

**PORTSMOUTH NAVAL SHIPYARD**

500 KW CLASSIC SSMG  
COMMUTATOR REFURBISHMENT  
CONTRACT AND QUALITY CONTROL REQUIREMENTS

COVER SHEET

## COMMUTATOR REFURBISHMENT PROCEDURE "CLASSIC"

The commutator shall be rebuilt in accordance with the following instructions. All materials shall be as specified. Equivalent materials may not be used without written authorization from Portsmouth Naval Shipyard. The commutator manufacturer is responsible to provide certified records including signatures required by this instruction, that the commutator has been rebuilt in accordance with this instruction. The manufacturer shall provide a copy of all spec or data sheets for all materials used during the manufacture of the commutator with the final certification package for each commutator manufactured. Failure to meet any requirements shall be cause for rejection.

### NOTES:

1. NO SILICONE OR SILICONE CONTAINING PRODUCTS SHALL BE USED IN THE REFURBISHMENT OF THE COMMUTATOR.
  2. ALL METERS AND MEASURING INSTRUMENTS USED FOR CERTIFICATION OF DATA SHALL MEET THE REQUIREMENTS OF ISO-10012-1 "QUALITY ASSURANCE REQUIREMENTS FOR MEASURING EQUIPMENT" AND/OR ANSI-Z540-1 "GENERAL REQUIREMENTS FOR CALIBRATION LABORATORIES AND MEASURING AND TEST EQUIPMENT".
  3. INSPECTION OF THE COMMUTATOR COMPONENTS AND COMPLETED ASSEMBLY SHALL BE PER ISO 9001/ANSI Q9001. INSPECTION AT ORIGIN WILL BE ACCOMPLISHED FOLLOWED BY INSPECTION AND ACCEPTANCE AT DESTINATION.
- a) The commutator carcass will be provided to the contractor after being removed from its shaft. The commutator is for a General Electric 500KW DC generator, 210 - 355 volts, 1200 RPM. The following data is provided for informational purposes only.

Number of Segments - 152	Mica segment thickness- .040"
Wire Size - .050" x .300"	No of Wires per slot - 12
Diameter (brush surface) 19 1/2"	Dust Groove - 3/8"W
Length of active surface 10 3/8"	Bar length - 11 3/4"
Dia over front V-Ring - 18"	Dia over back V-Ring - 18"
Front V-Ring Proj. - 1 5/8"	Rear V-Ring Proj - 1 3/4"
Riser Type - Double Inserted	Dia. over risers - 29.75" (As Folded)
Commutator weight approx. - 718 LB	Keyway - none
Shaft (commutator mounting surface) Diameter:	
Riser end (8.999 - 9.000"); Front end (8.989"- 8.990")	
Commutator Bore Diameter: Riser end (8.996 - 8.997");	
Front end (8.986 - 8.987")	

- b) The commutator shall be completely stripped of all insulation material prior to replacing copper segments and insulation (including any varnish).
- c) All commutator copper shall be new. Replacement commutator bars shall be manufactured from copper bar stock in accordance with the Copper Development Book, silver bearing type UNS C11600 with 25-30 troy ounces of silver per ton. Copper bar hardness shall be at least 70 Rockwell F and have a tensile strength of not less than 30,000 PSI. Riser material shall be oxygen free silver bearing type UNS C10700 copper. Risers shall be brazed to the bars with BCuP-5 brazing rod per Fed Spec QQ-B-654 without the use of flux. The brazed joint shall have excess material removed as required to ensure that excess filler material does not interfere with the fit up of the completed assembly. Use Figure I as a reference for copper segment manufacturing. Dimensions to be per the detailed commutator data sheet. Use Figure VI for formation of copper riser.
- d) All the mica insulation shall be new. Segment insulation (between commutator bars) shall be inorganic bonded muscovite micapaper. The segment insulation shall be sub flush 1/16" to 3/32" on the brush riding surface. Commutator ground insulation and the V-ring insulation shall be pasted mica, type PMM, in accordance with NEMA FI-1. The thickness and the extent of all insulation shall be equal, as a minimum to the thickness and extent of insulation as found on the original commutator provided for rebuild. Each Mica V-ring and barrel shell insulator will be built in such a manner that it is one molded assembly consisting of built up layers that are scarfed or tapered to obtain uniform thickness when successive strips are lapped over in making the ring. V-rings consisting of two pieces with a joint at the apex of the V-ring are unacceptable. Use Figure V for dimensions for V-ring manufacturing.
- e) Commutator steel parts shall be inspected for damage. Any damaged or missing parts shall be repaired or replaced. The V-ring barrel if replaced shall be manufactured from seamless steel tubing per ASTM A-106. Manufacture new barrel using Figure II as a guide. Dimensions are to be as found on the original commutator data sheet. The V-ring clamp rings if replaced shall be manufactured from carbon steel per ASTM A668, AISI 4140. Manufacture new clamp rings using Figures III & IV as a guide. Dimensions are to be as found on the original commutator data sheet.

Note: Repairs to steel parts shall consist of minor straightening. A bushing or sleeve shall not be used to repair damaged or over sized seating surfaces.

<b>CLAMP RINGS AND BARREL INPECTED/REPLACED, MAT'L AS SPECIFIED:</b>
SIGNATURE/DATE

- f) V-ring studs shall be replaced with heat-treated and stress relieved alloy steel bar per AISI-4140. All nuts, washers and locking plates shall be replaced; the material for the nuts shall be at least SAE Grade 5 alloy steel. New locking tabs will be manufactured from 1/16" carbon steel plate IAW Figure VII. Note: the locking tabs will not be bent over by the commutator manufacturer. These will be bent at PNS after the commutator is mounted on a shaft and final torque has been applied. Dimensions are to be as found on the original commutator data sheet.

<b>ALL NUTS, STUDS AND LOCKTABS ARE NEW MAT'L AS SPECIFIED:</b>	
SIGNATURE/DATE	

- g) The inside and outside V-rings shall be banded with 3/8" wide B-staged glass banding. No Teflon will be used in this area. Glass band to extend from the face of the clamp ring to the face of the commutator bars. Glass banding shall conform to Mil-I-24178, such as Fibertek Inc. RES-I-GLASS B-0322-F, or equivalent. The bands shall be built up on the V-rings to a level that will completely seal any opening at the V-ring where grit or carbon dust could become lodged on the V-ring surface. NO STRING BANDING, GLASS WEAVE OR TEFLON TYPE BANDING SHALL BE USED.

<b>GLASS BANDING PER MIL-I-24178 APPLIED AS DESCRIBED ABOVE:</b>	
SIGNATURE/DATE	

- h) The commutator steel mating surfaces (inside diameter) shall have a final dimension of: Riser end (8.996 - 8.997"); Front end (8.986 - 8.987"). Record actual dimensions below.

<b>FINAL COMMUTATOR STEEL MATING SURFACE DIMENSIONS:</b>			
RISER END:	IN	FRONT END:	IN
SIGNATURE/DATE			

- i) The commutator shall be spin seasoned after assembly. The commutator shall be seasoned at 1500-1550 RPM, at a temperature of at least 200°C for at least three five minute cycles. The maximum change in total indicator runout shall be 0.002 in.

<b>COMMUTATOR SATISFACTORILY SPIN SEASONED:</b>	
SIGNATURE/DATE	

- j) The axial skew of the commutator bars shall be checked from the riser to the end of the commutator. Commutator bar axial skew shall not exceed 0.015-in. Excessive axial skew shall be corrected.

<b>AXIAL SKEW IS LESS THAN .015 IN:</b>	
SIGNATURE/DATE	

- k) The commutator shall successfully pass a 400 VAC bar to bar test between the commutator bars. If the commutator does not successfully pass this test, it shall be rebuilt.

<b>400 VAC BAR TO BAR TEST SAT:</b>
SIGNATURE/DATE

- l) Wrap several turns of bare copper wire securely around the commutator to short bars together and conduct a 3500 VAC Hi-Pot between the commutator bars and ground to ensure there are no grounds or shorts between the commutator and ground. If the commutator does not successfully pass this test, it shall be repaired as necessary.

<b>3500 VAC HI-POT SATISFACTORY:</b>
SIGNATURE/DATE

- m) Measure for one minute the insulation resistance to ground of all the commutator bars connected together. The minimum insulation resistance value shall be 10,000 megohms. Log below the actual megohms (data such as infinity or greater than 100 megohms is unsatisfactory. Greater than 10,000 is an acceptable reading) If the commutator does not successfully pass this test, it shall be repaired as necessary.

<b>ACTUAL MEGOHMS TO GROUND</b>	<b>MEGS</b>
SIGNATURE/DATE:	

- n) The commutator outside diameter shall be machined to be concentric with the inside diameter of the mounting sleeve within 0.003 inch TIR. The bar-to-bar runout shall not exceed 0.0003 inch bar-to-bar. Log actual change in TIR and change in bar-to-bar runout in the table below.

<b>Concentricity of the commutator surface with respect to the mounting sleeve and commutator bar-to-bar runout:</b>		
	Change in TIR	Change in Bar-to-bar
one inch from front		
middle		
one inch from riser		
Required: Concentricity less than 0.003-in. TIR, bar-to-bar runout less than 0.0003 in. TIR		
SIGNATURE/DATE		

- o) The commutator manufacturer shall stamp or etch mark the outside V-ring (steel portion) in a visible location with the abbreviated company name, two digit month and two digit year date code of when the commutator was rebuilt. Verify data below.

<b>Company Abbreviation/Two Digit Month/Two Digit Year</b>	
SIGNATURE/DATE	

- p) All exposed steel parts (with the exception of bore to shaft mounting surfaces) shall be coated with air dry varnish per MIL-I-24092 Grade CA (NON SILICONE) or baking varnish per MIL-I-24092 Grade CB (NON SILICONE). NO PIGMENTED OR COLORED VARNISHES AND RESINS ARE ALLOWED. Ensure that the commutator serial number remains visible.
- q) After completion of all of the above work, the commutator shall be balanced to 5 ounce-inches or less.

<b>FINAL BALANCE DATA:</b>	
Required: $\leq 5 \text{ OZ-IN}$	Actual:
SIGNATURE/DATE	

- r) The commutator manufacturer shall cover the commutator mounting surfaces with a non-silicone rust inhibitor such as Cosmoline or "Dolph Lamination Coater With Orange Tracer". The completed commutator shall be wrapped in plastic or other suitable packing material to keep dirt and grit from the finished unit. The commutator shall then be installed in a suitable wooden crate and braced as required to prevent movement and damage to the commutator during shipping. A copy of all certification data shall be provided in the shipping crate.

<b>COMMUTATOR PROPERLEY CRATED AND BRACED IN CRATE. ALL DATA REQUIRED IS IN CRATE:</b>
SIGNATURE/DATE