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RDT Standards Transmittal

Hanford Engineering Development Laboratory

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RDT Standard

ORIFICE ASSEMBLIES FOR NUCLEAR SYSTEMS

AUGUST 1973

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Division of Reactor Research and Development
United States Atomic Energy Commission

ORIFICE ASSEMBLIES FOR NUCLEAR SYSTEMS

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ORIFICE ASSEMBLIES FOR NUCLEAR SYSTEMS

1. SCOPE

This standard delineates the requirements for orifice assemblies constructed in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section III, Nuclear Plant Components (hereinafter referred to as the Code) and special requirements that are additive or more restrictive. These orifice assemblies are for use in measuring or restricting flowrate in nuclear piping systems containing gas, liquid metal, or other fluids. This standard is not applicable to reactor core components.

1.1 Classification.1.1.1 Class.

Class 1 Orifice assemblies constructed in accordance with the Class 1 requirements of the Code as supplemented by RDT E 15-2 and this standard.

Class 2 Orifice assemblies constructed in accordance with the Class 2 requirements of the Code as supplemented by RDT E 15-2 and this standard.

1.1.2 Type.

Type A Orifice assemblies constructed and equipped to measure flowrate.

Type B Orifice assemblies constructed to restrict flow.

1.2 Definitions.

Flow Restricting Subassembly - One or more orifice plates mounted directly in a pipe section or an internal housing which is located between the inlet and outlet pipe section.

Inlet and Outlet Pipe Sections - The lengths of pipe upstream and downstream of the metering plate or flow restricting subassembly.

Metering Plate - The orifice plate, usually a single-hole plate, in an orifice assembly used to measure flowrate.

Orifice - Flow passage through an orifice plate.

Orifice Assembly - An assembly consisting of metering plate or a flow restricting subassembly and inlet and outlet pipe sections which is constructed for in-line installation in a piping system.

Orifice Plate - A plate containing one or more orifices.

Pressure Taps - Openings through the wall of the inlet and outlet pipe sections with provisions for attachment of instrumentation for pressure measurement.

2. APPLICABLE DOCUMENTS

The following documents form a part of this standard to the extent specified. The issue of a document in effect on the date of invitation to bid, including any amendment, addendum, etc. also in effect on that date, shall apply unless otherwise specified. Where the standard appears to conflict with the requirements of a reference document, the supplier shall call it to the attention of the purchaser for resolution.

2.1 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 5-1T	Cleaning and Cleanliness Requirements for Nuclear Components
RDT F 6-10T	Repair of Materials by Welding
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
RDT F 9-1T	Requirements for Nuclear Components at Elevated Temperatures (Supplement to ASME Elevated Temperature Code Case 1331)
RDT M 6-2T	Mechanical Locking Devices

2.2 American National Standards Institute (ANSI) Standards.

ANSI B1.1 Unified Screw Threads
ANSI B16.25 Buttwelding Ends for Pipe, Valves, Flanges and Fittings
ANSI B46.1 Surface Texture
ANSI Y14 Drafting Manual

2.3 American Society of Mechanical Engineers (ASME).

ASME Boiler and Pressure Vessel Code
Section III, Nuclear Power Plant Components
Code Case 1331, Nuclear Components in Elevated Temperature Service

2.4 Other Documents.

Code of Federal Regulations, Title 10, Atomic Energy

2.5 Applicable Drawings. (As specified in the Ordering Data)

3. TECHNICAL REQUIREMENTS

3.1 General.

3.1.1 Description. The Type A orifice assembly shall consist of a metering plate, inlet and outlet pipe sections, pressure taps for differential pressure measurement, and accessories as specified in the Ordering Data. The Type A orifice assembly is used to measure flowrate.

The Type B orifice assembly shall consist of a flow restricting sub-assembly, inlet and outlet pipe sections and accessories as specified in the Ordering Data. The Type B orifice assembly is used to restrict flowrate.

The inlet and outlet pipe sections of both Type A and Type B orifice assemblies may be terminated with buttwelding fittings where required for interfacing with the connecting piping.

The type of orifice assembly required shall be as specified in the Ordering Data.

3.1.2 Basis of Construction. Orifice assemblies shall be constructed* in accordance with the requirements of the Code, the supplementary requirements

*The term "construction" is used in this standard as defined in the Code, viz, an all-inclusive term pertaining to the materials, design, fabrication, examination, testing, inspection, and certification required in the manufacture and installation of components, parts, and appurtenances.

of RDT E 15-2, and the requirements of this standard that pertain to the Code Class specified in the Ordering Data.

3.1.3 Configuration. Any limitations on physical dimensions and the specific interface requirements such as dimensions of connecting pipe and length of inlet and outlet piping will be specified in the Ordering Data.

3.1.4 Basis of Acceptance - Fluid Flow Characteristics. Acceptance of orifice assemblies with respect to their fluid flow characteristics shall be based on either the performance option (3.1.4.1) or the design option (3.1.4.2). The option to apply will be specified in the Ordering Data.

3.1.4.1 Performance Option. Acceptance of the orifice assembly by the purchaser will be based on conformance to the fluid flow characteristics specified in 3.2 as verified by testing (4.6.1). The supplier shall be responsible for fluid flow design aspects, including the selection of design equations or the use of experimental tests to determine the orifice size and the metering plate or flow restricting subassembly configuration.

3.1.4.2 Design Option. Acceptance of the orifice assembly by the purchaser will be based on conformance to the design methods and equations specified in 3.3.2 in designing the orifice assembly to obtain the fluid flow characteristics specified in 3.3.2 and on conformance of the orifice assembly configuration to the approved drawings (3.6). Any flow tests required for calibration (4.6.1) will be for information only.

3.2 Performance.

3.2.1 Fluid Flow Characteristics. Where performance is selected as the basis of procurement (3.1.4), the required fluid flow characteristics will be specified in the Ordering Data.

3.3 Design and Construction.

3.3.1 Code Design. The orifice assembly shall be designed in accordance with the Code as supplemented by RDT E 15-2. Design criteria for design temperatures exceeding 800°F shall be in accordance with Code Case 1331 and the supplemental requirements of RDT F 9-1.

3.3.1.1 Design Pressure. The design pressure for the orifice assembly will be specified in the Ordering Data.

3.3.1.2 Design Temperature. The design temperature for the orifice assembly will be specified in the Ordering Data.

3.3.1.3 Design Mechanical Loads. The design mechanical loads for the orifice assembly will be specified in the Ordering Data. Weight, applied mechanical loadings, and those dynamic loadings required for Class 1 and Class

2 design will be specified. Where earthquake effects are to be considered, earthquake data for the operating basis earthquake (3.3.1.4) shall be used. Unless otherwise specified in the Ordering Data, nominal weights of standard components rated for use under the design pressure and temperature conditions may be used in calculating dead weight.

3.3.1.4 Operating Conditions. Class 1 orifice assemblies shall be designed for service under the normal, upset, emergency, and faulted conditions specified in the Ordering Data. Detailed descriptions of each operating condition will be provided. The data required for calculation of secondary and peak stress, for analysis of cyclic operation, and for assessing the conformance to special stress limits of the Code will be specified in the Ordering Data. The loadings, movements, and number of cycles to be used for earthquake analysis will be specified for the operating basis earthquake (OBE) and the safe shutdown earthquake (SSE).^{*} The OBE shall be categorized as an upset condition. The SSE shall be categorized as a faulted condition.

3.3.1.5 Testing Conditions. The testing conditions for any tests other than the Code pressure tests (4.6.3) will be specified in the Ordering Data.

3.3.1.6 Environmental Conditions. The applicable environmental conditions will be specified in the Ordering Data and shall include, as a minimum:

1. The composition of the contained fluid including the concentration of detrimental impurities.
2. Nuclear radiation level in the contained fluid.

3.3.1.7 Service Life. The orifice assembly shall be designed for the service life specified in the Ordering Data.

3.3.2 Design for Fluid Flow - Design Option. Where the design option has been specified (3.1.4), the desired pressure drop/flowrate relationship and the design method and flow equations to be used in determining the orifice size of metering plates or the internal configuration of the flow restricting subassembly including such features as the number and spacing of orifice plates; the number, size, and spacing of the orifices in each orifice plate; and the relative orientation of orifice plates in a multiple plate subassembly (staggered orifice design) will be specified in the Ordering Data. Any specific requirements for orifice or orifice plate geometry or other physical characteristics that must be satisfied to ensure validity of the prescribed flow equations will be specified in the Ordering Data.

^{*}OBE and SSE are defined in 10 CFR 100, Appendix A. The SSE was previously termed DBE (Design Basis Earthquake). The latter term may be encountered in documents related to projects initiated at an earlier time.

3.3.3 Limiting Criteria for Fluid Flow. Any specific limiting criteria for fluid flow characteristics such as maximum throat velocity, cavitation index, maximum pressure drop for individual orifice plates in a multi-plate flow restricting subassembly, etc., shall be as specified in the Ordering Data.

3.3.3.1 Flow-Induced Vibration. The orifice assemblies shall be designed to preclude impairment of operability due to local flow-induced vibration. The vibration analysis shall be documented in the design report (3.7.1).

3.3.4 Orifice Assembly Design - General.

3.3.4.1 Welded Construction. Except for the use of threaded connections to pressure taps for Class 2, Type A orifice assemblies (3.3.9.3), the pressure-retaining boundaries of all orifice assemblies shall be of welded construction throughout. No attachments shall be welded to the pressure-retaining boundary.

3.3.4.2 Assurance of Correct Assembly. The design of the orifice assembly and its parts shall assure that incorrect assembly cannot be achieved. The design of the orifice plate(s) and of the contiguous piping or housing shall assure either that assembly in the inverted position (inlet side of the orifice facing the outlet pipe section) cannot be physically accomplished or that the inverted position does not affect the fluid flow characteristics. Auxiliary parts shall also be designed to assure assembly in the correct position and orientation. Both the inlet and outlet pipe sections shall be labelled and the flow direction indicated by permanent marking on the top of the pipes (installed position).

Where mechanical assembly is used for multiple orifice plate installation in a Type B subassembly, provisions for pre-assembly and a locked assembled condition shall be provided to assure the correct orifice plate positions and orientations following installation within the pressure-retaining boundary or in the internal housing.

3.3.4.3 Surface Finish. The surface roughness of any surface exposed to the contained fluid shall not exceed the lesser of 125 microinches (AA) as determined in accordance with ANSI B46.1 or the value specified in the Ordering Data.

3.3.4.4 Plating. Unless otherwise specified in the Ordering Data, plating shall not be used.

3.3.4.5 Handling Attachments. All orifice assemblies weighing in excess of 25 pounds shall be provided with purchaser-approved attachments for handling during installation, disassembly for inspection, or replacement.

3.3.4.6 Insulation and Heaters. Any requirements for orifice assembly provisions for the attachment of insulation, electrical heaters, or both will be specified in the Ordering Data.

3.3.4.7 Threaded Fasteners. Unless otherwise specified, threaded elements shall conform to the following requirements:

1. Screw threads shall be in accordance with ANSI B1.1.
2. The Unified Thread Form shall be used.
3. Thread fits shall be Class 2A or 2B.
4. Locking devices meeting the Class A requirements of RDT M 6-2 shall be used for internal fasteners.

3.3.5 Orifice Plates - General.

3.3.5.1 Physical Characteristics.

1. Where the design option has been specified (3.1.4), the physical characteristics of the orifice plate(s) shall conform to all requirements established to assure the validity of the design equations (3.3.2) and any additional requirements specified in the Ordering Data.
2. Where the performance option has been specified (3.1.4), any requirements for orifice geometry such as edge configuration and tolerances to apply to critical orifice plate dimensions such as flatness, perpendicularity of the orifice, surface roughness, etc., will be specified in the Ordering Data.
3. Unless otherwise specified, all orifices shall be circular in cross section and the orifice in single-hole plates shall be concentric with the plate diameter.
4. Unless otherwise specified in the Ordering Data, vent or drain holes in orifice plates are not required.

3.3.5.2 Forming. All orifice plates shall be formed from a single piece of metal by mechanical means such as machining and grinding. Welding and thermal cutting shall not be used.

3.3.6 Type A Orifice Plates.

3.3.6.1 The metering plate shall be welded directly to the pressure-retaining boundary at the interface between the inlet and outlet piping.

3.3.6.2 Unless recommended by the supplier and approved by the purchaser, the metering plate shall be designed with a single orifice.

3.3.7 Type B Orifice Subassemblies.

3.3.7.1 The supplier shall recommend for purchaser approval the method of multi-plate installation, i.e., whether the plates will be mounted directly in the pipe section or in an internal housing.

3.3.7.2 The supplier shall recommend for purchaser approval the method of fixing the individual orifice plates in a multi-plate sub-assembly, i.e., by welding or mechanical means.

3.3.7.3 The flow restricting subassembly shall be welded directly to the inlet and outlet piping.

3.3.7.4 Unless otherwise specified in the Ordering Data, where a separate internal housing is used, vent or drain holes in the housing are not required.

3.3.8 Inlet and Outlet Piping.

3.3.8.1 Where the inlet and outlet pipe sections are the same nominal diameter and schedule as the connecting piping, the ends shall be prepared for butt welding to the connecting pipes in accordance with ANSI B16.25. Where these pipe sections are a different diameter than the connecting system pipings, butt welding fittings shall be provided.

3.3.8.2 Unless otherwise specified in the Ordering Data, the dimensions of the inlet and outlet pipe sections shall be recommended by the supplier for the purchaser's approval.

3.3.9 Pressure Taps.

3.3.9.1 Type A orifice assemblies shall be provided with pressure taps for differential pressure measurement. The locations and number of taps shall be as specified in the Ordering Data.

3.3.9.2 The tap hole size shall be as specified in the Ordering Data. The tap holes shall be perpendicular to the axis of the inlet and outlet pipe. Tolerances shall be as specified in the Ordering Data.

3.3.9.3 Pressure tap fittings shall be recommended by the supplier for the purchaser's approval. Fittings for Class 1 orifice assemblies shall be designed for welding to connecting lines. Where threaded connections are to be used for Class 2 orifice assemblies, removable closure plugs shall be provided in each pressure tap location.

3.4 Materials. All materials for parts within the boundaries of Code jurisdiction shall be in accordance with the Code and the supplemental requirements of RDT E 15-2. Material specifications to be used shall be limited to those RDT standards listed in Tables NNB-2120-1 and NNB-2120-2 of RDT E 15-2. Unless otherwise specified in the Ordering Data, orifice assemblies for liquid metal service shall be fabricated from solution annealed 304 or 316

austenitic stainless steel. The material type and grade and any of the optional requirements of the applicable RDT standards that are to apply shall be as specified in the Ordering Data.

3.5 Fabrication.

3.5.1 General. Fabrication of the orifice assembly shall be in accordance with the Code and the supplemental requirements of RDT E 15-2. Fabrication of any item shall not be initiated prior to purchaser approval of the drawings and the design reports (3.6 and 3.7.1).

3.5.2 Welding and Thermal Cutting. All welding, brazing, hard surfacing and thermal cutting shall be in accordance with the Code as supplemented by RDT E 15-2.

3.5.2.1 Material Repair. Unless otherwise specified, welding processes for repair of defects in material may be used where permitted by the Code and the applicable material standard. Any such repair welding shall be performed in accordance to the requirements of RDT F 6-10. No repair welding of orifice plate material shall be permitted.

3.5.3 Heat Treatment. Unless otherwise specified, all heat treatment shall be in accordance with the applicable material standards.

3.5.3.1 Sensitization. Austenitic stainless steel which has become sensitized during heat treatment, welding or forming shall be solution annealed per the applicable standard or be protected against corrosion during all subsequent manufacturing, testing, shipment and storage operations. Except for specific applications approved by the purchaser, all completed austenitic stainless steel parts shall be in the solution annealed condition at the time the parts are assembled by welding to form the completed orifice assembly.

3.5.4 Cleaning. The fabrication of orifice assemblies shall be conducted to facilitate cleaning and inspection for cleanliness and to prevent contamination. Surfaces shall be cleaned to satisfy the cleanliness requirements of RDT F 5-1 and shall be maintained in a clean condition up to delivery. Orifice assemblies shall be thoroughly dried following final cleaning. Unless specifically approved by the purchaser, multiple plate Type B subassemblies shall not be cleaned by immersion in fluids after final assembly. Unless otherwise specified in the Ordering Data, the supplier shall submit his cleaning procedures for the purchaser's approval.

3.5.5 Marking.

1. Raw materials shall be marked in accordance with the applicable RDT material standard.
2. Identification marking of all in-process parts and the permanent identification marking of parts shall satisfy the requirements of RDT F 7-3.

3. Orifice plates shall be identified only on the outlet (downstream) side with temporary type marking.
4. Inlet and outlet pipe sections shall be marked in accordance with paragraph 3.3.4.2.

3.5.6 Precautionary Measures. Shop practices and restrictions on use of materials shall satisfy the requirements of RDT F 5-1.

Hoisting and rigging of major parts and of complete orifice 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 is required.

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

3.6 Drawings. Drawings shall be prepared in accordance with ANSI Y14. Drawings shall be submitted for purchaser approval prior to fabrication (3.5.1).

3.6.1 Design Evaluation Drawings. Design evaluation drawings shall be submitted to the purchaser for approval prior to the initiation of procurement of materials. The drawings, which may include design layout drawings, interface control drawings, etc., shall provide a complete basis for independent design review prior to detailing. The drawings shall include, but not be limited to:

1. Complete configuration and arrangement of all parts showing assembled relationship.
2. All principal and critical dimensions including tolerances.
3. Material to be used for each part including referenced material specification or standard.
4. Location and design of all welds to be used.
5. Referenced nondestructive examination requirements.
6. Predicted orifice assembly performance.
7. Location of pressure taps.

3.6.2 Detail Drawings. Detail drawings shall define all features of each part shown including, as applicable, configuration, dimension, tolerances, materials, mandatory processes, required nondestructive examinations,

surface finish, markings, etc. All documents required to supplement the drawing through definition of material, fabrication, inspection and test requirements shall be referenced thereon.

3.6.3 Assembly Drawings. Assembly drawings shall define the assembled relationship of all parts of the orifice assembly and specify installation requirements either directly or by reference. Serial numbers or other coded design identification to be marked on parts of device shall be shown (3.5.5).

3.7 Technical Documentation and Reports. The supplier shall prepare the following documents and any additional documents specified in the Ordering Data. The time of submittals and approval requirements shall be as specified in the Ordering Data.

3.7.1 Design Report. A design report shall be submitted as the basis for approval of the orifice assembly design by the purchaser. As a minimum the design report shall include the following:

1. Fluid flow analysis.
2. Stress report for Class 1 assemblies prepared in accordance with the requirements of the Code.
3. Flow-induced vibration analysis.
4. Procedure for fixing orifice plates into a multi-plate assembly.
5. Thermal transient stress analysis of regions of discontinuities and thick sections.
6. Materials of construction.
7. Any information previously submitted in an interim design report.

3.7.2 Interim Design Report. An interim design report shall be submitted for review if early purchaser approval is necessary for proceeding with the design or manufacture.

3.7.3 Design Analysis Plan. For high temperature design where RDT F 9-1 is applicable, a design analysis plan meeting the requirements of RDT F 9-1 shall be submitted.

4. QUALITY ASSURANCE REQUIREMENTS

4.1 Quality Assurance Program. The supplier shall plan, establish, implement, and maintain a documented quality assurance program that satisfies all requirements of the Code and those requirements contained in Sections 1, 2, 3, 4, 5 and 8 of RDT F 2-2 that are specified in the Ordering Data.

4.2 Quality Assurance Documents. The supplier shall prepare all applicable documentation required by the program requirements of 4.1.

The following documents and any additional documents specified in the Ordering Data shall be submitted to the purchaser. Time of submittal and approval requirements shall be as specified in the Ordering Data.

1. Inspection and Test Plan.
2. Nonconformance Records - A copy of each nonconformance and corrective action record.
3. Material Certifications - Including chemical analysis and mechanical test results, nondestructive examination results, and heat treatment data. This data shall be traceable to the related finished parts.
4. Test Reports - Including test data, and any calculated test results for specified acceptance tests or calibrations of completed orifice assemblies.
5. Inspection Results - Inspection data for all acceptance inspections identified in the Inspection and Test Plan.

4.3 Nondestructive Examination Requirements. Nondestructive examination of materials and fabricated components shall be performed in accordance with the Code as supplemented by RDT E 15-2, the requirements of the applicable RDT material standard, and any additional requirements of this standard.

Acceptance criteria shall be in accordance with the Code as supplemented by RDT E 15-2 or the applicable material standard.

4.4 Examination of Materials. Examination of materials prior to use shall include:

1. Examination for identification traceable to the material certifications. Nontraceable material is unacceptable.
2. Visual examination for conformance to cleanliness requirements and for detecting obvious disqualifying defects.

4.4.1 Repaired Material. Areas in material where defects have been removed and repair welding is not required shall be examined as required by the Code and RDT E 15-2. Areas repaired by welding shall be examined in accordance with RDT F 6-10. All weld-repaired areas shall be examined by the methods and to the acceptance criteria required for the original inspection.

4.5 Examination of Fabricated Items. All finished items shall be visually examined and measured to verify conformance to approved drawings.

4.5.1 Weld Examination. Visual, dimensional, and nondestructive examination of welds and repaired welds shall be in accordance with Code and RDT E 15-2.

4.5.2 Cleanliness. Items shall be examined for conformance to the cleanliness requirements of RDT F 5-1 (3.5.4).

4.5.3 Permanent Identifications. All finished parts shall be examined for compliance to the permanent marking requirements of 3.5.5.

4.6 Testing.

4.6.1 Determination of Fluid Flow Characteristics. Unless otherwise specified in the Ordering Data, the supplier shall recommend the plan for determination of the orifice assembly fluid flow characteristics for purchaser approval. The supplier's test procedure shall be submitted to the purchaser for approval. Results of all individual flow-tests shall be reported.

4.6.2 Helium Leak Test. The completed orifice assembly shall be helium leak tested by the hood method in accordance with RDT F 3-6. Unless otherwise specified in the Ordering Data, the helium leak rate shall not exceed 1×10^{-7} std cc per second.

4.6.3 Pressure Test. Unless otherwise specified in the Ordering Data, the required Code pressure test shall be performed by the supplier.

4.6.3.1 Only pneumatic testing shall be permitted for multiple-plate assemblies.

4.6.3.2 Unless otherwise specified in the Ordering Data, hydrostatic testing of single-plate assemblies is permitted. Where hydrostatic testing has been performed, the orifice assembly shall be thoroughly dried.

5. PREPARATION FOR DELIVERY

5.1 Packaging and Packing. Sealing, packaging, packing, and identification marking shall be in accordance with RDT F 7-2. All parts of the orifice assembly shall be protected by sealed packaging to assure that cleanliness requirements of 3.5.4 are satisfied at the time of delivery. Orifice assemblies shall be packaged in a manner that precludes deterioration of any kind during extended storage periods. All orifice assemblies shall be packed in a manner to prevent mechanical damage to functional parts and sealing surfaces. The supplier's packaging and packing procedures shall be submitted to and approved by the purchaser prior to use.

5.2 Special Requirements. Any special packing, handling, or shipping requirements for items with physical characteristics or configuration for which conventional or commercial practices may be inadequate will be specified in the Ordering Data. Hoisting and rigging of items shall meet the requirements of 3.5.6.

6. NOTES AND ORDERING DATA CHECKLIST

6.1 Notes.

6.1.1 The specification, which will consist of this standard, modifications (if any), and the Ordering Data, must be certified by a registered professional engineer representing the purchaser either, (1), to be correct, complete, and in compliance with the requirements of the Code for design specifications, or, (2), to be correct and complete with respect to the certified design specifications for the component or system in which the orifice assemblies will be installed where such design specifications include the requirements for the orifice assemblies.

6.1.2 As RDT standards may not be readily available, copies of all RDT standards referenced in the specification should be provided to every prospective supplier. In addition, all subreferenced RDT standards - which are not listed in the Applicable Documents section - should also be provided unless their use is precluded by the specific requirements of this standard.

6.2 Ordering Data Checklist. The detailed requirements for the construction and delivery of orifice assemblies for the purchaser's specific application are to be included in the Ordering Data. These requirements are listed below in the Ordering Data Checklist. The list includes topics to which the standard makes specific reference and other supplemental information but should not be considered restrictive.

The applicable paragraph number of the standard is used herein to identify the location of the information. Any omission of a paragraph number in the checklist indicates that this paragraph of the standard is believed to adequately specify the particular requirement.

1. Scope. This section should be headed by a statement indicating that this document is the Ordering Data which supplements this standard. Include a brief summary of basic information which will aid the supplier in performing his work. Coverage should include:

- a) A brief description of the application.
- b) The location of the installation site as may be required for Code purposes.
- c) A summary of the components and services to be provided.

2. Applicable Documents. List all documents that are specifically called out in Sections 3, 4, and 5 of the Ordering Data that are not listed in the standard. List applicable drawings (if any).

Identify the applicable issue of all referenced documents in the standard and the Ordering Data, listing issue dates, the amendment or revision numbers, or addendum identification.

3. Technical Requirements.

- 3.1.1 Specify orifice assembly type required and accessories to be provided.
- 3.1.2 Specify Code Class.
- 3.1.3 Specify any physical limitations and interface data for connections.
- 3.1.4 Specify procurement basis option (performance or design).
- 3.2.1 Specify pressure drop/flowrate requirements for orifice assembly. (Performance option only).
- 3.3.1.1 Specify design pressure.
- 3.3.1.2 Specify design temperature.
- 3.3.1.3 Specify mechanical loads.
- 3.3.1.4 Specify operating conditions and applicable data (Class 1).
- 3.3.1.5 Specify conditions for any additional tests.
- 3.3.1.6 Specify environmental conditions.
- 3.3.1.7 Specify service life.
- 3.3.2 Specify design requirements and design methods. (Design option only).
- 3.3.3 Specify any limiting criteria for fluid flow characteristics.
- 3.3.4.3 Specify maximum surface roughness if less than 125 micro-inches (either for entire assembly or for specific parts or surfaces).
- 3.3.4.4 Specify where plating may be used (if desired).
- 3.3.4.6 Specify any provisions required for the attachment of insulation or heaters.
- 3.3.4.7 Specify alternate fastener requirements (if any).
- 3.3.5.2 Specify orifice geometry.
- 3.3.5.3 Specify critical orifice plate tolerances.
- 3.3.5.4 Specify orifice concentricity requirement.

- 3.3.5.5 Specify vent or drain hole requirements (if any).
- 3.3.7.4 Specify inclusion of vent or drain holes (if desired).
- 3.3.8.2 Specify pipe dimensions (if desired).
- 3.3.9.1 Specify location and number of pressure taps.
- 3.3.9.2 Specify pressure tap size and applicable tolerances.
- 3.4 Specify type, grade, and optional requirements for materials.
- 3.5.2.1 Specify any additional restrictions on material repair.
- 3.5.3 Specify any alternate heat treatment, if any.
- 3.5.4 State that procedure approval is not required (if desired).
- 3.5.6 Specify that Class C load testing or inspection is not required (if desired).
- 3.7 Specify document submittal requirements.

4. Quality Assurance Requirements.

- 4.1 Specify the requirements of F 2-2 that are to apply.
- 4.2 Specify quality assurance document submittal requirements.
- 4.6.1 Specify flow test or calibration requirements (if desired).
- 4.6.2 Specify alternate leak rate requirements (if desired).
- 4.6.3 Specify if pressure test will be performed after installation.
- 4.6.3.2 Prohibit hydrostatic testing (if desired).

5. Preparation for Delivery

- 5.2 Specify any special packing, handling, or shipping requirements.