

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

RFB Posted: January 6, 2020
Questions Due: January 15, 2020 2:00 P.M. (MT)
Answers Posted: January 17, 2020 2:00 P.M. (MT)
Bid Due Date: January 24, 2020 2:00 P.M. (MT)

The South Dakota Science and Technology Authority (SDSTA) is requesting a bid for the disassembly, transport, refurbishment, reassembly, and commissioning associated with the major components of the Yates Cage Motor-Generator Set. This motor-generator set is located in the Yates Hoist Building near the Yates Shaft (630 East Summit Street Lead, SD 57754). The lowest price technically acceptable (LPTA) source selection process will be used for awarding this contract. Selection will be made based on the lowest evaluated price of bids meeting or exceeding the acceptability criteria detailed in Section 4. Fixed bid prices shall be submitted for all items indicated herein, except for unforeseen conditions of MG set components that would warrant the need for repairs.

Documents included in this Request for Bids include:

- A. This Request for Bid
- B. Terms and Conditions
- C. Megger Measurements
- D. Component and Shipping Skid Photos
- E. Task Sequence Diagram
- F. Available Bearing Drawings
- G. Bearings #168 – #169 External Photos
- H. Example Bearing Photos from Similar MG Set
- I. Oil Clearance Requirements
- J. Operating Condition Videos Link
- K. Pre-purchased Materials List

This RFB is organized as follows:

- Section 1.0 – Introduction
- Section 2.0 – SDSTA Requirements
- Section 3.0 – Scope of Work
- Section 4.0 – Bid Requirements
- Section 5.0 – General Requirements
- Section 6.0 – Bid Submission Requirements
- Section 7.0 – Reference Materials

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

1.0 Introduction

The Yates cage hoist is driven by twin 1,250 horsepower DC motors. Power for these motors is supplied by an original 1930's vintage motor-generator (MG) set, consisting of a 1,000 horsepower wound-rotor induction AC motor that drives two 1,000 kilowatt DC generators and a 48.25 ton flywheel. Infrastructure assessments performed in 2011 determined that most of the windings and a few of the commutators were in "poor" condition. Results of the component assessment can be seen in Table 1 below. To improve the overall condition of the Yates Cage MG set, the main components will be sent out for refurbishment during the first half of the year 2020. To assure good shaft alignment of the rotating assembly, the pedestal supported journal bearings along the common shaft will also be refurbished through this same contract.

The layout of the Yates Cage MG set can be seen in Figure 1 below with component numbers shown next to the major pieces.

Yates Cage Hoist MG Set Test Results					
Item		Gen 1 [#160]	Gen 2 [#162]	DC Exciter [#164]	AC Motor [#163]
Armature Windings (MΩ)	Result	0.1	0.3	76	1.6
	Min. Criteria	1.00	1.00	1.00	2.00
Field Windings (MΩ)	Result	0.31	0.17	>550	135
	Min. Criteria	1.00	1.00	1.00	1.00
Winding Condition		Poor	Poor	Good	Poor
Brush Clearance		Good	Good	Good	Good
Commutator Condition		Good	Good	Poor	Poor

Table 1: Infrastructure Assessment Report (ARUP, 2011)

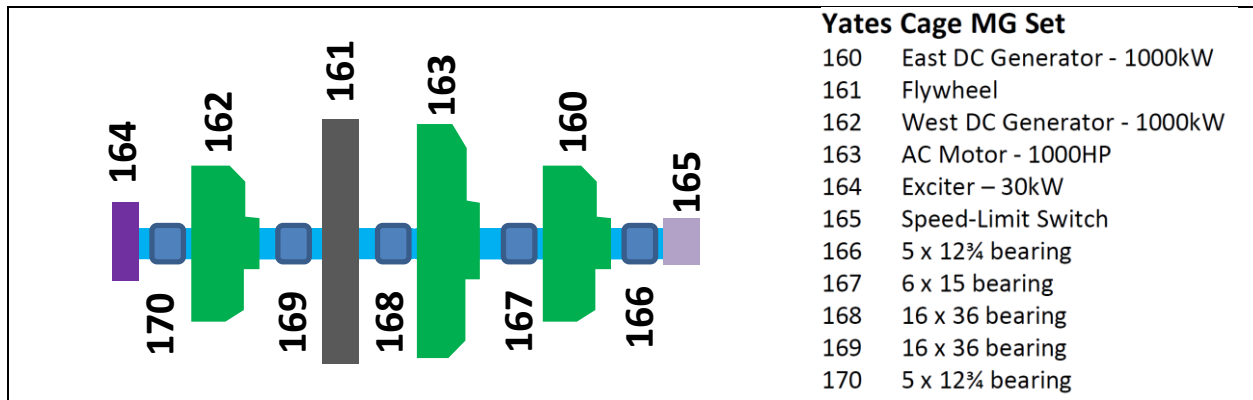


Figure 1: Yates Cage MG Set Component Layout and Identification

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

The overall approach for this project is:

- 1.1** After the MG set has been shut down, all components along the common shaft will be removed, with the exception of the Flywheel [#161] and the Speed-Limit Switch [#165].
- 1.2** All removed components will be transported to refurbishing/repairing facilities. Once there, they will be refurbished to like-new condition.
- 1.3** Refurbished components will be transported back to the Sanford Underground Research Facility. Once there, they will be reassembled along the common shaft.
- 1.4** After the entire refurbished MG set has been reassembled it will be aligned, tested, and commissioned.

The sequential breakdown of the above items has been detailed in Section 3.0.

2.0 SDSTA Conditions

MG Set Component Specifications

The original equipment design conditions are as follows:

- **DC Generator [#160] Specifications:** 1000 kW, 600 volts, 1666 amps, 712 rpm, Westinghouse Open-type Frame DD 513.7, Serial Number IS8P271
- **DC Generator [#162] Specifications:** 1000 kW, 600 volts, 1666 amps, 712 rpm, Westinghouse Open-type Frame DD 513.7, Serial Number IS8P270
- **AC Motor [#163] Specifications:** 1000 hp, 2200 volts, 233 amps, 60Hz, 3 Phase, 712 rpm, Westinghouse Open-type Frame 10-58-14, 40 Degree Celsius Rise, 617 rotor volts, 736 rotor amps, Westinghouse SO 8-P-272 Type CW, Serial Number 1S8P272
- **DC Exciter [#164] Specifications:** 30 kW, 250 volts, 120 amps, 708 rpm, Westinghouse ODP Frame 163 Type SK, 100% load @ 24hours with 40 Degree Celsius Rise, Style 8P273, Serial Number IS8P273

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

- **Bearing [#166] Specifications:** Yates Cage Hoist East Generator Outboard Bearing, 5" ID x 12-3/4" L hydrodynamic journal type bearing with oil slingers. This bearing has cast iron shells joined from two sections. The interior of the shells are lined with high grade Babbitt metal.
- **Bearing [#167] Specifications:** Yates Cage Hoist East Generator Inboard Bearing, 6" ID x 15" L hydrodynamic journal type bearing with oil slingers. This bearing has cast iron shells joined from two sections. The interior of the shells are lined with high grade Babbitt metal.
- **Bearing [#168] Specifications:** Yates Cage Hoist Flywheel East Bearing, 16" ID x 36" L hydrodynamic journal type bearing with oil slingers. Hydrostatic lift is provided during initial rotation by filtered lube pumps. This bearing has cast iron shells joined from two sections. The interior of the shells are lined with high grade Babbitt metal.
- **Bearing [#169] Specifications:** Yates Cage Hoist Flywheel West Bearing, 16" ID x 36" L hydrodynamic journal type bearing with oil slingers. Hydrostatic lift is provided during initial rotation by filtered lube pumps. This bearing has cast iron shells joined from two sections. The interior of the shells are lined with high grade Babbitt metal.
- **Bearing [#170] Specifications:** Yates Cage Hoist West Generator Outboard Bearing, 5" ID x 12-3/4" L hydrodynamic journal type bearing with oil slingers. This bearing has cast iron shells joined from two sections. The interior of the shells are lined with high grade Babbitt metal.

Onsite Equipment and Personnel

The following onsite equipment and personnel are available to assist in the removal and transport of MG set components between the contractor's trucks and the MG set room:

- **Overhead Cranes:** The MG set room in the Yates Hoist Building contains a 25 ton overhead crane that can be used to hoist equipment towards the perimeter of the room. The hoist room in the Yate Hoist Building contains a 30 ton overhead crane that can be used to hoist equipment towards the large entry doors. A trained SDSTA operator will be available to control the cranes.
- **Forklift:** A Lull fork lift rated at 10,000 lbs. and a trained SDSTA operator will be available to load and unload components.
- **Custom Built Shipping Skids:** During refurbishment of the Yates Production Hoist MG set, SDSTA fabricated custom metal & wood skids (some with casters) to assist in transporting the exciter, armatures of the DC generators, rotor of the AC motor, and motor stators. These skids will be available to assist in transport;

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

however, they may require slight modifications to match the differences in dimensions between the Production Hoist MG set components and the Cage Hoist MG set components. See Section 7.3 for more details.

- **Qualified Electrical Worker:** A SDSTA qualified electrical worker, who is knowledgeable in the construction and operation of the MG set, will be available to assist the Contractor/Subcontractors in de-energizing and re-energizing the MG set.

Present Operating Conditions

- An internet link to recent video recordings of the Yates Cage MG set while it is operating has been provided in the reference noted in Section 7.10.
- The Offeror may choose to perform an in-person walkthrough at his or her own expense prior to submitting a bid.
- The MG set is housed in a heated building, which is cooled by using exhaust fans and by opening windows.
- Variable frequency drives are not used with this MG set.

Pre-purchased Materials

- In the year 2016, SDSTA purchased materials that were intended to be used for refurbishing this MG set. These materials have since been stored with minimal movement in climate-controlled buildings. They are presently stored in the Yates Hoist Building. SDSTA intends for the contractor/subcontractors to utilize these materials in this refurbishment project. Bid pricing shall account for the contractor/subcontractors transporting the materials to their refurbishing facilities and for not having to purchase these materials. A detailed list of these materials has been provided in the reference noted in Section 7.11.

Disassembly

- The generators must be disassembled to be transported. They have opened framed enclosures that are split into two halves. The upper half must be removed to gain access to the armature, which then must be removed so that the lower frame half can be removed.
- The motor and exciter frames do not require splitting prior to shipment; however, the rotor/armature must be separated from the stator prior to shipment.

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

3.0 Scope of Work

- 3.1** Attend onsite project kickoff meeting. All personnel working onsite must first attend SURF orientation safety training (approx. 30 minutes).
- 3.2** With the MG set shut down and the flywheel no longer rotating, remove the DC Exciter [#164], load it onto the transporting truck, and make ready to transport for refurbishment.
- 3.3** Remove the DC Generator [#162] from MG set, load it onto the transporting truck along with the DC Exciter [#164], and make ready to transport for refurbishment.
- 3.4** Remove Bearings [#168], [#169], and [#170] from the MG set and make ready to transport for refurbishment.
- 3.5** In place of Bearings [#168] and [#169], install previously refurbished spare bearings that SDSTA has in storage.
- 3.6** In place of DC Generator [#162], install a previously refurbished spare DC Generator that SDSTA has in storage.
- 3.7** Transport the DC Exciter [#164] and the DC Generator [#162] to the refurbishing facility.
- 3.8** Transport Bearings [#168], [#169], and [#170] to the refurbishing facility.
- 3.9** Refurbish the DC Exciter [#164] to like-new condition.
- 3.10** Refurbish the DC Generator [#162] to like-new condition.
- 3.11** Refurbish Bearings [#168], [#169], and [#170] to like-new condition.

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

- 3.12** Transport the DC Exciter [#164] and the DC Generator [#162] to the Sanford Underground Research Facility.
- 3.13** Transport Bearings [#168], [#169], and [#170] to the Sanford Underground Research Facility.
- 3.14** Offload the DC Exciter [#164] from the transporting truck and install it at its original location along the MG set.
- 3.15** Offload the DC Generator [#162] from the transporting truck and place it in temporary storage near the hoist room.
- 3.16** Install Bearing [#170] at its original location along the common shaft of the MG set. Place Bearings [#168] and [#169] in SDSTA's long-term storage as new spares.
- 3.17** Remove the AC Motor [#163] from the MG set, load it onto the transporting truck, and make ready to transport for refurbishment.
- 3.18** Remove Bearings [#166] and [#167] from the MG set and make ready to transport for refurbishment.
- 3.19** Transport the AC Motor [#163] to the refurbishing facility.
- 3.20** Transport Bearings [#166] and [#167] to the refurbishing facility.
- 3.21** Refurbish the AC Motor [#163] to like-new condition.
- 3.22** Refurbish Bearings [#166] and [#167] to like-new condition.
- 3.23** Transport the AC Motor [#163] to the Sanford Underground Research Facility.

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

- 3.24 Transport Bearings [#166] and [#167] to the Sanford Underground Research Facility.
- 3.25 Offload the AC Motor [#163] from the transporting truck and install it at its original location along the MG set.
- 3.26 Install Bearings [#166] and [#167] at their original locations along the common shaft of the MG set.
- 3.27 Remove the DC Generator [#160] from the MG set, load it onto the transporting truck, and make ready to transport for refurbishment.
- 3.28 In place of DC Generator [#160], install the newly refurbished DC Generator [#162] being stored in temporary storage near the hoist room.
- 3.29 Perform final alignment, wiring, startup, and testing of the rebuilt MG set.
- 3.30 Transport the DC Generator [#160] to the refurbishing facility.
- 3.31 Refurbish the DC Generator [#160] to like-new condition.
- 3.32 Transport the DC Generator [#160] to the Sanford Underground Research Facility.
- 3.33 Offload the DC Generator [#160] to SDSTA's long-term storage for use as a new spare.
- 3.34 Attend onsite project closeout meeting
- 3.35 **Transfer Records:** All records (project reports, warranty information, meeting notes, data files, project data, original tracings, maps, field sketches, lab reports, test data, etc.) generated shall be the property of SDSTA and shall be turned over to SDSTA upon completion of the contract or as

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

directed. All deliverables shall be required to be delivered to SDSTA in hardcopy and electronic (original software and PDF) format.

4.0 Bid Requirements, Acceptability Criteria, and Pricing Breakdown

Bid Requirements

Your bid should be provided in digital format as a pdf file with standard letter size format. Please note there is a 30-page limit for your response to bid requirements. Bids must contain the following:

- 4.1 Provide the contact information, including an email address, for the Offeror's designated contact person who can receive and distribute RFB information.
- 4.2 Provide the contractual relationship, name, and a brief description of the role of each subcontracting organization that would be involved in the performance of this project. Note that the named subcontractors and outside associates or consultants must be used, and any change must be approved by the SDSTA.
- 4.3 Note exceptions to the draft contract or other RFB materials.
- 4.4 Disclose any existing relationships and previous work with SDSTA/Sanford Lab.
- 4.5 Provide demonstrated evidence of meeting the acceptability criteria (subsections 4.5.1 through 4.5.4) for this contract.

Acceptability Criteria: SDSTA will award a contract resulting from this solicitation to the responsible offeror whose bid package conforms to the bid requirements and is determined to be the lowest priced among those bids rated "technically acceptable." For purposes of determining whether a bid is "technically acceptable," the following criteria for acceptability shall apply:

4.5.1 **Evaluation Criterion #1**

Offeror shall have an effective worker safety and health program established for all work performed under this contract at the Sanford Underground Research Facility (SURF).

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

Evaluation Factors:

- Provide a description of the safety programs of contractors and subcontractors who would be performing work at SURF under this contract.
- Provide safety records for the past three years (incident/injury records, OSHA300 logs and EMR data) of contractors and subcontractors who would be performing work at SURF under this contract.

4.5.2 Evaluation Criterion #2

Offeror shall have an effective quality assurance (QA) & quality control (QC) program established for all services offered under this contract.

Evaluation Factors:

- Provide a description of the QA & QC programs of contractors and subcontractors who would be performing work under this contract. QA/QC manuals will not count towards the 30-page limit.

4.5.3 Evaluation Criterion #3

Offeror shall have experience refurbishing motors, generators, and journal bearings of similar size, construction, and vintage as those detailed in Section 1, Section 2, and Section 7.

Evaluation Factors:

- Describe at least one example of a 50+ year old wound-rotor induction AC motor that the Contractor/Subcontractor has refurbished within the past 10 years. The power rating(s) of the motor example(s) should be as close as possible to 1,000 horsepower. Example(s) should note the customer, the location, and the date of the project(s). Example(s) should also detail the extent of the refurbishment (inspecting, testing, reconditioning, rewinding, repairing, etc.), the motor specifications, and the results.
- Describe at least one example of a 50+ year old DC Generator that the Contractor/Subcontractor has refurbished within the past 10 years. The power rating(s) of the generator example(s) shall be as close as possible to 1,000 kilowatts. Example(s) should note the customer, the location, and the date of the project(s). Example(s) should also detail the extent of the refurbishment (inspecting, testing, reconditioning, rewinding, repairing, etc.), the generator specifications, and results.

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

- Describe at least one example of a Babbitt lined journal bearing that the contractor/subcontractor has refurbished within the past 10 years. The dimension(s) of the bearing example(s) should be as close as possible to 5"ID x 12-3/4"L, 6"ID x 15"L, or 16"ID x 36"L. Example(s) should note the customer, the location, and the date of the project(s). Example(s) should also detail the extent of the refurbishment (inspecting, testing, rebabbiting, milling, repairing, etc.) and the results.

4.5.4 **Evaluation Criterion #4**

Offeror shall have experience disassembling and reassembling motor-generator sets and performing post-assembly alignments, tests, and commissioning.

Evaluation Factors:

- Provide at least one example of a MG set that the contractor/subcontractor has disassembled, reassembled, aligned, tested, and commissioned in the past 10 years. The example(s) should give an overview of the project and note the customer, the location, the date of the project, the MG set component power ratings, the tests performed, and the commissioning results.

Each criterion will be rated using the following scoring method:

Acceptable	<i>Meets criteria for acceptability/evaluation required under the technical provisions. Weaknesses are correctable.</i>
Marginal	<i>Fails to meet criteria for acceptability/evaluation. Any significant deficiencies are correctable. Lacks essential information to define a bid package.</i>
Unacceptable	<i>Fails to meet a criterion for acceptability or an acceptable evaluation standard and the deficiency is uncorrectable. Bid package would have to undergo a major revision to become acceptable. Demonstrated lack of understanding of SDSTA's requirements or omissions of major areas.</i>

- 4.6** Provide a bid sheet with the pricing breakdown detailed below. The Offeror may submit a marked up copy of Section 4.6. Alternatively, the Offeror may submit a custom bid sheet, so long as the same line items are used as shown in the breakdown below.

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

Pricing Breakdown: Prices shall be broken down based on grouped scope of work (SoW) items from Section 3. These groups include disassembling, transporting, refurbishing, reassembling, and commissioning the MG set. Pricing shall be based on meeting an overall project duration of 113 workdays (M-F), with the MG set being down for 64 of those workdays. All lump-sum prices listed below shall account for all materials, labor, tools, equipment, lodging, per diem, overhead, and all contractor/subcontractor expenses directly related to planning and executing the refurbishment of the MG set.

Disassembling (SoW items 3.1, 3.2, 3.3, 3.4, 3.16, 3.17, 3.26)

Lump Sum Price for Disassembling \$ _____

Transporting (SoW items 3.7, 3.8, 3.11, 3.12, 3.18, 3.19, 3.22, 3.23, 3.29, 3.31)

Lump Sum Price for Transporting \$ _____

Refurbishing (SoW items 3.9, 3.10, 3.20, 3.21, 3.30)

Lump-sum pricing for refurbishing each exciter, generator, and motor shall be broken out in the four tables below based on two tasks, reconditioning and rewinding. If initial tests have determined that rewinding is needed, the fee for rewinding would be paid in addition to the reconditioning fee. If repairs are needed prior to rewinding and/or reconditioning, the repair service fees shall be based on parts and hourly shop & machine shop labor rates. Labor rates for repairs have been broken out as additional bid line items in the tables below.

The bid prices shall account for the contractor/subcontractors not having to purchase the pre-purchased materials noted in Section 2 and detailed in the Section 7.11 reference.

<u>DC GENERATOR [#160]</u>	
Lump-sum Recondition	\$ _____
Lump-sum Rewind Armature	\$ _____
Lump-sum Rewind Fields & Interpoles	\$ _____
Shop Labor Rate for Repairs	\$ _____ /hr
Machine Shop Labor Rate for Repairs	\$ _____ /hr

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

<u>DC GENERATOR [#162]</u>	
Lump-sum Recondition	\$
Lump-sum Rewind Armature	\$
Lump-sum Rewind Fields & Interpoles	\$
Shop Labor Rate for Repairs	\$ /hr
Machine Shop Labor Rate for Repairs	\$ /hr

<u>AC MOTOR [#163]</u>	
Lump-sum Recondition	\$
Lump-sum Rewind Rotor	\$
Lump-sum Rewind Stator	\$
Shop Labor Rate for Repairs	\$ /hr
Machine Shop Labor Rate for Repairs	\$ /hr

<u>DC EXCITER [#164]</u>	
Lump-sum Recondition	\$
Lump-sum Rewind Armature	\$
Lump-sum Rewind Fields & Interpoles	\$
Shop Labor Rate for Repairs	\$ /hr
Machine Shop Labor Rate for Repairs	\$ /hr

Lumped sum pricing for refurbishing the journal bearings shall be broken out in the table below. In the event that initial inspections have determined repairs are needed prior to reconditioning, these repair services shall be based on parts and hourly labor rates. Labor rates for repairs have been broken out as additional bid line items.

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

Bearing [#166] Lump-sum Recondition	\$
Bearing [#167] Lump-sum Recondition	\$
Bearing [#168] Lump-sum Recondition	\$
Bearing [#169] Lump-sum Recondition	\$
Bearing [#170] Lump-sum Recondition	\$
Shop Labor Rate for Repairs	\$ /hr
Machine Shop Labor Rate for Repairs	\$ /hr

Reassembling (SoW items 3.5, 3.6, 3.13, 3.14, 3.15, 3.24, 3.25, 3.27, 3.32, 3.33, 3.34)

Lump Sum Price for Reassembling \$ _____

Commissioning (SoW item 3.28)

Lump Sum Price for Commissioning \$ _____

5.0 General Requirements

- 5.1** To be eligible for contract award, the contractor and subcontractors performing work within the state of South Dakota must be registered as business entities with the South Dakota Secretary of State.
- 5.2** **Bearing Reconditioning**
The steps detailed in Subsections 5.2.1 through 5.2.8 shall be performed at a minimum as part of reconditioning the bearings.
- 5.2.1** **Initial Shop Inspections and Tests**
An initial inspection shall be made to take dimensional measurements and assess the general condition of the bearing shell exterior and oil slinger rings for defects, cracks, and broken welds.
- 5.2.2** **Melt and Remove Old Babbitt**
Old babbitt shall be removed from the shell using industry standard methods and temperature limits.
- 5.2.3** **Inspect Shell Interior**
An inspection shall be made to assess the general condition of the bearing shell interior for defects, cracks, and broken welds.

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

5.2.4 **Repair (if needed)**

Repairs are not included as part of the reconditioning service; however, this subsection serves as a placeholder to show between which reconditioning steps repairs would likely occur. Refer to Section 5.5 for the general requirements that apply to repairs.

5.2.5 **Apply New Babbitt**

- Prepare bearing surfaces by cleaning with stainless steel brushes, grit blasting, and solvents to remove oils and contaminant residues. Mild heat may be used to draw oils from the cast iron.
- Apply flux and commercial pure tin to the interfacing surface to obtain a high-quality bond between the Babbitt and the shell.
- The new Babbitt metal is to be applied using the centrifugal casting method while industry standard levels of heating & cooling are applied to the shell and the Babbitt.
- The new Babbitt metal is to consist of newly refined ASTM B-23, Grade 2 alloy.

5.2.6 **Machine Work**

Machine bore newly poured bearings to like-new dimensions. Machine & drill oil reliefs, oil ports, and oil slinger grooves.

5.2.7 **Final Shop Inspections and Tests**

Record all finished dimensions for future service. The refurbished bearings shall be tested using the following tests:

- Ultrasonic inspection (UT): Each bearing shall be ultrasonically inspected to ensure optimum bonding of the Babbitt to the base metal.
- Penetrant inspection (PT): All bond lines shall be inspected against separation by utilizing a dye penetrant.

5.2.8 **Prepare for Transport**

The shells shall receive a final cleaning and protective coating prior to transport. Reference Section 5.10 for the general requirements to transporting the bearings.

5.3 **Motor/Exciter/Generator Reconditioning**

The steps detailed in Subsections 5.3.1 through 5.3.15 shall be performed at a minimum as part of reconditioning the motor, exciter, and generators.

5.3.1 **Initial Shop Inspections and Tests**

A visual inspection shall be made to assess and record the as-received

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

condition of the component for cracks, broken welds, and missing parts. Insulation shall be examined for evidence of degradation or damage, such as: puffiness, cracking, discoloration, contamination, abrasion, corona discharges, loose supports, loose banding, and fretting at supports. Damage that might escalate under test may need to be corrected first to avoid destroying windings.

The initial shop tests shall include as a minimum:

- Winding resistance/reluctance measurement
- Insulation Resistance Test (a.k.a. Megger) armatures, windings, and brush holders
- Winding Surge Test
- Polarization Index (P.I.) Test

5.3.2 **Basic Dismantling**

If required, clean the external surfaces of the equipment to avoid contaminating internal parts during disassembly. Disassembly should be done methodically. While dismantling, record the condition of all parts and take dimensions necessary for reassembly. Each part should be marked so that it can be placed in the correct location upon re-assembly.

5.3.3 **Cleaning and Drying**

All windings and parts shall be cleaned and dried. Dirt, grit, grease, oil, and cleaning agent residue shall be removed.

5.3.4 **Post-cleaning Inspections and Tests**

The intent of the tests shall be to detect failures within the component, if any, and to determine if rewindings and/or repairs are needed.

The post-cleaning tests shall include as a minimum:

- Insulation Resistance Test (a.k.a. Megger) armatures, windings, and brush holders
- Winding Surge Test
- Polarization Index (P.I.) Test
- AC and DC High-Potential Test at 65% of the maximum test level (reference ANSI/EASA AR100 Table 4-1 and Table 4-2) **only after previous post-cleaning tests have successfully passed**

5.3.5 **Repair (if needed)**

Repairs are not included as part of the reconditioning service; however, this subsection serves as a placeholder to show between which reconditioning steps repairs would likely occur. Refer to Section 5.5 for the general requirements that apply to repairs.

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

5.3.6 **Rewind (if needed)**

Rewindings are not included as part of the reconditioning service; however, this subsection serves as a placeholder to show between which reconditioning steps the rewindings would likely occur. Refer to Section 5.4 for the general requirements that apply to rewindings.

5.3.7 **RTDs**

Install a standard quantity of new RTDs in field/stator windings and wire them to new terminal strips.

5.3.8 **Varnish Windings**

If needed, apply a fresh coat of insulation to windings using the dip & bake, trickle varnishing, or vacuum pressure impregnation (VPI) methods as best suited for the windings' construction and operating voltages. Preheat windings to remove internal moisture and to improve bonding of varnish to coils. New windings varnished using the dip and bake method shall require a double dip, with the windings allowed to cool and cure after first dip, to ensure varnish fully covers the windings.

5.3.9 **Turn & Undercut Commutator – Armature**

The commutator shall be turned and skimmed to maintain good concentricity with the shaft. The insulation between the commutator's segments shall be undercut. Both services will reduce arcing, vibration, and excessive wear of the carbon brushes.

5.3.10 **Turn Slip Rings**

Slip rings shall be turned and skimmed to maintain good concentricity with the shaft. The surface finish should be within manufacturer tolerances. If manufacturer tolerances are unavailable, the surface finish should be between 40 and 60 micro-inches. Slip rings should have sufficient stock to ensure proper brush performance.

5.3.11 **Balance Armature and Rotor**

To ensure straightness of the shaft, measure & record the shaft runout and compare against standard maximum tolerances. Dynamically balance the armature/rotor to NEMA MG 1 standard tolerances and record initial & final balancing results.

5.3.12 **Replace Carbon Brushes and Brush Springs**

Replace all carbon brushes and brush springs with replacements manufactured by Helwig Carbon Products. Brushholders should be clean and free of any debris, oil, or dirt. Movable brushholder parts should be free working. The brush fit in the brushholder box should be inspected for excessive clearance. Brush stud insulation should be free of cracks and should not be charred or have missing components. In the DC

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

machines, check brush rigging to ensure brushes are set for brush neutral.

5.3.13 Prime and Paint

All parts shall be primed and painted to match OEM specs and industry standards for comparable equipment. Anti-corona paint shall be applied in and beyond the slot portion of coils in motors and generators which originally had anti-corona paint.

5.3.14 Final Shop Inspection and Tests

A visual inspection shall be made to assess and record the as-refurbished condition of the component for comparison against the as-received condition.

The final shop tests shall include as a minimum:

- Insulation Resistance Test (a.k.a. Megger) armatures, windings, and brush holders
- Winding Surge Test
- Polarization Index (P.I.) Test
- AC and DC High-Potential Test at 65% of the maximum test level (reference ANSI/EASA AR100 Table 4-1 and Table 4-2) **only after previous final shop tests have successfully passed**

5.3.15 Prepare for Transport

Reference Section 5.9

5.4 Rewinding

If initial tests and inspections have determined that rewinding is needed, the Offeror shall develop a brief report of the findings with this recommendation. The Offeror shall not proceed any further in refurbishing this MG set component until written approval by SDSTA has been received.

The steps detailed in Subsections 5.4.1 through 5.4.6 shall be performed at a minimum as part of rewinding the motor, exciter, and generators.

5.4.1 Record Existing Winding Data

A visual inspection shall be made to assess and record the existing winding data (# of slots, # of coil turns, pitch and size of wire needed, special configurations, etc.). The rewind material specification shall meet or exceed the existing windings with regard to the number and size of conductors and insulating capabilities (electrical and thermal). Duplication of the original winding characteristics is crucial to maintaining the machine's performance, reliability, and energy efficiency.

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

5.4.2 **Remove Old Windings**

Use industry standard methods (e.g. burnout) to remove the old windings. Old windings shall be removed in a manner which prevents warping, cracking, or the deterioration of the core laminations or its magnetic qualities. Media blast leftover varnish, insulation, and contaminants from cores using soft media (e.g. walnut shell or dry ice) to avoid damaging coil laminations.

5.4.3 **Test Cores**

Cores shall undergo an interlaminar insulation test before and after winding removal to ensure that the cores were not damaged during the removal process. Results shall be recorded and any increase in losses or hot spots should be investigated. Damaged laminations should be repaired or replaced. Insulate and laminate cleaned cores as needed.

5.4.4 **Install Windings**

Install new windings while replacing loose or damaged wedges, slot sticks, and coil supports as needed. Apply banding, lacing, and fasteners as needed to prevent movement.

5.4.5 **Renew Leads**

Install new leads with insulated wire that meets or exceeds the machine's rated current, temperature class, and voltage. Labels conforming to original manufacturer markings or NEMA MG 1 standard shall be affixed to each lead.

5.4.6 **Test Windings and Leads**

New windings and leads shall be tested (continuity checked) to ensure that the phases/polarities and connections are correct. Electrical tests shall also be performed to ensure that the insulation was undamaged during installation.

The rewinding tests shall include as a minimum:

- Insulation Resistance Test (a.k.a. Megger) armatures, windings, and brush holders
- Winding Surge Test
- Polarization Index (P.I.) Test
- AC and DC High-Potential Test with a one-time high-potential test at 100% of the maximum test level (reference ANSI/EASA AR100 Table 4-1 and Table 4-2) **only after previous rewinding tests have successfully passed**

5.5 **Repairing**

If initial tests and inspections have determined that repairs are needed, the Offeror shall develop a brief report of the findings with an explanation of the

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

recommended repairs. The report shall also provide a quote for labor and materials to perform the repairs. The Offeror shall not proceed any further in refurbishing or repairing this MG set component without written approval by SDSTA.

5.6 **Commissioning**

After the machines are assembled, the following tests shall be performed as part of the commissioning service:

5.6.1 Winding resistance/reluctance measurements

5.6.2 Insulation Resistance Test (a.k.a. Megger) armatures, windings, and brush holders

5.6.3 Winding Surge Test

5.6.4 Polarization Index (P.I.) Test

5.6.5 **AC and DC High-Potential Test**

After equipment is assembled and tests 5.6.1 through 5.6.4 have passed, the windings shall be tested with a one-time high-potential test at 80% of the maximum test level. All subsequent high-potential tests of the windings shall not exceed 65% of the maximum test level. (Reference ANSI/EASA AR100 Table 4-1 and Table 4-2)

5.6.6 Commutator surfacing and brush tensioning & alignment.

5.6.7 Bearing and shaft measurements to ensure proper clearances and alignments.

5.6.8 Verification that the motor operates at magnetic center with no axial thrust on bearings or shaft ends.

5.6.9 Thermal measurements of electrical connections, field & armature windings, and bearing/shaft surfaces, before and after the recommended break-in period.

5.6.10 Vibration measurements to ensure assembly is operating within standard limits and to establish a new baseline. Horizontal, vertical, and axial vibration readings shall be measured and recorded for each MG set component.

5.7 **Applicable Standards and Practices**

In addition to the manufacturer's instructions, the standards and practices listed below shall be followed for refurbishing and commissioning this MG

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

set and shall be a component of the Contractor/Subcontractors' QA/QC programs. If different standards or practices would be followed during this project, the Offeror shall note the followed standards and practices as part of the evidence for meeting the acceptability criteria given in response to subsections 4.5.2, 4.5.3, and 4.5.4.

- **ANSI/EASA AR100-2015** – Recommended Practice for the Repair of Rotating Electrical Apparatus
- **ANSI/NEMA MG 1-2016** – Standard for Motors and Generators
- **DOD-STD-2183** – Bond Testing, Babbitt-Lined Bearings
 - The Chalmers and chisel tests are not required.
 - Alternative standard: **ISO 4386-1:2019** – Non-destructive ultrasonic testing of bond of thickness greater than or equal to 0.5mm
- **DOD-STD-2188** – Babbitting of Bearing Shells (Metric)
- **DOE/BP-2748** – Electric Motor, Model Repair Specifications
 - Available at <https://www.osti.gov/servlets/purl/233344>
- **EASA Sleeve Bearing Repair Tips**, EASA Convention 2007
- **EASA Technical Manual-2019**
- **EPRI 1009698** – Shipping and Storage of Electric Motors
- **ISO 4386-3:2018** – Non-destructive penetrant testing
- **Westinghouse IB 5411** – Motor-Generator Instruction Book
 - Electronic copy available upon request

5.8 The Contractor/Subcontractors shall abide by all applicable federal, state, and local laws and ordinances, as amended from time to time. Including but not limited to, the applicable local laws and ordinances.

5.9 All repair work and parts supplied shall be guaranteed for a minimum of one year from the date the MG set is returned to service against defects in materials or workmanship supplied by the Contractors and Subcontractors. Any warranted failures shall be corrected at no cost to the SDSTA including transportation to and from SURF. This warranty is not required to cover against defects in the pre-purchased materials (detailed in Section 7.11) provided by SDSTA.

5.10 The Contractor/Subcontractors shall be responsible for transporting the MG set components and shall ensure the components are properly prepared for shipment. All MG set components shall be covered, secured, and protected from water, dust, and damage during transit.

5.11 The Contractor/Subcontractor shall supply all timbers, blocking and tie downs necessary to properly secure components during transit. SDSTA has prebuilt shipping skids, noted in Section 7.3, that may be used by the Contractor/Subcontractor during this project.

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

- 5.12** The contractor/subcontractors shall be responsible for the proper handling of all waste resulting from this project's tasks.
- 5.13** The SDSTA may at its sole and absolute discretion reject any and all, or parts of any and all submissions; re-advertise this solicitation; postpone or cancel at any time this solicitation process; or waive any irregularities in this solicitation or in the submittals received as a result of this solicitation.
- 5.14** All expenses involved with the preparation and submission of materials to the SDSTA, or any work performed in connection therewith, shall be borne by the Offeror(s). No payment will be made for any responses received, nor any other effort required of or made by the Offeror(s) prior to commencement of work as defined by a contract approved by SDSTA.
- 5.15** The bid package materials will be evaluated by the Selection Committee appointed by the SDSTA. The Selection Committee will recommend an Offeror by consensus based on the Selection Criteria described in this RFB.
- 5.16** The SDSTA reserves the right to enter contract negotiations with the selected Offeror. If the SDSTA and the Offeror do not agree to terms of a Contract, the SDSTA may elect to terminate negotiations and begin negotiating with other vendors. This process will continue until a contract has been executed, or, all submittals have been rejected. No Offeror shall have any claims and/or rights against the SDSTA arising from such negotiation and/or the qualification process.
- 5.17** The SDSTA reserves the right to contract for all or part of the work program described in this RFB.
- 5.18** Offeror(s) submitting bid materials should not submit any information in response to this solicitation which the Offeror(s) considers to be a trade secret or confidential. The submission of any information in connection with this solicitation shall be deemed conclusively to be a waiver of any trade secret or other protection, which would otherwise be available to the Offeror. In the event that the Offeror submits information in violation for this restriction, either inadvertently or intentionally and clearly identifies that information in the submission as protected or confidential, the SDSTA will endeavor to redact and return that information to the Offeror. The Selection Committee will then evaluate the balance of the submission. The redaction or return of information pursuant to this clause may render a submission nonresponsive.

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

5.19 Bid security: Bids over \$50,000 must be accompanied by a bid security as follows:

- Bid Bond: A bid bond of ten percent (10%) of the total amount of the bid including all add alternatives, shall be furnished by the Contractor. A form of Bid Bond is included with the bid documents.
- Certified Check or Cashier's Check: In lieu of a Bid Bond, a certified check or cashier's check for five percent (5%) of the amount of the bid, including all add alternates, may be furnished. Such check shall be certified or issued by either a state or national bank and payable to the South Dakota Science and Technology Authority.
- Payment and Performance Bond: Upon award of contract, Contractor shall provide a Payment and Performance Bond produced by a South Dakota licensed insurance producer (agent) and issued by a South Dakota licensed surety in an amount not less than the amount of the awarded contract. The Payment and Performance Bond surety or sureties shall meet all requirements of South Dakota law. This bond is to secure the faithful performance of the contract and the payment of those to whom the offeror may become legally indebted for labor, materials, tools, equipment, or services of any kind used or employed by the offeror in performing the work. The surety bond shall be on a form similar to the form of Payment and Performance Bond in the time state shall be cause for consideration by the Owner of awarding the contract to another responsible and responsive offeror, and retention of the bid deposit.
- Power of Attorney: Attorneys-in-fact who sign bid bonds or contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.

6.0 Bid Submission Requirements

The contractor shall submit an electronic copy (.pdf format) of the bid no later than **2:00 P.M. Mountain Time on January 24, 2020**, to: mbaumann@sanfordlab.org. Late submissions will not be accepted.

Please submit all questions to mbaumann@sanfordlab.org no later than **2:00 P.M. Mountain Time on January 15, 2020**

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

The bid period may be extended at the discretion of SDSTA based on the quantity and/or complexity of questions. Any notices of extension of time to respond will be distributed to all prospective offeror by SDSTA.

7.0 Reference Materials

- 7.1 *Megger Measurements.pdf* – This document shows the results of resistance testing performed in 2011 on the Yates Cage MG set components. Results of the megger measurements are summarized in Table 1 of this RFB.
- 7.2 *Exciter [164].pdf, AC Motor [163].pdf, DC Generator [160].pdf, DC Generator [162].pdf* – These documents contain pictures of the main MG set components taken in Fall 2019.
- 7.3 *Shipping Skid Photos.pdf* – This document shows pictures of metal and wood skids used to transport the Yates Production Hoist MG Set components for refurbishment.
- 7.4 *Yates Hoist MG Set Room Picture 1938.pdf* – This document shows a picture of the Yates Hoist MG Set room when it was first commissioned. The Yates Production Hoist MG Set is in the foreground. The Yates Cage Hoist MG Set is in the background.
- 7.5 *Yates Cage MG Refurb Task Sequence.pdf* – This document shows a preliminary and high-level view of the sequence of tasks for this project. The current sequence anticipates that four round-trips will be needed to haul MG set components from SURF to the contractor's shop and back after being refurbished. Since a spare DC generator is on-hand, the final alignment, re-wiring, and startup can commence before all the existing components have been refurbished.
- 7.6 *DWG Bearing 168_169.pdf, DWG Oil Slinger 168_169.pdf* – These documents are the available bearing and oil slinger drawings. These drawings are for bearing numbers 168 and 169.
- 7.7 *Bearings [166-170] Yates Cage MG Set.pdf* – This document contains pictures taken in Fall 2019 of the bearings along the common shaft of the Yates Cage MG Set. These photos show the external parts of the bearing housings.
- 7.8 *Example Bearing Photos from Production Hoist MG Set.pdf* – This document contains pictures taken when bearings on the Yates Production Hoist MG Set were being disassembled and refurbished in 2014. The bearings on the Yates Cage Hoist MG Set are very similar to

SDSTA Yates Cage Motor-Generator Set Refurbishment RFB

the bearings on the Yates Production Hoist MG Set.

- 7.9** *Oil Clearance Requirements.pdf* – This document shows the minimum and maximum clearances permitted between the journal and sleeve of the bearing.
- 7.10** *Operating Condition Videos Link.pdf* – A series of videos were recorded in December 2019 of this MG set in its operating condition. These video can be accessed by clicking on the hyperlink in this document, which should then open the user’s web browser and load the Microsoft OneDrive directory where these videos are being stored. The user may play the videos in the web browser or download to his/her computer first.
- 7.11** *Pre-purchased Materials List.pdf* – This document lists the pre-purchased materials for refurbishing the motor, generators, and exciter on this project.