WELDING QUALITY CONTROL CHECKLIST

Prior to Beginning Any Welding Work

The following contract documents should be reviewed before starting any welding work:

Specific References:

Standard Specifications Sections:
- Section 6-3.02, Testing by Contractor
- Sections 49, 52, 55, 56, 75 and 86 (as applicable to the work)
American Welding Society (AWS) - AWS D-1.1, D-1.4, D-1.5 (appropriate year)
  - AWS D-1.1: Prequalification of WPS, Qualification, an Inspection
  - AWS D-1.4: Direct Butt Joint Figure 3.2, Workmanship, Technique, Qualifications and Inspection
  - AWS D-1.5: Figure 2.4, Workmanship, Technique, Qualification, Inspection, Welded Steel Bridge, and Fracture Control Plan

Contract Plans
Contract Special Provisions
Bridge Construction Records and Procedures Manual
  - BCM 9-1.1
  - Section 180 – Welding
  - BCM 145-16

OSM forms QCP 1 & 5 – (attachment 4)

Before starting any welding, three items need to be completed. A pre-weld meeting with OSM personnel only, a pre-weld meeting with the contractor, and the review and approval of the Contractor’s Welding Quality Control Plan (WQCP). These and other items are explained further below.

1. Inform OSM immediately after contract approval that welding, including shop welding, will be performed for your project (see BCM 180-4 & BCM 180-9 for a list of OSM contact phone numbers). At this time, set up an initial meeting with OSM Personnel Only to discuss the welding requirements for the project, and to plan the pre-welding meeting with the contractor.

2. Conduct a pre-welding meeting with the prime contractor for each type of welding to be performed in the shop or in the field for the contract (i.e. piles, column casings, structural steel, reinforcing steel, miscellaneous metal, etc.). OSM will conduct this meeting if you so request. The Resident Engineer, Structure Representative, Prime contractor, QCM, QC Inspector, any welding subcontractor, suppliers or fabricators and the NDT firm should attend this meeting. The State should have their QA Inspector from OSM present to assist with the following discussion topics:
WELDING QUALITY CONTROL CHECKLIST

Prior to Beginning Any Welding Work (Cont.)

a. The submittal and approval process for the WQCP. Supply and explain OSM form QCP-1 (attachment 4) to the contractor. Form QCP-1 is a checklist of the minimum requirements for the WQCP. The contract documents may require additional information to be submitted with the contractor’s WQCP beyond those listed on form QCP-1.

b. Discuss the appropriate sections of the AWS code and contract documents as they pertain to the acceptance and approval process of the contractor’s WQCP (a OSM welding inspector should cover this portion). The WQCP will be reviewed by OSM and must be approved by the Structure Representative prior to any welding in either the shop or the field. In order for the Structure Representative to accept the WQCP, personnel from OSM will have to review the contractor’s WQCP. This acceptance of the WQCP may require OSM personnel to witness the welder(s) welding test plates and the testing of those plates before accepting the WQCP. The same is true of the PQR.

c. Remind the contractor to provide adequate notice prior to starting any welding work (request one week minimum advance notice). This will allow time to schedule an OSM QA Inspector.

d. Inform the prime contractor they are responsible for QC, and they must hire the QC Inspector (a CWI) and the NDT firm, unless stated otherwise in the Special Provisions (i.e. AISC Quality Certification Program, Category Cbr, Major Steel Bridges).

e. Discuss the frequency of inspection, visual and NDT, as well as the frequency of the QCM’s submittal of the QC Inspector and NDT reports.

f. Establish a method to identify the welds and lot sizes. This needs to be established for traceability purposes.

g. Discuss the process to randomly select welds to be NDT (see BCM 145-16 for random selection method).

h. Discuss corrective measures when welding does not conform with AWS or the contract documents.

i. Discuss OSM agenda items and any additional requirements addressed in the contract documents.
WELDING QUALITY CONTROL CHECKLIST

Prior to Beginning Any Welding Work (Cont.)

j. Confirm all discussions of each pre-weld meeting in writing and send a copy to the contractor.

3. Obtain three copies of the contractor’s WQCP. Using form QCP-1 and the contract documents, review the contractor’s WQCP and ensure the submittal is complete before forwarding to OSM - this will save review time. Once the contractor’s WQCP is complete, send two copies to OSM for their review. OSM will assist the Structure Representative with the acceptance and approval of the WQCP. Keep the other copy in your project files.

4. If resistance butt welding, or any other shop welding is to be performed, ensure OSM has approved the welding procedure, performed a shop audit if required, and performed any testing that may be required to accept the welding process (see BCM 165-10 Ultimate Butt Splice).

5. After OSM has completed their review, they will notify you by phone, followed by an acceptance memo (QCP–5 for WQCP and or QCP-7 for the Fracture Control Plan, attachment 4) for your project files.

6. After reviewing OSM acceptance memo, and if it is acceptable, place the standard stamp 5-1.02, on both the WQCP and the approved WPS to be used on the project. Do not place your PE number on the WQCP, the WPS, or the approval letter to the contractor.

7. Send the contractor a letter approving their WQCP and request 7 copies of these approved documents.

PROJECT RECORDS FILES

Welding Documents are to be Filed in Category 9

NOTE: To limit duplication and confusion, the Structure Representative may want to use a cross-reference system with the other project record categories (ensuring records can be easily audited). For example, correspondences are filed in Category 5. If the issue is welding, the Structure Representative shall file the document in Category 9 as described in the Construction Manual Section 3-01-2, Category 5, General Correspondence.

The following is a suggested list for filing welding documents.
WELDING QUALITY CONTROL CHECKLIST

Project Record Files (Cont.)

1. The WQCP will be submitted for each item of work for which welding will be performed in the shop and field (i.e. piles, structural steel, rebar, etc.). The WQCP shall conform to the requirements of the Special Provisions and shall include, as a minimum, the items listed on form QCP-1. **Remember, welding is not allowed until the WQCP is accepted by OSM and approved by the Structure Representative.** Each approved copy of the contractor’s WQCP is to be filed in Category 9, *Welding*, along with forms QCP-1, QCP-5 and QCP-7 if required.

2. Structure Representatives and their Assistants shall file their reports/diaries in Category 45 and 46 respectively. If welding item work is included within the report, one of two things shall happen: write a separate report, or place a copy of the report in category 9. The welding report shall include: location and type of welding work, amount of production, welder, QC Inspector, QA Inspector, equipment, comments or observations made by either the QC or QA Inspectors and any other pertinent information.

3. OSM welding inspection reports are to be filed in Category 9. All others inspection reports from OSM should be filed in their appropriate Category as outlined in the Construction Manual.

4. If you receive an OSM Non-Conformance Report (NCR) it is to be filed in Category 9, along with the documentation showing what corrective action was taken (repairs and re-inspections of the non-conformance work). **It is the Structure Representative’s responsibility to ensure the non-conformance work is corrected and additional testing and inspection is performed per the contract documents (OSM will only assist in the re-inspection when requested and instructed as to the acceptance criteria).**

5. Contractor’s QCM is to submit their welding report to the Engineer within 7 days following the performance of any welding. The Engineer shall review the report for completeness and ensure the welding was found to be satisfactory. The completed report is to be filed in Category 9.

6. Copies of all welding correspondences are to be filed in Category 9 (reference Construction Manual 3-01-2).

7. Test results of all field and shop welding are to be filed in Category 9.

8. The contractor shall furnish to the Engineer a Certificate of Compliance for all welding and electrodes used, as required by the contract documents and in accordance with Section 6-1.07, *Certificates of Compliance*, of the Standard Specification and Section 8.
WELDING QUALITY CONTROL CHECKLIST

Project Record Files (Cont.)

of the Special Provisions. These certificates shall be filed within Category 9 with reference to the appropriate section within the project files.

During Weld Production

1. Make arrangements so an OSM welding inspector is present at the job site or the shop on the first day of welding (if the first day is not possible, then the next available day - the key is to provide OSM adequate notice). If welding is being performed in the shop, OSM should be informed by a Notice of Materials To Be Used, (Form CEM 3101). This will ensure the welding for your project gets off to a good beginning and the QC Inspector has a clear understanding of the QA Inspector’s role and expectations.

2. OSM is responsible for assisting the Structure Representative with QA inspection on the project. OSM is responsible for welding QA at the fabrication shop. Every effort shall be made to ensure a representative from OSM is present during production welding; however, if OSM is not available, the Structure Representative and/or the Assistant Structure Representative shall provide QA inspection and document their findings in their daily reports. The following items should be discussed with an OSM inspector before the pre-weld meeting with the contractor. This discussion should be done in the event a QA Inspector is not available during production welding.

   a) Verify the contractor is providing QC inspection and using the appropriate AWS code, Contract Special Provision, and Standard Specification to evaluate the weld and weld procedure. The contractor is to provide a sufficient number of QC Inspectors to perform the inspection prior to, during, and after welding. The inspection interval of each welder’s work shall not lapse more than 30 minutes, as stipulated in the contract documents.

   b) Verify the welder is listed within the approved WQCP and is qualified and was accepted by OSM to perform the specified weld. For example, if the WPS calls for SMAW in the vertical position, make sure the welder is qualified to perform SMAW in the vertical position. Note: the AWS code specifically disallows a vertical downward progression of welding.

   c) Ensure the welders are following the approved WPS. Items easily verified, include: correct base metals, fit up, joint details (such as bevel angle and root opening), weld process, weld position, electrode type and size, travel speed, voltage and amp settings, preheat and interpass temperature, cleaning/slaging between each weld pass, number of weld passes, and ensuring the welder is placing a string bead and not a weave weld. The QC Inspector should also verify and record these items daily.
WELDING QUALITY CONTROL CHECKLIST

During Weld Production (Cont.)

d) Review the appropriate AWS code to ensure welding is not done when the ambient temperature is too low, when surfaces are wet or exposed to wind, or when welders are exposed to inclement conditions (see the appropriate AWS Code under workmanship or technique).

e) Ensure backing plates, if shown in the WPS, are tight against the base metal or rebar (it might be necessary to grind down only the bar deformations that interferes with the tight fit, not the core area of the reinforcing steel). The Special Provisions, for bar reinforcement, requires the backing plate to be a flat plate. Backing plates are not to be removed for radiographing. If the backing plate is for welding a column casing refer to BCM 180-6 and BCM 180-7.

f) Ensure the electrodes are properly stored. For SMAW electrodes, once the hermetically sealed container is opened, or after electrodes are removed from drying or storage ovens, the electrode exposure to the atmosphere shall not exceed the times stated in the AWS code (typically 4 hours maximum). For FCAW electrodes, they shall be stored in clean and dry conditions at all times.

g) Ensure the welder does not make any errant arc strike (contact between the electrode and the base metal outside the weld area). If an errant strike does occur, the material is subject to rejection, but confer with OSM first.

h) Verify NDT and destructive testing, when required, is being performed properly and in accordance with the Special Provisions and other contract documents (OSM may be of assistance in this regard).

i) Keep an eye on the production and failure rate. A dramatic increase in production and a drop in the failure rate generally result in non-conformance with the WPS.

3. Obtain the QCM welding reports within 7 days or as specified by the contract documents, following performance of any welding. Review this report with the assistance of OSM to determine if the contractor is in conformance with their WQCP. Except for steel piling, this report must be reviewed and a written response approving or rejecting the report must be returned to the contractor within 7 days (your time frame may vary, read your Special Provisions). For piling, this review time will be specified in the Contract Special Provisions.

4. Review all reports regarding NDT, destructive testing, and radiographing. As described in the contract documents, all reports shall have the appropriate signature of the reviewer. For radiographs - the NDT technician, the person performing the review and the QCM
WELDING QUALITY CONTROL CHECKLIST

During Weld Production (Cont.)

shall sign these reports. The reviewers name shall be clearly printed or type written next to their signature. If they are not, return them to the QCM.

5. All radiographic envelopes shall have clearly written on the outside the names of the: QCM, NDT firm, radiographer, date, contract number, complete part description, and include the weld numbers or a report number as detailed in the WQCP. In addition, all innerleaves shall have clearly written on them the part description and include weld numbers, as detailed in the WQCP.

Weld Acceptance

1. There are different forms of NDT (VT, UT, RT, MT, and PT) that may be performed on weld elements, but the contractors QC Inspector will always perform a visual inspection (VT) and write up a daily report. The contractor is responsible to ensure all necessary and required NDT is performed. The contractor is also responsible to ensure all welding fulfills the requirement of the contract documents and the appropriate AWS codes. It is the Engineers prerogative to perform QA inspection. If the QC Inspector identifies a defect it is to be noted in the welding report along with the corrective action taken. If the QA Inspector identifies a defect, a Non-Conformance Report will be written and given to the Structure Representative that day. These reports are not to be given to the contractor. It is the Structure’s Representatives responsibility to notify the contractor in writing and ensure the defect is repaired and any additional testing is performed and evaluated. Inform OSM of the repair and request an inspection of the repaired weld.

2. Welds can be accepted if both the Contractor’s QC and OSM QA Inspectors find the welding quality to be acceptable by visual inspection and/or NDT, in accordance with the appropriate AWS code.

3. In addition to the inspection, the contractor shall furnish to the engineer, in accordance with Section 6-1.07, Certificate of Compliance, of the Standard Specifications and Section 8 of the Special Provisions, a Certificate of Compliance for each item of work for which welding was performed. This certificate shall state that all of the materials and workmanship incorporated in the work, and all required tests and inspections of this work, have been performed in accordance with the details shown on the plans, and the requirements of the Standard Specifications and the Special Provisions.

Project Close Out

1. The location of all splices need to be shown on the as-build drawings per BCM 9-1.1.
WELDING QUALITY CONTROL CHECKLIST

Project Close Out, (Cont.)

2. Met with the OSM representative to confirm all NCR and any other details are resolved before accepting the project.