SECTION 18100A
GENERAL WELDING REQUIREMENTS
FOR TARGET BUILDING AND BEAM DUMP SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Welding fabrication and construction activities occurring both on-site and off-site for components/hardware to be installed in the Target Building. These requirements apply to structural welding, pipe welding, and ductwork welding when invoked by other technical sections, specifications, drawings, or when specifications or drawings require fabrication to codes referenced in this document.

B. The off-site welding requirements are specified in Part 2 of this section.

C. For on-site welding, Part 3 of this section identifies the welding program requirements and responsibilities. The on-site program that includes welding procedure specifications, weld joint details, welder qualifications requirements, and a filler material control procedure necessary to comply with this section, are contained in Div. 18B which is available from the Construction Manager (CM) upon request.

D. Approval of a Contractor's welding procedures and welders for on-site welding may be granted for either of the following:
   1. The Contractor wishes to use a welding process not included in Div. 18.
   2. The majority of the fabrication is off-site, and the Contractor will use the welding procedures and welders approved for off-site welding for the on-site installation welding.

E. Special Qualification Requirements for Welding
   1. If conditions of access for welding require the use of a mirror, the welder shall demonstrate his/her ability to weld using a mirror on a welder qualification test under access conditions which simulate the production conditions.
   2. If conditions of access for any weld are such that the welder and/or the welder's supervisor/foreman determines that it is doubtful that the weld can be successfully made, the supervisor/foreman shall either:
      a. Have the welder weld a mockup duplicating the conditions that make the success of the weld questionable. The weld mockup shall be examined in the same manner and meet the same requirements as required for the production weld, or;
      b. Request that the designer evaluate the connection for redesign to provide for adequate access for welding.
   3. Construction Manager inspectors shall include in inspections and Contractor representatives shall include in spot checks an evaluation of the adequacy of conditions for making acceptable welds.
   4. Conduct a pre-job briefing with the welders and supervisors to review special welding requirements resulting from the materials, personal protective equipment, or accessibility restrictions.

1.2 RELATED SECTIONS

A. Section 18600, Welding Electrode and Filler Material Control

B. Section 01120, Safety Requirements for Welding and Cutting (Burning) and Incidental Welding

1.3 REFERENCES

A. AWS D-1.1, Structural Welding Code, Steel, 1998 Edition.

B. AWS D-1.2, Structural Welding Code, Aluminum, 1997 Edition.

C. AWS D-1.3, Structural Welding Code, Sheet Steel, 1989 Edition.

D. AWS B-2.1, Standard for Welding Procedure and Performance Qualification, 1984 Edition.

E. AWS D-9.1, Sheet Metal Welding Code, 1990 Edition.

F. AWS QC-1, Specification for Qualification and Certification of Welding Inspectors, 1996 Edition.

G. ASME Boiler and Pressure Vessel Code, Sect. IX, Welding and Brazing Qualifications, 1998 Edition.

H. ASME Boiler and Pressure Vessel Code, Sect. V, Nondestructive Examination, 1998 Edition.

I. ASME Boiler and Pressure Vessel Code, Sect. II, Part C, Material Specification, 1998 Edition.

J. Technical Specification Div. 18B, On-Site Welding, January 1999 Edition (available on request).

K. ASME B31.3, Chemical Plant and Petroleum Refinery Piping, 1996 Edition.

L. ASNT, Recommended Practice SNT-TC-1A, December 1996 Edition.

1.4 DEFINITIONS

A. Engineer: The Company's engineering organization or representative responsible for the design of the system, component, or structure.

B. Examination: Nondestructive testing performed on a weld to determine its compliance with established acceptance standards. A visual examination evaluates specifically listed attributes to established acceptance criteria. Only certified examiners perform examinations.

C. Examiner: A qualified and certified individual who performs examinations and inspections.

D. Faying Surface: The mating surface of a member which is in contact with or in close proximity to another member to which it is to be joined.

E. Inspection: Oversight function of welding provided by the Construction Manager (CM) to verify that specified requirements applicable to the welding program are satisfied.

F. Spot Check: Random observation by an individual designated by the organization performing welding activities to verify conformance to the welding program requirements of this specification.

G. On-Site: Welding activities which occur within the boundaries of the SNS facilities.

H. Off-Site: Welding activities which occur outside the boundaries of the SNS facilities.

I. Procedure Qualification Record (PQR): Written documentation of the qualification of a welding procedure specification (WPS) by examination and testing of physical weld specimens made using the WPS.

J. Performance Qualification Test (PQT): Standard performance test(s) which a welder must successfully pass in order to be qualified to weld. The requirements for these tests are based on a qualified WPS and establish a specific range of essential variables the welder is qualified for.

K. Shared WPS: A welding procedure specification that, when qualified by one company, may be used by another company without additional testing after accepting it in writing.

L. Welder Performance Qualification (WPQ): The record which documents a welder's successful completion of a performance qualification test and establishes the range of variables the welder is qualified for.

M. Welding Procedure Specification (WPS): A written document which establishes the essential, nonessential, and supplementary essential (when required) variables for welding and provides direction to the welder for making production welds to ensure compliance with requirements.

N. Weld Sketches: Informal sketches that show the location of welds in a system so that documentation such as certified material test reports, welder identification, and weld examination records can be traced to the weld it represents.

1.5 SUBMITTALS

A. Off-Site Welding
1. The following summarizes submittals required from the Vendor, Supplier, or Subcontractor for performing off-site welding activities. Approval of the following are required prior to welding.
   a. Visual examination and nondestructive examination procedures.
   b. Qualifications of examination personnel.
   c. Welder/welding operator performance qualification records, including evidence of updates.
   d. WPSs and PQRs (unless prequalified per AWS D-1.1).
   e. Certified Material Test Reports (CMTR) for welding materials when required by this specification.
2. Submit nondestructive examination reports including two complete sets of radiographs of all welds radiographed prior to delivery of the equipment.
3. For Specifications 05121,15128, 15130, 15146, 15455, 15456, 15895, and 15897 requiring Certified Material Test Reports, submit one “For Information” copy of weld maps that locate welds on a drawing with unique weld numbers that provide traceability to examination/inspection reports, base material and weld material heat numbers and weld records.

B. On-Site Welding
1. Submit “For Information” completed “Weld History Cards” (Attachment D) and weld sketches at project completion.
2. The Subcontractor records acceptance of Division 18 and each WPS to be used by signing and submitting a copy of the “Form for Contractor Acceptance of WPS” included as Attachment F.
3. Submit “For Approval” prior to welding, copies of PQRs for those pipe WPSs that the Subcontractor is required to qualify per Section 3.2.

4. Submit "For Approval" prior to welding, copies of the following when the Subcontractor requests approval to use their own procedures on site.
   a. WPQ records
   b. WPSs and PQRs (unless prequalified per AWS D-1.1).
5. For Specifications 05121,15128, 15130, 15146, 15455, 15456, 15895 and 15897 requiring Certified Material Test Reports, submit one "For Information" copy of weld maps that locate welds on a drawing and use unique weld numbers that provide traceability to examination/inspection reports, base material and weld material heat numbers and weld records.

1.6 QUALITY ASSURANCE

A. Welding to this specification requires that welders, welding procedures, examiners, and examination procedures meet the requirements specified in Part 2 or Part 3. For on-site welding, examinations are performed by the subcontractor using procedures included herein or previously submitted and approved. For off-site welding, the Subcontractor performs examinations using personnel and procedures approved by the Construction Manager.

PART 2 - PRODUCTS

2.1 MATERIAL REQUIREMENTS

A. Welding Rods and Electrodes for Off-Site Welding
   1. Verify filler materials delivered are legibly marked in accordance with the General Requirements for each specification listed in AWS or the ASME Boiler and Pressure Vessel Code, Sect. II, Part C, Material Specifications.
   2. Verify bare filler material is identified with the applicable classification and/or specification numbers and is attached to each rod, strip, coil, or spool. Label each piece of rod when it is separated from a labeled rod.
   3. Control, handle, and identify welding rods and electrodes at all times to avoid material degradation or inappropriate usage and to ensure they are identifiable as acceptable material until the material is consumed in the welding process.
      a. Unless otherwise specified by the Company, store and handle low-hydrogen electrodes in accordance with AWS D-1.1.
   4. Technical Specifications 05121,15128, 15130, 15146, 15455, 15456, 15895 and 15897 require Certified Material Test Reports for stainless steel and Nickel alloy filler materials. Submit CMTRs for each heat of material reporting chemical analysis for those elements prescribed for that classification in the ASME/AWS specification. Heat number traceability to the time of consumption is required by these technical specifications for these materials.
      a. Use ASME SFA5.9 or AWS A5.9, filler materials with a minimum delta ferrite of 5 ferrite number for Section 05121, 15128 or 15898 stainless steel welds. Use the type of filler material specified in the WPS.
      b. Use ASME SFA 5.14 or AWS A5.14, filler materials for Nickel alloy welds. Use the type of filler material specified in the WPS.

B. Welding Rods and Electrodes for On-Site Welding.
   1. Control welding electrodes and filler material for on-site welding in accordance with Sect. 18600.

C. Base Material Control for On-Site and Off-Site Fabrication.
   2. Control base material and the marking of cut material to ensure the material is identifiable and traceable to applicable documentation when required by the Technical Specification or Contract.

D. Welding Equipment for On-Site Welding
   1. For welded systems placed under ground or in direct contact with low resistance materials having contact with the ground, in addition to OSHA, follow the requirements of Attachment G, Welding Machine Requirements for Field Welding.

2.2 OFF-SITE WELDING REQUIREMENTS

A. Welding Procedures
   1. Prepare written welding procedures and qualify them for the scope of welding required in accordance with the applicable code in para. 3.01.
   2. Written approval of the WPS and PQR is required prior to welding.

B. Qualification of Welders
   1. Qualify welders and welding operators using the appropriate approved and qualified welding procedure specification. Submit records of welder qualification, including updates, required by the applicable code for the procedure. The welder performance qualification requirements and limits of qualification are those of the code for which the procedure is qualified.
   2. Written approval of the welder performance qualification records is required prior to welding.

C. Welder Identification
   1. The Subcontractor assigns each welder or welding operator a unique identification symbol. Welders use this symbol to identify each weld, either by stenciling or marking the symbol adjacent to the weld or by records traceable to the weld joint.

2.3 INSPECTION/EXAMINATION OF WELDS MADE OFF-SITE

A. The Subcontractor is responsible for the performance and documentation of specified weld examinations. These examinations shall be performed by qualified Subcontractor personnel or by an outside qualified examination service. The following applies for examination of welds made off-site:
   1. Certify examination personnel per the requirements in Part 3 of this specification.
   2. Submit weld examination procedures for approval in accordance with the applicable construction code in Part 3 of this specification prior to welding.
   3. Examine welds in accordance with Part 3 of this specification.
   4. Prepare and file nondestructive examination reports. Submit them to the CM per the submittal requirements in Part 1 of this specification and General and Supplementary Conditions at project completion or when requested prior to final acceptance of work.

B. Welds and weld records are subject to inspection by the CM. The CM may request additional weld examinations on any weld to establish the quality of the weld. The CM reserves the right to select the welds to examine when random examinations are specified. The CM reserves the right to accept, reject, or demand removal of welds which are interpreted by the CM to be in violation of this specification. The Construction Manager may periodically select random welds for examination by the Construction Manager's testing laboratory.

PART 3 - EXECUTION

3.1 GENERAL WELDING REQUIREMENTS

A. Make groove and butt welds complete joint penetration and continuous unless specified otherwise by the Engineer. Backwelding of groove welds is acceptable. Weld size and length shall comply with design tolerances as indicated in the specifications, drawings, and referenced codes. Do not change the location of welds without the approval of the engineer.

B. Pipe Welding

1. Weld piping systems in accordance with ASME B31.3.
   a. Use the gas tungsten arc process for welds in the following materials:
      1) butt welds in piping 1 1/2-in. outside diameter and smaller,
      2) the root pass of stainless steel piping,
      3) copper and copper-base alloy piping, and
      4) the root pass of nickel and nickel-base alloy piping.
   b. Purge the back side of the weld with Argon for the following materials until a minimum of 3/16-in. material thickness separates the weld from the inside surface of the pipe. Analyze the purge with an oxygen analyzer to assure that oxygen does not exceed 1%.
      1) stainless steel and
      2) nickel and nickel-base alloys.
   c. Do not use copper or aluminum as temporary backing for pipe welding.
   d. Do not use backing rings unless permitted on the drawing or in the piping specification.
   e. Do not use the SMAW, FCAW, or SAW process for root pass welding of stainless steel piping welds.
   f. The GTAW, SMAW, GMAW, or FCAW process may be used for fillet welds or groove welds in pipe, fittings, and branch connections larger than 1 ½ inch outside diameter.
   g. GMAW with short circuiting transfer is prohibited for pipe welding.

C. Ductwork Welding

1. Compliance with AWS D-9.1 is required for ductwork welding. AWS D-9.1 applies to welds in or to the duct pressure boundary.
   a. Welds for ductwork stiffener and support materials may be made using WPSs qualified to AWS D-9.1, AWS D-1.1, or ASME Sect. IX provided the welders are qualified to the same code used to qualify the WPS. All other requirements of AWS D-9.1 not associated with the WPS or welder qualification apply.
   b. Ductwork fabricated from pipe may be made using WPSs qualified to the requirements of ASME Sect. IX provided the welders are qualified to ASME Section IX. All other requirements of AWS D-9.1 not associated with the WPS or welder qualification apply.
   c. Use the gas tungsten arc process with argon backing (purge) gas for welds in Technical Specifications 15897, 15895, and 15891. Analyze the purge with an oxygen analyzer to assure that oxygen does not exceed 1%.
   d. Unless otherwise specified on drawings or standards, make continuous fillet welds when the root or face is in contact with the contained media to eliminate cracks and crevices.
   e. Make pressure boundary weld joints continuous.
   f. Grind weld joints which are a portion of a gasket seating surface smooth and flush with adjacent base metals.
   g. Wire brush welded joints and seams to remove surface oxides, burrs, sharp edges, and weld spatter.
   h. Brush stainless steel material with clean, stainless steel wire brushes that have not previously been used on materials other than stainless steel.
   i. GMAW with short circuiting transfer is prohibited for ductwork welding of materials greater than 1/8 in. thick.

D. Liner Plate Welding

1. Weld stainless steel liner plate as follows:
   a. Use the gas tungsten arc process or the gas metal arc process.

b. Purge the back side of the weld with Argon or helium. Analyze the purge with an oxygen analyzer to assure that oxygen does not exceed 1%.
c. Do not use copper or aluminum as temporary backing.
d. Do not use the SMAW, FCAW, or SAW process for root pass welding of stainless steel piping welds.
e. The GTAW or GMAW process may be used for fillet welds or groove welds in liner plate.

3.2 ON-SITE WELDING

A. Operational Control
1. Division 18, Welding, implements the method of accomplishment for on-site welding and, therefore, is the Construction Manager's on-site welding specification which applies unless otherwise approved by the Construction Manager. To be in full compliance with the references in Part 1, welding must be within the operational control of each organization performing it. This may be achieved by each organization describing in their quality control program or adopting by reference to this section the following elements.
   a. Each Subcontractor using Div. 18, Welding, may request the CM to make changes. Identify the section number and the suggested change. General comments that the specification is unacceptable will be returned for specific comments.
   b. The CM and its Subcontractor records acceptance of Division 18 and each WPS to be used by signing a copy of the example form included in Attachment F.

B. General Responsibilities
1. Owner
   a. Maintains a comprehensive set of qualified on-site WPSs and PQRs for on-site welding.
2. Construction Manager
   a. The CM provides management of Contractor and Subcontractor welding activities.
   b. The CM is responsible for qualifying Pipe Welding WPSs when the applicable code does not permit shared WPSs..
   c. The CM performs checks of welding activities to verify compliance with this specification and and the WPSs.
3. Contractor or Subcontractor
   a. The Contractor is responsible for providing welding services in full compliance with the applicable code, contract, technical specifications, design drawings, and all other specified design documents.
   b. The Contractor is responsible for performing checks of welding activities to verify compliance with this specification and the WPSs.

C. Welding Procedures
1. The elements necessary to achieve qualified welding procedure specifications are summarized below. Comprehensive sets of on-site WPSs are provided in other sections as follows:
   a. 18350, Piping Welding Procedure Specifications (Div. 18B).
   b. 18351, Pipe Welding Procedure Specifications for Special Applications (Div. 18B).
   c. 18450, Ductwork Welding Procedure Specifications (Div. 18B).
2. General
   a. Use Div. 18B WPSs for on-site welding unless otherwise approved by the CM.

b. The following documents located in Div. 18B, used together, constitute a qualified welding procedure.
   1) WPS (Sect. 18350, 18351, or 18450).
   2) General Welding Requirements referenced by the WPS (Sect. 18310, or 18410).
   3) The PQRs referenced on the WPS.
   4) The weld joint details referenced on the WPS (Sect. 18370, or 18470) or shown on the drawing.

3. Subcontractor
   a. Accomplish on-site welding using Div. 18B weld procedures. These procedures have been or will be qualified in advance by the CM as required to be compliant with the applicable construction/welding codes. The CM will provide copies of the PQRs to its Subcontractor as is necessary for their acceptance of the WPS.
   b. When possible, use the prequalified (shared) on-site welding procedures as allowed by ASME B31.3, para. 328.2.2; procedures prequalified per AWS D1.1; or Procedures qualified by the Construction Manager per AWS D9.1 or D1.3. The Subcontractor representative's signature on Attachment F attests that the Subcontractor accepts the procedure without requalification. For ASME B31.3 shared procedures, the Seller must maintain at all times one certified welder whose qualification was tested and accepted by bend tests.
   c. For weld procedures which are not prequalified (shared), the Subcontractor submits PQRs which support the full range of the WPS in Div. 18. The Subcontractor's PQRs are entered on Attachment F. The Subcontractor's representative signs the form accepting the WPSs and PQRs. The Subcontractor is responsible for his own welders' testing and procedure qualifications.
   d. If a weld is identified that is not covered by this specification, notify the CM so that procedures can be provided.
4. Exception
   a. When specifically authorized by the CM, the Seller may submit its own written weld procedures and PQRs for approval to be used for on-site welding.

D. Weld Joint Details
   1. Use the piping and ductwork weld joint details specified on the WPS unless otherwise specified by the construction drawings. For on-site welding, weld joint details are provided in Sect. 18370, or 18470, which are available from the CM on request.

E. Welder Qualifications
   1. The key elements necessary to achieve qualified welders and welding operators are summarized below. The detailed administrative requirements necessary to achieve compliance with the applicable codes are provided in Sect. 18360, or 18460. Each organization performing welding is responsible for instructing their welders in the appropriate general welding requirements in Sects. 18310, 18410, and 18600.
   2. Subcontractor
      a. Provides welder qualification records to the CM and its Subcontractor and assigns a unique identification to each qualified welder.
      b. Verify the identity of each welder or welding operator.
      c. Provide the CM with a record of welder process usage by completing Attachment B
      d. May designate a responsible individual in accordance with the appropriate code to oversee the qualification of their welders and cosign test and inspection results.
   3. Exception

e. When specifically authorized by the CM to use Subcontractor supplied procedures, the Subcontractor submits welder certification records for approval by the CM for welders to be used for on-site welding.

F. Weld Execution

1. Each organization performing welding on-site is responsible for the following:
   a. Providing welding services in full compliance with the applicable code, contract, technical specifications, design drawings, and other specified design documents.
   b. Ensuring that the specified weld procedure is qualified for the application and that the welder(s) is currently qualified for the procedure and for the specific range of welds to be made.
   c. Notify the CM to resolve any situations in which weld procedures are not qualified for the full range of welding, or if welding of materials is required for which a procedure does not currently exist.
   d. Notifying the CM prior to the start of any welding activities. The Subcontractor fills out the form in Attachment C, “CM and Subcontractor Notification of Planned Welding Activities”, and submits “For Information” to the CM.
   e. Maintaining the “Weld History Cards” included in Attachment D and supplying weld sketches when specified on the “Weld History Cards”.
   f. Identifying completed welds using welder identification numbers assigned by the responsible organization.
   g. Maintaining project records required by the specification for base materials procured by that organization and filler materials used until completion of the project, at which time the records will be submitted to the Construction Manager.
   h. Repairing welds that fail acceptance standards.

G. Pipe WPSs

1. The welder selects one of the WPSs from Table 18100A-1. The piping WPSs are included in Section 18350 or 18351 that are available from the CM upon request.
2. SM11-1(PP), SM11-2(PP), GT11-1(PP), GT88-1(PP), GT88-2(PP), and SM88-1(PP) may be used (shared) by the Subcontractor, without requalification, as allowed by ASME B31.3. The remaining WPSs in Sect. 18350 or 18351 require qualification by the Subcontractor prior to use. Once qualified by a Subcontractor, the procedure may be used on-site by that Subcontractor indefinitely without further requalification. Submit for approval copies of the PQR to the Construction Manager prior to using WPSs that may not be shared.
3. Weld pipe supports using one of the pipe welding WPSs from Sect. 18350 for the materials specified in the technical specification.

Table 18100A-1

Section	Piping Material	Welding Procedure
15104, 15106	Carbon Steel - All sizes and weld types	GT11-1(PP)
	Carbon Steel - Fillet welds and groove welds in pipe, fittings, and branch connections with greater than 1 2 inch outside diameter	GT11-1(PP),SM11-1(PP), or SM11-2(PP)
15128, 15130, 15146, 15455, 15456 Note 1	Stainless Steel – All sizes and weld types	GT88-1(PP),GT88-2(PP) (Note 2)

Table 18100A-1

Section	Piping Material	Welding Procedure
	Stainless Steel – Fillet welds and groove welds in pipe, fittings, and branch connections with greater than 1 1/2 inch outside diameter	GT88-1(PP),GT88-2(PP) (Note 2), SM88-1(PP)(Note 3)
NOTES: 1. Filler materials for these systems require certified material test reports. 2. This WPS uses a flux-coated wire with restrictions noted on the WPS. 3. Para. 3.01.C.1 prohibits the use of the SM process for the root pass of piping welds.		

H. Ductwork WPSs

1. The welder selects the WPS for ductwork welding from Table 18100A-2. The WPSs are provided in Sect. 18450.
2. Weld ductwork stiffeners, attachments, or supports using one of the WPSs from Sect. 18450 or as permitted in para. 3.1 for the materials specified in the technical specifications.
3. For ductwork fabricated from pipe, select a pipe welding procedure from Sect. 18350 appropriate for the materials.
4. WPSs for ductwork welding may be used without additional qualifications.

Table 18100A-2

Section	Ductwork Service	Welding Procedure
15897	Stainless Steel	GT88-1(DW), GT88-2(DW),
15895	Stainless Steel Certified Materials	GT88-1(DW) (see Note) GT88-1 (PP)
NOTE: Filler materials for this system require certified material test reports.		

I. Liner Plate WPSs

1. The welder selects one of the WPSs from Table 18100A-3. The WPSs are included in Section 18350. GT88-1(PP) or GM88-1(PP) may be used (shared) by the Subcontractor, without requalification. The remaining WPSs in Sect. 18350 or 18351 require qualification by the Subcontractor prior to use. Once qualified by a Subcontractor, the procedure may be used on-site by that Subcontractor indefinitely without further requalification. Submit for approval copies of the PQR to the Construction Manager prior to using WPSs that may not be shared.

Table 18100A-3

Section	Piping Material	Welding Procedure
05121 Note 1	Stainless Steel Plate – All thicknesses and weld types	GT88-1(PP), GM88-1 (PP) (Note 2)
NOTES: 1. Filler materials for these systems require certified material test reports. 2. This WPS uses a flux-coated wire with restrictions noted on the WPS.		

J. Inspection/Examination
   1. The CM will provide the following:
      a. Inspect welding activities as necessary to assure compliance with this specification. As a guide, at least 5% of all welding activities should be randomly inspected for compliance with the specification. This does not relieve or replace the responsibility for each organization to monitor their own work as described in Section 3.2.F.
      b. Selection of welds to be inspected/examined, as required by this specification.
   2. The Subcontractor will provide the following:
      a. Weld inspection/examination services required by the specifications. This does not relieve the Subcontractor from complying with other requirements of the code.
      b. Interpretation of the results of weld inspections/examinations and acceptance or rejection of inspected/examined welds.
      c. Prepare and file inspection/examination reports.
      d. Maintain status of completed examinations.
      e. Timely notification of all inspection results.
      f. Enter status of completed examinations on “Weld History Cards”.

3.3 PERSONNEL CERTIFICATION REQUIREMENTS FOR ON-SITE AND OFF-SITE WELD EXAMINATIONS

A. Personnel performing nondestructive examination other than visual shall be currently certified per the employer’s written practice in accordance with SNT-TC-1A. Only individuals certified as NDT Level II or III may perform nondestructive examinations in accordance with this specification.

B. Personnel performing visual examination of welds shall be currently certified as an AWS CWI

C. The Level III shall, in the methods certified, conduct the examination of Level II personnel for those same methods.

3.4 EXAMINATION OF ON-SITE AND OFF-SITE STRUCTURAL WELDS

A. Required Examinations
   1. Visually examine all completed structural welds in accordance with AWS D-1.1, Sect. 6.

B. Examination Procedures and Acceptance
   1. Perform examinations to written procedures in accordance with AWS D1.1. Submit weld examination procedures for approval prior to welding.
   2. Acceptance criteria for examination of structures is in accordance with the criteria for “Statically Loaded Nontubular Connections” of AWS D-1.1, Table 6.1.

3.5 EXAMINATION OF ON-SITE AND OFF-SITE PIPING WELDS

A. Required Examinations

1. Examination Required for Category D Fluid Service Pipe Welding

Section

15104 15106

a. The inspector shall randomly select (spot check) a sufficient number of welds (5% min of each system) for examination in order to be satisfied that they conform to the specification. Include welds made by each welder or welder operator in those examined. Include the following activities in spot checks: base materials; weld joint fit-up; alignment of parts; surface cleanliness; welder qualification; adequate access to weld; filler material; WPS followed; purge; and workmanship.

b. Perform a final visual examination of all welds (not just the 5% specified by ASME B31.3) in accordance with ASME B31.3, para. 341.4.1(a).

c. If a random examination reveals a defect, the requirements of ASME/ANSI B31.3, para. 341.3.4, Progressive Examination, apply.

d. For Section 15104 liquid-penetrant weld all welds in accordance with ASME B31.3, para. 344.4.

2. Examination Requirements for Normal Fluid Service Pipe Welding

Section

15146 15455 15456

a. The inspector shall randomly select (spot check) a sufficient number of welds (5% min of each system) for examination in order to be satisfied that they conform to the specification. Include welds made by each welder or welder operator in those examined. Include the following activities in spot checks: base materials; weld joint fit-up; alignment of parts; surface cleanliness; welder qualification; adequate access to weld; filler material; WPS followed; purge; and workmanship.

b. Perform a final visual examination of all welds (not just the 5% specified by ASME B31.3) in accordance with ASME B31.3, para. 341.4.1(a).

c. The inspector shall randomly select (spot check) a sufficient number of welds (5% min of each system) for radiography. Include welds made by each welder or welder operator in those examined.

1) Examine fully by random radiography in accordance with ASME B31.3, para. 344.5, the circumferential butt and miter groove welds selected. Include at least 1 1/2 in. of the longitudinal welds which intersect the circumferential or miter groove welds in the radiographs.

d. Radiograph 100% of fabricated longitudinal welds (excluding those in components made in accordance with a material specification) in accordance with ASME B31.3, para. 344.5.

e. When approved by the Engineer in writing, the in-process visual examination alternative to radiography described below may be substituted for every field weld that the Engineer determines to be impractical to radiograph.

f. If a random examination reveals a defect, the requirements of ASME B31.3, para. 341.3.4, Progressive Examination, apply.

3. Examination Requirements for Special Service - 15128 & 15130

a. Perform a visual examination of the weld joint fit-up of all welds to assure, at a minimum, that markings and certifications of base materials and filler materials are in accordance with specified requirements, the base metals are of specified

thicknesses and types, materials are free from contaminants, fit-up meets the joint detail for the welding procedure specification, the weld purge is set up properly and exit gas is being analyzed with calibrated equipment, and the welder is qualified to make the weld.

b. Perform a final visual examination of all welds (not just the 5% specified by ASME B31.3) in accordance with ASME B31.3, para. 341.4.1(a).

c. Examine fully by radiography all circumferential butt and miter groove welds in accordance with ASME B31.3, para. 344.5. Include at least 1 1/2 in. of the longitudinal welds which intersect the circumferential or miter groove welds in those radiographed.

d. Fully radiograph 100% of fabricated longitudinal welds (excluding those in components made in accordance with a material specification) in accordance with ASME B31.3, para. 344.5.

e. Liquid-penetrant examine all pressure boundary welds and attachment welds to the pressure boundary after completion of the last layer of weld in accordance with ASME B31.3, para. 344.4.

f. When approved by the Engineer in writing, the following alternative to radiography may be substituted for every field weld that the Engineer determines to be impractical to radiograph.

1) In-process examination as described below;

2) liquid-penetrant examine the root layer and the final welds in accordance with ASME B31.3, para. 344.4.

4. Examination Requirements for Stainless Steel Liner Plate – 05121

a. Perform a visual examination of the weld joint fit-up of all welds to assure, at a minimum, that markings and certifications of base materials and filler materials are in accordance with specified requirements, the base metals are of specified thicknesses and types, materials are free from contaminants, fit-up meets the joint detail for the welding procedure specification, the weld purge is set up properly and exit gas is being analyzed with calibrated equipment, and the welder is qualified to make the weld.

b. Perform a final visual examination of all welds.

c. The following alternative to radiography shall be substituted for every field weld:

1) In-process examination as described below;

2) liquid-penetrant examine the root layer and the final welds after completion of the last layer of weld.

5. In-process Examination Requirements

a. When approved by the Engineer, perform the following visual examinations as a substitute for the required radiography:

1) joint preparation and cleanliness;

2) preheating;

3) fit-up, joint clearance, and internal alignment prior to joining;

4) variables specified by the joining procedure, including filler material, position, electrode, etc.;

5) condition of the internal weld root surface by direct visual examination, by the use of a borescope, or by using the window method of examining the partially completed weld root prior to final closure of the weld roots;

6) condition of the root pass external surface after cleaning aided by liquid penetrant or magnetic particle examination when specified in the engineering design (As is the case for 15128 and 15130).

7) slag removal and weld condition of at least each layer of weld metal. The welder shall notify the examiner after each layer of weld before progressing to the next layer;

8) a final weld examination for at least the attributes and to the acceptance criteria specified in ASME B31.3.

b. The weld examiner records individual weld examinations for in-process examinations.

B. Examination Procedures and Acceptance Criteria

1. Perform examinations to written procedures in accordance with ASME B31.3, para. 343. For radiography, the geometric unsharpness shall not exceed the limits of ASME Section V, paragraph T-285. Two complete sets of acceptable radiographs for each weld radiographed are required for off-site welds. Submit weld examination procedures for approval prior to welding.
2. The acceptance criteria of ASME B31.3, para. 341.3.2, and Table 341.3.2 for normal fluid service apply for visual and radiographic examination with the exception that incomplete penetration for complete penetration welds is unacceptable.
3. The acceptance criteria for liquid-penetrant examination follows:
   a. Relevant indications are those with major dimensions greater than 1/16 in.
   b. The following relevant indications are unacceptable:
      1) cracks;
      2) linear indication (indication whose length is more than three times its width);
      3) rounded indications with dimensions greater than 1/16 in.;
      4) four or more rounded indications in a line separated by 1/16 in. or less edge to edge; and
      5) ten or more rounded indications in any 6 sq. in. of surface area with the major dimension of this area not to exceed 6 in. and with the area taken in the most unfavorable location relative to the indications being evaluated.

3.6 EXAMINATION OF ON-SITE AND OFF-SITE DUCTWORK WELDS

A. Required Examinations

1. Visually examine all final ductwork welds.
2. For ductwork systems in accordance with Sects. 15895 and 15897, visual and liquid-penetrant examine the final weld surface of all pressure boundary and wetted perimeter welds, in accordance with ASME V, Article 6.

B. Examination Procedures and Acceptance Criteria

1. Perform visual examinations to written procedures in accordance with AWS D9.1. Perform liquid penetrant examinations to written procedures in accordance with ASME Section V, Article 6, or ASTM E-165.
2. The acceptance criteria of AWS D-9.1, para. 6 applies for visual examination of welds.
3. Indications exceeding 1/16 in. in any dimension are rejectable for liquid-penetrant examinations.

3.7 TESTING LINER WELDS

A. Responsibilities

1. The Subcontractor provides the following:
   a. Leak testing materials, equipment, and services required by the specifications.
   b. A plan for tracking the status of tests and inspections.
   c. Accept or reject tests and identify welds failing the test.
   d. Certify that all liner leak boundary welds passed the leak test at job completion.

B. Required Tests

1. For all welds acting as a leak boundary perform vacuum box bubble test per ASME Section V, Article 10 and Article 10 Appendix II. Prepare and submit a vacuum box bubble test procedure before testing welds. Substitute liquid penetrant examinations per

para. 3.4 for the vacuum box leak test for leak boundary welds that the Subcontractor and the CM's oversight inspector jointly agree are impractical to vacuum box test.

2. Select a bubble forming solution that is compatible with the material being tested and the applicable specification section.
3. Perform the test at a partial vacuum of at least 4 psi below atmospheric pressure.

C. Acceptance

1. Evidence of through-wall discontinuities indicated by a continuous stream of bubbles is unacceptable. Retest after completely removing, rewelding and reexamining the discontinuities. Sealing over the surface of a discontinuity is prohibited.

D. Records

1. Submit a testing/inspection plan for the leak boundary liner welds for approval prior to fabrication. Address the method for tracking the status of inspections and tests of liner welds that support the Subcontractor certifying on completion that all welds passed the testing requirements of this specification.

3.8 REPAIR

A. The Subcontractor is responsible for the repair or replacement and reexamination of rejected welds.

WELDER PERFORMANCE QUALIFICATION REQUEST REQUIREMENTS

CM, and LMES or CM Subcontractors request welder or welding operator qualifications on this form.

1. The welder's supervisor fills out and signs the form.

   SUBCONTRACTOR

   Sends the form to the CM Welding Engineer 48 hr in advance (when practical) of the need for qualification testing.

   CM

   The CM's welding engineer or his designee signs the form.

   The CM's welding engineer or designee will witness the test and sign the Welder Qualification Test Record form. If the CM will be sharing Weld Procedure Specifications as allowed by Sect. 18100A, para. 3.2 H, designates a welder to be qualified by bend tests.

2. The welder performs the Performance Qualification Tests requested. These tests will be witnessed by the Weld Test Shop test supervisor/welding inspector. The responsibilities are described in Div. 18, Welding, Sect. 18100 and Sect. 18360, or 18460 as appropriate.

3. The test supervisor/welding inspector fills out the Welder Qualification Test Record form at the conclusion of the tests.

4. The test supervisor/welding inspector signs the form for Facilities Manager welders. A representative of the company that employs the welder signs the record for CM and its subcontractor welders.

5. The original records are filed by the CM.

6. The welder's qualification information is added to the welder qualification data base which is distributed a minimum of once each month.

ATTACHMENT A

REQUEST FOR WELDER OR WELDING OPERATOR PERFORMANCE QUALIFICATION

SNS

FILL OUT FORM IN BLACK INK

Name	Employee No.	Stencil No.
Dept.	Employer	Test Date

List Standard Test Numbers from Div. 18, Welding, Sect. 18360, or 18460.
If you don't know the Standard Test Numbers, skip and fill out the next section below.

1.	2.	3.
4.	5.	6.

If you don't know the standard test numbers, describe the welding you expect the welder to do.

Code:			Piping ASME B31.3				Ductwork AWS D9.1		Other	
Process:	SMAW		GTAW		FCAW		GMAW-SA		GMAW	OTHER
Base Material 1	CS	SS	Ni	Cu	NiCu	CuNi	Alum	Other		
Base Material 2	CS	SS	Ni	Cu	NiCu	CuNi	Alum	Other		
Form	Pipe	(Smallest Diameter_____)					Plate			
Thickness	Minimum					Maximum				
Filler Material										
Other										
If B31.3, should welder be qualified by bend tests?					Yes	No				

Signature-Supervisor	Date
Signature-MK-F Welding Engineer (1)	Date

Note 1: Not required for LMES welders.

WELDER PERFORMANCE QUALIFICATION UPDATE REQUIREMENTS

All CM, and CM Subcontractor welders whose qualifications are maintained by the CM use this form to update.

Either of the following activities will update a welder's qualifications in the welding process used:

1. The welder using the process or procedure on a job observed by a welding inspector or supervisor, and that observation is documented.

2. The welder welding a sample coupon observed by a welding inspector or supervisor, and that observation is documented.

The "Record of Welder or Welding Operator Process Usage" Form UCN-18983 is available from the CM and is designed for documenting this activity. Fill out the form in black ink.

The following procedure is required:

1. The welder signs the form acknowledging use of the procedure.

2. The welding inspector, or the welder's supervisor who observed the welding verifies this information for each procedure/process (GTAW, SMAW, GMAW, etc.) usage entry on the form.

3. The welder's supervisor signs at the bottom of the form verifying the accuracy and completeness of the form. The supervisor is responsible for the welder properly updating each qualification.

4. After a welding update test has been completed, the inspector administering the test signs as the person verifying use of the process and as the supervisor.

<u>CM and Its Subcontractors</u>

1. CM and its subcontractors keep the original form for their records.

2. For CM and its subcontractor welders updating their qualifications the original form is sent to the CM.

The CM retains all records as necessary for audit purposes.

RECORD OF WELDER OR WELDING OPERATOR PROCESS USAGE

SNS

FILL OUT FORM IN BLACK INK

WELDER'S NAME	EMPLOYEE NUMBER		STENCIL NUMBER
DEPARTMENT	EMPLOYER		
PROCEDURE/PROCESS (GMAW,SMAW,GTAW,etc.)	**DATE USED PROCESS**	**WELDER SIGNATURE**	**INSPECTOR/SUPERVISOR SIGNATURE**
SIGNATURE-SUPERVISOR		DATE	

RETURN THIS FORM TO THE CONSTRUCTION MANAGER

THE SUPERVISOR IS RESPONSIBLE FOR THE WELDER PROPERLY UPDATING EACH QUALIFICATION.

ATTACHMENT C

CM AND SUBCONTRACTOR

NOTIFICATION OF PLANNED WELDING ACTIVITIES

Week of

Fax completed form to CM prior to 2:00 PM each Friday

DATE	TIME	W.O. #	LOCATION	TECH. SPEC.	DESCRIPTION	No. of WELDERS	No. of WELDS

ATTACHMENT C (continued)

Welding Inspection Service Request

To: Construction Manager	**Request No.:** (this block filled out by ET&I)
Requester's Name:	**Date of Request:**
Requestor's Mailing Address:	**Requestor's Phone and Pager No.**
Division / Department / Organization:	**MJR / Work Order No.:**
Building / Location of Fabrication and Installation:	**Labor / Materials Charge No.:**
Project / System:	**Technical Specification:**
Welding Category: Piping Structural Ductwork Incidental	**Drawing / ESO No.:**

Welding Specification:
LMES DIV. 18 ASME B31.3 AWS D.1.1 Other

Type of Examination or Inspection Required

Procedure / Specification for Examination
Visual Weld Examination
Liquid Penetrant Examination
Magnetic Particle Examination
Other Test/Examination Requested

24 hour advanced notification of needed service will be issued by
Name / Phone

Special Instructions:

Distribute Inspection Reports To:

Name/Bldg./MS/Phone

Dispositioned By: _____ Date: _____ETI-109 (3 3/99)

ATTACHMENT D

WELD HISTORY CARD FOR _____

Work Order No.	Card No. / Page of	Initiated By / Reviewed By	Date / Date	**WPS** GT88-1(PP) or SM88-1(PP) (Restrictions of 18100, para. 3.01 apply for SMAW)	Specification/Code – ASME B31.3 Section 15128 Piping WELD SKETCHES REQUIRED FOR THIS SYSTEM

WELD PLANNING DATA (Completed by designee of company performing welding)					INSPECTION REQUIRED & STATUS (LMES inspection/examination personnel initial & date)							REMARKS
Weld No.	WPS	Filler Type/Heat	Welder(s)/Date	Spot Check	Spot Inspection	VT-FU 100%	VT-F 100%	PT-F 100%	RT 100%	N/A	N/A	
W-1												
W-2												
W-3												
W-4												
W-5												
W-6												
W-7												
W-8												
W-9												
W-10												
W-11												
W-12												

FINAL REVIEW	CM/Subcontractor Review Date	Facilities Manager Review Date

VT-FU = Fit-up visual VT-F = Final visual VT-RI = Visual external weld root and internal root surface by direct visual, window method, or borescope.
VT-R = Visual external and internal root surface when accessible by use of mirrors and flashlight. VT-IP = Visual of all intermediate weld passes
In_Process Visual = VT-FU, VT-RI, VT-IP, and VT-F
PT-R = Liquid penetrant of root pass PT-F = Liquid penetrant of final weld PT-ID = Liquid penetrant of final inside root surface RT = Radiographic examination
Spot Check = Spot observation of welding activities for compliance with the specification by a person designated by the welder's employer.
Spot Inspection = Oversight to verify conformance to the welding program. Include at least 5% of functions not included in the required examinations.

ATTACHMENT E

WELD AND INSPECTION REQUIREMENTS FOR DUCTWORK WELDS AND LINER PLATE WELDS

WELD PLANNING DATA			INSPECTION REQUIRED					REMARKS
Specification or Drawing No.	WPS	Spot Check	Spot Inspection	VT-F 100%	PT-F 100%	RD-F 5%	PT-R	
15891 Ductwork-Aluminum-All Welded	GT23.23-1(DW)	Req'd.	Req'd.	Req'd.	N/A	N/A	N/A	
15897 Ductwork-Stainless Steel-All Welded	GT88-1(DW),	Req'd.	Req'd.	Req'd.	N/A	N/A	N/A	
15895 Ductwork-Stainless Steel-All Welded-Certified Materials	GT88-1(DW), GT88-1(PP)	Req'd.	Req'd.	Req'd.	Req'd.	Req'd.	N/A	
05121 Stainless Steel	GT88-1(PP), GM88-1(PP)	Req'd.	Req'd.	100%	100%	N/A	100%	

VT-FU = Fit-up visual VT-F = Final visual RD-F = Radiography of Final Weld
PT-R = Liquid penetrant of root pass PT-F = Liquid penetrant of final weld PT-ID = Liquid penetrant of final inside root surface
Spot Check = Spot observation of welding activities for compliance with the specification by a person designated by the welder's employer other than the welder.
Spot Inspection = Oversight to verify conformance to the welding program. Include at least 5% of functions not included in the required examinations.

ATTACHMENT F

FORM FOR CONTRACTOR ACCEPTANCE OF WPS (R)

WELDING PROCEDURE SPECIFICATION (WPS) NUMBER:

STRUCTURAL PIPE DUCTWORK REVISION:

CONTRACTOR	AUTHORIZED SIGNATURE	DATE	PQR(S)

NOTE 1: For shared procedures as allowed by ASME B31.3, para. 328.2.2; procedures prequalified per AWS D1.1; or procedures qualified by the Facilities Manager per AWS D9.1, the PQRs are those listed on the WPS. The contractor's signature asserts that he has reviewed and approves the WPS, the PQRs listed on the WPS, and the specifications referenced on the WPS. For ASME B31.3 shared procedures, the contractor must identify at all times one welder whose qualification was tested by bend tests.

ATTACHMENT G

WELDING MACHINE REQUIREMENTS FOR FIELD WELDING

1. SCOPE

These welding equipment requirements apply to construction, fabrication, or installation of metallic systems such as piping, duct work, and structures in locations where the system is in direct contact with the ground (earth) or with low-resistance materials which are in contact with the ground.

2. GENERAL REQUIREMENTS

The purpose of this procedure is to prevent stray welding currents from passing through the earth and contributing to accelerated corrosion of components in contact with the earth. These requirements are in addition to requirements imposed by the Welding Procedure Specification.

3. EQUIPMENT REQUIREMENTS

3.1 Use welding machines with no less than one megohm electrical resistance between the welding machine output and the machine enclosure.

3.2 Use welding cables with a voltage rating of at least 600 volts, and electrical resistance to ground of the insulation (welding cable and cable connectors) of no less than one megohm.

3.3 Provide footswitches, when used, which cut off voltage to the electrode holder when released.

3.4 For testing equipment, use a motor driven megger with output voltage of at least 500 volts d.c.

4. OPERATING PRACTICE

4.1 Locate the welding machine as near the point of welding as possible, and support both cables (positive and negative) off the ground by methods which will provide electrical isolation from the ground during machine operation. Make both cables as short as practical.

4.2 Firmly clamp the grounding cable for good electrical contact at a location which will provide a low resistance path to the weld and not permit stray currents through the earth. Attach the ground as near the weld as possible preferably on the material being welded (within 10 feet when possible).

4.3 Turn the welding machine off during extended periods of non-use such as lunch breaks, end-of-shift, or other welding delays.

4.4 The Facilities Manager inspector approves the initial setup at a job site and any significant changes in welding equipment arrangements when the work is on material in direct physical contact with the earth.

4.5 Do not allow the welding torch and “hot” connectors to contact wet earth while the welding voltage is on.

5. EQUIPMENT TESTING

5.1 The equipment owner/operator is responsible for assuring that the welding machine and welding cables meet the requirements of Section 3.0 prior to their installation at the job site.

5.2 Prior to use, have a qualified person test the welding equipment and/or allow the inspector to approve the equipment arrangement. No initial testing is required if sufficient information is provided as to the adequacy of the equipment. If the inspector questions any equipment, have the insulation tested in accordance with 5.3 or 5.4 by a qualified person.

5.3 Check the welding machine insulation resistance between the output terminals and the machine enclosure with the megger (Section 3.1 and 3.4) at 500 v.d.c. applied for a minimum of 15 seconds. CAUTION: if the inverse peak (I.P.V) rating of the rectifier is less than 500 volts, either short out the rectifier or use lower megger voltage.

5.4 Check the welding cable insulation integrity between the cable conductor and ground, with the cable arranged as for welding, with the megger at 500 v.d.c. applied for a minimum of 15 seconds for compliance with Section 3.2. If the initial test is made on a dry ground surface, repeat this test at the first opportunity following a rain while the cable and ground surfaces are wet. Follow this requirement for subsequent retests.

5.5 Install a 0-150 volt d.c. voltmeter on the welding machine and connect to indicate welding machine output voltage. Check this meter daily to confirm proper operation of foot pedal control if output voltage does not return to zero when the foot pedal is released, perform maintenance or have the pedal replaced.

5.6 Repeat the resistance test of 5.3 and 5.4 at the request of the Facilities Manager inspector at intervals depending upon weather, site conditions, equipment handling care, etc. When machines or cables are being used in a wet or muddy environment, repeat the test at least once each month.

5.7 Document the equipment checks of 5.3 and 5.4. Attach a check-off card (see Fig. 1 for an example) to each welding machine.

5.8 When a foot switch is not required for welding control, use a non-conductive support approved by the Facilities Manager inspector for holding the welding electrode and clamp when not in use. Include this support in the test of 5.4 with the electrode connected to the cable and resting on the support.

WELDING EQUIPMENT RESISTANCE CHECK

WELDING ORGANIZATION _____

JOB LOCATION _____

JOB TITLE _____

WORK ORDER _____

(Check appropriate column each day check is made.)

MONTH _____ YEAR _____

DAY	FOOT SWITCH	CABLE	MACHINE	DAY	FOOT SWITCH	CABLE	MACHINE
1				17			
2				18			
3				19			
4				20			
5				21			
6				22			
7				23			
8				24			
9				25			
10				26			
11				27			
12				28			
13				29			
14				30			
15				31			
16							

SIGN AT END OF MONTH OR END OF JOB	
DESIGNEE	INSPECTOR

ATTACHMENT H

WELDING REQUIREMENTS FOR HEPA FILTER HOUSINGS

PART 4 - GENERAL

4.1 SUMMARY

A. Section includes: Welding fabrication activities for HEPA filter housings.

4.2 REFERENCES

A. AWS D-9.1, Sheet Metal Welding Code, 1990 Edition.

B. AWS QC-1, Specification for Qualification and Certification of Welding Inspectors, 1998 Edition.

C. ASME Boiler and Pressure Vessel Code, Sect. IX, Welding and Brazing Qualifications, 1992 Edition.

D. ASME Boiler and Pressure Vessel Code, Sect. V, Nondestructive Examination, 1992 Edition.

E. ASME Boiler and Pressure Vessel Code, Sect. II, part C, Material Specification, 1992 Edition.

F. ASNT, Recommended Practice SNT-TC-1A, December 1988 Edition.

4.3 DEFINITIONS

A. Procedure Qualification Record (PQR): Written documentation of the qualification of a weld procedure by examination and testing of physical weld specimens made using the weld procedure.

4.4 SUBMITTALS

A. Approval of the following are required prior to welding.
   5. Welder/welding operator qualification records, including evidence of updates.
   6. Welding procedures and PQRs.
   7. Visual examination and nondestructive examination procedures.
   8. Qualifications of examination personnel.

B. Submit weld examination reports prior to delivery of the equipment.

C. Submit certified mill test reports for weld filler material.

4.5 QUALITY ASSURANCE

A. Welding to this specification requires that welders, welding procedures, inspectors, and inspection procedures meet the requirements specified in Part 2.

PART 5 - PRODUCTS

5.1 MATERIAL REQUIREMENTS

A. Welding rods and Electrodes.

1. Purchase ASME SFA5.9 or AWS A5.9, Classification ER308L filler materials with a minimum delta ferrite of 5 ferrite number. Use a minimum of schedule H level of testing per AWS A5.01. Use lot classification Class S3.

2. Verify filler materials are legibly marked in accordance with the General Requirements for each specification listed in AWS or the ASME boiler and Pressure Vessel Code, Sect. II, Part C, Material Specifications.

3. Verify bare filler material is identified with the applicable classification and/or specification numbers on each rod, strip, coil, or spool. Label each end of 36-in. rods.

4. Control, handle, and identify welding rods and electrodes at all times to avoid material degradation and to ensure they are identifiable as acceptable material until the material is consumed in the welding process.

B. Base Material

1. Control base material and the marking of cut material to ensure the material is identifiable and traceable to applicable documentation.

5.2 WELDING REQUIREMENTS

A. Make groove and butt welds complete joint penetration and continuous unless approved otherwise by the FM. Backwelding of groove welds is acceptable. Do not make welds smaller or shorter than specified by design requirements and indicated on drawings, and do not make them substantially larger or longer than specified without the approval of the engineer. Do not change the location of welds without the approval of the engineer.

1. Compliance with AWS D-9.1 is required for welding. Welds may be made using procedures and welders qualified to AWS D-9.1 or ASME Sect. IX within the limits of their respective qualification tests provided all other requirements of AWS D-9.1 are attained.

2. Unless otherwise approved, use the gas tungsten arc or gas metal arc process. Use argon backing (purge) gas for complete joint penetration welds welded from one side.

3. Unless otherwise specified on drawings or standards, make continuous fillet welds when the roof or face are in contact with the wetted perimeter or the air stream to eliminate cracks and crevices.

4. Make pressure boundary weld joints continuous.

5. Grind weld joints which are a portion of a gasket seating surface smooth and flush with adjacent base metals.

6. Wire brush welded joints and seams to remove surface oxides, burrs, sharp edges, and weld spatter.

7. Brush stainless steel material with clean, stainless steel wire brushes which have not previously been used on any other materials.

8. GMAW with short circuiting transfer is prohibited for welding materials greater than 1/8 in. thick.

B. Welding Procedures

1. Prepare written welding procedures and qualify them for the scope of welding required in accordance with the applicable code in para. 2.02 A.

C. Qualification of Welders

1. Qualify welders and welding operators to weld using the appropriate approved and qualified welding procedure(s). Submit records of qualification, including updates, as required by the applicable code for the procedure. The welder qualification requirements and limits of qualification are those of the code for which the procedure is qualified.

2. Written approval of the qualification records is required prior to welding.

D. Welder Stamps

1. The Seller assigns each welder or welding operator a unique identification symbol. Welders use this symbol to identify each weld, either by stenciling the symbol adjacent to the weld or by records traceable to the weld joint.

5.3 INSPECTION/EXAMINATION OF WELDS

A. The Seller is responsible for the performance of specified examinations. These examinations may be performed by Seller personnel or by an outside qualified examination service.

1. Submit examination personnel certifications for approval.

2. Submit examination procedures for approval.

3. Examine welds in accordance with para. 2.03 C.

4. Welds are subject to inspection by the Facilities Manager and/or the CM. The Facilities Manager or CM may request additional weld examinations on any weld to establish the quality of the weld. The Facilities Manager reserves the right to accept, reject, or demand removal of welds which are interpreted to be in violation of this specification.

B. Examination Personnel Certification Requirements

1. Personnel performing nondestructive testing other than visual shall be currently certified in accordance with SNT-TC-1A. Only individuals certified for NDT Level I and working under the supervision of an NDT Level II or III or individuals certified as NDT level II or III may perform nondestructive testing to this specification.

2. Personnel performing visual examination of welds shall be currently certified either as an AWS CWI or in accordance with the requirements of SNT-TC-1A as in para. 2.03 B 1, or work under the direct supervision of an SNT-TC-1A Level II, III, or CWI. If certified to SNT-TC-1A, satisfy the training and experience requirements entirely by time spent in weld examination related work.

C. Examination of Welds

1. Visually examine all welds.

2. Liquid-penetrant examine the final weld surface of all pressure boundary and wetted perimeter welds, in accordance with ASME V, Article 6.

D. Acceptance

1. The acceptance criteria of AWS D-9.1, para. 6 applies for visual examination of welds.

2. Linear indications (length greater than three times the width) exceeding 1/16 in. in length are rejectable for liquid-penetrant examinations.

5.4 REPAIR

A. The Seller is responsible for the repair or replacement and reexamination of rejected welds.

END OF SECTION 18100A