DCMA NSEO MANUFACTURING PROCESS REVIEW (MPR) CHECKLIST #28

BRAZING

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| **SUPPLIER & CAGE:** |  |
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| **LOCATION:** |  |
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**Program Type:**

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|  | Level I/SUSBAFE (LI/SS) |  | Navy Propulsion Program (NPP) |  | Deep Submergence Systems/Scope of Certification Program (DSS-SOC) |
|  | Nuclear Plant Material (NPM) |  | Naval Nuclear Propulsion Program (NNPP) |  | Aircraft Launch & Recovery Equipment (ALRE) |
|  | Fly By Wire Ships Control Systems (FBWSCS) |  | Ships Critical Safety Items (SCSIs) |  | Other: |

**Contractual Requirement(s) for this Process:**

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**Supplier Procedure Number(s), Title(s) & Revision Level(s)/Date(s):**

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| **Process Reviewed By:** |  |
|  |  |
| **Date(s) of Review:** |  |
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**Process Concerns and Guidance:**

* **PROCEDURE**: the process must be controlled by a written procedure, which reflects the contractually imposed brazing specification requirements, and appropriate controls for each process input. A properly written procedure must detail process inputs such as
* Operator Qualification
* Technique
* Materials (filler wire flux, etc.)
* Equipment
* Fit-up
* Brazing Method
* Pre-cleaning and post
* Gas and the required psi
* Temperature parameters
* Atmosphere
* **QUALIFICATIONS**: only certified personnel having satisfied the qualification requisites specified in the applicable brazing specification are authorized to perform the metal joining process.
* **MATERIALS**: storage, marking, and handling of filler-metals and brazing flux aids in preventing material mix-ups, contamination, and damage. Brazing the wrong material and application of the wrong flux during the brazing process has resulted in failures in the field.
* **METHODS**: joint spacing (fit-up, gap) of the parts to be brazed is critical to the process because filler metal is drawn into the joint by a pulling force known as capillary action, which occurs during the heat cycle. So it is particularly important to maintain proper part spacing, as specified in the technical document in order to achieve the desired process outcome.
* **CLEALINESS/ATMOSPHERE**: Brazed joints require a high degree of base-metal cleanliness. Some brazing applications require the use of fluxing agents to control cleanliness. Pre-coating with flux, a chemical compound which protects the part surfaces from air, which is an atmospheric concern. Flux helps prevent oxidation when the metal heats up, and it improves filler metal flow. A point to remember flux should melt and become completely liquid before the alloy melts. Most often flux is sold in paste form so it can be brushed on to the parts just before the actual heating cycle. Flux is not the only method used to prevent oxidation. Nitrogen, hydrogen or dissociated ammonia, are used in a controlled atmosphere glove box or a vacuum furnace. Without oxygen in the surrounding atmosphere, there is no potential for oxidation.
* Inadequate cleaning or inadequate atmospheric control can diminish the structural integrity of the brazed joint and can result in failures.
* **Basic steps in brazing**

1. Ensure fit and clearance
2. Clean metal
3. Flux prior to brazing
4. Fixturing of parts
5. Brazing the assembly
6. Cleaning the new joint

**A**. **MANPOWER:**

1. Are the personnel performing the Brazing and quality assurance functions of the appropriate skill/experience level and/or properly trained/certified to produce conforming product? ***What are the requirements? (NAV28-II20)***

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1. Are training records available (review sample), and are they accurate and complete? Have personnel performing the brazing process passed an annual vision test if required? (NAV28-II21)

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1. Are personnel performing the brazing process knowledgeable in the use of applicable procedures and tools? (NAV28-II29B)

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1. Are inspection and manufacturing personnel trained in the use of procedures? Is this recorded and part of employees’ files? (NAV28-II5)

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**B. MATERIALS**:

1. Are certifications for raw materials used in the brazing process reviewed for acceptance and maintained on file for review? (NAV28-II16)

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1. Is stored wire and flux protected, properly identified, and does it match the material specified in the procedure to be used?

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1. Do brazing wire, rings, flux, and raw materials have traceability markings on containers? Are materials controlled and traceable throughout the process, if required? (NAV28-II13/V27)

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1. Are there adequate methods of segregating accepted and rejected materials in use? (NAV28-V26)

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**C. MACHINERY**:

1. Is **brazing** equipmentadequate to produce/assess conforming supplies in compliance with contractual specifications and drawing(s)? *What Items were sampled and were they part of the supplier’s calibration program and within the calibration/check cycle? (NAV28-II9/15)*

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1. Is **inspection and testing equipment** of the required adequacy, accuracy, precision, and range to assure supplies produced comply with specifications and drawings? *What Items were sampled and were they part of the supplier’s calibration program and within the calibration/check cycle? (NAV28-II15)*

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1. **For Furnace Brazing:** Are automatic temperature controlling and recording devices (potentiometer, e.g.) provided to control furnace temperature? Are periodic surveys conducted, and is there data available? Are the control/recording devices within calibration? (NAV28-VI31/33/34)

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1. **For Induction Brazing:** Are induction coils designed to assure uniform heating? (NAV28-VII39)

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1. **For Dip Brazing:** Is the Dip brazing bath controlled? Are there written instructions provided for the removal of brazing salts and/or fluxes? Is this process in control? (NAV28-VII40/41)

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**D**. **METHODS**:

1. Identify the standard the supplier is using for performing brazing? MIL-B-007883B, MIL-B007883 Rev?, NAVSEA 0900-LP-001-7000, or other (specify). (NAV28-I1)

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1. Does a written, detailed procedure exist, and is it readily available and utilized for the brazing process? Is the procedure based on contract invoked requirements or generic company-based standards? Is the procedure approved by the customer? List the procedure and reference approval number, if applicable. (NAV28-II2A/3/6/7)

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1. Does a written, detailed procedure exist, and is it readily available and utilized for the assembly of components prior to brazing? Identify procedure number and revision. (NAV28-II2B/3)

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1. Are inspection procedures utilized for brazing? Identify procedure number and revision. Does the procedure include a system for identification of inspection status on parts and documentation? (e.g. inspection stamp) (NAV28-II4/10)

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1. Identify the inspection methods used to verify conformance with procedures and standards. Are inspection documents properly completed and maintained? What inspection documents exist? Review and record number of samples. (NAV28-II11/12A/B/17)

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1. Are procedures/work instructions adequate for the control of the proper equipment and materials? (NAV28-II8A/B)

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1. Verify that completed records are properly reviewed and maintained. Review a sample of completed work packages and verify compliance with procedures. Record sample. Are shop travelers and work records traceable to the inspection personnel? (NAV28-II18/19/23/24)

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1. **For Furnace Brazing:** Are de-carbonization tests run when carbon and low alloy steel items are furnace brazed? If so, are the de-carbonization limits allowed correct? (NAV28-VI32)

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1. **For Brazing Rework:** Are re-worked Braze joints controlled? (documented and includes number of repair attempts prior to requirement for disassembly) Is there a written instruction for routine repairs and the use of brazing alloy for repair? Are braze joints re-fluxed prior to repair attempt? Is the same NDT used for acceptance of repaired joints during as during initial fabrication? (NAV28-VIII42-45)

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**E.** **ENVIRONMENT**:

1. Are work areas clean from debris and separate from other areas for brazing operations? (NAV28-V28)

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1. Is exhaust equipment utilized in brazing areas to provide fresh air for personnel? (NAV28-V29)

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1. Do controls exist for handling and disposing of brazing waste? (NAV28-V30)

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1. **For Furnace Brazing:** What furnace atmosphere is used? (Argon, Hydrogen, other?) Is the dew point and composition of atmospheres controlled to prevent oxidation or carbonization of carbon, low alloy, and stainless steels? (NAV28-VI35/36)

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**F. PRODUCT EXAMINATION:**

***The QAR must perform a product examination in order to verify the output of the process being reviewed and document the results below. If available, witness a brazing operation on a component. If not available, verify by interview that the operator is familiar with the process and procedure/work instructions. (NAV28-III26-29A/30)***

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| Date(s) Conducted: |  |
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| Product Examination Performed By: |  |
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| Contract Number(s): |  |
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| Part Number(s)/Serial number(s): |  |
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| Part Nomenclature(s): |  |
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| Supplier Personnel Contacted and Titles: |  |
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| Drawing Number & Revision: |  |
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| Lot Size and Sample Size: |  |

1. Identify the inspection methods (W, I, T, V) used to verify conformance with procedures and standards:

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| **W** |  |  | **I** |  |  | **T** |  |  | **V** |  |

1. Indicate specific brazing process observed (Torch, furnace, induction, resistance, dip) and the base material(s) being brazed. (NAV28-III27/28/29)

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1. Verify proper joint preparation (squared, de-burred, any required scribe marks are applied, and noted if any deviation is required) and assembly is performed in accordance with approved procedures. (NAV28-II2/3/4)

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1. Verify proper pre-cleaning, type of filler material, flux and consistency, and re-fit if necessary due to time limit (flux dries). (NAV28-II6/8/9/10)

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1. Verify proper brazing at correct temperature, proper cooling, post cleaning, flux removal, heat treat, and passivation, if applicable. (NAV28-II15-19)

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1. Verify the completed braze is properly inspected and documented in accordance with applicable requirements.

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| Any Additional observations: | # Observations |
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**PE Comments/Concerns**

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| **Overall MPR Results:** | **SATISFACTORY** |  | **UNSATISFACTORY** |  |

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| **Corrective Action Generated?** | **No** |  |  | **Yes** |  |  | **CAR#** |  |

FOLLOW-UP ACTION REQUIRED?

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**SUMMARY/NOTES/COMMENTS/CONCERNS**:

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