

[CompanyName]

[CompanyAddress]

[CompanyPhone]

Fabrication and Installation

Quality Manual

Operating Policies of the [CompanyName] Quality System

Management acceptance

This Quality Manual has been reviewed and accepted

Endorsed By: (Name / Title)	[PresidentName], President		
Signature:	<i>[PresidentName]</i>	Date:	[Date]

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QUALITY MANUAL

TABLE OF CONTENTS

1. Quality Management, Roles and Responsibilities	7
1.1. Overview.....	7
1.2. [CompanyName] Quality Policy Responsibilities	7
1.3. Appointment of Key Project Personnel	7
1.4. Project QC Organization Chart.....	7
1.5. Quality Duties, Responsibilities, and Authority	8
2. Personnel Qualifications	11
2.1. Overview.....	11
2.2. Qualification of [CompanyName] Visual, MT, or PT Personnel	11
2.3. Qualification of Welders and Welding Operators	12
2.4. Qualification of Welders for Specific Welding Procedures.....	12
2.5. Maintenance of Welder and Welding Operator Qualifications.....	12
2.6. Certified Welding Inspector Requirements	12
2.7. NDE Welding Inspector Requirements	13
3. Project Quality Assurance/Quality Control Plan	14
3.1. Identification of Quality Controlled Work Tasks.....	14
3.2. Project Quality Inspection and Test Plan (ITP)	14
3.3. Project Quality Communications Plan	14
3.4. Project Quality Training Plan	14
3.5. Project Startup and Coordination Meeting	15
3.6. Project Records and Documentation Plan	15
3.7. Project Audit Plan	15
4. Contract Specifications	16
4.1. Overview.....	16
4.2. Contract Technical Specifications	16
4.3. Contract Drawings	16
4.4. Contract Submittals	16
4.5. Customer Submittal Approval	18
4.6. Contract Warranty.....	18
4.7. Contract Review and Approval	19
5. Detail Design Review and Control	20
5.1. Overview.....	20
5.2. Detail Design Input Review.....	20
5.3. Detailing Design Plan	20
5.4. Detail Design Progress Reviews.....	21
5.5. Detail Design Output Verification and Approval	21

6. Project-Specific Quality Standards	22
6.1. Overview.....	22
6.2. Regulatory Codes.....	22
6.3. [CompanyName] Quality Standards	22
6.4. Welding Quality Standards	22
7. Qualification of Outside Organizations.....	24
7.1. Overview.....	24
7.2. Prequalification of Subcontractors and Outside Organizations	24
8. Purchasing	26
8.1. Overview.....	26
8.2. Purchase Order Requirements	26
8.3. Material Purchase Order Approvals	26
8.4. Subcontracts.....	27
9. Welding Control	28
9.1. Welding Procedure Specifications (WPS)	28
9.2. Welder ID.....	28
9.3. Tack Welds.....	28
10. Material Controls	29
10.1. Material Specifications	29
10.2. Work Process Specifications.....	29
10.3. Application of Multiple Sources of Specifications	29
10.4. Welding Material	30
10.5. Material Receiving Inspection	30
10.6. Material Inspection and Test Status	30
10.7. Material storage	30
10.8. Control of Customer Property	31
10.9. Controlled Use of Materials.....	31
10.10. Controlled Material Identification and Traceability	31
11. Weld Examination and Inspection Program.....	33
11.1. Inspection of Welding Work	33
11.2. Required Work Task Quality Inspections and Tests.....	34
11.3. Material Inspections and Tests.....	34
11.4. Work in Process Inspections.....	35
11.5. Work Task Completion Inspections	35
11.6. Inspection of Special Processes	35
11.7. Independent Measurement and Tests	35
11.8. Hold Points for Customer Inspection.....	36
11.9. Quality Inspection and Test Specifications	36
11.10. Inspection and Test Acceptance Criteria	36
11.11. Inspection and Testing Standards.....	36
11.12. Work Task Inspection and Test Status.....	37

11.13. Independent Quality Assurance Inspections	38
11.14. Work Task Inspection and Test Records	38
11.15. Project Completion and Closeout Inspection	39
12. Nondestructive Examination	40
12.1. Overview	40
12.2. Subcontracted NDE Procedures	40
12.3. Subcontractor NDE Personnel	40
12.4. NDE Records	40
13. Calibration of Measurement and Test Equipment	41
13.1. Overview	41
13.2. Calibration Procedure	41
13.3. Calibration Records	41
13.4. Verification and Validation of Welding Machines	41
13.5. Calibration Identification	42
13.6. Discrepant Equipment	42
14. Storage, Shipping and Handling	43
14.1. Preservation, Storage and Protection of Materials and Completed Work	43
15. Nonconformances and Corrective Actions	44
15.1. Overview	44
15.2. Nonconformances	44
15.3. Corrective Actions	45
16. Preventive Actions	46
16.1. Overview	46
16.2. Identify Preventive Actions for Improvement	46
16.3. Train Preventive Actions for Improvement	46
17. Quality System Audits	48
17.1. Overview	48
17.2. Project Quality System Audit	48
17.3. Company-wide Quality System Audit	48
18. Record and Document Controls	50
18.1. Overview	50
18.2. Quality System Documents	50
18.3. Document Controls	50
18.4. Record Control and Retention	51
19. Forms	53

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9. WELDING CONTROL

9.1. WELDING PROCEDURE SPECIFICATIONS (WPS)

Welding procedure specifications shall be qualified and approved in accordance with the applicable AWS Welding code(s) or Specification(s) (i.e., D1.1., D1.5) or AWS B2.1, *Specification for Welding Procedure and Performance Qualification*.

When the governing Welding code(s) mandates that welding procedures be qualified by test, the [CompanyName] shall have PQRs that support the applicable WPSs. When prequalified WPSs or Standard Welding Procedure Specifications (SWPSs) published by the AWS are permitted, PQRs are not required.

The Quality Manager or a Certified Welding Inspector (CWI) reviews and approves the welding procedure before being used in production welding operations.

Revisions to the WPSs and PQRs are controlled by the Quality Manager according by the document and record control procedures specified in the relevant section of this Quality Manual.

The applicable WPSs shall be available to welders or welding operators during testing and production welding.

The Quality Manager is responsible for selecting and assigning welding procedures. The Quality Manager or qualified designee shall ensure that welding procedures are listed on applicable shop fabrication drawings.

9.2. WELDER ID

Each qualified welder is issued a unique stamp (stencil) by the Quality Manager with which to identify each weld made. When conditions prevent the stamping of welds, the QC Inspector enters the stencil on the Supplemental Traveler for each joint welded, or the QC Inspector will record all stencils for each weld joint on an as-built drawing.

9.3. TACK WELDS

Tack welds, whether left in place or completely removed, are made by qualified welders using a qualified procedure.

If left in place, the ends of each tack weld are ground to ensure complete fusion into the final weld, and the welder's symbol is recorded on the Supplemental Traveler or as-built drawing.

After preparation, each tack weld is visually examined by the QC Inspector and if found defective, completely removed.

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11. WELD EXAMINATION AND INSPECTION PROGRAM

11.1. INSPECTION OF WELDING WORK

11.1.1. DIMENSIONAL INSPECTIONS – SIZE, LENGTH, AND LOCATION OF WELDS

A qualified welding inspector inspects all weld dimensions to ensure that the size, length, and location of all welds conform to the requirements of the applicable AWS Welding Code(s) or Specification(s) (i.e., D1.1., D1.5) as specified in the Manual Conformance section of this Manual, and to the detail drawings; and that no unspecified welds have been added without the approval of the contract Engineer.

11.1.2. WELD INSPECTIONS

During the welding process, at suitable intervals, weld inspections are performed by a qualified welding inspector. Such inspections will be conducted, on a sampling basis, prior to assembly, during assembly, and during welding. The welding inspector will observe joint preparation, assembly practice, and the welding techniques, and performance of each welder, welding operator, and tack welder to ensure that the applicable requirements of the AWS Welding Code(s) or Specification(s) (i.e., D1.1., D1.5) as specified in the Manual Conformance section of this Manual are met.

11.1.3. FINAL INSPECTIONS

After completion of the work, a certified welding inspector performs a final visual inspection of every weld to ensure that the requirements of the applicable sections of code are met. Other acceptance criteria, different from those described in the applicable AWS Welding Code(s) or Specification(s) (i.e., D1.1., D1.5) as specified in the Manual Conformance section of this Manual, may be used when approved by the Engineer on the contract.

Size and contour of welds will be measured with suitable gages. Visual inspection for cracks in welds and base metal and other discontinuities will be observed with the aid of a strong light, magnifiers, or such other devices as may be found helpful.

11.1.4. WELD INSPECTION AND TEST STATUS

The inspector identifies final acceptance or rejection of the work either by marking on the work or with other recording methods.

Final product acceptance inspection shall be indicated by permanent stamping or marking adjacent to the weld or must be unambiguously identified in the inspection report.

11.1.5. WELD INSPECTION RECORDS

The inspector shall make a record of the inspection which shall include the following information:

- Unique part identifier (serial number, shop order, or batch number)
- Drawing number and revision
- Procedure and applicable acceptance criteria
- Inspector identity and date of inspection
- Record of defect findings

- Nominal
- Actual
- Tolerance

The Inspector will record inspection results on the Visual Weld Inspection Report or other form if approved by the contract Engineer.

An example of the Visual Weld Inspection Report is included in the Forms section at the end of this Manual.

11.2. REQUIRED WORK TASK QUALITY INSPECTIONS AND TESTS

The Quality Manager identifies each Task that is a phase of fabrication and erection that requires separate quality controls to assure and control quality results. Each Task triggers a set of requirements for quality control inspections before, during and after work tasks.

Tasks are divided into two categories:

- Discrete Tasks are standard type of work where a completion inspection is performed one time at the completion of a phase of work.
- Process Tasks are tasks where completion inspections are performed continuously. Continuous inspections are required when there is a limited window of time to perform a completion inspection before the next task begins. Process tasks may also be characterized by independent monitoring of a work process, such as welding, where the observer verifies conformance to work procedures.

Process tasks undergo additional quality controls that continuously monitor compliance to specifications.

Independent quality audits are conducted to verify that the task quality controls are operating effectively.

Fabrication and erection projects may execute a work task multiple times in a project, in which case a series of quality inspections are required for each work task.

11.3. MATERIAL INSPECTIONS AND TESTS

Material quality inspections and tests ensure that purchased materials meet purchase contract quantity and quality requirements.

11.3.1.1. MATERIAL RECEIVING INSPECTION

The Supervisor inspects or ensures that a qualified inspector inspects materials prior to use for conformance to project quality requirements. The receiving inspection includes a verification that:

- The correct material has been received
- The material is identified and meets the traceability requirements for the material
- Material certifications and/or test reports meet the specified requirements
- Materials are tested and approved for the specific application

11.3.1.2. SOURCE INSPECTIONS

Source quality inspections are required when quality characteristics cannot or will not be verified during subsequent processing. The Quality Manager determines if a source inspection is necessary to validate supplier quality before materials are delivered to the project jobsite.

The Supervisor ensures that each work task that uses the source inspected materials proceed only the material has been accepted by the source inspection.

11.4. WORK IN PROCESS INSPECTIONS

Work in process quality inspections continuously verify compliance project quality standards beginning at the start of a work task, as work is conducted, and continues until the work task is complete.

11.4.1.1. INITIAL JOB-READY INSPECTIONS

For each work task, the Supervisor or a qualified inspector performs job-ready quality inspections to ensure that work activities begin only when they should begin. Job-ready quality inspections verify that conditions conform to the project quality requirements.

11.4.1.2. INITIAL WORK IN PROCESS INSPECTION

For each work task, the Supervisor or a qualified inspector performs an initial work in process inspection when the first representative portion of a work activity is completed.

11.4.1.3. FOLLOW-UP WORK IN PROCESS INSPECTIONS

The Supervisor or a qualified inspector performs ongoing work in process quality inspections to ensure that work activities continue to conform to project quality requirements. Punch Items

If the Supervisor or inspector observes an item for correction prior to a work task completion inspection, the item is identified for correction. During the work task completion inspection each punch item correction is verified.

Any outstanding punch items remaining after the work task completion inspection is deemed a nonconformance.

11.4.2. ADDITIONAL INSPECTION REQUIREMENTS FOR PROCESS TASKS

For each process task, a qualified person inspects the ongoing completion work for conformance to project quality requirements. This is in addition to discrete task completion inspections that are performed one time at the end of a phase of work.

The continuous monitoring inspections are conducted before starting other work activities that may interfere with an inspection.

11.5. WORK TASK COMPLETION INSPECTIONS

For each work task, the Quality Manager or a qualified inspector inspects the completion of each work task to verify that work conforms to project quality requirements.

Completion quality inspections are performed for each work task. Completion quality inspections are conducted before starting other work activities that may interfere with an inspection.

Any outstanding punch items remaining after the work task completion inspection is deemed a nonconformance.

11.6. INSPECTION OF SPECIAL PROCESSES

The Quality Manager identifies special processes where the results cannot be verified by subsequent inspection or testing and determines if continuous work in process inspections are required. For these special processes, a qualified inspector continuously inspects the work process.

11.7. INDEPENDENT MEASUREMENT AND TESTS

The Quality Manager ensures that quality tests that apply to a specific project are clearly identified. Tests for a project include:

- Customer required quality tests as specified by the contract, contract technical specifications, contract drawings, and approved submittals.
- Additional quality tests necessary to assure quality results.

11.8. HOLD POINTS FOR CUSTOMER INSPECTION

The Supervisor stops work when reaching a hold point specified on the inspection and test plan. The Supervisor ensures that work proceeds only with customer approval.

11.9. QUALITY INSPECTION AND TEST SPECIFICATIONS

Specifications for each inspection or test are clearly understood before the inspection or test is performed including:

- Items to be inspected/tested
- Inspections/tests to be performed
- Testing schedule frequency
- Specification references including contract drawing identification number and version, if applicable, and/or contract technical specification number and version, if applicable
- Performing party
- Witness parties
- Certificates required
- Checklists/procedures
- Reference standards

11.10. INSPECTION AND TEST ACCEPTANCE CRITERIA

Inspections assess conformance of materials or work for each work task to project quality requirements, including applicable:

- Applicable AWS and AISC Codes
- Contract technical specification
- Contract drawings
- Approved shop drawings
- Approved product submittals
- Approved allowances and unit prices
- Product identification requirements
- Approved submittals
- [CompanyName] quality standards

The material or completed work task is accepted only when it meets all project quality requirements.

11.11. INSPECTION AND TESTING STANDARDS

Inspection and testing standards that may apply to this project include those listed below. Specifications that determine the rules for controlling the welding process and weld acceptance include but are not limited to the inspection and testing standards listed on Table 12.1.

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Table 12.1

Description	Reference Standard No.	Reference Standard Title
Identification markings to conform to ASTM standards specified in the approved construction documents	AISC 360 Section A3.3 and applicable ASTM material Standards	Material verification of high-strength bolts, nuts and washers
Identification markings to conform to AWS specification in the approved construction documents	AISC 360, Section A3.5 and applicable AWS A5 documents	Material verification of weld filler materials
Inspection of high-strength bolting	AISC 360, Section M2.5	Inspection of high-strength bolting
For structural steel, identification markings to conform to AISC 360	AISC 360, Section M5.5 and applicable ASTM material standards	Material verification of structural steel and cold-formed steel deck
Ultrasonic weld inspecting techniques	ASNT SNT-TC-1A Q&A Bk C	Ultrasonic Testing Method
Ultrasonic Inspection	ASTM E 164	Standard Practice for Contact Ultrasonic Testing of Weldments
Liquid Penetrant Inspection	ASTM E 165	Standard Practice for Liquid Penetrant Examination for General Industry
Magnetic Particle Inspection	ASTM E 709	Standard Guide for Magnetic Particle Testing
Radiographic Inspection	ASTM E 94.D	Standard Guide for Radiographic Examination
Non-destructive weld testing and visual examination	AWS B1.11	Guide for the Visual Examination of Welds
Specification for Welding Procedure and Performance Qualification	AWS B2.1/B2.1M	Specification for Welding Procedure and Performance Qualification
Test frequency for ferrous materials	AWS D1.1/D1.1M	Structural Welding Code – Steel
Visual inspection of welds	AWS D1.1/D1.1M	Structural Welding Code – Steel
Structural Welding Code - Sheet Steel	AWS D1.3	Structural Welding Code - Sheet Steel
Inspection of Reinforcing Steel welding	AWS D1.4 ACI 318, Section 3.5.2	REQUIRED VERIFICATION and INSPECTION OF CONCRETE CONSTRUCTION

11.11.1.1. NDE TEST PROCEDURES

NDE shall be performed in accordance written NDE procedures by a certified NDE inspector.

The NDE procedures shall be approved by a Level III in the NDE method(s) that the procedure is based on. The Level III shall be qualified and certified in accordance with the employer’s written practice based on ASNT SNT-TC-1A. The certification process shall include the educational, training, experience, and testing provisions described in SNT-TC-1A.

NDE test procedures will be issued revised and distributed according to the Project Documents and Record control procedures described in the appropriately titled section of this Quality Manual.

11.12. WORK TASK INSPECTION AND TEST STATUS

The status of each quality control work task inspection or test is clearly marked by tape, tag, or other easily observable signal to ensure that only items that pass quality inspections is accepted.

12. NONDESTRUCTIVE EXAMINATION

12.1. OVERVIEW

Nondestructive Examination (NDE) required for code compliance is specified on the drawings or in the contract specifications, and is performed by a qualified NDE subcontractor, whose written procedures, personnel qualifications and certifications and equipment calibration records have been reviewed and approved by the Quality Manager. Some NDE activities (PT, MT, and VT) may be performed in-house after approval of NDE procedures and personnel qualifications by the Quality Manager.

12.2. SUBCONTRACTED NDE PROCEDURES

All NDE performed by the NDE subcontractor is performed using written procedures that are approved by a Level III Examiner qualified in the method. The Quality Manager will review and approve all NDE Subcontractor personnel.

12.3. SUBCONTRACTOR NDE PERSONNEL

The Quality Manager will review and approve qualification records after he has assured himself that subcontracted NDE personnel used on code work have the training, experience, qualifications and are certified for the methods, including to SNT-TC-1A current Code accepted Edition requirements, in accordance with their employers Written Practice and the Code.

NDE personnel qualification records are available for review by the Welding Inspector, who may request re-qualification if he has reason to question an examiner's ability to perform the examination.

Copies of the following Subcontractor NDE personnel qualification and certification records for all examiners performing Code NDE are kept on file by the Quality Manager, and made available for review:

- Name, level of certification and examination method.
- Educational background and experience of examiner.
- Statement indicating satisfactory completion of training in accordance with the employer's written practice
- Results of annual visual acuity examination.
- Copies of current examinations, or documentation or successful completion of examinations in each method qualified.
- Composite grades, or documented grades for each of the above examinations.
- Dates of each certification and or recertification in each method qualified, and dates of assignment to NDE.
- Signature of the Employer's designated representative.

12.4. NDE RECORDS

All reports of NDE, including RT film, are reviewed and accepted by the Level II/III NDE subcontractor and the Quality Manager before submittal to the Welding Inspector for acceptance.

NDE reports, including RT film are filed by the Quality Manager for retention as described in Section 22 of this Manual.

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14. STORAGE, SHIPPING AND HANDLING

14.1. PRESERVATION, STORAGE AND PROTECTION OF MATERIALS AND COMPLETED WORK

[CompanyName] will preserve and protect work in process, completed work, component parts, materials, and when applicable, delivery to the destination, to maintain compliance with project requirements and standards. This includes handling, storage, protection from natural elements, and reducing risks of damage.

Completed work is protected from dirt, oil, ferrous material, other foreign matter, and damage as specified by government regulations, contract technical specifications, industry standards, or product installation instructions.

Protections will be employed that prevent water from collecting and pooling.

Aluminum will be packaged and stored in a manner that prevents damage to the material properties of the metal.

The Quality Manager identifies supplemental protection requirements that apply to a specific project when they are necessary to assure quality results.

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19. FORMS

[CompanyName] Controlled Materials Form	54
[CompanyName] Metals Material Receiving Inspection Report	55
[CompanyName] Material Inspection and Receiving Report	56
[CompanyName] Quality Inspection and Test Plan	57
[CompanyName] Inspection and Test Report.....	58
[CompanyName] Welding Personnel Qualification Form	59
[CompanyName] Welding Personnel Certifications and Licenses	60
[CompanyName] Subcontractor and Supplier Certifications and Licenses.....	61
[CompanyName] Test Equipment Calibration Plan and Log	62
[CompanyName] Daily Production Report	63
[CompanyName] Visual Weld Inspection Report	64
[CompanyName] Work Task Inspection Form	65
Form N-1 Welding Procedure Specification Prequalification	66
Form N-3 WPS QUALIFICATION TEST RECORD_ELECTROSLAG and ELECTROGAS WELDING	68
Form N-4 WELDER, WELDING OPERATOR, OR TACK WELDER QUALIFICATION TEST RECORD.....	69
Form N-9 STUD WELDING APPLICATION QUALIFICATION TEST DATA.....	70
Form M-8 Ultrasonic Unit Calibration Report-AWS	71
Form M-9 dB Accuracy Evaluation.....	72
Form M-10 Decibel (Attenuation or Gain) Values Nomograph	73
Form M-11 Report of UT of Welds	74
Form N-7 REPORT OF RADIOGRAPHIC EXAMINATION OF WELDS.....	76
Form N-8 REPORT OF MAGNETIC-PARTICLE EXAMINATION OF WELDS	77
Form S-15 Report of UT (Alternative Procedure).....	78

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[CompanyName] Material Inspection and Receiving Report								
Contract ID	Contract Name	Purchase Order No.	Supplier			Bill of Lading No.	Date	
[ProjectNumber]	[ProjectName]							
Item No.	Stock/Part No.	Description	Quantity Received	Condition	Marking	Accept	Conditional Use	Reject
						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Receiving Quality Control								
<p>ACCEPTANCE</p> <p>Listed items have been accepted by me or under my supervision</p> <p><input type="checkbox"/> Conform to contract specifications EXCEPT as noted herein or on supporting documents.</p> <p><input type="checkbox"/> Received in apparent good condition EXCEPT as noted</p> <p>Signature of authorized person and date: _____</p>								
<p>EXCEPTIONS:</p>								

[CompanyName] Welding Personnel Qualification Form			
Name:		Job Position:	
Project ID	Project Name	Approval	Approved By
[ProjectNumber]	[ProjectName]	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Review Topics	Project-Related Job Credentials		
	Certification required:	Certifications and expiration dates:	
	Training required:	Training completed and expiration date:	
	Licenses required:	License and expiration dates:	
	Type and length of experience required:	Certifications and expiration dates:	
	Qualifications		
	<input type="checkbox"/> Knowledge of Company quality standards <input type="checkbox"/> Knowledge of Company job responsibilities and authority <input type="checkbox"/> Demonstrated skills and knowledge <input type="checkbox"/> Demonstrated ability <input type="checkbox"/> Demonstrated results		
Qualification Notes:			
Provisional Approval: Action plan for improvement			
Follow-up results and date			

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**[CompanyName]
Welding Personnel Certifications and Licenses**

Project ID	Project Name	Preparer	Date
[ProjectNumber]	[ProjectName]		

Person	Certification, License, or Credential	Expiration Date

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[CompanyName] Visual Weld Inspection Report

Report ID #	Unique Part ID <small>(Serial #, Shop order, or batch number)</small>	Project ID	Project Name	Drawing # & Rev.	Date of Inspection
Final acceptance of completed work (sign and date)					
Inspector Sign and Date			Superintendent Sign and Date		

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Form N-1 Welding Procedure Specification Prequalification

ANNEX N

AWS D1.1/D1.1M:2010

WELDING PROCEDURE SPECIFICATION (WPS) Yes
PREQUALIFIED _____ QUALIFIED BY TESTING _____
or PROCEDURE QUALIFICATION RECORDS (PQR) Yes

Company Name _____ Welding Process(es) _____ Supporting PQR No.(s) _____ <hr/> JOINT DESIGN USED Type: _____ Single <input type="checkbox"/> Double Weld <input type="checkbox"/> Backing: Yes <input type="checkbox"/> No <input type="checkbox"/> Backing Material: _____ Root Opening _____ Root Face Dimension _____ Groove Angle: _____ Radius (J-U) _____ Back Gouging: Yes <input type="checkbox"/> No <input type="checkbox"/> Method _____ <hr/> BASE METALS Material Spec. _____ Type or Grade _____ Thickness: Groove _____ Fillet _____ Diameter (Pipe) _____ <hr/> FILLER METALS AWS Specification _____ AWS Classification _____ <hr/> SHIELDING Flux _____ Gas _____ Composition _____ Electrode-Flux (Class) _____ Flow Rate _____ Gas Cup Size _____ <hr/> PREHEAT Preheat Temp., Min. _____ Interpass Temp., Min. _____ Max. _____	Identification # _____ Revision _____ Date _____ By _____ Authorized by _____ Date _____ Type—Manual <input type="checkbox"/> Semiautomatic <input type="checkbox"/> Mechanized <input type="checkbox"/> Automatic <input type="checkbox"/> <hr/> POSITION Position of Groove: _____ Fillet: _____ Vertical Progression: Up <input type="checkbox"/> Down <input type="checkbox"/> <hr/> ELECTRICAL CHARACTERISTICS Transfer Mode (GMAW) _____ Short-Circuiting <input type="checkbox"/> Globular <input type="checkbox"/> Spray <input type="checkbox"/> Current: AC <input type="checkbox"/> DCEP <input type="checkbox"/> DCEN <input type="checkbox"/> Pulsed <input type="checkbox"/> Power Source: CC <input type="checkbox"/> CV <input type="checkbox"/> Other _____ Tungsten Electrode (GTAW) Size: _____ Type: _____ <hr/> TECHNIQUE Stringer or Weave Bead: _____ Multi-pass or Single Pass (per side) _____ Number of Electrodes _____ Electrode Spacing _____ Longitudinal _____ Lateral _____ Angle _____ Contact Tube to Work Distance _____ Peening _____ Interpass Cleaning: _____ <hr/> POSTWELD HEAT TREATMENT Temp. _____ Time _____
---	---

WELDING PROCEDURE

Pass or Weld Layer(s)	Process	Filler Metals		Current		Volts	Travel Speed	Joint Details
		Class	Diam.	Type & Polarity	Amps or Wire Feed Speed			

Form N-1 (Front)

ANNEX N

AWS D1.1/D1.1M:2010

Procedure Qualification Record (PQR) # _____
Test Results

TENSILE TEST

Specimen No.	Width	Thickness	Area	Ultimate Tensile Load, lb	Ultimate Unit Stress, psi	Character of Failure and Location

GUIDED BEND TEST

Specimen No.	Type of Bend	Result	Remarks

VISUAL INSPECTION

Appearance _____
 Undercut _____
 Piping porosity _____
 Convexity _____
 Test date _____
 Witnessed by _____

Radiographic-ultrasonic examination
 RT report no. _____ Result _____
 UT report no. _____ Result _____

FILLET WELD TEST RESULTS

Minimum size multiple pass _____ Maximum size single pass _____
 Macroetch
 1. _____ 3. _____ 1. _____ 3. _____
 2. _____ 2. _____

Other Tests

All-weld-metal tension test
 Tensile strength, psi _____
 Yield point/strength, psi _____
 Elongation in 2 in, % _____
 Laboratory test no. _____

Welder's name _____

Clock no. _____ Stamp no. _____

Tests conducted by _____

Laboratory _____

Test number _____

Per _____

We, the undersigned, certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in conformance with the requirements of Clause 4 of AWS D1.1/D1.1M, (_____) *Structural Welding Code—Steel*.
 (year)

Signed _____

Manufacturer or Contractor

By _____

Title _____

Date _____

Form N-1 (Back)

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