Preparing Activity: NASA

Superseding
UFGS-40 17 30.00 40 (May 2016)
UFGS-23 31 13.20 40 (February 2009)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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02/23

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USACE / NAVFAC / AFCEC / NASA **UFGS-40 17 30.00 40 (February 2023)**

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SECTION 40 17 30.00 40

WELDING GENERAL PIPING
02/23

****
NOTE: This guide specification covers the requirements for welding of metals for mechanical use.

This section covers work requiring steel welding. Accordingly, include Section 05 05 23.16 STRUCTURAL WELDING; in this specification if any such welding is required.

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).
****

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.

****

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 SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B31.1	(2022) Power Piping
ASME B31.3	(2022) Process Piping
ASME B31.4	(2022) Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquid
ASME B31.5	(2022) Refrigeration Piping and Heat Transfer Components
ASME B31.8	(2022; Supplement 2022) Gas Transmission and Distribution Piping Systems
ASME B31.9	(2020) Building Services Piping
ASME BPVC SEC IX	(2017; Errata 2018) BPVC Section IX-Welding, Brazing and Fusing Qualifications
ASME BPVC SEC V	(2017) BPVC Section V-Nondestructive Examination
ASME BPVC SEC VIII D1	(2019) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1
ASME BPVC SEC VIII D2	(2017) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 2-Alternative Rules

INTERNATIONAL CODE COUNCIL (ICC)

ICC IPC	(2021) International Plumbing Code

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

RCBEA GUIDE	(2004) NASA Reliability Centered Building and Equipment Acceptance Guide

NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS (NBBI)

NBBI NB-23	(2013) National Board Inspection Code

PIPE FABRICATION INSTITUTE (PFI)

PFI ES 1	(2010) Internal Machining and Solid Machined Backing Rings for Circumferential Butt Welds
PFI ES 3	(2009) Fabricating Tolerances
PFI ES 7	(2013) Minimum Length and Spacing for Welded Nozzles
PFI ES 21	(2010) Internal Machining and Fit-up of GTAW Root Pass Circumferential Butt Welds
PFI ES 31	(2016) Standard for Protection of Ends of Fabricated Piping Assemblies
PFI ES 35	(2016) Nonsymmetrical Bevels and Joint Configurations for Butt Welds
PFI TB1	(2013) Pressure - Temperature Ratings of Seamless Pipe Used in Power Plant Piping Systems

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction

1.2 SUBMITTALS

****

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.

****

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-03 Product Data

Welding Equipment; G[, [____]]

Welding Rods and Accessories; G[, [____]]

SD-04 Samples

Welder's Pre-Qualification Samples; G[, [____]]

SD-06 Test Reports

Radiographs

PT&I Tests

SD-07 Certificates

Certified Welding Procedure Specifications (WPS); G[, [____]]

Certified Brazing Procedure Specifications (BPS); G[, [____]]

Certified Procedure Qualification Records (PQR); G[, [____]]

Certified Welder Performance Qualifications (WPQ); G[, [____]]

Certified Brazer Performance Qualifications (BPQ); G[, [____]]

Certificates of Conformance

1.3 QUALITY CONTROL

Within [fifteen] [_____] calendar days after receipt of Notice to Proceed, submit for[approval][review] to the Contracting Officer Certified Welding Procedure Specifications (WPS), Certified Brazing Procedure Specifications (BPS) and Certified Procedure Qualification Records (PQR).

[Fifteen] [_____] calendar days prior to any employee welding on project material, submit for[approval][review] to the Contracting Officer[two] [_____] copies of each Certified Welder Performance Qualifications (WPQ)

and Certified Brazer Performance Qualifications (BPQ).

For safety, conform all work performed to 29 CFR 1910 and 29 CFR 1926.

1.3.1 Personnel Qualifications

****
NOTE: This specification contains the minimum requirements for qualifying welding procedures, welders, and welding operators for making and inspecting welds in mechanical fabrications of carbon steel, low alloy steel, extra-high-strength quenched and tempered low alloy steels, and austenitic stainless steel materials.
****

[No pre-qualified welding procedures are allowed. Provide qualification of welding procedures and welders by tests prescribed in accordance with ASME BPVC SEC IX, notwithstanding the fact the code or specification may allow pre-qualified procedures.

] Submit welder's pre-qualification samples prepared by qualified welding operators performing work on contract prior to start. Only after acceptance of samples, are qualified welding operators permitted to begin work.

1.3.2 Pressure Vessels Qualification

Ensure qualification documents[WPS][BPS], PQR and[WPQ][BPQ] are in accordance with ASME BPVC SEC IX.

1.3.3 Piping Qualifications

1.3.3.1 High Pressure Piping

Ensure qualification documents for 860 kilopascal 125 psig or above,[(WPS][BPS], PQR and[WPQ)][BPQ] are in accordance with ASME BPVC SEC IX.

1.3.3.2 Low Pressure Piping

Perform all plumbing work by a state licensed plumber registered in the state where the work is being performed.

Submit certificates of conformance for the following:

1.3.3.2.1 Refrigeration Piping

Qualification documents for below 860 kilopascal 125 psig,[WPS][BPS], PQR and[WPQ][BPQ] for "Refrigeration Piping" in accordance with ASME B31.5.

1.3.3.2.2 Other Low Pressure Piping

Qualification documents for below 860 kilopascal 125 psig,[WPS][BPS], PQR and[WPQ][BPQ] for other low pressure piping systems in accordance with ASME B31.9 for "Building Services Piping".

1.3.4 Predictive Testing and Inspection Technology Requirements

****

NOTE: The Predictive Testing and Inspection (PT&I) tests prescribed in Section 01 83 13.07 40 RELIABILITY CENTERED ACCEPTANCE FOR SUPERSTRUCTURE PERFORMANCE REQUIREMENTS and Section 01 86 12.07 40 RELIABILITY CENTERED ACCEPTANCE FOR MECHANICAL SYSTEMS are MANDATORY for all [NASA] [_____] assets and systems identified as Critical, Configured, or Mission Essential. If the system is non-critical, non-configured, and not mission essential, use sound engineering discretion to assess the value of adding these additional test and acceptance requirements. See Section 01 86 12.07 40 RELIABILITY CENTERED ACCEPTANCE FOR MECHANICAL SYSTEMS for additional information regarding cost feasibility of PT&I.

****

This section contains systems and equipment components regulated by NASA's Reliability Centered Building and Equipment Acceptance Program. This program requires the use of Predictive Testing and Inspection (PT&I) technologies in conformance with RCBEA GUIDE to ensure building equipment and systems have been installed properly and contain no identifiable defects that shorten the design life of a system and its components. Satisfactory completion of all acceptance requirements is required to obtain Government approval and acceptance of the work.

Perform PT&I tests and provide submittals as specified in Section 01 86 12.07 40 RELIABILITY CENTERED ACCEPTANCE FOR MECHANICAL SYSTEMS.

PART 2 PRODUCTS

2.1 EQUIPMENT

2.1.1 Welding Equipment

Submit manufacturer's catalog data for welding equipment and welding rods and accessories. Ensure all equipment meets referenced standards contained in this section.

PART 3 EXECUTION

3.1 ERECTION

3.1.1 Pressure Vessels

3.1.1.1 New Construction

Ensure the fabrication, welding, brazing and inspection meet the requirements of[ASME BPVC SEC VIII D1][ASME BPVC SEC VIII D2].

****

NOTE: Specifier should also reference any companion codes necessary to meet applicable national standards or specific project requirements.

****

3.1.1.2 Repairs to Existing Pressure Vessels

Code Stamped Vessels: Meet the fabrication, welding, brazing and inspection requirements of NBBI NB-23.

Non-Code Vessels: Meet the fabrication, welding, brazing and inspection requirements of NBBI NB-23 with the following exception:

a. It is not necessary that a National Board Code Inspector inspect the work.

b. A National Board ("R" Stamp) Code stamping is not required.

3.1.2 Piping

****
NOTE: Specifier may elect to use any or all of the following fabrication guidelines. Any companion code requirements may be added at the specifier's option.
****

3.1.2.1 High Pressure 860 Kilopascal 125 Psig or Above

Steam Piping: Fabricate, assemble, and weld, braze piping systems in accordance with ASME B31.1, and Power Piping Codes, PFI ES 1, PFI ES 3, PFI ES 7, PFI ES 21, PFI ES 31, PFI ES 35, and PFI TB1, of the Piping Fabrication Institute's companion code requirements.

Other High Pressure Piping: Fabricate, assemble, and weld, braze other high pressure piping systems in accordance with ASME B31.3, and Power Piping Codes, PFI ES 1, PFI ES 3, PFI ES 7, PFI ES 21, PFI ES 31, PFI ES 35, and PFI TB1, of the Piping Fabrication Institute's companion code requirements.

3.1.2.2 Low Pressure Below 860 Kilopascal 125 Psig

3.1.2.2.1 Refrigeration Piping

Fabricate, assemble, and weld, braze piping systems in accordance with the ASME B31.5.

3.1.2.2.2 Plumbing

Fabricate, assemble, and weld, braze plumbing systems in accordance with ICC IPC.

3.1.2.2.3 Other Low Pressure Piping

Fabricate, assemble, and weld, braze other low pressure piping systems in accordance with ASME B31.9

3.1.2.2.4 Pipeline Transportation Systems

For Liquid Hydrocarbons and Other Liquid; fabricate, assemble, and weld, braze other low pressure piping systems in accordance with the ASME B31.4

3.1.2.2.5 Gas Transmission and Distribution Piping Systems

Fabricate, assemble, and weld, braze other low pressure piping systems in accordance with the ASME B31.8

3.1.3 Heat Input Requirements

3.1.3.1 Preheat

Do not weld at ambient temperature below 0 degrees C 32 degrees F, or when the surfaces are wet or exposed to rain, snow, or high wind. Ensure the temperature of the metals in the area where the welding is performed is not less than 10 degrees C 50 degrees F. When the ambient conditions are such that the normal temperature of the base metal is below 10 degrees C 50 degrees F, preheat the area surrounding the joint to provide a base metal temperature of 38 degrees C 100 degrees F for a distance of at least 75 millimeter 3-inches in all directions from the joint to be welded. Preheat in accordance with ASME BPVC SEC VIII D1[, ASME BPVC SEC VIII D2] and ASME BPVC SEC V.

****

NOTE: When welding a steel which is at an initial temperature below 38 degrees C 100 degrees F, localized preheating may be required to remove moisture from the surface of the steel.

****

3.1.3.2 Interpass

In a multipass weld, the interpass temperature is the temperature of the weld metal before the next pass is started. Ensure interpass requirements are in accordance with[ASME BPVC SEC VIII D1][ASME BPVC SEC V][ASME BPVC SEC VIII D2].

3.1.3.3 Postweld

Do not apply a postweld heat treatment to weldments unless noted in the applicable code welding documentation, WPS, PQR and WPQ.

3.2 FIELD QUALITY CONTROL

3.2.1 Nondestructive Testing (NDT)

****

NOTE: Inspection and acceptance requirements of these codes and standards are the minimum requirements. Additional inspections and tighter acceptance requirements may be used; if required, annotate the additional NDT requirements on the specifications/drawings.

****

3.2.1.1 General

Perform fabrication and erection inspections prior to assembly, during assembly, during welding and after welding to ensure that materials and workmanship meet the requirements of the contract documents.

Submit radiographs to the Contracting Officer. Verify each specified

radiograph, as a minimum, has the following additional information permanently included in the image:

a. Agency Weld No. (including repair cycle no.)

b. Agency Drawing No.

c. Agency View No.

d. Agency Contract No.

Final interpretation and acceptance of all radiographs of welded joints, with the exception of code stamped pressure vessel welds, will be by the Contracting Officer.

Final acceptance of all welded, brazed joints will be by the Contracting Officer.

Prior to the Contracting Officer's inspection, remove all slag and scale from all welds. Procedures which produce notches in either the weld metal or adjacent base metal are not acceptable.

Immediately repair unacceptable welds and make ready for Government re-inspection at no additional cost to the Government.

After weld joints have been satisfactorily completed and accepted by the Contracting Officer, clean the joint area to a bright, unpitted, and unscarred surface and protect in accordance with the contract documents.

3.2.1.2 Pressure Vessels

3.2.1.2.1 Test Method

Perform all nondestructive testing in accordance with the requirements of ASME BPVC SEC V.

****
NOTE: If the specified system is identified as critical, configured, or mission essential, use Section 01 83 13.07 40 RELIABILITY CENTERED ACCEPTANCE FOR SUPERSTRUCTURE PERFORMANCE REQUIREMENTS and 01 86 12.07 40 RELIABILITY CENTERED ACCEPTANCE FOR MECHANICAL SYSTEMS to establish predictive and acceptance testing criteria. and coordinate those requirements with this section. Add the following paragraph.
****

Perform PT&I tests and provide submittals as specified in Section [01 83 13.07 40 RELIABILITY CENTERED ACCEPTANCE FOR SUPERSTRUCTURE PERFORMANCE REQUIREMENTS] [and] [01 86 12.07 40 RELIABILITY CENTERED ACCEPTANCE FOR MECHANICAL SYSTEMS].

3.2.1.2.2 Acceptance Requirements

Ensure acceptance requirements are in accordance with[ASME BPVC SEC V][ASME BPVC SEC VIII D2]

3.2.1.3 Piping

3.2.1.3.1 Test Method

Perform NDT of all piping systems, except plumbing systems, in accordance with the requirements of ASME BPVC SEC V.

[For high pressure (860 kilopascal 125 psig or above) systems, fully examine no less than 10 percent of all butt welds by random radiography. Select welds to be examined to ensure that the work product of each welder or welding operator doing the production welding is included. If any of the butt welds examined reveals an unacceptable indication, examine and accept by radiography, all butt welds welded by [that] [those] welder[s].

]3.2.1.3.2 Acceptance Requirements

High Pressure (860 kilopascal 125 psig or above):

a. Steam piping systems - ASME B31.1

b. Other high pressure piping systems - ASME B31.3

Low Pressure {Below 860 kilopascal 125 psig):

a. Refrigeration piping systems - ASME B31.5.

b. Plumbing piping systems - ICC IPC.

c. Other low pressure piping systems - ASME B31.1.

Other Systems:

a. Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquid - ASME B31.4

b. Gas Transmission and Distribution Piping Systems - ASME B31.8

3.3 PROTECTION OF ADJACENT MATERIALS

Protect machinery, materials, floor, furnishings, finishes and other items adjacent to the welding, brazing operations to prevent any damage from these operations.

-- End of Section --