Submerged-Arc-Welded Steel Pipe
Supplementary to CSA Z245.1-07

EES102 – (2010)

Enbridge Pipelines Inc.
Enbridge Energy Partners L.P.

Revision: 1.0
Approval Date: March 4, 2010
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1 Scope

1.1 General: Replace

This Specification covers requirements for the manufacture, qualification, inspection and testing of submerged arc-welded steel pipe for transportation of hydrocarbon fluids. This Specification supplements the requirements of CSA Z245.1-07, Steel Pipe and is to be used in conjunction with that standard. For continuity, clause numbers in this Specification follow the same sequence and primary headings as CSA Z245.1-07. Clauses in this Specification may either add to or replace requirements of CSA Z245.1-07, and are identified as such. Additional clauses covering subjects not addressed by CSA Z245.1-07 have been inserted in sequence. Clauses specified in CSA Z245.1-07 that are not applicable to this Specification have been left out.

The requirements of the Appendices of this Specification shall also be met when applicable.

Specific agreements with individual Manufacturers shall be attached as addenda to this Specification and are only applicable to that Manufacturer. Pipe shall be supplied to meet this Specification, the requirements specified on the Specification Datasheet and the purchase order applicable to each order.

Any and all deviations from this Specification shall be brought to the attention of the Company in writing for resolution prior to final acceptance.

1.2 - 1.3: Applicable

2 Reference Publications: Replace

This Specification refers to the following publications and where such reference is made, it shall be to the latest edition of the publication. In case of discrepancies between this Specification, CSA Z245.1-07, referenced publications, purchase orders or any other related documents, the more stringent requirement shall apply unless otherwise agreed by the Company.

Publications referenced are:

National Energy Board Act
Onshore Pipeline Regulations

CSA Z662
Oil and Gas Pipeline Systems

CSA Z245.1-07
Steel Pipe

ASME B31.3
Process Piping

ASME Section IX
Boiler and Pressure Vessel Code: Welding & Brazing Qualifications

ASTM E384
Standard Test Method for Microindentation Hardness of Materials

All pipe shall meet the requirements of CSA Z245.1-07, this Specification and shall be satisfactory for installation, testing and operation as specified by CSA Z662 and ASME B31.3.
3 Definitions: Additional

In addition to the terms referenced in CSA Z245.1-07, the following definitions shall also apply:

Crack - a stress induced separation of the metal which, without any other influence, may be insufficient in extent to cause complete rupture of the material.

Company - the company which is stated on the Specification Datasheet as Purchasing Company, and shall include any so-designated authorized representatives.

Lot - a lot for testing frequency is the heat number as assigned by the steel mill. The lot shall also be considered to mean material produced and rolled to plate or coil using the same rolling practice made into pipe using the same forming and welding procedures.

Manufacturer - a pipe manufacturer who proposes to, or has been contracted to, provide to the Company pipe manufactured to this Specification.

Specification Datasheet - information issued to the prospective manufacturer in a format as outlined in Appendix C of this Specification, and shall also include information issued to the Manufacturer on purchase order documentation or on any request for quotation documentation associated with a specific project.

Welding Procedure - The Welding Procedure Specification (WPS), Procedure Qualification Record (PQR) and all associated nondestructive and destructive material test data.

4 General Requirements

4.1 Product Ordering Requirements: Applicable

4.1.1 Standard Requirements: Applicable

4.1.2 Optional Requirements: Replace

For optional requirements refer to Specification Datasheet and purchase order.

Additional Clauses:

4.1.3 Product Ordering

Product ordering requirements are listed in this Specification, Specification Datasheet and purchasing documents. The Specification Datasheet supplied for each order shall include applicable information outlined in Clauses 4.1.1: Standard Requirements and 4.1.2: Optional Requirements of CSA Z245.1-07. It shall remain the responsibility of the Manufacturer to clarify and submit as part of each specific quotation for supply, any specific requirements of these clauses not issued in request-for-quotation documentation.

4.1.4 Manufacturing Procedure Specification (MPS)

As part of the quotation for supply under this Specification, the Manufacturer shall submit an MPS document providing the information including, but not limited to, that listed in Appendix A. The MPS shall be approved by the Company in writing prior to commencement of production, and any subsequent changes to the agreed MPS shall be approved by the Company prior to implementation.
4.2 Joinability

4.2.1 Weldability: Additional

Pipe shall be capable of being welded in the field using conventional welding procedures qualified as specified by the latest edition of CSA Z662 and as specified by ASME Boiler and Pressure Vessel Code Section IX.

4.3 Rounding Procedure: Applicable

4.4 Quality Program: Applicable

Additional Clauses:

4.5 Nondestructive Examination

4.6 Internal Coating

Pipe ordered to this Specification may be internally coated. Where internal coating is specified, the coating contractor and the Manufacturer shall cooperate to produce a finished product that complies with this Specification and the Company’s specification for the Internal Coating of Line Pipe.

4.7 External Coating

Pipe ordered to this Specification may be externally coated. Where external coating is specified, the coating contractor and the Manufacturer shall cooperate to produce a finished product that complies with this Specification and the Company’s specification for External Coating for Line Pipe. Where the Manufacturer’s pipe mill is not responsible for the external coating and suitability for fusion bond epoxy (FBE) and other coatings are specified on the purchase order, the Manufacturer shall be responsible for ensuring the surface quality is adequate for such coatings.

5 Materials and Manufacture

5.1 Steelmaking Process: Applicable

5.2 Deoxidation Practice: Replace
5.3 **Skelp:** Replace

5.4 **Pipe Manufacture**

5.4.1 Applicable

5.4.2 Replace

Skelp end welds shall not be permitted in finished pipe.

5.4.3 Applicable

5.4.6 Applicable

*Additional Clauses:*

5.4.6.1.

Material grade shall be considered as an essential variable for qualification of welding procedures as specified by the ASME Boiler and Pressure Vessel Code, Section IX.

5.4.6.2.

Where specified, weld hardness traverse qualification tests are required for the pipe weld metal, parent metal and heat affected zone of longitudinal, helical and circumferential jointer welds.

5.4.6.3.

Utilization of pre-qualified welding procedures may be permitted, if qualification documentation meets requirements of this Specification and approved by the Company prior to start of production. Qualified production welding procedure shall be submitted to the Company 1 month prior to the start of the production.

*Additional Clauses:*

5.5 **Cold Expansion: Outside Diameter (OD)**

5.5.1
5.5.2

Suitable provisions shall be incorporated to protect welds from contact with the expander when mechanical expansion is used.

5.6 Surface Cleanliness

The Manufacturer shall maintain sufficient surface cleanliness for inspection purposes by a Company representative. Where necessary, plate, skelp or pipe may be cleaned by shot blasting.

5.7 Weld Procedure Qualification

All production and repair welding shall be qualified as specified by CSA Z662 and ASME Section IX as applicable.

5.8 Nondestructive Examination (NDE) – Pipe Seam and Double Joint (DJ) Weld

During production, should a change in qualified welding procedure be considered, the proposed procedure requires qualification as specified by Clause 5.7. Weld quality verification and acceptance by approved NDE procedures of the initial three (3) production pipe is required before pipe manufacturing may proceed.

5.9 Traceability – Materials Records

5.10 Traceability – Welding Records

6 Chemical Test Requirements

6.1 General: Additional
6.2 **Heat Analysis:** Replace

6.3 **Product Analysis**

6.3.1 **General:** Replace

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6.3.2 **Frequency:** Applicable

6.3.3 **Sampling Methods:** Replace
6.3.4 Preparation: Applicable

6.3.5 Retests

6.3.5.1 - 6.3.5.3: Applicable

6.3.5.4 Replace

Additional Clauses:

6.4 Reporting

6.4.1

Additional Clauses:

6.4.2

7 Mechanical Test Procedures

7.1 General

7.1.1 Replace

Test specimens shall not be heat tested, but shall be taken from pipe in the same condition as the finished bare metal or coated pipe and shall be representative of the pipe in the plain end condition.

The Manufacturer shall report and receive approval from the Company prior to production for the method to be used.

7.1.2 Applicable

Additional Clauses:

7.1.3

For the mechanical tests required under this Specification, lot size for testing frequency shall be as specified by Appendix B.
7.1.4
Samples for all mechanical tests shall be taken from first length of pipe processed for each lot.

7.2 Tension Tests
7.2.1 - 7.2.4.7: Applicable

7.2.5 Transverse Weld Tension Tests
7.2.5.1. Replace

7.2.5.2. Applicable

7.2.6 Retest: Applicable

7.5 Guided-Bend Tests
7.5.1 Submerged-Arc-Welded Pipe
7.5.1.1. Procedure
7.5.1.1.1. - 7.5.1.1.4.: Applicable
7.5.1.1.5. Additional Clause

7.5.1.2. Retests: Applicable

7.6 Charpy V-Notch Impact Tests: Applicable

7.7 Drop-Weight Tear Tests: Applicable

7.8 Hardness Tests: Additional
8 Mechanical Properties

8.1 General: Replace

Mechanical properties shall be determined as specified by Clause 7 of this Specification.

8.2 Tensile Properties

8.2.1 Body Tension Tests

8.2.1.1 Additional

8.2.1.2 Applicable

8.2.1.3 Additional Clause

8.2.2 Transverse Weld Tension Tests

8.2.2.1 - 8.2.2.2; 8.2.2.4 - 8.2.2.5: Applicable

8.2.2.6 Additional Clause

8.3 Ductility Tests

8.3.1 General

8.3.1.1 Replace

Submerged-arc-welded pipe shall be subject to the requirements of the guided-bend test.
8.3.3 Guided-Bend Tests

8.3.3.1 Submerged-Arc-Welded Pipe

8.3.3.1.1 Applicable

8.4 Notch-Toughness Tests – Pipe Body

8.4.1 Frequency: Applicable

8.4.2 Test Temperatures: Applicable

8.4.3 Category I Pipe Notch-Toughness Requirements: Replace

8.4.5 Category III Pipe Notch-Toughness Requirements

8.4.5.2 Absorbed Energy: Replace

8.4.5.3 Additional

8.5 Notch Toughness Tests – Weld

8.5.1 Submerged-Arc-Welded Pipe

8.5.1.1 Frequency: Replace

8.5.1.2 - 8.5.1.3: Applicable

8.6 Hardness Tests: Replace

8.6.1
9 Mill Hydrostatic Testing

9.1 Mill Hydrostatic Testing Requirements: Applicable

9.2 Test Duration: Applicable

9.3 Verification of Test: Replace

Individual pressure chart recordings shall be traceable to each pipe number and heat number. Hydrostatic test pressure gauges shall be calibrated with a deadweight tester prior to commencement of production, and at least daily thereafter, and after each expander failure and hydrostatic test failure in the presence of the Company representative. In addition, the tester shall be equipped with positive and automatic or interlocking device to prevent pipe from being classified as tested until the test requirements (pressure and time) have been met. The associated records or charts shall be available for examination.

9.4 Test Pressures: Replace

Additional Clauses:

9.4.1

9.4.2
9.4.3

9.5 End Load Compensation

9.6 Hydrostatic Test Records

The Manufacturer shall provide the formal test reports, complete with pressure charts, to the Company representative.

10 Dimensions, Masses and Lengths

10.1 - 10.5: Applicable

10.6 Mill-jointers

10.6.1 General: Replace

10.6.2 - 10.6.4: Applicable

10.7 Pipe End

10.7.1 Plain End Pipe

10.7.1.1. Applicable

10.7.1.2. Replace
10.7.1.3 - 10.7.1.5: Applicable

10.7.1.6. Replace

10.7.1.7. Additional Clause

Removal of weld reinforcement shall not reduce the wall thickness of the pipe below 95 percent of the specified wall thickness.

11 Inspection, Tolerances, and Work Quality

11.1 Inspection: Replace

The Manufacturer shall inspect pipe by a combination of visual and nondestructive methods to detect defects and to determine compliance with the dimensional and work quality requirements of this Specification. Manufacturer Inspection and Test Plans (or equivalent), including referenced procedures and practices, shall have been provided to the Company, reviewed and accepted by the Company for production to start.

Additional Clauses:

11.1.1

Company quality assurance personnel may be assigned to monitor all aspects of pipe production, testing and shipping and act as Company's representative in all matters pertaining to inspection and acceptance of pipe. Company quality assurance personnel may also be assigned to monitor steel making, casting and/or rolling operations.

11.1.2

All pipe shall be visually inspected. A visual inspection shall include, but not be limited to, examination of:

a) the entire external pipe surface including the weld seam, by the inspector walking the full length of the pipe;

b) the internal pipe surface, end to end, by crawling the pipe. For pipe 508 mm O.D. and smaller, the pipe internal inspection may be carried out visually at each end using suitable inspection lamps; and

c) the pipe ends.

11.1.3

The inside and outside surfaces of pipe presented for inspection shall be clean and free of unacceptable metallic or non-metallic contaminants including oil, grease, dirt, rust, scale, grinding residue and welding flux. If the Company representative determines that pipe has an
unacceptable level of cleanliness, it shall be returned to the Manufacturer for cleaning by methods acceptable to the Company. Heat and pipe number identification shall be maintained.

11.1.4

Slivers, scabs, bristles or other surface imperfections that could result in an unacceptable applied coating shall be considered as defects and removed by grinding or by other means acceptable to the Company.

11.1.5

11.1.6

Company pipe inspection representatives or third parties designated by the Company shall have the authority to reject any pipe that does not comply with this Specification.

11.2 Inspection Notice: Replace

The Manufacturer shall provide the Company with a current Manufacturing and Testing Schedule (or equivalent) at least one week in advance of the start of any such activities, to permit mobilization of Company representative.

11.3 Plant Access: Replace

11.3.1

The Manufacturer shall allow the Company free access to all steelmaking, casting and rolling mill facilities providing steel and/or skelp for the pipe order.

11.3.2

The Company may arrange under separate contract with one or more third party agencies to conduct supervisory, visual, mechanical, electromagnetic, ultrasonic or other types of inspection in the pipe mill, rolling mill, or steel mill. Manufacturer shall supply acceptable space to the Company as may be necessary for the performance of this work.

11.3.3

Manufacturers shall permit access by the Company to all test specimens and test records applicable to Specification compliance testing and production control testing during the manufacture of steel and pipe.
11.3.4
The Manufacturer shall provide for review by Company, documentation required by ISO 9001 with respect to manufacturing processes, quality program, inspection procedures and the qualification of inspectors.

11.3.5
Company representatives may, at Company's discretion, conduct audit checks as deemed necessary to ensure compliance with this Specification.

11.4 Tolerances on Dimensions and Mass

11.4.1 Tolerances on Outside Diameter – Pipe Body

11.4.1.1. Replace

11.4.1.2. Applicable

11.4.2 Tolerances on Outside Diameter – Pipe Ends

11.4.2.4. Replace

11.4.2.5. Applicable

11.4.3 Tolerances on Out-of-Roundness

11.4.3.1 - 11.4.3.2. Replace

11.4.4 Tolerances on Wall Thickness: Replace

11.4.5 Tolerances on Mass: Applicable

11.4.6 Tolerances on Length: Replace

Length tolerances shall be as specified on the Specification Datasheet.
11.5 Work Quality

11.5.1 Radial Offset at Weld Seams

11.5.1.2 Replace

11.5.2 Tack Welds in Submerged-Arc-Welded Pipe: Applicable

11.5.3 Misalignment of Weld Seam of Submerged-Arc-Welded Pipe: Replace

Refer to Clause 11.5.1.2.

11.5.4 Height of Inside and Outside Weld Beads of Submerged-Arc Welded Pipe

11.5.4.1 Replace

11.5.4.2 Replace

11.5.4.3 Applicable

11.5.7 Hard Spots: Replace
11.5.8 Location of Weld Seams

11.5.8.1 Location of Skelp End Welds

11.5.8.1.1 Replace

It shall not be permissible for skelp end welds to be present in finished longitudinal or helical seam pipe or jointer welds.

11.5.8.2 Location of Seam Welds at Jointer Welds: Applicable

11.5.9 Straightness: Replace

11.5.10 Geometric Deviations: Replace

11.6 Defects

11.6.1 Replace
11.6.2 Applicable

11.7 Residual Magnetism: Replace

11.7.1

The longitudinal magnetic field shall be measured on the root face of pipe ends prior to loading for shipment from the Manufacturer's facility.

11.7.2

A calibrated Hall Effect gauss meter that produces accurate and consistent results is required. An example of such a meter would be one produced by FW Bell-Series 5100 – Hall Effect Gauss-Tesla Meter. The meter must be calibrated at required intervals and the Manufacturer's operating instruction followed. Maximum readings occur when the flux lines are perpendicular to the sensor (hall element).

11.7.3

Measurements shall be made on each end of at least three pipes to be selected at 2 hour intervals during the operating shift. The measurements shall be recorded and documented.

11.7.4

Residual magnetism shall be measured on both ends of all pipes following any inspection or process that utilizes or produces a magnetic field, prior to loading for shipment from the Manufacturer's facility.

11.7.5

As a minimum, four readings shall be taken approximately 90° apart around the circumference of each end of the pipe. The average of the four readings shall not exceed 30 gauss (3.0 mT), and no one reading shall exceed 35 gauss (3.5 mT). Measurements shall be taken on the root face or square cut face of finished plain-end pipe. The hall element area of the probe shall be in contact with the root face or square cut face when the reading is taken. The flux lines shall be perpendicular to the hall element of the probe to ensure that maximum readings are obtained.
11.7.6

Measurements made on pipe in stacks or bundles are not considered valid. Pipes shall be separated by at least 300 mm and not be in contact in order to achieve valid residual magnetism readings. Pipe shall not be in contact with the ground and shall be off the ground at least 150 mm in height.

11.7.7

Any pipe that does not meet the requirements as listed above shall be considered defective. In addition, all pipe produced between the defective pipe and the last acceptable pipe shall be individually measured. All defective pipes shall be demagnetized full length and re-measured to ensure compliance with the requirements.

11.7.8

If the pipe has undergone a coating process that utilizes a magnetic field or has a magnetic field produced as the result of static electricity being discharged, all pipe ends shall be measured prior to stockpiling or shipment from the facility. The results shall be documented and recorded.

12 Nondestructive Inspection

12.1 General

12.1.1 Replace

The welded seams of submerged-arc-welded pipe shall be nondestructively inspected for their full length.

12.1.2 - 12.1.4: Applicable

Additional Clauses:

12.1.5

12.1.6

12.1.7
12.2 Methods of Inspection

12.2.2 Submerged-Arc-Welded Pipe

12.2.2.1 Replace

12.2.2.2 - 12.2.2.5: Applicable

12.2.4 Circumferential Jointer Welds: Additional

12.3 Qualifications of Personnel: Applicable

12.4 Radiological Inspection

12.4.1 Equipment: Applicable

12.4.2 Procedures: Replace

Additional Clauses:

12.4.2.1

12.4.2.2
12.4.2.3.

12.4.3 Sensitivity: Applicable
12.4.4 Image Quality Indicators: Applicable
12.4.5 Acceptance Limits: Applicable

12.5 Ultrasonic Inspection
12.5.1 Equipment
12.5.1.1 - 12.5.1.2: Applicable
12.5.1.3 Couplant: Additional

An audio device shall be used to indicate the loss of coupling effectiveness.
12.5.1.4 - 12.5.1.6: Applicable

12.5.2 Reference Standards: Applicable
12.5.3 Standardization: Applicable
12.5.4 Acceptance Limits: Applicable
12.5.5 Alarm Limits: Applicable
12.5.6 Inspection Sensitivity Checks: Applicable
12.5.7 Ultrasonic Inspection: Plate or Skelp: Additional Clause

Plate or skelp shall be subject to straight-beam ultrasonic inspection as specified by ASTM A578.

12.7 Magnetic Particle Inspection: Applicable
12.8 Liquid Penetrant Inspection: Applicable
12.9 Nondestructive Inspection of Pipe Ends
Additional Clauses:

12.9.1

The finished bevel of all pipe ends shall be inspected for seams and laminations using an ultrasonic, liquid penetrant or magnetic particle inspection method.

12.9.2

13 Repair of Pipe Containing Defects

13.1 General: Applicable

13.2 Grinding: Additional

13.3 Welding: Applicable

13.4 Procedure for Repair of Defective Welds by Welding: Additional

13.5 Repair Welding Procedure Tests

13.5.1 General: Applicable

13.5.2 Radiographic Test: Applicable

13.5.3 Transverse Weld Tension Test: Applicable

13.5.4 Transverse Guided Bend Test: Applicable

13.5.5 Additional Tests: Additional
13.6 Repair Welder Performance Tests: Applicable

13.7 Repair Weld Practice: Additional Clause

13.7.1
Circumferential jointer welds shall be made using procedures qualified as specified by ASME Boiler and Pressure Vessel Code, Section IX and also as specified by Clauses 5.4.6.2, 7.8 and 8.6.3 of this Specification as applicable.

13.7.2
Manufacturer shall monitor, record and report jointer production welding variables.

13.7.3
Welding records shall be fully traceable to jointer welds produced and provided to Company.

13.7.4
Weld procedure and welder qualifications shall be submitted for Company approval prior to the start of production welding.

14 Procedure for Welded Mill-Jointers

14.1 - 14.9: Applicable

14.10 Replace

The full length of circumferential jointer welds shall be ultrasonically inspected after hydrostatic testing as specified by Clause 12.2.4.

15 Markings and Coating

15.1 General: Applicable

15.2 Required Markings: Additional

o) Each jointer pipe shall also be identified with this Specification number and a unique “pipe number” that is fully traceable through the Manufacturer quality system to the coils, plates, slabs, ingots, strands, ladles or heats used to make each pipe of the finished jointer pipe, such as a triple jointer.

15.3 Marking Location and Method of Application

15.3.3 - 15.3.5: Applicable
Additional Clauses:

15.3.6

The pipe number, length and heat number (or code traceable to the heat number) shall be legibly and permanently marked on the inside of both ends of each pipe.

15.3.7

The pipe Manufacturer shall assign a unique traceability number to each length of pipe to facilitate tracking through the production and finishing and shall ensure that each section of pipe and jointer pipe are identifiable during each stage of the manufacturing process.

15.3.8

Additional marking requirements shall be outlined on the Specification Datasheet.

15.4 Sequence of Required Markings: Applicable

15.6 Coating: Applicable

17 Certification

17.1 Replace

The Manufacturer shall, within 2 weeks of manufacturing completion of each order, supply a certificate of compliance and MTRs in a format acceptable to the Company. Supply of material test certificates shall be a condition of acceptance and payment for pipe.

17.2 Replace

The Manufacturer shall furnish a report of the steelmaking process and casting method used.

17.3 Replace

The Manufacturer shall furnish a report of the type of skelp rolling mill used.

17.4 Additional

The elements reported shall also include all those referenced in Clause 6.3.1 of this Specification.

17.6 - 17.7: Applicable

17.8 Additional Clause

The reports and certificates shall also provide information including the following:

a) heat number and qualification pipe number;

b) mechanical test results applicable to body tensile tests, Y/T ratio, transverse weld tensile tests, notch toughness tests and hardness tests. (As applicable, reports of notch toughness
tests shall include a designation indicating that the pipe material complies with the minimum absorbed energy specified on the Specification Datasheet;

c) certification of hydrostatic test, including duration and pressure;

d) certification of completion of guided bend tests;

e) certification that nondestructive inspection was performed as specified, and met the requirements of this Specification and CSA Z245.1-07;

f) certification correlating pipe number to heat, coil and plate as applicable;

g) certification that the pipe has been manufactured as specified by the approved Manufacturing Procedure Specification, CSA Z245.1-07 and this Specification; and

h) expansion factor applied for cold expanded pipe.

Additional Clauses:

18 Shipping

18.1 General

18.1.1

With the pipe bid, the Manufacturer shall submit, for Company acceptance, procedures with necessary drawings and supporting calculations that detail methods of handling, stacking, protecting and securing pipe for mill storage and shipment. Procedures shall indicate the location of bunks, bearing strips, spacers and tie-down straps. Procedure revisions shall require acceptance by the Company before implementation.

18.1.2

As a minimum, rail transportation shall be as specified by API RP 5LI and marine transportation shall be as specified by API RP 5LW.

18.1.3

Pipe shall be handled, stored, loaded and transported in such a manner as to avoid damage, corrosion and induction of additional residual magnetism. Nylon slings, padded forks or special end hooks with soft non-metallic inserts shall be used for handling. The occurrence of critical stresses and the possibility of excessive cold work or fatigue cracking of the pipe in transit shall be avoided.

18.1.4

Weld seams of submerged-arc-welded pipe, including jointer welds, shall not contact separator blocks or any part of a truck, rail car, ship or other transportation device.

18.1.5

No direct contact shall be permitted between adjacent pipe, pipe and metallic tie-down devices or pipe and bulkheads. Minimum separation between pipe and bulkheads shall be 300 mm.
Suitable non-metallic materials such as rope encirclements shall be used to prevent metal-to-metal contact.

18.1.6

Rail cars, truck trailers, ship holds and any other transportation devices shall be adequately cleaned before loading for shipment.
Appendix A
Manufacturing Procedure Specification Requirements
Manufacturing Procedure Specification Requirements

The manufacturing procedure specification requirements include:

1. Material specification
2. Welding procedure specification
3. Pre-welding cleanliness requirements
4. Pre-welding heat treatment requirements
5. Welding procedure test parameters
6. Post-weld heat treatment requirements
7. Inspection and testing requirements
8. Quality control procedures
9. Acceptance criteria
10. Record-keeping and documentation requirements

For detailed specifications, please refer to the Engineering Equipment Specification EES102 - 2010.
Appendix B
Materials Testing – Frequency Table
Materials Testing – Frequency Table
Table B-1 Specification Testing Frequency

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</table>

Note: The table above shows the testing frequency for different materials. The specific tests are not detailed in the image.
Appendix C
Submerged-Arc-Welded Pipe Specification Datasheet
<table>
<thead>
<tr>
<th>Pipe Requirements</th>
<th>Item No.</th>
<th>OD (mm)</th>
<th>WT (mm)</th>
<th>Grade</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design and Operating Information</td>
<td>Class Location</td>
<td>Maximum Operating Pressure (kPaq)</td>
<td>Maximum Operating Temperature (°C)</td>
<td>Minimum Operating Temperature (°C)</td>
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<tr>
<td>Notch Toughness Tests</td>
<td>Test Location</td>
<td>Test Temp (°C)</td>
<td>Minimum Energy (Joules)</td>
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<td></td>
<td>Single Specimen</td>
<td>Single Test</td>
<td>All-Heat Average</td>
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<tr>
<td>Charpy Impact Test</td>
<td>Pipe Body</td>
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<tr>
<td></td>
<td>Weld &amp; HAZ's</td>
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<tr>
<td>Fracture Appearance</td>
<td>% Shear</td>
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</tbody>
</table>

Note 1: Single test means average of three CVN or two DWTT specimens
Note 2: Applies to orders filled with more than five heats (heat average)
Note 3: Energy requirements are for full size specimens

<table>
<thead>
<tr>
<th>Pipe Length</th>
<th>Minimum Single Pipe Length (m)</th>
<th>Maximum Single Pipe Length (m)</th>
<th>Minimum Average Pipe Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Coating</td>
<td>Coating Location</td>
<td>Coating Type</td>
<td>Coating Thickness</td>
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<tr>
<td>Pipe Colour Code</td>
<td>Required Y/N</td>
<td>Colour</td>
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### Supplementary Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Details</th>
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<tbody>
<tr>
<td>Plant Inspection</td>
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<tr>
<td>End Preparation</td>
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<tr>
<td>External Weld</td>
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<tr>
<td>Flush-Off</td>
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<tr>
<td>Plant Inspection</td>
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<td>Other</td>
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<table>
<thead>
<tr>
<th>Revision</th>
<th>Description</th>
<th>Initiated By</th>
<th>Reviewed By</th>
<th>Approved</th>
<th>Date</th>
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