

**Attachment NASME-1-D: Equivalency Evaluation of
Category D Requirements for Metallic Piping
not Associated with Pressure Vessel, Boilers, or Air Receivers
(B31.3-2010, 2012, and 2014¹)**

RECORD OF REVISION

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>
2	11/09/18	A342 changed to use B31.3 paragraph as written; other minor clarifications and corrections.	Ari Ben Swartz, <i>ES-EPD</i>	Larry Goen, <i>ES-DO</i>

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

Chapter 17	<u>Pressure Safety POC and Committee</u>
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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.

¹ Requires CPSO review prior to use with 2016, 2018

Section NASME - New Non-ASME System Requirements
Attachment NASME-1-D Category D Metallic

Rev. 2, 11/09/2018

Category D Fluid Service Equivalency Evaluation (within the allowance of notes above this table)	
Title: Scope and Definitions	
300 GENERAL STATEMENTS (b) Responsibilities	<p>System Owner designs system, but must be approved by PSO Duty Area 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 as Owner's Inspector.</p>
300.1.3 Exclusions	<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 in Section GEN Att 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, ADMIN-1, (9. <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 PD1020, P 1020-1, and P 1020-2; also, as applicable, AP-341-608, <i>Engineering Drawings and Sketches</i>, and AP-341-402, <i>Engineering Document Management In Operating Facilities</i>. Also see ESDO-AP-001, Engineering Document Control Desktop Instruction.</p> <p>Relief device retest frequency is a 5 year interval.</p>
300.2 Definitions	<p>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)</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>
Title: Design	
301.1 Qualifications of the Designer	See above 300 General Statements (b) Responsibilities

Section NASME - New Non-ASME System Requirements
Attachment NASME-1-D Category D Metallic

Rev. 2, 11/09/2018

Paragraph	Category D Fluid Service Equivalency Evaluation (within the allowance of notes above this table)
Title: Scope and Definitions	
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 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.

**Section NASME - New Non-ASME System Requirements
Attachment NASME-1-D Category D Metallic**

Rev. 2, 11/09/2018

Category D Fluid Service Equivalency Evaluation (within the allowance of notes above this table)	
Title: Scope and Definitions	
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, EXIST-1, Risk-Based Engineering Evaluation Process, Table EXIST-1-4 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	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).
304.1 Straight Pipe	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.

Paragraph	Category D Fluid Service Equivalency Evaluation (within the allowance of notes above this table)
Title: Scope and Definitions	
304.2 Curved and Mitered Segments of Pipe	<p>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).</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> <p>When the wall thickness is 1.5 times the minimum required by equation 3a no additional evaluation of Intrados or Extrados is required.</p> <p>or</p> <p>Use approved vendor tubing or pipe bender with their required tubing to their published standard.</p>
304.3 Branch Connections	<p>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).</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>
304.4 Closures	<p>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).</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>
304.5 Pressure Design of Flanges and Blanks	<p>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> <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>
304.6 Reducers	<p>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).</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>

**Section NASME - New Non-ASME System Requirements
Attachment NASME-1-D Category D Metallic**

Rev. 2, 11/09/2018

Paragraph	Category D Fluid Service Equivalency Evaluation (within the allowance of notes above this table)
Title: Scope and Definitions	
304.7 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> <ol style="list-style-type: none"> 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	<p>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).</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>
307 VALVES AND SPECIALTY COMPONENTS	<p>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).</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>
308 FLANGES, BLANKS, FLANGE FACINGS, AND GASKETS	<p>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).</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>
309 BOLTING	<p>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).</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>
310 GENERAL	Use B31.3 paragraph as written.
311 WELDED JOINTS	Welding or Brazing shall be done in accordance with ESM Chapter 13 <i>Welding, Joining, and Non-destructive examinations (NDE)</i> .

Section NASME - New Non-ASME System Requirements
Attachment NASME-1-D Category D Metallic

Rev. 2, 11/09/2018

Paragraph	Category D Fluid Service Equivalency Evaluation (within the allowance of notes above this table)
Title: Scope and Definitions	
311.2 Specific Requirements	Welding or Brazing shall be done in accordance with ESM Chapter 13 <i>Welding, Joining, and NDE</i> .
311.2.1 Welds for Category D Fluid Service	Welding or Brazing shall be done in accordance with ESM Chapter 13 <i>Welding, Joining, and NDE</i> .
311.2.7 Seal Welds	Welding or Brazing shall be done in accordance with ESM Chapter 13 <i>Welding, Joining, and NDE</i> .
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	<p>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).</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>
315 TUBING JOINT	<p>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).</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> <p>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.</p>
316 CAULKED JOINTS	Use B31.3 paragraph as written for Category D Fluid Service.
317 SOLDERED AND BRAZED JOINTS	Braze joints shall be done in accordance with ESM Chapter 13 <i>Welding, Joining, and NDE</i> . Soldering shall meet B31.3 requirements.
318 SPECIAL JOINTS	<p>As written for Category D Fluid Service and evaluate in accordance with 304.7.2 in this table.</p> <p>NOTE: Gland here does not mean Swagelok gland fitting.</p>

Section NASME - New Non-ASME System Requirements
Attachment NASME-1-D Category D Metallic

Rev. 2, 11/09/2018

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Title: Scope and Definitions	
319 PIPING FLEXIBILITY	<p>The design temperature is from -29°C (-20°F) through 186°C (366°F)</p> <p>Paragraph is required to be evaluated and discounted or applied</p> <p>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.</p>
320 ANALYSIS OF SUSTAINED LOADS	<p>Piping is not to be used to support equipment (not a piping component).</p> <p>Paragraph is required to be evaluated and discounted or applied.</p> <p>Piping supports may be in accordance with LANL Master Spec 22 0529 for all Category D Fluid Service pressures.</p> <p>If additional support is required see 321.</p>
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	<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 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>

Title: Materials	
323 GENERAL REQUIREMENTS	<p>Use listed materials for example: 304, 316, B88, and A108; additional listed materials are in B31.3 Appendix A.</p> <p>This evaluation does not apply to Test Articles.</p>
323.1.1 Listed Materials	Use B31.3 paragraph as written.

<p>323.1.2 Unlisted Materials</p>	<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.</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 323.1.2 if necessary to determine the suitability of the material.</p>
<p>323.1.3 Unknown Materials</p>	<p>Don't use unknown materials.</p>
<p>323.1.4 Reclaimed Materials</p>	<p>Use B31.3 paragraph as written.</p>
<p>323.2 Temperature Limitations</p>	<p>Any carbon steel material may be used to a minimum temperature of -29°C (-20°F) for Category D Fluid Service.</p>
<p>323.2.1 Upper Temperature Limits, Listed Materials</p>	<p>Know the temperature limits of the materials.</p>
<p>323.2.2 Lower Temperature Limits, Listed Materials</p>	<p>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.</p>
<p>323.2.3 Temperature Limits, Unlisted Materials</p>	<p>Verify the temperature limits of the unlisted material meet the requirements of the design temperature.</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 temperature and must be evaluated in accordance with 323.2.3 if necessary to determine the suitability of the material.</p>
<p>323.2.4 Verification of Serviceability</p>	<p>Use B31.3 paragraph as written.</p>
<p>323.3 Impact Testing Methods and Acceptance Criteria (entire)</p>	<p>Not required for Category D Fluid Service</p>
<p>323.4 Fluid Service Requirements for Materials (entire)</p>	<p>Not required for Category D Fluid Service</p>
<p>323.5 Deterioration of Materials in Service</p>	<p>Designer is required to design the pressure system for the service life of the system and consider material compatibility.</p>

Section NASME - New Non-ASME System Requirements
Attachment NASME-1-D Category D Metallic

Rev. 2, 11/09/2018

<p>325 MATERIALS — MISCELLANEOUS 325.1 Joining and Auxiliary Materials</p>	<p>Use B31.3 paragraph as written.</p>
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<p align="center">Title: Standards for Piping Components</p>	
<p>326 DIMENSIONS AND RATINGS OF COMPONENTS</p>	<p>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.</p>
<p>326.1 Dimensional Requirements</p>	<p>Apply B31.3 paragraph as written (see 301.2.2)</p>
<p>326.2 Ratings of Components</p>	<p>Apply B31.3 paragraph as written (see 301.2.2)</p>
<p>326.3 Reference Documents</p>	<p>Apply B31.3 paragraph as written (see 301.2.2)</p>

<p align="center">Title: Fabrication, Assembly, and Erection</p>	
<p>327 GENERAL</p>	<p>Use B31.3 paragraph as written.</p>
<p>328 WELDING (entire)</p>	<p>Welding or Brazing shall be done in accordance with ESM Chapter 13 Welding</p>
<p>330 PREHEATING</p>	<p>Welding or Brazing shall be done in accordance with ESM Chapter 13 Welding</p>
<p>331 HEAT TREATMENT</p>	<p>Welding or Brazing shall be done in accordance with ESM Chapter 13 Welding</p>
<p>331.2 Specific Requirements</p>	<p>Welding or Brazing shall be done in accordance with ESM Chapter 13 Welding</p>
<p>332 BENDING AND FORMING</p>	<p>Bend or form in accordance with the manufactures requirements</p>
<p>333 BRAZING AND SOLDERING</p>	<p>Welding or Brazing shall be done in accordance with ESM Chapter 13 Welding, Joining, and NDE. Soldering shall meet B31.3 requirements.</p>
<p>335 ASSEMBLY AND ERECTION</p>	<p>Assemble in accordance with the manufacturer's requirements</p>

Section NASME - New Non-ASME System Requirements
Attachment NASME-1-D Category D Metallic

Rev. 2, 11/09/2018

Title: Inspection, Examination, and Testing	
<p>A340 INSPECTION 340.1 General</p>	<p>PSO Duty Area B will be the Owner’s Inspector. Owner’s Inspector will be knowledgeable with the pressure system of interest.</p>
<p>340.2 Responsibility for Inspection</p>	<p>Use B31.3 paragraph as written.</p>
<p>340.3 Rights of the Owner’s Inspector</p>	<p>Use B31.3 paragraph as written.</p>
<p>340.4 Qualifications of the Owner’s Inspector</p>	<p>See paragraph 300; PSO Duty Area B will act as the Owner’s Inspector or equivalent.</p>
<p>341 EXAMINATION 341.1 General</p>	<p>Use B31.3 paragraph as written. Use B31.3 paragraph as written if applicable.</p>
<p>342 Examination Personnel</p>	<p>Use B31.3 paragraph as written.</p>
<p>343 EXAMINATION PROCEDURES</p>	<p>Use B31.3 paragraph as written.</p>
<p>344 TYPES OF EXAMINATION</p>	<p>Use B31.3 paragraph as written.</p>
<p>345 TESTING</p>	<p>Owner has elected to use Initial Service Leak Test for Category D Fluid Service (additional testing may be required by the Designer). See Exist – Legacy System Requirements (3.B.1) for vacuum rate of rise and inert gas referee test gas Pneumatic leak testing is approved for all systems less than 2 cubic feet in volume. Additional volume must be approved by the CPSO. ² 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) 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>

² EMRef-73 ASME Interpretation of Para. 345.5.5 Pneumatic Leak Test Procedure.

Section NASME - New Non-ASME System Requirements
Attachment NASME-1-D Category D Metallic

Rev. 2, 11/09/2018

346 RECORDS	Required information is as follows: <ul style="list-style-type: none">• 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.
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