *Water capacity of the container in pounds or U.S. gallons
   - *Design pressure in pounds per square inch (psi). The working pressure must be at least 250 psi for propane.
   - The wording "This container shall not contain a product having a vapor pressure in excess of 215 psi at 100°F."
   - Tare weight of container fitted for service
   - Outside surface area in square feet
   - Year of manufacture
   - Shell and head thickness
   - Overall length, outside and head diameter of the tank
   - *Manufacturer's serial number
   - *ASME Code symbol

   ***** These items must appear on the data plate or the tank should not be filled.

WARNING	If the tank does not have a data plate, or if its working pressure is not at least 250 psi, you must not fill it.

Operation

During the filling operation, no one can be inside the vehicle. Additionally, ignition sources must be controlled as described in Section 4 of this handbook.

Most motor fuel tanks are equipped with stop-fill or auto-stop valves. These valves are not the primary means of preventing overfilling. The dispenser operator's responsibility is to close the hose end valve when the fixed maximum liquid level gauge vents liquid LP-Gas.

Filling procedures for **mobile fuel** tanks are similar to those for motor fuel tanks, with one important addition - mobile fuel tanks are used to supply LP-Gas appliances that are possible ignition sources. So, **before the filling procedure is started:**

- Shut off the vapor service valve to eliminate the fuel supply to the pilots of the gas appliances.
- Notify the vehicle operator that you are turning the LP-Gas fuel supply off at the service valve and verify with him or her that appliance pilots are off.
- Allow ample time to ensure pilots are extinguished.
- Verify that pilots and pilot safety systems are off.

Once these steps have been taken, begin the filling process as follows:

1. Set the LP-Gas meter to zero.
2. Connect the motor fuel hose to the tank fill valve.
3. Open the vent valve on the fixed maximum liquid level gauge.
4. Start the pump and slowly open the valve on the hose.
5. When a steady white mist or fog is first emitted from the fixed maximum liquid level gauge vent valve, this indicates the maximum permissible fill has been reached.
6. Immediately close the hose end valve.
7. Close the fixed maximum liquid level gauge.
8. Shut off the pump.
9. Slowly loosen the filler adapter to vent liquid LP-Gas trapped between the filler adapter and the motor fuel tank filler valve.

Wait until LP-Gas stops venting and pressure is relieved between the adapter and the filler valve, before completely disconnecting the adapter.

10. When venting has stopped, disconnect and stow the hose assembly.

11. Check the valve for leaks and replace the dust cap or filler valve cap.

12. For mobile ASME fuel tanks, inform the operator that the service valve will need to be returned to the fully open position and appliance pilots re-lit after the vehicle has been moved from the LP-Gas transfer area. If it is not your company's policy to light customer pilot lights, advise the customer to have a professional service company or gas distributor light the pilot lights, that if the customer does this without professional help he/she must carefully follow the manufacturer's instructions.

Shutdown

When the dispenser is not in use, or at any time that a qualified dispenser operator is not in attendance, the dispenser should be shut down and secured in keeping with company operating procedures. The shut down procedure should ensure that dispenser operating valves are closed, transfer hoses are secured in storage cabinets or their designated locations, and the dispenser cabinet or fence gates are closed and locked.

5.2 Vapor Distribution Systems

The following sections contain guidelines for operating procedures specific to industrial plants using a vapor distribution system. These facilities will have some operating procedures that are similar to those at a Bulk Storage Facility. Therefore, refer to the appropriate subsections under Section 5.1 that apply to the normal operations of a large volume vapor distribution system.

Vapor Distribution Systems – Tank Vaporization Only

While the equipment at a large volume customer operating off of a vapor distribution system will vary in size (i.e., storage capacity, meters, regulators), the basic procedures to follow are usually much the same as for the bulk storage tank. Prior to any operation, one should review and be familiar with its design, layout, equipment, piping functions, and company operating procedures. *CETP Modules 4.1 & 4.2* provide detailed supporting information.

Startup

1. Before beginning any operation ensure the transfer equipment is in satisfactory operating condition, the bulk storage container is safe to be filled, and the surrounding area is free from hazards.

2. The following system checks/tests should be performed during the installation or modification of the vapor distribution system(s). Instructional details are provided in the referenced CETP Modules:

    - Purging of piping systems (per *CETP Module 4.2.21*).
    - Pressure tests and inspection of piping (per *CETP Module 4.2.19*).
    - Regulator operational tests (per *CETP Module 4.2.15*).
    - System leak checks (per *CETP Module 4.2.22*).
    - As required by local jurisdictional authorities, any changes in the system design made during the course of system installation (per *CETP Module 4.2.24*).

3. Ensure that all of the appropriate manual valves (i.e., globe, angle, or ball) are open on the bulk storage containers.

4. If the container has manually operated internal valves, ensure that the Emergency Shutdown system is operational and that internal valves are opened.

    c. For *pneumatically* operated systems, ensure that there is adequate pressure (typically 30-70 psig) and that the system is leak free.

    d. For *cable* operated systems, ensure that all cables are operational

Operation

2. The system is now operational and ready to:

    a. Supply a large volume vapor distribution system.

    b. Supply LP-Gas vapor to a jurisdictional (OPS) vapor distribution system.

    c. Supply liquid LP-Gas to a vaporizer system prior to supplying vapor to the distribution system (i.e., in systems where vaporizers are installed).

Shutdown

3. Ensure that all of the appropriate manual valves (i.e., globe, angle, or ball) are closed on the bulk storage container(s).

4. If the container has manually operated internal valves, ensure that these valves are closed by releasing the pressure in Emergency Shutdown System (pneumatic) or pulling the manual cable for the system.

Vaporizers

The types of vaporizers and their respective startup, operating and shutdown procedures vary considerably. Therefore, it is not possible to provide generic operating procedures or guidelines for this equipment.

SAFETY	Operators of vaporizers should be trained on the specific startup, operating and shutdown procedures prior to use. Follow all safety and operating instructions provided by the manufacturer.

Insert the vaporizer manufacturer's literature in Section 9, Manufacturers' Equipment Information.

Section Purpose and Objectives

This section of the handbook is intended to provide owners or operators of propane systems the information necessary to comply with the general requirements of NFPA 58-2004 for maintaining the mechanical integrity of an LP-Gas bulk plant through maintenance manuals and the incorporated procedures, Chapter 14 (§14.3.1 and §14.3.2).

A checklist approach for the development of procedures specific to the maintenance of the transfer system and plant equipment is provided in Section 7. Also, refer to Section 8 of this handbook for maintenance requirements and guidelines for bulk plant fire protection equipment.

Maintenance Manuals

Written maintenance procedures provided by equipment manufacturers may be used as maintenance manuals for the related equipment.

Maintenance Procedures

- Maintenance procedures are in written form in order to be used as the basis for maintaining the mechanical integrity of bulk plant LP-Gas systems.

- Whenever a change in equipment or the system occurs, the affected procedure(s) must be updated.

Maintenance Record Keeping

Maintenance records provide the tracking and documented verification that the facility is being properly maintained and in a safe condition in accordance with NFPA 58-2004.

- *Record Storage* - Maintenance records for all fixed equipment used to store and transfer LP-Gas must be kept at each facility. For unattended facilities, these records can be maintained at the unattended facility or another designated location.

- *Accessibility* – These records must be available to an authority having jurisdiction at any time during normal business hours.

- *Retention* – Maintenance records must be retained for the life of the equipment.

Sample charts for preventive maintenance record keeping (see Chart 6.1) and for logging equipment repairs (see Chart 6.2) are provided at the end of this section.

Maintenance Personnel - Training

- Individuals performing maintenance on the LP-Gas systems must be trained in the hazards of the system.
- Maintenance personnel also must be trained in the maintenance and testing procedures applicable to the systems or equipment on which they are working.
- In order to perform the maintenance procedures, all maintenance contractors must train the personnel under their supervision as noted in the previous two requirements, or ensure that personnel working on a system or LP-Gas equipment are under the supervision of a properly trained individual.

Physical Protection of Equipment

The following bulk plant equipment must be protected against physical damage due to impact from vehicles:

- LP-Gas containers.
- Aboveground piping, which also must be properly supported.
- Dispensers.

Corrosion Control

Aboveground Containers

- Aboveground containers must be painted to protect against atmospheric corrosion.
- The portion of an ASME container that comes in contact with saddles or foundations (including masonry) must be protected against localized corrosion by coating the affected area or by some other means (e.g., felt, weather stripping).
- Where necessary, non-metallic materials must be provided with protection to prevent deterioration due to atmospheric or chemical exposures. Corrosion protection of non-metallic materials should be in accordance with accepted engineering practice.

Underground and Mounded Containers

- For underground or mounded equipment, all metallic components must be coated or protected by some other means (e.g., cathodic protection) to minimize corrosion. The corrosion protection/control system must be

maintained, where applicable, to minimize corrosion.

- For mounded containers, the mounding material (e.g., earth, sand, fillers) must be a non-combustible and non-corrosive material.

- For partially underground, unmounded ASME containers, the corrosion protection must extend for a vertical distance of at least 3 inches above the surface.

Containers and Appurtenances

NFPA 58-2004 provides for a number of general maintenance requirements associated with containers in order to allow their continued used. The important elements required by Chapter 14 of the Code include:

- **Steel containers** that have been involved in a fire and show no signs of distortion must be requalified before being placed back in service.
    - DOT containers must be requalified by either a DOT-approved repair facility or by a cylinder manufacturer of that type cylinder.
    - ASME containers must be retested using the hydrostatic test procedure that was applicable at the time of the original fabrication.
    - For both DOT and ASME containers involved in a fire, the appurtenances must be replaced by qualified personnel.
- **Aluminum DOT cylinders** that have been involved in a fire must be permanently taken out of service.
- All containers that have excessive external corrosion or dents, bulges or gouges must be removed from service.
- **DOT stationary cylinders** that are filled at the customer's location must be:
    - Requalified in accordance with DOT requirements; or
    - Visually inspected within 12 years of the date of manufacture and every 5 years thereafter. Visual inspection requirements are detailed in Paragraph 5.2.3.1 of NFPA 58.

Additional maintenance requirements for container appurtenances are as follows:

- **Gaskets** for container appurtenances and the system piping must be resistant to the action of LP-Gas. Furthermore, gaskets must be replaced whenever a flange is opened. Other detailed gasket requirements are defined in §5.7.1.4 and §12.3.3.4

through §12.3.3.6 of NFPA 58-2004.

- **Pressure Relief valves** and discharge piping must be protected to minimize the entrance of water or extraneous materials through the use of rain caps or any other effective means that do not affect their operability.

Emergency Shutoff Valves

- Emergency shutoff valves (ESVs) and backflow check valves that are required by the Code must be tested annually for their functionality. ESVs must be specifically tested for:

    - Automatic shutoff associated with thermal (fire) actuation.
    - Manual shutoff from a remote location.
    - Manual shutoff at the valve

  The results of these tests must be documented (see sample Chart 6.3 at the end of this section). The Code does not set requirements for the retention and maintenance of these test results. Therefore, you should check with established company policy for the manner in which and the length of time that these records should be kept.

- Temperature-sensitive elements (i.e., thermal links) cannot be painted nor have any ornamental finishes applied after they have been manufactured.

Hose Inspection and Maintenance

Hose assemblies used for liquid transfer must be inspected prior to each use for leakage and any damage that could impair their integrity, and no less than annually.

When inspecting the hose assembly, look for:

- Damage to the outer cover that exposes the reinforcement.
- Kinked or flattened hose.
- Soft spots or bulges in the hose.
- Damaged couplings (including loose bolts, missing parts and slippage).
- Leakage.

Leaking or damaged hose assemblies must be immediately repaired or removed from service.

The Code does not set requirements for the documentation, retention and maintenance of hose inspection results. Therefore, you should check with established company policy.

Chart 6.1 (Sample)
Preventive Maintenance Records

Company: _____ *Location:* _____ *Year:* _____

Equipment	Procedure	Frequency	Dates Performed
Propane Pump	Inspect coupling; grease pump	Per Mfg. Recommendations	
Propane Compressor	Inspect belts; change oil & filter	Per Mfg. Recommendations	
Hoses	Inspect for cracks, cuts, gouges, wear and other damage	Per company policy	
Others, etc.			

Chart 6.2 (Sample)
Fixed Equipment Log
Repairs, Replacements and Unscheduled Maintenance

Company: _____ *Location:* _____ *Year:* _____

Equipment	Maintenance/Repair/Replacement Procedure	Date Performed

Chart 6.3 (Sample)
ESV & Back Check Valve Testing Log

Company: _____ *Location:* _____ *Year:* _____

Plant Location	Liquid Service (✓)	Vapor Service (✓)	Acceptable* (✓)		Corrective Action *(if "no" in previous column)*
			Yes	No	
Bobtail #1					
Bobtail #2					
Bobtail #3					
Transport Unloading					
Transport Loading					
Railcar Unloading					
Railcar Loading					
Bulk Storage #1					
Bulk Storage #2					
Bulk Storage #3					
Other, etc.					

** Based on visual inspection of thermal link (no paint), manual shutoff from remote location, manual shutoff at installed location, and/or positive shutoff by back check valve*

Section Purpose and Objectives

NFPA 58-2004 requires that bulk plants and industrial plants have maintenance procedures that are documented and readily available (§14.3.1 and 14.3.2). This section provides guideline maintenance and inspection procedures that will provide the basis for maintaining the mechanical integrity of LP-Gas Systems.

Scope and Application of Section

While maintenance and inspection procedures are typically similar at LP-Gas bulk storage facilities and large-volume storage/vapor distribution systems, the equipment can vary in size (e.g., storage capacity), design, layout, equipment complexity or function (e.g., rail unloading facilities, cylinder filling operations, on-site commercial dispensers). Similar to the operating procedures in Section 5, this handbook section should be considered to be a "template" for the maintenance and inspection activities conducted at any specific LP-Gas bulk storage facility. Additions, modifications or deletions to these procedures could be necessary. Therefore, owners or site management/supervisors should consider site-specific features and conditions that need to be included, modified or deleted in the information in this section in order to accurately reflect local operations and conditions. With these changes, operators, technicians, drivers and other site personnel can use this document as the maintenance procedures required by NFPA 58-2004.

Although NFPA 58-2004 references the need for documented maintenance and inspection requirements with respect to refrigerated storage, marine and pipeline LP-Gas systems, these systems (which can vary significantly in design and complexity) come under the authority of other jurisdictions which have very specific and detailed requirements.

IMPORTANT: All bulk plant maintenance and inspections performed should conform to equipment manufacturers' instructions as they apply to specific equipment installation and maintenance procedures.

Manufacturer's literature provides the recommended procedures for maintenance and repair for equipment specific to your facility. Owners and managers/supervisors must obtain that information and include it in Section 9 of this handbook ("Manufacturers' Equipment Information") for use by operators, technicians, drivers and other personnel in carrying out their responsibilities. Review this information to determine the appropriate action to take for inspections, maintenance and repairs.

Content of Section

The chart below is a guide to easily identify which equipment in the facility is subject to maintenance and inspection requirements and where these requirements can be found in the checklists that follow. Applicable CETP modules are included in the table for easy reference to further instructional information and materials.

Topic	CETP Ref.	Handbook Sect. 7 Pages	Check, If Applicable
Bulk Storage Containers	3.4.1 & 3.4.2	3 - 6	
Piping	3.4.2	7	
Liquid Pumps	3.4.5	8 - 9	
Bulkheads	3.4.3	10 - 11	
Vapor Compressor	3.4.6	12 - 13	
Tank Car Unloading Tower	3.4.3	14 - 15	
Scales	3.4.8	16	
Meters (Retail Sales Only)	3.4.8	17	
Vaporizers	N/A	18	
Regulators	4.2.15	18	
Electrical Systems	3.4.7	19	

Maintenance and Inspection Procedural Checklist

This section provides a bulk storage facility maintenance and inspection checklist detailing some of the many preventative maintenance and inspection steps that must be conducted in typical bulk storage facility and large volume vapor distribution systems.

This checklist is based on the 2004 Edition of NFPA 58. If your facility is not equipped with an item on this checklist, refer to the edition of NFPA 58 that was applicable at the time of installation. If the edition in effect did not require the item on the checklist, mark the “N/A” (not applicable) box and note the referenced edition in the “Comments” section.

To use this checklist to support and document your maintenance and inspection activities, simply take the actions as directed by the questions and check the appropriate column (i.e., yes, no, not applicable). If the “no” box is checked, comments describing the corrective action steps that have been taken must be documented. If additional space is required, separate sheets can be attached to the checklist. Refer to Appendix 7.1 at the end of this section for additional guidance for completing the checklist.

	Inspection / Maintenance Item	*Yes*	*No*	*N/A*	*Comments*
1. Bulk Storage Containers					
Tank#:	**Mfg Serial#:**				
National Board #: **Manufacturer Name:** **Year Built:**					
(A) Construction—Code Compliance					
	Is the Manufacturer's Data Plate secured and legible?	☐	☐	☐	
	Is the data plate free of corrosion?	☐	☐	☐	
	Is the pressure rating proper for the product?	☐	☐	☐	
(B)Container – Condition and Markings					
	Are aboveground tanks properly painted?	☐	☐	☐	
	Are containers free of excessive corrosion damage, dents, gouges or other damage?	☐	☐	☐	
	Are all container markings and decals in accordance with NFPA 58?	☐	☐	☐	
(C) Container Foundations					
	Are foundations in good condition?	☐	☐	☐	
	Are containers/saddles free of corrosion at masonry contact areas?	☐	☐	☐	
	Are saddle pads in good condition?	☐	☐	☐	
(D) Container Fittings					
	Are all container openings (except relief valve connections) equipped with proper fixed restriction, back check, or internal valves and shutoff valves?	☐	☐	☐	
	Are connections on containers greater than 2,000 gallon water capacity marked "vapor" or "liquid"?	☐	☐	☐	

	Inspection / Maintenance Item	*Yes*	*No*	*N/A*	*Comments*
(D) Container Fittings (cont'd)					
	Are all fittings that are subject to container pressure rated for at least 250 psig working pressure?	☐	☐	☐	
	Are all unused openings plugged or capped?	☐	☐	☐	
	Are all fittings leak-free?	☐	☐	☐	
(E) Container Gauges					
	Are pressure gauges in good condition and suitable for 250 psig service (such as 0 - 400 psig)?	☐	☐	☐	
	Are thermometers in good condition?	☐	☐	☐	
	Are liquid level gauges arranged and installed so that the liquid level can be accurately determined?	☐	☐	☐	
(F) Container Pressure Relief Valves					
	Is relief valve data legible?	☐	☐	☐	
	Is the relief valve marked for use with LP-Gas and labeled by an independent testing agency?	☐	☐	☐	
	Is the relief capacity sufficient, as determined by NFPA 58?	☐	☐	☐	
	Do relief valves communicate with the container vapor space and discharge upward, unobstructed to the open air?	☐	☐	☐	
	Are relief valves on containers >2000 gallons water capacity equipped with vent stacks of proper diameter and length?	☐	☐	☐	
	Are relief valve vent stacks on containers >2000 gallons water capacity equipped with breakaway couplings?	☐	☐	☐	
	Do relief valves or vent stacks have loose-fitting protective caps or closures to prevent entry of foreign matter?	☐	☐	☐	
	Are weep holes for moisture drainage open and is gas impingement of the container prevented?	☐	☐	☐	

	Inspection / Maintenance Item	Yes	No	N/A	Comments
(G) Container - Internal Valves					
	Are the valve body seams leak-free?	☐	☐	☐	
	Are operating cables working correctly?	☐	☐	☐	
	Is the pneumatic control system in good working condition?	☐	☐	☐	
	Are hydraulic operators in good working condition?	☐	☐	☐	
	Is the thermal link intact and free of paint?	☐	☐	☐	
(H) Container - Emergency Shut-off Valves					
	Are ESVs in good working condition and leak free?	☐	☐	☐	
	Has an annual test been performed and documented as required by NFPA 58?	☐	☐	☐	
	Are operating cables working correctly?	☐	☐	☐	
	Is the pneumatic control system in good working condition?	☐	☐	☐	
	Are remote emergency shutoff devices between 25 and 100 feet from the ESV and within the path of egress?	☐	☐	☐	
	Is the thermal link intact and free of paint?	☐	☐	☐	
(I) Container - Manual Shut-off Valves					
	Are valves located so that they can be easily reached during normal operations and in an emergency?	☐	☐	☐	
	Are valves in good condition and leak-free?	☐	☐	☐	
	Do valves have the proper service pressure rating, equal to or greater than the maximum allowable working pressure of the container?	☐	☐	☐	

	Inspection / Maintenance Item	*Yes*	*No*	*N/A*	*Comments*
(J) Container - Catwalks and Stairways					
	Are stairways well anchored and supported?	☐	☐	☐	
	Are catwalk railings provided and in good condition?	☐	☐	☐	
	Does decking design offer drainage and prevent accumulation?	☐	☐	☐	
(K) Container – Presence of Combustibles					
	Is the area within 10 feet of the containers free of weeds, long grass, rags, paper, wood or other loose or piled combustible debris?	☐	☐	☐	
(L) Underground ASME Storage Tank					
	Is protection against vehicular damage provided for the fitting housing, housing cover, tank connections and piping?	☐	☐	☐	
	Is the container protected against corrosion by at least one of the following means:				
	a.) An external coating on the tank?	☐	☐	☐	
	b.) Cathodic protection?	☐	☐	☐	

	Inspection / Maintenance Item	Yes	No	N/A	Comments
2. Piping					
(A) Condition of Pipe and Paint					
	Are aboveground pipes properly painted?	☐	☐	☐	
	Are pipes free of corrosion damage, dents, gouges or other damage?	☐	☐	☐	
	Are pipes adequately supported?	☐	☐	☐	
	Are pipes adequately protected against physical damage by vehicles?	☐	☐	☐	
	Are pipes properly marked “vapor” or “liquid” or color coded accordingly?	☐	☐	☐	
(B) Pipe Fittings					
	Are all flanges and fittings properly sized for the pressure rating, equal to or greater than the maximum allowable working pressure of the system?	☐	☐	☐	
	Are all stainless steel flex connectors in good working condition (i.e., reinforcement braid is not damaged)?	☐	☐	☐	
	Are all flow indicators and sight checks in proper working condition and leak-free?	☐	☐	☐	
	Are all fittings and pipes leak-free?	☐	☐	☐	
(C) Hydrostatic Relief Valves					
	Are hydrostatic relief valves installed in each section of piping in which liquid can be isolated between shut-off valves?	☐	☐	☐	
	Are hydrostatic relief valves approved for use with LP-Gas?	☐	☐	☐	
	Do the hydrostatic relief valves have pressure settings between 400 – 500 psig?	☐	☐	☐	
(D) Piping - Manual Shut-off Valves					
	Are valves located so that they can be easily reached during normal operations and in an emergency?	☐	☐	☐	
	Are valves in good condition and leak-free?	☐	☐	☐	
	Do valves have the proper pressure rating, equal to or greater than the maximum allowable working pressure of the system?	☐	☐	☐	
(E) Underground Piping					
	Is metallic underground piping protected against corrosion by at least one of the following means:				
	a.) An external coating on piping?	☐	☐	☐	
	b.) Cathodic protection?	☐	☐	☐	

	Inspection / Maintenance Item	Yes	No	N/A	Comments
3. Liquid Pump					
(A) General					
	Are pumps free of corrosion or other damage?	☐	☐	☐	
	Are pump pads and/or foundations in good condition and properly supporting the pumps?	☐	☐	☐	
	Are base plate bolts in place and properly securing the pump to that foundation?	☐	☐	☐	
	Are the pumps properly lubricated?	☐	☐	☐	
	Are strainers in good working condition (i.e., strainer screens free of debris) and leak-free?	☐	☐	☐	
	Are hydrostatic relief valves installed in the appropriate location and in good working condition?	☐	☐	☐	
	Are all stainless steel flex connectors in good working condition (i.e., reinforcement braid is not damaged)?	☐	☐	☐	
	Are fittings and piping associated with the pump leak-free?	☐	☐	☐	
(B) Pump Drive Components					
	Are drive belts properly aligned and in good working condition?	☐	☐	☐	
	For shaft coupling-driven pumps, are shaft couplings properly aligned?	☐	☐	☐	
	For shaft coupling-driven pumps, are spacing bushings in good working condition?	☐	☐	☐	
	For gear reduction-driven pumps, are universal joints and couplings properly aligned and in good working condition?	☐	☐	☐	
	Are drive belt guards in place and secure?	☐	☐	☐	
(C) Pump Gauges					
	Are pressure gauges in good condition (i.e., 0 - 400 psig)?	☐	☐	☐	
(D) Automatic Bypass Valves					
	Are bypasses in good working condition and leak-free?	☐	☐	☐	
	Are bypasses set at the appropriate pressure differential?	☐	☐	☐	

	Inspection / Maintenance Item	*Yes*	*No*	*N/A*	*Comments*
(E) Pump – Manual Shut-off Valves					
	Are valves located so that they can be easily reached during normal operations and in an emergency?	☐	☐	☐	
	Are valves in good condition and leak-free?	☐	☐	☐	
	Do valves have the proper pressure rating, equal to or greater than the maximum allowable working pressure of the system?	☐	☐	☐	

	Inspection / Maintenance Item	*Yes*	*No*	*N/A*	*Comments*
4. Bulkheads					
(A) General					
	Are bulkheads properly protected against vehicular damage?	☐	☐	☐	
	Are bulkheads (i.e., structure and foundation) in good condition and properly supporting the bulkhead, especially in the event of an attempted pull-away?	☐	☐	☐	
(B) Bulkheads- Piping and Fittings					
	Are pipe nipples and couplings that are attached to the bulkhead in good working condition and free of excessive wear?	☐	☐	☐	
	Are all flanges and fittings properly sized for the pressure rating, equal to or greater than the maximum allowable working pressure of the system	☐	☐	☐	
	Are all stainless steel flex connectors in good working condition (i.e., reinforcement braid is not damaged)?	☐	☐	☐	
	Are all flow indicators and sight checks in proper working condition and leak-free?	☐	☐	☐	
	Are hydrostatic relief valves installed in the appropriate location and in good working condition?	☐	☐	☐	
	Are all fittings and pipes leak-free?	☐	☐	☐	
(C) Bulkheads - Emergency Shut-off Valves (ESVs)					
	Are ESVs in good working condition and leak-free?	☐	☐	☐	
	Has an annual test been performed and documented as required by NFPA 58	☐	☐	☐	
	Are operating cables operating correctly?	☐	☐	☐	
	Is the pneumatic control system in good working condition?	☐	☐	☐	

	Inspection / Maintenance Item	*Yes*	*No*	*N/A*	*Comments*
(C) Bulkheads - Emergency Shut-off Valves (ESVs) (Cont'd)					
	Are remote emergency shutoff devices between 25 and 100 feet from the ESV and within the path of egress?	☐	☐	☐	
(D) Bulkheads - Hoses					
	Are the hose covers free of exposed reinforcement?	☐	☐	☐	
	Is wire braid reinforcement free of kinks and not flattened?	☐	☐	☐	
	Are hoses free of soft spots when not under pressure, show no bulging under pressure, and have no loose outer coverings?	☐	☐	☐	
	Are hose coupling assemblies secure and in good working condition?	☐	☐	☐	
	Are the ACME threads, O-rings, or gaskets in good working condition (i.e., showing little sign of excessive wear)?	☐	☐	☐	
(E) Bulkheads – Manual Shut-off Valves					
	Are valves located so that they may be easily reached during normal operations and in an emergency?	☐	☐	☐	
	Are valves in good condition and leak-free?	☐	☐	☐	
	Do the valves have the proper pressure rating, equal to or greater than the maximum allowable working pressure of the system?	☐	☐	☐	

	Inspection / Maintenance Item	*Yes*	*No*	*N/A*	*Comments*
5. Vapor Compressor					
(A) General					
	Are compressors free of corrosion or other damage?	☐	☐	☐	
	Are compressor pads and/or foundations in good condition and properly supporting the compressors?	☐	☐	☐	
	Are base plate bolts in place and securing the compressor to that foundation?	☐	☐	☐	
	Are the compressors properly lubricated?	☐	☐	☐	
	Is the crankcase oil properly filled?	☐	☐	☐	
	Is the crankcase oil pressure properly set?	☐	☐	☐	
	Has the oil filter been changed at the manufacturer's recommended interval?	☐	☐	☐	
	Are strainers elements in good working condition (i.e., strainer screens free of debris) and leak-free?	☐	☐	☐	
	Are pressure relief valves installed in the appropriate location and in good working condition?	☐	☐	☐	
	Are all stainless steel flex connectors in good working condition (i.e., reinforcement braid is not damaged)?	☐	☐	☐	
	Are all back check valves in proper working condition and leak-free?	☐	☐	☐	
	Are fittings and piping associated with the compressor leak-free?	☐	☐	☐	
(B) Compressor Drive Components					
	Are drive belts properly aligned, tension properly set, and in good working condition?	☐	☐	☐	
	For direct drive compressors, are shaft couplings properly aligned and in good working condition?	☐	☐	☐	
	Are drive belt guards in place and secure?	☐	☐	☐	
(C) Compressor Gauges					
	Are pressure gauges (suction and discharge) in good condition (i.e., 0 - 400 psig)?	☐	☐	☐	

	Inspection / Maintenance Item	*Yes*	*No*	*N/A*	*Comments*
(D) Compressor – Manual Shut-off Valves					
	Are valves located so that they can be easily reached during normal operations and in an emergency?	☐	☐	☐	
	Are valves in good condition and leak-free?	☐	☐	☐	
	Do valves have the proper pressure rating, equal to or greater than the required working pressure of the system?	☐	☐	☐	

	Inspection / Maintenance Item	*Yes*	*No*	*N/A*	*Comments*
6. Tank Car Unloading Tower					
(A) Tower Foundations					
	Are foundations in good condition?	☐	☐	☐	
(B) Tower- Piping and Fittings					
	Are all flanges and fittings properly sized for the pressure rating equal to or greater than the maximum allowable working pressure of the system?	☐	☐	☐	
	Are all stainless steel flex connectors in good working condition (i.e., reinforcement braid is not damaged)?	☐	☐	☐	
	Are all flow indicators and sight checks in proper working condition and leak free?	☐	☐	☐	
	Are hydrostatic relief valves installed in the appropriate location and in good working condition?	☐	☐	☐	
	Are all fittings and pipes leak-free?	☐	☐	☐	
(C) Towers - Emergency Shut-off Valves (ESVs)					
	Are ESVs in good working condition and leak-free?	☐	☐	☐	
	Are ESVs and/or back checks (including thermal release) on riser ends of the liquid hoses in good working condition?	☐	☐	☐	
	Are ESVS on riser ends of the vapor hose (including thermal release) in good working condition?	☐	☐	☐	
	Has an annual test been performed and documented as required by NFPA 58?	☐	☐	☐	
	Is the pneumatic control system in good working condition and free of leaks?	☐	☐	☐	
	Are remote emergency shutoff devices between 25 and 100 feet from the ESV and within the path of egress?	☐	☐	☐	

	Inspection/ Maintenance Item	*Yes*	*No*	*N/A*	*Comments*
(D) Tower - Hoses and Loading Arms					
	Are the hose covers in good condition to prevent exposure of the reinforcement?	☐	☐	☐	
	Is wire braid reinforcement free of kinks and not flattened?	☐	☐	☐	
	Are hoses free of soft spots when not under pressure, show no bulging under pressure, and have no loose outer coverings?	☐	☐	☐	
	Are hose coupling assemblies secure and in good working condition?	☐	☐	☐	
	Are the ACME threads, O-rings, or gaskets in good working condition (i.e., showing little sign of excessive wear)?	☐	☐	☐	
	Are loading arms leak-free and in good working condition?	☐	☐	☐	
	Are the loading arm swing-joints properly lubricated?	☐	☐	☐	
	Are all factory installed protective guards in place and secure?	☐	☐	☐	
(E) Tower – Manual Shut-off Valves					
	Are valves located so that they can be easily reached during normal operations and in an emergency?	☐	☐	☐	
	Are valves in good condition and leak-free?	☐	☐	☐	
	Do valves have the proper pressure rating, equal to or greater than the required working pressure of the system?	☐	☐	☐	

	Inspection/ Maintenance Item	*Yes*	*No*	*N/A*	*Comments*
7. Scales					
(A) General					
	Has the scale(s) been checked periodically using a certified/standard dead weight?	☐	☐	☐	
	Is the scale(s) properly calibrated and been certified by the proper authority having jurisdiction?	☐	☐	☐	
	Have all loops, pivots, and bearings been periodically lubricated?	☐	☐	☐	
	Are the scale pit(s) and/or platform(s) free of any debris?	☐	☐	☐	
(B) Automatic Shut-off System					
	Are all actuators and control valves leak-free and in good working condition (i.e., proper fluid levels and proper alignment with scale)?	☐	☐	☐	
	Are all sensing lines leak-free and in good working condition (i.e., free of kinks and proper alignment with the scale)?	☐	☐	☐	
(C) Hoses					
	Are the hose covers free of exposed reinforcement?	☐	☐	☐	
	Is wire braid reinforcement free of kinks and not flattened?	☐	☐	☐	
	Are hoses free of soft spots when not under pressure, show no bulging under pressure, and have no loose outer coverings?	☐	☐	☐	
	Are hose coupling assemblies secure and in good working condition?	☐	☐	☐	
	Are the ACME threads, O-rings, or gaskets in good working condition (i.e., showing little sign of excessive wear)?	☐	☐	☐	

	Inspection / Maintenance Item	*Yes*	*No*	*N/A*	*Comments*
8. Meters (For Retail Sales Only)					
(A) General					
	Is the meter(s) properly calibrated or "proved" at the appropriate time intervals?	☐	☐	☐	
	Is the seal(s) in place by the appropriate authority having jurisdiction?	☐	☐	☐	
	Is the meter in good working condition and free of leaks?	☐	☐	☐	
	Has the strainer been properly cleaned out of any debris?	☐	☐	☐	
(B) Hoses					
	Are the hose covers free of exposed reinforcement?	☐	☐	☐	
	Is wire braid reinforcement free of kinks and not flattened?	☐	☐	☐	
	Are hoses free of soft spots when not under pressure, show no bulging under pressure, and have no loose outer coverings?	☐	☐	☐	
	Are hose coupling assemblies secure and in good working condition?	☐	☐	☐	
	Are the ACME threads, O-rings, or gaskets in good working condition (i.e., showing little sign of excessive wear)?	☐	☐	☐	
	Are pull-away couplings in place and in good working condition?	☐	☐	☐	

	Inspection / Maintenance Item	Yes	No	N/A	Comments
9. Vaporizers					
(A) General					
	Is the vaporizer(s) leak-free and in good working condition?	☐	☐	☐	
	Have pilot lights been cleaned on a regular basis?	☐	☐	☐	
	On a periodic basis, have all strainers been cleaned at the inlet side of the vaporizer(s)?	☐	☐	☐	
	Have heavy ends been cleaned from the vaporizer(s) and/or separator tank?	☐	☐	☐	
	Have the burner openings, thermostat, and flue been cleaned?	☐	☐	☐	
	Is the vaporizer(s) located in accordance with NFPA 58?	☐	☐	☐	

	Inspection / Maintenance Item	Yes	No	N/A	Comments
10. Regulators					
(A) General					
	Is the first-stage or high-pressure regulator directly attached by flexible connectors to the vaporizer outlet or to the interconnected piping of manifolded vaporizers?	☐	☐	☐	
	Are all first-stage and high-pressure regulators installed outside of buildings?	☐	☐	☐	
	Are all regulators that are outside of buildings installed and protected so that their operation will not be affected by environmental elements (e.g., freezing rain, sleet, snow, ice, mud or debris) or insects?	☐	☐	☐	
	Is the point of discharge on the regulator's relief device at least 3 feet horizontally away from any building opening that is below the level of the discharge?	☐	☐	☐	
	Is the point of discharge on the regulator's relief device located at least 5 feet in any direction from any source of ignition or mechanical ventilation air intakes?	☐	☐	☐	

	Inspection / Maintenance Item	*Yes*	*No*	*N/A*	*Comments*
11. Electrical Systems					
(A) General					
	Are all electrical components and wiring in compliance with Table 6.20.2.2 (Electrical Area Classification) in NFPA 58-2004?	☐	☐	☐	
	Are electrical control switches and wiring in compliance with Class 1, Group D, Division 1 or 2 (where applicable) in compliance with Table 6.20.2.2 (Electrical Area Classification) in NFPA 58-2004?	☐	☐	☐	
	Are pump and/or compressor switches readily accessible to the operator?	☐	☐	☐	
	Are electrical controls for equipment clearly marked or color-coded to indicate the on and off (stop) positions?	☐	☐	☐	
	Is the electrical emergency shutdown located more than 20 ft (but less than 100 ft) from any dispensing devices, and prominently labeled?	☐	☐	☐	
	Is electrical wiring, in Division 1 or 2 areas, installed in rigid conduit? Class 1, Group D in flexible sections?	☐	☐	☐	
	For electric motors, are flexible connectors Class 1, Group D, Division 1 or 2 where applicable?	☐	☐	☐	
	Are all seal-off fixtures filled with suitable putty and installed in the appropriate locations?	☐	☐	☐	

Appendix 7.1

Maintenance and Inspection Procedural Checklist Guidelines

These guidelines are based on the 2004 Edition of NFPA 58. Check with your supervisor if your facility or equipment was constructed or installed under a previous Code edition. If the item on the checklist is not subject to the requirements of the 2004 Edition, refer to the applicable Code edition for guidance.

1. BULK STORAGE CONTAINERS

A. CONSTRUCTION – CODE COMPLIANCE

- ***Is the Manufacturer's Data Plate (i.e., nameplate) secured and legible?***
  - The nameplate should be stainless steel and attached to the container in such a way that minimizes corrosion of the nameplate and does not contribute to corrosion of the container.
    .
  - The nameplate should be located so that it is visible after the container is installed.
  - Where the container is buried or otherwise covered so that the nameplate is obscured, the information contained on the nameplate can be duplicated and installed on adjacent piping or on a structure in a clearly visible location.
- ***Is the data plate free of corrosion?***
  - See the guidelines for the above inspection point.
- ***Is the pressure rating proper for the product?***

  For use in propane service, stationary tanks must have a minimum working pressure of 250 psig (200 psig for some specific ASME tanks built before 1950). Check with your supervisor if the minimum working pressure is something other than 250 psig.

B. CONTAINER – CONDITION AND MARKINGS

- ***Are aboveground tanks properly painted?***
  - The container should have a paint/coating system in place that prevents corrosion (rusting).
  - Generally, a light reflecting color paint is preferred unless the system is installed in an extremely cold climate.
- ***Are containers free of excessive corrosion damage, dents, gouges or other damage?***
  - External visual inspection of the shell and heads of the container should indicate that no loss of wall thickness has occurred on the container, either generally or locally. If there is any question regarding the potential loss of wall thickness, a qualified inspector can be employed using appropriate non-destructive testing techniques.
- ***Are all container markings and decals in accordance with NFPA 58?***

  See the first item regarding requirements for the manufacturer's data plate. Additionally, all ASME containers that contain unodorized LP-Gas must be marked "NOT ODORIZED" in letters 4 inches high with a contrasting background, surrounded by a ½ inch rectangular border.

C. CONTAINER FOUNDATIONS

- ***Are foundations in good condition?***
  - The structural supports must be constructed of masonry or another noncombustible material, and located on concrete or masonry foundations. They should be free of excessive cracking and have no significant loss of the structural materials. Footings should be level and stable.
- ***Are containers/saddles free of corrosion at masonry contact areas?***
  - The parts of the ASME container in contact with the saddles or foundations must be coated or protected in some manner to minimize corrosion. No signs of rust bleeding should be apparent.
- ***Are saddle pads in good condition?***
  - The pads should show no signs of excessive deterioration and should have adequate weather sealing to prevent moisture from accumulating and causing corrosion on the container.

D. CONTAINER FITTINGS

- ***Are all container openings (except relief valve connections) equipped with proper fixed restriction, back check, or internal valves and shutoff valves?***
  - Check with your supervisor and refer to the Code edition applicable for your installation for specific requirements.
- ***Are connections on containers greater than 2,000 gallon water capacity marked "vapor" or "liquid"?***
  - Labels or color codes are permitted to be on valves. Connections for pressure relief devices, liquid level gauges and pressure gauges are not required to be labeled.
- ***Are all fittings that are subject to container pressure rated for at least 250 psig working pressure?***
  - Possible exception: The requirement could be 200 psig associated with some specific ASME tanks built before 1950. Check the container nameplate and discuss with your supervisor if other than 250 psig rating.
- ***Are all unused openings plugged or capped?***
  - A blind flange or plugged companion flange is acceptable, also.
- ***Are all fittings leak-free?***
  - Check each fitting using a gas detector calibrated for LP-Gas or an ammonia-free leak testing (soap) solution. No gas should be detected. For the leak test solution, no bubbles should form. Listen and smell for possible leaks.

E. CONTAINER GAUGES

- ***Are pressure gauges in good condition and suitable for 250 psig service (such as 0 – 400 psig)?***
  - The gauges must be readable, functioning and leak-free. They must be attached directly to the container opening or to a valve or fitting that is directly attached to the container opening.
- ***Are thermometers in good condition?***
  - Temperature gauges (thermometers) must be readable, functioning and leak-free.
- ***Are liquid level gauges arranged and installed so that the liquid level can be accurately determined?***
  - The gauging devices must be either fixed maximum liquid level gauges or variable gauges of the slip tube, rotary or float types.
  - Bulk storage containers must be equipped with a fixed maximum liquid level gauge to indicate the maximum filling level.
  - ASME containers must have permanently attached markings showing the percentage of capacity that is indicated by that gauge. These markings must be attached to the container, immediately adjacent to the fixed maximum liquid level gauge or on the container nameplate.

F. CONTAINER PRESSURE RELIEF VALVES

- ***Is relief valve data legible?***
  - Each pressure relief valve must be plainly and permanently marked with the following information:

    + The pressure in psig at which the valve is set to discharge (i.e., start-to-leak).

    + Rated relieving capacity (cubic feet per minute).

    + Manufacturer's name and catalog number.

- ***Is the relief valve marked for use with LP-Gas and labeled by an independent testing agency?***
  - Underwriters Laboratory (UL) or other testing agency markings must be legible on the valve.

- ***Do relief valves communicate with the container vapor space and discharge upward, unobstructed to the open air?***
  - Self-explanatory.
- ***Are relief valves on containers > 2,000 gallons water capacity equipped with vent stacks of proper diameter and length?***
  - The diameter of the vent stack piping must be large enough so as not to restrict discharge flow.
  - The relief valve discharge must be piped upward to a point at least seven (7) feet above the top of the container.
  - Check with your supervisor if there is any question regarding the installation of vent stacks.
- ***Are relief valve vent stacks on containers > 2,000 gallons water capacity equipped with breakaway couplings?***
  - Inspect the base of the extension stack, immediately above the relief valve, for the presence of a breakaway coupling.
- ***Do relief valves or vent stacks have loose-fitting protective caps or closures to prevent entry of foreign matter?***
  - Rain caps or other protective devices must be provided to minimize the possibility of water or other foreign matter from entering into the relief device or any discharge piping. Where accumulation of water is anticipated, means for drainage must be provided.
  - The rain cap or other protective device must be designed to remain in place, except during discharge, and not restrict discharge flow.
- ***Are weep holes for moisture drainage open and is gas impingement of the container prevented?***
  - Weep holes must remain clear in order to prevent accumulation of moisture/condensation.
  - A deflector or other means must be in place to protect the container against flame impingement resulting from ignited product escaping from the drain opening.

G. CONTAINER – INTERNAL VALVES

- ***Are the valve body seams leak-free?***
  - Check each fitting using a gas detector calibrated for LP-Gas or an ammonia-free leak testing (soap) solution. No gas should be detected. For the leak test solution, no bubbles should appear. Listen and smell for possible leaks.
- ***Are operating cables working correctly?***
  - The cable should be free to move through its entire range without binding.
  - The cable should fully open and completely close the valve.
- ***Is the pneumatic control system in good working order?***
  - Check the operators to ensure proper functioning (typically, through release of air or nitrogen pressure and then repressurizing).
  - The system should be checked for leaks by pressurizing the system and checking all connections with a leak detector solution. No bubbles should appear.
  - The operator should fully open and completely close the valve.
- ***Are hydraulic operators in good working condition?***
  - Check the operators to ensure proper functioning (typically, through release of pressure and then repressurizing).
  - The operator should fully open and completely close the valve.
- ***Is the thermal link intact and free of paint?***
  - Self-explanatory. Additionally, the thermal link should be free of any coating (including foreign matter) that could interfere with the proper functioning of the link.

H. CONTAINER- EMERGENCY SHUT-OFF VALVES

- ***Are ESVs in good working condition and leak-free?***
  - Check for leakage at all body seams, plus the connections to the piping and hose. No gas should be detected through normal leak testing techniques.
  - Test (operate) the closing feature to ensure that it will close and open the valve.

- ***Has an annual test been performed and documented as required by NFPA 58?***

  - The valves need to be tested for the following functions:
    + Automatic shutoff through thermal (fire) actuation. (Note: Check for the presence of the thermal element.)
    + Manual shutoff from a remote location.
    + Manual shutoff at the installed location.

- ***Are operating cables working correctly?***

  - Check operating cables to make sure they can move through their entire range without binding.

  - Make sure the cable tension is not too tight since that might prevent the valve from latching properly, or vibration or jarring could cause inadvertent closure during normal transfer operations.

- ***Is the pneumatic control system in good working condition?***

  - Check the operators to ensure proper functioning (typically, through release of air or nitrogen pressure and then repressurizing).

  - The system should be checked for leaks by pressurizing the system and checking all connections with a leak detector solution. No bubbles should appear.

  - The operator should fully open and completely close the valve.

- ***Are remote emergency shutoff devices between 25 and 100 feet from the ESV and within the path of egress?***

  - Self-explanatory.

- ***Is the thermal link intact and free of paint?***

  - Self-explanatory. Additionally, the thermal link should be free of any coating (including foreign matter) that could interfere with the proper functioning of the link.

I. CONTAINER – MANUAL SHUT-OFF VALVES

- ***Are valves located so that they can be easily reached during normal operations and in an emergency?***

  - Check that valves are located so that they can be accessed and operated without the use of additional tools or equipment.

- ***Are valves in good condition and leak-free?***
  - Check for any excessive corrosion or damage to the body.
  - Check for leakage at all body seams and the stems/packing, plus the connections to the piping and hose. No gas should be detected through normal leak testing techniques.
  - Check for loose or missing hand-wheels or levers.
  - Some manual shut-off valves have a small hydrostatic relief valve installed in them. If a relief valve is present, be sure the outlet is clear and unrestricted. Be sure the rain cap is in place.
- ***Do valves have the proper service pressure rating, equal to or greater than the maximum allowable working pressure of the container?***
  - Check to make sure that the pressure rating stamped on the valve is no less than 250 psig. Again the possible exception is that the requirement could be 200 psig associated with some specific ASME tanks built before 1950. Check the container nameplate and discuss with your supervisor if other than 250 psig rating.

J. CONTAINER – CATWALKS AND STAIRWAYS

- ***Are stairways well anchored and supported?***
  - Check anchor bolts to make sure they are firmly attached and have not experienced excessive corrosion. Supports and handrails are in place and stable.
- ***Are catwalk railings provided and in good condition?***
  - Per OSHA standards (§1910.23), a standard railing consists of a top rail, middle rail, and posts, and has a height of 42 inches from the upper surface of the top rail to the platform floor. The top rail should be smooth for the entire length.
  - Check that the railings are in place, properly anchored, stable and free of excessive corrosion in order to provide fall protection for workers.
- ***Does decking design offer drainage and prevent accumulation?***
  - Self-explanatory.

K. CONTAINER – PRESENCE OF COMBUSTIBLES

- ***Is the area within 10 feet of the container(s) free of weeds, long grass, rags, paper, wood or other loose or piled combustible debris?***
  - Self-explanatory.

L. UNDERGROUND STORAGE TANKS

- ***Is protection against vehicular damage provided for the fitting housing, housing cover, tank connections and piping?***
  - Crash protection must be in place where LP-Gas storage equipment can be subjected to vehicular traffic.
- ***Is the container protected against corrosion by an external coating on the tank or by cathodic protection?***
  - When inspecting the components of the tank that are visible aboveground, check those portions of the coating system (e.g., paint) for damage.
  - When taking a tank-to-soil voltage reading, a minimum -0.85 voltage reading must be measured and maintained.

2. PIPING

A. CONDITION OF PIPE AND PAINT

- ***Are aboveground pipes properly painted?***
  - Piping should have paint and coatings systems in place that are not damaged and provide protection against external corrosion.
- ***Are pipes free of corrosion damage, dents, gouges or other damage?***
  - Check for excessive rust or corrosion that would indicate metal loss on the piping. Particular attention should be given to the areas around supports for localized corrosion.
  - Check for dents or gouges that could reduce the wall thickness of the pipe.
  - Check for evidence of localized pitting, especially at weld seams.
  - Check for any indications of fire damage.
- ***Are pipes adequately supported?***

- Check that supports are in place so that the piping is not bending or flexing in a manner that would appear to cause stress on the piping and subsequently cause leakage.

➢ ***Are pipes adequately protected against physical damage by vehicles?***

- Crash protection must be in place where piping can be subjected to vehicular traffic.

➢ ***Are pipes properly marked "vapor" or "liquid", or color coded accordingly?***

- Self-explanatory. Note: Labels are permitted to be on valves.

B. PIPE FITTINGS

➢ ***Are all flanges and fittings properly sized for the pressure rating, equal to or greater than the maximum allowable working pressure of the system?***

- Piping, flanges and fittings that can contain liquid LP-Gas, and that can be isolated by valves and require hydrostatic relief valves, must be designed for an operating pressure of 350 psig or a pressure that is equivalent to the maximum discharge pressure of any pump or any source feeding the piping system if it is greater than 350 psig.

- Otherwise, the minimum pressure rating is 250 psig for LP-Gas liquid or vapor at operating pressure over 125 psig and at or below container pressure.

- The minimum pressure rating is 125 psig for LP-Gas vapor at operating pressure of 125 psig or less.

➢ ***Are all stainless steel flex connectors in good working condition (i.e., reinforcement braid is not damaged)?***

- Check for mechanical or physical damage, excessive corrosion, cracking or bulging.

- Note: Flexible connectors should not be painted.

➢ ***Are all flow indicators and sight checks in proper working condition and leak-free?***

- Where installed, sight flow indicators must be either the simple observation type or be combined with a backflow check valve.

- Flow indicators <u>cannot</u> be constructed of cast iron.

- The sight indicators should be sufficiently clean and clear to see the flow upon liquid transfer.

- Check using a gas detector calibrated for LP-Gas or an ammonia-free leak testing (soap) solution. No gas should be detected. For the leak test solution, no bubbles should form.

- ***Are all fittings and pipes leak-free?***

  - Check the piping and fittings using a gas detector calibrated for LP-Gas or an ammonia-free leak testing (soap) solution. No gas should be detected. For the leak test solution, no bubbles should appear. Listen and smell for possible leaks.

C. HYDROSTATIC RELIEF VALVES

- ***Are hydrostatic relief valves installed in each section of piping in which liquid can be isolated between shut-off valves?***

  - Self-explanatory.

  - Hydrostatic relief valves should be fitted with rain caps to prevent moisture and debris from accumulating inside the valve.

- ***Are the hydrostatic relief valves approved for use with LP-Gas?***

  - Check the stamping on the valve body.

- ***Do the hydrostatic relief valves have pressure settings between 400 – 500 psig?***

  - Hydrostatic relief valves designed to relieve pressure in sections of liquid piping between closed shut-off valves must have pressure settings not less than 400 psig and not more than 500 psig unless installed in systems designed to operate above 350 psig. In this case, the settings must be not less than 110% or more than 125% of the system design pressure.

D. PIPING – MANUAL SHUT-OFF VALVES

- ***Are valves located so that they can be easily reached during normal operations and in an emergency?***

  - Check that valves are located so that they can be accessed and operated without the use of additional tools or equipment.

- ***Are valves in good condition and leak-free?***

  - Check for any excessive corrosion or damage to the body.

  - Check for leakage at all body seams and the stems/packing, plus the connections to the piping and hose. No gas should be detected through

normal leak testing techniques.

- Check for loose or missing hand-wheels or levers.

- Some manual shut-off valves have a small hydrostatic relief valve installed in them. If a relief valve is present, be sure the outlet is clear and unrestricted. Be sure the rain cap is in place.

➢ ***Do valves have the proper service pressure rating, equal to or greater than the maximum allowable working pressure of the container?***

- Check to make sure that the pressure rating stamped on the valve is no less than 250 psig. Again, the possible exception is that the requirement could be 200 psig associated with some specific ASME tanks built before 1950. Check the container nameplate and discuss with your supervisor if other than 250 psig rating.

E. UNDERGROUND PIPING

➢ ***Is the metallic underground piping protected against corrosion by an external coating on the piping or by cathodic protection?***

- When inspecting the portions of the underground piping system that that are visible aboveground, those portions of the coating system (e.g., paint) are not damaged.

- When taking a pipe-to-soil voltage reading, a minimum -0.85 voltage reading must be measured and maintained.

3. LIQUID PUMP

A. GENERAL

➢ ***Are pumps free of corrosion or other damage?***

- Check for excessive external corrosion or mechanical damage to the casing and drive assemblies.

➢ ***Are pump pads and/or foundations in good condition and properly supporting the pumps?***

- They should be free of excessive cracking or significant loss of the supporting materials.

- They should be level and stable, positioned so that there is no misalignment with the piping system.

- ***Are base plate bolts in place and properly securing the pump to that foundation?***
  - Self-explanatory.
- ***Are the pumps properly lubricated?***
  - Lubrication will vary depending on the type of LP-Gas pump. Check the equipment manufacturer's instructions for specific lubricants and frequency of lubrication.
- ***Are the strainers in good working condition (i.e., strainer screens free of debris) and leak-free?***
  - Isolate the strainer from the transfer system, bleed off the trapped LP-Gas and remove the cylinder and filter screen to inspect and clean to clear of particles and heavy ends.
  - Using a calibrated gas detector or a leak testing solution, check that the inlet and outlet connections and the cover are gas tight.
- ***Are the hydrostatic relief valves installed in the appropriate location and in good working order?***
  - Self-explanatory.
  - Hydrostatic relief valves should be fitted with rain caps to prevent moisture and debris from accumulating inside the valve.
- ***Are all stainless steel flex connectors in good working condition (i.e., reinforcement braid is not damaged)?***
  - Check for mechanical or physical damage, excessive corrosion, cracking or bulging.
  - Flexible connectors should not be painted.
  - Flexible connectors should not be used to compensate for misalignment with the piping or to take the place of elbows.
  - Note: Check with your supervisor regarding company policies or state/local regulations to ensure compliance before installing or servicing flexible connectors.
- ***Are fittings and piping associated with the pump leak-free?***
  - Check the piping and fittings using a gas detector calibrated for LP-Gas or a leak testing (soap) solution. No gas should be detected. For the leak test solution, no bubbles should appear. Listen and smell for possible leaks.

B. PUMP DRIVE COMPONENTS

- ***Are drive belts aligned and in good working condition?***
  - This should be done when lubrication is scheduled. Check manufacturer's literature for additional information.
  - Check belts for excessive wear, cracking or weathering.
- ***For shaft coupling-driven pumps, are shaft couplings properly aligned?***
  - Self-explanatory. Check manufacturer's literature for additional information.
- ***For shaft coupling-driven pumps, are spacing bushings in good working order?***
  - Check for excessive wear on the space bushings.
- ***For gear reduction-driven pumps, are universal joints and couplings properly aligned?***
  - Check universal joints or couplings for excessive wear.
  - Check alignment of the drive shaft, motor ad gear box. Check the mounts and securing bolts.
  - The gearbox and U-joints should be lubricated per the manufacturer's instructions.
- ***Are drive belt guards in place and secure?***
  - Self-explanatory.

C. PUMP GAUGES

- ***Are pressure gauges in good condition (i.e., 0 - 400 psig)?***
  - The gauges must be readable, functioning and leak-free.
  - Check manufacturer's literature for additional information.

D. AUTOMATIC BYPASS VALVES

- ***Are bypasses in good working condition and leak-free?***
  - An automatic bypass valve and piping circuit is required; a manual bypass circuit is optional.

- If the bypass valve or recirculating device is equipped with a shut-off valve, a secondary device is required and designed to do one of the following:
  + Operate at no more than 400 psig.
  + Operate at a pressure of 50 psig above the operating pressure when the design pressure exceeds 350 psig.

- The secondary device must be designed and installed such that:
  + It cannot be rendered inoperative.
  + It discharges into either the storage container or the pump inlet.

- Check the piping and fittings using a gas detector calibrated for LP-Gas or a leak testing (soap) solution. No gas should be detected. For the leak test solution, no bubbles should appear. Listen and smell for possible leaks.

➢ ***Are bypasses set at the appropriate pressure differential?***

- The bypass valve should be set at least 15 – 20 psig below the pump's internal relief valve setting.

- The bypass valves should not be set for a pressure higher than the differential pressure rating of the pump or higher than the maximum 125 psig differential pressure typically recommended by the manufacturer.

- To determine the automatic bypass opening setting, check the equipment manufacturer's instructions.

E. PUMP – MANUAL SHUT-OFF VALVES

➢ ***Are valves located so that they can be easily reached during normal operations and in an emergency?***

- Check that valves are located so that they can be accessed and operated without the use of additional tools or equipment.

➢ ***Are valves in good condition and leak-free?***

- Check for any excessive corrosion or damage to the body.

- Check for leakage at all body seams and the stems/packing, plus the connections to the piping and hose. No gas should be detected through normal leak testing techniques.

- Check for loose or missing hand-wheels or levers.

- Some manual shut-off valves have a small hydrostatic relief valve installed in them. If a relief valve is present, be sure the outlet is clear and unrestricted. Be sure the rain cap is in place.

- ***Do valves have the proper service pressure rating, equal to or greater than the maximum allowable working pressure of the system?***
  - Check to make sure that the pressure rating stamped on the valves is consistent with the maximum design pressure of other components in the pump discharge and bypass system.

4. BULKHEADS

A. General

- ***Are bulkheads properly protected against vehicular damage?***
  - Crash protection must be in place where LP-Gas transfer equipment can be subjected to vehicular traffic.
- ***Are bulkheads (i.e., structure and foundation) in good condition and properly supporting the bulkhead, especially in the event of an attempted pull-away?***
  - Bulkheads are normally made from steel beams and reinforced concrete. Check for excessive corrosion of the steel and mechanical damage to the concrete or rebar.

B. BULKHEADS – PIPE AND FITTINGS

- ***Are pipe nipples and couplings that are attached to the bulkhead in good working condition and free of excessive wear?***
  - Check for leakage through normal leak testing means.
  - Check the threads for excessive wear or deformation.
- ***Are all flanges and fittings properly sized for the pressure rating, equal to or greater than the maximum allowable working pressure of the system?***
  - Piping, flanges and fittings that can contain liquid LP-Gas, and that can be isolated by valves and require hydrostatic relief valves, must be designed for an operating pressure of 350 psig or a pressure that is equivalent to the maximum discharge pressure of any pump or any source feeding the piping system if it is greater than 350 psig.
  - Otherwise, the minimum pressure rating is 250 psig for LP-Gas liquid or vapor at operating pressure over 125 psig and at or below container pressure.
  - The minimum pressure rating is 125 psig for LP-Gas vapor at operating pressure of 125 psig or less.

- ***Are all stainless steel flex connectors in good working condition (i.e., reinforcement braid is not damaged)?***
  - Check for mechanical or physical damage, excessive corrosion, cracking or bulging.
  - Flexible connectors should not be painted.
- ***Are all flow indicators and sight checks in proper working condition and leak-free?***
  - Sight flow indicators must be either the simple observation type or be combined with a backflow check valve.
  - Flow indicators cannot be constructed of cast iron.
  - The sight indicators should be sufficiently clean and clear to see the flow upon liquid transfer.
  - Check using a gas detector calibrated for LP-Gas or an ammonia-free leak testing (soap) solution. No gas should be detected. For the leak test solution, no bubbles should form.
- ***Are hydrostatic relief valves installed in the appropriate location and in good working condition?***
  - Hydrostatic relief valves are designed to relieve pressure in sections of liquid piping between closed shut-off valves, and must have pressure settings not less than 400 psig and not more than 500 psig unless installed in systems designed to operate above 350 psig. In this latter case, the settings must be not less than 110% or more than 125% of the system design pressure.
  - Hydrostatic relief valves should be fitted with rain caps to prevent moisture and debris from accumulating inside the valve.
- **Are all fittings and pipes leak-free?**
  - Check the piping and fittings using a gas detector calibrated for LP-Gas or a leak testing (soap) solution. No gas should be detected. For the leak test solution, no bubbles should appear. Listen and smell for possible leaks.

C. BULKHEADS – EMERGENCY SHUT-OFF VALVES

- ***Are ESVs in good working condition and leak-free?***
  - Check for leakage at all body seams, plus the connections to the piping and hose. No gas should be detected through normal leak testing techniques.

- Test (operate) the closing feature to ensure that it will close and open the valve.

- ***Has an annual test been performed and documented as required by NFPA 58?***

  - The valves need to be tested for the following functions:
    + Automatic shutoff through thermal (fire) actuation. (Note: Check for the presence of the thermal element.)
    + Manual shutoff from a remote location.
    + Manual shutoff at the installed location.

- ***Are operating cables operating correctly?***

  - Check operating cables to make sure they can move through their entire range without binding.

  - Make sure the cable tension is not too tight since that might prevent the valve from latching properly, or vibration or jarring could cause inadvertent closure during normal transfer operations.

- ***Is the pneumatic control system in good working condition?***

  - Check the operators to ensure proper functioning (typically, through release of air or nitrogen pressure and then repressurizing).

  - The system should be checked for leaks by pressurizing the system and checking all connections with a leak detector solution. No bubbles should appear.

  - The operator should fully open and completely close the valve.

- ***Are remote emergency shutoff devices between 25 and 100 feet from the ESV and within the path of egress?***

  - Self-explanatory.

D. BULKHEADS – HOSES

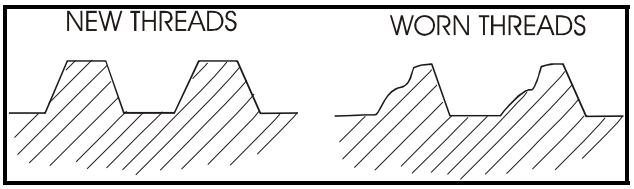
- ***Are hose covers free of exposed reinforcement?***

  - Self-explanatory.

- ***Is wire braid reinforcement free of kinks and not flattened?***

  - Self-explanatory.

- ***Are hoses free of soft spots when not under pressure, show no bulging under pressure, and have no loose outer coverings?***
  - Self-explanatory.
- ***Are hose coupling assemblies secure and in good working condition?***
  - Inspect each coupling for slippage, evidenced by misalignment of the coupling on the hose end, and/or if it is scored or exposed.
- ***Are the ACME threads, O-rings, or gaskets in good working condition (i.e., showing little sign of wear)?***
  - Check the threads on the hose end adapter or the CTMV filler connection for excessive wear to the point that the connection leaks with a new O-ring or gasket (see sketch below). The worn adapter or fitting must be replaced.



E. BULKHEADS – MANUAL SHUT-OFF VALVES

- ***Are valves located so that they can be easily reached during normal operations and in an emergency?***
  - Check that valves are located so that they can be accessed and operated without the use of additional tools or equipment.
- ***Are valves in good condition and leak-free?***
  - Check for any excessive corrosion or damage to the body.
  - Check for leakage at all body seams and the stems/packing, plus the connections to the piping and hose. No gas should be detected through normal leak testing techniques.
  - Check for loose or missing hand-wheels or levers.
  - Some manual shut-off valves have a small hydrostatic relief valve installed in them. If a relief valve is present, be sure the outlet is clear and unrestricted. Be sure the rain cap is in place.

- ***Do valves have the proper service pressure rating, equal to or greater than the maximum allowable working pressure of the system?***
  - Check to make sure that the pressure rating stamped on the valves is consistent with the maximum design pressure of other components in the pump discharge and bypass system.

5. VAPOR COMPRESSOR

A. GENERAL

- ***Are compressors free of corrosion or other damage?***
  - Check for excessive external corrosion or mechanical damage to the casing, drive assembly, suction and discharge piping, liquid trap, strainer and motor.
  - Check the cooling systems fins. They must be kept clean and the flywheel must be kept free of obstructions to allow sufficient air flow and cooling.
- ***Are compressor pads and/or foundations in good condition and properly supporting the compressors?***
  - Note: To prevent damage to the piping network from vibration, the compressor must be bolted to a solid, level foundation that will fully support both the compressor and its drive system. This is especially important with large units where heavier vibrations can be expected.
  - They should be free of excessive cracking or significant loss of the supporting materials.
  - They should be level and stable, positioned so that there is no misalignment with the piping system.
- ***Are base plate bolts in place and securing the compressor to that foundation?***
  - Self-explanatory (see note above).
- ***Are the compressors properly lubricated?***
  - Lubrication could vary depending on the compressor design and manufacturer. Check the equipment manufacturer's instructions for specific lubricants and frequency of lubrication.
  - Before starting the compressor, check the crankcase for leaks, especially around the flywheel-end of the crankshaft, the dipstick, and the breather valve assembly. When checking the breather valve assembly, be sure that it is clear and free of any dirt or trash. If any leaks are noticed, notify your supervisor.

- ***Is the crankcase oil properly filled?***
  - Check the oil level in the crankcase before each operation. If the oil level is low, check the manufacturer's instructions for the type of oil to use and the amount to add.
- ***Is the crankcase oil pressure properly set?***
  - Check the oil pressure gauge frequently during every compressor operation. If the oil pressure is unusually high or low, shut down the compressor and notify your supervisor.
- ***Has the oil filter been changed at the manufacturer's recommended interval?***
  - Self-explanatory.
- ***Are strainer elements in good working condition (i.e., strainer screens free of debris) and leak-free?***
  - Note: Compressor strainers usually have coarser screens than pump strainers. However, they must be opened and cleaned on a regular basis to prevent them from being clogged and restricting flow to the compressor.
  - While the compressor is not operating, isolate the strainer, bleed off any trapped LP-Gas and remove the cylinder and filter screen to inspect and clean.
  - Using a calibrated gas detector or a leak testing solution, check that the connections and the cover are gas tight.
- ***Are pressure relief valves installed in the appropriate location and in good working order?***
  - The discharge line of most compressors is equipped with a discharge relief valve to protect the compressor system from damage due to excessively high pressure.
  - The valve is usually set to open at a pressure of 250 psig.
  - Check the discharge relief valve regularly for leaks and be sure the inside of the valve is free from corrosion and debris that would prevent the valve from opening and closing properly.

    CAUTION: When inspecting relief valves, use an inspection mirror to check the inside of the valve. Never look directly into the outlet of any pressure relief valve.

- If found to be defective, the valve cannot be repaired and must be replaced.
- Discharge relief valves on compressors installed indoors or in enclosed spaces must be vented to the outside.

➢ ***Are stainless steel flex connectors in good working condition (i.e., reinforcement braid is not damaged)?***

- Check for mechanical or physical damage, excessive corrosion, cracking or bulging.
- Flexible connectors should not be painted.
- Flexible connectors should not be used to compensate for misalignment with the piping or to take the place of elbows.
- Note: Check with your supervisor regarding company policies or state/local regulations to ensure compliance before installing or servicing flexible connectors.

➢ ***Are all back check valves in proper working condition and leak-free?***

- Check to ensure that back check is completely shutting off any and all reverse flow.
- Check for any excessive corrosion or damage to the body.
- Check for leakage at all body seams and the stems/packing, plus the connections to the piping and hose. No gas should be detected through normal leak testing techniques.

➢ ***Are fittings and piping associated with the compressor leak-free?***

- Check the piping and fittings using a gas detector calibrated for LP-Gas or a leak testing (soap) solution. No gas should be detected. For the leak test solution, no bubbles should appear. Listen and smell for possible leaks.

B. COMPRESSOR DRIVE COMPONENTS

- ***Are drive belts properly aligned, tension properly set and in good working condition?***
  - V-belts should depress ½" to ¾" under moderate thumb pressure.
  - Check the equipment manufacturer's instructions if tension or alignment adjustments are necessary.
  - Check for belts for fraying and cracks; replace, if necessary.
- ***For direct drive compressors, are shaft couplings properly aligned and in good working condition?***
  - Self-explanatory. Check the manufacturer's instructions for additional information.
- ***Are drive belt guards in place and secure?***
  - Self-explanatory.

C. COMPRESSOR GAUGES

- ***Are pressure gauges (suction and discharge) in good condition (i.e., 0 – 400 psig)?***
  - The gauges must be readable, functioning and leak-free.
  - Check manufacturer's literature for additional information.

D. COMPRESSOR – MANUAL SHUT-OFF VALVES

- ***Are valves located so that they can be easily reached during normal operations and in an emergency?***
  - Check that valves are located so that they can be accessed and operated without the use of additional tools or equipment.
- ***Are valves in good condition and leak-free?***
  - Check for any excessive corrosion or damage to the body.
  - Check for leakage at all body seams and the stems/packing, plus the connections to the piping and hose. No gas should be detected through normal leak testing techniques.

- Check for loose or missing hand-wheels or levers.
- Some manual shut-off valves have a small hydrostatic relief valve installed in them. If a relief valve is present, be sure the outlet is clear and unrestricted. Be sure the rain cap is in place.

➢ ***Do valves have the proper pressure rating, equal to or greater than the required working pressure of the system?***

- Check to make sure that the pressure rating stamped on the valves is consistent with the maximum design pressure of other components in the compressor suction and discharge systems.

6. TANK CAR UNLOADING TOWER

A. TOWER FOUNDATIONS

➢ ***Are foundations in good condition?***

- They should be free of excessive cracking or significant loss of the supporting materials.
- They should be level and stable.

➢ ***Are footings free of settlement?***

- The footings should be level and stable, positioned so that no shifting of the tower has occurred.

B. TOWER – PIPING AND FITTINGS

➢ ***Are all flanges and fittings properly sized for the pressure rating, equal to or greater than the maximum allowable working pressure of the system?***

- Piping, flanges and fittings that can contain liquid LP-Gas, and that can be isolated by valves and require hydrostatic relief valves, must be designed for an operating pressure of 350 psig or a pressure that is equivalent to the maximum discharge pressure of any pump or any source feeding the piping system if it is greater than 350 psig.
- Otherwise, the minimum pressure rating is 250 psig for LP-Gas liquid or vapor at operating pressure over 125 psig and at or below container pressure.
- The minimum pressure rating is 125 psig for LP-Gas vapor at operating pressure of 125 psig or less.

- ***Are all stainless steel flex connectors in good working condition (i.e., reinforcement braid is not damaged)?***
  - Check for mechanical or physical damage, excessive corrosion, cracking or bulging.
  - Note: Flexible connectors should not be painted.
- ***Are all flow indicators and sight checks in proper working condition and leak-free?***
  - Where installed, sight flow indicators must be either the simple observation type or be combined with a backflow check valve.
  - Flow indicators cannot be constructed of cast iron.
  - The sight indicators should be sufficiently clean and clear to see the flow upon liquid transfer.
  - Check using a gas detector calibrated for LP-Gas or an ammonia-free leak testing (soap) solution. No gas should be detected. For the leak test solution, no bubbles should form.
- ***Are hydrostatic relief valves installed in the appropriate location and in good working condition?***
  - Check sections of liquid lines between shut-off valves for the presence of these valves.
  - Check regularly for leaks and inspect to ensure the valve is free from corrosion and debris that could prevent the valve from opening and closing properly.
  - Hydrostatic relief valves designed to relieve pressure in sections of liquid piping between closed shut-off valves must have pressure settings not less than 400 psig and not more than 500 psig.
  - Hydrostatic relief valves should be fitted with rain caps to prevent moisture and debris from accumulating inside the valve.
- ***Are all fittings and pipes leak-free?***
  - Check the piping and fittings using a gas detector calibrated for LP-Gas or an ammonia-free leak testing (soap) solution. No gas should be detected. For the leak test solution, no bubbles should appear. Listen and smell for possible leaks.

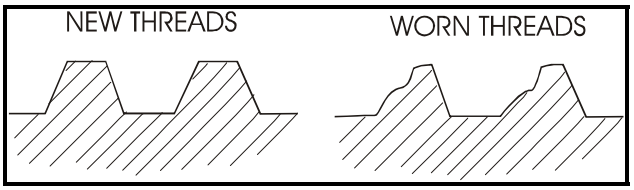
C. TOWERS – EMERGENCY SHUT-OFF VALVES (ESVs)

- ***Are ESVs in good working condition and leak-free?***
  - Check for leakage at all body seams, plus the connections to the piping and hose. No gas should be detected through normal leak testing techniques.
  - Test (operate) the closing feature to ensure that it will close and open the valve.
- ***Are ESVs and/or back checks (including thermal release) on riser ends of the liquid hoses in good working condition?***
  - Test (operate) the closing feature to ensure that it will close and open the ESV.
  - Check to ensure that back check is fully functional.
  - Check for any excessive corrosion or damage to the body.
  - Check for leakage at all body seams and the stems/packing, plus the connections to the piping and hose. No gas should be detected through normal leak testing techniques.
- ***Are ESVs and/or back checks (including thermal release) on riser ends of the vapor hose in good working condition?***
  - Test (operate) the closing feature to ensure that it will close and open the ESV.
  - Check to ensure that back check is fully functional.
  - Check for any excessive corrosion or damage to the body.
  - Check for leakage at all body seams and the stems/packing, plus the connections to the piping and hose. No gas should be detected through normal leak testing techniques.
- ***Has an annual test been performed and documented as required by NFPA 58?***
  - The valves need to be tested for the following functions:
    + Automatic shutoff through thermal (fire) actuation. (Note: Check for the presence of the thermal element.)
    + Manual shutoff from a remote location.
    + Manual shutoff at the installed location.

- ***Is the pneumatic control system in good working condition?***
  - Check the operators to ensure proper functioning (typically, through release of air or nitrogen pressure and then repressurizing).
  - The system should be checked for leaks by pressurizing the system and checking all connections with a leak detector solution. No bubbles should appear.
  - The operator should fully open and completely close the valve.
- ***Are remote emergency shutoff devices between 25 and 100 feet from the ESV and within the path of egress?***
  - Self-explanatory.

D. TOWER – HOSES AND LOADING ARM

- ***Are hose covers free of exposed reinforcement?***
  - Self-explanatory.
- ***Is wire braid reinforcement free of kinks and not flattened?***
  - Self-explanatory.
- ***Are hoses free of soft spots when not under pressure, show no bulging under pressure, and have no loose outer coverings?***
  - Self-explanatory.
- ***Are hose coupling assemblies secure and in good working condition?***
  - Inspect each coupling for slippage, evidenced by misalignment of the coupling on the hose end, and/or if it is scored or exposed.
- ***Are the ACME threads, O-rings, or gaskets in good working condition (i.e., showing little sign of wear)?***
  - Check the threads on the hose end adapter or the CTMV filler connection for excessive wear to the point that the connection leaks with a new O-ring or gasket (see sketch below). The worn adapter or fitting must be replaced.



- ***Are loading arms leak-free and in good working condition?***
  - See equipment manufacturer's instructions for leak testing and preventative maintenance/inspection requirements.
- ***Are loading arms swing joints properly lubricated?***
  - See equipment manufacturer's instructions for the proper lubricant(s) and the frequency of lubrication.
- ***Are all factory installed protective guards in place and secure?***
  - See equipment manufacturer's instructions for the required guards and check to ensure they are in place.

E. TOWER – MANUAL SHUT-OFF VALVES

- ***Are valves located so that they can be easily reached during normal operations and in an emergency?***
  - Check that valves are located so that they can be accessed and operated without the use of additional tools or equipment.
- ***Are valves in good condition and leak-free?***
  - Check for any excessive corrosion or damage to the body.
  - Check for leakage at all body seams and the stems/packing, plus the connections to the piping and hose. No gas should be detected through normal leak testing techniques.
  - Check for loose or missing hand-wheels or levers.
  - Some manual shut-off valves have a small hydrostatic relief valve installed in them. If a relief valve is present, be sure the outlet is clear and unrestricted. Be sure the rain cap is in place.
- ***Do valves have the proper pressure rating, equal to or greater than the required working pressure of the system?***
  - Check to make sure that the pressure rating stamped on the valves is no less than 250 psig.

7. SCALES

A. GENERAL

- ***Has the scale(s) been checked periodically using a certified/standard dead weight?***
  - Check with your supervisor regarding the frequency of checking the scale(s).
  - The certified or standard dead weight should be approximately equal to the typical tare weight of the cylinders being filled plus the LP-Gas contents of one of these cylinders.
- ***Is the scale(s) properly calibrated and been certified by the proper authority having jurisdiction?***
  - Check the scale manufacturer's instructions for their calibration procedure.
  - In most states and jurisdictions, scales must bear current certification decals from weights and measures officials.
- ***Have all loops, pivots and bearings been periodically lubricated?***
  - Check the scale manufacturer's instructions for lubrication requirements.
  - Note: Do not use oil on scale parts unless instructed to do so by the scale manufacturer.
- ***Are the scale pit(s) and/or platform(s) free of any debris?***
  - Check for accumulation of snow, ice, leaves and other debris that could cause the scale platform to bind and produce an inaccurate scale reading.
  - Check and clean these areas frequently.

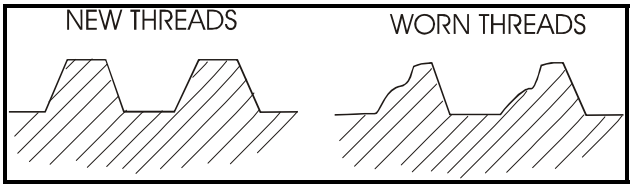
B. AUTOMATIC SHUT-OFF SYSTEM

- ***Are all actuators and control valves leak-free and in good working condition (i.e., proper fluid levels and proper alignment with scale)?***
  - Self-explanatory.
  - Also check scale manufacturer's instructions for any specific or unique requirements and instructions.

- ***Are all sensing lines leak-free and in good working condition (i.e., free of kinks and proper alignment with the scale)?***
  - Self-explanatory.

C. HOSES

- ***Are hose covers free of exposed reinforcement?***
  - Self-explanatory.
- ***Is wire braid reinforcement free of kinks and not flattened?***
  - Self-explanatory.
- ***Are hoses free of soft spots when not under pressure, show no bulging under pressure, and have no loose outer coverings?***
  - Self-explanatory.
- ***Are hose coupling assemblies secure and in good working condition?***
  - Inspect each coupling for slippage, evidenced by misalignment of the coupling on the hose end, and/or if it is scored or exposed.
  - Inspect for loose or missing bolts or fastenings on bolted hose coupling assemblies.
- ***Are the ACME threads, O-rings, or gaskets in good working condition (i.e., showing little sign of wear)?***
  - Check the threads on the hose end adapter or the CTMV filler connection for excessive wear to the point that the connection leaks with a new O-ring or gasket (see sketch below). The worn adapter or fitting must be replaced.



8. METERS (For Retail Sales Only)

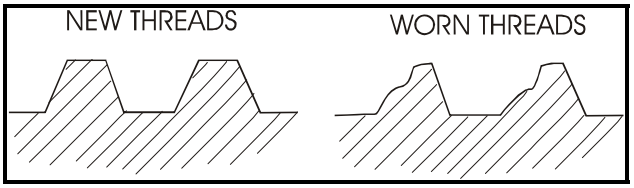
A. GENERAL

- ***Is the meter properly calibrated or "proved" at the appropriate time intervals?***
  - In most states, meter proving is under the jurisdiction of a state-level government authority such as the Bureau of Weights and Measures.
  - The responsible agency places a seal on the meter when it has been proved and found to be accurate.
  - Note: Many state and local codes require companies to recalibrate meters on a regular basis. Generally, this is accomplished by filling a volumetric prover (a tank of certified capacity) through the meter being tested. The reading on the meter is then compared to the quantity of LP-Gas in the prover and the meter adjusted accordingly. Only personnel who are properly trained and qualified to prove meters should do so.
- ***Is the seal(s) in place by the appropriate authority having jurisdiction?***
  - Check to see that the seal is not broken. If broken, the meter must be proved again and resealed before it is placed back into service.
- ***Is the meter in good working condition and free of leaks?***
  - Be alert for erratic meter operation, obvious over or under registration, increasingly noisy operation and excessively low delivery rates.
  - Check the seal that is either on the input or the output shaft of the gear train to prevent the LP-Gas from leaking out of the meter body and entering the register. The seal is usually a U-shaped packing or O-ring that fits around the drive shaft and is designed to be replaceable in case it begins to leak.

B. HOSES

- ***Are hose covers free of exposed reinforcement?***
  - Self-explanatory.
- ***Is wire braid reinforcement free of kinks and not flattened?***
  - Self-explanatory.

- ***Are hoses free of soft spots when not under pressure, show no bulging under pressure, and have no loose outer coverings?***
  - Self-explanatory.
- ***Are hose coupling assemblies secure and in good working condition?***
  - Inspect each coupling for slippage, evidenced by misalignment of the coupling on the hose end, and/or if it is scored or exposed.
- ***Are the ACME threads, O-rings, or gaskets in good working condition (i.e., showing little sign of wear)?***
  - Check the threads on the hose end adapter or the CTMV filler connection for excessive wear to the point that the connection leaks with a new O-ring or gasket (see sketch below). The worn adapter or fitting must be replaced.



- ***Are pull-away couplings in place and in good working condition?***
  - Check that the breakaway device is UL 567 approved (*Standard Pipe Connectors for Flammable and Combustible Liquids and LP-Gas*) and is capable of retaining liquid on both sides of the breakaway point. If this not the case, check with your supervisor and determine whether there is a device in place that provides equivalent protection and has been approved by the authority having jurisdiction.

9. VAPORIZERS

A. GENERAL

- ***Is the vaporizer(s) leak-free and in good working condition?***
  - The specific inspection steps will vary depending on the type of device being used to heat the liquid LP-Gas and the manufacturer's design. Refer to the equipment manufacturer's instructions for inspection requirements and procedures.

- ***Have pilot lights been cleaned on a regular basis?***
  - Refer to the equipment manufacturer's instructions for the frequency and instructions for inspecting and cleaning pilots.
- ***On a periodic basis, have all strainers been cleaned at the inlet side of the vaporizer(s)?***
  - Refer to the equipment manufacturer's instructions for the instructions and suggested frequency for inspecting and cleaning strainers.
- ***Have heavy ends been cleaned from the vaporizer?***
  - Refer to the equipment manufacturer's instructions for the instructions and suggested frequency for cleaning heavy ends from the vaporizer.
- ***Have the burner openings, thermostat and flue been cleaned?***
  - Self-explanatory.
- ***Is the vaporizer(s) located in accordance with NFPA 58?***
  - Vaporizers are generally installed outdoors. If the vaporizer is installed in a separate or attached structure, check with your supervisor for the specific requirements in Chapter 10 of NFPA 58 that are associated with the type of vaporizer in use.
  - Vaporizing burners must be installed outside of buildings, per NFPA 58. The minimum separation distance between a burner and container having >2,000 gallons water capacity is 50 feet. The minimum distance between a burner and container ≤500 gallons is 10 feet, and 25 feet for containers in the 501 – 2,000 gallon range.

10. REGULATORS

A. GENERAL

- ***Is the first-stage or high-pressure regulator directly attached by flexible connectors to the vaporizer outlet or to the interconnected piping of manifolded vaporizers?***
  - Self-explanatory. (Exception: Flexible connectors are not required for first-stage regulators that are installed downstream of high pressure regulators.)

- ***Are all first-stage and high-pressure regulators installed outside of buildings?***
  - Self-explanatory.
- ***Are all regulators that are outside of buildings installed and protected so that their operation will not be affected by environmental elements (e.g., freezing rain, sleet, snow, ice, mud or debris) or insects?***
  - The regulator must be installed such that the vent is protected against water accumulation in the form of rain, sleet, snow, mud or ground water. Typically, vents and pipe-aways are pointed downward and the opening protected with a screen.
  - The vent must be open to the atmosphere.
  - The bonnet cap must be in place and tightened.
- ***Is the point of discharge on the regulator's relief device at least 3 feet horizontally away from any building opening that is below the level of the discharge?***
  - Self-explanatory.
- ***Is the point of discharge on the regulator's relief device located at least 5 feet in any direction from any source of ignition or mechanical ventilation air intakes?***
  - Self-explanatory.

11. ELECTRICAL SYSTEMS

A. GENERAL

- ***Are all electrical components and wiring in compliance with Table 6.20.2.2 (Electrical Area Classification) in NFPA 58-2004?***
  - To accurately check ignition source control through assessment of the installation of electrical equipment, you should be knowledgeable of the requirements in the NFPA 58 Electrical Classification Table in Chapter 6. Also, you need to be familiar with the definitions of electrical classes, groups and divisions in NFPA 70, *National Electric Code*.
  - When classifying the extent of a hazardous area, consider the possible variations in the spotting of railroad tanks cars and CTMVs at the unloading points.

- ***Are electrical control switches and wiring in compliance with Class1, Group D, Division 1 or 2 (where applicable) and in compliance with Table 6.20.2.2 (Electrical Area Classification) in NFPA 58-2004?***
  - See comment in the previous guideline.
- ***Are pump and/or compressor switches readily accessible to the operator?***
  - Generally, NFPA 58-2004 simply requires that a pump or compressor operating control or disconnect switch be "located nearby", as stated in Chapter 6. For dispensers, see the fifth item in this checklist series.
- ***Are electrical controls for equipment clearly marked or color-coded to indicate the on and off (stop) positions?***
  - The designated color (by OSHA) for the off (or stop) position is **red**.
- ***Is the electrical emergency shutdown located not more than 20 feet (but less than 100 feet) from any dispensing devices, and prominently labeled?***
  - This is a specific requirement in Chapter 6 of NFPA 58 for dispensers.
  - The markings for the switches (or breakers) must be visible at the point of liquid transfer.
- ***Is electrical wiring in Division 1 or 2 areas installed in rigid conduit? Class1, Group D in flexible sections?***
  - Self-explanatory. Check with your supervisor if you need additional information regarding electrical area classifications.
- ***For electric motors, are flexible connectors Class1, Group D, Division 1 or 2 where applicable?***
  - Self-explanatory. Check with your supervisor if you need additional information regarding electrical area classifications.
- ***Are all seal-off fixtures filled with suitable putty and installed in the appropriate locations?***
  - A conduit seal-off fixture filled with a suitable putty must be installed within 18 inches of any spark producing device within a Hazardous Classified Location, unless the enclosure is outfitted with a factory seal at the conduit connection.
  - A conduit seal-off fixture filled with a suitable putty must be installed where a conduit is entering or leaving a Hazardous Classified Location (i.e., between the Hazardous Classified Location dispenser area and the main electrical supply) in order to prevent LP-Gas vapor from entering open wiring.

Section Purpose and Objectives

This section of the Handbook provides owners or operators of LP-Gas bulk plants with an introduction and general guidance for complying with the requirements of NFPA 58-2004 for maintaining fire protection equipment, as defined in Chapter 14 (§14.3.3).

References

- NFPA 10, *Standard for Portable Fire Extinguishers,* 2002 Edition
- NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems,* 2002 Edition

General Requirements

Facilities must prepare and implement a program for all plant fire protection equipment. Maintenance activities of fire protection equipment must be scheduled so that a minimum of equipment is taken out of service at any time and is returned to service in a reasonable time period. NFPA has not defined what “minimum” and “reasonable” mean in terms of number and length of time. Therefore, site management should make every effort to meet the intent of the requirement.

8.1 Portable Fire Extinguishers

Portable fire extinguishers must be maintained in accordance with NFPA 10, *Standard for Portable Fire Extinguishers.*

Since NFPA 10 provides the detailed requirements regarding the placement, maintenance, inspection and recharging, this handbook section simply provides an overview of the basic requirements for placement, maintenance and inspection of fire extinguishers such that LP-Gas marketers and distributors have a familiarity with the basic requirements. Additionally, a sample maintenance and inspection recordkeeping list is provided.

Summary of Requirements

a) Where cylinders of 1000 lb water capacity or less are stored and are awaiting use, resale or exchange, the following fire protection requirements apply:

- At least one approved portable fire extinguisher with a capacity of 18 pounds dry chemical with a B:C rating must be provided if the aggregate quantity of LP-Gas stored is more than 720 pounds.

- Each required fire extinguisher must be located no more than 50 ft from the storage location. (*Note: Where fire extinguishers have more then one letter classification, they can be considered to satisfy the requirements of that letter.*)

b) Fire extinguishers must be located, identified, and be readily accessible to all employees.

c) A fire extinguisher must be on each vehicle that transports a hazardous material (LP-Gas).

d) Each fire extinguisher must be maintained in a fully charged and operable condition at all times.

e) Each fire extinguisher must be visually inspected monthly by a designated employee. Each monthly inspection must be recorded on a tag or label affixed to the fire extinguisher, showing the date of inspection and initials of inspector.

f) An annual maintenance check must be performed on each fire extinguisher by an authorized service company. Each maintenance check must be recorded on a label affixed to the extinguisher by the service company.

g) Each location must maintain a record of the monthly inspections and annual maintenance, and retain this record for one year after the last entry or the life of the shell of the extinguisher, whichever is less (see sample Chart 8.1).

h) Each location must provide training to all employees upon initial hiring and at least annually thereafter to familiarize them with the general principles and proper operation of the fire extinguisher.

Chart 8.1 (Sample)
Maintenance & Inspection Record
Portable Fire Extinguishers

Company: _____ ***Location:*** _____ ***Year:*** _____

Extinguisher *(# or Location)*	**Inspection or Maintenance Performed** *(Monthly / Annual)*	**Corrective Action**	**Qualified Individual or Certifying Company Name** *(as applicable)*	**Date**	**Signature** *(Owner Rep.)*

8.2 Water-Base Fire Protection Systems

Water-base automatic fire extinguishers must be maintained in accordance with NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Base Fire Protection Systems.*

Water-base fire protection systems are designed and built by various manufacturers and construction firms. Since they are usually unique in design and operation, manufacturer recommendations should be consulted for testing and maintenance.

The following information and material are provided for those plants where water-base fire protection systems have been installed due to jurisdictional requirements.

Summary of Requirements

a) NFPA 25 stipulates the required testing and maintenance items. These requirements will be dependent upon the type and design of the systems that have been installed.

b) These inspections and maintenance requirements are required to be performed on a daily, weekly, monthly, quarterly or annual basis, depending on the specific type of system and components utilized in system.

c) Annual inspections of all types of systems must be performed by a qualified individual.

d) Records of the inspection and maintenance (including repairs) must be maintained at the location (see sample Chart 8.2).

Chart 8.2 (Sample)
Maintenance & Inspection Record
Water-Base Fire Protection Systems

Company: _____ ***Location:*** _____ ***Year:*** _____

Equipment Description	Procedure Performed	Qualified Individual or Certifying Company Name	Date	Signature *(Owner Rep.)*

Section Purpose

Section 7 of this handbook provided a checklist of maintenance and inspection procedures for maintaining the mechanical integrity of LP-Gas Systems. As mentioned previously, maintenance and inspection procedures are typically similar at LP-Gas bulk storage facilities and large-volume storage/vapor distribution systems. However, equipment can vary in capacity, design or complexity. Therefore, all equipment inspections and maintenance procedures should be conducted as specified in the equipment manufacturers' instructions.

Manufacturer's literature provides the recommended procedures for operations, maintenance and repairs on equipment specific to your facility.

Owners and managers/supervisors must obtain that information and include it within this section of this handbook for ready reference and use by operators, technicians, drivers and other personnel in carrying out their responsibilities.

Bulk plant personnel should review this information to determine the appropriate action to take when operating equipment or performing equipment inspections, maintenance and repairs.

► ACTION ◄

ADD YOUR COMPANY AND/OR THE MANUFACTURERS' EQUIPMENT INFORMATION THAT IS SPECIFIC TO YOUR LP-GAS BULK STORAGE FACILITY.

The documents, or portions of them, that are listed in this appendix are referenced in or used to perform the procedures noted in one or more sections within this handbook.

- ☐ American Petroleum Institute, API-ASME *Code for Unfired Pressure Vessels for Petroleum Liquids and Gases*, Pre-July 1, 1961.

- ☐ American Society of Mechanical Engineers, "Rules for the Construction of Unfired Pressure Vessels," Section VIII, *ASME Boiler and Pressure Vessel Code*, 2001.

- ☐ Association of American Railroads, *Field Manual of the Interchange Rules (#70, 88, 89, and 90)*.

- ☐ Association of American Railroads, *Manual of Standards and Recommended Practices, Section c, Part III, Specifications for Tank Cars, (M-1002)*.

- ☐ Canadian General Standards Board, CAN/CGSB 43.147-2005, *Construction, Modification, Qualification, Maintenance and Selection and Use of Means of Containment for the Handling, Offering for Transport, or Transporting of Dangerous Goods by Rail*.

- ☐ Compressed Gas Association, CGA C-6, *Standard for Visual Inspection of Steel Compressed Gas Cylinders*, 1993.

- ☐ Compressed Gas Association, ANSI/CGA C-6.3, *Guidelines for Visual Inspection and Requalification of Low Pressure Aluminum Compressed Gas Cylinders*, 1991.

- ☐ Compressed Gas Association, ANSI/CGA C-7, *Guide to the Preparation of Precautionary Labeling and Markings of Compressed Gas Containers*, 2000.

- ☐ National Fire Protection Association, NFPA 10, *Standard for Portable Fire Extinguishers*, 2002 Edition.

- ☐ National Fire Protection Association, NFPA 25, *Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems*, 2002 Edition.

- ☐ National Fire Protection Association, NFPA 58, *Liquefied Petroleum Gas Code*, 2004 Edition.

- ☐ National Fire Protection Association, NFPA 58, *Liquefied Petroleum Gas Code*, 2001 Edition.
- ☐ National Fire Protection Association, NFPA 58, *Liquefied Petroleum Gas Code*, 1995 Edition.
- ☐ National Fire Protection Association, NFPA 70, *National Electric Code®*, 2002 Edition.
- ☐ National Propane Gas Association, *Certified Employee Training Program*, 2nd Edition, Modules 1.0 - 4.2.
- ☐ Propane Education & Research Council, *Dispensing Propane [Safely],* 2005 Edition.
- ☐ U.S. Government Publication, Occupational Health and Safety Administration, OSHA Publication 3072, *Sling Safety,* 1996 Revision.
- ☐ U.S. Government Publication, Title 21, Code of Federal Regulations, “Food and Drugs”, Chapter I, Part 184.1655.
- ☐ U.S. Government Publication, Title 29, Code of Federal Regulations, “Labor”, Part 1910, *General Industry Standards.*
- ☐ U.S. Government Publication, Title 40, Code of Federal Regulations, “Protection of Environment.”
- ☐ U.S. Government Publication, Title 49, Code of Federal Regulations, “Transportation”, Subtitle B.