



## SUPPLIER QUALITY MANUAL

Approved:  Date: 2008.12.04  
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## REVISION HISTORY

Revision 2007.02.19 : Initial Release

Revision 2008.12.04: Added Section 3.1 and 10.0

## **1.0 SCOPE**

1.1 This manual applies to the supplier and the sub-supplier of items and services and the construction contractor (hereinafter called as supplier) as specified in the contract or procurement documents (hereinafter called as contract).

1.2 The supplier shall establish and implement an acceptable quality assurance program which wholly or selectively complies with the "Quality Assurance Program Criteria in Sec. 3.0" depending upon the work scope of the contract and the quality level of material, equipment and services supplied.

1.3 The quality system, policy, organization, responsibility, requirements (and including a list of procedures as necessary) necessary for control and assurance of quality throughout all phases of the contract shall be documented and implemented.

1.4 The requirements specified in the contract or procurement documents, general conditions, special conditions, and the technical specifications have priority over the requirements of this manual. If the supplier believes that an inconsistency and/or ambiguity exists between this manual and the contract, the supplier shall immediately notify the Buyer, and shall proceed relevant activities only after obtaining the Buyer's acceptance.

1.5 The supplier may delegate any or all activities to the sub-supplier, but in this case, the supplier shall assure that the sub-supplier is subjected to the applicable quality assurance requirements of this manual.

## **2.0 TERMINOLOGY**

2.1 Buyer: PaR Nuclear Inc., Ederer Nuclear Crane Group; subsidiary of Westinghouse Electric Company LLC. and his authorized agents.

2.2 Supplier: An entity which provides services, equipment, components, fabrication, construction, etc. to the Buyer in accordance with contract requirements. An all-inclusive term used in place of any of the following: vendor, seller, construction contractor, fabricator, consultant and their sub-tier levels.

2.3 Controlled Copy: A copy of the supplier's documents which is marked with a controlled copy number through which current status shall be maintained by transmittals of revisions, additions, and deletions.

2.4 Procedure: Written requirements which specify operational steps, how an activity is to be performed, and which assign responsibilities for reaching objectives.

2.5 Quality Assurance Manual(QA Manual): A written document which prescribes Quality Assurance program requirements so that all quality related activities are systematically performed and in accordance with regulatory requirements, contract requirements, codes and standards.

## **3.0 QUALITY ASSURANCE PROGRAM CRITERIA**

3.1. The supplier who performs Safety-Related works shall establish a QA program to meet criteria of Atomic Energy Laws, 10 CFR 50 App. B / ASME NQA-1 (1994 edition and 1995 addenda). These items/services shall be provided in accordance with the Suppliers/Manufacturers Quality Assurance Program which has been approved by PaR Nuclear's Quality Assurance Organization. The Supplier shall maintain and implement this Quality Assurance Program in accordance with 10CFR50 Appendix B and ANSI N45.2. The supplier shall extend applicable requirements to lower tier subcontractors and suppliers.

3.2 Title 10, Code of Federal Regulations, Part 21 applies to Safety-Related works. Under this regulation, the supplier may be required to report defects or noncompliance to the Nuclear Regulatory Commission. In the event the supplier, or one of its suppliers identify a potential defect or noncompliance as defined in 10 CFR 21.3, the supplier is to immediately notify PaR Nuclear, Quality Assurance Department at 899 Highway 96 West, Shoreview, MI 55126.

3.3 Commercial Grade Items - If the supplier provides any parts in satisfaction of this purchase order which are defined as commercial grade in accordance with 10 CFR 21, the supplier MUST dedicate those items for safety-related use by methods similar to those in EPR1 Report NP-5652, "Guidelines for the Utilization of Commercial Grade Items in Nuclear Safety Related applications (NCIG-07)."

3.4 For supplier who performs non-safety-related works, it is not required to establish a specific QA Manual, but it is required to perform quality activities in accordance with the item's characteristics and the contract requirements. When a quality assurance program is specifically required by the applicable regulatory requirements, code and standards in the contracts, the supplier shall establish and implement a QA Manual to meet those quality requirements.

3.5 In such case, supplier shall submit one(!) QA Manual to Buyer. Suppliers who have submitted a controlled copy of his QA Manual previously in other projects which has been accepted by the Buyer, need only submit documented evidence to provide commitment that the controlled copy is applicable to the scope of the work involved.

3.6 Suppliers who hold any certificate according to applicable code and standard, such as ASME Certificate of Authorization, ISO Certificates and other accredited authorization, shall submit a copy of his current certificates.

#### **4.0 QUALITY ASSURANCE PROGRAM REQUIREMENTS**

The following quality assurance program criteria identify the minimum essential requirements of a quality assurance program. The QA Manual shall meet these criteria, as a minimum. In case justification for selective application of quality assurance requirement is clearly identified, the following quality assurance program requirement may be tailored in accordance with item's characteristics.

##### **4.1 Organization**

4.1.1 The organizational structure, functional responsibilities, levels of authority, lines of communication for activities affecting quality, and implementation of QA Manual shall be documented.

4.1.2 The responsibilities and authorities of persons or organizations responsible for establishing appropriate QA Manual and for verifying that activities, affecting quality have been correctly performed shall be documented.

4.1.3 Persons or organizations responsible for verifying that activities affecting quality have been correctly performed shall have sufficient authority to identify quality problems, provide solutions, and assure that unsatisfactory conditions are controlled until appropriate measures have been taken.

4.1.4 The supplier shall identify a management position that retains overall authority and responsibility for the quality assurance program (normally, this position is the QA Manager).

4.1.5 Persons and organizations performing quality assurance functions shall have sufficient authority and freedom from cost and schedule considerations and shall report quality problems to a management at a level where appropriate action can be affected (Generally this is the President of the company).

4.1.6 Where more than one organization is involved in the execution of activities covered by the contract, the responsibility and authority of each organization shall be clearly established and procedures for information transmittal for each organization shall be prepared and all important information shall be documented.

##### **4.2 Quality Assurance Program**

4.2.1 The supplier shall establish and implement a QA Program in accordance with requirements in this manual.

4.2.2 The QA Program shall assure that activities affecting quality shall be performed in accordance with written instructions, procedures, or drawings.

4.2.3 Items, services, and processes to which the QA Program will apply shall be identified

4.2.4 Organizations responsible for establishing and executing the QA Program, and the responsibility and authority of relevant personnel and/or organizations shall be clearly prescribed.

4.2.5 The QA Program shall include consideration of the technical aspects that the supplier should implement, and the QA Program shall cover all comprehensive contract requirements.

4.2.6 The QA Program shall provide the planning and accomplishment of activities affecting quality under suitably controlled conditions.

4.2.7 The QA Program shall provide for indoctrination and training, as necessary, of personnel performing activities affecting quality, and the records of indoctrination, training, and qualification shall be maintained.

4.2.8 The QA Program shall be periodically reviewed and evaluated in adequacy and effectiveness, and revised as necessary.

4.2.9 Computer programs (verification of computer program to produce valid solution and identification of computer program used in applicable documents) and fire protection system whose failure could affect quality of nuclear power plant shall be applied with applicable QA requirements.

### **4.3 Procurement Document Control**

4.3.1 A control measure shall be established to assure that applicable regulatory requirements, design bases, technical and quality requirements are suitably included or referenced in the procurement documents.

4.3.2 The procurement requirements issued by the supplier shall require sub-suppliers to establish and provide a QA Manual consistent with the pertinent provisions of this manual.

4.3.3 The procurement document shall include the followings:

- A. Quality assurance program requirements
- B. Technical requirements
- C. Supplier's right to inspect and audit the subcontractor
- D. Document submittal requirements
- E. Quality verification documents submittal requirements

4.3.4 Procurement documents shall be reviewed by the quality organization to assure that the procurement document includes appropriate quality assurance requirements.

4.3.5 The supplier, when purchasing quality related items, shall procure them from a selected supplier who has sufficient capability to observe technical and QA requirements.

### **4.4 Document Control**

4.4.1 A control measure for preparation, issuance, and change of documents (instructions, drawings, or procedures, etc.) that specify quality requirements or prescribe activities affecting quality shall be established and documented.

4.4.2 The provisions for document control shall include the following requirements.

- A. Selection of individuals or organization responsible for preparation, review, approval and issuance of relevant documents (including revisions)
- B. Document changes, including major and minor changes
- C. Selection and use of quality documents applicable to relevant activities
- D. Control and cooperation of interfacing documents
- E. The use of the latest documents
- F. Preparation and maintenance of document distribution lists for maintaining the latest issues

### **4.5 Control of Purchased Materials, Equipment, and Services**

4.5.1 A control measure to assure that purchased materials, equipment, and services, whether purchased directly by the supplier or through a lower-tier sub-supplier, comply with the procurement requirements shall be established and documented in accordance with contract requirements.

4.5.2 Measures for control of purchased items and services shall include the following requirements as appropriate:

- A. Source evaluation and selection; maintenance of an Approved Suppliers List.

- B. Quality verification documents to be submitted by the sub-supplier
- C. Inspection and QA audit to sub-supplier
- D. Receiving inspection and acceptance criteria

#### **4.6 Identification and Control of Materials, Parts, and Components**

4.6.1 A measure for the control and identification of materials, parts, and components shall be established and documented.

4.6.2 A control measure shall be established and implemented to provide identification of storage items, such as materials, parts, and equipment, in accordance with item number (part, batch, lot and heat number). If nonconforming items are found, their use shall be stopped.

4.6.3 When heat lot traceability is critical, supplier shall maintain heat lot traceability through the entire phase of manufacturing.

4.6.4 The identification of materials, parts, and components consistent to the identification numbers stated on the contract shall be used through the entire phase of manufacturing.

#### **4.7 Process Control**

4.7.1 Process shall be controlled by procedures, instructions, drawings, checklists, travelers, or other appropriate means.

4.7.2 A measure shall be established and documented to assure that special processes such as welding, non-destructive examination, heat treatment, flushing and painting are accomplished by qualified personnel using qualified procedures.

4.7.3 Qualification for personnel, process, and equipment of each special process shall be performed, and qualification procedures and records shall be prepared and maintained.

#### **4.8 Inspection**

4.8.1 A plan for inspection of activities affecting quality shall be established and implemented by qualified personnel or groups responsible for verifying that the items or activities are in compliance with the requirements of procedures, instructions, drawings.

4.8.2 Prior to fabrication, supplier shall create a marked up document (or "ballooned" document) that correlates a characteristic number from the inspection report to the drawing, purchase order and approved technical data as applicable.

- Balloon drawing: A drawing with each characteristic or requirement clearly marked with a unique identifier number. The number may be circled or boxed for easy visual identification.

4.8.3 100% inspections, recording of 100% of all specifications, shall be performed on all custom fabricated items.

4.8.4 Prior to release of shipment, all measurable requirements shall be identified, measured and recorded on the inspection report and submitted to Seller for review and approval.

#### **4.9 Test Control**

4.9.1 Tests necessary to demonstrate that the items will perform satisfactorily in actual service shall be selected and implemented by the documented procedures or test plan, as required by the contract.

4.9.2 Test procedures or test plan shall include test requirements, acceptance criteria, and provisions for assuring that prerequisites for the given tests have been met, and that the adequate instrument is selected and used, and that suitable environmental conditions are maintained.

- A. Calibrated instrument

- B. Appropriate equipment
- C. Item to be tested
- D. Acceptance criteria

4.9.3 Test results shall be documented and evaluated by a responsible authority to assure that the test has been performed satisfactorily and that acceptance criteria has been observed,

4.9.4 The records for inspector qualification and qualification procedures shall be prepared maintained,

#### **4.10 Handling, Storage, and Shipping**

4.10.1 A control measure for handling, storage, cleaning, packaging, preservation, and shipping of items shall be established and documented to prevent damage or loss and to minimize deterioration.

4.10.2 Instructions for marking and labeling for packaging, shipment, handling, and storage of items shall be established as necessary to adequately identify, maintain, and preserve the item.

4.10.3 Packaging, Handling, Storage, and Shipping shall be in accordance with ANSI/ASME N45.2.2.

#### **4.11 Inspection, Test, and Operating Status**

4.11.1 The status of inspection and test activities shall be identified either on the items or in documents traceable to the items where it is necessary to assure that required activities are performed and to assure that items which have not passed the required inspections & tests are not inadvertently installed, used, or operated.

#### **4.12 Nonconforming Materials, Parts, or Equipments**

4.12.1 A measure to control items that do not conform to specified requirements shall be established to prevent inadvertent installation or use. This measure shall provide for identification, documentation, evaluation, segregation, disposition of nonconforming items, and notification to affected organizations.

4.12.2 Nonconformance Report (NCR) shall be issued in accordance with procedures, and nonconforming items shall be reviewed and properly disposed as to use-as-is, reject, repair, or rework in accordance with documented procedures.

4.12.3 When segregation for nonconforming items is impractical, a measure to prevent use of the rejected nonconforming item shall be prescribed, using appropriate identification method such as marking and tagging.

4.12.4 Technical justification for the acceptability of a nonconforming item, dispositioned repair or use-as-is shall be performed by the supplier and the results shall be submitted for the Buyer's approval,

4.12.5 The supplier shall submit to the Buyer a copy of the closed NCR.

4.12.6 If the Buyer finds nonconformances when performing surveillance, audit or other monitoring activity at the supplier's facilities, the Buyer may request a corrective action or stopwork as necessary.

#### **4.13 Corrective Action**

4.13.1 A measure shall be established and implemented to identify and correct any condition adverse to quality, such as failures, malfunctions, deficiencies, defective materials and equipment, and

4.13.2 In the case of a significant condition adverse to quality, the cause of the condition shall be determined and corrective action taken to prevent recurrence.

4.13.3 The identification, cause, and corrective action for any condition adverse to quality shall be documented and reported to appropriate levels of management.

4.13.4 If a significant deficiency to quality occurs or a similar condition adverse to quality occurs repeatedly, it is required to stop the related work as necessary.

#### **4.14 Quality Assurance Records**

4.14.1 Documented records for evidence of activities affecting quality shall be prepared and maintained to provide identification and traceability.

4.14.2 Responsibility and requirements for document transmittal, retention, and maintenance after completion of work shall be documented in accordance with contract requirements:

4.14.3 The records shall include the results of inspection, test, design, procurement, monitoring of work performance, audit, training and material analysis as specified in the procurement document.

4.14.4 The procedures or instructions for records storage shall be established to prevent damage from moisture, temperature, and pressure.

4.14.5 In case quality assurance records are controlled as electronic media, the control measures, including requirements for retrieval of stored information and duration life of media, shall be established and implemented.

#### **5.0 DOCUMENT SUBMITTAL**

5.1 The following shall be submitted 3 weeks prior to Fabrication:

- A. Welding Procedures Specification (WPS) and Procedure Qualification Record (PQR)
- B. Visual Weld Inspection Procedure
- C. Surface Preparation & Coating Procedure
- D. Post weld Heat Treatment Procedure
- E. NDE (RT/UT/MT/PT/VT) Procedure
- F. Inspector Qualifications (Paint, NDE, Visual Weld)

5.2 The following shall be submitted 3 weeks prior to Shipping.

- A. Packing and Shipping
- B. Packing Procedure
- C. Shipping & Transportation Procedure
- D. Site Storage Procedure

#### **6.0 QUALITY PLAN SUBMITTAL REQUIREMENTS**

6.1 (Submittal and Review) When required by Contract or Seller QA, the supplier shall prepare and submit a Quality Plan; describing in detail the inspections and tests during manufacturing, repair and installation to Seller. The Quality Plan shall be reviewed by Seller in advance of the work start and the Seller designates witness and hold points in the Quality Plan.

6.2 (Observance of Codes and Standards) Quality Plan shall be prepared to observe applicable codes and standards specified in the contract/procurement documents.

6.3 (Preparing Method) Quality Plan shall include at least the following and the typical example is showed in Attachment 1.

- A) Applicable Procurement Document No. / Contract No. (if assigned); and name
- B) Component name, component No.
- C) Quality Plan No. and revision No.
- D) Operation, test and examination process
- E) Applied documents (procedure, drawing etc.) for each process and revision No.
- F) Blank for designating the Contractor's inspection points

- G) Blank for designating the Seller's surveillance inspection points
- H) Blank for signature verifying inspection result
- I) Identification of Quality Verification Documents, etc.

6.4 The Contractor shall not proceed with fabrication without the Seller's approval of Quality Plan.

## **7.0 WITNESS AND HOLD POINTS**

7.1 Witness Point: The following tests/operation is to be witnessed by the Buyer's representative on first operation basis.

7.1.1 Witnessing of these activities after acceptable first operation will be on a representative sample basis unless otherwise directed below.

7.1.2 Witness Points (s)

- A. Fit-up and Welding, Each Reviewed Procedure
- B. In-Process Nondestructive Examination, Each Review Procedure
- C. Major Weld Repair if Applicable
- D. Visual Examination of Internal
- E. Cleanliness and System Close Out
- F. Surface Preparation and Application of Coating
- G. Heat Treatment, Each Reviewed Procedure
- H. Conformity Check of Control Panels

7.2 Hold Points: The following tests/operation are to be witnessed by the Buyer's representative on a 100% basis, unless otherwise directed below.

7.2.1 Waiver of Hold Points must be given by the Buyer.

7.2.2 Hold Points (s)

- A. Proof Load Test and Subsequent Non-Destructive Examination for Hooks.
- B. Radiographic Film Review
- C. Shop Test
- D. Operation Run Test
- E. Final Inspection
- F. Review and Sign-off of Quality Verification Document
- G. Packaging Inspection
- H. Release for Shipment
- I. Shipping Inspection



Rev	Date	Revision Description	Prepared By		Reviewed By		Approved By	
<b>Quality Plan Detail</b>								
No.	Description of Operation	Reference Document	Supplier Inspection Record		Buyer Inspection Point		QVD	Remarks
			Point	Verify	Point	Verify		
0010								
0020								
0030								
0040								
0050								
0060								
0070								
0080								
0090								
0100								
0110								
0120								
0130								
0140								
0150								
0160								
0170								
0180								
0190								
0200								
WP: Witness Point HP: Hold Point R: Document Review			Quality Verification Document; W: With QVD					

## **8.0 QUALITY VERIFICATION DOCUMENTATION LIST**

8.1 All the quality documents shall be subject to review by the Buyer prior to acceptance of goods. When Buyer surveillance inspection is required, a release for shipment shall not be granted until a satisfactory review of the quality documentation package(s) has been completed. A cover sheet detailing the following information shall be affixed to each Quality Verification Documentation package:

### **A. MATERIAL TEST REPORTS**

- Certified Material Test Report (CMTR)
- Certificate of Compliance

### **B. INSPECTION & TEST REPORTS**

- Speed vs. Load Curves for Motors
- Motor Test Report
- Non Destructive Examination, Reports with RT Films

### **C. INSPECTION & TEST REPORTS I (CONT.)**

- Heat Treatment Report
- Welding Verification Records
- Quality Assurance Documentation for Coating Work
- Test and Inspection Reports
- Hook Test Reports

### **D. FINAL SIGNED-OFF QPLAN**

### **E. SDDR / CAR (Close Out) IF ANY**

## **9.0 WELDING**

9.0.1 This Manual describes the welding requirements for structural steel and miscellaneous steel.

### **9.1 CODES & STANDARDS**

9.1.1 Welding, welding procedures and welder performance qualification shall meet the requirements of the specified code on the contract (hereinafter called "the Code").

### **9.2 GENERAL**

9.2.1 All welding shall conform to the requirements of this manual and the design drawings.

9.2.2 All welding procedures shall be approved by the Buyer prior to the commencement of any welding activities.

9.2.3 The Supplier shall be responsible for the welding performed by his organization. Qualification of welding procedures, welders, and welding operators by other organizations shall not be permitted.

9.2.4 The completed WPS shall describe all the essential, nonessential, and, when required, supplementary essential variables for each welding process used in the WPS. Ranges of these variables shall be correctly addressed.

9.2.5 The Supplier shall maintain a record of the results obtained in the WPS, Procedure Qualification Record (PQR), and Welder and Welder Operator Performance Qualification (WPQ).

9.2.6 Records of WPS, PQR, and WPQ shall be in reproducible form, as appropriate.

9.2.7 The WPS, PQR, and WPQ shall be certified by the Supplier.

9.2.8 The welder and welding operator shall be tested under the full supervision and control of the Supplier.

9.2.9 The Buyer or Buyer's Representative shall have the right of free access to the Supplier's facilities and equipment for the purpose of monitoring and witnessing welding activities performed by the Supplier.

### **9.3 SUBMITTAL AND APPROVAL**

9.3.1 In case of specific applications other than those deviated from this manual; the Supplier shall submit the complete details of the applications to be used for the Buyer's review and approval. Specific applications shall not be permitted without a written acceptance of the Buyer.

9.3.2 The Supplier shall demonstrate his capability to use specific application beyond this manual, if required. The Buyer shall be notified of the demonstration in advance for the witnessing purposes. Test specimens, such as procedure qualification test specimen used for a specific application, shall be maintained to be accessible to the Buyer and, if necessary, the Supplier shall submit the specimens to the Buyer.

9.3.3 The Supplier shall submit detailed welding related procedures which meet the requirements of the Code for the Buyer's review and approval.

9.3.4 The Supplier's submittals for the Buyer's review and approval are listed below as applicable.

- Welding Procedure Specification (WPS)
- Procedure Qualification Record (PQR)
- Heat treatment procedure, if applicable
- Others, if requested by the Buyer

### **9.4 WELD PROCESS**

9.4.1 The following processes shall be permitted for welding with the use of each individual welding process or with a combination of welding processes.

A. Shielded Metal Arc Welding (SMAW)

B. Submerged Arc Welding (SAW)

C. Gas Metal Arc Welding (GMAW) except for short circuiting transfer mode.

D. Flux Cored Arc Welding (FCAW)

9.4.2 Other welding processes may be used provided:

A The Supplier demonstrates its capability to use the process within procedural limitations that are acceptable to the Buyer;

B. Welding process acceptance shall also be based upon the Buyer's evaluation of the required reliability of the equipment or component being fabricated.

### **9.5 DETAILS OF WELDED JOINTS**

9.5.1 Weld joint details for major load carrying components shall be in accordance with the applicable sections of the Code e.g. section 2.0 of AWS D1.1.

9.5.2 Where possible, prequalified joints which meet the details prescribed in applicable sections for fillet welds, and complete joint penetration groove welds, and applicable sections for partial joint penetration groove welds of the Code shall be used. These joints shall be deemed as pre-qualified and should be exempt from test or qualification, except for all groove and fillet weld joints for weld metal and base metal with minimum specified yield strength of 90 ksi or higher.

## 9.6 WORKMANSHIP AND VISUAL EXAMINATION

9.6.1 Surfaces and edges of parts to be welded shall be smooth, uniform, and free from fins, tears, cracks, and other discontinuities that would adversely affect the quality or strength of the weld.

9.6.2 Welds on all load-carrying members shall be continuous.

9.6.3 Surfaces to be welded and surfaces adjacent to a weld shall also be free from loose or thick scale, slag, rust, moisture, grease, and other foreign material that would prevent proper welding.

9.6.4 Welding shall not be performed when the ambient temperature is lower than -20 °C (0°F). Ambient temperature does not mean the ambient environmental temperature but the temperature in the immediate vicinity of the weld.

9.6.5 Tack welds to secure alignment shall either be removed completely or shall be visually inspected for cracks to incorporate into the final welds. Tack welds, whether removed or left in place, shall be made by a qualified welder.

9.6.6 In assembling and joining parts of a structure to members, the procedure and sequence shall be established to minimize distortion and shrinkage.

9.6.7 Run-off tabs, when used in production welding of longitudinal welds, shall be removed after weld completion.

9.6.8 Members distorted by welding shall be straightened by mechanical means or by carefully supervised application of a limited amount of localized heat. The temperature of heated area as measured by approved methods shall not exceed 600°C (1100°F) for quenched and tempered steel nor 650 °C (1200°F) for other steels.

9.6.9 Complete Joint penetration groove welds made without the use of backing shall have the root of the initial weld gouged, chipped or otherwise removed to all but traces of the root of the initial weld before welding is started from the reverse side.

9.6.10 Peening may be used on intermediate weld layers for control of shrinkage stresses in thick weld to prevent cracking. No peening shall be done on the root or surface layer of the weld or the base metal at the edges of the weld. The use of manual slag hammers, chisels, and light weight vibrating tools for the removal of slag and spatter shall be permitted and shall not be considered peening.

9.6.11 Acceptance Criteria for Visual Examination shall be in accordance the referenced standard in the contract or if not specified in the contract, it shall be in accordance with "NCIG-OI, VWAC (Visual Weld Acceptance Criteria)".

## 9.7 PROCESS TECHNIQUES

9.7.1 Welding processes shall be subject to the limitations mentioned herein, as appropriate.

9.7.2 The following limitations shall apply for SMAW:

- A. Welding current shall be determined to reflect the range recommended by the electrode manufacturer;
- B. Complete joint penetration groove welds made with the use of steel backing shall have the root gouged to sound metal before welding is started from the reverse side.

9.7.3 The following limitations shall apply for SAW:

- A. The diameter of electrodes shall not exceed 6.5 mm (1/4 inch);
- B. The Supplier shall furnish an electrode manufacturer's certification that the electrode and flux combination meet the requirements of the classification or grade;
- C. All welds except fillet welds shall be made in the flat position;
- D. Fillet welds may be made in either flat or horizontal position, except that single pass fillet welds which may be made in the horizontal position. Removable starting and stopping tabs shall be used for longitudinal welds.

9.7.4 The following limitation shall apply for GMAW and FCAW:

- A. A gas or gas mixture used for shielding shall be of a welding grade having a dew point of -40 °C (-40°F) or lower;

B. The Supplier shall furnish a gas manufacturer's certification that the gas or gas mixture is suitable for the intended application and meet the dew point requirement;

C. Welding with external gas shielding shall not be done in a draft or wind unless the weld is protected by a shelter. Shelter shall be of material and shape appropriate to reduce wind velocity in the vicinity of the weld to maximum of five (5) miles per hour (2.2 m/sec.);

D. GMAW in the short circuiting transfer mode shall not be permitted unless prior review and written acceptance by the Buyer.

## **9.8 WELDING MATERIAL**

9.8.1 All welding material used in the construction and repair of components or material shall conform to the requirements of the welding material specification.

9.8.2 Suitable storage and handling of electrodes, fluxes, and other welding materials shall be maintained. Precaution shall be taken to minimize absorption of moisture by fluxes or cored, fabricated, and coated electrodes.

9.8.3 A written procedure shall be established to provide the method used to control the receipt, storage, baking, drying, and disbursal of all welding materials.

9.8.4 Low hydrogen electrode coverings shall be limited to a maximum moisture content not exceeding 0.4 percent by weight.

9.8.5 Low hydrogen type electrodes for SMAW shall be used when any of the following conditions apply:

A. For carbon steels having either specified allowable carbon content above 0.30 percent. or having a total alloy content of 0.50 percent or more;

B. For carbon steels having a specified minimum tensile strength of 70 ksi and a thickness greater than 25 mm (1 inch);

C. For repair welding of any steel casting.

## **9.9 HEAT TREATMENT**

### **9.9.1 Preheat**

A. Preheat requirements shall also apply to tack welds, fillet and attachment welds, and thermal gouging and cutting of structural steels.

B. The minimum preheat temperature shall be in accordance with the Code for the welding process being used and higher strength steel being welded. In any cases, minimum preheat temperature of 16°C (60°F) shall be applied.

C. The preheat temperature shall be checked by suitable methods, such as temperature-indicating crayons or thermocouple pyrometers, to ensure that the required temperature is uniformly maintained during the welding operation.

### **9.9.2 Interpass temperature**

Minimum preheat temperature requirements of the Code shall also apply to minimum interpass temperature.

### **9.9.3 Stress-relief heat treatment**

Where required by the drawings or specifications welded assemblies shall be stress relieved by heat treatment. The stress-relief heat treatment shall conform to applicable sections of the Code.

## **9.10 REPAIR**

9.10.1 The removal of weld metal or positions of the base metal shall be repaired in accordance with applicable sections of the Code.

9.10.2 Surface defects may be removed by grinding or machining and may not be repaired by welding provided that the following requirements are met

A. The remaining thickness of the section is not below the required thickness;

B. The area is examined, after blending, by a suitable method to ensure that the defect has been removed or the indication reduced to an acceptable limit.

9.10.3 The surface area of defects shall be cleaned of all foreign materials for a distance of 51 mm (2 inch) from the outside of the defect.

9.10.4 The repaired or replaced weld shall be restored by the method originally used, and the same technique and acceptance criteria shall be applied.

9.10.5 Additional weld metal to compensate for any deficiency in size shall be deposited using an electrode smaller than that used for making the original weld, and preferably not more than 4.0 mm in diameter.

9.10.6 After repair the surface shall be blended uniformly into the surrounding surface.

9.10.7 Prior written approval of the Buyer shall be obtained for repairs to base metal, repair of major defects or delayed cracks, or for a revised design to compensate for deficiencies.

9.10.8 Definition of major repair

Major repairs are defined as the repair of any crack other than crater cracks or the repair of defects that are indicative of a fundamental materials problem or of a process out of control.

## **10.0 NON DESTRUCTIVE EXAMINATION AND ACCEPTANCE CRITERIA :**

10.1 Magnetic Particle Testing of material per ASTM E709. Acceptance criteria: Cracks, forging laps, or linear indications open to the surface are not allowed. Linear subsurface indications more than ½ inch long are not acceptable. Only indications with major dimensions greater than 1/16 inch shall be considered relevant.

10.2 Liquid Penetrant Testing of material per ASTM E 165. Acceptance criteria: Same as MT of material.

10.3 Ultrasonic Testing of material per ASTM A 388 (forgings). Acceptance criteria, using straight beam, is as follows: One or more reflectors which produce complete loss of back reflection, not attributable to geometric configuration, are unacceptable. Complete loss of back reflection is assumed when back reflection falls below 5% of full calibration screen height.

10.4 Ultrasonic Testing of Hooks per ASTM A 388. Acceptance standard is per ASTM E 2375 Class B.

10.5 Ultrasonic Testing of material with per ASTM E 114 (pins, shafts, round bar, etc). Acceptance criteria, using straight beam, is as follows: One or more reflectors which produce complete loss of back reflection, not attributable to geometric configuration, are unacceptable. Complete loss of back reflection is assumed when back reflection falls below 5% of full calibration screen height.

10.6 Ultrasonic Testing of plate material per ASTM A 435. Any discontinuity indication causing a total loss of back reflection which cannot be contained within a circle, the diameter of which is 3 in. or one half of the plate thickness, whichever is greater, is unacceptable.

10.7 Liquid Penetrant Testing of Welds – Per PaR QCP-16 (latest current revision)

10.8 Magnetic Particle Testing of Welds – Per AWS D1.1

10.9 Leak test for Non– Sealed Containers - Per PaR QCP-187 (latest current revision)

10.10 Visual Examination of Welds – Per PaR QCP-28 (latest current revision)