

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

FIELD (JOB SITE) WELDER QUALIFICATION PROCEDURES FOR
SHIELDED METAL ARC WELDING,
AND GAS METAL ARC WELDING

1. PURPOSE

- 1.1 To establish a uniform procedure for testing and qualification of welders who will perform work under the jurisdiction of the Division of Highways.
 - 1.2 To establish an effective means for identifying and recognizing those individuals that possess the knowledge and ability to produce acceptable welds.
 - 1.3 To make available to the appropriate Division of Highways personnel a list of qualified welders.
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2. SCOPE AND LIMITATIONS

- 2.1 Welders qualified under the provisions of this Materials Procedure are qualified to weld steel sheet, plate, bars, and structural sections as documented and approved by the American Welding Society Structural Welding Code D1.1 as amended by the governing specifications. This procedure does not apply to the qualification of welders to weld pressure vessel or pressure piping.
- 2.2 Welding performed by welders qualified under the provisions of this Materials Procedure is limited to steel meeting the following specification requirements: AASHTO M-183 (ASTM A36), AASHTO M-223 (ASTM A572), Grades 42, 45, and 50 only, AASHTO M-222 (ASTM A588). Should the occasion arise to weld grades of steel other than those listed above, the Materials Control, Soils and Testing Division should be consulted for proper welder qualification procedures
- 2.3 The provisions of this Materials Procedure apply to welder qualification tests for the following welding processes only:
 - Shielded Metal Arc Welding (SMAW)
 - Gas Metal Arc Welding (GMAW)

Gas metal arc welding is considered semi- automatic welding processes.

- 2.4 Welders qualified for groove welding under the provisions of this Materials Procedure are qualified to weld only groove welds that will be welded from both sides or groove to be welded from one side against a steel back bar.

- 2.5 Qualification tests for vertical positions welds are administered with the direction of welding as vertical up. Should it become necessary for the welder to be weld vertical down, a re-qualification is necessary.

3. REQUEST FOR TESTS

- 3.1 Welder qualification tests are administered by appointment only. Contact appropriate personnel within the Materials Control, Soils and Testing Division for a test date and test time.
- 3.2 Requests for welder qualification test for personnel employed, or to be employed, by Contractors should be made by the Contractor or by the Division of Highways District Materials Section personnel. Add email address to contact here via generic.
- 3.3 Requests will also be honored from trade unions and individuals, but every effort should be made to make requests as outlined in paragraph 3.2 above.
- 3.4 Testing arrangements for Division of Highway personnel should be made by the District Materials Section.
- 3.4.1 Regardless of the origin of the request for testing, the following information must be supplied by the person making test arrangements:
1. Name of individual to be tested.
 2. Welding process to be tested.
 3. Nature of test requested; first test, re-test or re-certification.
 4. Type of test requested; groove weld plate qualification test for plate of unlimited thickness; groove weld plate qualification test for plate of limited thickness; or fillet welds only.
 5. Position of test welds.
 6. AWS classification of electrode to be used in test.

4. TESTING LOCATION

- 4.1 Welder qualification test are administered at the Division of Highways, Materials Control, Soils and Testing Division Laboratory, 190 Dry Branch Drive, Charleston, WV 25306.
- 4.2 Qualification test can be arranged at other locations provided a minimum of four (4) welders are to be tested at one time. Facilities for testing in this case are to be the responsibility of the agency requesting the testing and are subject to approval of the Materials Control, Soils and Testing Division. Welding test plates and shielded metal arc welding electrodes will be provided by the Materials Control, Soils and Testing Division. All other facilities, supplies, and equipment must be provided by the agency requesting the tests.

5. TESTING COSTS

- 5.1 The Division of Highways personnel will not be charged for welding test. All other applicants requesting qualification testing will be charged \$120.00 per test.
- 5.2 Payment shall be check or money order, made payable to WV Division of Highways. Cash or credit card will not be accepted under any circumstances.

6. TEST EQUIPMENT AND MATERIALS

- 6.1 The following welding equipment and supplies are available at the Materials Control, Soils and Testing Division laboratory for conduct of a welder qualification test for the shielded metal arc welding process:
- 6.1.1 Welding Machine: 275amp D.C. Lincoln Welder.
- 6.1.2 All test plates required for limited practice and the performance test.
- 6.1.3 Welding hood, slag chipping hammer, ice pick, wire brush and miscellaneous hand tools. The use of power tools for cleaning welds between weld passes will be permitted.
- 6.1.4 Sufficient stock of 2.4 mm, (3/32") 3.2 mm, (1/8") and 4.0 mm, (5/32") shielded metal arc welding electrodes, AWS class E 7018.

7. TESTING PROCEDURE

- 7.1 Limitations of Variables
- 7.1.1 The qualification tests described below are specially devised tests to determine the welder's ability to produce sound welds. The qualification tests are not intended to be used as a guide for welding during actual construction.
- 7.1.2 Qualification established with any one of the steels listed in paragraph 2.2 shall be considered as qualification to weld or tack weld any of the other steels. Qualification tests are currently conducted utilizing AASHTO M-183 (ASTM A36) grade steel.
- 7.1.3 A welder must successfully complete a test in each welding process for which qualification is requested. Qualification in one welding process as described by paragraph 2.3 does not qualify the welder for the other process listed.

- 7.1.4 A welder qualified for shielded metal arc welding with an electrode identified in the following table shall be considered qualified to weld or tack weld with any other electrode in the same group designation and with any electrode listed in a numerically lower group designation:

Group Designation	AWS Electrode Classification*
F4	EXX15, EXX16, EXX18
F3	EXX10, EXX11
F2	EXX12, EXX13, EXX14
F1	EXX20, EXX24, EXX27, EXX28

*The letters 'XX' used in the classification designations in this table represent the various strength levels (60, 70, 80, 90, 100, and 120) of deposited weld metal.

- 7.1.5 A welder qualified with an approved electrode and shielding medium combination shall be considered qualified to weld or tack weld with any other approved electrode and shielding medium combination for the process used in the qualification test.
- 7.1.6 A change in the position of welding to one for which the welder is not already qualified shall require re-qualification.
- 7.1.7 Vertical position qualification tests are administered with the direction of welding as vertical up. When a specific need arises for vertical down welding on the construction site, the welder must be qualified with the direction of welding as vertical down and all qualification documents noted accordingly.

8. QUALIFICATION TESTS REQUIRED

- 8.1 The welder qualification tests for manual and semi-automatic welding shall be as follows:

8.1.1 Groove Weld Plate Qualification Test for Plate of Unlimited Thickness

The joint detail shall be as follows: 25.4 mm plate, single V-groove, 45 degree included angle, 6.4 mm root opening with backing bar, (See Fig. 7.2.1a). For horizontal position qualification tests the joint detail will be as follows: Single-bevel groove, 45 degree angle, 6.4 mm root opening with backing (See Fig. 7.2.1b) Backing will be 9.5 mm by 75 mm. The length of the welding groove will be 175 mm.

8.1.2 Groove Weld Plate Qualification Test for Plate of Limited Thickness

The joint detail shall be as follows: 9.5 mm plate, Single V-groove, 45 degree included angle, 6.4 mm root opening with backing bar (See Fig. 7.2.2a). For horizontal position qualification tests the joint detail will be as follows: Single-bevel-groove, 45 degree angle, 6 mm root opening with backing (See Fig. 7.2.2b). Backing will be 9.5 mm by 75 mm. The length of the welding groove will be 175 mm.

8.1.3 Fillet Weld Qualification Test for Fillet Welds Only

For fillet weld qualifications only, the welder shall weld a T-test plate in accordance with Fig. 7.2.3.

8.2 Position of Test Welds (See Table 7.3)

8.2.1 Groove Plate Test Welds:

- (a) Qualification in the 1G (flat) position qualifies for flat position groove welding of plate and flat and horizontal position fillet welding of plate.
- (b) Qualification in the 3G (vertical) position qualifies for flat, horizontal and vertical position groove and flat, horizontal and vertical position fillet of welding plate.
- (c) Qualification for the 4G (overhead) position qualifies for flat and overhead position groove and flat horizontal and overhead position fillet welding of plate.

8.2.2 Fillet Weld Tests:

- (d) Qualification in the 1F (flat) position qualifies for flat position fillet welding of plate.
- (e) Qualification in the 3F (vertical) position qualifies for flat, horizontal, and vertical position fillet welding of plate.

8.3 Test Joint Welding Procedure

8.3.1 The welder shall follow a joint welding procedure applicable to the joint details being welded in the performance test. Electrode size, selection, current, voltage, travel speed, type of bead, electrode manipulation, etc. are at the welder's discretion and should be chosen considering best known practice so as to provide the most acceptable weld joint possible under the testing conditions.

8.3.2 Weld cleaning shall be done with the test plates in the same position as the welding position being qualified. Weld cleaning must be accomplished utilizing the normal hand tools provided. The use of the power chisels, scalers, chipping hammers, brushes or grinders is not allowed for weld cleaning.

8.4 Test Specimens: Number, Type, Preparation

- 8.4.1 The type and number of test specimens that must be tested to qualify a welder by mechanical testing together with the range of thickness that is qualified for use in construction based on the thickness of the test plate used in making qualification.
- 8.4.2 Guided bend test specimens shall be prepared by cutting the test plate as applicable to form specimens approximately rectangular in cross section. The specimens shall be prepared for testing in accordance with as applicable of the AWS Structural Welding Code D1.1.
- 8.5 Method of Testing Specimens
- 8.5.1 Root, Face, or Side-Bend Specimens
- Root, face and side-bend specimens shall be tested in accordance with paragraph 5.27.1 of the AWS Structural Welding Code D1.1 Rev. 1-76.
- 8.5.2 Fillet - Weld - Break Test
- The fillet-weld-break test specimens shall be tested in accordance with paragraph 5.27.2 of the AWS Structural Welding Code D1.1.
- 8.6 Test Results Required
- 8.6.1 Root, Face, or Side - Ben Specimens
- Root, face, and side - bend specimens, after testing, shall meet the requirements of paragraph 5.28.2 of the AWS Structural Welding Code D1.1 Rev. 1-76.
- 8.6.2 Fillet - Weld - Break
- After testing, the fillet - weld - break test specimens shall meet the requirements of paragraph 5.28.2 of the AWS Structural Welding Code D1.1 Rev. 1-76.
- 8.6.3 Visual Inspection
- For acceptable qualification, the welded test plates, when inspected visually shall conform to the requirements for visual inspection as contained in paragraph 9.25.1 of the AWS Structural Welding Code D1.1 Rev. 2-77 as revised and/or amended by the AASHTO Standard Specification for Welding of Structural Steel Highway Bridges - 1977, and as may be further revised and/or amended by the Division of Highways Standard Specifications or Special Provisions in effect at the time the welder qualification test administered.

9. RE-TESTS

- 9.1 In case a welder fails to meet the requirements of one or more test welds, the welder may immediate re-test, subject to scheduling limitations. All re-test specimens shall meet all the specified requirements.
- 9.2 If a welder fails one or more of the test plates as specified in paragraph 8.1 above, he will be required to wait thirty (30) days before being eligible for a second re-test. The intent of this waiting period is to provide the prospective welder ample time to obtain additional training as may be necessary. After expiration of the thirty (30) day waiting period, the second re-test shall consist of a single specimen test weld in the appropriate welding position.
- 9.3 If a welder fails the second re-test as specified in paragraph 8.2 above, he will be required to wait one (1) year before being eligible for further re-testing. A welder failing the second re-test unsuccessfully and obviously is in need of considerable additional welding skill training. The one year waiting period is designed to provide the welder the opportunity to obtain this training and experience.
- 9.4 If a welder is found to be welding their test plates in a different position than he or she is attempting to become certified in, that welder's test plates will be discarded and he or she will not be allowed to re-test for a period of one (1) year. If a welder is found to be welding out of position a second time, that welder will become permanently ineligible to re-test, thus forfeiting their right to weld for the Division of Highways.

10. PERIOD OF EFFECTIVENESS

- 10.1 Once qualified, the welder's qualification shall be considered as remaining in effect for a period of four years from the date of test.
- 10.2 Should a situation arise wherein the welder does not produce acceptable welds on the project site, or there is any reason to question the welder's ability after qualification, the Division of Highways may require the welder to re-qualify by taking all, or a portion of the welder qualification test. Should the welder not successfully complete these re-qualification tests, their qualification will be revised accordingly or revoked as determined by the results of the re-testing. Administration of such tests will be at no expense to the welder. Successful completion of these tests will not extend the welder's qualification beyond the original expiration date.

11. DOCUMENTATION AND RECORDS

- 11.1 Those welders who undergo the test will sign a blank Welder Qualification Card, and will be photographed. Upon successful completion of the test, the Welder Qualification Card will be completed by the Materials Control, Soils and Testing Division and forwarded to the welder as their identification and proof of qualification. This card will provide sufficient personal data to establish proper identification. The card will also contain information relative to the welder's qualification such as welding process, welding positions qualified, type of welding qualified (groove

and/or fillet), thickness limitations, and welding electrode limitations including the qualification expiration date.

- 11.2 In addition to the Welder Qualification Card, identification of qualified welders will be included in the List of Qualified Welders. The list contains necessary identification information as well as data relative to the Welders qualification limitations.

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