DCMA NSEO MANUFACTURING PROCESS REVIEW (MPR) CHECKLIST #27

TEFLON COATING

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

* Teflon coatings are used to provide lubricity. Failure of the coating may result in seizing of parts, resulting in part and possible system failure.
* Surfaces must be clean and properly prepared for adequate coating adhesion and coverage.
* Improper cleaning and surface preparation techniques can result in poorly adherent coatings of inadequate or non-uniform thickness.
* Thick coating passes tend to be less adherent than thinner passes.
* The shelf-life of the Teflon coating material is significantly affected by storage temperature; the use of out-dated or improperly stored products will likely cause premature failure.
* Coating material not stored properly (at proper temperatures)
* Coating material containers not labeled with expiration dates
* Oven control (Uniformity and System Accuracy Checks) not performed as required
* Thickness testing equipment verification not performed as required
* Processing equipment maintenance inadequate
* Surfaces to be coated are touched with bare hands (oil from the hands will interfere with proper coating).
* Pitting and undesirable marks where rack hooks contact the parts
* Failure to provide uniform coating thickness and/or complete coverage

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

1. Are the personnel performing the Teflon coating, and quality assurance functions of the appropriate skill/experience level and/or properly trained/certified to produce conforming product? ***What are the requirements?***

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1. Record all operations observed (include type and specification, where applicable) and the corresponding operators’ names. Are any personnel certifications expired and are they still working in the process?

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1. Are training records available (review sample) and are they accurate and complete?

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1. Are the credentials of the training/certification official in accordance with specification requirements? ***What are the requirements?***

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1. Is there a system in place for remedial training when errors occur? Is the system documented, and are there records of remedial training available, if applicable?

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**B. MATERIALS**:

1. Are materials controlled and traceable throughout the process, if required?

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1. Are certifications for raw materials used in the process reviewed for acceptance and maintained on file for review?

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1. Do the raw materials comply with contract/specification and/or supplier-imposed technical requirements? ***What were the materials reviewed?***

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1. Are coating materials identified/traceable with batch numbers?

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1. Are receipt inspections performed on the Teflon coating material? List inspections performed, primer used, and final coat used. Are receipt inspections documented for this material, and are batch numbers recorded? (NAV27-A3A/C

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1. Are inspections for proper storage temperature, shelf life, and lack of separation performed on the primer and topcoat prior to use? List any additional coating material inspections performed. (NAV27-A3B)

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1. Are there other controls to ensure conforming material is consistently used in the process? Describe.

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1. Was the base material’s integrity compromised by processing and/or practices? ***If so, how (e.g. improper cleaning, pretreatment, baking, stripping, etc.)?***

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**C. MACHINERY**:

1. Is **manufacturing equipment** adequate 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?*

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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?*

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1. Does equipment, requiring qualification or certification approval, have contractual approval for use?

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1. Identify the thickness measuring equipment available at this facility. Is all thickness testing equipment calibrated and within periodicity?

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1. Are standards, traceable to NIST, available to verify the accuracy of the thickness testing equipment?

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1. Is grit blasting equipment checked for sources of moisture, oil, or hydrocarbons? If so, how?

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1. Is spray equipment clean and well-maintained? Is there a written procedure for cleaning the spray gun, and is spray gun cleanliness checked prior to use? Describe the cleaning method used. (NAV27-BG/H)

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1. Is the air supply for the spray gun checked for moisture, oil, and hydrocarbons? How and how often? (NAV27-BF)

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1. Describe the type of oxidizing and curing ovens available. Is there a written procedure for calibrating the ovens? What are the methods and intervals used for oven calibrations, and what were the last calibration dates? Are ovens exhausted? What method is used for oven exhaust? (NAV27-A4A-D)

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

1. Does the supplier have procedures for cleaning, surface preparation, coating, and baking that cover all the processes that need to be performed, and are they readily available to personnel? (NAV27-A1A)

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1. Do the procedures include/correlate with the coating manufacturer’s Technical Data Sheet instructions and meet the applicable drawings, specifications, and/or contract requirements? Do procedures meet environmental laws? How does the supplier ensure compliance with local Environmental laws? (NAV27-A1B/C)

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1. Do the procedures include the inspection process with a system for the identification of processing and inspection status (e.g. individual operation sign-off/inspection stamping), sample size requirements, and record maintenance requirements?

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1. Are work instructions, test procedures, travelers, etc. adequate, clear, of the proper revision, readily available and in use by personnel?

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1. Is the product adequately identified on travelers/routers to provide clear material traceability throughout processing?

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1. Are the procedures/work instructions adequate for the control of proper equipment, materials, preparation of the basis material, pressure and flow settings for abrasive blasting, coating material preparation (proper mixing, filtering, and storage of coating materials in accordance with DuPont Fact Sheet), required drying times and temperatures for each coat of material, and baking temperatures and durations for each coat of material?

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1. **FOR BALL REPAIR ONLY:** Is there a procedure for cleaning balls in the as-received condition? Describe. (NAV27-A5A)

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1. **FOR BALL REPAIR ONLY:** Document the procedure used to determine acceptance for repair. Describe. (NAV27-A5B)

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1. **FOR BALL REPAIR ONLY:** Are inspections for dimensions, surface conditions, and generic material identity performed and properly documented on incoming balls for repair? (NAV27-A5C-F)

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1. **FOR BALL REPAIR ONLY:** Is welding repair performed? If so, list the procedure used. (NAV27-A5G)

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1. **FOR BALL REPAIR ONLY:** List the machining operations performed to clean up the ball after welding. List any cutting fluids used in the machining operations and describe the method used to obtain the 16 RHR (Roughness Height Reading) finish (prior to oxidizing). Are the cutting fluids/lubricants used a source of hydrocarbons? (NAV27-A5H/J)

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1. **FOR BALL REPAIR ONLY:** After machining or welding repair, are balls inspected for dimensions, surface finish, and porosity with the results properly documented? List any other inspections performed and documented after repair. (NAV27-A5K)

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1. Are solvents used to clean balls? List any solvents used. Are any solvents a source of hydrocarbons? Are balls inspected for residual oils/hydrocarbons after cleaning/drying? Describe the inspection method. (NAV27-A6A/B/E)

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1. Are balls dried prior to final cleaning? Are balls protected from contamination during drying? Describe the cleaning procedure and method of protection. (NAV27-A6C/D)

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1. Do the supplier’s procedures/work instructions specify a time between drying and oxidizing? Describe. (NAV27-A7A)

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1. Do the supplier’s procedures/work instructions specify a temperature for oxidizing and method to verify oxidation? Describe. Does this meet applicable requirements? (NAV27-A7B/C)

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1. Do the supplier’s procedures/work instructions specify the cooling method? Describe the cooling method. How are balls protected from contamination during cooling after the oxidation? (NAV27-A7D/E)

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1. For the final surface preparation prior to Teflon coating, list the time elapsed between oxidation and final surface preparation, the method used to obtain a 32 RHR finish after oxidizing, and the method used for grit blasting (type and size of media, pressure, and any other pertinent information). (NAV27-A8A-C)

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1. Does grit blasting remove the oxide coating? Is the grit blasting equipment checked for sources of moisture, oil, or hydrocarbons? (NAV27-A8D/E)

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1. Describe the method used to clean the balls after grit blasting and the method used to dry the balls after cleaning. List any solvents used for cleaning. (NAV27-A8F/G)

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| 1. Are the following inspections performed before/after cleaning and drying? List any other pertinent inspections. Are all the inspections properly documented? (NAV27-A8H-N)
 | **Before?** | **After?** | **Properly Documented?** |
| **Residual Oils/Hydrocarbons** |  |  |  |
| **Dimensions** |  |  |  |
| **Porosity** |  |  |  |
| **Surface Finish** |  |  |  |
| Other inspection: |  |  |  |
| Other inspection: |  |  |  |
| Other inspection: |  |  |  |

1. Are the balls properly handled and protected from contamination during the inspection process and prior to coating? Describe. (NAV27-A8O)

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1. What is the method used to transport balls to the spray area? What method is used to handle balls during transport? (NAV27-B2J/K)

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1. Is the primer coat material strained through a 100-mesh stainless steel screen prior to use (Ref. DuPont Technical Data Sheet)? (NAV27-A3D)

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| 1. Do the supplier’s procedures/work instructions for primer application specify the following: (NAV27-A9A-G)
 | **Record procedural value(s).** |
| Time limit between final surface preparation and application of the primer coat? |  |
| Number of primer coats required? |  |
| Thickness requirement for each coat? |  |
| Elapsed time limit between each coat? |  |
| Inspection for continuous and discontinuous coat? |  |
| Method of drying the primer coat prior to curing (time and temperature)? |  |
| Method used to protect material from contamination during drying. (Describe) |  |

1. Is the spray gun cleaned after primer coating? (NAV27-A9H)

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1. Are the balls protected from contamination during transport to the ovens? (NAV27-A10B)

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1. Record the elapsed time between spray coating and initiation of the final cure of the primer coat. (NAV27-A10A)

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1. Record the oven temperature settings for the primer final cure and the method used to determine when the primer is cured. (NAV27-A10C/D)

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1. Are the temperatures and times that the balls are in the oven recorded, and **is this information traceable to the balls processed?** (NAV27-A10E)

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1. What method is used to cool the balls after curing? (NAV27-A10F)

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1. Are the balls cleaned after curing and cooling? (NAV27-A10G)

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1. After cooling, are visual, thickness, and adhesion inspections performed and properly documented? List any other inspections performed. (NAV27-A10H/J)

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1. Are the balls protected from contamination while staging for final Teflon coating? Describe. (NAV27-10K)

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| 1. Do the supplier’s procedures/work instructions for final coating specify the following: (NAV27-A11A-G/12)
 | **Record procedural value(s).** |
| Time limit between primer application and application of the final coat? |  |
| Number of final coats required? |  |
| Thickness requirement for each coat? |  |
| Elapsed time limit between each coat? |  |
| Inspection for the final coat? |  |
| Method of drying the final coat prior to curing (time and temperature)? |  |
| Method used to protect material from contamination during drying. (Describe) |  |
| Elapsed time between spray coating and final curing? |  |

1. Is the spray gun cleaned after the final coating? (NAV27-A11H)

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1. Are the balls protected from contamination during transport to the ovens? (NAV27-A12B)

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1. Record the oven temperature settings for curing the final coat. Are the temperature and times in the oven documented properly and traceable to the balls processed? Describe the method used to determine when the coating is cured. (NAV27-12C-E)

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1. Describe the method used to cool the balls after curing. Are the balls cleaned after cooling? (NAV27-12F/G)

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1. Is the final coat inspected and properly documented for visual, thickness, and adhesion? Are any other pertinent inspections performed? (NAV27-12H/J/K)

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

1. Is the supplier’s Teflon coating spray area enclosed or isolated? Are adequate controls in place for temperature, humidity, and to protect from sources of contamination of the spray area? (NAV27-A2A/C/D)

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1. Is the area exhausted? How? Are the exhaust filters relatively clean to allow for positive air flow and overspray removal? Is there a schedule for filter changes, or how is the determination made to change the exhaust filters? (NAV27-A2B)

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1. Are adequate safety precautions established in the spray area (i.e. respirators, no smoking, no eating, washing of hands)? (NAV27-B2E)

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1. Describe how the coating material storage requirements are addressed. Is the storage area temperature controlled to preserve shelf lives? (NAV27-A3E)

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1. Are the areas where work is being performed uncluttered, clean, and free from dirt, debris, and airborne particulate?

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1. When humidity and temperature control is required, are the humidity and temperature measuring devices calibrated and within calibration periodicity?

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1. Is there adequate ventilation in the finishing area?

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1. Are respirators used when grit blasting?

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1. Are respirators, nitride rubber or neoprene gloves, and chemical goggles and/or face shields used when spray-coating or handling coating materials?

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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 at all possible the QAR should witness performance of the process to verify competency of supplier personnel.***

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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. Are all lot tests required by the coating specification being performed? Are adhesion tests performed in accordance with the specification requirements, using the correct sample size?

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1. Do test specimens, when used, meet the coating specification’s requirements (material, dimensions, etc.) for tests being performed?

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1. Are inspections properly documented with records traceable back to each individual who performed each inspection?

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| Additional PE Characteristics Examined: | # Observations |
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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** |  |

**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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