

ADMIN-4 Inspection and Testing

Table of Contents

1.0 INSPECTION AND TESTING 2

 A. INSPECTION/EXAMINATION 2

 B. TESTING 3

2.0 INSPECTION AND TESTING INTERVALS 5

 A. VESSEL INSPECTIONS 5

 B. RELIEF DEVICES 8

 C. PIPING..... 11

 D. FLEX HOSES..... 11

 E. PRESSURE REGULATORS 12

3.0 DOT, IM, AND UM PORTABLE TANKS..... 12

 A. GENERAL INFORMATION 12

 B. SPECIAL INSTRUCTIONS FOR DOT-4L CRYOGENIC CYLINDERS 12

 C. INSPECTION FREQUENCIES 12

4.0 MOBILE PRESSURE SYSTEMS AND TRANSPORT TANKS..... 14

 A. DEFINITIONS..... 14

 B. PROCUREMENT..... 15

 C. PRESSURE RELIEF DEVICES 15

 D. PIPING, VALVES, AND FITTINGS..... 16

 E. PRESSURE SYSTEM DOCUMENTATION PACKAGE 16

 F. REPAIRS AND ALTERATIONS..... 16

 G. TESTS AND INSPECTIONS..... 16

5.0 ATTACHMENTS 16

 ADMIN-4-1 PRESSURE VESSEL INSPECTION AND TEST PROCEDURE 16

 ADMIN-4-2 HOSE ASSEMBLY INSPECTION GUIDANCE 16

 ADMIN-4-3 PRESSURE REGULATOR MAINTENANCE GUIDANCE 16

RECORD OF REVISIONS

Rev	Date	Description	POC	RM
0	9/17/14	Initial issue; revision of material formerly in Section I, rev. 3.	Ari Ben Swartz, <i>ES-EPD</i>	Larry Goen, <i>ES-DO</i>
1	11/18/15	Clarified testing for all systems (1.0.B.2.3). In 2.0, added articles on multi-walled and cryo vessels and piping.	Ari Ben Swartz, <i>ES-EPD</i>	Larry Goen, <i>ES-DO</i>

Contact the Standards POC for upkeep, interpretation, and variance issues.

Chapter 17	<u>Pressure Safety POC and Committee</u>
-------------------	----------------------------------------------------------

This document is online at <http://engstandards.lanl.gov>

1.0 Inspection and Testing

A. Inspection/Examination

NOTE: It is the responsibility of the designer, the manufacturer, the fabricator, and the erector, as applicable, to prepare the records as required for inspections and testing that are defined by the most applicable ASME code.¹

1. Pressure systems must be examined as defined by the applicable ASME code prior to service.
2. Examination activities to verify the quality of the work must be performed by persons other than those who performed the activity being examined. Such persons must not report directly to the immediate supervisors responsible for the work being examined.
3. The designer of a pressure system or component must define the examination requirements to meet or exceed those required by the applicable ASME code. Examination documents must be maintained in the pressure system documentation package. Examination methods must be specified in the engineering design, and must define type, extent and acceptance requirements for the following methods, as instructed by the ASME Code:
 - a. Visual inspection
 - b. Magnetic particle examination
 - c. Liquid penetrant examination
 - d. Radiographic examination
 - e. Ultrasonic examination

¹ Example: ASME B31.3 Paragraph 346.

ADMIN-4 Inspection and Testing

- f. In-process weld examination
- 4. The designer must identify the minimum requirements of examination as defined by the code.
 - a. The manufacturer, fabricator or builder must perform examinations as required by the design documents and applicable code.
 - b. The fabrication, repair, or alteration documentation must have evidence of the examination; evidence must be maintained in the pressure system documentation package.
 - c. Where in-process weld examinations are substituted for RT or UT as allowed by ASME B31.3 Paragraph 341.4.3(3)(c), the in-process examination must be documented with the appropriate information as required by ASME B31.3, Paragraph 344.5 and this documentation must be maintained with the pressure system documentation package.
 - d. The Initial Service Leak Test specified in ASME B31.3 para. 345.7 may be applied for ASME B31.3 Category D fluids in low volume piping systems built from rigid tubing and listed tubing fittings or CPSO-approved alternative fittings with non-welded connections.

B. Testing

NOTE: The following testing criteria references B31.3 requirements; however, use the most applicable B31 code requirements in the event of conflict.²

- 1. Pressure systems must be pressure tested prior to service as defined in the applicable ASME code.
- 2. Pressure systems must be tested as defined by the code of record. *For existing systems, LANL Master Spec Section 22 0813 may need to be adapted for this purpose.*
- 3. Piping systems must undergo an initial leak check, and initial pressure qualification test as defined in B31.3 Chapter VI, Paragraph 345 (Testing) prior to being placed in service (or as defined in B31.1 Chapter VI). Test may be either pneumatic or hydrostatic, and must conform to the following:
 - a. A written procedure must be generated to instruct the test. Tests must be recorded and maintained in the pressure system documentation package.
 - b. The pressure of the leak test must be gradually increased in no less than three graduations, checking for leaks between each graduation.
 - c. All joints, including welds and bonds, are to be left un-insulated, and exposed for examination during leak testing (pressure qualification test).
 - d. Pneumatic pressure qualification tests must be conducted from a remote location with positive control of personnel access. After the test is completed, the system pressure must be reduced to MAWP, at which time personnel may then access the system.

² B31.3-based requirements are presented because the majority of LANL piping systems fall within the scope of B31.3 as defined in B31.3, paragraph 300.1.1

ADMIN-4 Inspection and Testing

- e. Test pressure for the pressure qualification test of pressure systems must not be less than 150% the design pressure for hydrostatic tests, and 110% for pneumatic tests as defined in ASME B31.3 Para's 345.4 and 345.5.
 - f. Hydrostatic tests must be performed with water. If water is not suitable (could freeze, or cause adverse effects to piping or process), another suitable non-toxic liquid may be used.
 - g. Test instrumentation used to meet the requirements of this document and codes must be calibrated by the manufacturer or LANL Calibration Lab.
 - h. The pressure of the qualification test must be maintained for at least 10 minutes.
 - i. Test procedures and results must be maintained in the system documentation package.
4. A modified initial service leak test of LANL legacy systems is allowed.
- a. The initial service leak test shall be conducted at normal system operational pressure.
 - b. The entire system shall be inspected for leak tightness at the normal system operational pressure. However, it is not required for portions of the system that are inaccessible to be inspected. Removal of external insulation is not required. Evidence of leakage in the insulation shall be cause for failure.
 - c. The leak test shall be for a minimum of 10 minutes.
 - d. Leak testing shall not be performed when metal temperatures are near the ductile-brittle transition temperature, as that may lead to brittle fracture.
 - e. Testing methods and results may be documented in multiple formats, but must be referenced and readily available for review. This information shall be considered a record and shall be included in the pressure system certification package.
5. The pneumatic or pneumatic/hydrostatic leak test in accordance with ASME B31.3 para. 345.5 may be applied to LANL systems for all ASME B31.3 fluid services except High Pressure. Pressure testing may not be done with reactive gas, flammable gas, Category M fluids, or radioactive gas, but testing with an inert substitute gas is allowed. Test volume is limited to approximately 2 cubic feet of volume not including the gas supply system.³
6. Application of ASME B31.3 345.5.2 Pressure Relief Device "A pressure relief device shall be provided, having a set pressure not higher than the test pressure plus the lesser of 345 kPa (50 psi) or 10% of the test pressure when design pressure is less than the piping component MAWP.
- a. The owner or owner's representative must have approved a pneumatic or hydrostatic-pneumatic test in accordance with B31.3.
 - b. The pressure system supplying the test gas shall have adequate relief protection to ensure the piping component MAWP is not exceeded.
 - c. If the first and second requirements above are satisfied then a relief device is not required if the test pressure is not above the MAWP of the piping components.

³ VAR-2012-014.1

ADMIN-4 Inspection and Testing

Example: The tubing MAWP is 2199 psig. The pressure testing supply gas has an adequately supplied relief valve set at 200 psig. The design pressure is 100 psig. No additional relief protection is required.

- 7. Rad Liquid Waste: The Owner has elected to treat RLW as B31.3 Normal Fluid Service and testing must be done accordingly; paragraph 345.1 (a) is not applicable.

2.0 Inspection and Testing Intervals

All inspection and testing intervals shall be fixed. All inspection and test intervals are granted a grace period of 90 days for performance of the requirement.

A. Vessel Inspections

- 1. Use the following tables for determining the inspection intervals for pressure vessels.⁴
- 2. Perform vessel inspections per ESM Chapter 17 ADMIN-4-1, Pressure Vessel Inspection and Test, using CPSO-approved organization (e.g., AET-6).

Table ADMIN-4-1 Pressure Vessels Exempt from Mandatory Periodic Test/Inspection⁵

Vessels listed as exempt from the scope of ASME Section VIII, Division 1 – 2007 with 2009 addendum shown others are similar. Use most current version of ASME Section VIII, Division 1 for latest exempt vessel list.

U-1(c)(2) Based on the Committee’s consideration, the following classes of vessels are not included in the scope of this Division; however, any pressure vessel which meets all the applicable requirements of this Division may be stamped with the Code U Symbol:

- (a) those within the scope of other Sections;
- (b) fired process tubular heaters;
- (c) pressure containers which are integral parts or components of rotating or reciprocating mechanical devices, such as pumps, compressors, turbines, generators, engines, and hydraulic or pneumatic cylinders where the primary design considerations and/or stresses are derived from the functional requirements of the device;
- (d) except as covered in U-1(f), structures whose primary function is the transport of fluids from one location to another within a system of which it is an integral part, that is, piping systems;
- (e) piping components, such as pipe, flanges, bolting, gaskets, valves, expansion joints, fittings, and the pressure containing parts of other components, such as strainers and devices which serve such purposes as mixing, separating, snubbing, distributing, and metering or controlling flow, provided that pressure containing parts of such components are generally recognized as piping components or accessories;
- (f) a vessel for containing water⁶ under pressure, including those containing air the compression of which serves only as a cushion, when none of the following limitations are exceeded:

⁴ Bases for frequencies documented in EM Ref-59. (EMRef is a Standards Program system for maintaining references/bases)

⁵ Based on API 510-2006, *Pressure Vessel Inspection Code: Inspection, Rating, Repair, and Alteration*, App A on exempted systems, with Section VIII Div 1 (pp 2-3, 2007) wording substituted for API’s paraphrasing. PSO may choose to require inspection regardless of any exemption.

ADMIN-4 Inspection and Testing

- (1) a design pressure of 300 psi (2 MPa);
- (2) a design temperature of 210°F (99°C);
- (g) a hot water supply storage tank heated by steam or any other indirect means when none of the following limitations is exceeded:
 - (1) a heat input of 200,000 Btu/hr (58.6 kW);
 - (2) a water temperature of 210°F (99°C);
 - (3) a nominal water containing capacity of 120 gal (450 L);
- (h) vessels not exceeding the design pressure...at the top of the vessel, limitations below, with no limitation on size [see UG-28(f), 9-1(c)]:
 - (1) vessels having an internal or external pressure not exceeding 15 psi (100 kPa);
 - (2) combination units having an internal or external pressure in each chamber not exceeding 15 psi (100 kPa) and differential pressure on the common elements not exceeding 15 psi (100 kPa) [see UG-19(a)];
- (i) vessels having an inside diameter, width, height, or cross section diagonal not exceeding 6 in. (152 mm), with no limitation on length of vessel or pressure;
- (j) pressure vessels for human occupancy.⁷

Table ADMIN-4-2 Inspection Frequencies for Non-Exempt Pressure Vessels

Service	External + wall thickness (e.g., ultrasonic)	Internal
Corrosive	3	5
Non-corrosive	5 ⁸	10 ⁹

⁶ The water may contain additives provided the flash point of the aqueous solution at atmospheric pressure is 185°F or higher. The flash point must be determined by the methods specified in ASTM D 93 or in ASTM D 56, whichever is appropriate

⁷ Requirements for pressure vessels for human occupancy are covered by ASME PVHO-1

⁸ The requirement for wall thickness measurement of vessels in non-corrosive service may be waived if inspection data indicates that no wall thinning is occurring.

⁹ Except where API 510 or NBIC allows on-stream [external and wall thickness] in lieu of internal inspection (excerpt below from API 510-2006 Para 6.5.2.1): At the discretion of the inspector, an [external and wall thickness] inspection may be substituted for the internal inspection in the following situations:

- a. When size or configuration makes vessel entry for internal inspection physically impossible.
- b. When vessel entry for internal inspection is physically possible and **all** of the following conditions are met:
 - 1. The general corrosion rate of a vessel is known to be less than 0.005 in. (0.125 mm) per year.
 - 2. The vessel remaining life is greater than 10 years.
 - 3. The corrosive character of the contents, including the effect of trace components, has been established by at least five years of the same or similar service.
 - 4. No questionable condition is discovered during the External inspection.
 - 5. The operating temperature of the steel vessel shell does not exceed the lower temperature limits for the creep-rupture range of the vessel material.
 - 6. The vessel is not subject to environmental cracking or hydrogen damage from the fluid being handled.
 - 7. The vessel does not have a non-integrally bonded liner such as strip lining or plate lining.

ADMIN-4 Inspection and Testing

3. Boilers: One exception to the above inspection intervals is boilers. Boilers must be inspected according to New Mexico Administrative Code (NMAC) [14.9.4.25](#), “Inspection Methods and Frequency.” A certificate of inspection may be issued with an external inspection; however, an internal inspection must be made within six months of the external inspection.¹⁰
 - a. When the construction does not permit an internal inspection, one external inspection annually is required.
 - b. Annual internal inspection is required for high-pressure boilers and high pressure steam generators.
 - c. Every 24 months an external and internal inspection must be performed on the following:
 - 1) Direct fire steam jacketed kettles
 - 2) Low-pressure steam boilers
 - 3) Low-pressure hot water heating boilers

4. Multiple-Walled Vessels

- a. For multiple-walled (greater than two) vessels and double-walled vessels that are not in cryogenic service, an engineering evaluation is required to support the inspection test and requirements. The engineering evaluation shall be performed by the system engineer with a PSO Duty Area B.
- b. The inspection and testing requirements shall be reviewed and approved by the CPSO and the Pressure Safety Committee, and the test/inspection performed by a CPSO-approved organization.

5. Cryogenic Vessels¹¹

Note: Cryogenic vessels are a unique case of pressure vessels and the inspection and testing requirements are different than single walled vessels.

- a. If the history of the vessel is known to be cryogenic service throughout, then a periodic inspection or test of the internal vessel is not required.
- b. An external inspection of the vacuum jacket must be performed to verify the annulus maintains vacuum in accordance with Table ADMIN-4-2.
- c. *When a cryogenic vessel is taken out of service for modification or maintenance, then accessible areas should be examined by a competent engineer or, preferably, a qualified vessel inspector, and a record made of the results of the inspection.*

¹⁰ At the date of release of this document, LANL is not considered exempt from this state regulation. See ESM Ch 1 Section Z10 Codes and Standards subsection.

¹¹ As discussed in AIGA, *Periodic Inspection of Static Cryogenic Vessels*, 046/08

ADMIN-4 Inspection and Testing

B. Relief Devices

1. Testing of pressure relief valve set points can be performed with the valve installed in the system or by bench test. The PSO must be present for in-place set point verifications, and flow tests. In-place testing must be performed using a PSO approved procedure¹².
2. Any relief valve that has been modified, (e.g. spring replacement, orifice exchange, welding, etc.) except for set point adjustments, must be flow tested to verify capacity and operation. Flow tests must be documented and maintained in the pressure system documentation package.¹³
3. Regardless if the relief valve is ASME Code stamped (UV) or not, where in-place set-point testing of relief valves is the preferred method of testing, the system must be provided with a traceable calibrated gage. Tolerance on set-point verifications must be +/- 2 psi for a set pressure less than 70 psi. For set points greater than 70 psi, the tolerance must be +/- 3% of the stamped set point as defined by ASME BPV Section VIII, Div 1, Part UG-126(d).
 - a. ASME (UV) stamped valves that require disassembly to change the set point (i.e., spring replacement) must be performed by an organization accredited by the National Board, holding a “VR” stamp, to disassemble the valve and change the set point (conversely, UV valves that don’t require such disassembly don’t require a VR stamp organization).
 - b. Adjustments of set point pressure on relief valves (regardless of UV stamp) must be performed by a CPSO-approved/designated relief device testing facility.
4. All tested valves (regardless of UV stamp) must have, affixed by the testing organization, a “Test Only” tag as described by NBIC Part 3 (*Section 5.9.4*) with a minimum of the following information:
 - a. Test report number (unique identification number)
 - b. Name of testing organization, LANL test shop identification, or in-place flow procedure document number.
 - c. MAWP
 - d. Set pressure
 - e. Date of test
 - 1) Due date of next test (as defined in this document)
5. *Guidance: LANL O&M Criterion and preventative maintenance procedures (PMIs) related to pressure relief devices are available at [this](#) internal link.*
PMI 419-A, Pressure Relief Valve Testing
 - a. *Criterion 403 “Boilers”*
 - 1) *PMI documents: 403-A: Low- and High-Pressure Steam Boiler and Low-Temperature Water Heating Boiler Inspection, Testing, and Maintenance; 403-A.001: Hot Water Boiler Startup After Lay-Up; 403-*

¹² See ASME PTC-25 for relief device testing requirements.

¹³ See ASME Section VIII, Division 1, Part UG-131.

ADMIN-4 Inspection and Testing

A.002: Hot Water Boilers Water Treatment; 403-A.003: Hot Water Boiler Weekly Preventive Maintenance; 403-A.004: Hot Water Boiler Weekly Log Sheet (Deleted - Do Not Use - Refer to 403.A.010); 403-A.005: Hot Water Boiler Monthly Preventive Maintenance (In Service Only); 403-A.006: Hot Water Boiler Annual Fireside/Waterside Inspection and Maintenance; 403-A.007: Steam Boiler Startup After Lay-Up; 403-A.008: Steam Boiler Water Corrosion and Scale Inhibitor Treatment; 403-A.009: Steam Boiler Weekly Preventive Maintenance; 403-A.010: Steam Boiler Weekly Log Sheet; 403-A.011: Steam Boiler Monthly Preventive Maintenance (In Service Only); 403-A.012: Steam Boiler Annual Waterside and Fireside Inspection and Maintenance (In Service Only); 403-A.013: Steam Boilers Summer Lay-Up; 403-A.014: Hot Water Boiler Summer Lay-Up

- b. *Criterion 419 “Inspection and Testing of Pressure Vessels and Pressure Relief Valves”*
 - 1) *PMI documents: 419-A: Boiler Relief Valve Testing; 419-A.001: Pressure Relief Device Removal, Transport, and Reinstallation Checklist; 419-A.002: Test Summary Report Form; 419-55-0000-A: 55-0000 Specialty Gas Systems; 419-55-0000-A.001: 55-0000 Specialty Gas Systems - Annual*
6. Pressure relief valves (regardless of ASME Code stamp) that are removed from the system and sent to either a VR holder or CPSO-authorized testing organization must be tested using the following fluid media as defined by NBIC/NB-23 Part 2 (2.5.7):

Fluid System	Fluid medium used to test valve
high pressure boilers	steam
high temperature hot-water boilers	steam
low pressure steam heating boilers	steam
programmatic and process steam service	steam*
all other valves marked for steam service	steam
hot water heating boiler	air or water
hot water heater temperature and pressure relief valves	air or water (replacement is preferred)
air and gas service	air or nitrogen
liquid service	water

*air is suitable provided the manufacturers steam to air correction factor is used

ADMIN-4 Inspection and Testing

- 7. Table ADMIN-4-3 indicates pressure relief device test (set point verification) and replacement intervals.

Table ADMIN-4-3 Relief Device Maintenance Intervals

Fluid Service/Type (alphabetical for PRVs; rupture disks at bottom)	Test Frequency (Years)¹⁴	Reuse or Replace Device	Reused Device Treatment
Corrosive or Harsh Service When harsh internal or external environment, corrosives, glutinous, acidic, or reactive fluids, rust likely, or otherwise damaging environs	2	Reuse or Replace	Clean and Test
Dewar vessel service (except for O ₂)	5	Reuse or Replace	Test
Inert gas or non-corrosive liquids (including dry air kerosene, non-acidic oils, etc.)	5	Reuse or Replace	Test
Natural Gas, LP, and Propane	5	Reuse or Replace	Test
Oxygen (Dewar or gas)	3	Reuse or Replace	Test and reclean
Refrigerant (<i>Henry, Superior, etc.</i>)	5	Reuse or Replace	Test
Steam (ASME BPV Section I / power boilers)	1	Reuse or Replace	Test
Steam (ASME Sec IV/VIII)	2	Reuse or Replace	Test
Steam Pilot Relief Valve	2	Reuse or Replace	Complete disassembly and test
Water -- Domestic Water Heater	5	Replace	N/A
Water if treated and other liquids non-reactive-to-valve <u>and not listed elsewhere in table</u>	5	Reuse or Replace	Clean and Test

¹⁴ The Pressure System Owner must petition the CPSO for longer test and inspection intervals if historical data has been collected which supports that change. Conversely, if trend data indicates that inspection intervals should be reduced, the PSO should initiate an appropriate change in the CMMS in conjunction with system owner/engineer.

ADMIN-4 Inspection and Testing

Fluid Service/Type (<u>alphabetical</u> for PRVs; rupture disks at bottom)	Test Frequency (Years)¹⁴	Reuse or Replace Device	Reused Device Treatment
Water in ASME Section IV heating boilers	2	Reuse or Replace	Test
Rupture Disk Reverse Buckling: If Damage Ratio is less than or equal to 1.0	N/A	Replace as required	N/A
Rupture Disk Reverse Buckling: If Damage Ratio is greater than 1.0**	2	Replace	Replace
Rupture Disk Flat/Forward Buckling in plugging service	2 yr inspection after installation	Establish inspection interval based on results of inspection.	Reuse or Replace based on results of inspection
Rupture Disk Flat/Forward Buckling in lethal service	N/A	Evaluate discharge for safety	N/A
Rupture Disk Flat/Forward Buckling and Bent/Breaking pins (non-plugging and non-lethal service)	N/A	Replace as required	N/A

NOTES:

** If installation direction cannot be verified or the damage ratio is ≥ 1.0 , disk must be replaced every 2 years.

Basis for table is EMRef-58 (EMRef is a Standards Program system for maintaining references/bases)

C. Piping

1. Piping inspection and maintenance priority shall be based on Attachment ADMIN-1-6, Risk Based Certification Processing and Maintenance (Guidance)
2. *Guidance: Evaluation of piping systems may apply B31.G, Manual for Determining Remaining Strength of Corroded Pipelines, the original code of record, or API 579-1/ASME FFS-1, Fitness-For-Service.*
3. Other evaluation processes may be approved by the CPSO.

D. Flex hoses

1. Flex hoses shall be inspected for flaws during system reviews by the PSO, and those found unacceptable shall be removed from service.
2. The inspection and acceptance evaluation process shall be based on the manufacturer's requirements and the PSO subjective evaluation of the flex hose to safely perform its function. See Section ASME (Attachment ASME-4-2).

ADMIN-4 Inspection and Testing

3. Flex hose inspection guidance is provided in Attachment ADMIN-4-2, Hose Assembly Inspection Guidance.

E. Pressure Regulators

1. Attachment ADMIN-4-3 contains pressure regulator maintenance guidance.

3.0 DOT, IM, and UM Portable Tanks

A. General Information¹⁵

1. Refilling of an expired DOT portable vessel is prohibited
2. Expired DOT vessels which still contain the contents may be used until the contents are gone, provided that no pressure source is connected to the vessel. Removal of contents must be by gravity or vapor pressure only.
3. If the vessel is to be used as a permanent installation and not maintained in accordance with 49CFR, the vessel must be reviewed according to ASME Section VIII, and the DOT stamp must be obliterated.

B. Special Instructions for DOT-4L Cryogenic Cylinders¹⁶

WARNING: A cylinder used for CO₂ service must not be used for other gas products, especially oxygen or nitrous oxide.

1. Follow the manufacturer’s instructions for service and maintenance
2. Excessive loss of product or excessive build-up of pressure is an indication of possible loss of vacuum in the vacuum jacket. Follow the manufacturer’s instructions for troubleshooting.
3. If frost spots appear in a non-uniform manner, or are in miscellaneous areas the cylinder may have internal damage and will need to be removed from service until repaired (call cylinder manufacturer for details.)
4. Relief devices must be maintained as defined in this document
5. Where manufacturer recommends checking the set point of relief devices in place, the method must be performed as defined in this document.
6. Solidified contents in cylinders (CO₂) must be re-liquefied per the manufacturer’s instructions.

C. Inspection Frequencies

1. Records of DOT, IM, and UM vessel inspection and certification reports must be made available upon request.
2. Owners of DOT, IM, and UM vessels must maintain their DOT vessels certified within the inspection interval frequency.
3. DOT or mobile pressure systems must be retested per 49 CFR or ASME Section XII.
4. DOT, IM, or UM vessels that are not permanently installed in a pressure system must comply with the retest frequencies in CFR Title 49, 180.209. The following table displays the inspection frequencies and retest pressure for cylinders, but does not contain

¹⁵ Chart Industries, Inc., “Liquid Cylinder” Users Manual P/N 10642912 Date:12/00

¹⁶ Ibid

ADMIN-4 Inspection and Testing

all the requirements of the CFR. The system owner is advised to carefully review the applicable sections.

Table ADMIN-4-4 Cylinder Inspection Frequencies and Retest Pressures

Specification to which cylinder was made	Minimum retest pressure (psig)	Retest period (years)
DOT-3	3000 psig	5
DOT-3A, 3AA	5/3 times service pressure, except non-corrosive service *	5, 10, or 12 *
DOT-3AL	5/3 times service pressure	5 or 12 *
DOT-3AX, 3AAX	5/3 times service pressure	5
3B, 3BN	2 times service pressure	5 or 10 *
3C	Retest not required	Retest not required
3D	5/3 times service pressure	5
3E	Retest Not Required	Retest not required
3HT	5/3 times service pressure	3 *
3T	5/3 times service pressure	5
4	700 psig	10
4A	5/3 Times service pressure *	5 or 10 *
4AA480	2 times service pressure	5 or 10 *
4B, 4BA, 4BW, 4B-240ET	2 times service pressure except non-corrosive*	5, 10, or 12 *
4C	Retest not required	Retest not required
4D, 4DA, 4DS	2 times service pressure	5
DOT-4E	2 times service pressure except non-corrosive*	5
4L	Retest not required	Retest not required
8, 8AL	-	10 or 20*
DOT-9	400 psig (maximum 600)	5
25	500 psig	5
26 (for filling over 450 psig)	5/3 times service pressure	5
26 (for filling at 450 psig)	2 times service pressure	5
33	800 psig	5
38	500 psig	5
Special Permit Cylinder	See current special permit.	See current special permit
Foreign Cylinder (see CFR Title 49 section 173.301(j) for restrictions on use).	As marked on the cylinder, but not less than 5/3 of any service or working pressure marking.	5
*See CFR Title 49 Section 173.34(e) for specific instructions for types of vessels.		

ADMIN-4 Inspection and Testing

5. The following table defines the NBIC inspection frequencies for DOT, IM, and UM portable tanks and vessels. Portable vessels must be maintained within their inspection due dates.¹⁷

Table ADMIN-4-5 Portable Tank and Vessel Inspection Frequencies (DOT, IM, and UM)

Specification	Periodic Inspection and Test	Intermediate Periodic Inspection and Test
UM or UN Portable Tanks once placed in service	5 years	2-1/2 years
DOT 51 Portable Tanks	5 years	-
DOT 56 or DOT 57 Portable Tanks (the first periodic inspection and test is required 4 years after being placed into service and each 2-1/2 years thereafter.)	2-1/2 years	-
DOT 60 Portable Tanks (the first periodic inspection and test is required 4 years after being placed into service and the per the schedule to the right)	For the first 12 years of service, every 2 years.	After 12 years of service, yearly.
Retesting is not required on a rubber lined tank, except before relining.		
For IM and UN Portable Tanks, periodic inspection and test must include at least an internal and external of the portable tank and fittings, taking into account the hazardous material intended to be transported.		

4.0 Mobile Pressure Systems and Transport Tanks

A. Definitions

1. LANL owned mobile pressure vessels and tanks [to include Category 406 (4 psi)] are subject to the requirements of this document which are included within the scope of ASME Section XII. These systems and vessels include, but are not limited, to the following:
 - a. Portable tanks for transporting cryogenic fluids (greater than 120 gallons), not part of a Road-Tank vehicle.
 - b. Rail Tanks
 - c. Cargo Tanks – Intended primarily for the carriage of liquids or gases and includes appurtenances, reinforcements, fittings, and closures. Is permanently attached to or forms a part of a motor vehicle, or is not permanently attached to a

¹⁷ NBIC Part-2 Table S6.14, Inspection Intervals

ADMIN-4 Inspection and Testing

motor vehicle but which by reason of its size, construction, or attachment to a motor vehicle is loaded or unloaded without being removed from the motor vehicle. Is not fabricated under a specification for cylinders, portable tanks, tank cars, or multi-unit tank car tanks.

2. Pressure vessel designs within the scope of Section XII are as follows:
 - a. Full vacuum to 3000 psig
 - b. Temperature range is between -452°F to 650°F
 - c. Thickness of shells and heads does not exceed 1.5 inches.

B. Procurement

1. Transport tanks must be procured with the ASME (T) stamp symbol.
2. Mobile pressure systems and transport tanks that do not bear the ASME stamp symbol must be evaluated as equivalent through engineering calculations.

C. Pressure Relief Devices

1. Must comply with the tolerances and capacities as defined by ASME Section VIII, and must be installed as defined in ASME Section XII, paragraph TR-130.
2. Must be tracked in the CMMS (*AssetSuite, formerly "PassPort"*) database and meet re-test/replace intervals as defined by this document.
3. Must be code stamped relief devices (TV) or (TD). ASME Section VIII stamped components are authorized to be used on (T) stamped vessels provided the requirements of Section XII are met as defined in ASME Section XII, Article TG-120.2.
4. When all components of a pressure system have a design pressure equal to or greater than the system pressure, there is no requirement for a pressure relief device. Consequently, there is no requirement for pressure relief documentation, calculations, maintenance of the pressure relief device, or inclusion of the relieve device into CMMS or the PSCS database as a maintenance item.
5. PRVs during leak testing: Application of the required relief device in accordance with ASME B31.3 345.5.2 shall be done as follows:
 - a. First the owner or owner's representative must have approved a pneumatic or hydrostatic-pneumatic leak test in accordance with B31.3 345.1(b).
 - b. Second, the pressure system supplying the test gas shall have adequate relief protection to ensure the piping component MAWP is not exceeded.
 - c. If the first and second requirements above are satisfied, then a relief device is not required if the test pressure is not above the MAWP of the piping components.

For example, if using TP304, ASTM A312, 4-inch schedule 40 pipe, the nominal thickness is 0.237 inch with the B31.3 Appendix A value.

$$t = PD/(2*(SEW+PY)) \text{ [304.1.2 equation 3a]}$$

$$\text{rearranged: } P = 2tSEW/(D-2Yt)$$

$$S = 20,000 \text{ psi}$$

$$E = 1$$

$$W = 1$$

ADMIN-4 Inspection and Testing

$$Y = 0.4$$

$$D = 4.5 \text{ (outside diameter)}$$

$$T = 0.237 \text{ (nominal not subtracting the production tolerances)}$$

$$P = 2 \cdot (0.237) \cdot 1 \cdot 1 \cdot 20,000 / (4.5 - 2 \cdot 0.4 \cdot 0.237)$$

$$P = 2199.3 \text{ psig nominal}$$

Assume an adequately sized relief device is installed to limit the pressure to less than 2199 psig + 10% (220 psig), or 2419 psig for the supply pressure for the leak test. So, if the system design pressure is 100 psig and the pneumatic leak test pressure is 110 psig, then because 110 psig << 2199.3 psig, no additional relief device is required.

D. Piping, Valves, and Fittings

1. Each connection must be clearly labeled to indicate its function
2. Piping, valves and fittings must be grouped and protected from damage.
3. Must comply with ASME B31.3 as defined by ASME Section XII.

E. Pressure System Documentation Package

1. The manufacturer's data report (T-1A, B, or C) and/or partial data report must be maintained in the pressure system documentation package.
2. Relief valve calculations, recall date, and set pressure must be documented and maintained in the pressure system documentation package.
3. Repairs and alterations must be documented and maintained in the pressure system documentation package.
4. Records of inspections must be maintained in the pressure system documentation package as defined in ASME Section XII, Article TP-6.

F. Repairs and Alterations

1. Must be performed by an institution holding the (TR) stamp.
2. Repairs and alterations must be performed in accordance with NBIC/NB-23
3. Must be performed as defined in ASME Section XII Part TP

G. Tests and Inspections

1. Testing and Inspection must be performed as defined in ASME Section XII, Articles TP-4, and TP-5.

5.0 ATTACHMENTS

ADMIN-4-1 Pressure Vessel Inspection and Test Procedure

ADMIN-4-2 Hose Assembly Inspection Guidance

ADMIN-4-3 Pressure Regulator Maintenance Guidance