APPENDIX 5G

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APPENDIX 5G

QUALITY CONTROL PROCEDURE FOR FIELD WELDING OF LINER PLATE

SCOPE

This procedure outlines the general requirements for welding quality control to assure that all field welding of liner plate is performed in full compliance with the applicable job specifications.

QUALIFICATIONS FOR WELDING INSPECTORS

All welding inspectors who inspect welds covered by this specification are qualified by meeting the following minimum requirements:

a. Inspectors have a thorough knowledge of the various welding processes and techniques employed in field construction, and are able to demonstrate the proper methods for shielded metal-arc welding, gas tungsten-arc welding, gas metal-arc welding, and oxyacetylene welding.

b. Inspectors have a minimum of two years' previous welding inspection experience, or equivalent experience and training in welding fabrication and nondestructive testing.

c. Inspectors are required to demonstrate to the satisfaction of the responsible Bechtel Metallurgical and Quality Control Services representative their knowledge of the fundamentals, techniques, and application of the inspection methods set forth in this standard, ie, visual magnetic particle, liquid penetrant and radiographic inspection.

WELDING PERFORMED BY BECHTEL CONSTRUCTION PERSONNEL

WELDING PROCEDURE SPECIFICATIONS

All welding performed by Bechtel construction personnel is in strict accordance with approved Bechtel welding procedure specifications. The appropriate Bechtel welding procedure specifications for field welds are being prepared, qualified and issued to the field by the Bechtel Metallurgy and Quality Control Services Department, as directed by Power Division Engineering.

WELDER QUALIFICATION

All welders who make welds under Bechtel welding procedure specifications are qualified by performing the tests required by the applicable Bechtel Welder Performance Specification WQ-F-1 for ferrous materials, and WQ-NF-1 for nonferrous materials. These Bechtel specifications encompass the requirements of Section IX of the ASME Code. No welder is permitted to perform

production welding until he has passed the necessary tests and has the appropriate Welder Performance Qualification Test Record (Form No. WR-1) on file at jobsite. All testing of welders is under the direction of the field welding inspector.

WELDING PERFORMED BY BECHTEL SUBCONTRACTORS

WELDING PROCEDURE SPECIFICATIONS

All welding performed by Bechtel Subcontractors is in strict accordance with the applicable job specifications. When those specifications require Engineering approval of welding procedures, no production welding is permitted without prior approval of such procedures by Power Division Engineering. When Engineering approval is not specified but welding is to be performed under a code or standard which requires qualified welding procedure specifications, then the Subcontractor prepares and qualifies his welding procedures accordingly, prior to beginning any production work. The field welding inspector is responsible in all cases for determining that the Subcontractor's welding is being performed in accordance with properly qualified and, as necessary, Engineering approved welding procedure specifications.

WELDER QUALIFICATION

All welders and welding operators employed by Subcontractors who make welds under a code or standard which requires qualification of welders are tested and qualified accordingly before beginning production welding. Each Subcontractor is responsible for testing and qualifying his own welders. The Bechtel field welding inspector is responsible in all cases for determining that the Subcontractor's welders have passed the necessary qualification tests and that the Subcontractor has on file at jobsite the proper qualification test record for each qualified welder.

INSTRUCTIONS FOR BECHTEL FIELD WELDING INSPECTORS

The general instructions for Bechtel field welding inspectors which follow cover welding performed by both Bechtel Construction and Becntel Subcontractors.

WELDING PROCEDURE SPECIFICATIONS

It is the responsibility of the field welding inspector to assure that all welding is performed in strict accordance with the appropriate qualified welding procedure specifications. Specific items to be checked follow:

a. Determine that the proper welding procedure specification has been selected to match the base materials being welded and the welding processes being employed.

b. Permit only welders properly qualified under the essential variables of each welding procedure specification to make welds under that procedure.

c. Check to see that the welding electrodes, bare filler rod, consumable insert rings, and backing rings all match that which has been specified.

d. Inspect weld joints as necessary prior to welding to insure proper edge penetration, cleaning, and fit-up.

e. Check to see that the welding machine settings are correct and fall within the range of current and voltage specified.

f. Check for proper preheat and interpass temperature.

g. Inspect the in-process welding for proper technique, cleaning between passes, and appearance of individual weld beads.

POST-WELD HEAT TREATMENT

The field welding inspector inspects each post-weld heat treatment (thermal stress relieving) operation to insure conformance with the applicable job specifications. Specific items to be checked shall include the following:

a. A sufficient number and proper location of thermocouples are selected to accurately record temperatures.

b. The thermocouples are connected to temperature indicator recorders which will provide a permanent record of the heating rate, holding temperature and time, and the cooling rate.

c. Temperature charts are checked for proper heating rate, holding temperature, holding time, cooling rate, and that the proper weld identification is recorded on the chart.

VISUAL INSPECTION OF WELDS

The field welding inspectors are responsible for carrying out the necessary welding surveillance to insure that all welding meets the following requirements for visual quality and general workmanship. Visual inspection is performed prior to, during, and after welding.

a. All weld beads, passes, and completed welds are free of slag, cracks, porosity, incomplete penetration and lack of fusion.

b. Cover passes are free of coarse ripples, irregular surface, non-uniform bead pattern, high crown, deep ridges or valleys between beads, and blend smoothly and gradually into the surface of the base metal.

c. Butt welds are slightly convex of uniform height, and have full penetration.

d. Fillet welds are of specified size, with full throat and, unless otherwise specified, the legs are of approximately equal length.

e. Repair, chipping, or grinding of welds is done in such a manner as not to gouge, groove, or reduce the base metal thicknesses.

f. Where different base metal thicknesses are jointed by welding, the finished joint has a taper no steeper than 1:4 between the thick and thin sections.

MAGNETIC PARTICLE INSPECTION

a. The field welding inspector is responsible for determining that all magnetic particle inspection is properly performed.

b. When the applicable job specifications require magnetic particle inspection of welds, the field welding inspector is responsible for determining that the proper technique is followed and that the results are properly interpreted. The field welding inspector requires the Subcontractor's responsible inspection personnel to demonstrate their knowledge and understanding of the applicable specifications prior to performing any production testing.

c. Special attention is given to the following items for all magnetic particle inspection:

(1) Determine that surfaces to be inspected have been properly cleaned and are free of crevices which can produce false indications by trapping the iron powder.

(2) Determine that the power source, current density, prod spacing, and application of iron powder all comply with the applicable specification requirements.

(3) Permit no arcing between the prods and weld surfaces.

(4) Interpret all linear or linearly disposed indications as defects.

(5) Probe questionable indications by thermal cutting, chipping, grinding, or filing to confirm the presence or absence of actual defects.

LIQUID PENETRANT INSPECTION

a. The field welding inspector is responsible for determining that all liquid penetrant inspection is properly performed.

b. When the applicable job specifications require liquid penetrant inspection for welds, the field welding inspector is responsible for determining that the proper technique is followed and that the results are properly interpreted. The field welding inspector requires the Subcontractor's responsible inspection personnel to demonstrate their knowledge and understanding of the applicable specifications prior to performing any production testing.

c. Special attention is given to the following items for all liquid penetrant inspection:

(1) Determine that surfaces to be inspected have been properly cleaned and are free of crevices which can produce false indications by trapping the dye penetrant.

(2) Check to see that cleaner, dye penetrant, and developer are properly applied and the specified time intervals for dye penetration and developing are followed.

(3) Determine that indications are properly interpreted. Defects will be identified as red stains against the white developer background. Red lines or linearly disposed red dots are indicative of cracks. Porosity and pinhole leaks appear as local red patches or dots.

(4) Examine questionable indications by a 5x or stronger hand lens, and probe by grinding or filing to confirm the presence or absence of defects.

RADIOGRAPHIC INSPECTION

a. The field welding inspectors are responsible for determining that all radiographic inspection is properly performed.

b. When the applicable job specifications require radiographic inspection of welds, the field welding inspector is responsible for determining that proper radiographic technique is followed and that the completed films are properly interpreted. The field welding inspector requires the Subcontractor's responsible personnel to demonstrate their knowledge and understanding of the applicable specifications prior to beginning the radiographic inspection. The field welding inspector shall also review each completed radiograph.

c. Special attention is given to each of the following items for all radiographic inspection:

(1) Check the type of film intensifying screens, penetrameters, and source of radiation for conformance to the job specifications.

(2) Check the relative location of film penetrameters, identifying numbers, and radiation source for each typical exposure.

(3) Review all completed film for quality and interpretation of defects. Check the exposed and developed film for proper density and visibility of penetrameters. Radiographic film of unacceptable quality or with questionable indications of defects is reradiographed.

REPAIRS

It is the responsibility of the field welding inspector to determine that all weld defects in excess of specified standards of acceptance are removed, repaired, and reinspected in accordance with the applicable job specifications.

RECORDS

It is the responsibility of the field welding inspector to determine that proper records of nondestructive testing are kept on file at the jobsite.