

**NASME-1-B: Equivalent Safety Evaluation for  
Category Normal Non-Metallic Requirements for  
Piping not Associated with Pressure Vessel, Boilers, or Air Receivers  
(B31.3-2010, 2012, and 2014)**

**RECORD OF REVISIONS**

Rev	Date	Description	POC	RM
0	9/17/14	Initial issue.	Ari Ben Swartz, <i>ES-EPD</i>	Larry Goen, <i>ES-DO</i>
1	6/30/15	A342 changed to use B31.3 paragraph as written. A345 added requirement based on ASME interpretation. Updates for B31.3-2014.	Ari Ben Swartz, <i>ES-EPD</i>	Larry Goen, <i>ES-DO</i>

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

<b>Chapter 17</b>	<a href="#"><u>Pressure Safety POC and Committee</u></a>
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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 NON - metallic piping systems.
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	Normal Fluid Service Non Metallic Equivalency Evaluation (within the allowance of notes above this table)
<b>Title: Scope and Definitions</b>	
A300 GENERAL STATEMENTS (b) Responsibilities	<p>System Owner designs system, but must be approved by PSO B for safety check.</p> <p>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.</p> <p>PSO Duty Area B may perform the role of Owner’s Inspector.</p>
300.1.3 Exclusions (referenced from A300 General Statements (f))	<p>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 Section GEN-2 as follows:</p> <p>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.</p> <p>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.</p> <p>In order to maintain the LANL pressure system inventory a system identification tag shall be applied in accordance with ESM Chapter 17, Section ADMIN, <i>System Identification Tag</i>, with the word Exempt on the tag.</p> <p>The regulator and relief device must be close coupled with no intervening stop valves and identified in accordance with ESM Chapter 17 requirements.</p> <p>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.</p> <p>Relief device retest frequency is a 5-year interval.</p>
300.2 Definitions (referenced from A300 General Statements (f))	<p>This table is <b>not</b> applicable to for Category M Fluid Service, Elevated Temperature Fluid Service, High Pressure Fluid Service, or High Purity Fluid Service ( reference Section II Attachment II-3 for Category M fluids , contact the CPSO for other fluids not listed)</p>

	<p>Flammability limits are per Compressed Gas Association (CGA) P-23 (NFPA 55)</p> <p>Determination of flammability limit is per American Society for Testing and Materials (ASTM) E681-85, <i>Standard Test Method for Concentration Limits of Flammability of Chemicals</i>,</p>
<b>Title: Design</b>	
301.1 Qualifications of the Designer (referenced from A301)	See above 300 General Statements (b) Responsibilities
301.2.2 Required Pressure Containment or Relief (referenced from A302)	<p>As written for Normal Fluid Service, but using manufacturers' published rating for design pressure.</p> <p>Or protect personnel using other controls; engineering, administrative, and/or PPE as approved by the PSO as per ASME B&amp;PVC Section VIII Div. 1 UG-140 "OVERPRESSURE PROTECTION BY SYSTEM DESIGN "</p>
A301.3 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).
A301.3.1 Design Minimum Temperature	<p>Minimum design temperature is a function of the material and the lower allowable temperatures in Table B-1.</p> <p>Note: Non-metallic materials exhibit a "glass transition temperature" where the material becomes hard and may be susceptible to brittle fracture.</p>
301.4 Ambient Effects (referenced from A301)	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 (referenced from A301)	Impact, wind, earthquake, vibration, discharge reactions are required to be evaluated and discounted or applied.
301.6 Weight Effects (referenced from A301)	Live and dead loads are required to be evaluated and discounted or applied.
301.7 Thermal Expansion and Contraction Effects (referenced from A301)	<p>This paragraph normally does not apply to 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)</p> <p>Applies to pressure systems with appreciable thermal expansion or phase change induced volumetric expansion (increases of specific volume).</p>
301.8 Effects of Support, Anchor, and Terminal Movements (referenced from A301)	This paragraph does not apply to restraints for whip hazard.

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301.9 Reduced Ductility Effects (referenced from A301)	Not applicable
301.10 Cyclic Effects (referenced from A301)	Not applicable
301.11 Air Condensation Effects (referenced from A301)	Required to be evaluated and discounted or applied
A302 Design Criteria	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.
A302.1 General	Required to be evaluated and discounted or applied
A302.2.1 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....
A302.2.2 Listed Components Not Having Specific Ratings	First use reputable manufacturers ratings for the service conditions (IESL, or add listing of example suppliers as attachment to web page.)  If none are available establish a rating for the service conditions temperature, pressure, compatibility, etc... as approved by the PSO.  NOTE: Institutional Evaluated Suppliers List (IESL) is not necessarily a listing of reputable manufacturers
A302.2.3 Unlisted Components	First use reputable manufacturers ratings for the service conditions (IESL, or add listing of example suppliers as attachment to web page.)  If none are available establish a rating for the service conditions temperature, pressure, compatibility, etc... as approved by the PSO.
A302.2.4	Required to be evaluated and discounted or applied
A302.2.5	Apply paragraph as written
A302.3 Allowable Stresses and Other Design 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.
A302.3.3 Limits of Calculated Stresses Due to Sustained Loads	Use B31.3 paragraph as written if applicable  Note: It is recommended that external loads be supported independent from the piping system.
A302.3.4 Limits of Calculated Stresses Due to Occasional Loads	Use B31.3 paragraph as written if applicable
302.4 Allowances (referenced from A302.4)	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.
Pressure Design of Piping Components A303 GENERAL	Use B31.3 paragraph as written
A304 PRESSURE DESIGN OF COMPONENTS  A304.1 Straight Pipe	All LANL designs or designs for LANL shall comply with para A304. The material shall meet A323.1 and must have a 3:1 factor of safety for materials not listed Table B1 (unlisted material). (if using reputable manufacturer's published ratings this Part 2 does not apply)  Or protect personnel using other controls; engineering, administrative, and/or PPE as approved by the PSO.
A304.2 Curved and Mitered Segments of Pipe	If LANL is designing or having a design for a pressure component, the design shall comply with paragraph A304.2 The material shall meet A323.1 and must have a 3:1 factor of safety for materials not listed Table B1 (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.
A304.3 Branch Connections	If LANL is designing or having a design for a pressure component, the design shall comply with paragraph A304.3 The material shall meet A323.1 and must have a 3:1 factor of safety for materials not listed Table B1 (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.
A304.3.1 General	Required to be evaluated and discounted or applied
A304.3.2 Branch Connections Using Fittings	Required to be evaluated and discounted or applied
A304.3.3 Additional Design Considerations	Required to be evaluated and discounted or applied
A304.4 Closures	If LANL is designing or having a design for a pressure component, the design shall comply with paragraph A304.4 The material shall meet A323.1 and must have a 3:1 factor of safety for materials not listed Table B1 (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 Nonmetallic Flanges	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).

	<p>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.</p>
A304.6 Reducers	<p>If LANL is designing or having a design for a pressure component, the design shall comply with paragraph A304.6 The material shall meet A323.1 and must have a 3:1 factor of safety for materials not listed Table B1 (unlisted material).</p> <p>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.</p>
A304.7 Pressure Design of Other Components	<p>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.</p> <p>Substantiation of the above may be done by one of the 4 items below:</p> <p>Note: System design pressure may be used to evaluate the component as the design pressure</p> <ol style="list-style-type: none"> <li>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)</li> <li>2) Determine if the piping component was previously used in accordance with paragraph A304.7.2 (a)</li> <li>3) Pressure test to 4x the design pressure (at maximum design temperature).</li> <li>4) Perform Engineering Finite Analysis (FEA) in accordance with paragraph 304.7.2 (d).</li> </ol>
A305 Pipe	<p>Paragraph is required to be evaluated and discounted or applied</p>
A306 FITTINGS, BENDS, MITERS, LAPS, AND BRANCH CONNECTIONS	<p>If LANL is designing or having a design for a pressure component, the design shall comply with paragraph A306. The material shall meet A323.1 and must have a 3:1 factor of safety for materials not listed Table A1 (unlisted material).</p> <p>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.</p>
A307 VALVES AND SPECIALTY COMPONENTS	<p>If LANL is designing or having a design for a pressure component, the design shall comply with paragraph A307. The material shall meet A323.1 and must have a 3:1 factor of safety for materials not listed Table A1 (unlisted material).</p> <p>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.</p>
A308 FLANGES, BLANKS, FLANGE FACINGS, AND	<p>If LANL is designing or having a design for a pressure component, the design shall comply with paragraph A308. The material shall</p>

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GASKETS	<p>meet A323.1 and must have a 3:1 factor of safety for materials not listed Table A1 (unlisted material).</p> <p>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.</p>
A309 BOLTING	<p>If LANL is designing or having a design for a pressure component, the design shall comply with paragraph A309. The material shall meet A323.1 and must have a 3:1 factor of safety for materials not listed Table A1 (unlisted material).</p> <p>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.</p>
A310 GENERAL	Use B31.3 paragraph as written.
311 BONDED JOINTS IN PLASTICS	<p>Welding shall be done in accordance with ESM Chapter 13 <i>Welding, Joining, and NDE</i> [Non-destructive examinations (NDE)].</p> <p>Use B31.3 paragraph as written.</p>
A312 FLANGED JOINTS	<p>Use B31.3 paragraph as written for Normal Fluid Service:</p> <p>"The designer should consult the manufacturer for ratings of flanged joints in nonmetallic piping and in piping lined with nonmetals."</p>
A313 EXPANDED JOINTS	Use B31.3 paragraph as written for Normal Fluid Service
A314 THREADED JOINTS	Use B31.3 paragraph as written for Normal Fluid Service
A315 TUBING JOINT	Use B31.3 paragraph as written for Normal Fluid Service.
A316 CAULKED JOINTS	Use B31.3 paragraph as written for Normal Fluid Service.
A318 SPECIAL JOINTS	<p>As written for Normal Fluid Service, and evaluate in accordance with A304.7.2 in this table.</p> <p>NOTE: Gland here does not mean Swagelok gland fitting.</p>
A319 FLEXIBILITY AND NONMETALLIC PIPING	<p>Paragraph is required to be evaluated and discounted or applied</p> <p>When pressure systems are fabricated and used at relatively constant temperature conditions (+/- 10 F), and fluid temperature is also held within the same range this paragraph is satisfied.</p>
A321 PIPING SUPPORTS	Use B31.3 paragraph as written and reference 321.1.2 "simple calculations and engineering judgment"
A322 SPECIFIC PIPING SYSTEMS	<p>Use B31.3 paragraph as written</p> <p>Pressure systems with vessels, air receivers or boilers require an ASME Stamped and approved relief device protecting the vessel, air receiver, or boiler.</p> <p>Existing piping relief devices may be used if they are stamped and</p>

	<p>the vessel cannot be pressurized through any other path or means.</p> <p>Piping relief is not required to be V stamped if no code stamped item (pressure vessel, boiler, or air receiver) is present.</p>
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<b>Title: Materials</b>															
A323 GENERAL REQUIREMENTS	<p>Use listed materials for example:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Acrylonitrile-butadiene-styrene plastics</td> <td>ABS</td> </tr> <tr> <td>Chlorinated poly(vinyl chloride)</td> <td>CPVC</td> </tr> <tr> <td>Perfluoro (alkoxyalkane)</td> <td>PFA</td> </tr> <tr> <td>Polypropylene PP, Poly(vinyl chloride)</td> <td>PVC</td> </tr> <tr> <td>Poly(vinylidene chloride)</td> <td>PVDC</td> </tr> <tr> <td>Poly(vinylidene fluoride)</td> <td>PVDF</td> </tr> <tr> <td>Polytetrafluoroethylene</td> <td>PTFE</td> </tr> </table> <p>Additional listed materials are in B31.3 Appendix B. This evaluation does not apply to Test Articles.</p>	Acrylonitrile-butadiene-styrene plastics	ABS	Chlorinated poly(vinyl chloride)	CPVC	Perfluoro (alkoxyalkane)	PFA	Polypropylene PP, Poly(vinyl chloride)	PVC	Poly(vinylidene chloride)	PVDC	Poly(vinylidene fluoride)	PVDF	Polytetrafluoroethylene	PTFE
Acrylonitrile-butadiene-styrene plastics	ABS														
Chlorinated poly(vinyl chloride)	CPVC														
Perfluoro (alkoxyalkane)	PFA														
Polypropylene PP, Poly(vinyl chloride)	PVC														
Poly(vinylidene chloride)	PVDC														
Poly(vinylidene fluoride)	PVDF														
Polytetrafluoroethylene	PTFE														
323.1. Listed Materials.(referenced from A323.1 Materials and Specifications )	Use B31.3 paragraph as written.														
323.1.2 Unlisted Materials (referenced from A323.1 Materials and Specifications )	<p>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 (referenced from A323.1).</p> <p>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 A323.1 if necessary to determine the suitability of the material.</p>														
A323.1.3 Unknown Materials.(referenced from A323.1 Materials and Specifications )	Don't use unknown materials.														
A323.1.4 Reclaimed Materials.	Use B31.3 paragraph as written.														



A323.2 Temperature Limitations	Use B31.3 paragraph as written.
A323.2.1 Upper Temperature Limits, Listed Materials	Materials shall have test results or manufacturers supplied data at or above the highest expected design temperature.
A323.2.2 Lower Temperature Limits, Listed Materials	Materials shall have test results or manufacturers supplied data at or below the lowest expected design temperature.  Note: Non-metallic materials exhibit a “glass transition temperature” where the material becomes hard and may be susceptible to brittle fracture.
A323.2.3 Temperature Limits, Unlisted Materials.	Use B31.3 paragraph as written. To 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 (referenced by A323.2.3) 3 if necessary to determine the suitability of the material.
A323.2.4 Verification of Serviceability	Use B31.3 paragraph as written.
A323.4 Fluid Service Requirements for Non-Metallic Materials  323.4.1 General	Use B31.3 paragraph as written.
A323.4.2 Specific Requirements	Use B31.3 paragraph as written.
A323.4.3 Piping Lined With Nonmetals	Use B31.3 paragraph as written.
A323.5 Deterioration of Materials in Service	Designer is required to design the pressure system for the service life of the system and consider material compatibility.
A325 MATERIALS MISCELLANEOUS	Use B31.3 paragraph as written.

<b>Title: Standards for Piping Components</b>	
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 maintained on the Engineer Services website.  Note: Institutional Evaluated Suppliers List (IESL) is not necessarily a listing of reputable manufacturers.

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A326.1 Dimensional Requirements	Apply B31.3 paragraph as written (see A301.2.2)
A326.4 Abbreviations in Table A326.1 and Appendix B	Apply B31.3 paragraph as written

<b>Title: Fabrication, Assembly, and Erection</b>	
A327 GENERAL	Use B31.3 paragraph as written.
A328 BONDING OF PLASTICS	Not required for a low risk pressure system (ESM Chapter 17, GEN-4, Qualitative Risk (greater than 3))
A329 FABRICATION OF PIPING LINED WITH NONMETALS	Apply B31.3 paragraph as written (see A301.2.2), or as per the variance VAR-2013-060 B31.3 – 2010 & 2012 Normal Requirements
A332 BENDING AND FORMING	Apply B31.3 paragraph as written (see A301.2.2), or as per the variance VAR-2013-060 B31.3 – 2010 & 2012 Normal Requirements
A334 JOINING NONPLASTIC PIPING	Use B31.3 paragraph as written.
A335 ASSEMBLY AND ERECTION	Assemble in accordance with the manufacturer's requirements

<b>Title: Inspection, Examination, and Testing</b>	
A340 INSPECTION	Paragraph A340 applies in its entirety. 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 (referenced by A340)	Use B31.3 paragraph as written.
340.3 Rights of the Owner's Inspector (referenced by A340)	Use B31.3 paragraph as written.
340.4 Qualifications of the Owner's Inspector (referenced by A340)	See paragraph 300; PSO Duty Area B will act as the Owner's Inspector or equivalent.
A341 EXAMINATION	Use B31.3 paragraph as written.
A342 EXAMINATION PERSONNEL	Use B31.3 paragraph as written.
A343 EXAMINATION PROCEDURES	Use B31.3 paragraph as written.

A344 TYPES OF EXAMINATION	Use B31.3 paragraph as written.
A345 TESTING	<p>Precautions in Appendix F, para. FA323.4 Material Considerations — Nonmetals should be considered.</p> <p>The Owner accepts pneumatic or hydro-pneumatic leak testing with inert gas or air (additional testing may be required by the Designer).</p> <p>See Exist – Legacy System Requirements (3.B.1) for vacuum rate of rise and inert gas referee test gas.</p> <p>Pneumatic leak testing is approved for all systems less than 2 cubic feet in volume. Additional volume must be approved by the CPSO. <sup>1</sup></p> <p>See A345 for other requirements for example test pressures (A345.4.2), test limitations (A345.2.1), and other requirements for pneumatic testing (A345.5.2)</p> <p>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.</p>
A346 RECORDS	<p>Required information is as follows:</p> <ul style="list-style-type: none"> <li>• Sketch,</li> <li>• Component list (manufacturer, model number, pressure rating, FM07 information)</li> <li>• Calculation</li> <li>• Relief device/flow calc.</li> <li>• Examinations</li> <li>• Inspections</li> </ul> <p>Electronic copy loaded into a master site repository.</p>

<sup>1</sup> EMRef-73 ASME Interpretation of Para. 345.5.5 Pneumatic Leak Test Procedure.