NASME-1-C: Equivalent Safety Evaluation for Normal Fluid Service Requirements for Metallic Piping Not Associated with Pressure Vessel, Boilers, or Air Receivers

(B31.3-2010 & 2012)

RECORD OF REVISION

Rev	Date	Description	POC	RM
0	9/17/2014	Initial issue.	Ari Ben Swartz, *ES-EPD*	Larry Goen, *ES-DO*

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

Chapter 17	**Pressure Safety POC and Committee**

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This evaluation of risk is per Chapter 17, Section EXIST-1 (Qualitative Risk greater than 3).

1. Applicable for B31.3 piping not including a pressure vessel, boiler, air receiver, or supporting piping.
2. This evaluation is for new pressure systems that allow workers to be in close proximity without additional shielding while the system is pressurized.
3. For severely cyclic system see specific code requirements.
4. Applicable only for metallic piping systems.
5. For Elevated Temperature Fluid Service (temperature in creep range) see specific code requirements.
6. A list of reputable manufacturers will be maintained by Engineering Services
7. The “Equivalency Evaluation” in the table below or the original paragraph in B31.3 may be followed. The equivalency is intended to provide an equivalent level of personnel safety to B31.3, not code compliance.

B31.3 Paragraph	Equivalency Evaluation (within the allowance of notes above this table)
Title: Scope and Definitions	
300 GENERAL STATEMENTS (B) RESPONSIBILITIES	System Owner designs system, but must be approved by PSO B for safety check. Training will be developed for System Owners to perform pressure system designs. In the interim until the training is developed and implemented, system owners with PSO assistance and concurrence may serve as designers.) PSO (B) acts as Owner's Inspector
300.1.3 Exclusions	Pressure systems will be inventoried with a system identification tag as defined in ESM Chapter 17. Those pressure systems that are excluded from B31.3 scope shall be declared exempt as defined in Section GEN as follows: B31.3 excludes pressure systems if less than 15 psig, nonflammable, nontoxic, and not damaging to human tissues with a design temperature from −29°C (−20°F) through 186°C (366°F) B31 series does not apply. LANL pressure systems where the supply pressure is greater than 15 psig but have a relief device proven adequate to protect the system from over pressurization by calculation or flow testing to less than 15 psig, and is non-flammable, nontoxic, and not damaging to human tissues with a design temperature from −29°C (−20°F) through 186°C (366°F) are excluded. In order to maintain the LANL pressure system inventory a system identification tag shall be applied in accordance with ESM Chapter 17, Section ADMIN, *System Identification Tag*, with the word Exempt on the tag. The regulator and relief device must be close coupled with no intervening stop valves and identified in accordance with ESM Chapter 17 requirements. A copy of a simplified system sketch and the documentation showing the system is adequately protected against overpressure shall be maintained as records, and must be managed per LANL P 1020, P 1020-1, and P 1020-2. Relief device retest frequency is a 5 year interval.
300.2 Definitions	This table is **not** applicable to for Category D Fluid Service, Category M Fluid Service, Elevated Temperature Fluid Service, High Pressure Fluid Service, or

Attachment NASME-1-C, Equivalent Safety Evaluation for Normal Fluid Service Requirements for Metallic Piping Not Associated with Pressure Vessel, Boilers, or Air Receivers

B31.3 Paragraph	Equivalency Evaluation (within the allowance of notes above this table)
	High Purity Fluid Service (reference Chapter 17 Section II Attachment II-3 for Category M fluids; contact the CPSO for fluids not listed) Flammability limits are per Compressed Gas Association (CGA) P-23 (NFPA 55) Determination of flammability limit is per ASTM E681-85, *Standard Test Method for Concentration Limits of Flammability of Chemicals*.

Title: Design	
301.1 Qualifications of the Designer	See above 300 General Statements (b) Responsibilities
301.2.2 Required Pressure Containment or Relief	As written for Normal Fluid Service, but using manufacturers' published rating for design pressure. Or protect personnel using other controls; engineering, administrative, and/or PPE as approved by the PSO as per ASME B&PVC Section VIII Div. 1 UG-140 "OVERPRESSURE PROTECTION BY SYSTEM DESIGN "
301.3 Design Temperature	This paragraph does not apply if the pressure system is in a relatively constant temperature environment (+/- 10 F) and the temperature is less than 120 F (50C) (note: this is to ensure there is no effect from thermal linear change).
301.3.1 Design Minimum Temperature	Minimum design temperature is a function of the material and the lower allowable temperatures in Table A.
301.4 Ambient Effects	Does not apply if the pressure system is in a relatively constant temperature environment (+/- 10 F) and the temperature is less than 120 F (50C) (note this is to ensure there is no effect from thermal linear change).
301.5 Dynamic Effects	Impact, wind, earthquake, vibration, discharge reactions are required to be evaluated and discounted or applied.
301.6 Weight Effects	Live and dead loads are required to be evaluated and discounted or applied.
301.7 Thermal Expansion and Contraction Effects	Paragraph normally does not apply to pressure system is in a relatively constant temperature environment (+/- 10 F) and the temperature is less than 120 F (50C) (note this is to ensure there is no effect from thermal linear change) This paragraph applies to pressure systems with appreciable thermal

	expansion or phase change induced volumetric expansion (increases of specific volume).
301.8 Effects of Support, Anchor, and Terminal Movements	This paragraph does not apply to pressure system is in a relatively constant temperature environment (+/- 10 F) and the temperature is less than 120 F (50C) (note this is to ensure there is no effect from thermal linear change) This paragraph applies to pressure systems with appreciable thermal expansion or phase change induced volumetric expansion (increases of specific volume). Note: This paragraph does not apply for flex hoses restraints to reduce whip hazard
301.9 Reduced Ductility Effects	Paragraph is required to be evaluated and discounted or applied
302.2.1 Listed Components Having Established Ratings	Use listed component if available, but if none are available manufacturer's ratings are acceptable for the service conditions temperature, pressure, compatibility, etc…
302.2.2 Listed Components Not Having Specific Ratings	Use reputable manufacturers' published ratings. A reputable manufacturers' listing will be maintain by Engineering Services. Note: Institutional Evaluated Suppliers List (IESL) is not necessarily a listing of reputable manufacturers.
302.2.3 Unlisted Components	Use reputable manufacturers' published ratings. A reputable manufacturers' listing will be maintain on the Engineering Services.
302.3 Allowable Stresses and Other Stress Limits	Per design may consider other protective measures in order of precedence as follows: engineering controls (barriers, interlocks or controls), procedural controls (access control), and/or PPE.
302.3.3 Casting Quality Factor, Ec	Use B31.3 paragraph as written if applicable
302.3.4 Weld Joint Quality Factor, Ej	Use B31.3 paragraph as written if applicable
302.3.5 Limits of Calculated Stresses Due to Sustained Loads and Displacement Strains	Paragraph is required to be evaluated and discounted or applied If unlisted, use manufacturer's allowable stress ratings for the material. Note: If piping and piping elements (unions, couplings, etc...) are rated above the maximum design pressure for the Normal Service and is sufficiently supported (see paragraph 321 "Piping Supports"), and the other piping components that are in the pressure system are adequately

	supported this paragraph does not apply.
302.3.6 Limits of Calculated Stresses Due to Occasional Loads	Do not apply paragraph if application of ESM Chapter 17 Att GEN-4 Table GEN-4-4, *Qualitative Risk (QR) Determination*, bounding conditions shows low risk (less than 3) approved by the PSO or apply paragraph.
302.4 Allowances	Fluid will be evaluated and determined to be compatible for the service life of the system with the materials of construction and manufacturer's recommendations or allowances must be added in accordance with the paragraph.
304 PRESSURE DESIGN OF COMPONENTS 304.1 Straight Pipe	If LANL is designing or having a design for a pressure component, the design shall comply with paragraph 304.1. The material shall meet 323.1 and must have a 3:1 factor of safety for materials not listed Table A1 (unlisted material). Note: This paragraph is for designing pipe and components, not for procurement of items offered for sale. If using reputable manufacturer's published ratings this paragraph does not apply.
304.2 Curved and Mitered Segments of Pipe	If LANL is designing or having a design for a pressure component, the design shall comply with paragraph 304.2 The material shall meet 323.1 and must have a 3:1 factor of safety for materials not listed Table A1 (unlisted material). Note: This paragraph is for designing pipe and components, not for procurement of items offered for sale. If using reputable manufacturer's published ratings this paragraph does not apply. When the wall thickness is 1.5 times the minimum required by equation 3a no additional evaluation of Intrados or Extrados is required. or Use approved vendor tubing or pipe bender with their required pipe/tube to their published standard.
304.3 Branch Connections	If LANL is designing or having a design for a pressure component, the design shall comply with paragraph 304.3 The material shall meet 323.1 and must have a 3:1 factor of safety for materials not listed Table A1 (unlisted material). Note: This paragraph is for designing pipe and components, not for procurement of items offered for sale. If using reputable manufacturer's published ratings this paragraph does not apply.
304.4 Closures	If LANL is designing or having a design for a pressure component, the design shall comply with paragraph 304.4 The material shall meet 323.1

	and must have a 3:1 factor of safety for materials not listed Table A1 (unlisted material). Note: This paragraph is for designing pipe and components, not for procurement of items offered for sale. If using reputable manufacturer's published ratings this paragraph does not apply.
304.5 Pressure Design of Flanges and Blanks	If LANL is designing or having a design for a pressure component, the design shall comply with paragraph 304.5 The material shall meet 323.1 and must have a 3:1 factor of safety for materials not listed Table A1 (unlisted material). Note: This paragraph is for designing pipe and components, not for procurement of items offered for sale. If using reputable manufacturer's published ratings this paragraph does not apply.
304.6 Reducers	If LANL is designing or having a design for a pressure component, the design shall comply with paragraph 304.6 The material shall meet 323.1 and must have a 3:1 factor of safety for materials not listed Table A1 (unlisted material). Note: This paragraph is for designing pipe and components, not for procurement of items offered for sale. If using reputable manufacturer's published ratings this paragraph does not apply.
304.7 Pressure Design of Other Components	Initial design consistent with the design criteria of ASME B31.3 shall be a hoop stress evaluation at the minimum wall thickness at the maximum part diameter (worst case hoop stress) showing the design meets or exceed the stress. Note: Use 31.3 material allowable stress values with B31.3 equations. Substantiation of the above may be done by one of the 4 items below: 1) For a simple part that has no stress intensification factors (notches, threads, pits, cracks, etc...) the minimum calculated hoop stress shall be 4x the design pressure (MAWP) 2) Determine if the piping component was previously used in accordance with paragraph 304.7.2 (a) 3) Pressure test to 4x the design pressure. 4) Perform Engineering Finite Analysis (FEA) in accordance with paragraph 304.7.2 (d)
305 PIPE	Paragraph is required to be evaluated and discounted or applied
306 FITTINGS, BENDS, MITERS, LAPS, AND BRANCH CONNECTIONS	If LANL is designing or having a design for a pressure component, the design shall comply with paragraph 306. The material shall meet 323.1 and must have a 3:1 factor of safety for materials not listed Table A1 (unlisted

	material). Note: This paragraph is for designing pipe and components, not for procurement of items offered for sale. If using reputable manufacturer's published ratings this paragraph does not apply.
307 VALVES AND SPECIALTY COMPONENTS	If LANL is designing or having a design for a pressure component, the design shall comply with paragraph 307. The material shall meet 323.1 and must have a 3:1 factor of safety for materials not listed Table A1 (unlisted material). Note: This paragraph is for designing pipe and components, not for procurement of items offered for sale. If using reputable manufacturer's published ratings this paragraph does not apply.
308 FLANGES, BLANKS, FLANGE FACINGS, AND GASKETS	If LANL is designing or having a design for a pressure component, the design shall comply with paragraph 308. The material shall meet 323.1 and must have a 3:1 factor of safety for materials not listed Table A1 (unlisted material). Note: This paragraph is for designing pipe and components, not for procurement of items offered for sale. If using reputable manufacturer's published ratings this paragraph does not apply.
309 BOLTING	If LANL is designing or having a design for a pressure component, the design shall comply with paragraph 309. The material shall meet 323.1 and must have a 3:1 factor of safety for materials not listed Table A1 (unlisted material). Note: This paragraph is for designing pipe and components, not for procurement of items offered for sale. If using reputable manufacturer's published ratings this paragraph does not apply.
310 GENERAL	Use B31.3 paragraph as written.
311 WELDED JOINTS	Welding and brazing shall be done in accordance with ESM Chapter 13 *Welding, Joining, and NDE* [Non-destructive examination].
311.2 Specific Requirement	See above
311.2.7 Seal Welds	See above
312 FLANGED JOINTS	Conflat and KF flanges are not pressure joints unless qualified in accordance with the requirement in this table.
313 EXPANDED JOINTS	Use B31.3 paragraph as written for Normal Fluid Service

314 THREADED JOINTS	If LANL is designing or having a design for a pressure component, the design shall comply with paragraph 314. The material shall meet 323.1 and must have a 3:1 factor of safety for materials not listed Table A1 (unlisted material). Note: This paragraph is for designing pipe and components, not for procurement of items offered for sale. If using reputable manufacturer's published ratings this paragraph does not apply.
315 TUBING JOINT	If LANL is designing or having a design for a pressure component, the design shall comply with paragraph 314. The material shall meet 323.1 and must have a 3:1 factor of safety for materials not listed Table A1 (unlisted material). Note: This paragraph is for designing pipe and components, not for procurement of items offered for sale. If using reputable manufacturer's published ratings this paragraph does not apply. Evaluate inter-mixed fittings using paragraph 304.7 above. May consider de-rating the fitting based on the application to define or establish the MAWP.
316 CAULKED JOINTS	Not allowed for Normal Fluid Service.
317 SOLDERED AND BRAZED JOINTS	Brazed joints shall be done in accordance with ESM Chapter 13 Welding, Joining, and NDE. Soldering shall meet B31.3 requirements.
318 SPECIAL JOINTS	Use B31.3 paragraph as written for Normal Fluid Service and evaluate in accordance with 304.7.2 in this table. NOTE: Gland here does not mean Swagelok gland fitting.
319 PIPING FLEXIBILITY	Paragraph is required to be evaluated and discounted or applied Does not apply to pressure systems where thermal expansion is not an issue. When pressure systems are used at relatively constant temperature conditions (+/- 10 F), normally within buildings and labs, and ambient temperature is less than 120 degree F this paragraph is not applicable.
320 ANALYSIS OF SUSTAINED LOADS	Piping is not to be used to support equipment (not a piping component). Paragraph is required to be evaluated and discounted or applied. Piping supports may be in accordance with LANL Master Spec Section 22 0529 for all Normal Fluid Service including pressures above 150 psig. If additional support is required see 321.
321 PIPING SUPPORTS	Use B31.3 paragraph as written in 321.1.2 "simple calculations and

	engineering judgment"
322 SPECIFIC PIPING SYSTEMS	Use B31.3 paragraph as written
322 SPECIFIC PIPING SYSTEMS	Use B31.3 paragraph as written. Pressure systems with vessels, air receivers or boilers require an ASME Stamped and approved relief device protecting the vessel, air receiver, or boiler. Existing piping relief devices may be used if they are stamped and the vessel cannot be pressurized through any other path or means. Piping relief is not required to be V-stamped if no code stamped item (pressure vessel, boiler, or air receiver) is present.

Title: **Materials**	
323 GENERAL REQUIREMENTS	Use listed materials for example: 304, 316, B88, and A108; additional listed materials are in B31.3 Appendix A. This evaluation does not apply to Test Articles.
323.1.1 Listed Materials.	Use B31.3 paragraph as written.
323.1.2 Unlisted Materials	Prior to using an unlisted material the chemistry, physical and mechanical properties, method and process of manufacture, heat treatment, and quality control must be known as required by 323.1.2. Note: This paragraph is for designing pipe and components, not for procurement of items offered for sale. If using reputable manufacturer's published ratings this paragraph does not apply. The Designer is cautioned that materials must be suitable for the application and must be evaluated in accordance with 323.1.2 if necessary to determine the suitability of the material.
323.1.3 Unknown Materials.	Don't use unknown materials.
323.1.4 Reclaimed Materials.	Use B31.3 paragraph as written.
323.2 Temperature Limitations	Use B31.3 paragraph as written.

323.2.1 Upper Temperature Limits, Listed Materials.	Know the temperature limits of the materials.
323.2.2 Lower Temperature Limits, Listed Materials	Use B31.3 paragraph as written.
323.2.3 Temperature Limits, Unlisted Materials.	Verify the temperature limits of the unlisted material meet the requirements of the design temperature. Note: This paragraph is for designing pipe and components, not for procurement of items offered for sale. If using reputable manufacturer's published ratings this paragraph does not apply. The Designer is cautioned that materials must be suitable for the temperature and must be evaluated in accordance with 323.2.3 if necessary to determine the suitability of the material.
323.2.4 Verification of Serviceability	Use B31.3 paragraph as written.
323.3 Impact Testing Methods and Acceptance Criteria	Use B31.3 paragraph as written.
323.3.1 General.	Use B31.3 paragraph as written.
323.3.2 Procedure.	Use B31.3 paragraph as written.
323.3.3 Test Specimens.	Use B31.3 paragraph as written.
323.3.4 Test Temperatures.	Use B31.3 paragraph as written.
323.3.5 Acceptance Criteria	Use B31.3 paragraph as written.
323.4 Fluid Service Requirements for Materials 323.4.1 General.	Use B31.3 paragraph as written.
323.4.2 Specific Requirements	Use B31.3 paragraph as written.

323.4.3 Cladding and Lining Materials.	Use B31.3 paragraph as written.
323.5 Deterioration of Materials in Service	Designer is required to design the pressure system for the service life of the system and consider material compatibility.
325 MATERIALS — MISCELLANEOUS 325.1 Joining and Auxiliary Materials	Use B31.3 paragraph as written.

Title: Standards for Piping Components	
326 DIMENSIONS AND RATINGS OF COMPONENTS	Use components as defined in the code or use reputable manufacturers' published ratings. A reputable manufacturers' listing will be maintain on the Engineer Services website. Note: Institutional Evaluated Suppliers List (IESL) is not necessarily a listing of reputable manufacturers.
326.1 Dimensional Requirements	Apply B31.3 paragraph as written. (see 301.2.2)
326.2 Ratings of Components	Apply B31.3 paragraph as written (see 301.2.2)
326.3 Reference Documents	Apply B31.3 paragraph as written (see 301.2.2)

Title: Fabrication, Assembly, and Erection	
327 GENERAL	Use B31.3 paragraph as written.
328 WELDING	Welding and brazing shall be done in accordance with ESM Chapter 13 Welding.
328.1 Welding Responsibility	See above.

328.2 Welding Qualifications	See above.
328.3 Welding Materials	See above.
328.4 Preparation for Welding	See above.
328.5 Welding Requirements	See above.
328.6 Weld Repair	See above.
330 PREHEATING	See above.
331 HEAT TREATMENT	See above.
331.2 Specific Requirements	See above.
332 BENDING AND FORMING	Bend or form in accordance with the manufactures' specification or requirements
333 BRAZING AND SOLDERING	Welding and brazing shall be done in accordance with ESM Chapter 13. Note: 317.1 Soldered Joints: "Soldered joints shall be made in accordance with the provisions of paragraph 333 and may be used only in Category D fluid service." i.e. soldered joints are not allowed for Normal Fluid Service.
335 ASSEMBLY AND ERECTION	Assemble in accordance with the manufactures' requirements

Title: Inspection, Examination, and Testing	
340 INSPECTION 340.1 General	PSO Duty Area B will be the Owner's Inspector Owner's Inspector will be knowledgeable with the pressure system of interest.
340.2 Responsibility for Inspection	Use B31.3 paragraph as written.
340.3 Rights of the Owner's Inspector	Use B31.3 paragraph as written.

340.4 Qualifications of the Owner's Inspector	See paragraph 300. PSO Duty Area B will act as the Owner's Inspector or equivalent.
341 EXAMINATION 341.1 General	Use B31.3 paragraph as written.
342 EXAMINATION PERSONNEL	Examiners shall have training and experience commensurate with the needs of the specified examinations. The requirements of VAR-2012-008 shall be met until the variance expires. All personnel will be qualified as per ESM Chapter 13. It is recommended examiners use the following procedure to attain the necessary training hours. Bubble leak testing Examiners will take a bubble leak test qualification course "Category D Requirements for Piping not associated with PV, Boilers, or Air Receivers", pass a quiz for material comprehension (80%), and be approved by a PSO B. Alternatively the Examiner may take the 8 hour "NDT: Bubble Leak Testing – Level II" course number 15050 and pass the practical and written exam The official training records will be retained on UTrain. For both the Category D class and the "Bubble leak test class" The examiner will then work performing leak testing (bubble leak and hydrostatic leak test). The PSO B will maintain a list of the approved examiners during the interim (while VAR-2012-008 is in effect). For Category D class examiners: If the examiner desires to be ASNT-TC-1A certified they must 1) pass a written general exam, 2) pass a written specific exam, and 3) pass a hands on practical exam 4) provide documentation of sufficient hours (38?) performing the examination. Note: Level II or higher ASNT-TC-1A must comply with ESM Chapter 13 application and documentation.
343 EXAMINATION PROCEDURES	Use B31.3 paragraph as written.
344 TYPES OF EXAMINATION	Use B31.3 paragraph as written.
345 TESTING	The Owner accepts pneumatic or hydro-pneumatic leak testing with inert gas or air. Test (additional testing may be required by the Designer). See variance VAR-2011-032.1 for vacuum rate of rise and inert gas referee test gas. Be aware of the large

	Note: Be aware of the ramifications of using high molecular weight gases to test system for lower molecular weight gas. The engineering best practice is to use a lower or equal weight molecular weight gas as the referee test gas except for hydrogen where helium is accepted.
346 RECORDS	Required information is as follows: • Sketch, • Component list (manufacturer, model number, pressure rating, FM 07 information) • Calculation • Relief device/flow calc. • Examinations • Inspections Electronic copy loaded into a master site repository.