Liquid Metal Engineering Center

Operated for
the U.S. Atomic Energy Commission by Atomics International Division
Rockwell International Corporation

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RDT STANDARDS TRANSMITTAL

DISTRIBUTION	DATE August 12, 1974	NO. SC434
List 1	RETURN COMMENTS TO W. G. Dewart LMEC	TYPE SUBMISSION ☐ 1. PRELIMINARY ☐ 2. DRAFT ☐ 3. TENTATIVE ☐ 4. FINAL ☒ 5. Revision
	NOT LATER THAN	TYPE ACTION ☐ A. APPROVAL ☐ B. INFORMATION ☐ C. COMMENTS ☒ D. TRIAL USE ☐ E.
	NUMBER	DESCRIPTION
	RDT E 1-19T Class 2 Valves for Liquid Metal Service, June 1974 Supersedes RDT E 1-19T, September 1970	D
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RDT E 1-19T

Supersedes

RDT E 1-19T, September 1970

RDT Standard

CLASS 2 VALVES FOR LIQUID METAL SERVICE

JUNE 1974

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FOREWORD

This standard supersedes the September 1970 issue of RDT E 1-19T and incorporates those changes to that issue of the standard that were approved and published as Amendments 1 through 3 and those changes approved for publication in this revision. These changes are identified by the following marginal notations:

- A1 Amendment 1, October 1971
- A2 Amendment 2, November 1971
- A3 Amendment 3, September 1972
- A4 Amendment approved March 1974
- C Change approved June 1974
- D Deletion approved June 1974
- N Addition approved June 1974

Editorial changes made during preparation of this revision are not identified.

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UNITED STATES ATOMIC ENERGY COMMISSION
DIVISION OF REACTOR RESEARCH AND DEVELOPMENT

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CLASS 2 VALVES FOR LIQUID METAL SERVICE

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1. SCOPE

This standard establishes the requirements for performance, design, fabrication, handling, marking, cleaning, packaging, shipping, testing, inspection, and quality assurance of austenitic stainless steel valves for use in high-temperature liquid metal systems.

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Class 2 valves specified in this standard are in accordance with the ASME Boiler and Pressure Vessel Code, Section III, (the Code). Other codes and standards invoked herein supplement the existing requirements of Class 2 valves.

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1.1 Classification. Valves covered by this standard shall be classified according to pressure-temperature ratings, size of inlet and outlet piping, type of valve body, throttling or isolation operation mode, and type of valve operator.

1.2 Definitions.

1.2.1 Back Seating. A seat formed by the disk or stem against the bonnet in the valve open position.

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1.2.2 Bellows Seal. A method of sealing bonnet stem opening in which the ends of the sealing material are fastened to the bonnet and to the stem and the seal expands and contracts with the stem travel.

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1.2.3 Bonnet. That part of the pressure boundary which is attached to the valve body and allows assembly of the internals.

1.2.4 Freeze Seal. An arrangement in which a leak-tight seal can be obtained by freezing sodium between the stem and an extension of the valve bonnet.

1.2.5 Hands-on Maintenance. Indicates that tools can be handled directly by personnel, rather than through the use of remote manipulators or slave devices. High radiation fields, high temperatures, toxic gases, or interposed mechanical structures are among the conditions that interfere with hands-on maintenance.

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1.2.6 Maintainability. Those inspection, servicing, testing, and repair characteristics of an item which affect the operating continuity of the facility and the effort required to restore the function of the item to its in-tolerance state.

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1.2.7 Pressure Boundary. Those elements of the valve which form the barrier between the liquid metal contained within the valve interior and the exterior environment. It includes the valve body, bonnet, stem seals, and related assembled joints.

1.2.8 Primary Seal. The stem seal nearest to the liquid metal, which provides a liquid metal pressure boundary. Primary seals may be either a bellows seal or freeze seal.

1.2.9 Secondary Seal. The backup seal for the primary seal. Secondary seals, depending upon seal configuration, are either a liquid metal pressure boundary or a seal for inert cover gas. Secondary seals can be either packing or bellows.

1.2.10 Valve. The complete valve assembly, i.e., valve body, valve internals, and the bonnet, but not the operator (manual or power).

2. APPLICABLE DOCUMENTS

The following documents are a part of this standard to the extent specified herein. The issue of a document in effect on the date of invitation to bid, including any amendments also in effect on that date, shall apply unless otherwise specified. Where this standard appears to conflict with the requirements of a reference document, such conflict shall be brought to the attention of the purchaser for resolution.

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2.1 RDT Standards.

RDT E 15-2T	Requirements for Nuclear Components (Supplement to ASME Boiler and Pressure Vessel Code, Section III)	A1
RDT F 2-2	Quality Assurance Program Requirements	
RDT F 3-6T	Nondestructive Examination	
RDT F 3-15T	Requirements for Inspection of Dimensional Characteristics	A4
RDT F 5-1T	Cleaning and Cleanliness Requirements for Nuclear Reactor Components	A1
RDT F 6-5T	Welding Qualifications (Supplement to ASME Boiler and Pressure Vessel Code, Section IX)	
RDT F 7-2T	Preparations for Sealing, Packaging, Packing and Marking of Components for Shipment and Storage	
RDT F 7-3T	Requirements for Identification Marking of Reactor Plant Components and Piping	

RDT F 8-6T	Hoisting and Rigging of Critical Components and Related Equipment	C
RDT M 1-1T	Stainless Steel Covered Welding Electrodes (ASME SFA-5.4 with Additional Requirements)	
RDT M 1-2T	Stainless Steel Welding Rods and Bare Electrodes (ASME SFA-5.9 with Additional Requirements)	A1
RDT M 1-5T	Welding Rods and Electrodes, Surfacing (AWS A5.13 with Additional Requirements)	A3
RDT M 2-2T	Stainless and Low Alloy Steel Forgings (ASME SA-182 with Additional Requirements)	A1
RDT M 2-4T	Alloy Steel Forgings (ASME SA-336 with Additional Requirements)	
RDT M 2-5T	Austenitic Stainless Steel Welding Fittings (ASME SA-403 with Additional Requirements)	
RDT M 3-2T	Stainless and Alloy Steel Seamless Tubes (ASME SA-213 with Additional Requirements)	
RDT M 3-3T	Austenitic Stainless Steel Seamless Pipe (ASME SA-376 with Additional Requirements)	
RDT M 3-5T	Austenitic Stainless Steel Welded Tubing (ASME SA-249 with Additional Requirements)	
RDT M 3-6T	Austenitic Stainless Steel Pipe (ASME SA-312 with Additional Requirements)	
RDT M 4-2T	Austenitic Stainless Steel Castings (ASME SA-351 with Additional Requirements)	
RDT M 5-1T	Stainless Steel Plate, Sheet and Strip (ASME SA-240 with Additional Requirements)	
RDT M 7-3T	Stainless Steel Bars and Shapes (ASME SA-479 with Additional Requirements)	

2.2 American National Standards Institute (ANSI).

ANSI B16.5	Steel Pipe Flanges and Flanged Fittings	A4
ANSI B16.25	Buttwelding Ends	A1
ANSI B46.1	Surface Texture	
ANSI C1	National Electrical Code (NFPA70)	A3

ANSI Y14 Drafting Manual

2.3 American Society of Mechanical Engineers (ASME).

ASME Boiler and Pressure Vessel Code:

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Section II Material Specifications, Parts A, B, and C

Section III Nuclear Power Plant Components

Section VIII Pressure Vessels, Division 1

Code Case 1481 Elevated Temperature Design of Class 2 and 3 Nuclear Components

2.4 American Welding Society (AWS).

AWS D1.0 Code for Welding in Building Construction

2.5 Manufacturers Standardization Society (MSS) of Valves and Fittings.

MSS SP-25 Standard Marking Systems for Valves, Fittings, Flanges, and Unions

3. TECHNICAL REQUIREMENTS

3.1 General. Valves shall be constructed in accordance with the Code and RDT E 15-2. Valves furnished to this standard shall be suitable for liquid metal service and shall be Class 2 as defined by the Code. A code stamp is required in accordance with NA-8000 of the Code, unless otherwise specified in the Ordering Data. The specific valve type will be called for in the Ordering Data.

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3.1.1 Handwheel Rotation. Manual valve operators shall be right-hand closing (clockwise rotation).

3.1.2 Interchangeability. The supplier shall furnish information necessary to assure the interchangeability of parts purchased to the same design.

3.1.3 Maintainability. Valves shall be designed for accessibility to permit inspections, preventive maintenance, and repair, in compliance with guidelines in the Ordering Data. Schedules shall be recommended and qualified procedures shall be established for inspection, packing replacement, and other servicing operations covering the valves and operators. The means of inspection and maintainability chosen by the supplier shall be described in the design report. These procedures and schedules shall be included in the operations and maintenance manual (3.9) and shall describe the techniques and procedures

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for each maintenance task, emphasizing the approach of hands-on-maintenance without precluding the application of remote techniques, such as remote manual; remote machine - manual setup; or remote machine - remote setup.

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3.1.4 Fluid. The valve shall be designed for service with liquid metal or gases containing liquid metal vapor. The physical properties and the quality of the liquid metal or gases containing liquid metal vapors shall be as specified in the Ordering Data.

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3.2 Qualification. Valves shall be provided in accordance with Subsection NC of the Code. A valve will be considered qualified for service meeting the requirements of this standard provided that the supplier:

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1. Furnishes evidence of satisfactory service for an identical or larger valve under conditions of service or time equal to or more severe than that required by 3.3, or
2. Perform prototype testing as required by 3.4, or
3. Furnishes evidence of satisfactory design as required by 3.5.1.

Manufacturing controls required by this standard are to ensure uniformity of quality and are not to be waived based on previous service experience.

If the valve is qualified by previous service as described in item 1 above, the design analyses of 3.5.1 are not required.

3.3 Service. Service requirements include operational, environmental, and performance requirements given in the Ordering Data. Special environment factors for radioactive fluids will be specified in the Ordering Data. Valves shall be capable of operation for the design life without leakage through the pressure boundary and without impairment of function when subjected to the tests of Section 4 and the service conditions specified in the Ordering Data. Valves closed at any temperature in the operating temperature range shall have the capability of being opened at any other temperature in the operating temperature range (other than solidified liquid metal conditions).

3.4 Prototype Testing. When implemented for qualification, prototype testing shall be performed on the valve at or above the design levels for the functions and environments in natural combination. Testing shall demonstrate both design adequacy and manufacturing capability. A valve shall be qualified for a specific service application based upon the test performance in liquid metal of a prototype valve of the same or similar design characteristics. Supplier may recommend other test fluids for purchaser approval.

3.4.1 Test Specification. The supplier shall submit for approval a prototype test specification outlining tests which demonstrate performance requirements for the service conditions specified in the Ordering Data. The test specification shall identify and briefly describe the facility in which the tests are to be performed.

3.4.2 Prototype Valve Operator. A prototype valve operator may be qualified in conjunction with a valve prototype test. When valve operator qualification is to be performed, details of the tests shall be included in the test specification required by 3.4.1.

3.4.3 Acceptance. Operation of the test article without malfunction for the duration of the tests and the absence of visible defects or other irregularities, as determined by the post-test examination, shall constitute successful completion of the test.

3.5 Design.

3.5.1 Analyses. When the valve is to be qualified by design analysis, as provided by item 3 of 3.2, the following analyses shall be performed:

1. A stress analysis based on the design conditions defined by the pressures, temperatures, and various forces applicable to valve service. For design temperatures over 700°F for ferritic steels and over 800°F for austenitic steels, Code Case 1481 shall apply. The design shall be directed toward a minimum, uniform-body wall thickness. A1
2. A stress analysis to show that the complete valve and operator assembly can withstand the loads specified in the Ordering Data, including the combined operator thrust load and seismic forces when firmly supported only at the body. A constant load support may be assumed at the operator center of gravity. When specified in the Ordering Data, the analysis shall show that the natural frequency of the valve and operator assembly falls outside the range of the frequencies stated in the Ordering Data. A4
3. Hydraulic analysis or fluid flow data demonstrating C_v characteristics of the valve. A4
4. Stem seal analysis for the seal configuration specified in 3.5.4.

3.5.2 Body and Bonnet. The valve body and bonnet shall be of integral construction with full penetration welds at any required weld joints, unless otherwise specified in the Ordering Data. Backing rings shall not be used, and weld joint design shall permit nondestructive examination to the requirements of this standard.

The valve shall be able to withstand the maximum bending moment, axial forces, and shear forces that can be transmitted by the pipe of the schedule and material specified in the Ordering Data in accordance with ANSI B16.5. The supplier shall demonstrate this capability by conducting tests. If prior tests have been conducted, the supplier may fulfill the requirement of this paragraph by submitting documented evidence of such prior tests.

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Gate valves shall have in-line end connections. Valves shall provide for disk retention and guiding to prevent scoring of the seating surfaces and to maintain disk stability during operation.

Standard, offset, angle, and "Y" globe valves shall be provided with in-line or right-angle end connections. The angle from stem to run shall be 45 degrees or greater in a "Y" pattern valve.

Butterfly valves shall have in-line end connections.

Valve design shall minimize thermal transient distortions which could lead to binding of moving parts and leakage.

3.5.2.1 Flow Passages. Flow passages shall be shaped with the objective of minimizing:

1. Vibration of internal parts due to flowing sodium.
2. Deposition and collection of particulate matter in pockets and dead flow spaces.
3. Erosion of surfaces.

3.5.2.2 Joints and Crevices. Integral or welded construction shall be used to avoid the occurrence of loose valve internal parts or to retain any potential loose parts from being released into flowing liquid metal. Threaded joints exposed to liquid metal are not permitted. Necessary crevices shall be designed to avoid narrow and deep annuli that are susceptible to deposition of impurities and to crevice corrosion.

3.5.2.3 Drainage. For liquid metal service, drainage of the piping system to the maximum possible extent is mandatory; therefore, when specific valve position is known at the time of placement of the order, the supplier shall ascertain that the valve proposed can fulfill this requirement.

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3.5.2.4 Supports. The design of valve assemblies weighing 50 lb or more shall have pads, clevises, or tabs on which or from which the valve assembly is to be supported.

3.5.2.5 Piping Connections. The inlet and outlet connections of the valve body shall each have a minimum length of 6 in. when

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measured from the nearest edge of the seat, unless otherwise specified in the Ordering Data. End connections shall be machined for butt welding in accordance with ANSI B16.25. Threaded seal welded joints or socket welds shall not be used. The runout of a machined surface to the inside diameter of the valve body shall be as depicted by Figure NB-4233-1 of the Code.

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3.5.3 Seats. Valve seating surfaces shall have a minimum of contact area consistent with present commercial practice. Acceptable seating configurations for gate valves are split wedge or parallel disks. In globe valves, the seat included angle shall be a minimum of 75 degrees. Butterfly valve disks shall have piston rings with 360-degree contact. Butterfly valve designs which accomplish metal-to-metal seating by wedging the disks against the valve body is not permitted.

3.5.4 Stem Seals. The valve shall be provided with both a primary and secondary seal. The required seal configuration shall be one of the following as specified in the Ordering Data:

<u>Seal Configuration</u>	<u>Primary Seal</u>	<u>Secondary Seal</u>
1	Bellows	Packing
2	Bellows	Bellows
3	Freeze Seal	Packing

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The seal design for configurations 1 and 3 shall meet the following requirements:

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1. Configuration 1 - The packing shall limit leakage from the valve to the amount specified in the Ordering Data upon failure of the primary seal at design temperature and pressure.
2. Configuration 3 - The freeze seal shall be designed so that the frozen sodium plug will not obstruct the gas port or contact the bottom of the packing.

In each seal configuration, both the primary and the secondary seal shall be capable of retaining the system pressure. The allowable leakage rates shall be as specified in the Ordering Data.

3.5.4.1 Bellows Seal. Valves equipped with bellows seals shall have back seating, when specified in the Ordering Data, to allow for partial sealing in case of stem seal leakage due to a bellows failure. Bellows shall be installed at a minimum stress when the valve is in its normal position. As an example, the bellows of a normally closed valve shall be at a minimum stress when the valve is closed. A seamless, formed bellows is the preferred type; use of other bellows types shall require justification and prior purchaser approval. Direct impingement of flowing liquid metal upon the bellows is unacceptable.

Bellows installed in a valve to be delivered shall not have been subjected to tests or assembly operations resulting in stresses exceeding the yield strength of the bellows materials.

3.5.4.2 Freeze Seals. Use of freeze seals shall be limited to sodium systems with the valve stem orientation in or above the horizontal plane. The freeze seal length shall be such that liquid sodium does not contact the secondary seal during valve operation at design pressure and temperature conditions. Natural convection cooling of the freeze stem is the preferred method; other methods require justification and prior purchaser approval. The freeze seal design method shall be approved by the purchaser.

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3.5.4.3 Packing. Packing shall be permitted only as a secondary seal. Packing materials shall be nonhygroscopic, shall not contain lead, cadmium, mercury, or their alloys or compounds, and shall be compatible with the liquid metal and valve construction materials in contact with the packing at design temperature.

3.5.5 Leak Detector or Purge Port. Each valve shall be provided with a leak detector port or purge port, of the type and configuration specified in the Ordering Data, between the primary and secondary seals.

3.5.6 Operators. Operators shall consist of an assembly of proven design components. Components shall be sized to provide a minimum actuation force equal to one and one-quarter times the maximum total force required to actuate the valve. The calculated sodium shear force for freeze stem valves shall be increased by a factor of two to compensate for the change in shear strength of pure sodium due to oxidation.

A manual override feature shall be provided on power operators when specified in the Ordering Data. Electrical components used in the operators shall conform to ANSI C1. A fail-safe device shall automatically actuate the valve to the specified fail position in the event of loss of power or control signal. A visual valve position indicator shall be mounted on the valve.

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Complete specifications and informational data substantiating the adequacy and delineating the operational characteristics, installation, and service requirements of the operator shall be furnished.

3.5.6.1 Limiting Devices. A method of limiting valve operating speed shall be provided to meet the requirements of the Ordering Data. The devices shall be described in the design report and shall be approved by the purchaser.

3.5.7 Heating. Valves shall be designed to operate with thermal insulation and electric heaters attached to the valve body and end connections. Insulation and heaters will be furnished and

installed by others after delivery. The design, installation, and operation of the trace heaters will be coordinated with the valve supplier to ensure concurrence and compatibility of the valve and heater design. When specified in the Ordering Data, the supplier shall define the heating requirements to heat the valve and the contained liquid metal, at the rate and to the maximum temperature indicated.

3.5.8 Instrumentation. When specified in the Ordering Data, the supplier shall provide instrumentation sensors and shall design the valve with location and interconnect conditions that meet the approval of the purchaser.

3.5.9 Design Report. The design report shall include a description of the valve design and the analyses called for in the Ordering Data. Reduced sized drawings of the valve assembly showing the details of the valve and valve operator shall be included. The drawings shall be prepared in accordance with ANSI Y14. When analyses are to be performed to qualify the valve design, a copy of each analysis shall be included in the report. The known parameters, assumptions, approximations, calculations, and references in sufficient details to permit independent checking shall be included. The references from which data or formulae are taken shall be identified. The validity of the data and the conclusions which support the design shall be discussed. Computer programs used shall be identified and described to enable independent verification.

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The supplier shall be responsible for making additions or corrections to the report to keep the information current. The revisions shall be numbered and dated.

3.6 Materials of Construction. Cladding or plating shall not be allowed for valve body, bonnet, and internal parts, unless otherwise specified in the Ordering Data. Special material requirements, if any, will be specified in the Ordering Data. The materials used in the construction of the valves shall be described on the assembly drawing.

3.6.1 Pressure Boundary Materials. Materials selected from Table 1 shall be used for pressure boundary applications.

3.6.2 Valve Internal Materials. Materials for valve internals shall comply with the requirements of the applicable material standard. Where standards are not specified for materials, specifications of ASME Code Section II shall apply. These materials shall be proven to be suitable for liquid metal service in combination with materials used for pressure-containing parts and with other valve construction materials. Suitability shall be determined with respect to erosion, corrosion, mass transfer, carburization, decarburization, weldability, fatigue, and creep in addition to other design and performance requirements. For wear applications, hard-metal inserts or hardsurfacing materials shall be used as specified in 3.7.2.4.

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Table 1. Material Selection Chart

Material	Type	RDT Standard
304 or 316	Weld rods	RDT M 1-1 and M 1-2
Hardfacing	Weld Rods	RDT M 1-5
304H or 316H	Forgings	RDT M 2-2 and M 2-4
	Fittings	RDT M 2-5
	Tube	RDT M 3-2 and M 3-5
	Pipe	RDT M 3-3 and M 3-6
	Castings	RDT M 4-2
	Plate, sheet, and strip	RDT M 5-1
	Bars and shapes	RDT M 7-3
	Bellows	RDT M 3-2

NOTES:

1. For service conditions below 1000°F, the requirement for H grade is optional.
2. Stem and bellows materials other than RDT M 2-5, M 3-2, and M 7-3, as applicable, may be used; however, these materials are subject to approval by the purchaser.

3.6.3 Other Materials. Materials for valve actuators and other parts, whether structural or nonstructural, shall comply with ANSI or ASTM standards, appropriate for the intended service.

3.7 Fabrication. The valves shall be manufactured in accordance with the requirements of the Code, RDT E 15-2, the appropriate RDT material standards, and the Quality Assurance Requirements of Section 4 herein. Prior to start of fabrication, the supplier shall prepare manufacturing procedures that meet the applicable requirements of NA-4400 and NA-4500 of the Code, and shall obtain purchaser approval of all fabrication procedures in accordance with ANB-4110 of RDT E 15-2.

3.7.1 Fabrication Release. Release to fabricate valves and operators shall require prior purchaser approval of assembly and outline drawings and such design, performance, procedural data, and information as may be required by this standard. Information shall include a listing of Codes and standards to be applied to design, materials, fabrication, testing, examination, and inspection.

3.7.2 Welding and Thermal Cutting. Thermal cutting is not permitted. Welding shall meet the requirements specified in the following paragraphs.

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3.7.2.1 Pressure Boundary. Welds shall conform to the requirements of the Code and RDT E 15-2.

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3.7.2.2 Other Welds. Welds required for structures and operators shall be equivalent to that specified in Section VIII of the ASME Boiler and Pressure Vessel Code or the American Welding Society Standard, AWS D1.0.

3.7.2.3 Weld Rod Control. Weld rod shall be stored in a locked cabinet with controlled access by specifically authorized persons. Rods shall be segregated by heat, size, and type. Rod disbursement shall be recorded and only one heat of each size and type of rod shall be disbursed until exhausted, prior to disbursing a different heat. Rods shall not be returned to storage. Weld rod shall be wipe-tested for cleanliness in accordance with 4.3 of RDT F 5-1 at the welding station immediately prior to use. The supplier shall prepare and submit procedures for control of welding materials to the purchaser for approval in accordance with ANB-4411 of RDT E 15-2.

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3.7.2.4 Hardsurfacing. Hardsurfacing and weld-metal overlay procedures and qualifications shall be in accordance with manufacturer's recommendation appropriate to the materials and services and shall meet the requirements of ANC-4100 of RDT E 15-2. It is preferred that hardsurfaced items consist of integral hardsurfacing or full penetration weld-in-style hardsurfaced rings. However, subject to approval by the purchaser, high-temperature nickel braze may be used for sealing crevices or for bonding inert materials. Brazing shall conform to the requirements of NB-4500 of the Code and RDT E 15-2. Samples of each type of hardsurfacing process shall be subjected to metallurgical examination to qualify the process and the operator in accordance with Part F of RDT F 6-5.

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3.7.3 Heat Treatment. Heat treatment, including stress relieving, shall be in accordance with applicable material standards.

Where austenitic stainless steel has become sensitized during heat treatment or welding, it shall be solution annealed in accordance with the applicable standard or be protected against corrodents and moisture during subsequent manufacturing, testing, and storage operations.

3.7.4 Cleaning. The fabrication of a part, combination of parts, subassembly, or complete valve assembly shall be so conducted as to facilitate cleaning and inspection for cleanliness, and to minimize contamination during fabrication. Surfaces shall be cleaned in accordance with RDT F 5-1 and shall be maintained in a clean condition up to and including final assembly.

3.7.5 Assembling. Component parts shall be assembled in accordance with a detailed assembly procedure prepared by the supplier.

The procedure shall contain:

1. Assembly sequence.
2. Cleaning procedures, sequence, and precautionary rules.
3. Any special machining or fitting-at-assembly instructions.
4. Intermediate and final inspection criteria and hold points.
5. Handling methods and precautions.
6. Torque values for threaded parts.
7. Procedures for actuating locking devices and for tack welding.
8. Drawings or photographs as required to illustrate assembly problems or techniques.
9. Special data, measurements, or observations to be recorded in quality control records.
10. Any other data instructions, or cautions deemed necessary by the supplier.

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3.7.6 Identification.

3.7.6.1 Marking. Raw materials shall be identified and marked in accordance with the appropriate RDT material standard. In-process identification marking and permanent identification of components, equipment, and auxiliaries shall be in accordance with RDT F 7-3. Valve bodies shall also be identified and marked in accordance with MSS SP-25. Impression stamping shall not be used on any of the pressure boundary parts of the valve.

Normal flow direction shall be permanently marked on globe and butterfly valves.

3.7.6.2 Nameplates. Valves shall have permanently attached nameplates which are visible after insulation is installed, and which indicate:

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- *1. N-type symbol including numeral 2 (if required).
- *2. Name of manufacturer.
3. Manufacturer's drawing or part number.

*Indicates requirements of NA-8000 of the Code.

*4. Manufacturer's serial number.

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5. Purchase order or contract number.

6. This standard number (RDT E 1-19).

*7. Design Pressure: _____ psi at _____ °F.

8. Valve body material (ASME SA XXX, RDT M X-XX).

9. Valve nominal size.

10. Direction of fluid flow.

*11. Year built.

The nameplates shall conform to the following requirements:

1. The nameplate shall be of a corrosion-resistant material compatible with the surface to which it is fastened.

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2. Caustic resistant enamel shall be used to fill the markings on the nameplate.

3. The nameplate shall be attached to these components in accordance with RDT E 15-2. Location and attachment of the nameplate shall not result in distortion or other effects that would impair proper functioning of the valve.

4. The nameplates shall contain information as specified in the Ordering Data.

5. Nameplates shall not be painted over or otherwise covered.

Each valve actuator shall be provided with a nameplate which shall contain the following:

1. Manufacturer's name.

2. Identification number.

3. Failed position.

4. Contract number.

5. Unit operating parameters specified in the Ordering Data pertinent to valve operation service and maintainability.

*Indicates requirements of NA-8000 of the Code.

3.7.6.3 Traceability. The control and identification of material shall be in accordance with NA-4440 of the Code.

A1

3.7.7 Personnel Qualification and Certification. Personnel satisfactorily passing the required tests shall be issued a card, badge, or similar objective evidence of their certification (indicating the date of the last certification) to be carried on their person while performing the operation for which they have been qualified.

Responsibility for personnel qualification and certification shall rest with the supplier, whether the supplier does the work or sub-contracts to a specialized laboratory.

3.8 Document and Sample Submittals. Documentation, including drawings, plans and procedures, reports, analyses, certifications, etc., required by this standard, shall be submitted by the supplier as specified in the Ordering Data.

3.9 Operations and Maintenance Manual. The supplier shall provide valve operation and maintenance information to form part of the plant operations manual. This manual shall reflect the "as-built" configuration of the delivered item. Information shall include the following:

A1

1. A detailed description of the valve and associated equipment.
2. Instructions for installation, operation, preventive maintenance, and repairs, including removal and replacing packing, cutting and rewelding welds, lubrication, and maintenance of the operator.
3. A description of special tools required for servicing the valve or operator when installed in the plant.
4. Procedures for replacing replaceable components.
5. Instructions for use of lifting and handling fixtures, and special tools and equipment.
6. Reduced size drawings for operation, maintenance, and instructional purposes, including drawings of special tools and equipment.
7. Instructions for disassembly, cleaning, preparing for shipment, and for crating constituent parts.
8. A list of recommended spare parts.
9. Schedules of inspections and servicing.

C

A1

4. QUALITY ASSURANCE REQUIREMENTS

4.1 Quality Assurance Program. The supplier's quality assurance system shall satisfy the requirements of NA-4000 of the Code and RDT F 2-2. | A1

A quality assurance program plan in accordance with RDT F 2-2 shall be submitted to the purchaser for approval.

4.1.1 Examinations and Inspections. The supplier shall be responsible for obtaining the services of an authorized third-party inspector to perform inspections and provide certification that the valve meets the minimum requirements of Subsection NC of the Code. | A1

Examination points in the fabrication of valves under this standard shall be identified prior to fabrication.

Examinations at the supplier's plant shall be in accordance with an examination schedule established in advance of fabrication.

Evidence of source examination shall be shown on shipping documents.

4.1.2 Traceability. The supplier's traceability procedure shall be submitted to the purchaser for approval prior to fabrication. Materials traceability shall ensure compliance with requirements of 3.7.6.3 of this standard and RDT F 2-2. | A1

4.1.3 Control of Changes. The supplier shall obtain approval prior to making any change to items which have been approved, such as design features, workmanship standards, manufacturing processes, or test procedures. | C

The effective date of approved changes shall be identified in shipping documents.

When specified in the Ordering Data, the supplier's procedures for control of changes shall be submitted to the purchaser for approval prior to fabrication.

4.2 Quality Assurance Documents. The type, number of copies, and date for transmittal of quality assurance documentation required herein shall be as specified in the Ordering Data.

4.2.1 Certifications. The following records and information as required by NA-4900 of the Code and RDT F 2-2 shall be supplied prior to each valve shipment. Each report and information shall be certified to be correct by the supplier and shall contain the signature and title of the authorized contract representative of the supplier or other agency performing the tests. This information shall include: | A1

1. Material certifications including chemical, physical, and non-destructive tests of materials used for fabrication of valve bodies, bonnets, and internals.
2. Process certification for special processes, such as heat treating, welding, and cleaning.
3. A certification of conformance including the following statement: Materials and parts, components, or services furnished under this contract have been manufactured, tested, and inspected in accordance with applicable contract requirements and specifications, and such inspection and other records as required by this contract are on file and available for review and inspection.
4. Personnel qualification, and certification of personnel performing process or operations, such as metallurgical, welding, brazing, cleaning, heat treatment, radiography, ultrasonic, magnetic particle, and liquid penetrant examination.

4.2.2 Nondestructive Examination Reports. The supplier shall furnish, prior to each shipment, reports of nondestructive examinations. The reports shall be identifiable to the respective item or material, including specific sections, joints, or view of the item furnished, and to the applicable acceptance criteria.

The reports shall contain the name(s) of the evaluator(s) and test performer(s) and the signature and title of the authorized contract representative of the supplier or other agency performing the tests.

For serialized items, the serial numbers shall appear on the reports and films.

The reports shall be submitted for review and acceptance.

4.2.3 Acceptance Test Reports. Prior to each valve shipment, test reports shall be furnished and shall include the actual results of pressure and leak tests. Reports shall state requirements and observed results and shall be identifiable to the acceptance criteria of items submitted and shall meet the requirements of the contract documents and applicable drawings and specifications. The reports shall contain the signature and title of the authorized contract representative of the supplier or other agency performing the tests.

4.2.4 Report of Discrepancy. Any nonconformance of materials or components to drawings, specifications, or other purchase order or contract requirements shall be identified and recorded as required by NA-4550 of the Code.

A1

Disposition of nonconforming items must be approved in writing by the purchaser prior to delivery. A copy of such documented approval

shall accompany each affected shipment of material, or, in the case of a service, such copy shall be included in a final buy-off release.

4.3 Marking and Identification.

4.3.1 Materials. Materials used in the manufacture of the valves shall be examined to ensure compliance with requirements of 3.7.6.

4.3.2 Permanent Marking. Finished valves, components, spare parts, and special handling fixtures to be delivered as part of the requirements of this standard shall be examined to ensure that they are permanently marked for purposes of identification in accordance with 3.7.6.

4.4 Nondestructive Examination. Nondestructive examinations shall be in accordance with the Code, RDT E 15-2, and the applicable material and process standards.

A1

Where a specified examination cannot be accomplished or where a change in an accepted procedure is required, the supplier shall submit a written request for deviation, outlining an equivalent inspection technique. Approval of an alternate by the purchaser shall be required for deviations.

4.4.1 Calibration and Control of Instruments. Instruments and measurement and test devices used for nondestructive examinations, inspections, and acceptance tests shall be calibrated and controlled in accordance with NA-4600 of the Code and with RDT F 2-2.

A1

4.4.2 Personnel Qualification. Personnel and equipment utilized in the performance of nondestructive tests shall be qualified and certified in accordance with the requirements of RDT F 3-6 and 3.7.7 of this standard.

4.4.3 Radiographic Examination. Section VIII, Division 1, Paragraph UW-51 of the ASME Boiler and Pressure Vessel Code shall apply to welds in the pressure and nonpressure boundary portions of the valve.

A1

4.4.4 Liquid Penetrant Examination. Surfaces of valve components, including welds and hardsurfacing in contact with liquid metal, shall be examined by the liquid penetrant technique in addition to any other methods which may be required by this standard or the applicable codes for design, materials, and examination standards. Surface roughness shall be 250 μ in. (AA) or better, prior to examination in accordance with ANSI B46.1, Surface Texture.

A1

For sand castings, where the surface finish requirements cannot be met because of inaccessibility for machining operations, the internal

surface finish and acceptance criteria for liquid penetrant examination shall be mutually agreed upon.

Following liquid penetration examination, surfaces shall be thoroughly cleaned before proceeding with repair or fabrication.

4.4.5 Ultrasonic Examination. Hardsurfacing shall be ultrasonically examined in accordance with ANB-5273 of RDT E 15-2.

A1

4.4.6 Examination of Repairs. The type, extent, and method(s) of examination and the limits of imperfections for repair of defects shall be the same as for the original examinations.

4.4.7 Measurement of Pressure Boundary Wall. The thickness of the pressure boundary wall shall be measured to ascertain that the minimum required thickness has been obtained in all parts of the body and bonnet. Measurements may be made by means of calipers or ultrasonic examination. Inspection of dimensional characteristics shall conform to the requirements of RDT F 3-15. Any requirements for recording measurements other than required by RDT F 3-15 shall be as specified in the Ordering Data. Dimensional limits depicted on the approved drawings shall be interpreted as absolute.

A4

4.5 Acceptance Testing. The supplier shall be responsible for the performance of valve acceptance tests in accordance with the requirements of the Ordering Data.

Prior to performing acceptance tests, the supplier shall submit, for purchaser approval, the plans and procedures for conducting the tests.

The results of acceptance tests shall be reported in accordance with the requirements of 4.2.3 of this standard.

4.5.1 Water Used for Acceptance Tests. Water used for tests shall be Grade A as defined in RDT F 5-1. The effluent water may be permitted to degrade to a maximum conductivity of 5 micromhos per cm. After completion of the test, the component shall be thoroughly dried to ensure the complete removal of all water.

4.5.2 Functional Test. The functional test shall be designed to demonstrate that the valve meets the requirements of the Ordering Data and that the operation of auxiliary components meet their specified requirements.

4.5.2.1 Seat Leakage Test. Seat leakage tests shall be conducted with water or other liquid called for in the Ordering Data. The tests shall be performed in each flow direction. The valve shall be closed with the design seat loading force applied. With the maximum shutoff pressure differential across the seat, the leakage rate shall be measured. The seat leakage test shall then be repeated after five

open-close cycles. Seat leakage in excess of the requirements given in the Ordering Data shall be cause for rejection.

4.5.2.2 Secondary Seal Test. Secondary seal test shall be performed by one of the following methods, as applicable.

A3

a. Bellows Seal Test. For valves using bellows as secondary seals, configuration 2, the secondary seal leakage test shall be accomplished by pressurizing the secondary seal with gaseous nitrogen to the pressure specified in the Ordering Data and applying a bubble-forming solution, Leak-tec or equivalent, to the external joints. The valve shall be actuated open-close a minimum of two cycles during the test. Bubbles or fuzz leakage shall not be acceptable.

b. Packing Seal Test. For valves using packing as secondary seals, configuration 1 or 3, the secondary seal leakage test shall be accomplished by pressurizing the secondary seal with gaseous nitrogen to the pressure specified in the Ordering Data and measuring the resulting flowrate. Leakage flow shall not exceed the amount specified in the Ordering Data.

CAUTION: The pressure applied to the back side of the primary bellows (configuration 1 or 2) during the secondary seal test must not cause damage or distortion to the primary bellows.

4.5.2.3 Valve Operator Test. The valve operator shall be subjected to acceptance testing when called for in the Ordering Data. The test is conducted under simulated temperatures and forces at maximum operating values. The torque or force required to perform the open-close cycle shall be measured and reported in the test report.

4.5.2.4 Dry Operation of Valves. Valves shall be capable of being operated dry; that is, in a gas rather than liquid metal. Such operation shall not damage the valve in any way. This shall be demonstrated during final shop tests by dry operation of the valve through five cycles or as specified in the Ordering Data. The total number of dry cycles during the design life of the valve shall be as specified in the Ordering Data.

N

4.5.3 Hydrostatic or Pneumatic Tests (Proof Pressure). When proof pressure tests are called for in the Ordering Data, they shall be accomplished by hydrostatic testing or pneumatic testing in accordance with ANC-6100 of RDT E 15-2. The test pressure shall meet the requirements of the Code. Criteria for acceptance shall be:

A1

1. Nondestructive testing of welds in accordance with NNB-5420 of RDT E 15-2.

2. No visual evidence of permanent deformation or damage to the valve and satisfactory completion of functional test after proof pressure test.

A1

4.5.4 Helium Leak Test. When specified in the Ordering Data, and prior to hydrostatic testing, the pressure boundary of each complete valve shall be tested with a helium mass spectrometer leak detector, using the hood method in accordance with RDT F 3-6. The valve shall be cycled full open and full closed a minimum of two times during this test. The leakage rate shall not exceed that specified in the Ordering Data.

4.6 Prototype Testing. The following criteria shall apply when qualifying an article by prototype testing:

1. Testing shall simulate the most severe combination of operational and environmental ranges anticipated in the useful life of the valves.
2. Tests shall be conducted in accordance with written and approved test specifications and procedures.
3. Performance parameters shall be related to the approved test specification.
4. Maintenance, adjustment, and repair or replacement of parts, other than that provided for in the test procedure, shall not be permitted, unless necessitated by conditions extraneous to the test.
5. The test valve shall be disassembled following qualification testing and the parts examined for deterioration or failures. The presence of such failures shall disqualify the component under test and shall require corrective action and retest. The test specimen shall be examined for compliance to drawings, specifications, and workmanship standards. Noncompliances shall be explained, effective corrective action taken, and the effect on test validity determined. A valve or valve operator used for qualification shall be unacceptable for further use except by written approval of the purchaser.
6. Malfunctions during qualification testing, deterioration, or failure discovered after test, attributable to human error or manufacturing defects, shall be regarded as failures and shall disqualify the design until such time as effective corrective action has been taken and proven effective.

A1

5. PREPARATION FOR DELIVERY

5.1 Preparation. Preparation for delivery shall be in accordance with standard commercial practice, which provides for individual

packaging of valves in sealed moisture-vapor-proof envelopes, and meets the requirements of RDT F 7-2.

The supplier shall recommend for the purchaser's approval the specific methods of sealing, preserving, packaging, packing, and shipping of the items to be delivered. The sealing method shall conform to the requirements of 7.2 of RDT F 7-2, and shall include provisions for the following:

1. Protection of surfaces during shipping and subsequent handling and storage at the installation site, with particular reference to prevention of damage to machined surfaces and fragile components, parts, or linkages which may require protection against vibration wear, atmospheric corrosion, or improper handling.
2. Provisions for maintaining cleanliness during transfer, shipment, and storage at the job site.
3. Drawings and charts as needed to clearly depict the intended methods.
4. Methods of marking with caution notices as required in 10.3.2 of RDT F 7-2.

5.2 Handling. Hoisting and rigging of major parts and of complete valve assemblies that are designated as "critical" in the Ordering Data shall satisfy the requirements of RDT F 8-6. Unless otherwise specified in the Ordering Data, load testing and inspection of Class C hoisting and materials handling equipment in accordance with RDT F 8-6 shall be required.

A4

The supplier shall include the appropriate instructions and restrictions in his fabrication procedures and other documents that define acceptable shop practices.

Lifting points and tiedown points shall be provided for shipping fixtures. If a loaded shipping fixture requires upending, points of attachment for tackle, trunnions, or other features required for safe, controlled positioning shall be provided.

The supplier shall take special precautions to prevent brittle fracture of shipping fixtures and lifting attachments if shipping is scheduled during months when ambient temperatures below -10°F may be anticipated.

5.3 Shipping. The supplier shall be responsible for the delivery of items covered by this standard to the delivery point. These responsibilities include routing, shipping instructions, and documentation.

5.3.1 Routing. The supplier shall recommend routing for materials and components for which he is responsible. When approved, the supplier shall make the arrangements necessary to ship those materials and components in accordance with the terms of the purchase order and the requirements of this standard.

5.3.2 Shipping Instructions. The supplier shall prepare suitable instructions to the shipper for handling, shipping, in-transit storage, and storing of the major items for which the supplier has delivery responsibility.

5.3.3 Documentation. The supplier shall identify the technical documentation, e.g., instructions, drawings, reports, and manuals, which is to accompany deliverable items during shipment.

6. NOTES AND ORDERING DATA CHECKLIST

6.1 Compliance. When this standard is used as a basis for procurement, the purchase specification will be certified by a registered Professional Engineer representing the purchaser to be in compliance with the rules for a design specification of the ASME Boiler and Pressure Vessel Code, Section III, Nuclear Power Plant Components.

6.2 Ordering Data Checklist. The Ordering Data are composed of the information called for in the valve specification sheet and the following:

<u>Item</u>	<u>Refer to Paragraph</u>
1. Requirement for code stamp on valve, valve type	3.1
2. Design requirements for maintainability	3.1.3
3. Physical properties and quality of liquid metal or gases containing liquid metal vapors	3.1.4
4. Special environment factors for radioactive fluids, if applicable	3.3
5. Instructions if other than full penetration strength welds will be allowed for valve body and bonnet construction	3.5.2
6. Length of valve inlet and outlet connection, if other than 6 in. minimum	3.5.2.5
7. Allowable leakage rate for packing seal	3.5.4
8. Back seating requirement, if any, for bellows seal valves	3.5.4.1
9. Allowable leakage in event of bellows failure for seal configuration 1	3.5.4.3
10. Items required in the Design Report	3.5.9
11. Specific materials requirements including cladding or plating, if allowed	3.6

LIQUID METAL VALVE SPECIFICATION SHEET NO. ____ PART A

STANDARD: RDT _____ CODE: _____

VALVE CLASS: _____ CODE RATING: _____ POUND

DESIGN CONDITIONS FOR ASME SECTION III CLASS 2 VALVES:

DESIGN CONDITIONS:	REMARKS
TEMPERATURE, F	
PRESSURE, psig	
OTHER DESIGN INFORMATION:	
CORROSION ALLOWANCE, in.	
EXTERNAL ENVIRONMENT:	
ATMOSPHERE	
TEMPERATURE RANGE, F	
RELATIVE HUMIDITY RANGE, %	
FLOW, gpm	
CONTAINED FLUID:	
DENSITY, lb/ft ³	
VISCOSITY, centipoise	
FLOW COEFFICIENT, C _v	
THROTTLING CHARACTERISTICS	
MAXIMUM ALLOWABLE SHUTOFF SEAT LEAKAGE	
MAXIMUM SHUTOFF PRESSURE DIFFERENTIAL, psi	
INSULATION TYPE AND THICKNESS (Par. 3.5.7)	
HEATING (Par. 3.5.7)	
INSTRUMENTATION REQUIREMENTS (Par. 3.5.8)	
RADIOACTIVITY APPLICATION, Yes-No (Par. 3.3)	
SECONDARY SEAL:	
ATMOSPHERE	
PRESSURE, psig	
SPECIAL REQUIREMENTS:	
GENERAL DESCRIPTION FOR VALVES COVERED ON SHEET NO. _____ PARTS A, B, AND C:	

LIQUID METAL VALVE SPECIFICATION SHEET NO. PART B				
OPERATING CONDITIONS:		VALVE NUMBER		
NORMAL OPERATING TEMPERATURE, °F				
NORMAL OPERATING PRESSURE, psig				
TEMPERATURE RANGE, °F				
PRESSURE RANGE, psig				
FLOW RANGE, gpm				
MAXIMUM SHUTOFF PRESSURE, psig				
NORMAL OPERATING POSITION (OPEN, CLOSED, OR OTHER)				
OPERATIONAL FUNCTION				
SYSTEM ATTITUDE (VALVE STEM)				
OPERATING LIFE AT NORMAL OPERATING CONDITIONS, hr				
OPERATING LIFE AT NORMAL OPERATING CONDITIONS, cycles				
NORMAL STARTUP AND SHUTDOWN CONDITIONS –				
NUMBER OF STARTUP/SHUTDOWN TEMPERATURE CYCLES:				
MAXIMUM RATE OF TEMPERATURE CHANGE, °F/hr				
TEMPERATURE CYCLE LIMITS, °F				
PRESSURE CYCLE LIMITS, psi				
UPSET CONDITIONS –				
NUMBER OF UPSET TEMPERATURE CYCLES:				
MAXIMUM RATE OF TEMPERATURE CHANGE, °F/min				
TOTAL TEMPERATURE CHANGE AND DIRECTION, °F				
PRESSURE CYCLE LIMITS, psi				
SPECIAL REQUIREMENTS:				
MATERIALS	PAR. NO.	REMARKS		
BODY AND BONNET	3.6.1			
VALVE INTERNALS	3.6.2			
VALVE TRIM	3.6.2			
HARDSURFACING	3.6.2			
BELLOWS	3.6.1			
SECONDARY SEAL	3.5.4.3			
END CONNECTIONS	3.6.1			
SPECIAL REQUIREMENTS:				

LIQUID METAL VALVE SPECIFICATION SHEET NO. PART C				
		PAR. REF.	REMARKS	
VALVE CONFIGURATION:				
BODY TYPE		3.5.2		
VALVE INTERNALS		3.5.3		
SEAL CONFIGURATION		3.5.4		
LINE SIZE		3.5.2.5		
PIPING CONNECTIONS		3.5.2.5		
LEAK DETECTOR OR PURGE PORT		3.5.5		
VALVE OPERATOR CONFIGURATION:				
TYPE		3.5.6		
OPERATOR POWER REQUIREMENTS		3.5.6		
AUXILIARY EQUIPMENT:				
POSITIONER		3.5.6		
POSITION INDICATOR		3.5.6		
MANUAL OVERRIDE		3.5.6		
LIMITING DEVICES		3.5.6.1		
FAIL-SAFE MODE		3.5.6		
CLOSING TIME, sec		3.5.6		
OPENING TIME, sec		3.5.6		
TEST REQUIREMENTS:				
TEST	PAR. REF.	REQUIRED		ACCEPTANCE CRITERIA/ REMARKS
		YES	NO	
FUNCTIONAL	4.5.2			
GAS UNDER WATER SEAT LEAKAGE	4.5.2.1			
HYDROSTATIC SEAT LEAKAGE	4.5.2.1			
WATER FLOW SEAT LEAKAGE	4.5.2.1			
SECONDARY SEAL	4.5.2.2			
VALVE OPERATOR	4.5.2.3			
HYDROSTATIC PROOF	4.5.3			
PNEUMATIC PROOF	4.5.3			
HELIUM LEAK	4.5.4			
SPECIAL REQUIREMENTS:				

<u>Item</u>	<u>Refer to Paragraph</u>
12. Operating parameters to be included on nameplate for valve actuators	3.7.6.2
13. Listing of documents and samples to be submitted by the supplier, including number of copies and samples to be furnished	3.8, 4.2, and 6.3
14. Dimensional measurements requirements	4.4.7
15. Designation of critical parts	5.2

6.3 Documentation Checklist. The following list is composed of items which are to be furnished by the supplier at the time specified, unless otherwise specified in the Ordering Data.

A1

<u>Item</u>	<u>Document</u>	<u>Codes*</u>
1.	Conceptual Assembly Drawing	a
2.	Production Assembly Drawing	b,c
3.	Drawing List and complete set of Certified Production Detailed Drawings	b,c
4.	List of Codes and Standards to be applied to design, materials, fabrication, testing, examination, and inspection	b,c
5.	Design Report, including analyses requested	b,c
6.	Traceability procedures	b,c
7.	Quality Assurance Program Plan	b,c
8.	Procedures for control of changes	b,c
9.	Nondestructive examination procedures	b,c
10.	Assembly procedures and instructions	b,c
11.	Cleaning and packaging procedures	b,c
12.	Fabrication procedures, including welding, brazing, heat treatment, and stress relief	b,c
13.	Acceptance test procedure	b,c
14.	Process and personnel qualification certification	b,c
15.	Material test reports	b,c
16.	Shipping methods, including marking methods for crates and containers	c,d
17.	Material certifications	d
18.	Acceptance test reports	d
19.	Inspection, test, and examination reports	d
20.	Valve operation and maintenance manual	d
21.	Material sample for each material test	e
22.	List of documents which will accompany delivered items	e

*For explanation of codes, see end of list on following page.

<u>Item</u>	<u>Document</u>	<u>Codes*</u>
23.	Installation instructions	e
24.	Certification of conformance	e
25.	Nonconformance report and hardware disposition	c,f
26.	Unpriced purchase orders for procurement of new materials and services for materials and parts containing or in contact with sodium or sodium vapor	f

*Codes:

- a - With proposal
- b - Prior to fabrication
- c - For purchaser approval
- d - Prior to delivery
- e - With delivery and prior to final acceptance
- f - Upon issuance

R D T S T A N D A R D

UNITED STATES ATOMIC ENERGY COMMISSION
DIVISION OF REACTOR DEVELOPMENT AND TECHNOLOGY

RDT E 1-19T, Amendment 1
Date October 1971
Page 1 of 14

SMALL, CLASS 2, LIQUID METAL VALVES

AMENDMENT 1

This amendment forms a part of RDT E 1-19T
dated September 1970

1. Cover sheet and throughout entire document:

Change valve class designation from "Class II" to "Class 2."

2. Page 1, Section 1:

Delete the second and third paragraphs and substitute the following:

Class 2 valves are specified by this standard in accordance with the ASME Boiler and Pressure Vessel Code, Section III, hereinafter referred to as the Code. Other standards and codes described herein will be used to supplement the existing requirements of Class 2 valves.

3. Page 1, Par. 1.2: Add the following definitions:

Hands-on Maintenance - Hands-on maintenance indicates that tools can be handled directly by personnel, rather than through the use of remote manipulators or slave devices. High radiation fields, high temperatures, toxic gases, or interposed mechanical structures are among the conditions that interfere with hands-on maintenance.

Maintainability - Those inspection, servicing, testing and repair characteristics of an item which affect the operating continuity of the facility and affect the effort required to restore the function of the item to its in-tolerance state.

4. Pages 2, 3, and 4, Section 2:

Delete entire section and substitute the following:

2.1 Application

The following documents are a part of this standard to the extent specified herein. The issue of a document in effect on the date of invitation to bid, including any amendments also in effect on that date, shall apply unless otherwise specified. Where the standard appears to conflict with the requirements of a reference document, such conflict shall be brought to the attention of the purchaser for resolution.

2.2 Reactor Development and Technology (RDT) Standards

RDT E 15-2T*	Requirements for Nuclear Components (Supplement to ASME Boiler and Pressure Vessel Code, Section III)
RDT F 2-2T	Quality Assurance Program Requirements
RDT F 3-6T	Nondestructive Examination
RDT F 3-37T	Special Requirements for Metal Products
RDT F 5-1T	Cleaning and Cleanliness Requirements for Nuclear Reactor Components
RDT F 6-5T	Welding Qualifications (Supplement to ASME Boiler and Pressure Vessel Code, Section IX)
RDT F 7-2T	Preparations for Sealing, Packaging, Packing, and Marking of Components for Shipment and Storage
RDT F 7-3T	Requirements for Identification Marking of Reactor Plant Components and Piping
RDT M 1-1T	Stainless Steel Covered Welding Electrodes (ASME SFA-5.4 with Additional Requirements)
RDT M 1-2T	Stainless Steel Welding Rods and Bare Electrodes (ASME SFA-5.9 with Additional Requirements)
RDT M 2-2T	Stainless and Low Alloy Steel Forgings (ASME SA-182 with Additional Requirements)
RDT M 2-4T	Alloy Steel Forgings (ASME SA-336 with Additional Requirements)
RDT M 2-5T	Austenitic Stainless Steel Welding Fittings (ASME SA-403 with Additional Requirements)
RDT M 3-2T	Stainless and Alloy Steel Seamless Tubes (ASME SA-213 with Additional Requirements)
RDT M 3-3T	Austenitic Stainless Steel Seamless Pipe (ASME SA-376 with Additional Requirements)
RDT M 3-5T	Austenitic Stainless Steel Welded Tubing (ASME SA-249 with Additional Requirements)
RDT M 3-6T	Austenitic Stainless Steel Pipe (ASME SA-312 with Additional Requirements)

*The letter "T" which appears at the end of RDT standard numbers designates approval for use as "tentative" standard.

RDT M 4-2T	Austenitic Stainless Steel Castings (ASME SA-351 with Additional Requirements)
RDT M 5-1T	Stainless Steel Plate, Sheet and Strip (ASME SA-240 with Additional Requirements)
RDT M 7-3T	Stainless Steel Bars and Shapes (ASME SA-479 with Additional Requirements)

2.3 American National Standards Institute (ANSI) Standards

ANSI B16.25	Buttwelding Ends
ANSI B46.1	Surface Texture
ANSI Y14	Drafting Manual
ANSI B1.1	Unified Screw Threads

2.4 American Society of Mechanical Engineers (ASME)

ASME Boiler and Pressure Vessel Code:

Section II	Material Specifications, Parts A, B, and C
Section III	Nuclear Power Plant Components
Section VIII	Pressure Vessels, Division 1
Code Case 1481	Elevated Temperature Design of Class 2 and 3 Nuclear Components

2.5 American Welding Society (AWS)

AWS D1.0	Code for Welding in Building Construction
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2.6 Manufacturers Standardization Society (MSS) of Valves and Fittings

MSS SP-25	Standard Marking Systems for Valves, Fittings, Flanges, and Unions
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5. Page 4, Par. 3.1: Delete and substitute the following:

3.1 General

Valves shall be constructed in accordance with the Code and RDT E 15-2. Valves furnished to this standard shall be suitable for liquid metal service and shall be Class 2 as defined by the Code. A code stamp is required in accordance with NA-8000 of the Code unless otherwise specified in the Ordering Data.

6. Page 4, Par. 3.1.3: Delete and substitute the following:

3.1.3 Maintainability - Valves shall be designed for accessibility to permit necessary inspections, leak location, preventive maintenance, and repair, in compliance with guidelines in the Ordering Data. The supplier shall recommend schedules and establish qualified techniques and procedures for inspection, leak locations, packing replacement, and other servicing operations covering all serviceable parts of the valves and auxiliary equipment. The means of inspection and maintainability chosen by the supplier shall be described in the design report. These procedures and schedules shall be included in the Operations and Maintenance Manual (3.9) and shall describe the techniques and procedures for each maintenance task, emphasizing the approach of hands-on maintenance without precluding the application of remote techniques, such as remote manual, remote machine - manual setup, or remote machine - remote setup.

7. Page 4, Par. 3.2: Delete first sentence and substitute the following:

Valves shall be provided in accordance with Subsection NC of the Code.

8. Page 5, Par. 3.5.1, item 1: Delete and substitute the following:

1. Stress analysis based on the design conditions defined by the pressures, temperatures, and various forces applicable to valve service. For design temperatures over 700 F for ferritic steels and over 800 F for austenitic steels, Code Case 1481 applies. The design shall be directed toward a minimum, uniform-body wall thickness.

9. Page 6, Par. 3.5.2.5: Delete and substitute the following:

3.5.2.5 Piping Connections - The inlet and outlet connections of the valve body shall each have a minimum length of 6 in. when measured from the nearest edge of the seat unless otherwise specified in the Ordering Data. End connections shall be machined for butt welding in accordance with ANSI B16.25. Threaded seal welded joints or socket welds shall not be used. The runout of a machined surface to the inside diameter of the valve body shall be as depicted by Figure NB-4233-1 of the Code.

10. Page 9, Par. 3.6.2: Delete second sentence and substitute the following:

Where standards are not specified for materials, specifications of ASME Code Section II shall prevail.

11. Page 10, Par. 3.7: Delete and substitute the following:

3.7 Fabrication - The valves shall be manufactured in accordance with the requirements of the Code, RDT E 15-2, the appropriate RDT material standards, and the Quality Assurance Requirements of Section 4 herein.

Prior to start of fabrication the supplier shall prepare manufacturing procedures that meet the applicable requirements of NA-4400 and NA-4500 of the Code, and shall obtain purchaser approval of all fabrication procedures in accordance with ANB-4110 of RDT E 15-2.

12. Page 10, Par. 3.7.2.1: Delete and substitute the following:

3.7.2.1 Pressure Boundary - Welds shall conform to the requirements of the Code and RDT E 15-2.

13. Page 10, Par. 3.7.2.3: Add sentence at end of paragraph:

The supplier shall prepare and submit procedures for control of welding materials to the purchaser for approval in accordance with ANB-4411 of RDT E 15-2.

14. Pages 10 and 11, Par. 3.7.2.4: Delete and substitute the following:

3.7.2.4 Hardsurfacing - Hardsurfacing and weld-metal overlay procedures and qualifications shall be in accordance with manufacturer's recommendation appropriate to the materials and services and shall meet the requirements of ANC-4100 of RDT E 15-2. It is preferred that hardsurfaced items consist of integral hardsurfacing or full penetration weld-in-style hardsurfaced rings. However, subject to approval by the purchaser, high-temperature nickel braze may be used (1) for sealing crevices, or (2) for bonding insert materials, provided that braze material shall not become a part of the pressure-containing boundary of the valve in either the closed or open position. Brazing shall conform to the requirements of NB-4500 of the Code and RDT E 15-2. Samples of each type of hardsurfacing process shall be subjected to metallurgical examination to qualify the process and the operator in accordance with Part F of RDT F 6-5.

15. Page 12, Par. 3.7.6.2 and pertinent footnote: Delete first paragraph relative to nameplates for valves and substitute the following:

3.7.6.2 Nameplates - Valves shall have permanently attached nameplates which are visible after insulation is installed, and which indicate as a minimum:

- *1. N-type symbol including numeral 2 (if required)
- *2. Name of manufacturer
- 3. Manufacturer's drawing or part number
- *4. Manufacturer's serial number
- 5. Purchase order or contract number

*Indicates requirements of NA-8000 of the Code.

-
6. This standard number (RDT E 1-19)
- *7. Design Pressure: _____ psi at _____ F
8. Valve body material (ASME SA XXX, RDT M X-XX)
9. Valve nominal size
- *10. Year built
16. Page 12, Par. 3.7.6.3: Delete and substitute the following:
- 3.7.6.3 Traceability - The control and identification of material shall be in accordance with NA-4440 of the Code.
17. Page 13, Section 3: Add the following paragraph:
- 3.9 Operations and Maintenance Manual - The supplier shall provide valve operation and maintenance information to form part of the plant operations manual. This manual shall reflect the "as-built" configuration of the delivered item. Information shall include, but not be limited to, the following:
1. A detailed description of the valve and associated components, and instrumentation for installation, operation, preventive maintenance, and repair (3.1.3), such as removal and installation of packing, cutting, cleaning, and rewelding of welds, and lubrication and maintenance of valve operators. These procedures shall include a description of the tools required to make these repairs with the unit installed in the plant.
 2. Procedures for replacing replaceable components.
 3. Instructions for use of all lifting and handling fixtures, and special tools and equipment.
 4. Reduced size drawings for operation, maintenance, and instructional purposes, including drawings of special tools and equipment.
 5. Instructions for disassembly, cleaning, preparing for shipment, and for crating constituent parts.
 6. A list of recommended spare parts.
 7. Schedules of inspections and servicing.

*Indicates requirements of NA-8000 of the Code.

18. Page 13, Par. 4.1: Delete and substitute the following:

4.1 Quality Assurance Program - The supplier's quality assurance system shall satisfy the requirements of NA-4000 of the Code and RDT F 2-2.

A quality assurance program plan in accordance with RDT F 2-2 shall be submitted to the purchaser for approval.

19. Page 13, Par. 4.1.1: Delete first sentence and substitute the following:

The supplier shall be responsible for obtaining the services of an authorized third party inspector to perform inspections and provide certification that the valve meets the minimum requirements of Sub-section NC of the Code.

20. Page 13, Par. 4.1.2: Delete and substitute the following:

4.1.2 Traceability - The supplier's traceability procedure shall be submitted to the purchaser for approval prior to fabrication. Materials traceability shall ensure compliance with requirements of 3.7.6.3 of this standard and RDT F 2-2.

21. Page 14, Par. 4.2.1: Delete first sentence and substitute the following:

The following records and information as required by NA-4900 of the Code and RDT F 2-2 shall be supplied as a minimum to the purchaser prior to each valve shipment.

22. Page 14, Par. 4.2.4: Delete first sentence and substitute the following:

Any nonconformance of materials or components to drawings, specifications, or other purchase order or contract requirements shall be identified and recorded as required by NA-4550 of the Code.

23. Page 15, Par. 4.4: Delete first two paragraphs and substitute the following:

All nondestructive examinations shall be in accordance with the Code, RDT E 15-2, and the applicable material and process standards.

24. Page 15, Par. 4.4.1: Delete and substitute the following:

4.4.1 Calibration and Control of Instruments - All instruments and measurement and test devices used for nondestructive examinations, inspections, and acceptance tests shall be calibrated and controlled in accordance with NA-4600 of the Code and with RDT F 2-2.

25. Page 15, Par. 4.4.3, Visual Examination: Delete entire paragraph.

26. Page 15, Par. 4.4.4: Delete and substitute the following:

4.4.4 Radiographic Examination - Section VIII, Division 1, Paragraph UW-51 of the ASME Boiler and Pressure Vessel Code, shall apply to welds in the nonpressure boundary portions of the valve.

27. Page 16, Par. 4.4.5: Delete the first paragraph.

28. Page 16, Par. 4.4.6: Delete and substitute the following:

4.4.6 Ultrasonic Examination - Hardsurfacing shall be ultrasonically examined in accordance with ANB-5273 of RDT E 15-2.

29. Page 17, Par. 4.5.3: Delete and substitute the following:

4.5.3 Hydrostatic or Pneumatic Tests (Proof Pressure) - Proof pressure tests may be accomplished by hydrostatic testing or pneumatic testing in accordance with ANC-6100 of RDT E 15-2. The test pressure shall meet the requirements of the Code. Criteria for acceptance shall be:

1. Nondestructive testing of welds in accordance with NNB-5420 of RDT E 15-2.
2. No visual evidence of permanent deformation or damage to the valve and satisfactory completion of functional test after proof pressure test.

30. Page 18, Par. 4.5.4: Delete first sentence and substitute the following:

When specified in the Ordering Data, and upon completion of all other acceptance tests, the pressure boundary of each complete valve shall be tested with a helium mass spectrometer leak detector, using the hood method in accordance with Section 14 of RDT F 3-6.

31. Page 18, Par. 4.8: Delete entire paragraph.

32. Page 19, Section 6: Add new Par. 6.1 as follows:

6.1 Compliance - When this standard is used as a basis for procurement, the purchase specification will be certified by a registered Professional Engineer representing the purchaser to be in compliance with the rules for a design specification of the ASME Boiler and Pressure Vessel Code, Section III, Nuclear Power Plant Components.

33. Pages 19 and 20, Par. 6.1: Renumber and reword as follows:

6.2 Ordering Data Checklist - The Ordering Data are composed of the information called for in the valve specification sheet, the piping reaction table (Table 2), and the following:

Refer to Par.

1.	Requirement for code stamp on valve	3.1
2.	Design requirements for maintainability	3.1.3
3.	Special environment factors for radioactive fluids, if applicable	3.3
4.	Instructions if other than full penetration strength welds will be allowed for valve body and bonnet construction	3.5.2
5.	Length of valve inlet and outlet connection, if other than 6 in. minimum	3.5.2.5
6.	Back seating requirement, if any, for bellows seal valves	3.5.4.1
7.	Allowable leakage in event of bellows failure for seal configuration 1	3.5.4.3
8.	Specific materials requirements including cladding or plating, if allowed	3.6
9.	Operating parameters to be included on name-plate for valve actuators	3.7.6.2
10.	Listing of documents and samples to be submitted by the supplier, including number of copies and samples to be furnished.	3.8 and 6.3

34. Pages 21, 22, and 23, Specification Sheet, Parts A, B, and C:

Delete and replace with the following:

LIQUID METAL VALVE SPECIFICATION SHEET NO. ____ PART A

STANDARD: RDT _____ CODE: _____

VALVE CLASS: _____ CODE RATING: _____ POUND

DESIGN CONDITIONS FOR ASME SECTION III CLASS 2 VALVES:

DESIGN CONDITIONS:	REMARKS
TEMPERATURE, F	
PRESSURE, psig	
OTHER DESIGN INFORMATION:	
CORROSION ALLOWANCE, in.	
EXTERNAL ENVIRONMENT:	
ATMOSPHERE	
TEMPERATURE RANGE, F	
RELATIVE HUMIDITY RANGE, %	
FLOW, gpm	
CONTAINED FLUID:	
DENSITY, lb/ft ³	
VISCOSITY, centipoise	
FLOW COEFFICIENT, C _v	
THROTTLING CHARACTERISTICS	
MAXIMUM ALLOWABLE SHUTOFF SEAT LEAKAGE	
MAXIMUM SHUTOFF PRESSURE DIFFERENTIAL, psi	
DRAINAGE, PERMISSIBLE RETENTION, % (Par. 3.5.2.3)	
INSULATION TYPE AND THICKNESS (Par. 3.5.7)	
HEATING (Par. 3.5.7)	
INSTRUMENTATION REQUIREMENTS (Par. 3.5.8)	
RADIOACTIVITY APPLICATION, Yes-No (Par. 3.3)	
SECONDARY SEAL:	
ATMOSPHERE	
PRESSURE, psig	

SPECIAL REQUIREMENTS:

GENERAL DESCRIPTION FOR VALVES COVERED ON SHEET NO. _____ PARTS A, B, AND C:

LIQUID METAL VALVE SPECIFICATION SHEET NO. ___ PART B				
OPERATING CONDITIONS:	VALVE NUMBER			
NORMAL OPERATING TEMPERATURE, F				
NORMAL OPERATING PRESSURE, psig				
TEMPERATURE RANGE, F				
PRESSURE RANGE, psig				
FLOW RANGE, gpm				
MAXIMUM SHUTOFF PRESSURE, psig				
NORMAL OPERATING POSITION (OPEN, CLOSED, OR OTHER)				
OPERATIONAL FUNCTION				
SYSTEM ATTITUDE (VALVE STEM)				
OPERATING LIFE AT NORMAL OPERATING CONDITIONS, hr				
NORMAL STARTUP AND SHUTDOWN CONDITIONS –				
NUMBER OF STARTUP/SHUTDOWN TEMPERATURE CYCLES:				
MAXIMUM RATE OF TEMPERATURE CHANGE, F/hr				
TEMPERATURE CYCLE LIMITS, F				
PRESSURE CYCLE LIMITS, psi				
UPSET CONDITIONS –				
NUMBER OF UPSET TEMPERATURE CYCLES:				
MAXIMUM RATE OF TEMPERATURE CHANGE, F/min				
TOTAL TEMPERATURE CHANGE AND DIRECTION, F				
PRESSURE CYCLE LIMITS, psi				
SPECIAL REQUIREMENTS:				
MATERIALS	PAR. NO.	REMARKS		
BODY AND BONNET	3.6.1			
VALVE INTERNALS	3.6.2			
VALVE TRIM	3.6.2			
HARDSURFACING	3.6.2			
BELLOWS	3.6.1			
SECONDARY SEAL	3.5.4.3			
END CONNECTIONS	3.6.1			
SPECIAL REQUIREMENTS:				

LIQUID METAL VALVE SPECIFICATION SHEET NO. ____ PART C				
		PAR. REF.	REMARKS	
VALVE CONFIGURATION:				
BODY TYPE	3.5.2			
VALVE INTERNALS	3.5.3			
SEAT CONFIGURATION	3.5.4			
LINE SIZE	3.5.2.5			
PIPING CONNECTIONS	3.5.2.5			
LEAK DETECTOR OR PURGE PORT	3.5.5			
VALVE OPERATOR CONFIGURATION:				
TYPE	3.5.6			
OPERATOR POWER REQUIREMENTS	3.5.6			
AUXILIARY EQUIPMENT:				
POSITIONER	3.5.6			
POSITION INDICATOR	3.5.6			
MANUAL OVERRIDE	3.5.6			
LIMITING DEVICES	3.5.6.1			
FAIL-SAFE MODE	3.5.6			
CLOSING TIME, sec	3.5.6			
OPENING TIME, sec	3.5.6			
TEST REQUIREMENTS:				
TEST	PAR. REF.	REQUIRED		ACCEPTANCE CRITERIA/ REMARKS
		YES	NO	
FUNCTIONAL	4.5.2			
GAS UNDER WATER SEAT LEAKAGE	4.5.2.1,1			
HYDROSTATIC SEAT LEAKAGE	4.5.2.1,2			
WATER FLOW SEAT LEAKAGE	4.5.2.1,3			
DRAINAGE	4.5.2.2			
SECONDARY SEAL	4.5.2.3			
VALVE OPERATOR	4.5.2.4			
HYDROSTATIC PROOF	4.5.3			
PNEUMATIC PROOF	4.5.3			
HELIUM LEAK	4.5.4			
BURST	4.6.0			
SPECIAL REQUIREMENTS:				

35. Page 25, Par. 6.2: Renumber and replace with the following:

6.3 Documentation Checklist - This list is composed of items which are to be furnished by the supplier at the time specified unless otherwise specified in the Ordering Data.

<u>Item</u>	<u>Document</u>	<u>Codes*</u>
1.	Conceptual Assembly Drawing	a
2.	Production Assembly Drawing	b,c
3.	Drawing List and complete set of Certified Production Detailed Drawings	b,c
4.	List of Codes and Standards to be applied to design, materials, fabrication, testing, examination, and inspection	b,c
5.	Design Report, including all analyses	b,c
6.	Traceability procedures	b,c
7.	Quality Assurance Program Plan	b,c
8.	Procedures for control of changes	b,c
9.	Nondestructive examination procedures	b,c
10.	Assembly procedures and instructions	b,c
11.	Cleaning and packaging procedures	b,c
12.	Fabrication procedures, including those for welding, brazing, heat treatment, and stress relief	b,c
13.	Acceptance test procedure	b,c
14.	Process and personnel qualification certification	b,c
15.	Material test reports	b,c
16.	Shipping methods, including marking methods for crates and containers	d,c
17.	Material certifications	d
18.	Acceptance test reports	d

*For explanation of codes, see end of list on following page.

<u>Item</u>	<u>Document</u>	<u>Codes</u>
19.	Inspection, test, and examination reports	d
20.	Valve operation and maintenance manual	d
21.	Material sample for each material test	e
22.	List of documents which will accompany delivered items	e
23.	Installation instructions	e
24.	Certification of conformance	e
25.	Nonconformance report and hardware disposition	f,c
26.	Unpriced purchase orders for procurement of new materials and services for materials and parts containing or in contact with sodium or sodium vapor	f

Codes:

- a - With proposal
- b - Prior to fabrication
- c - For purchaser approval
- d - Prior to delivery
- e - With delivery and prior to final acceptance
- f - Upon issuance

36. Page 30, Appendix A: Change the equation after "...transposing equation (4):" to read as follows:

$$\cosh m (L_f - x') = \frac{(T_x - T_A) \cosh mL_f}{T_b - T_A}$$