

BI-WR02 – Verify welding Procedure Qualification Records (PQR)

WR02.1- Parent Cite:

These subchapter D (Tank) references kick to ABS Rules for Building and Classing Steel Vessels (ABS SVR). The second reference, 31.30-1 is our key to Subchapter F: Marine Engineering. Sub F is then our gateway to the end goal: the American Society of Mechanical Engineer (ASME) Code; see WR02.2 below.

PQS Listed Cites:

- 46 CFR 31.10-1
 - Subchapter D: Tank Vessels
 - Part 31; Inspections and Certification
 - Subpart 31.10: Inspections
 - §31.10-1: Standards established by ABS Rules for Building and Classing Steel Vessels shall be accepted as standard by CG.
- 46 CFR 31.30-1
 - Subchapter D: Tank Vessels
 - Part 31; Inspections and Certification
 - Subpart 31.30 Marine Engineering
 - Kicks to Subchapter F: Marine Engineering
- 46 CFR 32.60-1
 - Subchapter D: Tank Vessels
 - Part 32; Special Equipment, Machinery and Hull Requirements
 - Subpart 32.60: Hull requirements for tank vessels constructed 01JUL1951
 - §32.60-1: Tank vessels construction/conversion shall at least be equivalent to ABS standards (or other recognized class)

WR02.2- Confirm need for qualified welding procedure:

The first reference is in Subchapter A and kicks to the appropriate subchapter for your vessel to determine the welding procedures required; then that subchapter kicks to ABS rules and Subchapter F: Marine Engineering.

Our second ref is Subchapter F Marine Engineering Part 57: Welding and Brazing and contains numerous limitations and modifications to the ASME code; see §57.02-2(c).

- Sub D > Sub F > ASMEIX
- Sub A > Sub D > ABS Rules

THE "ASME CODE" IS KNOWN FORMALLY AS THE ASME BOILER AND PRESSURE VESSEL CODE (BPVC). THIS IS A 12-SECTION CODE PERTAINING TO NUMEROUS ASPECTS, BUT PART IX; WELDING AND BRAZING QUALIFICATIONS IS THE "ASME IX" THAT WE PULL OUR INFORMATION FROM. FIND A 2010 COPY HERE:

http://www.elcoweld.com/files/editor/downloads/elmi/ASME%20Sec%20IX%202010.pdf

ASMEIX is where we finally get into detailing Weld Procedure Specification (WPS) and Procedure Qualification Record (PQR). See WR01.3 below. Jump to page 193 for a great list of welding definitions aka QW/QB-492.

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PQS Listed Cites:

- 46 CFR 2.75-70
 - Subchapter A: Procedures Applicable to the Public
 - Kicks to appropriate **subchapter** for guidance on weld procedure
 - Each chapter then kicks to ABS and/or Subchapter F
 - O ABS / Sub F then kicks to AWS, EN, ISO, ASME, MIL and JIS
- 46 CFR 57.02-2(a)(1)
 - Subchapter F: Marine Engineering
 - Kicks to ASMEIX... but;
 - Contains modifications and limitations to ASME in CFR: see §57.02-2(c)

WR02.3- Verify variables on PQRs to the WPS:

Our first ref; ASME IX/QW-200.1(b) states: "Contents of the WPS. The completed WPS shall describe all of the essential, nonessential, and, when required, supplementary essential variables for each welding process used in the WPS. These variables are listed in QW-250 through QW-280 and are defined in Article IV, Welding Data. The WPS shall reference the supporting Procedure Qualification Record(s) (PQR) described in QW-200.2. The manufacturer or contractor may include any other information in the WPS that may be helpful in making a Code weldment."

There are a TON of welding procedures listed after this, pages worth beginning with ASME QW-250 and running through QW-280. Each of these procedures has a list of variables, and numerous choices within those that can be made pertinent to whatever work or process is required. ESSENTIAL VARIABLES, NONESSENTIAL VARIABLES AND SPECIAL PROCESS definitions can all be found here on page 19 of ASME IX. The variables for each weld procedure are:

- Joints
- Base metals
- Filler metals
- Positions
- Preheat
- Post Weld Heat Treatment (PWHT)
- Gas
- Technique

Second ref; QW-483 is a template / guide for the PQR. Several WPS can be prepared from a single PQR. A single WPS can cover several ESSENTIAL VARIABLE changes if the appropriate PQR exists for each variable. See the previous page for QW-482: suggested form for WPS.

PQS Listed Cites:

- ASMEIX/QW-200.1(b)
 - Page 14
- ASMEIX/QW-483
 - Page 250
 - ASME suggested format for PQR
 - Also see page 248 for QW-482
 - ASME suggested format for WPS

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WR02.4- Verify tests and results:

This reference gives us the definition for PQR and then details the contents required. This is the contractor or manufacturer's responsibility to prove and maintain. Jump down to QW-202 for type of tests required but see the CFR modification §57.03-1 as well.

How many tests? What kind of tests? See §57.04, kick to QW-451 (p. 144) and find the type of weld to be tested. There are numerous tests for different welds ranging from chemical analysis, face / side / root bend / pipe side bend / plate bend, seam weld peel, and tension tests. QW-462 (p. 157) details the methods required.

PQS Listed Cites:

- ASMEIX/QW-200.2(b)
 - o Page 14

Definitions:

- Welding Procedure Specification (WPS)
 - O QW-100.1 A WELDING PROCEDURE SPECIFICATION (WPS) IS A WRITTEN DOCUMENT THAT PROVIDES DIRECTION TO THE WELDER OR WELDING OPERATOR FOR MAKING PRODUCTION WELDS IN ACCORDANCE WITH CODE REQUIREMENTS.
 - WELDING PROCEDURE QUALIFICATION ESTABLISHES THE PROPERTIES OF THE WELDMENT, NOT THE SKILL OF THE WELDER OR WELDING OPERATOR.
- PROCEDURE QUALIFICATION REPORT (PQR)
 - QW-100.2 IN PERFORMANCE QUALIFICATION, THE BASIC CRITERION ESTABLISHED FOR WELDER QUALIFICATION IS TO
 DETERMINE THE WELDER'S ABILITY TO DEPOSIT SOUND WELD METAL. THE PURPOSE OF THE PERFORMANCE QUALIFICATION
 TEST FOR THE WELDING OPERATOR IS TO DETERMINE THE WELDING OPERATOR'S MECHANICAL ABILITY TO OPERATE THE
 WELDING EQUIPMENT.
 - THE PQR DOCUMENTS WHAT OCCURRED DURING WELDING THE TEST COUPON AND THE RESULTS OF TESTING THE COUPON.
- AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
- "ASME Code" or "ASME IX"
 - ASME BOILER AND PRESSURE VESSEL CODE: SECTION IX: WELDING AND BRAZING QUALIFICATIONS
- ESSENTIAL VARIABLE
- Nonessential Variable
- SPECIAL PROCESS

Additional References:

- ASMEIX definitions QW/QB-492 (p. 193)
- ASMEIX WPS format QW-482 (p. 248)