

DEP SPECIFICATION

**STRUCTURAL WELDING AND INSPECTION OF
DEEPWATER FLOATING PRODUCTION SYSTEMS
(AMENDMENTS/SUPPLEMENTS TO
AWS D1.1/D1.1M:2010)**

DEP 37.81.10.33-Gen.

February 2017

ECCN EAR99

DESIGN AND ENGINEERING PRACTICE



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PART I INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the structural welding, welding procedure qualification, welder qualification, visual and non-destructive examination and the corresponding material applications for Floating Production System (FPS) hulls and decks.

This DEP is based on the American Welding Society, Structural Welding Code – Steel, AWS D1.1/D1.1M:2010, herein referred to as AWS D1.1. Part III of this DEP amends, supplements and deletes various clauses of AWS D1.1. Part III follows the clause numbering of AWS D1.1 for easy reference.

In addition to the AWS requirements, the Contractor shall follow the applicable sections of DEP 37.81.10.34-Gen, API RP 2FPS, API RP 2T, API RP 2A WSD and the Drawings. In case of conflict the most stringent requirement shall apply.

This is a revision of the DEP of the same number dated September 2013; see (1.5) regarding the changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorized by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them. Any authorized access to DEPs does not for that reason constitute an authorization to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in facilities related to oil and gas production, gas handling, oil refining, chemical processing, gasification, distribution and supply/marketing. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process shall be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases, the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for it. The Principal may also include an agent or consultant authorized to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

The word **may** indicates a permitted option.

1.3.2 Specific definitions

Term	Definition
Accept	The Principal's written acceptance of the submitted document.
Approve	The Principal's written approval of the submitted document which shall be completed prior to ordering materials and/or beginning the Work.
Clause	Refers to a portion(s) of AWS D1.1 or portion(s) of this DEP that includes a modification to an AWS Clause.
Contract	The specific agreement between the Principal and the Contractor containing commercial terms and conditions
Critical Steel	Steel designated as Critical on the Drawings
Drawings	Principal furnished drawings, spreadsheets, databases or data files and revisions thereof. Drawings may be in the form of summary Drawings, typical details, notes and rules from which the Contractor shall develop the necessary shop and erection drawings
Paragraph	Refers to a portion of the referenced applicable document.
Primary Steel	Steel designated as Primary on the Drawings
Review	The Principal's right, but not obligation, to review and comment on the submitted document.
Secondary Steel	Steel designated as Secondary on the Drawings
Section	A portion of this DEP unless specifically combined with a reference standard (e.g., API RP 2A Section 6).
Special Steel	Steel designated as Special on the Drawings
Tertiary Steel	Steel designated as Tertiary on the Drawings
Work	Any portion of engineering, procurement, manufacturing, fabrication, welding, inspection, coating and all other activities identified in the Contract
Zone(s)	These Zones (e.g., Zones 1, 1A, 1F, 2 and 3) are zones of structural criticality and are identified on drawings. Within this DEP, inspection techniques, acceptance criteria and extent of coverage are designated by Zone.

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section or clause number is shown in brackets (). Other documents referenced by this DEP are listed in (Part IV).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated September 2013.

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be submitted to the Administrator using one of the following options:

Shell DEPs Online (Users with access to Shell DEPs Online)	Enter the Shell DEPs Online system at https://www.shelldeps.com Select a DEP and then go to the details screen for that DEP. Click on the "Give feedback" link, fill in the online form and submit.
DEP Feedback System (Users with access to Shell Wide Web)	Enter comments directly in the DEP Feedback System which is accessible from the Technical Standards Portal http://swwww.shell.com/standards . Select "Submit DEP Feedback", fill in the online form and submit.
DEP Standard Form (other users)	Use DEP Standard Form 00.00.05.80-Gen. to record feedback and email the form to the Administrator at standards@shell.com .

Feedback that has been registered in the DEP Feedback System by using one of the above options will be reviewed by the DEP Custodian for potential improvements to the DEP.

1.7 DUAL UNITS

This DEP contains both the International System (SI) units, as well as the corresponding US Customary (USC) units, which are given following the SI units in brackets. When agreed by the Principal, the indicated USC values/units may be used.

1.8 NON NORMATIVE TEXT (COMMENTARY)

Text shown in italic style in this DEP indicates text that is non-normative and is provided as explanation or background information only.

Non-normative text is normally indented slightly to the right of the relevant DEP clause.

PART II GENERAL REQUIREMENTS**2.1 GENERAL**

1. Part III of this DEP amends, supplements and deletes various clauses/paragraphs of AWS D1.1/D1.1M:2010. Wherever reference is made to AWS D1.1, it shall be understood to mean AWS D1.1/D1.1M:2010 as amended/supplemented by this DEP.

For ease of reference, the clause numbering of AWS D1.1 has been used throughout Part III of this DEP.

Only those clauses with clarifications, modifications, deletions and additions are included herein.

2. Clauses of AWS D1.1 that are not mentioned in this DEP shall remain applicable as written.
3. Qualification of structural welding and personnel shall be in accordance with AWS D1.1, as modified by this DEP.

2.2 CONTRACTOR'S QUALITY SYSTEM

1. The Contractor's quality management system shall comply with and be certified to ISO 9001.

2.3 CONTRACTOR'S STANDARD PRACTICES

1. The Contractor's standard practices that exceed the requirements of this DEP shall be applicable.

2.4 DOCUMENTS REQUIRING SUBMITTAL

1. The Contractor shall submit 2 copies of the documentation as indicated throughout this DEP and as summarized in Table 2.4, with the exception of radiographs, photo-macrographs and chart recordings.

The submittal timing and the Principal's action (e.g., Approve, Accept or Review) that will be taken relative to the submitted document are included in Table 2.4.

PART III AMENDMENTS/SUPPLEMENTS TO AWS D1.1/D1.1M:2010**1 GENERAL REQUIREMENTS****1.1 SCOPE**

Add the following sentence:

1. In cases where there is a conflict between Clause narratives, Tables or Figures, the most stringent requirement shall apply.

1.4 RESPONSIBILITIES**1.4.1 Engineers Responsibilities**

Add the following sentences to the already existing list items (1) through (8):

1. All AWS code requirements are required and shall be considered specified by the Engineer.
Codes that apply in addition to AWS D1.1 are identified in (Part III) and in the contract.
2. The applicable AWS and other code Non Destructive Testing (NDT) methods and requirements, including progressive inspection protocol shall be according to Section 6, as modified herein.
3. The extent and required minimum percentages of NDT by method and weld type shall be as specified in the Drawings.
4. The Contractor shall perform all verification inspections identified in AWS and additional verification inspections for materials, processes, procedures and final products in accordance with this DEP and the Drawings.
5. The Contractor shall permit The Principal to perform additional verification inspections.
6. Weld inspection criteria in addition to AWS Clause 6 shall be in accordance with this DEP and the Drawings.
7. The Charpy V-Notch (CVN) toughness test criteria and requirements, percent shear evaluation, Crack Tip Opening Displacement (CTOD), drop-weight and other base metal, weld metal, fusion line and Heat Affected Zone (HAZ) testing shall be per this DEP and the Drawings.
8. The Lowest Anticipated Service Temperature (i.e., LAST) shall be as specified in the Drawings.
9. Floating Production Systems, including all portions of hulls, decks and modules built to this DEP shall be considered to be "Cyclically Loaded".
10. The "Cyclically Loaded" provisions within AWS shall always be selected in lieu of alternative provisions for "Statically Loaded" components.
11. This DEP and the Drawings contain requirements in addition to those in AWS. The Engineer acknowledges that in some cases, the requirements in this DEP and the Drawings are similar to those in AWS but are more stringent.
12. As specified in this DEP and as used within AWS context, the Contractor is not considered an Original Equipment Manufacturer (OEM). The Contractor assumes no responsibilities of the Engineer.

2 DESIGN OF WELDED CONNECTIONS

Part A Common Requirements for Design of Welded Connections (Nontubular and Tubular Members)

2.3 CONTRACT PLANS AND SPECIFICATIONS

2.3.2 Notch Toughness Requirements

Add the following sentence:

1. Special mechanical and chemical testing requirements shall be as specified in this DEP and on the Drawings.

2.3.3 Specific Welding Requirements

Add the following paragraphs:

1. Specific assembly order, welding sequence, verification hold-points and special precautions shall be as specified in this DEP, on the Drawings and in the Contractor's Approved Inspection and Test Plan.
2. The Principal's omission of requirements shall not relieve the Contractor of the basic responsibilities as defined in AWS.
3. The Contractor shall be solely responsible for distortion, NDT completion, decisions that limit access for welding, NDT, etc., regardless of the Principal's omissions relative to specifying assembly order, weld sequence, etc.

2.3.4 Weld Size and Length

Add the following sentences to the following clauses:

1. Fillet weld leg sizes shown on the Drawings are those associated with two surfaces that nominally intersect at 90 degrees.
2. For parts that intersect with angles between 85 to 95 degrees inclusive, the fillet leg lengths shown on the Drawings shall apply.
3. Fillet weld leg sizes shown on the Drawings are those associated with two surfaces that nominally intersect at 90 degrees.
4. For the sides of components that intersect with angles greater than 95 degrees and less than or equal to 135 degrees, the fillet weld leg length shown on the Drawing shall be increased by the factors shown in AWS Annex B.
5. For the sides of components that intersect between 60 and 84 degrees, the fillet weld leg length shown on the Drawing shall apply.
6. For the sides of components that intersect at angles less than 60 degrees, the Z-Loss dimension shown in AWS Table 2.2 shall be added to the fillet weld leg length.

2.3.5 Shop Drawing Requirements**2.3.5.3 Welding Symbols**

Add the following paragraph:

1. Welds shown on the Drawings with groove weld symbols, including any of the 11 groove types shown in AWS, "Legend for Figures 3.3 and 3.4", with no dimensions and without the designation CJP shown in the tail, shall be Complete Joint Penetration (CJP) welds.
2. All CJP welds shall be backgouged and backwelded unless specifically noted otherwise on the Drawings.
3. The Shop Drawings developed by the Contractor shall show all fillet weld sizes so that shop and field personnel need not perform any calculations to determine weld sizes or make other adjustments to the sizes shown on the Shop Drawings.

2.3.5.5 Special Details

Add the following sentence:

1. Groove details shall be as specified in this DEP and on the Drawings.

2.3.5.6 Specific Inspection Requirements

Add the following sentence:

1. Inspection requirements shall be as specified in this DEP and on the Drawings.

2.4 EFFECTIVE AREAS**2.4.2 Fillet Welds****2.4.2.4 Intermittent Fillet Welds (Minimum Length)**

Add the following sentence:

1. Intermittent fillet welds shall not be permitted as permanent welds.

2.4.3 Skewed T-Joints

Add the following sentence:

1. CJP skewed T-joint groove and weld dimensions shall be as shown in the Drawings and need not be adjusted for Z-loss.

Part B Specific Requirements for Design of Nontubular Connections (Statically or Cyclically Loaded)**2.6 STRESSES****2.6.4 Allowable Weld Metal Stresses**

Add the following paragraphs:

1. The allowable weld metal stresses shall be matched with the allowable base metal stresses for all types of applied stress shown in Table 2.3.
 - a. This shall apply to all welds (i.e., tubular and nontubular and cyclical and noncyclical).
2. Refer to the Table 2.3 clarifications in this DEP for an example of the matching weld metal calculation and other qualifications.

2.7 JOINT CONFIGURATION AND DETAILS**2.7.5 Butt, Corner, and T-Joint Surface Contouring**

Add the following:

1. Surface contouring and the dimensional limits thereof shall be as specified on the Drawings.

2.7.6 Weld Access Holes

Add the following:

1. Permanent weld access holes shall not be permitted except as specifically specified on the Drawings.
2. Temporary access holes shall be as specified in Section 6.

2.8 JOINT CONFIGURATION AND DETAILS – GROOVE WELDS**2.8.1 Transitions in Thickness and Widths**

Add the following:

1. The transitions shown in AWS Figure 2.3 shall not be permitted, unless specifically shown in section detail on the Drawings.

2.9 JOINT CONFIGURATION AND DETAILS – FILLET WELDED JOINTS**2.9.3 Fillet Weld Terminations****2.9.3.2 Lap Joints Subject to Tension**

Add the following:

1. This requirement to terminate tension welds near edges shall not apply.

2.9.3.5 Opposite Sides of a Common Plane

Add the following:

1. Welding on opposite sides of a common plane shall be permitted.

2.9.5 Intermittent Fillet Welds

Add the following:

1. Permanent intermittent fillet welds shall not be permitted.

2.11 FILLER PLATES

Add the following:

1. Filler plates shall not be permitted.

2.12 BUILT-UP MEMBERS**2.12.2 Maximum Spacing of Intermittent Fillet Welds**

Add the following:

1. Permanent intermittent fillet welds shall not be permitted.

Part C Specific Requirements for Design of Nontubular Connections (Cyclically Loaded)**2.16 ALLOWABLE STRESSES AND STRESS RANGES****2.16.1 Allowable Stresses**

Add the following:

1. Refer to Clause 2.6.4 and Table 2.3 for additional requirements for matching weld metal strength.

2.17 DETAILING, FABRICATION AND ERECTION**2.17.1 Transitions in Thickness and Width****2.17.1.1 Butt-Joint Thickness Transitions**

Add the following:

1. Thickness transitions shall have a slope of no more than 1 in 4, as shown on the Drawings.
2. The referenced AWS Figure 2.3 shall be modified to AWS Figure 2.2.

2.17.2 Backing

Add the following:

1. Permanent steel backing shall not be permitted unless specifically shown on the Drawings or otherwise Approved (e.g., Approved temporary manway single sided closures).

2.17.3 Contouring Weld at Corner and T-Joints

Add the following:

1. Surface contouring and the dimensional limits thereof shall be as specified on the Drawings.

2.18 PROHIBITED JOINTS AND WELDS

Add the following:

2.18.1 One-Sided Groove Welds

Replace with:

1. Non-backgouged groove welds made from one or two sides, with or without backing, shall be prohibited in Zones 1 and 2 unless shown on Drawings or otherwise Approved, for example, in accordance with Clause 5.13.1.
2. Non-backgouged Zone 3 groove welds, as permitted in accordance with the Drawings, shall be qualified in conformance with Clause 4.
 - a. This shall include groove welds made without backing and those made with removable backing, including steel and other materials.
3. Permanent backing shall not be permitted, unless Approved otherwise.
 - a. This general prohibition shall apply to Critical, Special, Primary and Secondary Steel and corner joints.

2.18.2 Flat Position Groove Welds

Add the following:

1. As qualified according to this DEP, bevel-groove and J-groove welds shall be permitted.

Part D Specific Requirements for Design of Tubular Connections (Statically or Cyclically Loaded)**2.21 ALLOWABLE STRESSES****2.21.3 Welds Stresses**

Add the following:

1. Refer to Clause 2.6.4 for additional requirements for matching weld metal strength.

2.21.6 Fatigue**2.21.6.6 Fatigue Behavior Improvement**

Add the following:

1. Tubular welding details shall be as shown on the Drawings.

Add the following to the list item (3):

3. Peening of the welds shall not be permitted as a means to increase the design fatigue life.

2.24 WELD DESIGN**2.24.2 Groove Welds****2.24.2.1 Prequalified PJP Groove Weld Details**

Add the following:

1. Partial Joint Penetration (PJP) welds shall not be permitted unless specifically detailed on the Drawings.

2.25 LIMITATIONS OF THE STRENGTH OF WELDED CONNECTIONS**2.25.1 Circular T-, Y-, and K-Connections (see 2.27.1.1)****2.25.1.6 Overlapping Connections**

Add the following:

1. Overlapping tubular connections shall not be permitted unless specifically shown on the Drawings.

2.26 THICKNESS TRANSITION

Add the following:

1. The thickness transition shown in Figure 2.21, "Welded from One Side (C) Transition by Taper Weld", shall not be permitted.

2.27 MATERIAL LIMITATIONS

Add the following:

This DEP applies specifically to structural steels conforming to the requirements contained on the Drawings and in other DEPs and/or Specifications explicitly referenced in the Contract.

Material requirements are specified on the Drawings and in DEP 37.81.10.34-Gen.

2.27.2 Tubular Base-Metal Notch Toughness**2.27.2.1 CVN Test Requirements**

Add the following:

1. The CVN toughness minimum absorbed energy shall be as specified on the Drawings.

2.27.2.2 LAST Requirements

Add the following:

1. The CVN toughness test temperature and LAST shall be as specified on the Drawings.

Clarify the existing AWS Tables and Figures by adding the following:

Table 2.3 Allowable Stresses (see 2.6.4 and 2.16.1):

1. The required filler metal strength level shall be matching, based on the allowable stress levels for the filler metal and base metal, for all types of applied stress and weld types.

This is typically governed by shear on the effective area where 0.30 x classification tensile strength of the filler metal has to match 0.4 x the yield strength of the base metal.

When the Contractor proposes to use a moderately higher over matching filler metal, a proposal inclusive of all relevant electrode manufacturing data shall be submitted.

An example of over matching filler metal strength is E70XX electrodes used with 345 N/mm (50 ksi) yield strength base metal, to satisfy strength requirements.

An example of over matching filler metal is E80XX electrodes used with 345 N/mm (50 ksi) yield strength base metal, to meet Charpy impact values.

Table 2.6 Allowable Stresses in Tubular Connection Welds (see 2.21.3):

1. Partial Joint Penetration (PJP) welds shall not be permitted unless specifically detailed on the Drawings.

Table 2.9 Z Loss Dimensions for Calculating Prequalified PJP T-, Y- and K-Tubular Connection Minimum Weld Sizes (see 2.24.2.1):

1. Partial Joint Penetration (PJP) welds shall not be permitted unless specifically detailed on the Drawings.

Figure 2.2 Transition of Butt Joints in Parts of Unequal Thickness (Cyclically Loaded Nontubular) (see 2.17.1.1):

1. Thickness transitions shall have a slope of no more than 1 in 4, unless specifically shown on the Drawings.

Figure 2.3 Transition of Thicknesses (Statically Loaded Nontubular) (see 2.7.5 and 2.8.1):

1. The transitions shown in Figure 2.3 shall not be permitted, unless shown in section detail on the Drawings.

Figure 2.6 Termination of Welds Near Edges Subject to Tension (see 2.9.3.2):

1. This requirement to holdback and/or terminate tension welds near edges shall not apply.

Figure 2.8 Fillet Welds on Opposite Sides of a Common Plane (see 2.9.3.5):

1. This prohibition against joining the welds together around the corners of the common plane shall not apply.

Figure 2.9 Thin Filler Plates in Splice Joint (see 2.11.1):

1. Filler plates shall not be permitted.

Figure 2.10 Thick Filler Plates in Splice Joint (see 2.11.2):

1. Filler plates shall not be permitted.

Figure 2.11 Allowable Stress Range for Cyclically Applied Load (Fatigue) in Nontubular Connections (Graphical Plot of Table 2.5):

1. If the fatigue stresses are of variable amplitude (i.e., if the stress range is not constant), the threshold ranges (i.e., the no slope portions) in the Figure shall be ignored and the slope of the category lines extended down to the 1 ksi stress range abscissa.

Figure 2.13 Allowable Fatigue Stress and Strain Ranges for Stress Categories (see Table 2.7), Redundant Tubular Structures for Atmospheric Service (see 2.21.6.3):

1. If the fatigue stresses are of variable amplitude (i.e., if the stress range is not constant), the threshold ranges (i.e., the no slope portions) in the Figures shall be ignored and the slope of the category lines extended down to the 1 ksi stress range abscissa.

Figure 2.18 Detail of Overlapping Joint (see 2.25.1.6):

1. Overlapping tubular connections shall not be permitted unless specifically shown on the Drawings.

Figure 2.20 Overlapping K-Connections (see 2.25.2.4):

1. Overlapping tubular connections shall not be permitted unless specifically shown on the Drawings.

Figure 2.21 Transition of Thickness of Butt Joints in Parts of Unequal Thickness (Tubular) (see 2.26):

1. The thickness transition shown in Figure 2.21, "Welded from One Side (C) Transition by Taper Weld", shall not be permitted.

3 PREQUALIFICATION OF WPS (WELDING PROCEDURE SPECIFICATION)**3.1 SCOPE**

Add the following:

1. Prequalified and previously qualified WPSs shall only be permitted for Tertiary Steel, noting that a prequalified WPS differs from a previously qualified WPS.
2. Requirements for the use of previously qualified WPS's shall be as specified in Clause 4.2.1.

3.3 BASE METAL/FILLER METAL COMBINATIONS

Add the following:

1. The required minimum filler metal strength level shall be matching for all types of applied stress and weld types.
2. Refer to Clause 2.6.4 and Table 2.3 for additional requirements for matching weld metal strength.

3.11 COMMON REQUIREMENTS OF PJP AND CJP GROOVE WELDS

Add the following:

1. Partial Joint Penetration (PJP) welds shall not be permitted unless specifically detailed on the Drawings.

3.12 PJP REQUIREMENTS

Add the following:

1. Partial Joint Penetration (PJP) welds shall not be permitted unless specifically detailed on the Drawings.

3.13 CJP GROOVE WELD REQUIREMENTS**3.13.2 Backing**

Add the following:

1. Permanent backing shall not be permitted.

3.13.5 Tubular T-, Y- and K-Connections

Add the following:

1. Tubular welding details shall be as shown on the Drawings.

3.14 POST WELD HEAT TREATMENT

1. Post Weld Heat Treatment (PWHT) shall be as specified in this Clause and DEP 37.81.10.34-Gen. (Appendix A).

Add the following to the existing Tables and Figures:

Table 3.1 Prequalified Base Metal-Filler Metal Combinations for Matching Strength (see 3.3):

1. AWS D1.1, Table 3.1, footnote b, may be applicable to Group II steels when using the FCAW welding process.

Special submittal for this specific over-matching condition is not required.

2. The basic AWS electrode specification, by welding process, shall be as specified in this Table.

Table 3.4 Minimum Prequalified PJP Weld Size (E) (see 3.12.2.1):

1. Partial Joint Penetration (PJP) welds shall not be permitted unless specifically detailed on the Drawings.

Table 3.6 Prequalified Joint Dimensions and Groove Angles for CJP Groove Welds in Tubular T-, Y- and K-Connections Made by SMAW, GMAW-S and FCAW (see 3.13.5):

1. Tubular welding details shall be as shown on the Drawings.

Figure 3.3 Prequalified PJP Groove Welded Joint Details (see 3.12):

1. Partial Joint Penetration (PJP) welds shall not be permitted unless specifically detailed on the Drawings.

Figure 3.4 Prequalified CJP Groove Welded Joint Details (see 3.13):

1. Joint designation B-L1-S shall be backgouged unless specified otherwise on the Drawings.
2. Backing shall not be left in-place unless specified on the Drawings.

**Figure 3.5 Prequalified Joint Details for PJP T-, Y- and K-Tubular Connections
(see 3.12.4):**

1. Partial Joint Penetration (PJP) welds shall not be permitted unless specifically detailed on the Drawings.

**Figure 3.6 Prequalified Joint Details for CJP T-, Y- and K-Tubular Connections
(see 3.13.5):**

1. Figure 3.6 details shall be applicable for connections of square and rectangular Hollow Structural Sections (HSS).

Figure 3.7 Definitions and Detailed Selections for Prequalified CJP T-, Y- and K-Tubular Connections (see 3.13.5 and Table 3.5):

1. Tubular welding details shall be as shown on the Drawings.

Figure 3.8 Prequalified Joint Details for CJP Groove Welds in Tubular T-, Y- and K- Connections – Standard Flat Profiles for Limited Thickness (see 3.13.5):

1. Tubular welding details shall be as shown on the Drawings.

Figure 3.9 Prequalified Joint Details for CJP Groove Welds in Tubular T-, Y- and K- Connections – Profile with Toe Fillet for Intermediate Thickness (see 3.13.5):

1. Tubular welding details shall be as shown on the Drawings.

Figure 3.10 Prequalified Joint Details for CJP Groove Welds in Tubular T-, Y- and K- Connections – Concave Improved Profile for Heavy Sections or Fatigue (see 3.13.5):

1. Tubular welding details shall be as shown on the Drawings.

4 QUALIFICATION

Add the following:

1. For Welding Procedure Specification (WPS) qualification, FCAW-SS (Shelf Shielded) and FCAW-G (Gas Shielded) shall be considered separate processes.
2. Conditions under which fabrication welding is to be done shall be limited to those described in an Approved WPS.
3. The WPS shall include reference to the procedure qualification test records (PQRs) for supporting tests and allowable ranges of welding parameters, based on the actual qualification data.
4. For PQRs, the preheat, interpass temperature, voltage, current and travel speed shall be reported for every individual pass.
5. A WPS written with more than one supporting PQR shall not permit optional processes.
 - a. The WPS shall uniquely specify the process for each pass.
6. The attachment of architectural insulation pins by means of a welding process shall be considered Stud Welding.

The attachment shall follow AWS D1.1, Section 7, as modified by this DEP.
7. Stud Welding requires procedure qualification welding and WPS submittal.
8. Pin and base metal material combinations shall be qualified by test.

Part A General Requirements**4.2 GENERAL****4.2.1 Welding Procedure Specification (WPS).****4.2.1.1 Qualification Responsibility**

Clarify and add the following:

1. WPSs and PQRs shall be qualified, submitted and Approved for the current project.
2. WPSs previously Approved for other Principal projects may be Approved for utilization on this project provided all essential variables are in compliance with this DEP.
 - a. The Principal can Accept the use of existing Procedure Qualification Records (PQRs) to establish new WPSs after a review of the existing data.
 - b. Each procedure will be evaluated on a case-by-case basis.
 - c. If the Contractor proposes to use previously Principal Approved WPS and/or PQR, the WPS and PQR shall be submitted.
3. The Subcontractors may use the Contractor's WPS/PQRs in areas that are under the direct control of the Contractor's Quality System and provided that the Contractor provides technical support.
4. Direct control shall require full time, on-site Contractor inspectors and supervisors at the Subcontractor's location.
 - a. The Subcontractors shall utilize the Contractor's Quality Manual, Quality Plan, Quality Procedures and Inspection and Test Plans.
 - b. Subcontractors working outside the direct control of the Contractor's Quality System shall utilize their own Quality System and establish their own WPS/PQRs.
 - c. Tubular pipe made from Principal-Approved materials and dimensionally in accordance with API Spec 2B shall be welded in accordance with this DEP.

4.2.1.2 WPS Qualification to Other Standards

Add the following.

1. The AWS B2.1 series of Standard Welding Procedure Specifications shall not be permitted, except for Tertiary Steel.

4.2.1.3 CVN Test Requirements

Add the following:

1. AWS D1.1, Table 4.6 shall be used in addition to Table 4.5 for all qualified welding procedures that require CVN and/or CTOD testing per the Drawings.
2. All welding procedures, except those for Tertiary Steel, shall require Charpy V-Notch (CVN) and/or Crack Tip Opening Displacement (CTOD) testing to the minimum values shown on the Drawings.
3. CVN and CTOD requirements shall apply to all weld types described in AWS D1.1, Clause 4.6.
4. CVN testing shall be done for each plate position qualified.
5. Table 4.5, item 28, shall not apply for CTOD testing.
6. CTOD testing shall be done on material thickness equal to the maximum material thickness to be welded.

7. Other CTOD essential variable requirements are listed in (Appendix A4.9.7). See Clause 4.8.1 for additional modifications to Tables 4.5 and 4.6.

4.2.2 Performance Qualification of Welding Personnel

Add the following:

1. Welders, welding operators and tack welders shall be qualified and Approved specifically for Work. Refer to Clause 4.19 modifications.

4.2.2.1 Previous Performance Qualification

Add the following:

1. Welders, welding operators and tack welders previously qualified to AWS D1.1 shall not require re-qualification provided that their previous qualifications were witnessed and verified by a Principal Approved third party inspection agency and have not expired.
2. A copy of the original certification document, bearing the seal and signature of the inspection agency, the employment maintenance record of the welder and evidence of the NDT or Destructive Testing of his/her test coupon shall be submitted.
3. Welders exhibiting poor practices and workmanship and/or repair rates outside normal industry practice shall lose their qualification and be retested when deemed necessary by the Principal.

4.2.2.2 Qualification Responsibility

1. Refer to modification provided for Clause 4.19.

4.2.3 Period of Effectiveness

Add the following:

1. The Contractor's welder continuity records, or equivalent documentation providing information regarding when welding was done, and the date and result of the original testing, shall be required to verify welder certification validity.

The Contractor's in-house quality record logs combined with employment record validation through the Contractor's Human Resource (HR) department can be regarded by the Principal as sufficient evidence that the welder was engaged in the desired process.

4.2.3.1 Welders and Welding Operators

Add the following:

1. When Contractor proposes to use personnel, previously qualified by the Principal, that have allowed their original qualification to expire, the documentation shall be submitted.
 - a. For these cases, individual verification tests may be required.
 - b. Welders with previous 6G and 6GR qualifications shall be requalified in these positions.
2. For welders with previous 3G and higher qualifications, other than 6G and 6GR, the welder shall pass a verification test in the highest position qualified.
 - a. Verification of welders with lesser qualifications shall be tested with applicable 1G, 2G or fillet weld tests.
 - b. Welding operator qualification shall be verified by producing a satisfactory radiograph of the first production weld.
 - c. Welding operator qualification for fillets only shall be verified by producing a 1F or 2F fillet weld test.

3. For “all position” welder qualifications of CJP production plate welds (i.e., not including 6G and 6GR), combination 3G and 4G welder qualifications shall be required.

4.2.3.2 Tack Welders

Add the following:

1. Refer to the modification provided for Clause 4.2.3.1.

Part B Welding Procedure Specification (WPS)

4.6 WELD TYPES FOR WPS QUALIFICATION

Add the following:

1. Partial Joint Penetration (PJP) welds shall not be permitted unless specifically detailed on the Drawings.

4.7 PREPARATION OF WPS

Add the following:

1. Welding Procedure Proposals (WPPs), including those for the repair of defects, shall be submitted.
2. WPPs shall have the format of a WPS and include test ranges for essential variables (e.g., voltage, amperage, travel speed, min preheat, etc).
3. Standard welding parameters shall be provided for each electrode diameter, welding position and location in the joint (i.e., root, ‘hot pass’, fill, cap, and any other distinctions normally made by the Contractor).
4. The proposed Procedure Qualification Test (PQT) plan shall be submitted and be in the format of a Procedure Qualification Record (PQR).
5. WPSs and PQRs shall be submitted including all data that is shown in AWS D1.1 Annex N and that is required by this Clause, including:
 - a. the name of the Manufacturer, Manufacturer's location and their material designation for Critical, Special and Primary Steel per 4.8.3;
 - b. thickness range;
 - c. joint detail dimensions and tolerances, position(s), type, and
 - d. AWS classification of welding consumables, including brand name and place of manufacture which are essential variables for Critical Steel;
 - e. size of electrodes;
 - f. voltage range for each pass;
 - g. current range for each pass;
 - h. travel speed range for each pass;
 - i. heat input range for each pass;
 - j. bead width and pass sequence;
 - k. depth and width of backgouging for Critical steels;
 - l. preheating and interpass temperature requirements, and
 - m. post weld heat treatments.
6. For WPSs, the voltage, current and travel speed may be combined into layers or groups.

7. Segregation shall be into at least three groups, namely 1) root and hot pass, 2) fill passes, and 3) cap passes.
8. The Contractor shall submit repair procedures that detail repair and inspection steps to be taken for each type of repair that is likely to be encountered, such as the repair of surface imperfections, weld defects and excessive root openings.
9. Where the Contractor proposes to fillet weld over a weldable primer or other coating, a proposal shall be submitted prior to performing qualification testing.
10. A WPS, using the proposed primer or coating, shall be qualified and submitted.
11. Testing and acceptance criteria shall be as in Clause 4.9.
12. Welding over galvanized and/or Thermal Sprayed Aluminum (TSA) surfaces shall not be permitted.

4.8 ESSENTIAL VARIABLES

4.8.1 SMAW, SAW, GMAW, GTAW and FCAW

Add the following:

1. Modify Table 4.5 item 31): welding PQTs shall be performed for all weld types.
 - a. The only exception is that single bevel groove and double bevel groove welds shall qualify single V-groove and double V-groove welds, respectively.
2. Modify Table 4.5, item 32) as follows:
 - a. welding Procedure Qualification Tests (PQTs) shall be performed for each of the eleven weld types (e.g., 1 – square-groove, 2 – single V-groove, etc.) shown in AWS D1.1, “Legend for Figures 3.3 and 3.4”;
 - b. production joint details on the WPS may vary from that qualified, provided they meet the requirements of Clause 3.13 and are within the “As Detailed” tolerances of Figure 3.4 for the specific weld type used in the PQT.
3. The minimum thickness qualified in Table 4.6 Item 2) shall only be applicable for Critical, Special and Primary Steel.

Table 4.6 Item 6) shall be replaced with:

1. “A change in travel progression from vertical down to vertical up and vice-versa”, noting that Table 4.5, Item 27 and (Appendix A4.8.6) and (Appendix A4.9.7) remain applicable.

Table 4.6 Item 9) shall be replaced with:

1. “Heat input outside of the heat input range specified in Clause 4.8.6 and (Appendix A4.8.6).”

The shielded metal arc welding (SMAW), submerged arc welding (SAW), gas tungsten arc welding (GTAW), and flux cored arc welding (FCAW) processes are Approved.

 - a. Other proposed processes shall be submitted for consideration.
2. The FCAW-SS (Self Shielded) process may be used in a WPS, alone, or in combination with other processes.
 - a. However, any welding procedure using a combination of FCAW-SS as one of the welding processes shall be specifically tested for that combination and sequence.
3. Charpy testing shall examine the region of maximum dilution to verify that the minimum required toughness can be obtained.

4. Other weld metals for the Approved processes that are in accordance with D1.1 Table 3.1, or otherwise tested and Approved, may be combined without limitation.
5. The use of gas metal arc welding (GMAW-S) may be Approved for specific applications.
 - a. However, additional restrictions and limitations are applicable as given in (Appendix A4.8.1) and Clause 4.8.3.

4.8.2 ESW and EGW

Delete this clause.

4.8.3 Base-Metal Qualification

Replace Clause 4.8.3 with the following:

1. Welding Procedure Qualification Tests (PQTs) shall be performed for each grade of steel, based on minimum yield strength and/or the referenced industry standard (e.g., API Spec 2H vs. ASTM A572),
2. PQTs shall be performed for each steel from a different manufacturing process.

For example: normalized, Thermal Mechanical Controlled Processing (TMCP) including Thermal Mechanical Rolling (TMR), quenched and tempered (Q & T), quenched and self tempered (QST), normalized and tempered, controlled rolled, as rolled, rolled shapes with enhanced chemistry, cast, forged, etc.
3. For Critical, Special and Primary Steels, the plate, rolled shape, casting or forging Manufacturer and manufacturing location shall be an essential variable.
4. PQT plate material certificates shall be submitted.
5. Material selected for PQTs shall have a Pcm value within 0.02 points of the highest Pcm plate that will be used in production;
6. Welding PQTs performed using low sulfur treatment steels (i.e., less than or equal to 0.006%) shall not qualify for steels without low sulfur treatment except Tertiary Steel;
7. Welding PQTs shall be performed on all steels with specially enhanced weldability, as reported by the Manufacturer, (e.g., high heat input resistant steels with fine titanium nitride or titanium oxide precipitates):
 - a. these PQTs may be used to support welding procedures only for the specific steel;
 - b. the proprietary steel name is an essential variable that shall be included on the WPS.
8. Additional PQTs shall be performed on rolled shapes for application as Primary Steel that have been produced using special chemistry and/or controlled rolling, TMCP, Q & T and QST in lieu of normalizing;
9. The Contractor's proposed material matrix for PQTs shall be submitted;

An example material matrix for Welding Procedure Qualification Tests (PQTs) utilizing single material test plates that incorporates these essential variables for steels to be utilized is presented in Figure 4.8.3-1.
10. The Contractor may consider PQTs using two unique steels in combination on a single test specimen (e.g., different grades, different Manufacturers, varying Manufacturer's locations, unique production processes, etc.);

11. By taking Charpy specimens from both HAZs and performing the macro hardness bead on plate test on both sides of the joint, WPSs for both base metals may be qualified by one test weld.

An example material matrix for Welding Procedure Qualification Tests (PQTs) utilizing dual material test plates, that incorporates these essential variables for steels to be utilized, is presented in Figure 4.8.3-2.

12. As an alternative to 4.8.3.f above, joints between two different grades of steel, the PQTs qualified for the lower grade and higher grade steels may be combined to form a single WPS provided the most stringent requirements applicable to each grade are selected;

(e.g., a Tertiary Steel member may be welded to a Critical member using a WPS qualified for Tertiary Steel, provided the minimum preheat and maximum interpass temperatures from both WPSs are maintained and that the Heat Input (HI) used is greater than the lowest HI from either WPSs).

13. When welding metals not listed on Drawings to those steels listed, the following requirements apply:

- a. a steel type listed on the Drawing shall be used for one side of the test joint and on the other side of the test joint the unlisted metal to be qualified;

If Primary Steel is used as the Drawing-listed steel, no higher grade need be tested.

- b. suitable heat inputs and preheats shall be selected from an existing PQR that has been qualified for the listed steels;
- c. in Clause 4.9, MT examination shall be replaced by PT for non-magnetic materials.

14. Where all weld metal tensile tests are required, the minimum tensile strength shall meet that of the lower strength metal joined.

15. Macro-section examination shall be required.

An example would be welding CuNi to a listed steel or stainless steel to a listed steel.

4.8.4 Preheat and Interpass Temperature

Replace Clause 4.8.4 with the following:

1. The use of Annex I for determining preheats shall not be permitted.
2. Preheat temperatures shall not be less than the highest minimum preheat required by the following:
 - a. table 3.2 of AWS D1.1 for prequalified procedures;
 - b. preheats used during the actual PQTs;
 - i. Table 4.8.4-1, of this DEP, for qualified procedures performed without additional Controlled Thermal Severity (CTS) or Y-Groove testing, or
 - ii. Table 4.8.4-2, of this DEP, for qualified procedures performed with additional Controlled Thermal Severity (CTS) and/or Y-Groove testing.
 - iii. CTS testing shall be in accordance with new Clause 4.9.8 for welds of low and medium restraint.
 - iv. Y-Groove testing shall be in accordance with new Clause 4.9.9 for welds of high restraint.
3. For steels with specified minimum yield strength greater than 414 N/mm² (60 ksi) the minimum preheats stated in 4.8.4.a and 4.8.4.c shall be increased by 28 °C (50 °F).

Add new Clauses 4.8.4.1 and 4.8.4.2 as follows:

4.8.4.1 Preheat Temperature Restrictions

1. When different grades or classes of steel are joined, the higher preheat temperature and the lower maximum interpass temperature shall govern.
2. Due to inherent restraint for weld repairs an increase of 28 °C (50 °F) in the stated preheat, shall be made to the applicable preheat requirement and be used in the Repair WPS.
3. The repair WPS shall utilize basic preheats established during the PQTs, increased as described above with no preheat reductions based on Y-Groove or CTS Testing.
4. The reduced preheats specified in Table 4.8.4-2 shall not be used for repair WPSs.
5. For Critical Steel, the maximum interpass temperature shall not be more than 14 °C (25 °F) above the actual temperature sustained during Crack Tip Opening Displacement (CTOD) prequalification testing of the base metal or be more than 14 °C (25 °F) above the actual temperature sustained during CTOD qualifications of the weld metal at the locations sampled by CTOD testing, whichever is lower.
6. For all other steels, the maximum interpass temperature shall not be more than 28 °C (50 °F) above the actual temperature sustained for the locations sampled for CVN testing, as shown on Figure 4.40, during the procedure qualification testing.
7. Where prequalified WPSs are permitted, the maximum interpass temperature shall be 250 °C (480 °F).
8. For the build up (buttering) of members as allowed in Section 5.4.4, the maximum interpass temperature shall not exceed that given in 4.8.4.1 (c) and (d).
9. Before applying the closing root pass, the interpass temperature shall be allowed to cool to within 28 °C (50 °F) of the minimum preheat.
10. For offshore welds and welds performed on quayside floating vessels an increase of 28 °C (50 °F) in the stated preheat, shall be made to the applicable preheat requirement and be used in the offshore WPS.

4.8.4.2 Preheat General Conditions

1. Preheat temperatures shall be established to develop the specified mechanical properties and to prevent cracking in the weld and HAZ.
2. Preheats shall be established to ensure that the particular base metal/consumable/thickness/preheat/heat input combination is not susceptible to delayed cracking at the lowest preheat, highest Pcm, maximum base metal thickness, lowest heat input and highest weld metal diffusible hydrogen level permitted by the WPS.
3. Preheat shall be applied to establish and maintain the required temperatures for a distance equal to the thickness of the part to be welded, but not less than 76 mm (3 in) in all directions (including through thickness) from the point of welding.
4. In the direction of weld travel, preheat shall be for the length to be welded with the particular weld pass.
5. Preheat temperature shall be measured a minimum of 76 mm (3 in) from the edge of the weld bevel.
6. Temperature indicating crayons shall not be marked on weld bevels, weld beads or surfaces to be welded.
7. The interpass temperature shall be measured adjacent to the weld groove.
8. The measurements to determine minimum preheat and maximum interpass temperature shall be taken during the time between successive passes, just prior to initiating the arc for the next pass.

9. Preheat and interpass temperatures shall be specified in the WPS for the full range of thicknesses, steel grades and heat inputs allowed by the WPS.
10. Regardless of which minimum preheat is used, surface moisture at the point of welding, whether visually apparent or not, shall be removed using heat before beginning to weld.

Add the following new Clauses 4.8.5 and 4.8.6.

4.8.5 Consumables

1. Extra low hydrogen consumables shall be used.
2. Extra low hydrogen consumables shall be defined herein as those that produce deposited weld metal with less than:
 - a. 4 mL/100 g of diffusible hydrogen in accordance with AWS A4.3 for FCAW-G and SMAW;
 - b. 5 mL/100 g for SAW electrode/flux combination;
 - c. 8 mL/100 g for FCAW-SS.
3. For electrodes classed to AWS A5.29, G class electrodes shall not be used.
4. For electrodes classed to AWS A5.20, electrodes with unspecified chemical composition (i.e., in AWS A5.20 Table 6) shall not be used.
5. All elements shall be reported whether intentionally added or not.



4.8.6 Additional Essential Variables

1. Welding procedures shall be qualified by tests within the limitation of variables of AWS D1.1 and as modified herein.
2. Essential variables shall apply to the welding of Critical Steel, Special Steel, Primary Steel and Secondary Steel.
3. The following changes shall require re-qualification:
 - a. any change in electrode diameter for welding procedures qualified by CTOD testing;
 - b. a change from tandem (two) wire SAW to single wire, when the pass size of the single wire exceeds the pass size of the tandem wire (i.e., thickness and width of pass);
 - c. a change from tandem (two) wire SAW to single wire, when the Heat input (HI) for the single wire exceeds 1/2 of the HI as computed for the tandem wire SAW WPSs;
 - d. a change in electrode or electrode/flux, AWS classification, brand name or electrode Manufacturer;
 - e. change in the place of electrode manufacture used for Critical Steels;
 - f. any change in the mode of metal transfer across the arc;
 - g. any change in the type of welding current or polarity;
 - h. any change in HI outside the established range. For detailed information on setting HI ranges, see (Appendix A4.8.6);
 - i. for welding procedures qualified using flat plate test pieces in the PQT, a change to a tubular production piece with a D/t ratio of less than 35, and as further restricted by AWS D1.1, Table 4.1. (where D is the outside diameter and t is the thickness of the production tubular);

This is equivalent to a forming strain of 3% or more.
 - j. for welding procedures qualified using tubular test pieces in the PQT, with a D/t ratio of 35 or more, and heat input (HI) of 3.15 kJ/mm (80 kJ/in) or less, a change resulting in a D/t ratio below 35, (and as further restricted by AWS D1.1, Table 4.1);
 - k. for welding procedures qualified using tubular test pieces in the PQT, with a D/t ratio of 35 or more, and heat input greater than 3.15 kJ/mm (80 kJ/in), a change resulting in a D/t ratio less than that used in the PQT, (and as further restricted by AWS D1.1, Table 4.1);
 - l. for welding procedures qualified using tubular test pieces in the PQT, with a D/t ratio less than 35, and heat input below or above 3.15 kJ/mm (80 kJ/in), a change resulting in a D/t ratio less than that used in the PQT, (and as further restricted by AWS D1.1, Table 4.1);
 - m. for CTOD tested procedures, a change resulting in a reduction of the depth or width of backgouging.
 - i. the maximum depth and width of backgouging recorded during the PQT shall be the minimum backgouge depth and width specified on the WPS.
4. For single process WPSs, the polarity used for successive passes shall never change.

(For example, if reverse polarity is used on the root pass of a weld, the weld is to be completed using reverse polarity).

4.9 METHODS OF TESTING AND ACCEPTANCE CRITERIA FOR WPS QUALIFICATION

Add the following:

1. The Contractor shall allow The Principal, Certifying Authority and Regulator to witness procedure qualification welding, non-destructive examination (NDT) and sectioning, machining and mechanical properties testing. The Contractor shall notify the Principal in writing 72 hours prior to conducting such activities.
2. Welding procedures, including all longitudinal and girth welds for tubulars made from rolled plate per API Spec 2B, shall be qualified by non-destructive examination and mechanical tests as specified in AWS D1.1. The following additional requirements apply:
 - a. mechanical testing shall be performed by an Approved testing laboratory;
 - i. the proposed test laboratory and latest audit report shall be submitted.
 - b. ultrasonic and radiographic examinations shall be performed by Approved technicians;
 - i. the UT reports and/or graded radiographs shall be submitted.
 - c. the results of testing, an original photo-macrograph clearly showing the locations of the hardness testing and copies of the mill certificates shall be included with the PQR and submitted with the WPS;
 - d. The PQR shall include the steel Manufacturers' API RP 2Z prequalification record for CTOD WPSs, and the electrode Manufacturers' recommendations regarding heat input, minimum preheat and maximum interpass temperature.
 - e. for newly qualified PQRs, the Contractor shall retain and preserve all mechanical test specimens and macro-sections until completion of the project or until a written release is given by the Principal;

- f. where the Contractor proposes to fillet weld over a weldable primer or other coating, a proposal shall be submitted prior to performing qualification testing;
 - i. a procedure shall be qualified using the proposed primer or other coating that will be used in production;
 - ii. if both members to be joined will be coated in production, both of the test plates shall be coated accordingly;
 - iii. proof of a non-toxic fume shall be furnished with the PQR;
 - iv. testing and procedure qualification shall be in accordance with AWS D1.1, including acceptance of the macro-etch specimens and an additional fillet weld break test in accordance with AWS D1.1 Clauses 4.31.2 and 4.31.4;
 - v. the two plates of the fillet weld break test shall be brought into as close contact as practicable for the test;
 - vi. the maximum thickness of the coating shall be an essential variable;
 - vii. the minimum thickness measured on the test plate shall be the maximum thickness permitted during production;
 - viii. the Contractor should qualify a weldable primer with a production coating thickness less than 20 microns and a zinc content less than 68%;
 - ix. the Principal may reject the use of weldable primers based upon compatibility with coating systems, quality control issues or other concerns;
 - x. for Complete Joint Penetration (CJP) welds, welding over primers shall not be permitted.
- g. for flat plate, test plate assemblies shall be prepared so that the Principle Rolling Direction (PRD) of the plate is oriented parallel to the weld axis.

This is in order that CVNs from the HAZ will test the transverse properties of the altered base metal.
- h. For shapes and manufactured pipe, test plate assemblies shall be oriented to test base metal in the longitudinal direction.
- 3. All results of mechanical testing (including results of failed tests) shall be submitted to the Principal in the form of a PQR or test dossier.

4.9.1 Visual Inspection of Welds

4.9.1.1 Visual Inspection of Groove Welds

Add the following:

1. Test welds shall be visually examined over 100% of the length of weld surfaces.
2. 25 mm (1 in) at the beginning and end of each plate test piece may be disregarded.
3. Visual acceptance by the Contractor and the Principal shall be required prior to mechanical testing.
4. The weld shall meet the AWS D1.1 requirements for weld profiles and visual examination as specified in Clauses 5 and 6.