NASME-1-D: Equivalent Safety Evaluation for Category D 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. Applicable only for metallic piping systems.
3. This evaluation is for new pressure systems that allow workers to be in close proximity without additional shielding while the system is pressurized.
4. For severely cyclic system see specific code requirements.
5. A list of reputable manufacturers will be maintained by Engineering Services.
6. The “Equivalent Risk 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.
7. Applies to ML-4 only.

Paragraph	Category D Fluid Service 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 Duty Area B shall perform the role as Owner's Inspector 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 Att GEN-2 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 nonflammable, 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 8.0, *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 M Fluid Service, Elevated Temperature Fluid Service, High Pressure Fluid Service, or High Purity Fluid Service (reference ESM Chapter 17 Section ASME Att ASME-4, contact the CPSO for other fluids not listed) Flammability limits are per Compressed Gas Association (CGA) P-23 (NFPA 55) Determination of flammability limit is per American Society for Testing and Materials (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 Category D 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	Lowest allowable minimum design temperature is -20 F (-29 C).
301.4 Ambient Effects	Does not apply if the pressure system is in a relatively constant temperature environment (+/- 10 F) and ambient temperature is less than 120 degree F.
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	Normally does not apply to pressure system is in a relatively constant temperature environment (+/- 10 deg F) and the temperature is less than 120 F (50C) (note this is to ensure there is no effect from thermal linear change) 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	Restraints do not apply for whip hazard.
301.9 Reduced Ductility Effects	Not applicable
302.2.1 Listed Components Having Established Ratings	Listed items are recommended, but manufacturer's published ratings are acceptable.
302.2.2 Listed Components	Use reputable manufacturers' published ratings. A reputable manufacturers' listing will

Not Having Specific Ratings	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 of 150 psig for Category D Fluid 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 because application of ESM Chapter 17 Att GEN-4 Table GEN-4-4, Qualitative Risk (QR) Determination, bounding conditions show low risk.
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.
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 tubing 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 B31.3 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 or Brazing shall be done in accordance with ESM Chapter 13 *Welding, Joining, and* Non-destructive examinations (NDE).
311.2 Specific Requirements	Welding or Brazing shall be done in accordance with ESM Chapter 13 *Welding, Joining, and NDE*.
311.2.1 Welds for Category D Fluid Service.	Welding or Brazing shall be done in accordance with ESM Chapter 13 *Welding, Joining, and NDE.*

311.2.7 Seal Welds	Welding or Brazing shall be done in accordance with ESM Chapter 13 *Welding, Joining, and NDE*.
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 Category D 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	Use B31.3 paragraph as written for Category D 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	As written for Category D 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	The design temperature is from −29°C (−20°F) through 186°C (366°F) 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	Piping is not to be used to support equipment (not a piping component).

LOADS	Paragraph is required to be evaluated and discounted or applied. Piping supports may be in accordance with LANL Master Spec 22 0529 for all Category D Fluid Service pressures. 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	Any carbon steel material may be used to a minimum temperature of −29°C (−20°F) for

Limitations	Category D Fluid Service.
323.2.1 Upper Temperature Limits, Listed Materials.	Know the temperature limits of the materials.
323.2.2 Lower Temperature Limits, Listed Materials	Select materials that are ductile (including welds/braze/solder) at -20 F. Normally these materials include 304, 316 (austenitic SS), brass, etc…; additional listed materials are in B31.3 Appendix A.
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	Not required for Category D Fluid Service
323.3.1 General.	Not required for Category D Fluid Service
323.3.2 Procedure.	Not required for Category D Fluid Service
323.3.3 Test Specimens.	Not required for Category D Fluid Service
323.3.4 Test Temperatures.	Not required for Category D Fluid Service
323.3.5 Acceptance Criteria	Not required for Category D Fluid Service
323.4 Fluid Service Requirements for Materials 323.4.1 General.	Not required for Category D Fluid Service
323.4.2 Specific Requirements	Not required for Category D Fluid Service
323.4.3 Cladding and Lining Materials.	Not required for Category D Fluid Service

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 or Brazing shall be done in accordance with ESM Chapter 13 Welding
328.1 Welding Responsibility	Welding or Brazing shall be done in accordance with ESM Chapter 13 Welding
328.2 Welding Qualifications	Welding or Brazing shall be done in accordance with ESM Chapter 13 Welding
328.3 Welding Materials	Welding or Brazing shall be done in accordance with ESM Chapter 13 Welding
328.4 Preparation for Welding	Welding or Brazing shall be done in accordance with ESM Chapter 13 Welding
328.5 Welding Requirements	Welding or Brazing shall be done in accordance with ESM Chapter 13 Welding
328.6 Weld Repair	Welding or Brazing shall be done in accordance with ESM Chapter 13 Welding

330 PREHEATING	Welding or Brazing shall be done in accordance with ESM Chapter 13 Welding
331 HEAT TREATMENT	Welding or Brazing shall be done in accordance with ESM Chapter 13 Welding
331.2 Specific Requirements	Welding or Brazing shall be done in accordance with ESM Chapter 13 Welding
332 BENDING AND FORMING	Bend or form in accordance with the manufactures requirements
333 BRAZING AND SOLDERING	Welding or Brazing shall be done in accordance with ESM Chapter 13 Welding, Joining, and NDE. Soldering shall meet B31.3 requirements.
335 ASSEMBLY AND ERECTION	Assemble in accordance with the manufacturer's requirements

Title: Inspection, Examination, and Testing	
A340 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. In the interim perform examination as defined in VAR-2012-008 while variance is in effect. 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. The quiz will be retained on UTrain. 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 or if ASNT-TC-1A certification is not desired.

	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 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	Owner has elected to use Initial Service Leak 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. 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, FM07 information) • Calculation • Relief device/flow calc. • Examinations • Inspections Electronic copy loaded into a master site repository.