Los Alamos NATIONAL LABORATORY EST. 1943

Conduct of Engineering
Request for Variance or Alternate Method

Assigned by SMPO or SMPOR: ☒ Alternate Method ☐ Variance Tracking number VAR-2016-021

Affected Document(s)

☐ Engineering Processes (e.g., P 341) ☒ Engineering Standards (e.g., P 342) ☐ Engineering Training & Qualification (e.g., P 343) If against P documents themselves, revision: _____	Subordinate (Functional Series) document if applicable (ESM Chapter, Master Spec, AP, etc.): Document Title/Number: Engineering Standards Manual STD-342-100 Chapter 17, Pressure Safety Revision: Rev. 0, 9/17/2014 LANL Engineering Standards Manual STD-342-100 Chapter 1 – General; Section Z10 - General Requirements for all Disciplines/Chapters Revision: Rev. 13, 7/16/2015

Section/Para

ESM Chapter 17

Section GEN - General Requirements

1.0 GENERAL

A. Introduction and Applicability

Paragraph 1; Footnote 1

E. Alternate Method/Variance

Paragraphs 3 and 4

GEN-1 – Definitions And Acronyms

ESM Chapter Z10

Table Z10-2 Standards Amendments: Clarifications, Interpretations, Alternates, and Variances — Methods, Approvals, and Appeals

2.2 Alternate Methods, Variances, and Non-Conformances

Specific Requirement(s) as Written in the Document(s)

ESM Chapter 17

A. Introduction and Applicability

1. Engineering Standards Manual Chapter 17 Pressure Safety contains the requirements for management of pressure systems to ensure that both new and existing systems are compliant with applicable 10CFR851 Appendix A, Part 4 requirements (reproduced as REF-1 of this chapter).[1]

Footnote 1: At time of writing, the Engineering Services Division Leader is the safety management program owner for pressure safety

E. Alternate Method/Variance

3. Approval is requested per ESM Chapter 1 Section Z10. (*Owner submits a Conduct of Engineering Request*

for Variance or Alternate Method, LANL Form 2137)

4. The alternate method or variance (with duration, if applicable) must be approved by the CPSO and the Site Chief Engineer.

(from GEN-1 Definitions and Acryonyms)
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).

EMC Chapter Z10

Table Z10-2 Standards Amendments: Clarifications, Interpretations, Alternates, and Variances — Methods, Approvals, and Appeals

	Requirement Type					
	TYPE 1 • Not ESM*, • POC preference (not Type 2 or 3), and • Not for ML-1 or 2		**TYPE 2** • ESM and • SMPO preference (not Type 3)		**TYPE 3** NNSA Contract-mandated and not delegated to LANL	
	Method	**Approving Authority**	**Method**	**Approving Authority**	**Method**	**Approving Authority**
POC Help	Phone or Email					
Amendments						
Formal Clarification or Interpretation	Form 2176	POC	Form 2176	Design Authority	Form 2176	Design Authority
Alternate Method or Variance (Type 1 or 2)	Form 2137	POC	Form 2137**	Design Authority	N/A	N/A
Equivalency or Exemption (Type 3)	N/A	N/A	N/A	N/A	Form 2137*** + P 310-1, *Exemptions to Appendix G Requirements or* 10CFR851 variance website; etc.	DOE Los Alamos Field Office or higher
But if work contrary to Standards is submitted for acceptance…	…then an NCR is normally required. When NCR use-as-is or repair disposition is proposed, an amendment per above is also required with NCR to involve institutional requirement owner.					

Design Authority (DA)

The Site Chief Engineer (see P340, P342). This amendment process authority is not delegated to FDARs. For fire matters, substitute Fire Marshal (and possibly FP-Div forms)24; for electrical safety, Electrical Safety Committee. The safety (or security) management program owner (SMPO) is the technical authority, is similar in this process, and is the term used by Form 2137 at time of writing.

2.2 Alternate Methods, Variances, and Non-Conformances
A. Personnel shall not deviate from the LANL Standards in developing the technical requirements (including

programming, functions & requirements, and requirements & criteria documents); in design; during fabrication, construction, testing, inspection; or in written direction to any LANL entity or subcontractor unless the Standards Program has granted such variance as described below. 1. Alternate methods and variances must proceed as follows:

a. LANL Requestor collaborates with POC when developing the request form 2137.

• As it is in the best interest of LANL to consistently follow the Standards, it is expected that variances will be granted only rarely, and only when a strong justification exists. As such, it is incumbent upon the requestor to provide sufficient justification in their request, and to show that the variance has significant long-term cost savings, programmatic benefit, etc. associated with it.

b. POC reviews the request, and either concurs with or without comments or recommends against; approval authority takes final action. i. NOTE: Per Table Z10-2's Type 1 above, for variance granted by the POC alone, the SMPO approval field of Form 2137 is N/A.

ii. Guidance: Variance extensions should be processed as a revision to the original request; documentation provided with the extension request should be current and support the justification.

B. LANL review, acceptance, or lack of rejection of design or other submittals not meeting the Engineering Standards or Contract does not constitute an approved alternate or variance to the Standards – nor tacit approval to continue with non-acceptable work. Compliance is required unless variance is formally granted per above.

2.0 Request

Brief descriptive title:

Delegate the Review, Approval, and Acceptance of Unlisted Components to the Chief Pressure Safety Officer (CPSO) to act as the Safety or Security Management Program Owner

NCR required (work has occurred)? ☐ Yes ☒ No	If Yes, NCR Number
TA-Bldg-(Room) and/or Project Affected LANL	System/Component Affected All pressure systems using unlisted components

Proposal

This Alternative Method authorizes the ~~ES-EPD~~ LANL Chief Pressure Safety Officer (CPSO) to accept unlisted materials and components that meet the requirements of the specific ASME B31 code section (31.1, 31.3, 31.5, 31.8, and 31.9) as the Safety or Security Management Program Owner.

Justification/Compensatory Measures

The Owner's representative, the LANL Chief Engineer, designates the Chief Pressure Safety Officer (CPSO) as the Safety Management Program Owner (SMPO) for acceptance of unlisted materials or piping components in accordance with the requirements of the Code of Record. This authorization empowers the CPSO to create a library of approved unlisted items for each of the B31 codes. The attached forms or other forms that meet the B31 code will be transitioned into official forms for the ESM Chapter 17.

The wording of the attached forms is done per B31 edition (year). As new editions are issued changes required to meet the new editions are allowed, and will be documented as additions to this variance or to the ESM Chapter 17 form. Other forms may be developed to meet the evaluation needs in accordance with the requirements of the B31 codes.

The evaluation forms (and updated forms) are to be added to the "Allowed Unlisted Components Listing per ADMIN-2, Article Z" and may also be added to the "Reputable Manufactures" listing as discussed in NASME-1 –a, -b, etc..

Attachments

1. Form for Unlisted Valve acceptance for B31.9
2. Form for Unlisted Valve acceptance for B31.3
3. Form for Unlisted Material for B31.9
4. Form for Unlisted Material for B31.3 Metallic
5. Guidance to Evaluate Unlisted Materials for B31.3

Summary

The Chief Pressure Safety Officer (CPSO) shall act as the Safety Management Program Owner (SMPO) who acts for the owner in the acceptance of unlisted piping components for B31 services.

Duration of Request:	Start Date: 02 - 05 - 2016		End Date:	☒ Lifetime
Requestor Ari Ben Swartz	Z Number 235211	Organization ES-EPD	Signature Signature on file	Date 2/4/16
USQD/USID required (Nucl. High/Mod Hazard)? ☐ Yes ☒ No		If Yes, USQD/USID Number		
Design Authority Representative Lawrence Kenneth Goen	Z Number 106351	Organization ES-DO	Signature Signature on file	Date 2-7-16
LANL Owning Manager (FOD or Programmatic) Lawrence Kenneth Goen	Z Number 106351	Organization ES-DO	Signature Signature on file	Date 2-7-16

3.0 Safety Management Program Owner (SMPO) Representative (SMPOR/POC)

☐ Decline ☒ Accept ☐ Accept Labwide ☐ with Modification:

POC	Z Number	Signature	Date
Ari Ben Swartz	235211	Signature on file	2/4/16

4.0 Additional Approval for P341 and APs; P342, ESM, Code, and Regulation Matters; and P343

☐ Accepted ☒ Accepted with comments ☐ Declined

Comments:

Accepted only for the specific purpose of accepting unlisted components & materials in accordance with the appropriate ASME code and to build the LANL library for approved unlisted components.

Safety or Security Management Program Owner	Z Number	Signature	Date
Lawrence Kenneth Goen	106351	Signature on file	2-7-16

B31.9 -2014 Valve Comparison (907.1.2)

	Comparable Listed Valve		Evaluated Valve		Within Limitations?
Manufacturer					
Model					
Pressure Rating					
Temperature Rating					
Service					
Composition					
Mechanical Properties					
Dimensions					
Method of Manufacture					
Quality Control Standard					

Conclusion:

In Accordance with ASME B31.9-2014, Paragraph 907.1.2, these valves are being used in accordance with the manufacturer's temperature and pressure ratings of

Attach documentation if necessary to support the above information.

Evaluated By: _____ Date: _____

CPSO/SMPO Designee: _____ Date: _____

ASME B31.3-2014 Valve Evaluation

Are pressure-temperature ratings established by the method set forth in ASME B16.34? Y ☐ N ☐

If Yes, valve is acceptable as is per 307.1.2 (attached proof), If No, valve to be evaluated as follows:

Item	Requirement	Completed (attached)
A	extensive, successful service experience under comparable conditions with similarly proportioned components of the same or like material.	
B	experimental stress analysis, such as described in the BPV Code, Section VIII, Division 2, Annex 5.F.	
C	proof test in accordance with ASME B16.9, MSS SP-97, or Section VIII, Division 1, UG-101.	
D	detailed stress analysis (e.g., finite element method) with results evaluated as described in Section VIII, Division 2, Part 5. The basic allowable stress from Table A-1 shall be used in place of the allowable stress, S, in Division 2 where applicable. At design temperatures in the creep range, additional considerations beyond the scope of Division 2 may be necessary.	

	ASME B31.3-2014 Valve Evaluation paragraph 304.7.2
Required Field	**Valve Information**
Manufacturer	
Model	
Pressure Rating	
Temperature Rating	
Service	
Composition	***302.2.3***
Mechanical Properties	***302.2.3***
Method of Manufacture	***302.2.3***
Design	***302.2.3***
Dimensions or Sizes	
Quality Control Standard	

Evaluated By: _____ Date: _____

CPSO/SMPO Designee: _____ Date: _____

ASME B31.9-2014 Unlisted Metallic Material

Is material listed in Mandatory Appendix A of ASME B31.1? Y ☐ N ☐

If Yes, material is acceptable to ASMB 31.1 it is acceptable for ASME B31.9 per 923.1.2 (attached proof),
If No, material to be evaluated as follows:

	ASME B31.9-2014 Material Evaluation paragraph 923.1.2
Required Field	**Published Specification**
Composition	
Physical and mechanical properties	
Method and Process of Manufacture	
Heat treatment (if applicable)	
Quality control	
Allowable Stress (902.3.1)	

Attach documentation to support the above information.

Evaluated By: _____ Date: _____

CPSO/SMPO Designee: _____ Date: _____

ASME B31.3-2014 Unlisted Metallic Material

	ASME B31.3-2014 Material Evaluation paragraph 323.1.2
Required Field	**Published Specification**
Chemistry	
Physical and mechanical properties	
Method and process of manufacturer	
Heat treatment	
Quality control	
Allowable Stress	

Attach documentation to support the above information

Evaluated By: _____ Date: _____

CPSO/SMPO Designee: _____ Date: _____

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Guidance to Evaluate Unlisted Materials for B31.3

Description	Metallic	Non-Metallic	Category M Metallic	Category MA Non-Metallic	Category K
Design Criteria General	302 DESIGN CRITERIA 302.1 General Paragraph 302 states pressure–temperature ratings, stress criteria, design allowances, and minimum design values together with permissible variations of these factors as applied to the design of piping.	A302.1 General The designer shall be satisfied as to the adequacy nonmetallic material and its manufacture, considering at least the following: (a) tensile, compressive, flexural, and shear strength, and modulus of elasticity, at design temperature (long term and short term) (b) creep rate at design conditions (c) design stress and its basis (d) ductility and plasticity (e) impact and thermal shock properties (f) temperature limits (g) transition temperature —	M302.1 General Paragraph M302 pertains to pressure–temperature ratings, stress criteria, design allowances, and minimum design values, together with permissible variations of these factors as applied to piping design. Paragraph 302 applies in its entirety, with the exception of para. 302.2.4. See para. M302.2.4.	MA302 DESIGN CRITERIA Paragraphs A302.1 and A302.4 apply. See paras. MA302.2 and MA302.3.	K302.1 General In para. K302, pressure–temperature ratings, stress criteria, design allowances, and minimum design values are stated, and permissible variations of these factors as applied to design of high pressure piping systems are formulated. The designer shall be satisfied as to the adequacy of the design, and of materials and their manufacture, considering at least the following: (a) tensile, compressive, flexural, and shear strength at design temperature (b) fatigue strength

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Guidance to Evaluate Unlisted Materials for B31.3

Description	Metallic	Non-Metallic	Category M Metallic	Category MA Non-Metallic	Category K
		melting and vaporization (h) porosity and permeability (i) testing methods (j) methods of making joints and their efficiency (k) possibility of deterioration in service			(c) design stress and its basis (d) ductility and toughness (e) possible deterioration of mechanical properties in service (f) thermal properties (g) temperature limits (h) resistance to corrosion and erosion (i) fabrication methods (j) examination and testing methods (k) hydrostatic test conditions (l) bore imperfections
Allowable Stress	302.3 Allowable Stresses and Other Stress Limits 302.3.1 General. The allowable stresses defined in paras. 302.3.1(a), (b), and (c) shall be used in	A302.3 Allowable Stresses and Other Design Limits A302.3.1 General (a) Table B-1 contains hydrostatic design stresses (HDS). Tables B-2 and B-3 provide	M302.1 General Paragraph M302 pertains to pressure–temperature ratings, stress criteria, design allowances, and minimum design values, together with	MA302 DESIGN CRITERIA Paragraphs A302.1 and A302.4 apply. See paras. MA302.2 and MA302.3.	K302.1 General In para. K302, pressure–temperature ra tings, stress criteria, design allowances, and minimum design values are stated, and

Description	Metallic	Non-Metallic	Category M Metallic	Category MA Non-Metallic	Category K
	design calculations unless modified by other provisions of this Code. (a) Tension. Basic allowable stresses S in tension for metals and design stresses S for bolting materials, listed in Tables A-1 and A-2, respectively, are determined in accordance with para. 302.3.2. In equations elsewhere in the Code where the product SE appears, the value S is multiplied by one of the following quality factors:1 (1) casting quality factor Ec as defined in para. 302.3.3 and tabulated for various material specifications in Table A-1A, and for various	listings of specifications that meet the criteria of paras. A302.3.2 (b) and (c), respectively. Tables B-4 and B-5 contain allowable pressures. These HDS values, allowable stress criteria, and pressures shall be used in accordance with the Notes to Appendix B, and may be used in design calculations (where the allowable stress S means the appropriate design stress) except as modified by other provisions of this Code. Use of hydrostatic design stresses for calculations other than pressure design	permissible variations of these factors as applied to piping design. Paragraph 302 applies in its entirety, with the exception of para. 302.2.4.		permissible variations of these factors as applied to design of high pressure piping systems are formulated. The designer shall be satisfied as to the adequacy of the design, and of materials and their manufacture, considering at least the following: (a) tensile, compressive, flexural, and shear strength at design temperature (b) fatigue strength (c) design stress and its basis (d) ductility and toughness (e) possible deterioration of mechanical properties in service

ASME B31.3 – 2014 Guidance to Evaluate Unlisted Materials for B31.3					
Description	**Metallic**	**Non-Metallic**	**Category M Metallic**	**Category MA Non-Metallic**	**Category K**
	levels of supplementary examination in Table 302.3.3C, or (2) longitudinal weld joint factor Ej as defined in 302.3.4 and tabulated for various material specifications and classes in Table A-1B, and for various types of joints and supplementary examinations in Table 302.3.4 The stress values in Tables A-1 and A-2 are grouped by materials and product forms, and are for stated temperatures up to the limit provided in para. 323.2.1 (a). Straight line interpolation between	has not been verified. The bases for determining allowable stresses and pressures are outlined in para. A302.3.2. (b) The stresses and allowable pressures are grouped by materials and listed for stated temperatures. Straightline interpolation between temperatures is permissible.			(f) thermal properties (g) temperature limits (h) resistance to corrosion and erosion (i) fabrication methods (j) examination and testing methods (k) hydrostatic test conditions (l) bore imperfections K302.2 Pressure–Temperature Design Criteria K302.2.1 Listed Components Having Established Ratings. Pressure–temperature ratings for certain piping components have been established and are contained in some of the standards in Table K326.1. Unless limited elsewhere in this Chapter, those ratings are acceptable

ASME B31.3 – 2014 Guidance to Evaluate Unlisted Materials for B31.3					
Description	**Metallic**	**Non-Metallic**	**Category M Metallic**	**Category MA Non-Metallic**	**Category K**
	temperatures is permissible. The temperature intended is the design temperature (see para. 301.3). (b) Shear and Bearing. Allowable stresses in shear shall be 0.80 times the basic allowable stress in tension tabulated in Table A-1 or A-2. Allowable stress in bearing shall be 1.60 times that value. (c) Compression. Allowable stresses in compression shall be no greater than the basic allowable stresses in tension as tabulated in Appendix A. Consideration shall be given to structural stability.				for design pressures and temperatures under this Chapter. With the owner's approval, the rules and limits of this Chapter may be used to extend the pressure–temperature ratings of a component beyond the ratings of the listed standard, but not beyond the limits stated in para. K323.2. K302.2.2 Listed Components Not Having Specific Ratings (a) Piping components for which design stresses have been developed in accordance with para. K302.3, but that do not have specific pressure–

ASME B31.3 – 2014 Guidance to Evaluate Unlisted Materials for B31.3					
Description	**Metallic**	**Non-Metallic**	**Category M Metallic**	**Category MA Non-Metallic**	**Category K**
					temperature ratings, shall be rated by rules for pressure design in para. K304, within the range of temperatures for which stresses are shown in Table K-1, modified as applicable by other rules of this Chapter. (b) Piping components that do not have allowable stresses or pressure–temperature ratings shall be qualified for pressure design as required by para. K304.7.2. K302.2.3 Unlisted Components (a) Piping components not listed in Table K326.1 or Table K-1, but that conform to a published specification or

ASME B31.3 – 2014 Guidance to Evaluate Unlisted Materials for B31.3					
Description	**Metallic**	**Non-Metallic**	**Category M Metallic**	**Category MA Non-Metallic**	**Category K**
					standard, may be used subject to the following requirements: (1) The designer shall determine that composition, mechanical properties, method of manufacture, and quality control are comparable to the corresponding characteristics of listed components. (2) Pressure design shall be verified in accordance with para. K304, including the fatigue analysis required by para. K304.8. (b) Other unlisted components shall be qualified for pressure design as required by para. K304.7.2.

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Guidance to Evaluate Unlisted Materials for B31.3

Description	Metallic	Non-Metallic	Category M Metallic	Category MA Non-Metallic	Category K
Bases for Design Stresses	302.3.2 Bases for Design Stresses.2 The bases for establishing design stress values for bolting materials and allowable stress values for other metallic materials in this Code are as follows: (a) Bolting Materials. Design stress values at temperature for bolting materials shall not exceed the lowest of the following: (1) except as provided in (3) below, the lower of one-fourth of specified minimum tensile strength at room temperature (ST) and one-fourth of tensile strength at temperature (2) except as provided in (3) below, the	A302.3.2 Bases for Allowable Stresses and Pressures1 (a) Thermoplastics. The method of determining HDS is described in ASTM D2837. HDS values are given in Table B-1 for those materials and temperatures for which sufficient data have been compiled to substantiate the determination of stress. (b) Reinforced Thermosetting Resin (Laminated). The design stress (DS) values for materials listed in Table B-2 1 Titles of ASTM Specifications and AWWA Standards referenced herein are as follows:	M302.1 General Paragraph M302 pertains to pressure–temperature ratings, stress criteria, design allowances, and minimum design values, together with permissible variations of these factors as applied to piping design. Paragraph 302 applies in its entirety, with the exception of para. 302.2.4. See para. M302.2.4.	MA302.3 Allowable Stresses and Other Design Limits Paragraph A302.3 applies.	K302.3.2 Bases for Allowable Stresses. The bases for establishing allowable stress values for materials in this Chapter are as follows: (a) Bolting Materials. The criteria of Section II, Part D, Appendix 2, para. 2-120 or 2-130, or Section VIII, Division 3, Article KD-6, para. KD-620, as applicable, apply. (b) Other Materials. For materials other than bolting materials, the following rules apply: (1) Except as provided in (b)(2) below, allowable stress values at design temperature for materials shall not

ASME B31.3 – 2014 Guidance to Evaluate Unlisted Materials for B31.3					
Description	**Metallic**	**Non-Metallic**	**Category M Metallic**	**Category MA Non-Metallic**	**Category K**
	lower of two-thirds of specified minimum yield strength at room temperature (SY) and two-thirds of yield strength at temperature (3) at temperatures below the creep range, for bolting materials whose strength has been enhanced by heat treatment or strain hardening, the least of one-fifth of ST, one-fourth of the tensile strength at temperature, one-fourth of SY, and two-thirds of the yield strength at temperature (unless these values are lower than corresponding values for annealed material,	ASTM C14, Concrete Sewer, Storm Drain, and Culvert Pipe ASTM C301, Method of Testing Vitrified Clay Pipe ASTM C582, Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion Resistant Equipment ASTM D2321, Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications ASTM D2837, Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe			exceed the lower of two-thirds of SY and two-thirds of Syt. Syt is determined in accordance with eq. (31) Syt p SYRY (31) where RY p ratio of the average temperature dependent trend curve value of yield strength to the room temperature yield strength SY p specified minimum yield strength at room temperature Syt p yield strength at temperature (2) For solution heat treated austenitic stainless steels and certain nickel alloys with similar stress-strain behavior, allowable stress

Description	Metallic	Non-Metallic	Category M Metallic	Category MA Non-Metallic	Category K
	in which case the annealed values shall be used) (4) two-thirds of the yield strength at temperature [see para. 302.3.2(f)] (5) 100% of the average stress for a creep rate of 0.01% per 1 000 h (6) 67% of the average stress for rupture at the end of 100 000 h (7) 80% of minimum stress for rupture at the end of 100 000 h (b) Gray Iron. Basic allowable stress values at temperature for gray iron shall not exceed the lower of the following: (1) one-tenth of the specified minimum tensile strength at	Products ASTM D2992, Practice for Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-RTR) Pipe and Fittings ASTM D3839, Underground Installation of Fiberglass Pipe AWWAC900, PVC Pressure Pipe, 4-inch through 12-inch, for Water AWWA C950, Glass-Fiber-Reinforced Thermosetting Resin Pressure Pipe shall be one-tenth of the minimum tensile strengths specified in Table 1 of ASTM C582 and are valid only in the temperature range from −29°C (−20°F) through			values shall not exceed the lower of two-thirds of SY and 90% of Syt. Application of stress values so determined is not recommended for flanged joints and other components in which slight deformation can cause leakage or malfunction. [These values are shown in italics or boldface in Table K-1, as explained in Note (5) to Appendix K Tables.] Instead, either 75% of the stress value in Table K-1 or two-thirds of the yield strength at temperature listed in Section II, Part D, Table Y-1, as

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Guidance to Evaluate Unlisted Materials for B31.3

Description	Metallic	Non-Metallic	Category M Metallic	Category MA Non-Metallic	Category K
	room temperature (2) one-tenth of the tensile strength at temperature [see para. 302.3.2(f)] (c) Malleable Iron. Basic allowable stress values at temperature for malleable iron shall not exceed the lower of the following: (1) one-fifth of the specified minimum tensile strength at room temperature (2) one-fifth of the tensile strength at temperature [see para. 302.3.2(f)] (d) Other Materials. Basic allowable stress values at temperature for materials other than bolting materials, gray iron, and malleable iron	82°C (180°F). (c) Reinforced Thermosetting Resin and Reinforced Plastic Mortar (Filament Wound and Centrifugally Cast). The hydrostatic design basis stress (HDBS) values for materials listed in Table B-3 shall be obtained by the procedures in ASTM D2992 and are valid only at 23°C (73°F). HDS shall be obtained by multiplying the HDBS by a service (design) factor2 selected for the application, in accordance with procedures described in ASTM D2992, within the following limits:			applicable, should be used. (c) Unlisted Materials. For a material that conforms to para. K323.1.2, allowable stress values at design temperature shall not exceed the lower of two-thirds of SY and two-thirds of Syt. (1) Except as provided in (c)(2) below, Syt shall be determined in accordance with eq. (31). (2) If the yield strength at temperature for an unlisted material is contained in Section II, Part D, Table Y-1, that yield strength at temperature value may be used directly in the determination

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Description	Metallic	Non-Metallic	Category M Metallic	Category MA Non-Metallic	Category K
	shall not exceed the lowest of the following: (1) the lower of one-third of ST and one-third of tensile strength at temperature (2) except as provided in (3) below, the lower of two-thirds of SY and two-thirds of yield strength at temperature (3) for austenitic stainless steels and nickel alloys having similar stress–strain behavior, the lower of two thirds of SY and 90% of yield strength at temperature [see (e) below] (4) 100% of the average stress for a creep rate of 0.01% per 1 000 h	(1) When using the cyclic HDBS, the service (design) factor F shall not exceed 1.0. (2) When using the static HDBS, the service (design) factor F shall not exceed 0.5. (d) Other Materials. Allowable pressures in Tables B-4 and B-5 have been determined conservatively from physical properties of materials conforming to the listed specifications, and have been confirmed by extensive experience. Use of other materials shall be qualified as required by para. A304.7.2.			of allowable stress. (d) Cyclic Stresses. Allowable values of alternating stress or equipment alternating stress, as applicable, shall be in accordance with Section VIII, Division 2, Part 3, para. 3.15 and Part 5; or Division 3, Article KD-3; respectively.

ASME B31.3 – 2014 Guidance to Evaluate Unlisted Materials for B31.3					
Description	**Metallic**	**Non-Metallic**	**Category M Metallic**	**Category MA Non-Metallic**	**Category K**
	(5) 67% of the average stress for rupture at the end of 100 000 h (6) 80% of the minimum stress for rupture at the end of 100 000 h (7) for structural grade materials, the basic allowable stress shall be 0.92 times the lowest value determined in paras. 302.3.2(d)(1) through (6) In the application of these criteria, the yield strength at temperature is considered to be SYRY; the tensile strength at temperature is considered to be 1.1STRT. (e) Application Limits. Application of stress				

Description	Metallic	Non-Metallic	Category M Metallic	Category MA Non-Metallic	Category K
	values determined in accordance with para. 302.3.2(d)(3) is not recommended for flanged joints and other components in which slight deformation can cause leakage or malfunction. [These values are shown in italics or boldface in Table A-1, as explained in Note (4) to Appendix A Tables.] Instead, either 75% of the stress value in Table A-1 or two-thirds of the yield strength at temperature listed in the BPV Code, Section II, Part D, Table Y-1 should be used. (f) Unlisted Materials. For a material which conforms to para.				

ASME B31.3 – 2014 Guidance to Evaluate Unlisted Materials for B31.3					
Description	**Metallic**	**Non-Metallic**	**Category M Metallic**	**Category MA Non-Metallic**	**Category K**
	323.1.2, the tensile (yield) strength at temperature shall be derived by multiplying the average expected tensile (yield) strength at temperature by the ratio of ST (SY) divided by the average expected tensile (yield) strength at room temperature.				
					K321.1.4 Materials. Paragraph 321.1.4 applies, but replace (e) with the following: (e) Attachments welded to the piping shall be of a material compatible with the piping and the service. Other requirements are specified in paras. K321.3.2 and K323.4.2(b).

ASME B31.3 – 2014 Guidance to Evaluate Unlisted Materials for B31.3					
Description	**Metallic**	**Non-Metallic**	**Category M Metallic**	**Category MA Non-Metallic**	**Category K**
Materials and Specifications	323.1 Materials and Specifications 323.1.1 Listed Materials. Any material used in pressure containing piping components shall conform to a listed specification except as provided in para. 323.1.2. 323.1.2 Unlisted Materials. Unlisted materials may be used provided they conform to a published specification covering chemistry, physical and mechanical properties, method and process of manufacture, heat treatment, and quality control, and otherwise meet the requirements of this	A323.1 Materials and Specifications Paragraph 323.1 applies except for para. 323.1.4. See para. A323.1.4.	M323 GENERAL REQUIREMENTS M323.1 Materials and Specifications Paragraph 323.1.1 applies. See paras. M323.1.2, M323.1.3, and M323.1.4. M323.1.2 Unlisted Materials. Paragraph 323.1.2 applies, with the additional requirement that the designer shall fully document the determination of	MA323 GENERAL REQUIREMENTS Paragraph A323.1 applies with the additional requirement described in para. MA323.1.2. Paragraph A323.2 applies in its entirety. See para. MA323.4. MA323.1.2 Unlisted Materials. Paragraph 323.1.2 applies with the additional requirement that the designer shall fully document the determination of allowable stresses as part of the engineering design.	K323.1 Materials and Specifications K323.1.1 Listed Materials (a) Any material used in a pressure-containing piping component shall conform to a listed specification, except as provided in (b) below or in para. K323.1.2. (b) Materials manufactured to specification editions different from those listed in Appendix E may be used, provided (1) the requirements for chemical composition and heat-treatment condition in the edition of the specification to which the material was

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	Code. See also ASME BPV Code Section II, Part D, Appendix 5. Allowable stresses shall be determined in accordance with the applicable allowable stress basis of this Code or a more conservative basis.				manufactured meet the requirements of the listed edition (2) the specified minimum tensile and yield strengths, and, if applicable, the specified maximum tensile and yield strengths, required by the two editions of the specification are the same, and (3) the material has been tested and examined in accordance with the requirements of the listed edition of the specification A material that does not meet the requirements of paras. K323.1.1(b)(1), (2), and (3) may be evaluated as an unlisted material in

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					accordance with para. K323.1.2. K323.1.2 Unlisted Materials. An unlisted material may be used, provided it conforms to a published specification covering chemistry, physical and mechanical properties, method and process of manufacture, heat treatment, and quality control, and otherwise meets the requirements of this Chapter. Allowable stresses shall be determined in accordance with the applicable allowable stress basis of this Chapter or a more conservative basis.
		A323.2.3 Temperature Limits,	M323 GENERAL REQUIREMENTS	MA323 GENERAL REQUIREMENTS	

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		Unlisted Materials. Paragraph 323.2.3 applies.	M323.1 Materials and Specifications Paragraph 323.1.1 applies. See paras. M323.1.2, M323.1.3, and M323.1.4. M323.1.2 Unlisted Materials. Paragraph 323.1.2 applies, with the additional requirement that the designer shall fully document the determination of	Paragraph A323.1 applies with the additional requirement described in para. MA323.1.2. Paragraph A323.2 applies in its entirety. See para. MA323.4. MA323.1.2 Unlisted Materials. Paragraph 323.1.2 applies with the additional requirement that the designer shall fully document the determination of allowable stresses as part of the engineering design.	