



**NASA TECHNICAL STANDARD**

National Aeronautics and Space Administration

**NASA-STD-8719.26**

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**Baseline**

**NASA REQUIREMENTS FOR GROUND BASED  
NON-CODE METALLIC PRESSURE VESSELS**

## NASA-STD-8719.26

### DOCUMENT HISTORY LOG

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Baseline		2021-05-11	Initial Release

# NASA-STD-8719.26

## FOREWORD

This NASA technical standard provides uniform engineering and technical requirements for processes, procedures, practices, and methods that have been endorsed as standard for NASA facilities, programs, and projects, including requirements for selection, application, and design criteria of ground-based pressure vessels (PVs).

This standard establishes continued use justification for non-code PVs to ensure an equivalent or greater level of protection for affected employees in accordance with Agency Responsibilities, 29 CFR § 1960.8(a). For some applications, Occupational Safety and Health Standards (OSHA) requires PVs to be built in accordance with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (BPVC). This standard specifically addresses cases in which compliance with ASME BPVC Section VIII Division 1 or Division 2-1968, Unfired Pressure Vessels, is required but is not achieved. This standard also establishes supplementary requirements to ensure a safe employment and place of employment as required by 29 CFR § 1960.8(a), and Supplementary Standards, 29 CFR § 1960.18. The supplementary requirements are for those cases in which there exists no appropriate OSHA standard but compliance with the ASME Codes cited above has been deemed applicable by OSHA through various Letters Of Interpretation (LOIs).

This standard is a performance standard that forms the basis for use by NASA Installation Pressure Systems Managers (PSMs) to certify qualification of these non-code metallic PVs, in accordance with existing internal NASA policy and procedures.

This standard was developed by the NASA Office of Safety and Mission Assurance (OSMA) and representatives of each of the NASA Installations. Requests for information, corrections, or additions to this standard should be submitted to the OSMA by email to [Agency-SMA-Policy-Feedback@mail.nasa.gov](mailto:Agency-SMA-Policy-Feedback@mail.nasa.gov) or via the “Email Feedback” link at <https://standards.nasa.gov>.

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May 11, 2021

Approval Date

# NASA-STD-8719.26

## Table of Contents

<b>Document History Log .....</b>	<b>2</b>
<b>Foreword.....</b>	<b>3</b>
<b>List of Appendices.....</b>	<b>4</b>
<b>1. SCOPE .....</b>	<b>5</b>
1.1 Purpose.....	5
1.2 Applicability .....	5
1.3 General Approach .....	9
<b>2. APPLICABLE AND REFERENCE DOCUMENTS .....</b>	<b>10</b>
2.1 Applicable Documents .....	10
2.2 Reference Documents .....	10
2.3 Order of Precedence.....	11
<b>3. ACRONYMS AND DEFINITIONS .....</b>	<b>12</b>
3.1 Acronyms and Abbreviations .....	12
3.2 Definitions.....	12
<b>4. REQUIREMENTS.....</b>	<b>14</b>
4.1 Technical Requirements.....	14
4.2 Documentation Requirements.....	17
4.3 Qualification .....	18
4.4 Documentation Records .....	18

## LIST OF APPENDICES

Appendix A. OSHA Standard Interpretations, Pressure Vessels Used at Oil and Gas Extraction/Production Facilities and Applicability of 29 CFR 1910.106, dated July 17, 2006 .....	19
Appendix B. OSHA Standard Interpretations, Application of 29 CFR 1910.169 Air Receivers, and other OSHA standards, to pressure systems in service at NASA, dated May 3, 2010 .....	28

## **REQUIREMENTS FOR NASA GROUND BASED NON-CODE METALLIC PRESSURE VESSELS**

### **1. SCOPE**

#### **1.1 Purpose**

1.1.1 The purpose of this standard is to ensure the safety of personnel and manage risk to facilities, operations, and the environment posed by the use of existing ground-based, non-code metallic pressure vessels (PVs) owned by NASA that either do not comply with applicable ASME code requirements specified in OSHA regulations (see Occupational Safety and Health Standards, 29 CFR pt. 1910), or are in a service not covered by specific regulations of 29 CFR pt. 1910. This is accomplished through demonstration of the structural integrity and fitness for service of these PVs through implementation of a minimum set of inspection, testing, and analytical requirements in accordance with this standard to ensure an equivalent or greater level of safety and protection for affected personnel as required by OSHA for Federal Agencies in Alternate Standards, 29 CFR § 1960.17 and Supplementary Standards, 29 CFR § 1960.18.

1.1.2 NASA has implemented Occupational Safety and Health (OSH) programs (see Occupational Safety and Health programs for Federal Employees, E.O. 12196 and 29 CFR § 1960.8(c)) at each of its facilities that comply with the OSHA regulations of 29 CFR pt. 1910 to the extent possible. However, due to the unique nature of NASA's mission and accompanying research and development programs, not all regulations concerning PVs of 29 CFR pt. 1910 can be met in all cases.

1.1.3 This NASA technical standard provides uniform engineering and technical requirements for processes, procedures, practices, and methods that have been endorsed as standard for NASA facilities, programs, and projects, including requirements for selection, application, and design criteria of ground-based PVs that do not, or cannot, comply with all applicable 29 CFR pt. 1910 regulations. Letters of Interpretation (LOI)s published by OSHA or sent to NASA without publication, as per OSHA practice for Federal Agencies, are also considered.

1.1.4 While most NASA PVs are ASME code compliant, some are not. For some applications, OSHA regulations in 29 CFR pt. 1910 require that PVs comply with the ASME BPVC Section VIII Division 1 or Division 2-1968, Unfired Pressure Vessel. For many NASA PV applications, however, the OSHA regulations of 29 CFR pt. 1910 provide no requirements or guidance. This Standard addresses both situations and provides a tool for NASA to implement the requirements in 29 CFR §§ 1960.17-1960.18 for a safe employment and place of employment.

#### **1.2 Applicability**

1.2.1 This standard is applicable to NASA Headquarters and NASA Centers, including Component Facilities and Technical and Service Support Centers. This language applies to the Jet Propulsion Laboratory (a Federally-Funded Research and Development Center), other

## NASA-STD-8719.26

contractors, recipients of grants, cooperative agreements, or other agreements only to the extent specified or referenced in the applicable contracts, grants, or agreements for work performed at such NASA facilities, to include programs and other Agency documents as technical requirements for existing non-code metallic PVs located at those facilities.

1.2.2 Operations with non-code PVs controlled by NASA exist at the following sites: Armstrong Flight Research Center, Ames Research Center, Glenn Research Center, Glenn Research Center Neil A. Armstrong Test Facility, Goddard Space Flight Center, Jet Propulsion Laboratory, Johnson Space Center, Kennedy Space Center, Langley Research Center, Marshall Space Flight Center, Michoud Assembly Facility, Stennis Space Center, Wallops Flight Facility, White Sands Test Facility, and Aerojet Rocketdyne West Palm Beach Test Stand E-6.

1.2.3 This Standard applies only to NASA employees and contractors. NASA requests that OSHA use this standard when evaluating the working conditions of non-NASA employees affected by this equipment and these specified operations for compliance.

1.2.4 This standard applies to the following non-code metallic PVs located on Federal property that are operated by NASA or by contractors performing work for NASA with NASA-owned ground-based metallic PVs (this does not include commercial entities or other tenants operating on their own behalf) and which expose personnel to potential hazards:

- a. Any NASA owned ground-based metallic PVs existing on the date of publication of this standard which are within the scope of ASME BPVC Section VIII Division 1 or Division 2-1968 (as specified in the 29 CFR pt. 1910 regulations), but which were not fabricated in accordance with that code or its later editions.
- b. Any NASA owned ground-based metallic PV existing on the date of publication of this standard that was originally compliant with the requirements of the ASME BPVC Section VIII Division 1 or Division 2-1968 but, which due to physical modifications, alterations, or service changes, no longer complies with the applicable code or standard.

### 1.2.5 OSHA Letters of Interpretation

1.2.5.1 In 2021 OSHA reviewed this standard and indicated it does not require formal submission to OSHA as an Alternate or Supplemental Standard because it is consistent with the applicable OSHA LOIs attached for reference in Appendix A and Appendix B. In accordance with applicable OSHA LOIs (reference from Appendix A):

*“In cases where traceability is not possible, OSHA will treat as a de minimis violation any pressure vessel that is required by a specific OSHA standard ... to be built in accordance with the Code, but that does not have the Code-required NRS, provided that the criteria below are met:*

*1. The employer can demonstrate that it has taken reasonable steps to obtain or retain the required NRS. For example, did the employer contact the previous owner in an attempt to obtain the pressure vessel's NRS; if the employer has the pressure vessel number, did it contact ASME or the National Board of Boiler and Pressure Vessel*

## NASA-STD-8719.26

*Inspectors to obtain the required records; does the employer have a procedure in place to assure that any new or used pressure vessel it purchases or takes control of has the required Code NRS; does the employer routinely purchase used pressure vessels without the NRS; and*

*2. The employer verifies the fitness-for-operations integrity of the vessels by utilizing the procedure contained in API 510, Section 6.7. This procedure is for pressure vessels with no "traceability," such as those with no nameplate and minimal or no design or construction documentation. This procedure includes items such as: performing inspections and making necessary repairs; defining design parameters, and preparing drawings and calculations; basing calculations on applicable codes/standards; evaluating unidentified materials; use of radiography; marking with nameplate or stamping; and performing pressure testing."*

1.2.5.2 This standard applies the criteria established in the OSHA LOI referenced in 1.2.5.1 for the specific subparagraphs of the OSHA General Industry regulations of 29 CFR cited below only with respect to non-compliance of PVs with ASME BPVC Section VIII Division 1 or Division 2-1968:

- a. 29 CFR § 1910.103(b)(1)(i) - Hydrogen, Gaseous Hydrogen Systems, Design, Containers; subparagraph 29 CFR § 1910.103(b)(1)(i)(a)(1).
- b. 29 CFR § 1910.103(c)(1)(i) - Hydrogen, Liquefied Hydrogen Systems, Design, Containers; subparagraph 29 CFR § 1910.103(c)(1)(i)(a).
- c. 29 CFR § 1910.104(b)(4)(ii) - Oxygen, Bulk Oxygen Systems, Storage Containers, Construction – Liquid; subparagraph 29 CFR § 1910.104(b)(4)(ii).
- d. 29 CFR § 1910.104(b)(4)(iii) - Oxygen, Bulk Oxygen Systems, Storage Containers, Construction – Gaseous; subparagraph 29 CFR § 1910.104(b)(4)(iii)(a).
- e. 29 CFR § 1910.106(b)(1)(iv) - Flammable Liquids, Tank Storage, Design and Construction of Tanks, Low Pressure Tanks; subparagraph 29 CFR § 1910.106(b)(1)(iv)(b)(2).
- f. 29 CFR § 1910.106(b)(1)(v) - Flammable Liquids, Tank Storage, Design and Construction of Tanks, Pressure Vessels; subparagraph 29 CFR § 1910.106(b)(1)(v)(b).
- g. 29 CFR § 1910.169(a)(2) - Air Receivers, General Requirements, New and Existing Equipment; subparagraph 29 CFR § 1910.169(a)(2)(i).

### 1.2.6 Supplementary Requirements

1.2.6.1 This Standard applies to those non-code metallic PVs, described in 1.2.4 which are in a service not covered by the 29 CFR pt. 1910 sections identified in 1.2.5.2 or any other sections, for which the Occupational Safety and Health Act, General Duty Clause § 5(a)(1) applies.

## NASA-STD-8719.26

1.2.6.2 This standard applies to non-code metallic Layered Pressure Vessels (LPV), operated by NASA, for which no existing OSHA regulations apply.

1.2.6.3 Non-code metallic PVs containing compressed air, other compressed gases or pressurized fluids (other than oxygen, hydrogen, acetylene, and flammable liquids, which are covered by specific regulations), and including Highly Hazardous Chemicals below the threshold quantities listed in Process Safety Management of Highly Hazardous Chemicals, 29 CFR § 1910.119.

1.2.6.4 These supplementary requirements may apply to other non-code metallic PVs as determined and documented by each PSM.

### 1.2.7 Out of Scope PVs

1.2.7.1 This standard does not apply to:

- a. Non-code metallic PVs that are not owned by NASA, such as leaseholder or contractor owned PVs.
- b. Non-code metallic PVs that are owned by NASA but are not operated for NASA, regardless of whether or not they are operated on NASA property.
- c. Non-metallic PVs, including PVs having a metal liner reinforced by non-metallic outer wrappings.
- d. PVs not within the jurisdiction of the ASME BPVC Section VIII Division 1 or Division 2-1968, such as vessels operated at 15 psig or less internal or external pressure, vessels 6 inches or less inside diameter, and pressurized water vessels of 120 gallon or less capacity.
- e. Fired or unfired metallic PVs within the jurisdiction of ASME BPVC Sections I or IV.

1.2.8 The principal application of this standard is to permit the continued use of existing ground based non-code metallic PVs that were placed into service prior to the publication of this standard that cannot be replaced with fully ASME compliant PVs for technical or economic reasons, while providing an equivalent or greater level of protection to affected employees as would be provided in 29 CFR pt. 1910 regulations.

1.2.9 It is NASA's specific intent that this standard not be used to justify procurement or transfer from outside the agency of any new non-code ground based metallic PVs subsequent to March 18, 2021.

1.2.10 In this standard, all mandatory actions (i.e., requirements) are denoted by statements containing the term "shall." The term "may" denotes a discretionary privilege or permission, "can" denotes statements of possibility or capability, "should" denotes a good practice and is



## NASA-STD-8719.26

recommended, but not required, "will" denotes expected outcome, and "are/is" denotes descriptive material.

### 1.3 General Approach

1.3.1 29 CFR pt. 1910 does not distinguish between ASME BPVC Section VIII Division 1 or Division 2-1968. Therefore, NASA qualifies PVs based on documentation essentially following the requirements of ASME BPVC Section VIII Division 1 or Division 2-1968, whichever is most applicable.

1.3.2 This standard, provides alternate requirements to those found in the OSHA regulations identified in 1.2.5.2 that PVs comply with ASME BPVC Section VIII Division 1 or Division 2-1968. This standard assures an equivalent or greater level of protection to affected employees to that achieved by compliance with the applicable ASME BPVC Section VIII Division 1 or Division 2-1968.

1.3.3 This standard provides permanent supplementary requirements to address safety of non-code metallic PVs in situations not covered by the OSHA General Industry regulations found in 29 CFR pt. 1910, and assures the vessels are fit for operation and provide an adequate level of protection consistent with OSHA standards in 29 CFR pt. 1960.

1.3.4 This standard generally requires the verification of fitness-for-operations and structural integrity at each NASA facility following the approach of API 510-2006, Pressure Vessel Inspection Code and API 579-1/ASME FFS-1-2016, Fitness for Service. For some non-code metallic PVs that are not currently addressed by API 510-2006 or API 579-1/ASME FFS-1-2016, such as NASA's fleet of ground-based LPVs, the existing American Petroleum Institute (API) approaches are supported by additional work performed by NASA involving extensive investigations, analyses, materials data development, and Nondestructive Examination (NDE) research and methods development and qualification.

1.3.5 For each non-code metallic PV, the NASA Installation PSM performs and/or approves all of the requirements contained in Section 4 of this standard. This ensures this standard is consistent with API 510-2006 Section 7.7.

1.3.6 Installation, inspection, rerating, alterations, and repair of non-code metallic PVs shall be performed based on the direction of the PSM and to the fullest extent possible in accordance with the National Board Inspection Code (NBIC), NB-23 parts 1, 2 or 3.

1.3.7 Demonstrating compliance with this standard is deemed to provide the same level of protection as afforded by operating an ASME code stamped vessel.

1.3.8 Requirements in addition to, and that do not conflict with, those listed herein may be appropriate for inclusion in Center-specific Pressure Vessels and Pressurized Systems (PVS) policies and procedures for certification and acceptance of these vessels to deal with unique applications and situations not addressed by this document. Such additional requirements are outside the scope of this standard.

## NASA-STD-8719.26

### 2. APPLICABLE AND REFERENCE DOCUMENTS

#### 2.1 Applicable Documents

The documents listed in this section contain provisions that constitute requirements of this standard as cited in the text. Use of more recent editions of cited documents may be authorized by the responsible PSM. The applicable documents are accessible via the NASA Technical Standards System at <https://standards.nasa.gov> or may be obtained directly from the Standards Developing Organizations or other document distributors.

##### 2.1.1 Government Documents

NPR 1441.1	NASA Records Management Program Requirements
NPR 8715.1	NASA Safety and Health Programs
NASA-STD-8719.17	NASA Requirements for Ground-Based Pressure Vessels and Pressurized Systems (PVS)

##### 2.1.2 Non-Government Documents

API 579-1/ASME FFS-1-2016	Fitness-for-Service
API 510-2006	Pressure Vessel Inspection Code
ASME BPVC-1968	Unfired Pressure Vessel, Division 1 and Division 2
ASME BPVC-2019	Boiler and Pressure Vessel Code
ASNT SNT-TC-1A-2016	Personnel Qualification and Certification in Nondestructive Testing
ANSI/ASNT CP-189-2016	ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel
Welding Research Council (WRC) Bulletin 528,	Development of Material Fracture Toughness Rules for the ASME B&PV Code, Section VIII, Division 2
WRC Bulletin 562	Recommendations for Establishing the Minimum Pressurization Temperature (MPT) for Equipment

#### 2.2 Reference Documents

The reference documents listed in this section are not incorporated by reference within this standard, but may provide further clarification and guidance.

##### 2.2.1 Government Documents

## NASA-STD-8719.26

E.O. 12196	Occupational Safety and Health programs for Federal Employees
29 CFR pt. 1910	Occupational Safety and Health Standards
29 CFR pt. 1960	Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters
OSHA Standard Interpretations	Pressure Vessels Used at Oil and Gas Extraction/Production Facilities and Applicability of 29 CFR 1910.106, dated July 17, 2006, Charles H. Morgan
OSHA Standard Interpretations	Application of 29 CFR 1910.169 Air Receivers, and Other OSHA Standards, to Pressure Systems in Service at NASA, dated May 3, 2010, Michael G. Stamatelatos, Ph.D.
2.2.2 Non-Government Documents	
ASME BPVC Code Case 1205	Integrally Forged Vessels, SA-372, Section VIII, Division 1
NB-23 parts 1, 2 and 3	National Board Inspection Code

### 2.3 Order of Precedence

2.3.1 This standard prescribes requirements to be followed by NASA for qualification of existing non-code metallic PVs. It includes provisions to ensure compliance with OSHA regulations in 29 CFR pt. 1960, Basic Program Elements for Federal Employees, which requires a safe employment and place of employment for personnel. See 1.2.5 and 1.2.6.

2.3.2 Where conflicts exist between this standard and standards that contain provisions that constitute requirements of this standard as cited in the text, this standard takes precedence, except in the case where those standards are to Federal or State regulations.

2.3.3 Clarification and further resolution of conflicts is resolved by the responsible PSM.

## NASA-STD-8719.26

### 3. ACRONYMS AND DEFINITIONS

#### 3.1 Acronyms and Abbreviations

ASME	American Society of Mechanical Engineers
ASNT	American Society for Nondestructive Testing
BPVC	Boiler and Pressure Vessel Code
LOI	Letter of Interpretation
LPV	Layered Pressure Vessel
MAWP	Maximum Allowable Working Pressure
MDMT	Minimum Design Metal Temperature
MPT	Minimum Pressurization Temperature
NBIC	National Board Inspection Code
NDE	Nondestructive Examination
OSH	Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
OSMA	Office of Safety and Mission Assurance
PSM	Pressure Systems Manager
PV	Pressure Vessel
PVS	Pressure Vessels and Pressurized Systems

#### 3.2 Definitions

**Certification.** The Center PSM's formal statement that a PVS complies with Agency requirements and this standard, which require a documented process for assessment of integrity and risk, and compliance with applicable requirements. *Source:* NASA-STD-8719.17.

**Code Pressure Vessels.** PVs that are designed, fabricated, installed, stamped, and maintained in strict conformance with the requirements of Section VIII of the ASME BPVC.

## NASA-STD-8719.26

**Factor of Safety.** The design margins equivalent to those of the 1968 edition of ASME BPVC, same as “design factor” used in API 510-2006 Section 7.7.

**Ground-Based Layered Pressure Vessel.** A metallic PV having a shell and/or heads made up of two or more separate layers.

**Maximum Allowable Working Pressure (MAWP).** As part of the design basis of the vessel, the maximum pressure permissible at the top of the vessel in its normal operating position at the designated coincident temperature specified for that pressure.

**Minimum Design Metal Temperature (MDMT).** As part of the design basis of the vessel, the coldest metal temperature expected in service at a coincident MAWP.

**Minimum Pressurization Temperature (MPT).** An analytically derived temperature based on the Fracture Toughness Master Curve (Master Curve) and/or Fracture Mechanics below which a vessel must be depressurized to ensure against brittle fracture. MPT curves as derived in WRC 562 serve as an alternate form of an impact test exemption curve to those provided in 2019 edition of ASME BPVC Section VIII, Division 1, Section UCS-66 and VIII, Division 2 Figures 3.7 and 3.8.

**Non-Code Metallic PV.** Any PV that is not stamped with the appropriate ASME code symbol and documented as complying with the original applicable ASME construction code, including PVs that were fabricated from non-code materials by non-code processes or organizations. This category also includes ASME code stamped PVs later repaired or modified without a National Board R-stamp.

**Pressure Systems Manager (PSM).** The person at a NASA Installation designated by the Installation Director as the Institutional Safety Discipline Lead having technical oversight for ground-based pressure systems, managing safety policies and programs for pressure systems and ensuring their implementation at the NASA Installation. The PSM serves as the jurisdiction having authority for PVs for facilities operating under exclusive Federal jurisdiction and is analogous to a state chief boiler inspector in regards to the issuance of operating permits. However, neither the PSM nor their staff functions as a National Board inspector unless they are so certified by the National Board of Boiler and Pressure Vessel Inspectors.

**Qualification.** A written statement by the PSM that documentation for an individual PV complies with the requirements of this standard.

## NASA-STD-8719.26

### 4. REQUIREMENTS

#### 4.1 Technical Requirements

4.1.1 Prior to qualification of an existing non-code metallic PV or introduction of an existing non-code metallic PV to a new service under this standard, the following requirements shall be met:

4.1.1.1 Inspections shall be performed to determine the condition of the vessel including a complete dimensional checking of all components necessary to determine the minimum required thickness and adequacy of the design of the vessel (i.e., heads, shell(s), transitions, openings, reinforcement pads, saddle supports, etc.).

4.1.1.2 Design parameters shall be defined and drawings prepared.

4.1.1.3 Applicable base and welding metal material properties (including chemistry, yield strength, ultimate strength, elongation, fracture toughness, and other characteristics) relevant to the particular PV, as needed, to calculate the factor of safety at the maximum allowable working pressure (MAWP) and coincident minimum design metal temperature (MDMT) or minimum pressurization temperature (MPT), remaining safe life (due to degradation or cyclic pressure), and thermal service shall be determined by one or more of the following means:

- a. Use of credible existing original manufacturer material properties documentation that are shown to be applicable.
- b. Development of material properties data through testing and analysis of similar vessels that can be demonstrated as applicable to the PVs being qualified.
- c. Development of actual material properties above minimum specified through testing and analysis. Actual material properties for a particular vessel rather than specified minimum properties can only be used to qualify a PV if every lot of material used to fabricate the vessel is tested and the minimum actual values are identified.
- d. Selection of material properties (other than layered vessels) based on conservative assumptions in accordance with API 510-2006 and API 579-1/ASME FFS-1-2016. See API 510, Evaluation of Existing Equipment with Minimal Documentation.

4.1.2 A PV structural analysis shall be performed to show the following, which are deemed to provide an equivalent level of safety to ASME BPVC Section VIII-1968 construction if all requirements of this standard are met.

4.1.2.1 The documented MDMT or MPT shall be equal to or lower than the coldest operating condition including consideration of adiabatic cooling at nozzles due to blowdown conditions, if applicable.

4.1.2.2 The MDMT or MPT shall be determined for each non-code metallic PV using one of the following approaches:

## NASA-STD-8719.26

a. Complying with the impact test exemption curves provided in ASME BPVC-2019, Section UCS-66 of VIII, Division 1 or Section 3.11.2.3 of VIII, Division 2, as applicable. Later editions of ASME BPVC may be used subject to approval by the PSM.

b. Performing, or having records of, impact and lateral expansion testing to achieve MDMT less than permitted by the impact test exemption curves in accordance with the rules of ASME BPVC-2019, Section UCS-66 VIII, Division 1 or section 3.11.2.2 of Section VIII, Division 2, as applicable. Later editions of ASME BPVC may be used subject to approval by the PSM.

c. Performing fracture mechanics evaluations to document the MPT in accordance with API 579-1/ASME FFS-1-2016, consistent with ASME BPVC Section VIII-2019, Division 2, section 3.11.2.8 for minimum reference flaw size. In this approach, an MPT may be determined using a Master Curve approach consistent with that developed in WRC Bulletin 528, Development of Material Fracture Toughness Rules for ASME BPVC Section VIII, Division 2, and WRC 562, Recommendations for Establishing the Minimum Pressurization Temperature (MPT) for Equipment. Later editions of ASME BPVC may be used subject to approval by the PSM.

4.1.3 A user defined MAWP at the coincident MDMT or MPT that meets the following four criteria shall be determined:

a. The MAWP assures a factor of safety not less than 4.0 for PVs essentially following the qualification requirements of ASME BPVC Section VIII Division 1-1968, and a factor of safety equal to or greater than 3.0 for PVs essentially following the qualification requirements of ASME BPVC Section VIII Division 2-1968.

b. Non-code metallic PVs essentially following the qualification requirements of ASME Code Case 1205 have a factor of safety equal to or greater than 3.0.

c. The MAWP provides a remaining safe life based on the relevant damage mechanisms and fatigue or fracture mechanics analysis consistent with section 4.1.4 and the NDE requirements of 4.1.5, with appropriate conservative bounding defect size estimates, a documented cyclic life capability of at least twice the period until the next scheduled inspection for relevant defects, degradation, and cracks.

d. The MAWP does not exceed the original manufacturer's pressure rating.

4.1.4 Calculated remaining safe life shall include an assessment of all relevant damage mechanisms in accordance with API 579-1/ASME FFS-1-2016.

4.1.5 NDE for qualification of in-service non-code metallic PVs shall be performed and meet the following requirements.

4.1.5.1 The extent of NDE performed shall be in accordance with ASME BPVC Section VIII Division 1 or Division 2 as required for the joint efficiencies applied in the design calculations.

## NASA-STD-8719.26

4.1.5.2 Surface and volumetric examination, as applicable, shall be used to screen for the presence of defects identified as critical to PV safe life in Sections 4.1.2 through 4.1.4.

4.1.5.3 NDE shall be performed at intervals not exceeding one-half the qualified remaining safe life as determined from the structural analyses, or every 20 years, whichever is more frequent.

4.1.5.4 Inspections and examinations shall be performed using validated and documented techniques and processes.

4.1.5.5 For inspection techniques covered by voluntary consensus standards, NDE examiner qualifications shall be in accordance with their employers written practice which shall be in accordance with one of the following documents: ASNT SNT-TC-1A-2016, Personnel Qualification and Certification in Nondestructive Testing or CP-189, ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel, or the ASNT Central Certification Program, and any additional requirements set forth by the ASME BPVC Section V, (i.e., additional on the job training or experience in a method before certification). This paragraph does not intend to require an individual to be certified and maintain an ANDE-1-2015, ASME Nondestructive Examination and Quality Control Central Qualification and Certification Program.

4.1.5.6 Inspection techniques not covered by a voluntary consensus standard shall be performed in accordance with a documented and qualified procedure approved by NASA.

4.1.5.7 NDE acceptance and rejection criteria shall either be in accordance with ASME BPVC Section VIII Division 1 or Division 2, or be derived based on fracture mechanics analysis and/or demonstrated detection capability as appropriate.

4.1.6 The following additional requirements apply for LPVs.

4.1.6.1 For non-code metallic LPVs, measurement of LPV expansion from zero to maximum operating pressure using pi tape measurement as described in ASME BPVC Section VIII, ULW-78 or other validated method shall be performed and demonstrate that the expansion of each shell course is between 50 percent and 105 percent of the expected value in order for the LPV to remain in service. For the purposes of measuring baseline efficiency and manufacturing quality, this inspection is only required once during the service life of the LPV.

4.1.6.2 For non-code metallic LPVs, vent holes through shell layers shall be monitored annually for blockage and leakage, or more frequently if so determined by the PSM.

4.1.7 Either a pressure test shall be performed as soon as practical, or documentation be obtained demonstrating that a pressure test was previously performed, as required by the code of construction used for design calculations (i.e., ASME BPVC Section VIII Division 1 or Division 2-1968).



## NASA-STD-8719.26

4.1.8 Those PVs lacking a permanent nameplate, marking or stamping with unique serialization shall be provided with such identification, including: MAWP at temperature and MDMT or MPT, and year of fabrication, if available.

### 4.1.9 Exceptions

4.1.9.1 For cases in which conformance with all of the above requirements is not feasible, a risk-informed hazard assessment shall be performed and a request for relief obtained in accordance with NPR 8715.1, NASA Safety and Health Programs and NASA-STD-8719.17, NASA Requirements for Ground-Based Pressure Vessels and Pressurized Systems (PVS).

4.1.9.1.1 Mitigations such as reduced operational pressure, increased MDMT, and reduced personnel exposure (e.g., separation distance, access controls, and physical barriers) shall be accessed.

4.1.9.1.2 Analyses addressing uncertainty in known or suspected defects, material properties, structural and fracture analysis, etc. shall be assessed.

## 4.2 Documentation Requirements

4.2.1 The PSM at each NASA Installation shall ensure that documentation for qualification of each in-service non-code metallic PV owned and operated by the NASA Installation is maintained, consisting of the following:

- a. Assessment of the need to operate the non-code metallic PV justifying why operations cannot be performed effectively and economically without its use, including an investigation of feasible alternates such as replacement or separation of PV operation from personnel.
- b. Design and service parameters and limitations, including pressure and temperature cycling limits and frequencies.
- c. PV configuration and support structure, sufficient to permit valid engineering analyses to be performed with respect to stresses, structural integrity, and growth of potential defects. Prepare drawings if none exist.
- d. Inspector/examiner qualifications (4.1.5.5).
- e. Inspections/examinations performed and their results (4.1.5.4).
- f. Pressure test records as applicable.
- g. Materials of construction and their strength and fatigue or fracture properties as applicable (4.1.1.3).
- h. PV structural and calculated remaining safe life (4.1.2, 4.1.3, 4.1.4); and fracture analysis (4.1.2), as applicable.
- i. The risk informed hazard assessment if required by (4.1.9).

## **NASA-STD-8719.26**

4.2.2 The PSM shall maintain a record of all PVs approved in accordance with exceptions (4.1.9).

### **4.3 Qualification**

4.3.1 Existing in-service non-code metallic PVs may continue to operate after publication of this standard and prior to qualification in accordance with this standard if associated hazards have been assessed and rationale provided for operation by the Center PSM.

4.3.2 An existing non-code metallic PV being placed into new service shall be qualified in accordance with this standard prior to operation.

4.3.3 For each non-code metallic PV in operation, the PSM shall assess the documentation package provided in accordance with section 4.2 based on compliance with section 4.1.

4.3.4 If the PSM deems the documentation for an individual PV complies with the requirements of this standard, then the PSM may qualify that non-code metallic PV for service.

4.3.5 A non-code metallic PV qualified in accordance with this standard shall be identified as such in the configuration management system used to track PVS certification at the owning NASA Installation and be identified for NASA reporting purposes as “Compliant Non-Code”.

### **4.4 Documentation Records**

4.4.1 Documentation shall be maintained in accordance with this standard and NPR 1441.1, NASA Records Management Program Requirements.

4.4.2 The results of inspections and analyses performed to qualify a PV in accordance with this standard shall be retained by the owning NASA Installation until the PV is removed from NASA inventory.

4.4.3 Qualification records shall be incorporated into the PVS documentation system at the NASA Installation per NASA policy and procedures.

## NASA-STD-8719.26

# APPENDIX A. OSHA STANDARD INTERPRETATIONS, PRESSURE VESSELS USED AT OIL AND GAS EXTRACTION/PRODUCTION FACILITIES AND APPLICABILITY OF 29 CFR 1910.106, DATED JULY 17, 2006

### Standard Interpretations

/ Pressure vessels used at oil and gas extraction/production facilities and applicability of 29 CFR 1910.106

- **Standard Number:** 1910.106 ; 1910.106(a)(19) ; 1910.106(b) ; 1910.106(b)(1)(v) ; 1910.106(b)(1)(v)(b) ; 1910.106(i)(3)(i) ; 1910.106(i)(3)(ii) ; 1910.119 ; 1910.169

OSHA requirements are set by statute, standards and regulations. Our interpretation letters explain these requirements and how they apply to particular circumstances, but they cannot create additional employer obligations. This letter constitutes OSHA's interpretation of the requirements discussed. Note that our enforcement guidance may be affected by changes to OSHA rules. Also, from time to time we update our guidance in response to new information. To keep apprised of such developments, you can consult OSHA's website at <https://www.osha.gov>.

July 17, 2006

Mr. Charles H. Morgan  
One Atlantic Center  
1201 West Peachtree Street  
Atlanta, Georgia 30309-3424

Dear Mr. Morgan:

Thank you for your January 12, 2005 letter to the Occupational Safety and Health Administration's (OSHA's) Directorate of Enforcement Programs (DEP). We apologize for the delay in our reply. Our response is based on information you provided in your letter to me and follow-up communication with a member of my staff (phone call — February 22, 2005 and email — March 10, 2005). You have questions regarding OSHA's *Flammable and Combustible Liquids* Standard, 29 CFR 1910.106 related to pressure vessels used at oil and gas extraction/production facilities. Please be aware that this response may not be applicable to any question or situation not delineated within your original correspondence. Your specific issues are related to OSHA's requirements for pressure vessel safety. Please note that some of your scenarios and questions have been paraphrased.

**Scenario:** The following facts provide the basis for your questions:

- The facilities in question are on-shore oil and natural gas extraction/production facilities;

## NASA-STD-8719.26

- These facilities do not fall under the requirements of OSHA's *Process Safety Management of Highly Hazardous Chemicals; Explosives and Blasting Agents* standard (PSM), 29 CFR 1910.119 (i.e., they are not gas plants, nor are they classified under Standard Industrial Classification code — SIC 1321);
- The pressure vessels serve to separate the crude oil/natural gas/water, and at some locations they dehydrate the natural gas;
- The pressure vessels are not used as storage tanks;
- After leaving the pressure vessels the oil and water are piped to storage tanks, and the natural gas is either sold or transported via pipeline for further processing;
- The size of the pressure vessels at these facilities varies from 16 - 60 inches in diameter and from 10 to 15 feet in length;
- The normal operating pressures typically range from 50 to 1,000 psig;
- The contents of these pressure vessels typically are "*flammable liquids*" as defined by 1910.106(a)(19);
- The pressure vessels at these facilities were constructed over a period of many years (1940s to 1990s). As a result, some of the vessels were constructed prior to the promulgation of 1910.106;
- Many of the pressure vessels at these facilities were constructed in accordance with the edition of the ASME Boiler and Pressure Vessel Code (*Code*) that was in effect when these vessels were constructed — each of these pressure vessels possess a manufacturer's nameplate that is properly stamped with the *Code* symbol (generally a "U" stamp).
- Some pressure vessels at these facilities may not have been constructed in accordance with the *Code*. As a result, these pressure vessels may not possess a manufacturer's nameplate stamped with the *Code* symbol; and
- Due to the age of some of the vessels, the transfer of ownership of some vessels, or the closing of offices containing the records related to some vessels, your client is not in possession of all the necessary documentation that would establish that all the vessels in question were built in accordance with the *Code*. You state that it is highly unlikely that your client would be able to obtain the documentation.

### Background on PSM and Oil and Gas Production Facilities

OSHA stated in a 2000 memorandum to its Regional Administrators<sup>1</sup> that it would not enforce its PSM standards at oil and gas production facilities pending the outcome of an economic analysis with respect to the feasibility of compliance with PSM. Following the resolution of this issue, the oil and gas production facilities described above may be covered by the PSM standard.

For these reasons, our responses to your questions below do not address the application of any PSM requirements for pressure vessels.

**Question 1:** Are the pressure vessels located at oil and gas extraction/production facilities (as described in the scenario above) covered by the requirements of 1910.106 or some other OSHA standard that would require these pressure vessels to be built in accordance with or otherwise comply with the *Code*?

Note: The *Code* requirements relative to flammable and combustible liquids appear in only two provisions in 1910.106: 1910.106(b) and (i). By its terms, 1910.106(b) applies to "*tank storage*." Because the pressure vessels in question are process vessels and not storage vessels, it does not appear that 1910.106(b) would apply to the vessels in question. Similarly, by its terms, 1910.106(i) applies to "*refineries, chemical plants, and distilleries*." The pressure vessels in question are not used in refineries, chemical plants, or distilleries as those terms are specifically defined in 1910.106(a). Consequently, it would seem that 1910.106 does not impose any requirements regarding the *Code* on the vessels in question.

## NASA-STD-8719.26

**Response 1:** We agree with your analysis above. 1910.106(b) and 1910.106(i) do not apply to the design/fabrication/construction/installation (construction) of pressure vessels used for oil and gas production processing purposes such as you described, i.e. separation of oil/water/gas and the dehydration of natural gas. However, if pressure vessels are used to **store** flammable or combustible liquids, 1910.106(b)(1)(v)(b) mandates that *Code* pressure vessel construction requirements apply.

However, due to the serious hazards employees may be subject to as a result of the failure of pressure vessels used for oil and gas production processing purposes, an employer may be subject to Section 5(a)(1) of the OSH Act which requires employers to furnish a place of employment which is free from recognized hazards that are likely to cause death or serious physical harm to their employees.

The serious hazards related to the catastrophic failure of pressure vessels include being struck by high energy materials from the vessel and its contents, fire/explosion, and, depending on the vessel's contents, the release of toxic or corrosive materials. Pressure vessels can fail due to hazardous conditions related to their design, construction, operation, or in-service degradation. As a result, these production facilities, including the pressure vessels you describe, must be constructed properly to reduce the potential of a fire/explosion, high energy event, and/or a toxic or corrosives release from causing likely serious harm or death to employees. The mechanical integrity of production system equipment, including pressure vessel's construction is a recognized safe guard, especially in the petroleum industry, for protecting employees from serious hazards associated with the use of these vessels.

ASME and the American Petroleum Institute (API) have long recognized the serious safety considerations associated with the construction of pressure vessels. Both ASME and API recognize the *Code* as a recognized safe practice or good engineering practice for the construction of pressure vessels. Some API documents which acknowledge the *Code* and its construction requirements as a primary safeguard for the mechanical integrity of pressure vessels include:

1. API RP 74<sup>2</sup>, Section 2 — *References* list the *Code* as an industry code, practice or standard. This section also refers to API Spec 12J<sup>3</sup> and API Spec 12L<sup>4</sup>. Section 7 — (*Design*), identifies the design of pressure vessels as critical equipment which are essential in preventing the occurrence of, or mitigating the consequences of an uncontrolled event;
2. API 12J is an industry specification which covers among others the minimum requirements for the design and fabrication of oilfield type oil-gas-water separators used in the production of oil and/or gas. This specification contains many references to *Code* requirements such as construction, materials, testing, nameplate, stamping, etc;
3. API 12L is an industry specification that includes the minimum requirements for vertical and horizontal emulsion treaters. These treaters are pressure vessels used in the production industry for separating oil-water emulsions and gas. The function of these treaters is to dehydrate or dewater the produced crude oil to a specified level. This specification also contains many references to *Code* requirements such as construction, materials, corrosion, testing, inspection, nameplate, etc;

## NASA-STD-8719.26

4. An API pressure vessel inspection code<sup>5</sup> (API 510) applies to among others, pressure vessels constructed in accordance with the API/ASME Code for *Unfired Pressure Vessels for Petroleum Liquids and Gasses*, Section VIII of the *Code*. Additionally, API 510 applies to pressure vessels used for "*Exploration and Production*" for example producing, lease processing and treating liquid petroleum, natural gas and associated salt water. API 510 includes definitions for *ASME Code* and *construction code*. In these definitions, API states that the *ASME Code* was written for new construction of pressure vessels. *Construction Code* is said by API to be the code or standard to which the vessel was originally built, such as API/ASME.

API 510 states that in 1931, API and ASME created a joint committee to formulate and prepare a code for safe practices for pressure vessels in the petroleum industry. These safe practices include the design and construction of pressure vessels. That code was titled the *API/ASME Code for Unfired Pressure Vessels for Petroleum Liquids and Gasses* and was first published in 1934. API/ASME stated that they believed the *Code* actually applied to pressure vessels in most services.

The hazards related to the catastrophic failure of pressure vessels due to unsafe construction are recognized by the oil and gas industry (upstream and downstream) and by the petrochemical and refining industries. This hazard is the same whether the pressure vessel is used for *exploration and production* or is used in a refinery/chemical plant. To control the hazards related to the catastrophic failure of pressure vessels, employers must assure the mechanical integrity of their pressure vessels. One feasible means of abating this hazard would be to construct pressure vessels to *Code* requirements.

**Question 2:** What are the effective date(s) of any OSHA standard(s) that would require pressure vessels located at oil and gas extraction/production facilities to be built in accordance with or otherwise comply with the *Code*?

**Response 2:** Without more information about the specific nature and purpose of the pressure vessels located at oil and gas extraction/production facilities we cannot list all the standards that would apply in these situations. However, specific OSHA standards that might apply to the operations you describe, based on factors such as the material contained in the vessel or the specific use of the vessel, may include, but are not necessarily limited to, 29 CFR 1910.106 and 1910.169. For pressure vessels required to comply with 1910.106, *Flammable and Combustible Liquids*, and those required to comply with 1910.169, *Air Receivers*, the effective date was February 15, 1972 [36 FR 10466].

**Question 3:** Do the applicable standards, if any, apply retroactively to pressure vessels constructed before the effective date of the standard or are any such pressure vessels grandfathered; i.e., exempt from the specific requirements that the pressure vessels be built in accordance with or otherwise comply with the *Code*?

**Response 3:** Any pressure vessels built before the effective dates of any applicable OSHA standards must comply with the 1968 edition of the *Code*, where *Code* compliance is required by a specific standard. OSHA addressed this issue in a previous Memorandum<sup>6</sup> to one of its Regional Administrators in which it stated all pressure vessels must comply with the 1968 edition of the *Code*.

**Question 4:** What do the standards specifically intend when they require a vessel to "be built in accordance with the *Code*"? Is it OSHA's intention that "*built in accordance with the ASME Boiler and Pressure Vessel Code*" means that the vessel shall have a manufacturer's nameplate with a valid *Code* symbol stamp (such as the "U" stamp), or just that the vessel must have been built in accordance with the principles of the *Code*?

**Response 4:** Your question highlights the difference between building a pressure vessel "*in accordance*" with the *Code* and building a pressure vessel to the "*principles*" of the *Code*. Your question suggests that an employer

## NASA-STD-8719.26

could use a pressure vessel which was constructed to all the requirements of the *Code* for the pressure retaining portions of the vessel, but if the pressure vessel did not include a manufacturer's nameplate, other required records and a valid *Code* symbol stamp (nameplate, records and stamping denoted from this point forward as "NRS") it would still comply with the *Code* because it is built using its principles.

The manufacturer's NRS serves a safety management and hazard control function and is part of the quality control system for construction of a *Code* vessel. The *Code* NRS assures employers that they are using pressure vessels that have been constructed to a nationally recognized consensus standard/good engineering practice. Without the quality control system required by the *Code* through its specifications for NRS, employers cannot determine if they have pressure vessels which have been constructed to a recognized standard, and they cannot assure that their vessels are safe to operate.

OSHA therefore interprets the statement "*built in accordance with the ASME Boiler and Pressure Vessel Code*" to require that employers use pressure vessels that at least conform with the requirements of the *Code*, including the proper maintenance and display of NRS.

**Scenario:** Even though a pressure vessel does not display any NRS information, the employer believes the pressure vessel meets all other requirements under OSHA standards.

**Question 5:** To determine and document that such vessels are suitable for their intended use, and in doing so, bring the vessels into full compliance with applicable OSHA standards, is it acceptable to conduct an evaluation that would include: 1) appropriate nondestructive testing (for example, radiography, ultrasonic thickness testing, hardness testing, pressure testing, etc.) to ascertain the current condition of the vessel; and 2) detailed code calculations (using appropriately conservative safety factors) for each vessel component to establish the allowable operating parameters for the vessel (specifically, the maximum allowable working pressure and maximum allowable operating temperature)?

**Response 5:** Pressure vessels which are required by a specific OSHA standard, such as 1910.106(b)(1)(v) or 1910.106(i)(3)(i) and (ii), to be constructed in accordance with the *Code* must meet all requirements, including NRS requirements of the 1968 version of the *Code*, as stated in Response 3. Consequently, the employer would not be in compliance with specific OSHA "*Code construction*" standards when the *Code*-required NRS is not available.

OSHA recognizes that there are pressure vessels in use, especially older vessels, that do not have the *Code*-required NRS. We understand that there are some requirements of the *Code* that cannot be satisfied when the NRS is not available to the employer. For example, it may not be possible to retroactively obtain design and construction aspects such as welding procedures and use of certified welders.

However, an employer may still come into compliance with applicable OSHA standards requiring *Code* construction where the stamping on a pressure vessel becomes indistinct or the nameplate is lost, illegible, or detached, but traceability to the original data is still possible. Where there is traceability, the owner/employer must have the stamped data replaced. The National Board of Boiler and Pressure Vessel Inspectors provides a procedure<sup>7</sup> to restamp pressure retaining items/vessels where stamping or nameplate problems exist.

In cases where traceability is not possible, OSHA will treat as a *de minimis* violation any pressure vessel that is required by a specific OSHA standard, such as 1910.106(b)(1)(v), 1910.106(i)(3)(i) and (ii) to be built in accordance with the *Code*, but that does not have the *Code*-required NRS, provided that the criteria below are met:

## NASA-STD-8719.26

1. The employer can demonstrate that it has taken reasonable steps to obtain or retain the required NRS. For example, did the employer contact the previous owner in an attempt to obtain the pressure vessel's NRS; if the employer has the pressure vessel number, did it contact ASME or the National Board of Boiler and Pressure Vessel Inspectors to obtain the required records; does the employer have a procedure in place to assure that any new or used pressure vessel it purchases or takes control of has the required CodeNRS; does the employer routinely purchase used pressure vessels without the NRS; and
2. The employer verifies the fitness-for-operations integrity of the vessels by utilizing the procedure contained in API 510, Section 6.7. This procedure is for pressure vessels with no "traceability," such as those with no nameplate and minimal or no design or construction documentation. This procedure includes items such as: performing inspections and making necessary repairs; defining design parameters, and preparing drawings and calculations; basing calculations on applicable codes/standards; evaluating unidentified materials; use of radiography; marking with nameplate or stamping; and performing pressure testing.

Thank you for your interest in occupational safety and health. We hope you find this information helpful. OSHA requirements are set by statute, standards, and regulations. Our interpretation letters explain these requirements and how they apply to particular circumstances, but they cannot create additional employer obligations. This letter constitutes OSHA's interpretation of the requirements discussed. Note that our enforcement guidance may be affected by changes to OSHA rules. Also, from time to time we update our guidance in response to new information. To keep apprised of such developments, you can consult OSHA's website at <http://www.osha.gov>. If you have any further questions, please feel free to contact the Office of General Industry Enforcement at (202) 693-1850.

Sincerely,

Richard E. Fairfax, Director  
Directorate of Enforcement Programs

[Corrected 4/24/2009]

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## NASA-STD-8719.26

<sup>1</sup> OSHA Memorandum to Regional Administrators: Subject: OSHA will not enforce the PSM standard at oil and gas production facilities Dated: 04/11/2000 ([http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=INTERPRETATIONS&p\\_id=23727](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=23727)) [ back to text ]

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<sup>2</sup> API RP 74, *Recommended Practice for Occupational Safety for Onshore Oil and Gas Production Operations*, 1st Edition, October, 2001, API [ back to text ]

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<sup>3</sup> API Specification 12J (Spec 12J), *Specification for Oil and Gas Separators*, October 1, 1989, API [ back to text ]

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<sup>4</sup> API Specification 12L, *Specification for Vertical and Horizontal Emulsion Heaters*, 4th Ed., Nov. 1, 1994, API - Exploration and Production Department [ back to text ]

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<sup>5</sup> API 510, *Pressure Vessel Inspection Code: Maintenance Inspection, Rating, Repair and Alteration*, Addendum 4, August 2003, API [ back to text ]

## NASA-STD-8719.26

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<sup>6</sup> OSHA Memorandum to Regional Administrator - Linda R. Anku, From: John B. Miles, Jr., Director, Directorate of Field Operations, 12/16/85, Q&A #5([http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=INTERPRETATIONS&p\\_id=19361](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=19361)) [ back to text ]

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<sup>7</sup> What to Do When a Nameplate Is Lost, National Board of Boiler and Pressure Vessel Inspectors; (<http://www.nationalboard.org/NationalBoard/NBIC/NamePlate.aspx>) [ back to text ]

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### UNITED STATES DEPARTMENT OF LABOR

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## NASA-STD-8719.26

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## NASA-STD-8719.26

### APPENDIX B. OSHA STANDARD INTERPRETATIONS, APPLICATION OF 29 CFR 1910.169 AIR RECEIVERS, AND OTHER OSHA STANDARDS, TO PRESSURE SYSTEMS IN SERVICE AT NASA, DATED MAY 3, 2010

U.S. Department of Labor	Occupational Safety and Health Administration Washington, D.C. 20210	
Reply to the attention of:		
03 MAY 2010	DEP/GIE/JRL	
<p>Michael G. Stamatelatos, Ph.D. Director, Safety and Assurance Requirements Division Office of Safety and Mission Assurance NASA Headquarters Washington, DC 20546-0001</p>		
Dear Dr. Stamatelatos:		
<p>Thank you for your March 19, 2009 letter to the Occupational Safety and Health Administration (OSHA) Directorate of Enforcement Programs. We apologize for the delay in our reply. You have specific questions regarding the application of the 29 CFR 1910.169, Air Receivers, and other OSHA standards, to pressure systems in service at NASA. This letter constitutes OSHA's interpretation only of the requirements discussed and may not be applicable to any question not delineated within your original correspondence.</p>		
<p>Your paraphrased questions and our responses are provided below. Several questions addressing very similar issues have been grouped together. Question numbers are from your letter.</p>		
<p><b>Question 1 – Application of air storage vessels not mentioned in 29 CFR 1910.169, Air Receivers:</b> Are self-contained shop air compressor systems for which the air is used only to operate instruments or for laboratory research purposes included in the scope of 29 CFR 1910.169?</p>		
<p><b>Reply 1:</b> 29 CFR 1910.169 (a)(1) <i>Application</i> states “This section applies to compressed air receivers, and other equipment used in providing and utilizing compressed air for performing operations such as cleaning, drilling, hoisting, and chipping. On the other hand, this section does not deal with the special problems created by using compressed air to convey materials nor the problems created when men work in compressed air as in tunnels and caissons.” The standard also does not apply to compressed air systems used on transportation vehicles.</p>		
<p>The list of example common compressed air services is ‘such as’ and is thus non-exclusive. Furthermore, the service examples in 29 CFR 1910.169(a) are typical utility applications for compressed air, as are those referenced by NASA. Thus, 29 CFR 1910.169 applies to the services mentioned in your question.</p>		
<p><b>Question 2 - Applicability of 29 CFR 1910.169 to unique applications:</b> Are large, high pressure air storage vessels that have compressed air generated by a central compressor system, for which the air is used in research operations such as for wind tunnels and test articles, considered to be “Air Receivers” for the purposes of 29 CFR 1910.169?</p>		

## NASA-STD-8719.26

**Reply 2:** Research applications using compressed air, for example wind tunnels operating at supply air pressures beyond those encompassed by the 1968 edition of the ASME Boiler and Pressure Vessel Code ("Code"), as opposed to the service operations described in the standard, are not covered by 29 CFR 1910.169.

However, note that appropriate divisions of the Code may be used to support alleged violations of Section 5(a)(1) of the OSH Act, the "General Duty Clause" for air receivers not covered under 29 CFR 1910.169 or by other specific standards.

**Question 3 – Applicability of 29 CFR 1910.169 to gases other than air:** If a pressure system uses a gas other than air (e.g., nitrogen, hydrogen, helium, etc.), is the vessel still considered an "air receiver" for the purposes of 29 CFR 1910.169?

**Reply 3:** No. 29 CFR 1910.169 Air Receivers only applies to fixed pressure vessel systems in air service.<sup>1</sup>

**Question 4 – Use of Department of Transportation (DOT) vessels as air receivers:** Is the use of DOT vessels as air receivers acceptable?

**Reply 4:** DOT vessels are mobile containers used for transport. 29 CFR 1910.169(a) states that the standard does not apply to "compressed air machinery and equipment used on transportation vehicles..." Mobile DOT vessels providing air to NASA pressure systems are subject to DOT requirements, as opposed to the requirements of 29 CFR 1910.169.

However, DOT vessels removed from transport service and placed into service as fixed air receivers must comply with 29 CFR 1910.169, including the requirements of the 1968 Edition of the ASME Code, which are incorporated by reference into the standard. This could, under certain circumstances, require rerating of the vessels or other measures, to meet Code requirements.<sup>2</sup>

**Question 5 – Applicability of 29 CFR 1910.101 to gases other than air:** Are pressure systems containing gases other than air, and not specifically addressed in other sections of 29 CFR 1910, such as 29 CFR 1910.104, Oxygen, subject to the requirements of 29 CFR 1910.101 Compressed Gases (General Requirements)?<sup>3</sup>

**Answer 5:** 29 CFR 1910.101 applies to the "in-plant handling, storage, and utilization of all compressed gases in cylinders, portable tanks, rail tankcars, or motor vehicle cargo tanks". 29 CFR 1910.101 thus does not apply to fixed pressure systems used to store compressed gases, such as air receivers.

<sup>1</sup> This includes synthetic gas mixtures used by NASA that are essentially equivalent to the composition of air. Letter of interpretation (LOI) *Tricomi, May 23, 2008*.

<sup>2</sup> For example, DOT vessels typically have lower safety factors than are acceptable under the Code, and DOT's formula for calculating stresses in pressure vessels is not conservative for thin wall vessels ( $t/R > 0.7$ ) compared to Code.

<sup>3</sup> Material specific safety standards include 29 CFR 1910. 102 Acetylene, 1910.103 Hydrogen, 1910 104 Oxygen, 1910.105 Nitrous Oxide, and 1910.110 Storage and handling of liquefied petroleum gases.

## NASA-STD-8719.26

However, pressure systems containing flammable liquefied or compressed gases, or materials listed in Appendix A of the standard, may be covered under 29 CFR 1910.119 Process Safety Management (PSM). PSM is a performance based standard that applies to systems containing more than specified threshold quantities of highly hazardous chemicals (HHCs). The PSM standard requires the implementation of a comprehensive safety management system to control the hazards of catastrophic releases of toxic, reactive, flammable, or explosive chemicals.

Furthermore, where no specific standard applies, OSHA may issue citations for hazards under Section 5(a)(1) of the OSH Act (the "General Duty Clause").

**Questions 6, and 7(a) – 7(d) – Use of pressure vessels for gas storage, including vessels constructed prior to promulgation of the OSHA regulations:** These questions address the requirements for vessels (and associated pressure relief devices) for gas storage, including vessels constructed prior to the effective date of OSHA regulations and installed either before or after the effective date of the regulations, and for multi-wall vessels constructed prior to inclusion of design rules for such vessels in the ASME Code in 1977. NASA further asks if such multi-wall vessels can be evaluated using ASME Code Section VIII, Division 2.

**Answers 6, and 7(a) – 7(d):**

**Storage of Compressed Air and Gases in Code Stamped Vessels:**

In a letter to a Regional Administrator<sup>4</sup>, as well as a subsequent letter of interpretation<sup>5</sup>, OSHA has stated that any pressure vessels built before the effective dates of any applicable OSHA standards must comply with the 1968 edition of the Code, when Code compliance is required by a specific standard. There is no grandfathering. Code stamped vessels constructed in accordance with versions of the Code more recent than the 1968 edition are considered *de minimis*. *De minimis* conditions are those where an employer has implemented a measure different than one specified in a standard, that has no direct or immediate relationship to safety or health. While *de minimis* conditions are documented in the same manner as violations, no citations are issued and no penalties are proposed.

Furthermore, OSHA has stated<sup>6</sup> that the Code can be used to support alleged violations of Section 5(a)(1) of the OSH Act (the "General Duty Clause") when no standard applies. Thus storage of compressed air and gases in ASME Code Stamped vessels complying with the 1968, or more recent, versions of the Code is acceptable to OSHA.

For example, for an Air Receiver subject to 29 CFR 1910.169, and built prior to February 15, 1972, both the construction of the vessel and the construction, installation, and maintenance of the vessel's pressure relief device(s) must comply with the 1968 Edition of the ASME Code.

Because vessels constructed in accordance with more recent versions of the Code are considered *de minimis*, multi-wall vessels constructed in accordance with the 1977 or more recent Code editions are acceptable for compressed air and gas service.

<sup>4</sup> Regional Administrator Letter Anku 16DEC1985

<sup>5</sup> LOI Morgan 17JUL2006

<sup>6</sup> LOI Steadman, January 24, 1980



## NASA-STD-8719.26

### Vessels for which Code Compliance Cannot be Determined:

In a letter of interpretation<sup>7</sup>, OSHA clarified the requirements for vessels where Code compliance can not be documented, but is required by an OSHA standard:

In cases where traceability is not possible, OSHA will treat as a *de minimis* violation (*sic*) any pressure vessel that is required by a specific OSHA standard...to be built in accordance with the Code, but that does not have the Code-required NRS<sup>8</sup>, provided that the criteria below are met:

1. The employer can demonstrate that it has taken reasonable steps to obtain or retain the required NRS. For example, did the employer contact the previous owner in an attempt to obtain the pressure vessel's NRS; if the employer has the pressure vessel number, did it contact ASME or the National Board of Boiler and Pressure Vessel Inspectors to obtain the required records; does the employer have a procedure in place to assure that any new or used pressure vessel it purchases or takes control of has the required Code NRS; does the employer routinely purchase used pressure vessels without the NRS; and
2. The employer verifies the fitness-for-operations integrity of the vessels by utilizing the procedure contained in API 510...<sup>9</sup> This procedure is for pressure vessels with no "traceability," such as those with no nameplate and minimal or no design or construction documentation. This procedure includes items such as: performing inspections and making necessary repairs; defining design parameters, and preparing drawings and calculations; basing calculations on applicable codes/standards; evaluating unidentified materials; use of radiography; marking with nameplate or stamping; and performing pressure testing.

For multi-wall vessels constructed prior to inclusion of rules for multi-wall vessel design in the Code, and for certain other vessels, Code NRS may not exist. Verification of fitness-for-service in accordance with API 510 and based on applicable codes and standards is required. Use of ASME Section VIII Division 1 or Division 2 as the referenced code is at the discretion of the employer. Note that Division 2 may be more restrictive in terms of the materials and design features that are allowed, and in the type and level of the inspections required.

**Questions 8, 9, & 10 – Relief Devices:** NASA requests clarification on the use of relief devices other than spring-loaded safety valves on air receivers, the use of single relief devices to protect multiple air receivers, and the acceptability of exceeding the 10% maximum acceptable overpressure specified in 29 CFR 1910.169(b)(3)(i), when, in all cases, the requirements of the ASME Code for relief devices are complied with.

**Answers 8, 9, & 10:** OSHA considers compliance with current Code for relief devices to be a *de minimis* condition (see Answer 6). Relief devices acceptable under the Code, including, but not limited to, spring-loaded safety valves, may be installed to protect Air Receivers and other pressure vessels against overpressure. The use of appropriately sized single relief devices to

<sup>7</sup> LOI Morgan, 17JUL2006

<sup>8</sup> NRS: Nameplate, Records, and Stamping in accordance with National Board requirements

<sup>9</sup> See section 7.7 of API 510 Pressure Vessel Inspection Code, ninth edition, June 2006.

## NASA-STD-8719.26


protect multiple pressure vessels is acceptable when all aspects of the Code, including the requirements of non-mandatory Appendix M, are complied with. Finally, it is acceptable to allow the pressure in an Air Receiver or other pressure vessel to exceed 110% of the Maximum Allowable Working Pressure (MAWP) of the vessel when multiple relief devices are installed (in which case the pressure may increase to no more than 116% of the MAWP) or when relief devices are sized for fire exposure (in which case the pressure may increase to no more than 121% of the MAWP). Note that pressure vessels in gas service are susceptible to failure by over-temperature, as can occur in fire exposure scenarios, and that NASA should provide appropriate means of protection for pressure vessels in gas service that may be subject to over-temperature conditions.

Thank you for your interest in occupational safety and health. We hope you find this information helpful. OSHA requirements are set by statute, standards, and regulations. Our interpretation letters explain these requirements and how they apply to particular circumstances, but they cannot create additional employer obligations. This interpretation constitutes OSHA's interpretation of the requirements discussed. Note that our enforcement guidance may be affected by changes to OSHA rules.

Also, from time to time we may update our guidance in response to new information. To keep apprised of such developments, you can consult OSHA's website at <http://www.osha.gov>.

If you have any further questions, please call the Office of General Industry Enforcement at 202-693-1850.

Sincerely,



Thomas Galassi, Acting Director  
Directorate of Enforcement Programs