

## Definitions and Acronyms

**Alteration** – The change of a pressure-boundary component that changes the original design structure. Does not include the removal and replacement of components, but modification of the component itself (e.g., welding an additional port to a U-stamped vessel).

**ASME B31** - American Society of Mechanical Engineers Piping codes.

**ASME BPVC** – American Society of Mechanical Engineers Boiler and Pressure Vessel Code.

**Asset Suite** – Name of LANL’s Computerized Maintenance and Management System (CMMS) Ventyx software package that includes the Master Equipment List. Required by this pressure safety program for tracking facility and utility relief valve testing, vessel inspections, and flex hose inspections. Formerly PassPort.

**Authorized Inspector (AI)** – An inspector regularly employed by an ASME accredited Authorized Inspection Agency in accordance with the requirements in the latest edition of ASME QAI-1.

**Category D fluid** – A fluid service which is nonflammable, nontoxic, not damaging to human tissues, does not exceed 150 psig, and the design temperature is between –20 °F to 366 °F [ASME B31.3].

**Category M fluid** – A fluid service in which the potential for personnel exposure is judged to be significant and in which a single exposure to a very small quantity of a toxic fluid, caused by leakage, can produce serious irreversible harm to persons on breathing or bodily contact, even when prompt restorative measures are taken [from ASME B31.3 300.2 definition for fluid service].

**Certification** – All requirements of this document have been met and CPSO or delegate has approved pressure system for use. Is not to be understood as an ASME or NBIC certification, it is only a permit to operate the pressure system, granted by the CPSO.

**Check valve** – (see system interaction below) – A spring loaded poppet valve that has one flow direction to keep system contents from back flowing.

**CMMS** – Computerized Maintenance Management System (See Asset Suite).

**Code equivalent** – A pressure vessel or other component that, through documentation, proves that the design meets all of the design, fabrication, test, and inspection requirements established by the applicable code, but does not have a code stamp and does not require a code certified Inspector.

**Code non-compliance** – A violation of a national consensus code (e.g., ASME, UPC), or the lack of documentation demonstrating code-equivalent fabrication.

**Code of Record** – The codes and standards (by year) used to perform the design and construction are considered the code of record (COR). (see ESM Chapter 1 Section Z10 - General Requirements for all Disciplines/Chapters)

**Components** – The set of items within a piping system that are joined together to make up a functioning process. Piping components are a sub-set of all components in a piping system. See definition of Piping Components below for those components which are within the scope of the B31 pressure piping codes. Other components that make up a process (pumps, heat exchangers, etc.) are designed and fabricated in accordance with other industry codes and standards. Acceptable component acronyms for design documents, labels, and CMMS are addressed in ESM Chapter 1 [Sections 200 and 230](#).

**Corrosive service** – A fluid service in which the internal fluid, or external environment, is expected to produce a progressive deterioration in the pressure boundary material.

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**CPSO** – Chief Pressure Safety Officer. Point of Contact (POC) for this chapter and thus the LANL Pressure Safety Program. Final approver in system certification. Is a subject matter expert in pressure systems design, will assist system owners with applicable codes for pressure system design. Reviews and approves variations and alternate methods. May delegate certain functions to Pressure Safety Officers.

**Cryogenic fluids** – Fluids with a normal boiling point below -200 °F. Other fluids (e.g., CO<sub>2</sub>, refrigerants, etc.) that are not necessarily considered cryogenic must be taken into consideration as having similar pressure hazards as that of cryogenics.

**Damage ratio:** A damaged rupture disk will burst at some pressure other than that predicted. This disparity can be reported by a value called the "damage ratio." The damage ratio is equal to the actual burst pressure of a damaged disk divided by the stamped burst pressure. A damage ratio of 1 or less provides assurance that the disk, even damaged, will burst at or below the stamped burst pressure, while a value higher than one would indicate the actual burst pressure could exceed the stamped burst pressure. As an example, a damaged disk with a 100 psig stamped burst pressure and a damage ratio of 1.5 could have an actual burst pressure of 150 psig. This information can be provided by the burst disk manufacturer.

**DCF** – Design Change Form. See [AP-341-517](#). Used to make permanent modifications to configuration controlled structures, systems, and components (SSCs) in hazard category 2 and 3 nuclear facilities, and high and moderate hazard non-nuclear facilities.

**Deputy Chief Pressure Safety Officer** – Delegated by the CPSO. Alternate POC for this Chapter. Has signature authority for final approval of pressure system documentation packages.

**Design pressure** – Design Pressure is that pressure determined by the designer, for which the system or component must operate at worst case conditions/temperatures during normal operation (see ASME Section VIII Div 1, Part UG-21 and B31.3 Para. 301.2). Basically, the final design temperature and design pressure are that combination that gives the most critical result in terms of stresses and forces. It is commonly called the concurrent temperature and pressure that requires the thickest-wall pipe or highest rating of the components.

**Dewar** – A vacuum flask or vacuum-insulated shipping container used for storage of cryogenic fluids. Named for the inventor, Sir James Dewar.

**Engineering calculation** – Formal document performed in accordance with AP-341-605 (or equivalent for R&D) on all pressure relief valves, and as required by the applicable ASME code.

**Engineering Services Division** – Performs or facilitates detailed calculations and other design functions to aid PSO and system owners.

**ESM** – LANL Engineering Standards Manual (STD-342-100) mandated by P342.

**Examiner** – An individual with the training and experience commensurate with the needs of the specified examinations. It is the person who performs the quality control examinations and is performed by the manufacturer, fabricator, or erector. See ASME B31.3 Chapter VI, paragraph 341.

**Excluded systems** – Pressure systems that are not considered to be within the scope of the pressure safety program. Examples include, but are not limited to: vehicle pneumatic systems, propane-powered vehicles, and garden irrigation systems.

**Exempt System** – A system that by virtue of its design features is not required to meet code; the non-toxic material is being used at 75 F maximum and less than 15 psig with no possibility of over pressure.

**Existing pressure system** - Existing systems are all installed pressure systems (post construction) of which Legacy Pressure Systems are a subset.

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**Facility pressure system** – Any liquid or gas pressure system that is maintained by the facility operations director, or where the cost of maintenance or repair is paid for by the facility or institution, not directly by the program it supports. Normally either a utility proper or found in utility rooms that provide building services (e.g., building heating boilers, instrument air system, etc.). See programmatic pressure system for that definition.

**Fault condition** – Any failure caused by component failure, human error, chemical reaction, or environmental conditions that may cause an increase in pressure above the MAWP of the component or system.

**Flexible element** – A flexible element of a pressure or vacuum system including hoses, used in place of a pipe or rigid metal tubing. Also referred to as flexible tubing or flex-hoses.

**Fluid** – A chemical in gaseous or liquid (or sometimes solid) state which can be pressurized or be the pressure source in a pressure system.

**FS categories** – LANL-specific fluid service category which allows a graded approach for deficiency resolution in existing systems for both pressure vessels and piping. LANL fluid services are based on the fluid categories defined by ASME B31.3 Paragraph 300.2, thus:<sup>1</sup>

- **FS1**- Fluid systems for which fluid category has been determined to be either Category M or High Pressure as defined in ASME B31.3, where these categories are defined as follows:
  - Category M: A fluid service in which the potential for personnel exposure is judged to be significant and in which a single exposure to a very small quantity of a toxic fluid, caused by leakage, can produce serious irreversible harm to persons on breathing or bodily contact, even when prompt restorative measures are taken.
  - High Pressure Fluid Service: Pressure in excess of that allowed by the ASME [B16.5](#) Class 2500 rating for the specified design temperature and material group (see full definition below).
- **FS2** - Fluid systems not FS1 or FS3. Here, the fluid category is or would equate to Normal as defined in ASME B31.3 (i.e., not Cat D, M, or High Pressure).<sup>2</sup> Steam and hot water systems above 180 °F.<sup>3</sup>
- **FS3** - Fluid systems for which the fluid category is or would equate to Category D as defined in ASME B31.3, thus: 1) the fluid handled is nonflammable, nontoxic, and not damaging to human tissues; 2) the design gage pressure does not exceed 150 psig; and 3) the design temperature is from -20°F through 366°F.

Note: FS Categories are a designation of the most stringent requirements within a given system. They are not necessarily the appropriate requirements for every item within a system. Appropriate designation of the subsystems within a system is allowed with concurrence of the PSO. For example, an ambient temperature, B31.3 high-pressure nitrogen gas system at 10,000 psig is an FS1 system. If a regulator is used to drop the pressure to 1,500 psig (less than the rating requirement for a high pressure system), and there is appropriately sized pressure relief protection, the items of this

<sup>1</sup> Similarly, a graded approach can be found in API 570 “Piping Inspection Code.” FS Categories are fluid categories, not ASME Code categories. FS categories are not intended to provide design guidance (e.g., an FS1 pressure system does not necessarily need to be designed and built for ASME Category M fluid service, unless of course the system contains fluids that meet the ASME definition of Category M). Where consensus cannot be reached, the CPSO makes the final determination of fluid service category.

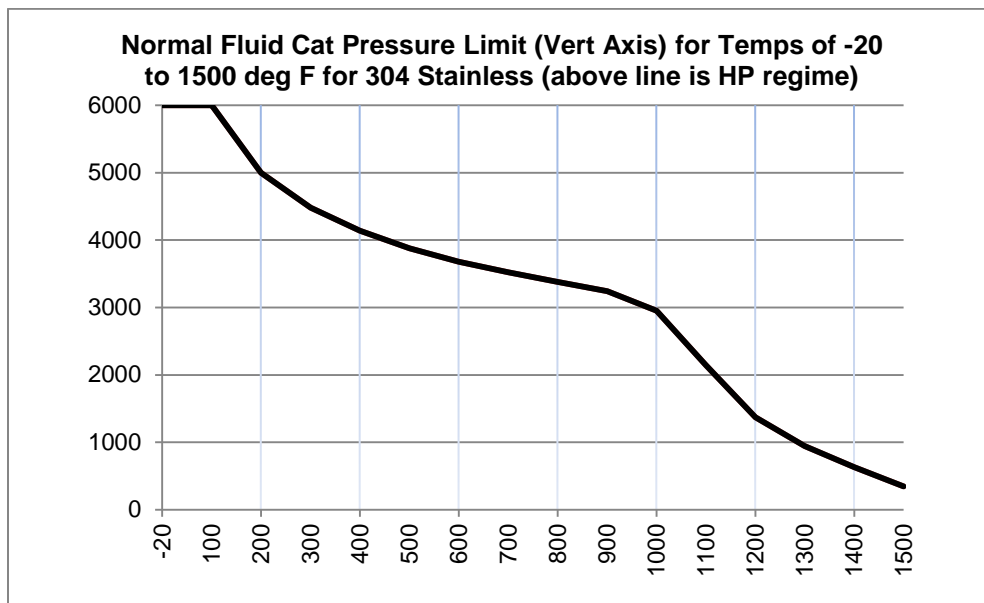
<sup>2</sup> “Equate to” appears here (and for FS3) so that piping subject to B31 codes other than B31.3 can use the FS definitions which are largely based on B31.3 definitions.

<sup>3</sup> Because steam is damaging to human tissue, LANL chooses to treat as FS2 for deficiency resolution reasons.

subsystem could be classified as FS2. Grace periods of ESM Chapter 17 for FS2 would then be applicable to those items. However, the overall designation of FS1 would remain for the system.

**Good operating history** - is defined as service history of an existing pressure system, where a record of successful service may be created by the System Owner confirming that no failures have occurred in the system pressure boundary, that no pressure or temperature transients have occurred which exceeded the system design basis, and that personnel have not been harmed while operating or in close proximity to the system.

**High pressure fluid service** – Pressure in excess of that allowed by the ASME B16.5 Class 2500 flange rating for the specified design temperature and material group. This category depends on material type at temperature. The chart below is only one example using B16.5 table data to illustrate the function of temperature versus pressure for Type 304 stainless (for which “high pressure” could be as low as 345 psig at 1,500 degrees F). See also Chapter IX of ASME B31.3.



**Hydraulic systems** – Those systems which use an incompressible fluid as the pressure media to perform work. These systems normally include pumps, piping, pressure safety valves, and accumulators.

**Hydrostatic test** – A test performed on a pressure vessel or system in which the vessel or system is filled with a liquid (usually water) and pressurized to a designated level.

**In Service leak test** – Joint examination at normal operating conditions to verify absence of leakage.

**Inspector** – Verifies all required examinations and testing have been completed and inspects to the extent necessary to be satisfied that the design of the system conforms to all applicable examination requirements of the Code and of the engineering design (see ASME B31.3, Chapter VI, 340).

**IRM** – Information Resource Management – the Pressure Safety Program utilizes a dedicated server, [Pressure System Certification System](#). Contact the CPSO for access to the database.

**Leak test** – A general term used to describe a pressure test which proves the integrity of a pressure boundary. More specific terms are: hydrostatic leak test, hydro-pneumatic leak test, pneumatic leak test, initial service leak test, and sensitive leak test. These tests are described in ASME B31.3, Section 345.

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**Legacy pressure system** - Systems that were operational as of March 10, 2009 (when ESM Chapter 17 revision 0 was issued) are considered legacy pressure systems.

**Lethal substance** – Poisonous gases or liquids of such a nature that a very small amount of the gas or of the vapor of the liquid mixed or unmixed with air is dangerous to life when inhaled. This class includes substances of this nature, which are stored under pressure or may generate a pressure if stored in a closed vessel.

**Major system modification** – Term used by the pressure program only, the addition of or modification to a pressure vessel, removal of a pressure relief device, replacement of a pressure relief device that is not an exact replacement or engineered equivalent, modification of the pressure relief path that materially changes its capacity, or any other change which calls into question the capacity or set point of the relief device(s). Major system modifications require recertification of the system.

**Manufacturer's service rating** – The service rating (MAWP and design temperature) of a component, pipe, or tube available on the open market which has been designed and tested to a recognized guideline or standard.

**Maximum allowable working pressure (MAWP)** – Typically stamped on individual components (or sub-components) of a pressure system. Is the maximum permissible pressure (internal or external) of a pressure component (or system) when operated in its normal operating position at the designated coincident temperature specified for that pressure using the code ratings. It is the least of the values found for maximum allowable working pressure for any of the essential pressurized components of a pressure system as defined in ASME Section VIII Div 1, Part UG-98 (see also Part UG-23). Value is typically less than the component burst pressure by a factor of safety used by the ASME Code.

**Maximum operating pressure (MOP)** – The maximum intended operating pressure, typically less than the MAWP to prevent premature system leakage through pressure-relieving devices.

**Minor non-compliance** – A LANL self-imposed requirement that is not a violation of a DOE policy directive or a national consensus code; e.g., missing/loose pipe brackets or unlabeled components.

**Mobile pressure containers** – Pressure vessels designed for travel on streets and highways; e.g., tube trailers, cryogen tankers, and other vessels mounted on trailers, trucks, etc. [ASME B&PV Code Section XII].

**Modification** – Any pressure system component change, addition, or deletion other than replacement of components with similar performance characteristics such as flow capacity and strength. This definition does not include alteration of pressure-boundary components (e.g., welding additional ports to pressure-bearing component – see “Alteration”).

**Non-conformance report (NCR)** – Process defined in LANL Procedure [P 330-6](#). Initiated by system owners, PSOs, or others when deficiencies require tracking and/or disposition. *At time of writing, this process was, at a minimum, applicable for code deficiencies or indeterminate conditions associated with an ML-1 or ML2 system or component.*

**Non-destructive examination (NDE)** – Examinations including visual examination, radiographic examination, ultrasonic examination, and dye-penetrant testing used to qualify the condition of a pressure vessel or component. At LANL, regulated by ESM Chapter 13 Volume 6.

**Non-hazardous fluids** – Any fluid or mixture that is nonflammable, nontoxic, and is not corrosive. Cryogenic fluids are considered hazardous.

**Normal fluid service** – A fluid service pertaining to most piping covered by the B31.3 Code but not subject to the B31.3 rules for Category M, Category D, or High Pressure fluid services. [B31.3, 300.2]



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**Operating pressure** – A pressure less than the MAWP at which the system is normally operated.

**Operating temperature** – A temperature between the lower and upper design temperatures of the pressure system or component.

**Out-of-service system** – A system that is formally designated inactive or not in use.

**Owner** – While DOE owns the pressure systems at LANL (except vendor owned), day-to-day fulfillment of the codes' Owner role is by the LANL Design Authority (Site Chief Engineer; see also ESM Chapter 1 Section Z10 regarding delegation). Owner's Representative is an agent of the Owner. System Owner is the user (see definition below).

**Pilot-operated pressure relief valve** – A pressure relief valve in which the major relieving device is combined with and is controlled by a self-actuated auxiliary pressure relief valve (commonly used in hydraulic systems and some steam systems).

**Piping components** – Mechanical elements suitable for joining or assembly into pressure-tight fluid-containing piping systems. Components include pipe, tubing, fittings, flanges, gaskets, bolting, valves, and devices such as expansion joints, flexible joints, pressure hoses, traps, strainers, inline portions of instruments, and separators [ASME B31.3, 300.2]

**Pneumatic test** – A test performed on a pressure system or component in which a gas is introduced and pressurized to a designated level in a manner prescribed in the applicable code.

**Poly tubing** – Term used for many types of flexible polymer tubing. Examples include Poly-Flo® and Tygon®.

**Portable pressure vessels** – Pressure vessels easily transported from one location to another but without mobile gear attached. Examples include portable Dewars, Department of Transportation (DOT) compressed gas cylinders, and sample bottles (e.g., Hoke bottle, Swagelok sample cylinders).

**Pressure pipe** – A relatively heavy-walled tubular fluid container/transporter that is normally attached or connected to fittings or components with threads or welds.

**Pressure qualification test** – A pressure test performed above the MAWP (may assume design pressure) using a non-hazardous fluid to ensure the integrity of the pressure system, or component. For example see ASME Section VIII Div 1 Part UG-99, UG-100, and UG-101 for further information.

**Pressure relief valve (PRV)** – Most common and preferred term for pressure protection valves at LANL used for a pressure relief valve which is actuated by inlet static pressure that opens in proportion to the increase in pressure over the opening pressure (typically liquid use).

**Pressure safety valve (PSV)** – Also known as a Pressure Relief Valve (PRV). A pressure relief device that is designed to re-close and prevent the further flow of fluid after normal conditions have been restored (typically gas or vapor service).

**Pressure system** – One or more items that fall within the scope of an ASME code.

**Pressure tubing** – Different from "Pressure Pipe." Is a relatively thin-walled tubular fluid container/transporter that is normally suitable for bending and is attached or connected by flared fittings, compression type fittings, or welding.

**Pressure vessel** – Containers for the containment of pressurized fluids, either internal or external. Excluded are pipe runs; however, a vessel may be fabricated from a section of pipe if the construction conforms to ASME code requirements. For this program, storage vessels such as 55-gallon drums are not considered pressure vessels and must not be pressurized by an external source.

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**Programmatic pressure system** – Any gas or liquid pressure system which is used for testing, manufacturing, research purposes, or used in support of testing, manufacturing, research processes. Maintenance or repair of these systems is normally both directly paid for and performed by the program, not the facility (see facility pressure system for that definition).

**Proof test** – A pressure test performed to establish the maximum allowable working pressure of a vessel, system, or component thereof when the strength cannot be computed with a satisfactory assurance of accuracy. This test will be performed in a manner equivalent to one of the methods specified in paragraph UG-101 of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

**PSCS** – Pressure Safety Certification System is the ES-EPD managed database for pressure system certification, pressure safety document repository, and tracking program for programmatic relief valve testing, vessel inspections, and flex hose inspections.

**PSO** – Pressure Safety Officer. Person familiar with ASME code and who performs system certification reviews (per this document) of pressure systems. Not required to perform design calculations, but aids system owners in compliance with this procedure and the use of the ASME code. A PSO can request an alternate or designee to help perform the functions defined in this document upon approval of the CPSO.

**RAD** – Responsible Associate Director

**Relief valve** – PRV designed for liquid or liquid mixed with steam or gas.

**Reversal ratio:** Is equal to the actual burst pressure of a rupture disk installed in reverse divided by stamped burst pressure. If the value is one or less, the disk will relieve at or below its stamped burst pressure even when installed in reverse. If the value is greater than one, the actual burst pressure will be greater than the stamped burst pressure. This information can be provided by the rupture disk manufacturer.

**Rupture disk device** – Also known as burst disk. A non-closing pressure relief device actuated by inlet pressure and designed to remain open after operation. The device performs its function by bursting a pressure-containing disk.

**Safety relief valve** – A pressure relief valve characterized by rapid opening or pop action or by opening in proportion to the increase in pressure over the opening pressure. Used for compressible or incompressible fluids.

**Safety valve** – A pressure relief valve actuated by inlet pressure and characterized by rapid opening or pop action. Normally used to relieve compressible fluids.

**Set pressure** – Set pressure is the value of increasing inlet static pressure at which a pressure relief device displays one of the operational characteristics as defined by opening pressure, popping pressure, start-to-leak pressure, burst pressure or breaking pressure.<sup>4</sup> Measured at the pressure relief valve inlet, at which there is a measurable lift, or at which discharge of a fluid becomes continuous. The terms open pressure, relief pressure, cracking pressure, and set points are equivalent when testing valves.

**Source pressure** – The pressure supply source that provides pressure to a system. Examples include: gas cylinder, pump, heated vessel (boiler), cryogen Dewar, trapped cryogen expansion, chemical reaction, etc. Is not a regulated pressure.

**SCFM** - Standard cubic feet per minute evaluated at 14.7 psia, 58 °F, and 36% relative humidity.

**Stop valve** – A valve that is installed between the piping or component being protected and its protective device (e.g., PRV) or between the protective device and the point of discharge. Although allowed by the

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<sup>4</sup> ASME Section VIII, Division 1, 2007 edition, footnote 61

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ASME code, this design scenario is discouraged. Designs using stop valves in any manner that is not allowed by the ASME code must be approved by the CPSO.<sup>5</sup>

**Sub-component** – Term used to describe an element which together with other elements comprise a component. For example: A boiler can be a component of a steam system, but the boiler itself is made up of sub-components (shell, tubes, PRV, etc.).

**Supporting piping systems** – Term shall be considered any and or all the piping necessary for the function of the process or system for all pressure vessels, boilers, and air receivers. Piping that is attached in excess of that required for the process or system operation is not “supporting piping”. For LANL, new system boundary rules are defined by ESM Chapter 1, Section 220 (existing may not always conform) and Chapter 1, Section 210, Attachment A lists existing systems and general boundaries. In practical applications to separate “supporting piping” from non-supporting piping, a unique pressure safety system identification number in accordance with ESM Chapter 17 will be used to identify piping that is considered to be non-supporting piping.

**System** – For this chapter, a combination of multiple components (and possibly subcomponents) which together make a pressure system. Example 1: A steam system can be comprised of two main components: The boiler and the steam piping which runs throughout a building. Example 2: A gas chromatograph system may consist of a combination of components (or sub-components) such as: gas cylinder, manual valves, tubing, pressure transducers, flexible hoses, vacuum pump, and the GC.

**System interaction** – Interactions among pressure systems that may cause a system to be over pressurized, or cause unwanted mixture of separate fluids, which necessitates the evaluation of all system interfaces (e.g., determination of check valve installation and placement). In extreme cases could warrant the use of dual check valves placed in series.

**System owner** – The individual responsible for the overall operation, maintenance, design (code compliance), documentation, and/or construction of a pressure system.

**Tank** – A container whose contents are maintained at atmospheric pressure or below 15 psig at all times, and cannot be pressurized above 15 psig, even during fault conditions.

**Test article** – An excluded pressure system/component. A component or system of components provided by a vendor, or is part of a research and design deliverable. It is temporarily installed in LANL facilities exclusively for the purpose of being tested for data purposes, or destructive purposes. Included in this definition are those test articles that are being designed by LANL personnel, which are considered product, and must undergo numerous design changes, modifications, and alterations.

Examples of excluded test article systems include flight hardware such as: WR pressure components and systems (e.g., vehicle-specific flight-weight tritium reservoirs and associated flight-weight plumbing/components), or space vehicle pressure components and systems (e.g., vehicle flight-weight propulsion or hydraulic systems/components). However, pressure systems that support the design, testing and/or evaluation of such hardware are not excluded.

**Vacuum system** – An assembly of components which may include vessels, piping, valves, relief devices, flex hoses, gages, etc., operated with the internal pressure reduced to a level less than that of the surrounding atmosphere. Some vacuum systems can be subjected to a positive pressure because of vacuum break and purging capabilities.

**Vacuum vessel** – A vessel operated with the internal pressure reduced to a level less than that of the surrounding atmosphere.

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<sup>5</sup> See ASME B31.3 paragraph 322.6.1



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**Vendor-owned equipment** - Pressure vessels and/or equipment owned by a vendor to transport, store fluids or gases, or to perform a support function on LANL property.

**Vessel** – For the purpose of this program, any pressure chamber, regardless of formed heads (e.g., dished, concave, convex, etc.) or cylindrical shape, which has been installed into a pressure system that can, through normal operation or fault conditions, be pressurized above 15 psig.

**Volumetric weld examination** – Examination of a full penetration weld by x-ray or ultrasonic testing.