Preparing Activity: NAVFAC Superseding
UFGS-34 11 19.00 20 (April 2006)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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SECTION 34 11 19.00 20

WELDING CRANE AND RAILROAD RAIL - THERMITE METHOD
08/18

NOTE: This guide specification covers the requirements for welding of crane rail and railroad rail by a thermite process.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

NOTE: Show the following information on the project drawings:

1. Location of welds.

PART 1 GENERAL

1.1 REFERENCES

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date,

and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2020; Errata 1 2021) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM E10	(2017) Standard Test Method for Brinell Hardness of Metallic Materials
ASTM E110	(2014; R 2023) Standard Test Method for Rockwell and Brinell Hardness of Metallic Materials by Portable Hardness Testers

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-1699	(1992; Rev B) Nondestructive Evaluation of Butt Welds in Crane and Railroad Rails

1.2 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for

Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force, and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Welding Procedure

Cold Weather Welding Procedures

Wet Weather Welding Procedures

SD-06 Test Reports

Ultrasonic Tests

Hardness Tests

Weld Correction Method

SD-07 Certificates

Operator Qualification

SD-08 Manufacturer's Instructions

Thermite Kit

SD-11 Closeout Submittals

Joint Records

1.3 QUALITY ASSURANCE

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NOTE: Thermite welding processes and kits have been developed by the following companies. There may be other processes available. This Guide Specification

has been prepared with the processes of these manufacturers in mind. If another manufacturer's product is available in the vicinity of the activity at which the work is to be performed, modify this Guide Specification as necessary.

1. Orgo-Thermit Inc., 3500 Colonial Drive North, Manchester, NJ 08759, Telephone: (732) 657-5781

2. Railtech Boutet, Inc., 25 Interstate Drive, P.O. Box 69, Napoleon, OH 43545, Telephone: (419) 592-5050

3. ESCO Equipment Service Co., 117 Garlisch Dr., Elk Grove Village, IL 60007, Telephone: (847) 758-9860

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Use only qualified procedures and personnel. Procedures and personnel previously qualified in accordance with this specification are not required to be requalified, provided qualifications have not lapsed and qualification records are available.

1.3.1 Operator Qualification

Notify the Contracting Officer in writing one week prior to making qualification welds. Qualify operators by welding one acceptable rail joint in accordance with a qualified procedure. This qualification may be accomplished either prior to production welding or on the first joints to be welded at the work site. If welding operator qualification is conducted at the work site, perform no further welding until the qualification weldments have been accepted by visual inspection and ultrasonic tests. Obtain written approval of the acceptability of the welded joint from the Contracting Officer prior to continuing with welding. Welding operator's qualifications are effective from the test date and will remain in effect for a period of one year.

1.3.2 Acceptable Welds

Welds that meet the visual inspection and ultrasonic test requirements of MIL-STD-1699 are considered acceptable. Welds selected for testing for Brinell Hardness must meet the requirements of ASTM E10 and paragraph HARDNESS TESTS.

1.3.3 Procedure Qualification

1.3.3.1 Written Procedure

Prepare for the welding process to be used. The procedure must include any particulars of the process deemed pertinent to the successful completion of the welds.

1.3.3.2 Manufacturer's Procedure

No separate qualification is necessary for various rail weights, although in order to be qualified for a specific rail weight or cross section, the procedure must include fit-up requirements and other features unique to the rail weight or cross section of the rails to be welded.

1.3.3.3 Welding Procedure Qualification

a. Submit welding procedure qualification records acceptable to the Contracting Officer as proof of previous qualification under this specification.

b. Welding procedure not previously qualified under this specification may be qualified by providing four consecutive acceptable welded rail joints. An acceptable weld is defined as a weld which has been visually inspected and ultrasonically tested and has been found acceptable in accordance with MIL-STD-1699 and ASTM E10. This qualification may be accomplished either by shop fabrication of the joints or on the first four joints welded at the work site. If procedure qualification is accomplished at the work site, perform no further welding until the qualification weldments have been accepted by visual inspection and ultrasonic tests. Obtain written approval of the acceptability of the four welded joints from the Contracting Officer prior to continuing with welding.

c. Ambient temperature: Welding procedures are considered qualified for use at an ambient temperature of 10 degrees C 50 degrees F and above regardless of ambient temperature during welding of qualification assemblies. Do not conduct welding below 10 degrees C 50 degrees F without a specifically qualified procedure. Procedures qualified for use at ambient temperatures less than 10 degrees C 50 degrees F must be qualified by welding test assemblies in accordance with the procedure qualification requirements of this specification at the desired minimum ambient temperature plus or minus one degree C 5 degrees F. Procedures thus qualified are considered acceptable for use at the minimum qualified ambient temperature and above. Submit cold weather welding procedures.

d. Wet weather welding: Perform welding only during dry weather. No welding will normally be permitted on wet, showery and inclement days. However, if means are provided to protect the work and work area, welding may be performed during other than dry weather, if approved by the Contracting Officer. Submit wet weather welding procedures.

e. Confined space welding: Welding in confined spaces must comply with AWS D1.1/D1.1M to assure adequate ventilation for personnel safety.

1.3.4 Required Data

Submit thermite kit manufacturer's instructions and recommendations covering rail end preheat treatment, thermite ignition, mold removal, and finishing.

1.3.5 Welding Procedure

Submit a report of the following information:

a. Thermite kit manufacturer's name and kit size or designation

b. Thermite kit batch numbers and manufacturing date

c. Welding procedure designation (name, number)

d. Size of rail section being joined and type of rail

e. Test assembly identification number

f. Results of nondestructive testing of qualifications assemblies

g. Date of qualification (test date)

1.3.6 Required Qualification Welds

Submit operator qualification welding results in accordance with paragraph OPERATOR QUALIFICATION. Submit procedure qualification welding results in accordance with paragraph WELDING PROCEDURE QUALIFICATIONS. Include results of ultrasonic test and hardness tests. Welders certification or procedure qualification may be substituted, pursuant to paragraph QUALITY ASSURANCE.

1.4 DELIVERY AND STORAGE

Deliver materials in the manufacturer's original unbroken packages or containers plainly labeled with the manufacturer's name and brand.

1.4.1 Receipt Inspection of All Thermite Weld Kits

Perform visual inspection of the weld kit package for freedom from damage and record the thermite weld mix batch number and manufacturing date. Do not use kits which have been manufactured more than 2 years before the date of use or show signs of having been wet.

1.4.2 Material Control

Store materials in the original package and keep dry at all times until used.

PART 2 PRODUCTS

2.1 MATERIALS

Provide in kit form including preformed mold, thermite powder, wicking cord, luting material, and all necessary materials and accessories needed to provide one welded rail joint per kit. Molds must be factory-made, moisture free, and of nonhygroscopic material.

PART 3 EXECUTION

3.1 SEQUENCE OF OPERATION

Perform work in strict accordance with the qualified procedure.

3.1.1 Rail Preparation

Cut rails which are battered, cracked or notched, or which contain bolt holes so that these irregularities are removed. Rail surface must be free of grease, dirt, loose oxide, and moisture on the face of and for approximately 125 mm 5 inches from the joint to be welded. Clean rail ends by grinding or wire brushing. Use a torch to remove grease, oil, or moisture in accordance with procedures in thermite manufacturer's instructions. Rail cutting, when necessary, must be by the saw-cut method. Remove all burrs, rolled-over edges, and loose oxide before applying the mold. No flame cutting of rails is permitted. If the space

between the mold and the rail is unusually large on used or relayer rails, fill this gap with a piece of wicking cord before luting or packing.

3.1.2 Rail Alignment

Separate rail ends as recommended by the welding process manufacturer. Align rails as to both surface and gage, and raise the rails at the joint to compensate for the greater thermal contraction that occurs in the rail head during cooling relative to the web and base regions. Measure the amount of joint elevation with a 900 mm 36 inch long straightedge centered at the joint. The correct elevation is obtained when 2 mm 1/16 inch separates the top of the rail head and bottom surface of the straightedge at both ends.

3.1.3 Placing of Molds

Attach the molds to the rails, centered over the joint, and seal the molds to the rail with luting material according to the welding kit manufacturer's instructions. Handle the luting material, a mixture of clay and sand, so that none is introduced into the weld chamber. Align so that the centerline of the mold coincides with the centerline of the gap. Install the tapping plug or discs in the crucible and pour in the prescribed amount of thermite mixture.

3.1.4 Preheating Rail Ends

Preheat the rail ends in accordance with the manufacturer's instructions and recommendations.

3.1.5 Ignition of Thermite

Follow manufacturer's instructions and recommendations regarding the ignition of the thermite.

3.1.6 Mold Removal

Follow manufacturer's instructions regarding mold removal.

3.1.7 Finishing

Follow manufacturer's instructions and recommendations. No finishing is required on the web and base of rail. Perform final grinding when the weld and rail have cooled to ambient temperature. Do not use a cutting torch to remove excess weld metal.

3.1.8 Joint Records

Submit a record of the date and location of each weld made. The record must also include the rail type, size, thermite kit manufacturer's name, and thermite weld portion batch number. Also, provide a record of the nondestructive test date and acceptance date.

3.2 INSPECTION AND TESTING

3.2.1 Visual Inspection

Inspect each welded joint after removal of the mold and grinding or removal of excess metal. Pay particular attention to surface cracking, lack of fusion and other surface irregularities. Correct or replace all

defective welds at no additional cost to the Government. Submit the weld correction method for approval by the Contracting Officer.

3.2.2 Nondestructive Inspection

Inspect each welded joint by ultrasonic tests using the method of inspection and acceptance as prescribed in MIL-STD-1699. Correct or replace all defective welds at no additional cost to the Government. The method of correction must be approved by the Contracting Officer. Inspect all repairs to defective welds using the method of inspection and acceptance as prescribed in MIL-STD-1699. Submit test reports showing compliance with MIL-STD-1699.

3.2.3 Hardness Tests

Perform Brinell hardness test in accordance with ASTM E10 and ASTM E110. The Brinell Hardness Number (BHN) of the weld and for the rail for a distance of 150 mm 6 inches on each side of the joint must be greater than 250. In the heat-affected zone (a distance not greater than 25 mm one inch to each side of the joint) the BHN may be up to 20 points lower except for the top of the rail, which must not be less than 250. Check hardness on at least 10 percent of all welds. Perform tests on randomly selected welds or as directed by the Contracting Officer. Submit test reports showing welds meet hardness requirements of this paragraph.

-- End of Section --