ANGOSTURA FIELD DEVELOPMENT

TRINIDAD AND TOBAGO

Seamless Line Pipe Specification

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1.0 INTRODUCTION

1.1 Scope

This Specification defines the performance and technical requirements for the manufacture and inspection of seamless carbon steel line pipe for subsea non-sour service in the Angostura Field, offshore Trinidad.

Line pipe purchased to this Specification will be used for hydrocarbon transportation and shall comply with the requirements of the current edition of API Specification 5L except as modified by the requirements set forth herein. Product Specification Level 2 shall be applied, and as further amended by this Specification.

The line pipe surface shall be free from slivers, oil, grease and other contaminants that may interfere with the application and integrity of external corrosion protection coating. The line pipe shall be readily weldable using automatic welding, submerged arc welding and manual welding processes in common usage offshore to achieve maximum weld area hardness no greater than 270 Hvl0 without the need for pre-heating or post weld heat treatment.

Line pipe shall be suitable for bending using the induction bending process in accordance with COMPANY Induction Bends Specification. The surface of the line pipe to be utilized for bends shall be free of copper and other low melting point contaminants.

1.2 Definitions

COMPANY - BHP Billiton Petroleum (Americas) Inc. or its agents authorized in writing and acting on its behalf.

CONTRACTOR Entity supplying goods or services to the Company defined in this specification.

Approved - Approved in writing by BHP Billiton Petroleum. Approval shall have a corresponding meaning.

Concession - Deviations from this Specification or nonconformities to requirements set forth in this Specification identified during the provision of line pipe that have been authorized by Company and are documented within a fully approved Company's Concession Report.

Quality Plan - Contractor's procedures for the implementation of the Quality System and manufacture of the line pipe.

1.3 Abbreviations

This Specification uses the following abbreviations:

API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ASNT	American Society of Non-destructive Testing
EMI	Electromagnetic Inspection
ISO	International Standards Organization
MPI	Magnetic Particle Inspection
MPQ	Manufacturing Procedure Qualification
MPS	Manufacturing Procedure Specification
NDT	Non-Destructive Testing
UT	Ultrasonic Testing

1.4 Reference Documents

The following reference documents shall apply.

1.4.1 Codes and Standards

The CONTRACTOR shall, where applicable, provide line pipe in accordance with the latest edition of the following Codes and Standards:

API – American Petroleum Institute

API Spec 5L	Specification for Line Pipe
API RP 5LI	Recommended Practice for Railroad Transportation of Line Pipe
API RP 5LW	Recommended Practice for Transportation of Line Pipe on Barges and Marine Vessels

API Spec Q1	Specification for Quality Programs for the Petroleum and Natural Gas Industry
API BUL 5T1	Standard on Imperfection Terminology
API Std 1104	Welding of Pipelines and Related Facilities

ASME – American Society of Mechanical Engineers

ASME Sec V	Boiler and Pressure Vessel Code Non-Destructive Examination, Subsection A: Nondestructive Methods of Examination
ASME Sec IX	Welding and Brazing Qualifications

ASTM – American Society for Testing and Materials

ASTM A370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products, Annex A2 - Steel Tubular Products
ASTM E112	Standard Test Methods for Determining Average Grain Size

ASNT – American Society for Nondestructive Testing

ASNT-TC-1A	Personnel Qualification and Certification in Non-Destructive Testing

ISO – International Organization for Standardization

ISO R148	Steel - Charpy Impact Test (V-notch)
ISO 8501-1	Preparation of Steel Substrates Before Application of Paints and Related Products - Visual Assessment of Surface Cleanliness
ISO 9001	Quality Management Systems
ISO 10474	Steel and Steel Products - Inspection Documents

Latest editions shall be used including amendments, addenda, supplements, or revisions thereto.

In the event of any conflict between codes, standards, references, specifications and data sheets, the more stringent requirement shall apply.

2.0 HEALTH, SAFETY, AND ENVIRONMENTAL REQUIREMENTS

All work shall be subject to approval by COMPANY Representative. Failure to discover or reject defective work or materials shall not be construed as an acceptance of such work or materials.

All work shall be performed in accordance with the requirements of the CONTRACTOR's HSE standards and/or other equivalent or applicable safety codes and regulations. CONTRACTOR shall place the highest priority on safety and health while performing the work.

CONTRACTOR shall provide and maintain a safe working environment for employees during progress of work and shall adequately protect the health and safety of CONTRACTOR's agents, subcontractors, their respective employees, COMPANY Representative, the public, and other third parties.

All tools, equipment, facilities, and other COMPANY items used and practices employed in accomplishing the work are considered and agreed to be part of the working environment as used in this specification.

Solvent fumes from adhesives may be explosive under certain conditions; therefore, no flames, welding, or smoking shall be permitted during the use of solvents. Precautions shall be taken to ensure that all electrical switches or materials that could cause sparks are a safe distance from solvent fumes.

CONTRACTOR shall provide personnel with suitable safety masks as protection against toxic solvent vapors during solvent washing operation. Adequate provisions for removal of solvent fumes by a suction blower and re-circulation of fresh air shall be provided.

Air-moving blowers shall have ground wires to eliminate the possibility of static sparks during any solvent washing operations.

3.0 PROCESS OF MANUFACTURING

3.1 Manufacturing Procedure Specification (MPS)

The CONTRACTOR shall provide for review and approval a MPS which includes a complete and detailed procedure for the manufacture of line pipe, listing all sequential steps, including steel making, ladle metallurgy treatments, continuous casting practice, target chemical composition and control ranges, hot mill practices, pipe manufacture, sizing, and inspection procedures, as listed below. The Manufacturing Procedure Specification shall include an outline of the mill control procedures and quality assurance practices carried out to assure that pipe meets the requirements of this Specification.

CONTRACTOR shall include details of techniques used to provide proper quality for surfaces to be coated by the Fusion Bond Epoxy process (FBE). CONTRACTOR shall include a description of quality control measures in the Manufacturing Procedure Specification that ensure surface quality consistency.

The CONTRACTOR shall submit for approval to COMPANY a complete MPS in accordance with the requirements set forth in this Specification, detailing the production of line pipe. The MPS shall include the following items:

- Name of steel mill
- Steelmaking method
- Deoxidation practice
- Desulphurization practice
- Chemical composition range
- Special additions
- Ladle treatments
- Vacuum degassing
- Slab treatments
- Pipe piercing and forming procedures including reductions and temperature range at each stage
- Hardness survey procedures
- Heat treatment (including temperatures, hold times, heating and cooling rate, cooling medium and furnace details)
- Hydrostatic Testing Procedure
- Pipe Tracking System - Quality Plan
- Non-Destructive Testing Procedures (including visual inspection)
- Dimensional check methods
- Handling, Transport and Storage Procedures

3.2 Manufacturing Procedure Qualification

A pipe length will be selected by COMPANY's Representative from the first pipe lengths off the mill. This pipe shall be used for all qualification testing of the manufacturing procedure as detailed below.

Failure of any of the qualification tests shall be cause for rejection of the MPS and all pipe lengths produced to it. COMPANY reserves the right to require requalification in the case of any major changes to the approved MPS or interruption in the production of line pipe.

All Mill qualification testing shall be completed within ten working days after commencement of production or subsequent restart of production after an interruption of production.

3.2.1 Scope

This section outlines the tests and criteria required for qualifying the Manufacturing Procedure Qualification line pipe selected in accordance with this Specification. COMPANY shall have opportunity to witness and approve all specimen preparation and testing.

3.2.2 Test Requirements

The selected line pipe joint shall be used for the following tests and inspections:

Production Tests and Inspection

All tests and inspections required for production line pipe by this Specification shall be performed.

Chemical and Mechanical Tests

All production and mechanical tests specified in this Specification shall be performed.

Field Weldability of Pipe

Pipe weldability shall be demonstrated by by CONTRACTOR by the use of previous welding procedures for automatic SAW, GMAW and manual SMAW, GTAW processes for pipe of similar chemistry, hardness and grade. . These welding procedures, established in accordance with Section 5 of API 1104, shall be suitable for application by established methods of welding pipelines.

Strain Aging Test

A line pipe sample shall be strained 2% in the longitudinal direction and then heated for 1 hour at 150 ℃. Three Charpy specimens shall be machined from the sample in the direction transverse to the longitudinal direction and tested at 0℃. Charpy V-notch impact energy values shall meet the requirements given in API 5L Table F-3 of this Specification and all specimens shall display at least 80% shear area.

Charpy Transition Curves

Sets of three Charpy impact specimens, taken from the locations specified in this Specification, shall be tested at a range of temperatures to establish energy and fracture appearance transition curves for each location. The curves shall be supplied to COMPANY for information.

3.3 Steelmaking Process

The steel shall be made by either the basic oxygen or the electric arc furnace process and shall be desulfurized and dephosphorized if necessary to meet the requirement of this Specification.

The steel shall be fully killed and fine grained (grain diameter not greater than 9 per ASTM E112). Calcium or other elements shall be added as required for inclusion morphology control. CONTRACTOR shall submit for COMPANY review and/or approval, prior to use, the range (maximum and minimum) of elements added and methods for verifying proper inclusion morphology control and product uniformity.

3.4 Chemical Composition

CONTRACTOR shall include a chemical composition range in the Manufacturing Procedure Specification. The range shall comply with the requirements listed in Section 4.0. The control limits shall be agreed upon and defined in the Manufacturing Procedure Specification prepared by CONTRACTOR and reviewed and/or approved by COMPANY.

3.5 Field Weldability

The pipe shall be suitable for field welding with SMAW, GMAW, SAW, or GTAW processes without the need for preheating or post welding heat treatment. CONTRACTOR shall supply data on the girth weldability of pipe of similar chemical composition, grade, thickness and manufacturing techniques as required by this specification. The girth welds produced shall meet the requirements of COMPANY Field Welding Specification and shall have a maximum hardness of 270 Hv10. The welding procedures submitted by

CONTRACTOR to demonstrate the weldability of similar pipe, shall be suitable for application by established methods for welding offshore pipelines.

3.6 Tracking System

CONTRACTOR shall operate a computerized line pipe tracking system which ensures full traceability of each individual pipe length to its particular heat number and to records of all stages of the manufacturing process. CONTRACTOR shall submit full details of the line pipe tracking system for COMPANY approval.

The line pipe tracking data compiled by CONTRACTOR during manufacture shall be provided in ASCII, Word and/or Excel format on CD. Data shall be compatible with dBase IV software.

The specific information documented and recorded by the line pipe tracking system shall include, but not be limited to, the following:

- Pipe identification number/code
- Pipe identifier after pipe mill
- Identifier for this Specification and Purchase Order
- Date on which ingot was made
- Date on which pipe was made
- Production start up pipe
- Length of pipe
- Weight of pipe
- Date and pressure of hydrostatic test
- Result/ date of final bench test
- Description of repairs and disposition
- Destination for pipe loaded out
- Consignment identifier for load-out
- Date on which pipe is dispatched

4.0 CHEMICAL COMPOSITION AND TEST POSITION

4.1 Composition

The chemical composition of the steel as presented in the Manufacturing Procedure Specification shall conform to the following limits:

Element	Max. permitted content, wt%
Carbon	0.12
Manganese	1.60
Silicon	0.45
Phosphorous	0.020
Sulphur	0.006
Aluminum	0.050
Titanium	0.025
Vanadium	0.08
Niobium	0.07
Nitrogen	0.009
Boron	0.0005
Calcium	0.0050
CE[1]	0.36
Pcm[2]	0.21

Notes:

1. CE (Carbon Equivalent) = C+Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15
2. Pcm = C+Si/30+(Mn+Cu+Cr)/20+Ni/60+Mo/15+V/10+5B

The CE shall not be less than 0.29, but not more than 0.36.

No intentional addition of boron or nitrogen shall be allowed. The minimum percentage of boron indicated herein shall be as a result of residuals from other elements, processes or equipment utilized during steel making.

When calcium or other elements are added for inclusion morphology control, the method for verifying the effectiveness of the practices shall be described in the Manufacturing Procedure Specification. The amount of elements to be added shall be given in the Manufacturing Procedure Specification.

Any other element(s) added intentionally shall be reported and any deviations from this Specification shall be stated by Contractor and shall be subject to review and/or approval by Company.

4.2 Heat Analysis

CONTRACTOR shall conduct a product analysis on the first pipe length used from each heat or from each batch of 100 pipe lengths, if there are more than 100 pipe lengths from a heat. The elements and residuals listed in Section 4.1 shall be reported by CONTRACTOR, from a cross section rather than from a surface analysis of the line pipe. If the value of any elements falls outside the limits listed, the pipe lengths made from the heat shall be rejected. At the discretion of COMPANY, CONTRACTOR may be permitted to check each pipe length from the rejected heat for compliance with this Specification. CONTRACTOR shall include the product analysis methods in the Manufacturing Procedure Specification submitted to COMPANY for review and/or approval.

5.0 MECHANICAL PROPERTIES AND TESTS

5.1 General

All tests shall be performed by CONTRACTOR in accordance with the Quality Plan submitted by CONTRACTOR for COMPANY approval. The acceptance criteria shall be in accordance with API 5L (Specification for Line Pipe) except as modified herein.

Production testing of pipe shall be carried out once for each 100 pipes with a minimum once per each heat.

Test specimens shall be taken by CONTRACTOR from pipe lengths that have been successfully heat treated. COMPANY will have the right to select pipe lengths for production testing.

5.2 Tensile Properties

The yield and tensile strength of the line pipe shall be in accordance with API 5L (PSL-2) (Table 3B). Yield strength shall not exceed the minimum specified by more than 18 ksi. Additionally the measured tensile strength of each test pipe shall not exceed the minimum, by 18 ksi. One longitudinal and one transverse tensile test shall be taken on the pipe material.

5.2.1 Transverse Tensile Properties

At least one transverse tensile test per 100 pipe lengths or a minimum of one per heat is required from the pipe body. The use of the ring expansion methods for determination of transverse yield strength is not acceptable. Transverse tensile properties shall conform to API 5L. The yield/tensile ratio shall not exceed 0.90.

5.2.2 Longitudinal Tensile Tests

Longitudinal tensile specimens shall be machined from the pipe body and tested at the same frequency as the transverse tensile specimens. The preparation of the specimens and acceptable criteria shall be those stated in API 5L. The yield/tensile ratio shall not exceed 0.90.

5.3 Fracture Resistance Tests

Charpy impact tests shall be performed on each test ring taken for tensile testing and tested in accordance with Appendix F, section SR5B of API 5L. The tests shall be conducted at 32°F (0 °C). The minimum impact energy shall be in accordance with the values listed in API 5L Table F-3.

Longitudinal sub-size specimens shall be extracted if transverse specimens cannot be obtained. The absorbed energy requirements for subsize specimens shall be pro rata those of full size specimens.

The fracture surface appearance of each specimen shall also be reported. A minimum of 80 % shear area shall apply.

5.4 Hardness Measurements

CONTRACTOR shall perform hardness surveys on cross section from one pipe length per 200 pipe lengths produced. Specimens shall also be taken for macro-graphic examination. Vickers hardness surveys are to be conducted in accordance with the procedures reviewed and/or approved by COMPANY. The maximum hardness shall be 270 Hv10.

6.0 HYDROSTATIC TESTS

CONTRACTOR shall hydrostatically test all pipe lengths at the mill in accordance with Section 9.4 of API Specification 5L to test pressure of 100% SMYS (based on minimum wall thickness) for a hold time of 15 seconds.

The hydrostatic testing gauge shall be calibrated against a dead weight tester before start of production an at least once per shift, thereafter. The pressure chart recorder shall be calibrated against the hydrostatic testing master gauge at least twice per working shift and as directed by COMPANY.

The identification number of the pipe length being test shall be legibly recorded on the hydrostatic test pressure charts. Pressure gauges used in the hydrostatic testing shall be a range of 11/2 to 3 times the minimum test pressure.

7.0 DIMENSIONS, WEIGHTS, AND LENGTHS

7.1 Diameter

7.1.1 Line Pipe Body

The outside diameter of the line pipe body shall be measured by CONTRACTOR and recorded at one location on the line pipe. The outside diameter of the line pipe body shall not deviate from the nominal value by more than 0.10 inch.

7.1.2 Line Pipe Ends

The inside diameters of both ends of each line pipe shall be measured by CONTRACTOR using a go/no-go gauge The measured inside diameter shall not deviate from the specified value by more than +/-1.6mm (219.1mm pipe) and by +/-1.8mm for 273.1mm pipe.

7.2 Out of Roundness

7.2.1 Line Pipe Body

The outside diameter of each line pipe shall be measured using a C- Gauge or COMPANY reviewed and/or approved equivalent at four locations spaced equidistantly around the circumference of the body of the line pipe. The difference between the maximum and minimum outside diameters on anyone line pipe length shall be less than 1.0%of the nominal diameter.

7.2.2 Line Pipe Ends

The inside diameters of both ends of each line pipe shall be measured by CONTRACTOR using a rod type gauge, or COMPANY approved equivalent, at four locations spaced equidistantly around the circumference, 4 inch from the end of the pipe. The difference between the maximum and minimum internal diameter measurement shall be less than 3mm.

7.3 Wall Thickness

The wall thickness of each pipe length shall be measured at several locations and at any location shall not deviate from the specified value by more than +12% or -8%.

7.4 Weight

CONTRACTOR shall weigh each pipe length and the results shall be included as part of the line pipe tracking record. The weight per unit length shall not vary more than +6.5% or -3.5% from the nominal weight.

7.5 Length

CONTRACTOR shall provide the pipe lengths in accordance with the following:

Minimum	Maximum	Minimum Avg.
39.4 ft (12.0 m)	41.3 ft. (12.6 m)	40 ft. (12.2 m)

CONTRACTOR shall measure the length of all line pipe and the results shall be included as part of the line pipe tracking record.

7.6 Straightness

The maximum deviation from a straight line shall not exceed 0.15%over 40 ft and 3.2mm over the last 1m from each end as defined in API-5CT All completed pipe lengths shall be rolled over a proven flat bed, or measured against a taught wire, to

demonstrate straightness. Any straightening shall be undertaken using procedures fully reviewed and/or approved by COMPANY.

7.7 Jointers

Jointers shall not be permitted.

7.8 Squareness

CONTRACTOR, at least once during each working shift shall perform squareness verification on two finished pipes lengths, selected by COMPANY. The pipe lengths shall be laid on horizontally aligned "V" blocks or roller and their ends butted together. The gap at the joint shall be measured by means of a tape gauge and shall not exceed 0.10 inch at any position when one pipe length is rotated. CONTRACTOR shall turn each pipe length end to end and the procedure repeated. Full details of the method used shall be included in the Manufacturing Procedure Specification.

7.9 Pipe Ends

The line pipe shall be supplied with a machined standard API 5L 30° bevel. The surface of the bevel shall be sufficiently smooth and free from tool marks as to permit proper inspection for laminations.

8.0 NON-DESTRUCTIVE INSPECTION

8.1 General

Nondestructive testing (NDT) shall conform with Section 9 of API 5L and as modified herein. Complete and detailed procedures for all nondestructive testing shall be set forth in the Manufacturing Procedure Specification submitted for COMPANY approval prior to commencement of WORK.

8.2 NDT Procedure

The NDT procedures shall include, but not be limited to, the following information:

- Equipment

  CONTRACTOR shall nominate equipment to be used and shall stipulate calibration and maintenance program.

- Personnel

  All operators of NDT equipment shall have a thorough knowledge of the operation of the equipment to be used and shall be required to demonstrate their ability to carry out NDT to the satisfaction of COMPANY before the start of WORK. All NDT operator qualifications and capability to perform examination will be reviewed and/or approved by COMPANY.

  Operator qualification shall be to a minimum of ASNT - TC-1A Level 2 or equivalent unless pipe is automatically rejected by machine, in which case Level 1 qualifications are acceptable. An examiner qualified to ASNT - TC-1A Level 3 or equivalent in all NDT techniques used shall be available to COMPANY.

- Preparation

  (a) Scanning Sheets

  CONTRACTOR shall in the case of ultrasonic examination submit as an essential part of its procedure detailed scanning technique sheets for all pipe lengths to indicate 100% coverage.

  (b) Examination Technique Sheets

  Technique sheets, for all pipes, shall contain information such as, type of steel and form, details of any repairs and specification/ examination criteria and acceptance criteria.

- Evaluation

  CONTRACTOR shall demonstrate by sectioning of pipe the absolute sensitivity of nondestructive testing procedures by relating indications to the size, location and nature of imperfections. The methods of assessing sensitivity shall be at the COMPANY's sole discretion.

- Reporting

  CONTRACTOR shall include copies of proposed report formats and demonstrate the ability to allow complete duplication of all examinations to the original parameters at a later date. Sufficient information shall be included to enable any examination to be repeated and repeatable results obtained.

8.3 Calibration

The calibration standard shall be located on project pipe of the same diameter, thickness and composition as the pipes to be examined.

Calibration of equipment shall be performed by CONTRACTOR whenever it has been out of function for any reason including on/off and whenever there is any doubt concerning proper functioning of the equipment.

For dynamic equipment, the Manufacturing Procedure Qualification shall include tests performed in both longitudinal and transverse orientation on test pieces containing artificial defects of the type which the testing procedure is intended to detect. The speed of calibration testing shall be compared to that of production testing. The notch type shall be N5. Calibration notch maximum length shall be 1.0 inch. Manual ultrasonic units shall be calibrated by CONTRACTOR in accordance with ASME Section V, Article 5.

Ultrasonic inspection shall be performed in accordance with Sections 9.7.4 and SR4.3 Appendix F of API 5L with a signal acceptance limit of 80% full screen height. CONTRACTOR shall provide complete information regarding calibration for review and/or approval by COMPANY.

During Manufacturing Procedure Testing, calibration checks shall be performed and recorded. The ultrasonic testing equipment shall be recalibrated at least once per working shift. If, on checking calibration during routine product testing, all reference standards are not detected, then all pipes tested since the previous calibration shall be retested after the equipment has been correctly calibrated. The results of all calibrations should be recorded and made available to COMPANY REPRESENTATIVE.

8.4 Inspection Requirements

The surface examined shall be clean and smooth and free of tool marks, i.e. free from dirt, paint or any other foreign matter which would invalidate the test or which may influence the results of testing. All line pipe shall be completely examined along the body ultrasonically for defects by CONTRACTOR. Pipe ultrasonic inspection method shall be in accordance with API 5L, Section 9 and Appendix F Supplementary Requirements SR4.

The surface of the bevel on all pipe lengths shall be smooth and free from tool marks. CONTRACTOR shall inspect every completed bevel for laminations and cracks by Magnetic Particle Inspection in accordance with ASME V, Article 7, Clauses T-743 or T-744 or COMPANY approved equivalent.

8.5 Acceptance Criteria

Acceptance shall be in accordance with API 5L Section 9 including Appendix F Supplementary Requirements SR4 and this Specification. An imperfection in excess of 0.04 inch in depth and 1 inch in length shall be considered an injurious defect and shall be given one of the dispositions specific in API 5L, Section 9, except that repairs by welding to the pipe body are not permitted. No cracks or discontinuities with a crack like morphology shall be permitted. In cases dispute the COMPANY interpretation of defects shall apply.

Wall thickness shall be in accordance with API 5L, Section 7.3 except as modified by this Specification.

Acceptance levels for Magnetic Particle and Ultrasonic inspection of pipe ends shall be in according with ASME Section VIII, Division 1 Appendix 6.4.

The external surface of all pipe to used for hot induction bending shall be subjected to 100% magnetic particle examination under fluorescent light in accordance with a procedures reviewed and/or approved by COMPANY. The surface of pipe intended for bending shall be free of copper and other low melting point contaminates.

8.6 Pipe Ends and Bevel Inspection

The line pipe ends and bevel of each line pipe joint shall be inspected for laminations by COMPANY approved ultrasonic inspection procedure. Line pipe ends and bevels shall be inspected using magnetic particle inspection for circumferential laminar indications on the bevel and longitudinal indication and similar defects within 8 inch of the pipe ends.

After removal of the indication from the pipe length CONTRACTOR shall re-examine the ends of the pipe length utilizing ultrasonic or magnetic particle techniques. asset forth in this Specification:

If additional defects are detected the pipe length shall be rejected.

Any longitudinal indications in the pipe body shall be further evaluated using hand held ultrasonic equipment. Circumferential indications on the bevel face shall be accepted in accordance with API 5L.

8.7 Magnetism

A digital or analogue gauss meter with a directional probe with an accuracy of +/- 2.0 Gausss shall be used by CONTRACTOR to determine the residual magnetism at both pipe ends. No residual magnetism in either longitudinal or transverse direction to pipe axis shall be greater than 18 Gauss. Demagnetization should be applied if the magnetic

measurement is greater than the acceptable level. The method of degaussing shall be included in the Manufacturing Procedure Specification.

9.0 WORKMANSHIP, VISUAL INSPECTION AND REPAIR DEFECTS

9.1 General

The workmanship visual inspection, repair, and disposition of defects shall be performed by CONTRACTOR in accordance with Section 9 of API 5L and as modified herein. COMPANY shall be entitled to reject pipe with excessive mill damage (e.g. scratches, dents, deep or rough grinding, gouges and similar items) if the total of ground surface exceeds 5% of the total surface area, even though the individual damaged areas are acceptable according to this Specification.

9.2 Dents

Pipes with dents exceeding API 5L Section 7.8.1 shall not be acceptable.

9.3 Defects

Any imperfection having a depth greater than 5% of the specified wall thickness, measured from the surface of the pipe, shall be considered a defect and may be ground out subject to remaining wall thickness remaining within the tolerances stated in this specification. CONTRACTOR shall define defects in accordance with API BUL 5TI.

Crack or crack-like defects shall be cause for rejection of the pipe length. Crack or crack-like defects are defined as linear discontinuities which includes separation of the metal.

9.4 Hard Spots

Hard spots shall be defined as by API 5L except that the hardness limit shall not exceed 270 Hv10. CONTRACTOR shall specify in the Manufacturing Procedure Specification the steps taken during production to prevent the presence of hard spots.

9.5 Repair of Defects

CONTRACTOR shall provide pipe free of significant defects. The repair of significant defects shall be allowed only with the approval of COMPANY. Repair of minor round bottomed defects in the pipe body by grinding, shall be allowed provided the wall thickness after grinding is not less than the specified minimum thickness. The ground area shall be 100% magnetic particle inspected with wall thickness checks using ultrasonic. Repairs by welding are not permitted.

Significant defects that occur near the end of the pipe length shall be rectified by removing a cylinder from the pipe length containing the defect.

9.6 Rejection

If, at any stage in production, the failure rate exceeds 5%, the quality control program shall be increased as appropriate until the failure rate during production is less than 5%. If the total of test failures exceeds 10% of those tested, or if, on anyone day, more than 10% of the production is rejected for other reasons, COMPANY will require CONTRACTOR to cease production until the cause of the problem has been identified and corrected.

Testing performed by CONTRACTOR that fails to meet the criteria depicted in this Specification shall cause the heat that is represented by the samples to be rejected. In the event of a rejected heat CONTRACTOR shall perform additional testing of the heats cast immediately before and immediately following the rejected heat. If any additional heat fails CONTRACTOR shall demonstrate by further testing the acceptability of all heats not tested.

10.0 MARKING AND COATING

10.1 General

CONTRACTOR shall mark all pipe supplied to this Specification for identification against a certificate. When material is stored, the identification markings shall be easily accessible. Materials which cannot be identified shall be rejected. Marking shall, generally, comply with the requirements of Section 10 of API 5L, but die stamping shall be used only as specified by COMPANY.

10.2 Marking

The minimum requirements for marking of linepipe utilizing paint and stencil on the inside surface at one end are:

1. Heat Number
2. Purchase Order/Item Number
3. Pipe Number
4. API 5L Materials Grade
5. Specified wall thickness and outside diameter
6. Measured weight and length

All such markings shall be carried out by a methods reviewed and/or approved by COMPANY and described in the Marking Procedures. Color coding bands shall be applied to the outside surface as specified on the Purchase Order. The pipe length number shall be hard stamped by CONTRACTOR on the bevel face at one end of the pipe.

10.3 Coating

The pipe shall be free from oil, grease and metal turnings and shall be supplied bare unless otherwise specified by COMPANY.

11.0 DOCUMENTATION AND CERTIFICATION

Documentation relating to the supply of pipe shall be provided by CONTRACTOR. Certificates shall be validated by COMPANY's representative in accordance with EN 10204 3.1C.

Certification shall cover all results required by this Specification. All certificates shall be marked with sufficient information to enable full traceability to the items it represents and the relevant specifications and procedures.

12.0 HANDLING, TRANSPORT AND STORAGE

12.1 General

CONTRACTOR shall submit for COMPANY approval, information detailing the proposed method of handling, stacking, and securing line pipe lengths during manufacture, storage and shipment. No welding of temporary attachments for handling, stacking or securing shall be permitted. All handling, loading and unloading shall be performed in such a safe manner as to avoid mechanical damage and corrosion. All handling shall be performed with certified soft slings, or pipe-shaped padded hooks reviewed and/or approved by COMPANY.

12.2 Bevel Protectors

Bevel protectors or hookable plastic end-caps, of a type reviewed and/or approved by COMPANY shall be supplied and installed before stockpiling or load out of the pipe.

12.3 Transport

Tail cars, trucks, lighters, ships or other conveyances shall be cleaned of debris or any substance that might damage the line pipe during handling and load out. Suitable timber and other dunnage shall be used to protect the line pipe against damage in transit.

Loading onto or into rail cars, trucks, lighters, ships or other conveyances shall be performed in accordance with API 5L1 or API RP 5LW as appropriate. In all cases loading shall be in accordance with the Packing and Shipping and Handling Procedures reviewed and/or approved by COMPANY.

No on-deck overseas shipment shall be allowed. Loading, removal of ship covers and unloading of line pipe shall be witnessed by COMPANY's representative, whose decisions on the suitability and acceptability of line pipe protection and handling during loading and unloading shall be final.

12.4 Protection

Finished line pipe to be stored by CONTRACTOR for a significant period of time at the mill or marshalling yard shall be stored in a safe manner to prevent corrosion. The storage techniques shall be in accordance with the Storage Procedure provided by CONTRACTOR to COMPANY for review and/or approval.

Suitable methods for the protection of internal surfaces from the effects of moisture during transport shall be provided by CONTRACTOR in the Handling Procedures reviewed and/or approved by COMPANY.

Methods utilized to transport line pipe for induction bending purposes shall be contained in the Handling Procedures provided by CONTRACTOR to COMPANY for review and/ or approval. The methods shall include a description of the technique proposed to ensure copper and other low melting point contaminants are not deposited on the exterior of the line pipe.

Line pipe shall not rest on projections which could result in point stresses or be allowed to rub on an adjacent object. Line pipe loading and unloading shall be performed in accordance with API 5L1 or API 5LW, as applicable.

13.0 QUALITY ASSURANCE

13.1 General

The CONTRACTOR shall establish and maintain a fully documented Quality Assurance/Quality Control System in accordance with API Q1 or ISO 9001.

COMPANY reserves the right to observe the work in progress at any given time and shall include any subcontractors and all locations.

CONTRACTOR shall provide access to all work areas where the work is being conducted.

CONTRACTOR shall submit for COMPANY review and approval an Inspection and Test Plan prior to commencing work.

CONTRACTOR shall input the required information into a Certification Data Base.

13.2 Quality Plan

Prior to commencing Work, the CONTRACTOR shall prepare a written Quality Plan which describes the inspections to be performed during the supply of line pipe. The Quality Plan shall identify witness, hold, review, and monitor points.

13.3 Quality Records

13.3.1 The CONTRACTOR shall maintain quality records as documenting evidence of conformance to quality requirements. Quality records shall be made available to COMPANY's Representative for analysis and review.

13.3.2 Quality records shall include item identification by reference to revision number, acceptance criteria, specific inspections performed and results obtained (if measurements are not a requirement, include in the record the basis of acceptance), date of inspection, identification of inspector, data recorder charts, qualification of material, personnel, procedures and equipment. The CONTRACTOR shall perform trend analyses of all factors affecting the quality of the product.

13.4 Final Inspection

The CONTRACTOR shall inspect the line pipe to ensure compliance with Contract requirements and check all inspection records to verify that the line pipe was inspected at all points shown in the Quality Plan and that these records are complete.

13.5 Tracking System

The CONTRACTOR shall operate a line pipe tracking system which ensures full traceability of each individual pipe length to its particular heat number, and which records all stages of the pipe manufacturing process. The CONTRACTOR shall submit full details of the pipe tracking system for approval.

13.6 Verification

At the sole discretion of COMPANY, the CONTRACTOR's inspection systems may be subject to evaluation and surveillance by COMPANY representative to ensure that it meets the requirement of the Specification.

13.7 Accommodation and Assistance

CONTRACTOR shall provide COMPANY representative with office accommodation and facilities required for the proper accomplishment of his work, and shall provide any reasonable assistance required by him for verification, documentation, or movement of pipe.

COMPANY shall be afforded unrestricted opportunity to perform verification of inspection. CONTRACTOR shall make available inspection equipment for reasonable use by COMPANY. The CONTRACTOR's personnel shall be made available for the operation of inspection