VPAR Instruction Brochure

Prepared by Electric Boat Welding Engineering, Department 341
Revision D, 08/20/2026

GENERAL DYNAMICS
Electric Boat

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1. Purpose

The purpose of this document is to provide direction for electronic processing of Vendor Procedure Approval Requests (VPARs) and aid in qualifying, documenting, and developing welding and brazing procedures acceptable for use in the production of submarines and associated hardware. The required specifications are defined and invoked within Electric Boat Purchase Orders. All welding and quality engineers are advised to review Standard Clause 60-77 for additional contractual and technical requirements.

The intent of this document is to provide general guidance on creating and submitting a weld procedure via VPAR, and to bring attention to certain requirements that are easily missed. This document is not intended to invoke requirements beyond those in the applicable fabrication document, drawing, and other contractual requirements. For any cases where this document does not provide sufficient clarification, please submit your question to the Electric Boat (EB) purchasing representative, and they will forward it to the correct party within EB.

2. Definitions

2.1 Definitions Used in This Document:

2.1.1 Activity: The term activity refers to all sites of an organization under the same quality assurance management and using the same quality assurance plan.

2.1.2 Build-up: Build-up is a surfacing variation in which surfacing metal is deposited to restore base material or weld surface dimensions.

2.1.3 Buttering: Buttering is a surfacing variation that deposits surfacing metal on one or more surfaces to provide metallurgically compatible weld metal for the subsequent completion of the weld.

2.1.4 Cladding: Cladding is a surfacing variation that deposits or applies surfacing materials, usually to improve corrosion or heat resistance.

2.1.5 Essential Elements: Essential elements are those elements, either material or process, that are important in establishing a welding or brazing procedure. These elements shall be defined as part of a welding or brazing procedure. Changes in these elements, after procedure has been qualified, shall require a change in the written procedure and may require level I or level II requalification, depending on the element being changed and the magnitude of the change.

2.1.6 Hardfacing: Hardfacing refers to a surfacing variation in which surfacing metal is deposited to reduce wear.

2.1.7 NAVSEA: Naval Sea Systems Command (NAVSEA)

2.1.8 NAVSEA Authorized Representative: A government representative specifically authorized to approve qualifications. Typically this will be SUPSHIP.

2.1.9 Open Root: A full penetration joint welded from one side only without a solid backing or without a consumable insert, which may be welded with or without gas backing (including a purge bar).

2.1.10 Pressure Containing: Pressure containing refers to the area of a component or weld which prevents contained liquid or gas from escaping.

2.1.11 Procedure Qualification Record (PQR): A written record that documents the process, parameters, materials and controls used to braze or weld a test assembly and the test results obtained from evaluation of the test assembly for the purpose of validating a BPS or a WPS. More than one PQR may be used to support a single procedure. The PQR validates that the parameters specified in the WPS or BPS are capable of making a sound weld or braze in the hands of a skilled welder or brazer. A compilation of data used to develop, test, and certify a weld procedure.

2.1.11.1 WPQR: Weld Procedure Qualification Record

2.1.11.2 BPQR: Braze Procedure Qualification Record

2.1.12 Procedure Specification: A written procedure for either welding, termed a "Weld Procedure Specification (WPS)", or brazing, termed a "Braze Procedure Specification (BPS)". This procedure will provide the essential elements required by the qualification and fabrication specifications.

2.1.13 Seal Weld: Seal welds are welds provided for a fluid containment function only, as in a closure where strength is provided by a separate device.

2.1.14 Socket Weld: Socket welds are MIL-STD-22, P-13, P-14, P-15, P-16, P-17, P-42, and P-80 joint design welds in pressure containing piping. (Note: P-80 joint design is not defined in MIL-STD-22)

2.1.15 SUPSHIP: The Supervisor of Shipbuilding, a NAVSEA authorized representative.

2.1.16 VPAR: Vendor Procedure Approval Request, the document used by Electric Boat to process supplier procedures for acceptance.

2.2 All Other Definitions: For all definitions not found above or in the fabrication/qualification documents, see AWS A3.0.

3. VPAR Processing

3.1 Revisions or new WPSs must always be submitted along with the supporting PQR(s) on a VPAR through EB purchasing, to EB Welding Engineering for review and include any previous PQR approvals if they exist (see Section 6 of this brochure).

3.2 If the BPS, WPS or PQR is missing specification requirements that would result in a requalification, retest, or unresolvable comments the VPAR package will be disapproved and a summary of the reason for disapproval provided. Ensure that all reasons for disapproval and other welding engineering comments/instructions provided on the disapproval are adjudicated prior to resubmittal. The disapproved VPAR should be referenced in the description of document for the new VPAR.

3.3 When the WPS and PQR have been deemed satisfactory by EB Welding Engineering, the VPAR packages are then sent to SUPSHIP or NAVSEA for approval of the PQR, if required. SUPSHIP or NAVSEA may also request additional information or disapprove the VPAR at their discretion. These requests/disapprovals will be flowed down through EB Welding Engineering. It should be noted that for the majority of all VPARs, NAVSEA or its authorized representative is the approval authority for the PQR. There are some cases where EB is the approval authority such as some commercial or other welds (see Section 8 of this brochure).

3.4 Once approved, the PQR approval statement or letter with the NAVSEA or authorized representative signature will be provided to the supplier for their records. This approval document must be kept with the PQR. A PQR without a signed approval statement is not considered approved and will require requalification. If the VPAR is for submittal of a subcontractor's weld procedure, the submitting supplier must provide a copy of this approval to the subcontractor.

3.5 Once the qualification data is approved, the VPAR will be conditionally approved by EB Welding Engineering and returned to the supplier via the EB Buyer. The condition of approval will typically be that the version of the procedure and PQR with all EB comments incorporated is the approved version, rather than the version of the procedure and PQR that were initially submitted. The approved versions of all documents will be attached by EB Welding Engineering for reference. Other conditions may be added if EB Welding Engineering finds it to be necessary.

3.6 In addition to being technically adequate, the WPS and PQR must be administratively correct. For all WPSs and PQRs, the following information must be reported and failure to provide this information will result in the VPAR being returned to the supplier.

3.6.1 All Non-Destructive Test (NDT) reports must include the following:

- PQR identification must be listed on the report
- Performance standard must be listed for each test
- Acceptance standard must be listed for each test
- Report must state if the test results were acceptable or not
- The PQR, in addition to the test reports, must list the tests and have the same information identified (performance standards, acceptance standard, and associated paragraphs, sub paragraphs, etc. and if the test result was acceptable)
  - See Section 4.10 of this brochure for more detailed information

3.6.2 All Destructive Test (DT) reports must include the following:

- The PQR identification must be on the report
- The performance standard (usually AWS B4.0) must be stated on the report
- The acceptance criteria, and applicable paragraph and subparagraph of NAVSEA S9074-AQ-GIB-010/248 as applicable must be stated on the report
- The report must state if the test results were acceptable or not
- The PQR, in addition to the test reports, must list the tests and have the same information identified (performance standards, acceptance standard, and associated paragraphs, sub paragraphs etc. and if the test result was acceptable)
- See Section 4.11 of this brochure for more detailed information

3.6.3 RT Films and Data:

- For PQRs performed in accordance with NAVSEA S9074-AQ-GIB-010/248, the RT film and report must be approved by EB NDT Engineering on a separate RT VPAR.
- Note: The RT procedures used in evaluation of test assemblies must be approved by EB NDT Engineering on a separate VPAR.
- Thus, the total number of VPARS required to obtain approval for a welding procedure may be up to three:
    1. VPAR for RT Procedure
    2. VPAR for PQR RT film and data
    3. VPAR for WPS and PQR
- See Section 4.10 of this brochure for more detailed information

4. Requirements for PQRs

4.1 Qualification Document: The qualification document (NAVSEA S9074-AQ-GIB-010/248, NAVSEA 0900-LP-001-7000) specifies the requirements for welding and brazing procedure qualification requirements. Note that there are other qualification documents (such as MIL-STD-2191 and EB-3425), but these are only required for a few specific applications and are therefore not discussed in this brochure. Any additional questions regarding qualification document should be submitted by VIR.

4.2 Essential Elements: Essential elements are listed in NAVSEA S9074-AQ-GIB-010/248 Table V, however, Table V does not list all the essential elements. Additional essential elements come from sections 4.7 and 4.8, Level I and Level II requalifiable parameters.

- If a parameter requires requalifying, then that parameter is an essential element and must be listed in the welding procedure and on the PQR.
- Additional machine settings that control weld parameters are also essential elements.
- Brazing procedure essential elements are as specified in the applicable brazing documents.
- Commercial and other specifications will have their own essential elements, all of which must be considered and covered appropriately.

4.3 Procedure Qualification Record (PQR) per NAVSEA S9074-AQ-GIB-010/248: A Procedure Qualification Record (PQR), consists of the following:

- The essential elements and additional supporting evidence
- A record of the actual parameters used for welding the procedure qualification test assembly
- Attached copies of the original test reports (NDT and DT)
- Certification statement, including applicable signatures
- Any other supporting documentation such as heat treatment records, material certifications, etc.
- See section 4.5 of this brochure for procedure qualification for correct procedure and report identifications required for submittal.

4.4 Reporting Weld Parameters: The PQR must report the actual values used to weld the test assembly.

- Reporting parameters values in terms of ranges is not acceptable unless, for example, the welder deliberately varies a parameter in the course of welding. In that case, each of the parameter values used must be individually reported together with the pass number where that parameter was used. Typically, this is a problem when reporting:
    1) Amperage
    2) Voltage
    3) Travel Speed
    4) Shielding Gas Flow Rate
    5) Minimum gas cup size
- For materials with heat input limitations, it is recommended that amperage, voltage, and travel speed be reported for each weld pass. With the exception of the root area, every effort should be made to weld all passes of the test assembly at approximately the same heat input. Root pass(es) which are completely removed cannot be counted when establishing heat input. EB Welding Engineering will review the reported heat input values to validate the maximum qualified heat input.

4.5 Heat Input: For base materials with impact toughness requirements, the qualified heat input is established by the PQR. This includes dissimilar welds where only one base material has impact toughness requirements and welds, such as cladding, where the base material has impact toughness but the filler metal does not.

- For applications involving heat input limitations, the maximum heat input is established by qualification. Do not rely on a single pass or small number of passes to establish the maximum heat input. The average heat input of all passes used in qualification must be at or close to the maximum qualified heat input. In general this means the average heat input should be within 5 kJ/in of the maximum qualified heat input and at least 20% of the passes should exceed the maximum qualified heat input.

4.6 Identification of PQRs and Associated Reports: PQR Identification must be a unique standalone identifier; it is not acceptable to label the PQR with the same identification as the WPS.

1. Acceptable Example: if the WPS is identified by WP1234 and the PQR is identified as PQR1234
2. Unacceptable Example: if the WPS is identified by WP1234 and PQR is identified WP1234

- The PQR identifier and revision must be listed on each page of the PQR.
- Each new PQR and supporting documents must have a new unique identifier. For example, when essential element changes require a requalification or a test assembly failure requires welding another test assembly.
- The PQR identifier must be listed on the lab reports and other supporting documents. Note: for outside labs the cognizant lab must list the PQR number; the PQR number should be supplied to the cognizant lab by the supplier along with a requirement to have the lab list it on the reports.

4.7 Weld Joint Design: Approval of a welding procedure and qualification on the VPAR does NOT constitute approval of joint designs; certain joint designs are restricted in use by the fabrication documents or other primary document (such as the component drawing) and approval to use in an application must be obtained through the EB cognizant component engineer.

- The qualification record must identify the test assembly weld joint in accordance with MIL-STD-22 and the joint type must be listed (i.e. B1V.1, P-14 etc.).
- If a MIL-STD-22 joint sketch is provided, all applicable dimensions must be shown including bevel angle and root gap used in qualification.
    - Joints that utilize backing bars must identify:
        - Type of backing material (specification and grade)
        - Width of backing bar
        - Thickness of backing bar
    - Joints that utilize consumable inserts must identify:
        - Type of consumable insert material (specification and grade)
        - Size of consumable insert
        - Class of consumable insert
    - Open root joints must identify:
        - Root gap dimension
        - Root land dimension

- Though not recommended, it is sometimes necessary to qualify with a joint not in accordance with MIL-STD-22. In such cases the supplier must provide:

- A detailed sketch of the joint used with dimensions labeled
- Justification as to why the non MIL-STD-22 joint design was necessary

- When HAZ toughness testing is required, the joint design shall be in accordance with NAVSEA S9074-AQ-GIB-010/248 Figure 24
- Cladding and hardfacing test assemblies are to be in accordance with appropriate figures in NAVSEA S9074-AQ-GIB-010/248 (Figures 4, 4a, 5, and 6). Cladding less than 3/16 inch and hardfacing less than 1/8 inch of deposit thickness is outside the scope of the figures, please contact EB Welding Engineering for direction on qualification of cladding or hardfacing procedures less than the deposit thickness shown.
- Cladding and hardfacing test assemblies must provide all key dimensions, for example:
  - Base metal thickness
  - Base metal plate area dimensions
  - Deposit thickness
  - Deposit layers
  - Deposit area dimensions
  - Direction of welding in relation to deposit area dimensions

4.8 Base Metal for Test Assembly: The base metal used in qualification must be:

- A listed S-Group material in NAVSEA S9074-AQ-GIB-010/248, S9074-AR-GIB-010/278, or S9074-AD-GIB-010/1688.
- Approved to be listed as an S-Group by NAVSEA or its Authorized Representative, see Appendix A
- For NAVSEA 0900-LP-001-7000 base materials must be one of the listed materials in table 4-4. Other materials require approval by an Authorized representative or NAVSEA to be listed in a particular P number. See Appendix A
- Special considerations shall be taken when welding qualifications for CN-7M and CN-7MS casting repairs. It is recommended to use CN-7M or CN-7MS as the post weld heat treatment temperature requirement for these material grades differs from all other S-8 grades (See NAVSEA S9074-AR-GIB-010/278 Table VI for S-8 base material).

4.9 Cleaning of Test Assembly: A statement of the cleaning performed on the qualification test assembly must be provided in the PQR.

- This should be a statement equivalent to that provided in the weld procedure
- Titanium PQRs must address the additional titanium cleaning requirements contained in NAVSEA S9074-AR-GIB-010/278

4.10 Nondestructive Testing: Copies of the original NDT reports, including internal documentation if NDT is performed in-house, must be submitted with the qualification data.

- The PQR can function as the NDT reports if NDT was performed in-house and all performance information and results are reported on the PQR
- Unless explicitly permitted in the contractual documents, all NDT must be performed prior to sectioning the sample for destructive testing.
- RT Films and associated set-up (technique) and reader sheets must be submitted on a separate VPAR for review and approval through EB NDT Engineering prior to destructive testing of the test assembly and submittal of the welding procedure VPAR.
  - The RT procedure used must be approval by EB NDT Engineering
  - The RT VPAR should be approved before destructive testing of the PQR. If the test assembly is sectioned before the RT film is approved, it is not possible to reshoot the assembly and an additional test assembly will need to be welded to address any RT comments.

- Visual Inspection (VT) shall be conducted and found satisfactory before performing final NDT of the test assembly.
- The RT VPAR submittal must include the following when submitted in SPARS and the required information should be included in the description of document block (block 13 of the paper VPAR form).
    - The statement "RT film and data for welding procedure qualification"
    - The PQR Number
    - The Weld Procedure Number
    - The results of the required VT or identification of a deviation and rational for acceptance if VT was not performed prior to RT
    - RT procedure identified by the performing activity, number, revision, date, any addenda, and the VPAR number that approved the procedure
    - Joint Type (i.e. butt, single bevel, double bevel, backing bar, etc.)
    - Base material type
    - Filler material type
    - Joint thickness defined and dimensioned
    - Material form (plate or pipe)
    - If the test assembly received a post weld heat treatment (PWHT), the RT VPAR shall identify if PWHT was performed before or after RT
- Note that if any incorrect information is discovered in the Description of Document block, or the RT technique and reader sheets, during the welding procedure VPAR review it may require resubmittal of the RT VPAR with corrected information so that it can be reapproved. It may also result in a RT VPAR that was approved previously being disapproved. Therefore, all information should be checked for errors prior to submittal to avoid delays later in the weld procedure VPAR review process.

- The reports must address all testing required by Table VII of NAVSEA S9074-AQ-GIB-010/248 including the footnotes.
- The tests must meet the requirements of paragraph 4.5.1 and associated subparagraphs.
- NDT is to be performed in accordance with NAVSEA T9074-AS-GIB-010/271 and accepted to MIL-STD-2035 Revision A Class 1 for qualifications in accordance with NAVSEA S9074-AQ- GIB-010/248. Note that the specific revision of NAVSEA T9074-AS-GIB-010/271 used must be documented (Rev -, Change Notice A, Rev 1)
- The record requirements of the applicable test standard shall be followed.
- For NAVSEA 0900-LP-001-7000 qualifications NDT is as specified therein
- For qualifications to commercial or other specifications NDT is as specified therein
- For ALL NDT reports:
    - The PQR number must be listed on the report
    - The performance standard must be listed for each test
    - The acceptance standard must be listed for each test
    - The report must state if the test results were acceptable or not

4.11 Destructive Testing: Copies of original test reports (including internal reports if destructive testing was performed in-house) must be submitted with the qualification data and must address all testing required by Table VII of NAVSEA S9074-AQ-GIB-010/248 including the footnotes.

- The PQR can function as the destructive testing reports if destructive testing was performed in-house and it is noted on the PQR that all performance information and results are reported directly on the PQR, no separate reports were used.

- Destructive testing is to be performed in accordance with AWS B4.0, use the most recent revision.
- Acceptance criteria is in accordance with NAVSEA S9074-AQ-GIB-010/248, paragraph 4.5.2 and associated subparagraphs.
- Typical test assembly design and locations for removal of destructive test specimens can be found in NAVSEA S9074-AQ-GIB-010/248 Figures 2, 3, and 7. Use of these designs and locations is not required but can be used for information.
- For all destructive test reports:
  - The PQR identification must be on the report.
  - The performance standard (AWS B4.0 or sections of NAVSEA S9074-AQ-GIB-010/248, as applicable) must be stated on the report.
  - The acceptance criteria (paragraph and subparagraph from NAVSEA S9074-AQ-GIB- 010/248 as applicable) must be stated on the report.
  - The report must state if the test results were acceptable or unacceptable. A detailed explanation and supporting rational for approval of the deviation if the results were unacceptable.
- Specific considerations for the most common destructive testing methods are addressed in sections 4.11.1 through 4.11.5. If you have questions on less common tests such as A-45 cladding chemistry, S-10H ferrite testing, S-6 (Type 410) welded with 410NiMo filler HAZ impact testing, contact EB Welding Engineering.
  - For NAVSEA 0900-LP-001-7000 qualifications, testing is as specified therein.
  - For qualifications to commercial and other specifications, testing is as specified therein.
  - In accordance with NAVSEA S9074-AR-GIB-010/278, Table VI Note 9 heat affected zone impact testing is required when base material type 410 and 410S welded with 410NiMo filler material when PWHT is used (See section 4.11.3).

4.11.1 Tensile Testing: When transverse tensile testing is required, AWS B4.0 details what is required on the report. It will be necessary to include specimen size in order to verify tensile strength and that the specimens represent the full thickness of the test assembly.

- Although round tensile specimens (figure 4.1 of AWS B4.0) are not excluded from use for the transverse tensile test, specimens to figure 4.2 of AWS B4.0 for plate and figure 4.4 or 4.5 for pipe are recommended. If rounded tensile specimens are used NAVSEA S9074-AQ-GIB-010/248, Table VII note 4 still applies. When test plate thickness is greater than 3/4", multiple sub specimens, at various depths, may be required to demonstrate tensile properties of the through thickness of the plate.
- All-weld-metal tensile tests, when required, are made in accordance with figure 4.1 of AWS B4.0 and must meet all of the tensile properties listed in the filler metal specification.
- Titanium specimens must meet the tensile properties of the applicable base metal specification when no tensile requirements exist in the filler metal specification.

4.11.2 Bend Testing: Refer to NAVSEA S9074-AQ-GIB-010/248, Table VII with notes 7 and 10 to determine the number and type of bend tests required.

- For full penetration butt joints welded from one side without backing rings or preplaced inserts, root bends with the root in the as welded condition are

required when the root is welded without the addition of filler metal or without internal inert gas purge.

- Guided bend tests are to be performed in accordance with section AWS B4.0 section 6.0 with its subsections.
- For dissimilar metal welds bend tests may be:
  - One transverse side bend (Multiple sub-specimens may be required if the through thickness of the test plate exceeds the limits of the testing apparatus)
  - Two transverse face bends and two transverse root bends for thicknesses less than 3/4 inch
  - The bend radius is determined by section 6.6.4 of AWS B4.0.Base metals with elongation greater than 20% may use a bend radius based upon 20% elongation. (AWS B4.0 Section 6.10.2)
- The bend test report must contain the following information:
  - Bend radius
  - Bend angle
  - Specimen thickness
  - The results of each test, and any observation of unusual characteristics of the specimens
  - Type of bend test (e.g., transverse side bend)
  - Number of tests performed
  - Number and size of defects
  - Specimen width, and notes of any machining or sectioning performed on the sample that would affect its width
  - When longitudinal bend tests are used, additional information is required:
    - Location of the specimen relative to the surface or root of the original joint (if the bend specimen is thinner than the original joint). And the direction of bending (face in tension vs. root in tension)
    - Amount of the specimen width that represents each area of the weld (first base metal, weld metal, and second base metal). The specimen width should be chosen to include a significant amount of each area.

4.11.3 Toughness Testing: When toughness is required for production materials, Charpy impact testing must meet the requirements specified in footnotes 2 and 5 of Table VII of NAVSEA S9074-AQ-GIB-010/248. Figure 24 of NAVSEA S9074-AQ-GIB-010/248 is applicable for HAZ Charpy testing.

- Test specimens shall be machined in accordance with paragraph 4.5.2.4 of NAVSEA S9074-AQ-GIB-010/248 and figure 7.1 of AWS B4.0.
- Weld metal tests must be performed in sets of five and must meet the requirements of the filler metal specification.
- Double beveled butt welds require at least two specimens from each side (ref NAVSEA S9074-AQ GIB-010/248 Table VII note 5)
- HAZ and base metal tests (when required) must be performed in sets of 3 and shall meet the requirements of the base metal specification.
- When HAZ Charpy testing is required and the base material specification does not contain impact requirements, please contact EB Welding Engineering.

- Test reports must include:
  - Test temperature
  - Energy absorbed
  - Fracture appearance and any observation of unusual characteristics of the specimens.

4.11.4 Hardness Testing: Must be performed and evaluated in accordance with paragraph 4.5.2.5 of NAVSEA S9074-AQ-GIB-010/248.

- As required by Note 2 to Figure 6 of NAVSEA S9074-AQ-GIB-010/248, a minimum of five hardness tests must be performed on the test specimen when hardness testing is required by Table VII.
- The acceptance standard and minimum hardness shall be identified.

4.11.5 Macro-etch Testing: Must be in accordance with paragraph 4.5.2.6 of NAVSEA S9074- AQ-GIB-010/248.

- The number of specimens is identified in Table VII of NAVSEA S9074-AQ-GIB- 010/248 except that:
  - Socket weld joints in pipe test assemblies with wall thickness less than 3/16" shall have four macro-etch specimens and two macro etches when diameter is less than 0.840" (ref NAVSEA S9074-AQ GIB- 010/248 paragraph 4.4.7.5).
  - Butt welds in plate test assemblies with thickness less than or equal to 0.058" shall have two macro-etch specimens. (ref NAVSEA S9074-AQ GIB- 010/248 table VII note 15)
- The report shall contain the number of specimens and the number and size of defects, as well as the magnification at which inspection occurred.
- The report must specify the subparagraph of section 4.5.2.6 of NAVSEA S9074-AQ- GIB-010/248 to which acceptance is made.

4.12 Certification: The WPS and PQR must be certified by the cognizant person at the activity (supplier) qualifying the weld procedure.

- NAVSEA S9074-AQ-GIB-010/248 Paragraph 4.2.2 states "After testing the responsible official of the activity shall certify that the tests and the test results meet all requirements of this document and that the welding procedure meets all requirements of this document and the applicable fabrication document."
- The following is the recommended wording for the certification statement:

  "I certify that the tests and the test results meet all requirements of S9074-AQ-GIB-010/248 and that the welding procedure meets all requirements of S9074-AQ-GIB-010/248, S9074-AR GIB-010/278 and T9074-AD-GIB-010/1688 Rev 1."

- Fabrication/qualification documents may be added or removed as necessary per contractual requirements, but the WPS will only be allowed to be used for those applications that are in accordance with the listed documents.
- If the WPS is for NAVSEA S9074-AR-GIB-010/278 and NAVSEA T9074-AD-GIB-010/1688 both specifications must be listed. All WPS's that are for fabrication documents other than these must be limited to only a single fabrication document.
- The certification statement may be broken into two parts: one part to certify the PQR (written on the PQR) and one part to certify the procedure (written on the procedure).

4.13 Identifying Deviations: Any deviations from the qualification or fabrication documentation requirements must be clearly identified.

- If the PQR was unable to meet a requirement of the qualification document and the supplier considers that the requirement does not affect the integrity of the PQR or weld procedure, the Supplier may request to waive that requirement and provide significant supporting technical justification as allowed by paragraph 4.2.2 of NAVSEA S9074-AQ-GIB- 010/248. It is advisable to consult EB Welding Engineering prior to any further qualification work after the deviation is identified, concerning the acceptability of the waiver request.
- All deviations must be identified on the VPAR submittal and supporting technical rational for accepting the deviation must be provided.
    - If a deviation is requested, the certification statement from section 4.12 should be modified to state:

"I certify that the tests and the test results meet all requirements of S9074-AQ-GIB-010/248 except (state deviation) and that…"

4.14 Special Welds: Special Welds are defined in NAVSEA S9074-AQ-GIB-010/248 section 3.2.12. Base materials not listed in Table I should be evaluated for approval as part of a grouping in accordance with Table 1, Footnote 1.

- Testing of special welds shall include testing of Table VII to the maximum extent practicable. However, some special welds must utilize production mock-up welds that do not lend themselves to full mechanical testing. In such cases, the minimum requirements shall be discussed with EB Welding Engineering prior to any qualification work.
    - The Supplier is responsible for assuring that any additional tests will produce results that can be used to evaluate the welds are specified, along with the associated acceptance criteria (i.e. a micro hardness survey).
- Production weld mock-ups are for a particular application and are not generally given a range of material thickness listed in Table VI.
- Along with all of the required data in the PQR, the Supplier shall submit a proposed welder/welding-operator performance qualification test program that specifies the testing required and what limitations are invoked for production welding using the proposed performance qualification.
- PQRs for special welds must receive NAVSEA approval (not Authorized Representative) if a special weld procedure is to be used in any application specified in paragraph 4.2.5 of NAVSEA S9074-AQ-GIB-010/248. Therefore, the associated special weld procedure must be limited from any of the applications listed in paragraph 4.2.5 if the application does not require NAVSEA approval. A description of the intended application (component, drawing, ship class, etc.) must be included in the VPAR submittal.
- Section 6.2 of NAVSEA S9074-AR-GIB-010/278 requires NAVSEA approval of special welds.

4.15 All Position Pulsed Gas Metal Arc Welding (GMAW-P): This section provides clarification of the requirement in Table VI footnote 2 of NAVSEA S9074-AQ-GIB-010/248.

- Qualification of all position GMAW-P weld procedures requires welding of two test assemblies:
    - The first assembly is welded in the vertical (3G) position and is subject to all NDT and Mechanical testing required for a level I qualification.

- The second assembly is welded in the horizontal position (2G) and is only subject to the NDT specified for a level II qualification

- The qualified limits and essential elements of the weld procedure are established by the parameters use to weld the vertical plate. The horizontal plate may not be used to expand any of the qualified ranges established by the vertical plate
  - The amperage and voltage used to weld the horizontal test assembly must be within the range qualified by the vertical test assembly.
  - The horizontal weld should be accomplished using faster travel speed and stringer beads instead of expanding the amperage or voltage range.
- Do not vary groove angle, joint design or material thickness from that used in the vertical test assembly. The horizontal test assembly should match the vertical test assembly in all regards other than position.

5. Revising PQRs

5.1 New PQRs that have not yet been approved.

- When revision is necessary the original date the PQR test assembly was welded must be listed along with the date revised.

5.2 Previously approved PQRs.

- Once the Authorized Representative as defined in paragraph 3.1.6 of NAVSEA S9074-AQ-GIB- 010/248 approves a PQR, no changes should be made unless it is found that the PQR contained an error. This includes both technical and editorial changes. In the case that an error is found:
  - The original approver is to be notified (NAVSEA or its Authorized Representative)
  - PQR should be presented back to the original approver with changes clearly identified and dated.
  - Obtain approval or direction from the original approver.
  - In the case that an error is found on a PQR which affects the qualified limits of a WPS, this must be made known to EB Welding Engineering via a VIR as soon as possible. This VIR must include a list of all known production applications where the WPS was used outside of its actual qualified limits.

6. Approval of PQRs

PQRs may be approved by NAVSEA or a NAVSEA authorized representative (typically SUPSHIP).

- Previously approved PQRs, which were approved at EB or other shipyards may be accepted at EB provided the approval document (SUPSHIP letter, NAVSEA letter, Prior approved VPAR sheet) is submitted along with the PQR and contains:
    - The PQR identifier
    - The signature of an authorized approver
- Note that a PQR needs an Authorized Representative approval to be used. An approved EB VPAR does not satisfy this requirement unless the signature of the Authorized Representative is included on the VPAR.
- Always file all SUPSHIP approvals. Loss may result in needing to perform a new qualification. This is required per NAVSEA S9074-AQ-GIB-010/248 Section 4.6.2. If the VPAR was submitted on behalf of a subcontracted activity, a copy of the approval must be provided to the activity performing the welding.
- In certain circumstances, updates to the contractually required qualification or fabrication documents may result in the need to requalify a PQR previously approved by the Authorized Representative. For instance, thin-wall socket welding qualification requirements were updated between MIL-STD-248C and NAVSEA S9074-AQ-GIB-010/248, so a PQR for thin-wall sockets previously approved to MIL-STD-248C would require requalification for a NAVSEA S9074-AQ-GIB- 010/248 application.
- Newer approvals through EB will include a SUPSHIP signature on a separate document. This document will be provided to the Supplier when the VPAR is approved.
- Older approvals through EB will have the SUPSHIP signature in the customer block on the bottom middle of the VPAR sheet. For NAVSEA approvals through EB the NAVSEA letter will be referenced in the customer block. In the case where a previous PQR approval is applied to approve the new VPAR, the customer block may reference:
    - The original EB VPAR number on which approval was first granted
    - Another Authorized Representative's Letter
    - A NAVSEA letter

7.]Requirements for a Welding Procedure, WPS

7.1 Unique Identification: Each procedure must be uniquely identified. Each page of the procedure must be dated and contain the unique procedure identification and revision identification.

- The procedure should also reference the identifiers(s) of the supporting PQR(s).
- The procedure must be revision controlled such that the revision letter or number is changed whenever a change is made to the procedure after it has been released for production. Within a revision cycle, changes may be made to a procedure draft that has not been released for production without changing the revision letter or number. However, the date must be changed in order to identify draft versions of the procedure.

7.2 Essential Elements: When developing welding procedures, care must be taken to ensure that the welding procedure does not violate any requirements of the qualification or fabrication document.

- The parameter ranges specified in the procedure must fall within the requirements of NAVSEA S9074-AQ-GIB-010/248, S9074-AR-GIB-010/278, T9074-AD-GIB-010/1688.
- The supplier is responsible to ensure that weld parameters specified in the WPS will produce acceptable results within the range of thickness specified in the procedure.
- Note that EB may require clarification of certain essential elements based on good engineering practice. For instance, gas flow-meter scale will be required for procedures involving mixed gases, due to the difference in measurement scale between certain gases.
- Some processes have additional requirements that must be accounted for. A common example of this is submerged arc welding, which has additional requirements for elements such as preheat, heat soaking, and equipment, listed in EB Specification 4906. All contract documents must be reviewed to ensure other supplementary requirements are not overlooked.

7.3 Base Materials: Base materials for non-special weld procedures must utilize materials specifically listed in Table I of NAVSEA S9074-AQ-GIB-010/248 and NAVSEA S9074-AR-GIB-010/278, as well as NAVSEA T9074-AD-GIB-010/1688.

- If the base material specification and class to be used in production is not listed in Table I, the supplier must request that the material be considered as part of a particular S-numbered group. The supplier must provide a comparison between the chemistry and mechanical properties for the material to be used and similar listed materials as part of the request. See Appendix A.
- In addition, previously approved materials are listed in the NAVWELD program along with a reference to the approval document. The supplier may use those materials without further approval from EB Welding Engineering.

7.4 Filler Materials: Filler materials used in production welding must be procured in accordance with the specified Military specification and type listed in Table II of NAVSEA S9074-AQ-GIB- 010/248 and NAVSEA S9074-AR-GIB-010/278, as well as NAVSEA T9074-AD-GIB-010/1688.

- If Table II specifies a commercial (AWS) specification, then the weld procedure must specify that the filler material be procured in accordance with AWS 5.01 and must as a minimum undergo the testing of schedule J and the lot definition of S2 (for bare solid electrodes and wire), C3 (for covered electrodes), T2 (for flux-cored electrodes), or F2

(for SAW fluxes). These conformance testing requirements must be noted on the procedure, or the supplier ordering document for the filler material which demonstrates these requirements are being met may be provided.

- Although not normally approved, use of alternate specifications for filler materials requires separate Authorized Representative approval as specified in paragraph 5.2.1 of NAVSEA S9074-AR-GIB-010/278. Table II Note 1 of NAVSEA S9074-AQ- GIB-010/248 and NAVSEA S9074-AR-GIB-010/278 also allow grouping of similar filler materials into A-groups. This process is similar to the base material grouping process.
- A-45 Filler materials require additional testing and have additional conformance criteria as specified in NAVSEA S9074-AR-GIB-010/278 Table II footnote 8 (for covered electrodes) or footnote 9 (for bare solid electrodes and wire). These conformance testing requirements must be noted on the procedure, or the supplier ordering document for the filler material which demonstrates these requirements are being met may be provided.
- For Cladding with A-45 materials see Appendix D for a flow chart to help with qualifications.
- For aluminum and austenitic stainless steel filler materials, there are often large differences in chemistry between filler materials in the same group. This can affect their compatibility with the base material. Therefore, it is required on the WPS to create a table or list of base material grades and filler materials that are chemically compatible. Tables to use can be found in NAVSEA T9074-AD-GIB-010/1688 Rev 1 Tables 10-3 and 10-4.

7.5 Weld Joint Design: The procedure must specify either those joint designs that the Supplier will be welding (such as "only for socket welds") or specify the joint designs that the procedure is not qualified to perform. The following is an example of the latter: (this statement may be copied into a weld procedure as applicable)

"Qualified within the stated limits of process, position, base material and thickness to weld all MIL-STD-22D joint designs except:"

1. Joints welded with pre-placed filler metal inserts (see NAVSEA S9074-AQ-GIB-010/248 Section 4.7.3.1(b)).
2. Butt joints welded from one side with no backing or pre-placed filler metal insert (see NAVSEA S9074-AQ-GIB-010/248 Section 4.7.3.1(a)).
3. Use of ceramic or other non-metallic backing (see NAVSEA S9074- AQ-GIB-010/248 Section 4.7.3.1(d)).
4. Seal welds other than edge or fillet types (see NAVSEA S9074-AQ- GIB-010/248 Section 4.4.7.1).
5. Socket welds and fillet type seal welds in pipe with nominal wall thickness less than 3/16 inch (see NAVSEA S9074-AQ-GIB-010/248 Section 4.4.7.1).
6. Tube-to-tube sheet welds (see NAVSEA S9074-AQ-GIB-010/248 Section 4.4.7.1).
7. Cladding or hardfacing (see NAVSEA S9074-AQ-GIB-010/248 Sections 4.4.2.1 and 4.4.2.2).
8. Weld joints with included angles less than XX degrees. (For semi-automatic and automatic processes only, see NAVSEA S9074-AQ-GIB-010/248, paragraph 4.8 (c)).
9. Single layer welds for pressure containing joints (see NAVSEA S9074-AR-GIB-010/278 Section 6.2.6 and NAVSEA T9074-AD- GIB-010/1688 Rev 1 Table 11-1 Note 13)."
    - NOTE: It is recommended that any of the above mentioned special qualifications be used to support a separate procedure to prevent unqualified WPS's from being accidentally misused.

- Multiple-pass qualifications can qualify single pass welding for the following conditions, provided the requirements of NAVSEA S9074-AQ-GIB-010/248 are met:
  - Fillet welds
  - Build up or repair welding
  - Joint designs listed in MIL-STD-22D which are restricted to base material thicknesses less than ¼ inch, e.g. B1S.1, B1S.2, C1S.1, etc.
- Approval of a welding procedure and qualification on the VPAR does NOT constitute approval of joint designs; certain joint designs are restricted in use by the drawing, fabrication document, or other contractual document, and approval to use these in an application must be obtained through the EB cognizant component engineer.

7.6 Thin Wall Socket Procedures (pipe less than 3/16 inch): Socket welds in pipe with a wall thickness less than 3/16 of an inch requires qualification by mockup in accordance with section 4.4.7.1 of NAVSEA S9074-AQ-GIB-010/248.

- It is recommended that weld procedures for socket weld joints with nominal pipe wall thickness less than 3/16" be contained in a separate weld procedure.
- These procedures are limited to +/- 15% of the welding current used during qualification as specified in paragraph 4.7.5 (c) of NAVSEA S9074-AQ-GIB-010/248.
- If needed, more than one range of welding current may be specified for different pipe wall thicknesses provided that they are supported by the appropriate number of weld procedure qualification tests.

7.7 Cleaning Statement: The cleaning requirements of NAVSEA S9074-AR-GIB-010/278 paragraph 7.2 or T9074-AD-GIB-010/1688 Rev 1 paragraph 14.2.2, as applicable must be specified in the welding procedure

- The following statement is from NAVSEA S9074-AR-GIB-010/278, and is recommended for NAVSEA T9074-AD-GIB-010/1688 Rev 1 applications as well. The wording may be changed to fit the standard practices of each activity as long as the intent is met:

  "The joint members to be welded, including the base metal surfaces, shall be cleaned to remove foreign material for a minimum of 1 inch from the weld edge. Mill scale or metallic oxides shall be removed from surfaces on which weld metal will be deposited. Slag shall be removed from all weld metal surfaces prior to depositing subsequent passes or layers and upon completion of the weld."

- Titanium welding procedures must address the additional cleaning requirements contained in NAVSEA S9074-AR-GIB-010/278, and Aluminum welding procedures must address the additional cleaning requirements contained in NAVSEA T9074-AD-GIB-010/1688 Rev 1.

8. Commercial, Commercial Best Practice, and other Welding or Brazing

8.1 Specifications and Practices

- Commercial Welding: Welding to a recognized commercial specification (AWS, ASME, AMS, etc.)
- Commercial Best Practice: Non-specification based welding. The procedure is based on the welding suppliers' experience and knowledge.
- Other: Welding to other standards such as military specifications other than those listed in section 10 of this brochure.
- Some submarine applications are suitable for the type of welding listed in the definitions above. In such cases when a commercial weld or other standard is applied the supplier must comply with all the requirements of that commercial standard. Failure to comply with the requirements of the particular commercial standard will result in a rejection of the VPAR.
- Commercial welding, commercial best practice, or other welding requires authorization from the cognizant authority; usually this is obtained through the appropriate EB component engineer. When it is not clear that such welding is authorized for a particular component, the supplier should submit a VIR to the EB purchasing agent for direction on how to proceed. VIRs which grant approval for use of commercial, commercial best practice or other welding must be referenced in the VPAR submittal. Common circumstances under which this would be granted, are sheet metal applications per NAVSEA S9074-AR-GIB-010/278 Section 1.3, and minor structure per NAVSEA T9074-AD-GIB-010/1688 Rev 1 Sections 4.3 and 3.33.3.1.
- Commercial best practice welding may be subject to a request for objective quality evidence (i.e., testing in order to prove that the weld or braze procedure will produce satisfactory welds for the intended application).
- **CAUTION** For AWS prequalified procedures the supplier must verify with EB component engineering that prequalified joint designs submitted meet the requirements for EB drawing specifications.
- **CAUTION** AWS Tubular joints may be subject to additional rigorous qualifications. The supplier should submit a VIR to the EB component engineer for direction where tubular joints are involved.
- Approval of commercial welding is limited to a particular purchase order when the WPS does not limit welding to a specific part. This means every time the part is to be welded for a new PO the VPAR must be resubmitted. The supplier may choose to limit the WPS to the specific part, in which case the VPAR may approve the WPS for that part only. An approval limited to a particular part precludes the need for the VPAR to come in for each PO. The supplier must specify the PO, EB part number, or drawing number they want the weld procedure limited to on the VPAR submittal. If the WPS is revised or the part revised the WPS must be resubmitted for review and approval.
- Brazing to NAVSEA 0900-LP-001-7000 is for piping and fitting applications. However, it is often invoked by drawing for other applications, in which case it must be approved for use on such applications and the class of brazing must be stated. If the supplier is unsure if NAVSEA 0900-LP-001-7000 is allowed for the application or the brazing class is not listed, a VIR must be submitted the cognizant EB component engineer for determination of applicability and class. A copy of the completed VIR must be submitted with the brazing procedure.
- Brazing to other specifications, when allowed, must comply with all the requirements of the invoked specification. If a supplier is not sure if a particular specification is allowed a VIR must be submitted for clarification.

9. Drawings: Military, commercial and other

- Drawings must indicate the welding or brazing specification.
- Some drawings are primary reference documents which have requirements that conflict with the fabrication specifications; in that case the primary reference document prevails. The supplier should verify applicability with the EB component engineer. Any special requirements from the drawing that affect qualification of weld procedures should be noted on the submittal.
- For NAVSEA S9074-AR-GIB-010/278 applications, the drawing must list the class and category of weld.
- **CAUTION** When a tiered drawing system is used and the welding or brazing requirements are on a different level drawing than the top tier drawing, the top tier drawing must reference the drawing the welding or brazing is done to. That is drawings shall be traceable.
- **CAUTION** In the event that top tier drawings do not reference the drawings that welding and brazing is performed on, the supplier shall provide a letter on the supplier's letter head signed by the cognizant supplier individual stating what drawings are used to weld or braze items on the top tier drawing.

10. References: Weld Related Specifications

This document covers the following specifications. Active revisions to these documents shall be as specified in the contractual requirements or the active revision specified in the Spec Effectivity Indexes found on the supplier page of the EB website:

- AWS B4.0 Standard Methods for Mechanical Testing of Welds
- Commercial welds
- MIL-STD-22D Welded Joint Design
- MIL-STD-248C Welding and Brazing Procedure and Performance Qualification
- MIL-STD-248D Welding and Brazing Procedure and Performance Qualification
- MIL-STD-271F Requirements for Non Destructive Test Methods
- MIL-STD-278F Welding and Casting Standard
- MIL-STD-1628 Fillet Weld Size Strength and Efficiency Determination
- MIL-STD-2035A Non Destructive Testing Acceptance Criteria
- NAVSEA 0900-LP-001-7000 Brazing Manual
- Other welds
- PPD 802-6335695 Welding and Brazing Procedure and Performance Qualification (Seawolf)
- PPD 802-6335694 (MIL-STD-1689 Rev A) Fabrication, Welding and Inspection of Ships Structure (Seawolf)
- PPD 802-6337550 Requirements for Fillet Weld Size Strength and Efficiency Determination
- PPD 802-6335720 (MIL-STD-1688 Rev B) Fabrication, Welding and Inspection of HY-80/HY-100 (Seawolf)
- NAVSEA T9074-AD-GIB-010/1688 Requirements for Fabrication Welding and Inspection of Submarine Structure (NAVSEA Technical Publication)
- NAVSEA S9074-AQ-GIB-010/248 Requirements for Welding and Brazing Procedure and Performance Qualification (NAVSEA Technical Publication)
- NAVSEA S9074-AR-GIB-010/278 Requirements for Fabrication Welding and Inspection, and Casting Inspection and Repair for Machinery, Piping and Pressure Vessels (NAVSEA Technical Publication)
- NAVSEA T9074-AS-GIB-010/271 Requirements for Non Destructive Test Methods (NAVSEA Technical Publication)

11. Appendixes

1) **Appendix A:** Template for Comparison to Request Approval of a Material in Accordance with NAVSEA S9074-AQ-GIB-010/248, Table 1, Note 1
2) **Appendix B:** Titanium: Guide to Finding Applicable Sections in the Qualification and Fabrication Documents
3) **Appendix C:** NAVWELD. The Electronic Weld Procedure Development System
4) **Appendix D:** Flow Chart: Cladding with C276 Approval for use of Heats

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Prepared by Electric Boat Welding Engineering, Department 341
Revision D, 08/20/2026

Appendix A

Template for Material Comparison to Request Approval of a Material in accordance with NAVSEA S9074-AQ- GIB-010/248, Table I note 1

Supplier Name
Date
WPS#
PQR#

Re: Request classification of (material specification, type, grade, condition, class etc. provide heat treated condition)

Rationale/Reason:

Chemical Requirement Similarity Evaluation Table:

Element Requirement	Listed Material	Unlisted Material
Residuals		

Note: (provide notes and amplifying information here)

Mechanical Requirement Similarity Evaluation Table:

Requirement		
TS		
YS		
%El		
%RA		
Hardness		

Note: (provide notes and amplifying information here)

Appendix B

Titanium: Guide to Finding Applicable Sections in the Qualification and Fabrication Documents

NAVSEA S9074-AR-GIB-010/278	**NAVSEA S9074-AQ-GIB-010/248**
Page/section	Page/section
21/4.1.3 (d)	19/4.4.5.2
22/Note (2)	21/4.5.1.1.1
23/4.2.11(a)	22/4.5.2.2.1, 4.5.2.4.1
24/4.3.2	27/4.7.7, h, k, l
25/4.5, 4.6	30/4.8q
37/Table	33/5.2.11, 5.2.11.1, 5.2.12
46/Table	35/5.4.1.1, 5.4.1.3
49/6.2	36/5.4.1.3
51/Table	38/5.6.7, d, f
54/6.2.7.1	55,56/Table
60/Table, 6.3.1.1	63/Table
61/6.3.2	75/Table
70/6.4.6, subparagraphs, MIL-H-81200	79/note 1, h, i
72/6.6.5, 6.7	80/note 7
73/7.2.2, 7.2.3, 7.3	82/note 12
74	83/Table
75/7.7.2, 7.9	85/note 6, 17
76/7.10, subparagraphs	87 Table
78/8.5.8	92/note 9
79/8.8, subparagraphs	
88/ note 7	
91/ note 18	
93/ note 10	
94/10.3.5.1	
95/10.3.13	
96/note 4, 5	
97/a, b, 10.4.1.2	
101/11.3.1	
112/Table	
123/13.2.8.1	
125/Table	
136-142/Appendix A	

Appendix C

NAVWELD: The Electronic Weld Procedure Development System

The NAVWELD System is available to suppliers wanting to use an electronic WPS and PQR development program, it is available at no cost for suppliers to use.

Previously approved procedures and qualification data may be re-written in the NAVWELD Format; this change will require submittal of the VPAR in the new format for review.

Foreign owned companies are not eligible to use this system at this time.

Information about NAVWELD can be obtained from:

Troy Paskell
Weld QC, Inc
82 Village Point Dr
Powell, OH 43065
(614) 956-1153
paskell@weldqc.com

Website: https://www.NAVWELD.com

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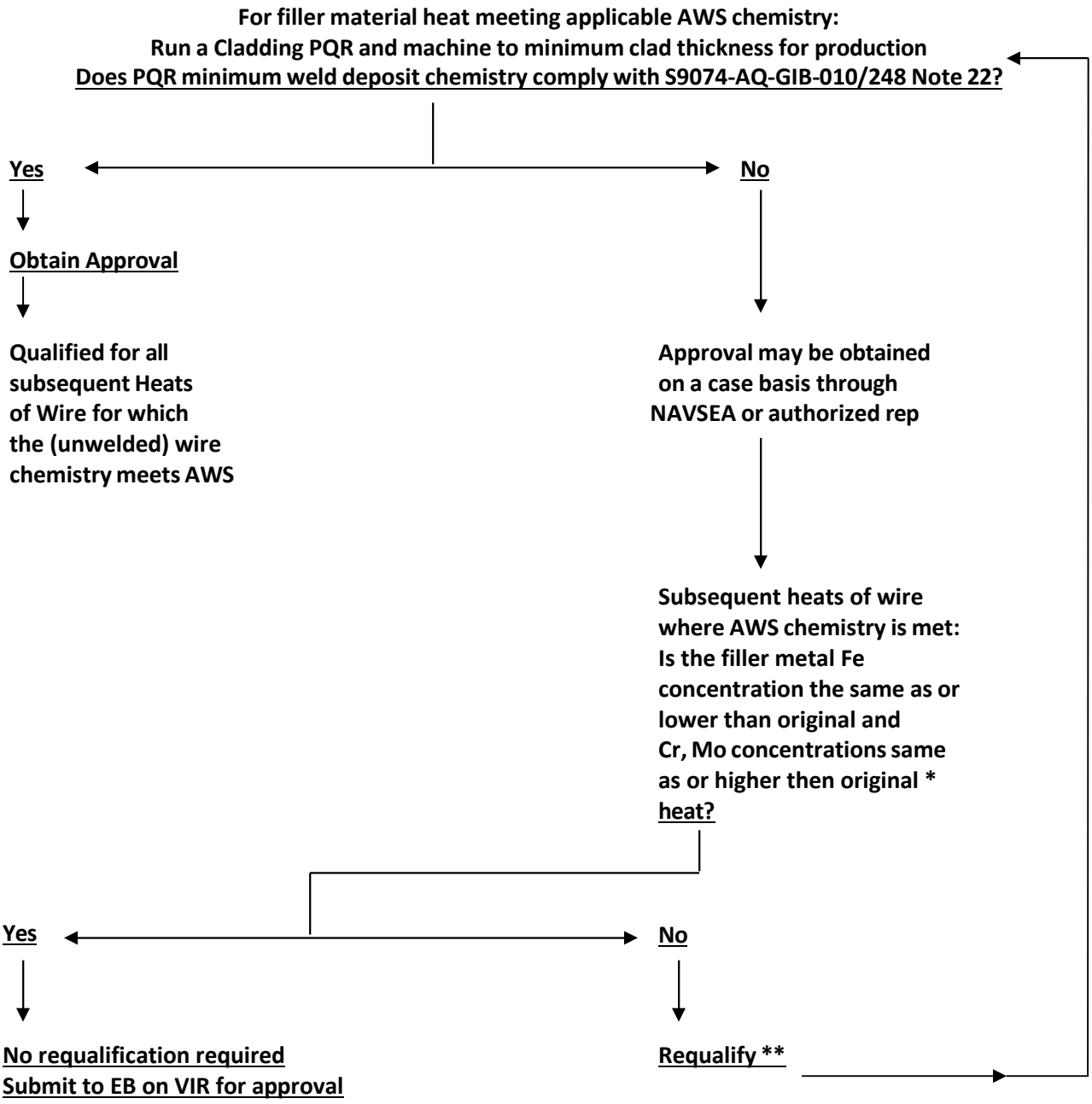
Appendix D

Flow Chart: Cladding with C276 Approval for use of Heats

References:

a.) NAVSEA letter 9100 OPR: 350T5 Ser 350A/1449 dated 22 APR 91
b.) NAVSEA letter 9074 Ser 450T2M/1079 dated 05NOV 2004
c.) AWS A5.11, A5.14
d.) NAVSEAS 9074-AQ-GIB-010/248



* Original heat refers to the heat found to produce acceptable welds in accordance with Reference (a)
** Requalified heat may become the "original" as you go back through the flow chart.