PART III
STATEMENT OF WORK

PART 1 - GENERAL REQUIREMENTS

1.01 The Requirement

a. General. - The Contractor shall design, fabricate, furnish, install and test, one complete class “F” stator winding for unit 1 at Headgate Rock Powerplant and shall install and test two Government-furnished class “F” stator windings in units 2 and 3 at Headgate Rock Powerplant, in accordance with the requirements of these specifications. Also, the Contractor shall clean, repair if needed, re-torque, treat stator slots, and paint the existing stator core iron for all three generators. The contractor shall furnish all manufacturing, materials, equipment, machinery, tools, supplies, labor, supervision, transportation, and perform all work necessary to complete the job. The materials shall include, but not be limited to, individual stator coils, coil supports, slot packing materials (including wedges), epoxies, paint, brazing equipment and resistance temperature detectors.

The existing generators will be disassembled and reassembled by the Government; however, the Contractor shall remove the existing winding from the stator slots. The Contractor shall be responsible for appropriate disposal of the old stator windings and materials. The existing winding does not contain asbestos.

1.02 General Description And Operating Conditions of Powerplant

a. General. - Headgate Rock Dam was completed in 1941. It was constructed to raise the water level of the Colorado River to provide permanent gravity-flow diversion facilities for irrigation of Indian land on the Arizona side of the reservoir. Headgate Rock Powerplant was built in 1992 immediately downstream of spillway gates numbers 8, 9, and 10. The powerplant is of the outdoor-surface type and is located at an elevation of approximately 330 feet.

The existing generators have a nameplate rating of 7,222 kilovolt amperes, at 4,160 volts, 0.9 power factor, and 60 hertz.

The generators were manufactured by Villares inc. of Brazil and installed by Voith Hydro in 1992.

In October of 1998, Headgate Rock Powerplant was flooded to the top of the generator housings after a failure of a flange in the area of the bulb turbine. The generators were under water for several weeks. Attempts to dry out the windings in these units proved unsuccessful. The Government has on site two spare armature windings and enough installation materials (tapes, wedges and slot filler materials but no epoxies or varnishes) for installing one winding.

1.03 Submittal Requirements

The Contractor shall make timely submittals to the Government in accordance with this paragraph, Table 1.03-1 (List of Submittals), and all other requirements in the provisions of FAR (Federal Acquisitions Regulations) clauses, and paragraphs of these specifications.

The word "submittals" shall be interpreted to include drawings, data, manuals, certifications, test reports, curves, samples, brochures, and other items furnished by the Contractor for approval, information, or other purposes.

The time required for review of each submittal or resubmittal furnished under an RSN for approval will not begin until the Government receives complete sets of all the submittal materials required for that particular RSN, if necessary for informational continuity. The number of calendar days required for review of drawings or data submitted or resubmitted for approval will include the date the drawings or data are received by the Government, and will extend through the date of return mailing to the Contractor. Except as otherwise provided in these specifications, the Government will require 40 calendar days for review of each submittal or resubmittal furnished by the Contractor for approval. This review time will apply to each separate submittal or resubmittal whether the submittals are approved, not approved, or otherwise returned for revision.

If the Government uses time in excess of the specified number of calendar days for review of any submittal or resubmittal, additional time, not to exceed the excess time, will be added to the time allowed the Contractor for delivery of the materials or equipment affected by such excess time, to the extent it is demonstrated that the excess time caused delay. If the Government's review of two or more separate submittals or resubmittals is late and results in concurrent days of excess time, such days will be counted only once in computing an extension of the delivery date. Further, if the Contractor fails to make complete approval submittals in the sequence and within the time periods specified in this specifications, and thus precludes the Government from approving or considering for approval such submittals within the specified calendar day period, then the Contractor shall not be entitled to an extension of time allowed for delivery of the materials or completion of work.

One set of the submittals required for approval will be returned to the Contractor either approved, not approved, or approved with comments, and will be marked to indicate changes if required. Submittals which are not approved or which require changes or revisions, shall be revised and resubmitted for approval, and shall show changes and revisions with revision date. All requirements specified for the initial submittal shall apply to any resubmittals required. All submittals which are to be resubmitted shall be resubmitted by the Contractor within 40 calendar days after the Contractor has received the Government's review comments.

Table 1.03-1 (List of Submittals) lists the submittals required by these specifications except those submittals which are required conditionally, required by entities other than the Federal Government, or which are periodic in nature. Any submittal required to be submitted by the Contractor, which is not listed in the table, shall be submitted in accordance with the applicable requirements elsewhere in these specifications. In case of a conflict between the requirements of this paragraph and the requirements included elsewhere in these

specifications, the requirements elsewhere shall take precedence over the requirements contained in this paragraph.

Each item in table 1.03-1 (List of Submittals) has been assigned an RSN (Required Submittal Number). The "Submittals required" column of the table specifies the material to be submitted for each RSN. All of the submittal items specified for an RSN will be considered a complete set.

Where the submittals required for an RSN are specified as separate or distinguishable parts, a complete set shall include all parts. Only complete sets shall be submitted whenever possible. As an option, the Contractor may submit materials required for more than one RSN with the same submittal cover letter, provided that they are required by the same responsible code.

The Contractor's submittal cover letter shall include:

1. Reference to the Government contract/specifications number.

2. Identification of responsible code for each RSN as listed in Table 1.03-1 (List of Submittals).

3. Complete list of RSN(s) for which material is being submitted.

4. List of materials being submitted for each RSN.

5. Identification of the submittal as an original submittal or resubmittal.

The number of complete sets to be submitted, and the location to which they are to be sent, shall be in accordance with the "No. of sets to be sent to:" column of the table, except as provided below for sets of original material.

When an RSN involves submittal of original (non-copied) material, all original material, or as much thereof as is necessary to form a complete set, shall be included in just one complete set. This "originals" set shall be sent to the proper address as determined by the "Responsible code" column of the table and the following:

1. CO indicates Contracting Officer.

2. RE indicates Regional Engineer.

3. TSC indicates Denver Office

The "originals" set shall be counted as one of the complete sets required to be submitted under the "No. of sets to be sent to:" column of the table.

Each drawing submitted by the Contractor shall have the Contractor's or supplier's title and drawing number on it. The drawings and data shall be labeled with the Government's contract/specifications numbers and the bidding schedule item number.

Manufacturer's data for commercial products or equipment, such as catalog cut sheets, shall be clearly marked to indicate the item(s) to be furnished. The data shall be sufficiently comprehensive to identify the manufacturer's name, product or equipment type, model, size, and characteristics. They shall completely demonstrate that the product or equipment meets the requirements of these specifications. Submittals requiring certification by registered professionals shall be signed and sealed.

The Contractor shall send the submittals to the applicable addresses listed below as required by table 1.03-1 (List of Submittals).

The Contractor shall also send a copy of the transmittal letter to each of the addresses listed below that are not receiving the complete submittal for a specific RSN.

Submittals shall be sent as required by table 1.03-1 (List of Submittals) to:

1. Contracting Officer, Attention: LC-3113, Bureau of Reclamation, P.O. Box 61470, Boulder City NV 89006-1470

2. Regional Engineer, Attention: LC-6000, Bureau of Reclamation, P.O. Box 61470, Boulder City NV 89006-1470

3. Denver Office, mail to: Bureau of Reclamation, Attention D-8160, PO Box 25007, Denver, Colorado 80225-0007

Table 1.03-1 - List of submittals

RSN	Item	Reference provision, clause, or paragraph	Respon-sible code	Submittal items	No. of sets to be sent to:*			Due date or delivery time
					C0	RE	TSC	
C1	Hazardous Material	1.04.c.	CE	Material Safety Data Sheets	1	2	0	Prior to bring materials onsite
C2	Safety Program	WBR 1452.223-81	CE	Safety Program	0	1	0	Prior to beginning work onsite
C3	Warranty	52.246-	CO	Warranty of Complex Items	1	1	1	Prior to final payment
C4	Liability Insurance	1452-228-70	CO	Acceptable evidence showing the insurance has been obtained	1	0	0	Prior to commencement of work onsite
C5	EFT Information	52.	CO	ACH Form	1	0	0	At least 14 days prior to submission of 1st invoice
C6	Release of Claims	1452-204-70	CO	Release of Claims	1	0	0	After completion of work and prior to final invoice
E1	Armature Winding	1.04.c. and 3.02.c.	D-8430	Approval Drawings and Data (1) Plan and Section Views (2) Installation Procedures (3) Winding Diagrams (4) Insulation System (5)Samples (6) Field Test Procedures	0	1	4	45 days after notice to proceed is received
E2	Armature Winding	1.04.e and 3.02.c.	D-8430	Final Drawings and Data	0	1	4	When armature winding is ready for shipment
E3	Armature Winding	1.04.f., 3.02.c. and 4.02.c.	D-8430	Test Reports (1) Factory	0	1	4	2 weeks after factory tests completed
E4	Armature Winding	1.04.f.,3.02.c. and 4.03.c.	D-8430	Test Reports (1) Field Installation	0	1	4	2 weeks after field installation tests completed

RSN	Item	Reference provision, clause, or paragraph	Respon-sible code	Submittal items	No. of sets to be sent to:*			Due date or delivery time
					C0	RE	TSC	
E5	Armature Winding	1.04.f. and 3.02.c.	D-8430	Test Reports (1) Field Acceptance (including calibration certificates)	0	1	4	Within three months after field tests completed
E6	Armature Winding	1.04.d and 3.02.c.	D-8430	Design Data	0	1	4	45 days after notice to proceed is received
E7	Armature Winding	1.04.g. and 3.02.c.	D-8430	O + M Instruction Manuals	0	0	6	When armature winding for Unit 1 is ready for shipment
E8	Wedges and Slot Fillers	1.04.c. and 3.03.c.	D-8430	Approval Drawings and Data (1) Plan and Section Views (2)Samples				45 days after notice to proceed is received
E9	RTDs (Resistance Temperature Detectors)	1.04.c. and 3.04.c.	D-8430	Approval Drawings and Data (1) Plan and Section Views	0	1	4	45 days after notice to proceed is received
E10	RTDs (Resistance Temperature Detectors)	1.04.c. and 3.04.c.	D-8430	Test Reports (1) Factory	0	1	4	2 weeks after factory tests completed
E11	Generator Inspection after Operation (first)	4.04	D-8430	Inspection Report	0	1	4	30 days after inspection
E12	Generator Inspection after Operation (second)	4.04	D-8430	Inspection Report	0	1	4	30 days after inspection
E13	Generator Inspection after Operation (third)	4.04	D-8430	Inspection Report	0	1	4	30 days after inspection

*RE indicates Regional Engineer, Boulder City NV, CO indicates Contracting Officer, Boulder City NV, and TSC indicates Technical Service Center, Denver. For mailing addresses, see subparagraph entitled "Addresses" of paragraph entitled "Submittal Requirements."

1.04 Drawings and Data to Be Furnished by the Contractor

a. General. - All drawings and data shall be in accordance with this paragraph; paragraph 1.03 (Submittal Requirements); and the applicable equipment and/or materials paragraph. All drawings and data shall be written in English, shall be made expressly for this contract (typical drawings will not be acceptable), shall be complete and accurate in their content, and shall be legible. Freehand sketches will not be accepted. Where feasible, all outline assembly and detail drawings shall be made to scale. When a scale is used to make a drawing, it shall be an engineer's or architect's scale with its graduations conforming to the United States of America foot and inch system. The scale used shall be indicated on the drawings.

The Government reserves the right to require the Contractor to make any changes in the equipment design and drawings which may be necessary to make the equipment and drawings conform to the requirements of these specifications, without additional cost to the Government.

When revised drawings are resubmitted, the changes from the previous submittal shall be clearly identified on the drawings. The submittal letters shall describe the reasons for significant changes.

After the approval drawings and data have been submitted and returned approved, with or without comments, the Contractor shall make no further changes to the design without the approval of the Contracting Officer. All of the approval drawings shall be submitted promptly. The time required for return of the approval drawings will start with the date of receipt of the last required approval drawings and data.

b. References:

ANSI C50.10 - 1990 - General Requirements for Synchronous Machines
ANSI Y14.1 - 1987 - Drawing Sheet Size and Format

c. Approval drawings and data. - Within 45 calendar days after date of receipt of notice to proceed with the contract and before beginning with factory fabrication, the Contractor shall submit to the Government for approval, five sets of all drawings and data listed below.

1. Stator coil design including sectional views of stator coils in slots with all dimensions, showing stranding, turn and ground insulation, wedges, fillers, springs, and resistance temperature detectors. Also, a view shall be submitted showing overall dimensions and angles of the coil and defining if the coils are left or right front when viewed from inside the stator bore. A drawing shall also show the coil support ring locations, tie down procedures, coil end separators, and tie and lock procedures.

2. Transposition drawing showing the location and method of insulating the transposition of the stands in the coil, development of strand cross-over, start and finish numbering system of the strand ends, connecting strands coil-to-coil, and insulation of connections.

3. Winding diagram, including an insert showing the parallel paths in each phase and showing views or notes clearly defining a slot numbering system, a method of determining the slot number in which each coil side is located, and if the coil side is in the top or bottom position. The position of slot No. 1 within the machine shall also be defined.

In addition, the Contractor shall furnish a tabulation listing each slot, and identifying each phase in the top and bottom position.

4. Plan and sectional views of parallel rings and connections between coils and parallel rings, and between parallel rings and main and neutral leads.

5. Description of the insulation and corona suppression system including a list of materials.

6. Material safety data sheets.

7. Shipping list of materials furnished.

8. Drawing showing plan and sectional views of the resistance temperature detectors.

9. Slot location of resistance temperature detectors and confirmation that resistance temperature detectors are located in slots that have the same phase in top and bottom portions of the slot. The Contractor shall also furnish a tabulation listing the slot number and corresponding phase in the slot and location from the neutral or line end of the parallel.

10. Wedge and slot filler assembly details.

11. The contractor shall submit a sample of the 3-conductor cable to be used for the resistance temperature detectors, and a 6-inch sample of the wedge and filler materials to be used.

12. A step-by-step description of the insulation system (materials and application) and a 6-inch sample taken from the slot portion of a completed coil which has an identical taping system to that proposed for these specifications.

Data shall include:

(a) Description and thickness of insulation system for strand, turn, and ground wall.

(b) Net mica thickness and volts/mil stress on turn and ground insulation.

(c) Copper cross-sectional area of strands and circuit rings.

(d) Evidence that the insulation system is class F, as defined in ANSI C50.10.

13. A step-by-step description of the removal and installation procedure. The description shall be in narrative form and shall include drawings or sketches, photographs, a list of materials, descriptive literature of resins and tapes, a list and description of tools unique to armature rewind work, and any other information necessary to clarify the description. The description should state specific installation characteristics that will prevent any and all slot materials from moving in the slots or working loose in the future, and describe a method of periodically checking the winding after installation to ensure that it remains securely installed. The description of the installation procedures shall include the following:

(a) Description of coils.

(b) Preparation of stator core to receive the new winding.

(c) Method of checking and adjusting stator core tightness and levelness including clamping bolt tension or torque value.

(d) Adjustment and insulation of surge rings.

(e) Installation of bus rings.

(f) Installation of stator coils, including method of connecting series, pole, and lead connection, and method of insulating the connections.

(g) Description and amount of side packing in slots.

(h) Method of installing spring-type wedge filler and method of measurement of tightness of coils in slots and of amount of spring-type filler compression.

(i) Method of installing and of measurement of tightness of wedges.

(j) Using a 6-inch-long by 1/2-inch-wide woven copper strap or other approved method, define the range of ohmic values that confirms an appropriate ground contact is achieved over the entire slot portion of the coil side.

14. Detailed field test procedures.

15. Calculations, including formulae, for determining the maximum forces on each coil side in the slots for same phase and for different phase coil sides.

16. A complete list of spare parts that the Contractor considers to be shelf-life limited or that require a specific storage environment.

If revised drawings are submitted for approval, the changes from the previous submittals shall be clearly identified on the drawings, with every revision made during the life of the contract shown by number, date, and subject in a revision block, and a notation shall be in the drawing margin to permit rapid location of the revision. The drawings shall be clear and legible in all respects.

The Contracting Officer shall have the right to require the Contractor to make any changes in the equipment design which may be necessary, in the opinion of the Contracting Officer, to make the equipment conform to the requirements of these specifications, without additional cost to the Government.

Approval by the Contracting Officer of the Contractor's drawings shall not be held to relieve the Contractor of any part of his responsibility to meet all of the requirements of these specifications or for the correctness of his drawings. Any manufacturing done or shipment made before approval of the drawings will be at the Contractor's risk.

Drawings shall be ANSI size D (22 inches in height, 34 inches in width).

A narrative index list shall be furnished by the Contractor indicating Contractor's drawing number and drawing title. The narrative index list shall be identified by solicitation/specifications numbers and project.

d. - Design data. - After design of the generator armature winding has been completed, but in any event within 45 calendar days after receipt of notice to proceed with the contract, the Contractor shall furnish five copies of the following calculated data regarding the generator with the new armature windings:

1. Losses for rated voltage, power factor and kilovolt ampere output, and 60 hertz, segregated as follows:

   (a) Armature I2R at both 75°C and 95°C.

2. Deviation factor of waveform.

3. Maximum value of no-load, balanced, telephone-interference factor.

4. Maximum value of no-load, residual, telephone-interference factor.

5. Maximum temperature rise in degrees Celsius above 45°C ambient, at rated volts, power factor, and kilovolt amperes for the:

   (a) Armature winding by embedded detector.

6. Field current required for operation at

   (a) Rated volts, rated power factor, and rated kilovolt amperes.

   (b) Rated volts, unity power factor, and rated kilovolt amperes.

7. The method of calculating and the value of test voltage to be used for the dielectric test for multi-turn coils, a wiring diagram of the test circuit, and a description of the test procedure.

8. Total capacitance of one phase of the armature winding to ground.

9. Calculations including formula for determining the maximum forces on each coil side in the slots for same-phase and for different-phase coil sides.

10. Nominal dielectric stress in volts per mil of the stator winding insulation.

e. - Final drawings. - When the armature winding coils are ready for shipment, the Contractor shall furnish one complete set of final drawings and computer files on 3.5-inch floppy disk or CD-ROM. All revisions shall be indicated in dated and signed or initialed revision blocks.

f. - Factory and installation test reports. - Within 2 weeks after completion of those tests required at the factory on the armature winding, resistance temperature detectors, and the spring filler materials, and those tests required on the armature windings during installation, the Contractor shall furnish five certified copies of all test reports, data, etc.

At least 2 weeks prior to start of the field tests, the Contractor shall furnish five copies of calibration certificates on all test instruments.

Within 3 months after completion of field tests, the Contractor shall furnish five certified copies of reports of the results of the field tests and shall furnish five copies of curves showing the characteristics of the machines as determined by the tests. Five copies of certificates on all test instruments calibrated after the field tests shall also be furnished.

g. - Operation and maintenance instruction manuals. - Each set of this material shall be assembled into one or more books with an enclosing cover.

The operation and maintenance instruction book(s) shall include:

1. An index sheet at the front of each book which provides page or index tab number information for each device or item of equipment in the book.

2. Manufacturer's operation and maintenance procedures; installation details, maintenance requirements.

3 Copies of all drawings (in the form of half-size prints) and bills of material, both revised to reflect approval comments.

h. - Contractor's representative. - After receipt of the approval drawings and data, and/or upon written request of the Contracting Officer, the Contractor shall, at the Contractor's own expense, send a responsible engineering representative from the Contractor's design office to the Regional Office in Boulder City Nevada, to review the drawings and the installation procedure with the Government's engineers for conformance with the requirements and intent of these specifications. The Contractor's representative shall be fully informed of the intent of the Contractor with respect to manufacture and installation and shall follow progress in the design office, the shop, and at the site. The Contracting Officer will notify the Contractor at least 10 calendar days in advance of the date set for review with the Contractor's representative.

The intent of the foregoing requirements is to avoid delay in completion of the contract which might be caused by a misunderstanding of the requirements of these specifications and especially the installation procedure.

i. Payment. - Payment for furnishing all drawings and data shall be made at the lump-sum price bid therefore in the schedule and shall include the following:

1. Performing all designs.

2. Furnishing drawings, data, and test reports.

3. Coordinating and cooperating with other Government contractors.

4. Participating in conference(s) with the Government.

1.05 Submission of Material Safety Data Sheets for Hazardous Materials

After award of contract, the Contractor shall submit updated List of Hazardous Materials (LHM) and Material Safety Data Sheets (MSDS) in accordance with the requirements of Paragraph (e) of the clause in FAR 52.223-3, "Hazardous Materials Identification and Safety Data."

The Contractor shall submit the updated LHM and completed MSDS and identification and certification for each material to the Regional Engineer. Copies of the LHM and completed MSDS shall be submitted to the Safety Program Manager, Bureau of Reclamation, P.O. Box 61470, Boulder City, NV 89006-1470 . The Contractor shall not deliver any hazardous material to the jobsite which was not included on the original LHM prior to acceptance of the Contractor's MSDS by the Regional Engineer.

The cost of complying with this paragraph shall be included in the applicable prices bid in the schedule for the items of work for which the hazardous materials are required

PART 2 - MATERIALS AND WORKMANSHIP

2.01 Materials and Workmanship

Unless otherwise stated in these specifications, materials used in the manufacture of the equipment shall be new and of the highest standard commercial quality as normally used for this type of equipment, and free of defects, considering strength, ductility, durability, best engineering practice, and the purpose for which the equipment is to be used.

Liberal factors of safety, which will assure durability and reasonably to be expected life for all new components, shall be used throughout the design and especially in the design of all parts subject to cyclic stress or shock. For all new parts of the equipment, the maximum stress in the materials shall not exceed one-third of the yield strength nor one-fourth of the ultimate tensile strength when subjected to maximum normal operating conditions (including load rejection or short circuit at the machine terminals).

2.02 Work and Materials to Be Furnished by the Government

a. The Government will provide, without cost to the Contractor, the following labor, materials, and storage, and perform the following work:

1. Disassemble the generator, including removing the generator rotor and shaft, and such other parts required to make the stator readily accessible to the Contractor.

2. Reassemble the generator after installation, dry out, and dielectric test of the new armature winding by the Contractor.

3. Furnish the cranes and crane operator as necessary when moving materials into and out of the powerplant.

The Government-operated cranes will be available for the Contractor's use based on the following backcharge. If a conflict exists, the Government will determine the necessary priorities. The crane and operator will cost the Contractor $40.00 per hour (including standby) when there is notification of the need more than 48 hours prior to use. If notification is less than 48 hours, the rate will be $60.00 per hour. Any labor, including rigging and rigger, other than the crane operator, required to handle the equipment, materials, or supplies, shall be furnished by the Contractor.

4. Furnish alternating-current electrical energy at 480 volts, 60 amperes, three-phase as required by the Contractor in connection with installation of the armature windings and field testing of the generators. The Contractor shall supply all equipment for connecting to this power supply.

5. Furnish alternating-current electrical energy at 120 volts, 15 amperes, single-phase as required by the Contractor for lighting and power tools.

6. Provide the use of the hydraulic turbine and such facilities as the Government has available for preliminary operation of the generator and for making field acceptance tests on the generator.

7. Furnish the required instruments and conduct direct-current absorption tests.

8. Furnish water. - Water can be furnished from service outlets. The Contractor shall furnish and install, at the Contractor's own expense, any additional pipelines, connections, and appurtenances required by the Contractor for the Contractor's own use or convenience in performing the work. The Contractor shall remove all such additional pipelines, connections, and appurtenances upon completion of the work. No waste of Government-furnished water will be permitted.

9. In the event storage is required for any generator materials prior to their installation, such storage shall be at the risk of and at the expense of the Contractor. The Government will, however, cooperate in providing without charge to the Contractor such inside or outside temporary project storage space as might be available for such purpose. Inside storage space is available at Parker Dam warehouse 15 miles from Headgate Rock.

10. The following listed materials are available for use by the Contractor in rewinding the generators at Headgate Rock Powerplant. These materials were shipped with the spare windings furnished by Villares and are for use in installing the Government-furnished windings. The number of available components is as noted on the shipping manifests for the spare parts. The Government does not guarantee that the numbers stated are correct. The Contractor shall inspect all spare parts shipping boxes and confirm the number, type, and condition of available materials.

Quantity	Description
1084	Spare Coils (See drawing 45-301-7210)
4378	Retainer (Spring Type)
4378	Wedge (Stationary)
4378	Wedge (Drive)
4368	Conductive Filler (Bottom, Middle, Top)
3460	Filler (Center)
2227	Filler (Side)
2260	Shim (Top)
2260	Filler (Top)
990	Felt Blocks
7600 meters	mica tape
1700 meters	glass tape
17.5 square meters	felt

2.03 Work and Materials to Be Furnished by the Contractor

a. Except as otherwise provided in the previous paragraphs, the Contractor shall furnish all labor, materials, equipment, instruments, and tools required in connection with the

manufacture, installation, and testing of the generator armature winding. The Contractor shall also furnish all labor for removal of the existing armature windings from the jobsite, including cleanup and transportation. Labor for testing shall include all labor except that furnished by the Government in conjunction with the acceptance tests. Accordingly, labor for testing shall include all major wiring connections involving the generator terminals, generator bus structure, disconnect switches, and all wiring changes involved in the main field and excitation circuit.

1. The contractor shall be responsible for all transportation and housing costs and subsistence expenses of its personnel.

2. The Contractor shall bear all costs of loading, transporting, unloading and handling all required materials from the Contractor's shipping point or points to the point of storage at the powerhouse. The Contractor shall also bear all costs of transporting test instruments and equipment to and from the jobsite.

3. The Contractor shall be responsible for all materials requiring special storage conditions, including controlling temperature, humidity, dust, or any other atmospheric conditions that are not a normal condition at the powerplant. The Contractor shall advise the Government of all materials which have a limited shelf life and which the Contractor recommends to be shipped immediately prior to installation. All hazardous materials shall be plainly identified as such on the container along with a label stating the contents, handling, and first-aid treatment. The Contractor shall also provide a storage cabinet or other suitable facilities for storing flammable or toxic materials.

4. Furnish scaffolding and work platforms as required.

5. Furnish fire protection for work area.

6. Furnish personnel safety equipment, hard hats, safety glasses, hearing protection, respirators, first aid supplies, etc.

7. Dryout of the stator winding, if necessary, will be accomplished by the Contractor.

8. Furnish wire ropes and slings for removal and installation of new stator windings as necessary.

9. Provide local (in the immediate work areas) approved flammable liquid storage cabinets to be used for the storage of solvents, resins, and other flammable liquids.

10. Conduct a safety inspection after each final shift for fire hazards, unnecessary energized equipment, and materials, boxes, etc. which may block access.

11. Each shift shall check in and out of the control room upon arrival/departure to/from the project.

12. No exhaust emissions will be allowed inside the powerhouse, which may be generated by gas or diesel driven generator sets.

13. The Contractor shall provide an On-Site Technical Supervisor who shall provide technical direction to the installation crews. This shall include but not be limited to training of special procedures which may be required to install the winding, inspection of the work to ensure that the drawings and installation procedures are being followed and quality assurance of the work, progress reports, general planning and layout of the work performance evaluation of the installation crews, and training of necessary safety procedures. The On-Site Technical Supervisor shall be present at the site at all times when work is in progress or must be available within four hours of the Government's request. The Government shall have the right to require the Contractor to replace any On-Site Technical Supervisor who fails to comply with Contract Document requirements.

14. The Contractor will be paid under the provisions of FAR clause 52.232-11 entitled "Extras," for any repairs the Contractor performs on the stator core iron or other generator components which are ordered by the Contracting Officer and which are not required because of an act of the Contractor.

PART 3 - REPLACEMENT GENERATOR ARMATURE WINDING

3.01 Type and Rating

a. General. - A new generator armature winding shall be furnished and installed by the Contractor for replacing the winding in existing generator unit No. 1. The Contractor shall install Government-furnished windings for units No. 2 and 3, including furnishing all materials not furnished by the Government. The existing generator is rated 7,222 kilovolt amperes at 4,160 volts, 0.9 power factor, 3-phase, 60 hertz. The generator is of the horizontal-shaft, water-wheel-driven, alternating-current, synchronous type, conforming to the requirements of ANSI and IEEE in regard to rating, characteristics, and tests at the time of purchase in the early 1990s. An approximation of a generator armature slot cross-section is shown on drawing no. 6 (45-301-7210, Generator Coil and Slot Cross Section).

After installation, the new generator armature shall conform to the latest American National Standards, except as may be otherwise specified. The new armature winding when operating at an elevation of 333 feet shall be rated in accordance with subparagraph b. below.

b. Rating:

Kilovolt amperes	7,222
Power factor	0.90
Frequency	60 hertz
Number of phases	3
Voltage between phases, volts	4,160
Speed, r/min	75
Armature winding	Wye connected, suitable for either grounded or ungrounded neutral operation

c. Generator data. - Information concerning the existing stator and the armature winding slots is approximately as indicated on the drawings. The Government assumes no responsibility for the uniformity of the existing stator or for the accuracy of the dimensions given. The Government, upon request, will make a generator available for inspection by any offeror, provided sufficient notice is given. Also, any offeror will be permitted to inspect operating data, test data, generator drawings, and any other material which the Government has available at the jobsite. Inspection schedules shall be coordinated with the Facility Manager of Parker Dam; telephone 760-663-0233. Inspection times are 6:30 AM to 5:00 PM Monday through Thursday.

d. The maximum temperature rise of the new stator winding shall not exceed 80°C when the generator is delivering rated load and with cooling air entering the generator at not more than 45°C. The temperature of the armature winding shall be determined by means of embedded resistance-type temperature detectors located in the armature winding. The temperature of the cooling air entering the generator shall be the ambient air temperature determined as outlined in subparagraph 4.03 (Field Tests).

The field current requirement at rated load shall not be greater than that required for the existing winding.

3.02 New Armature Winding for Unit No. 1 and Spare Coils

a. General - The new armature winding to be furnished under this contract for unit No. 1 shall be designed and manufactured to be an exact replacement of the existing winding in all ratings and dimensions except that the new winding shall contain turn insulation for turn-to-turn isolation. In additional to the coils manufactured for use in Unit 1, approximately 170 extra coils shall be manufactured for use in installing the two Government-furnished spare windings and to meet the requirements for spare parts.

b. References

ANSI C50.10 - 1990 - General Requirements for Synchronous Machines
ANSI C50.12 - 1989 - Requirements for Salient Pole Synchronous Generators and Generator/Motors for Hydraulic Turbine Applications
NEMA ME 1 - 1965 - Standard for Manufactured Electrical Mica.
IEEE Std 1 - 1986 - General Principals for Temperature Limits in the Rating of Electrical Equipment and the Evaluation of Electrical Insulation

c. Submittals - Submittals shall be in accordance with this subparagraph, paragraph 1.03 (Submittal Requirements) and 1.04 (Drawings and Data to be Furnished by the Contractor).

The Contractor shall submit for review the drawings and data listed below:

1. Approval drawings and data showing the stator coil design, strand transposition, winding diagram, plan and sectional views of coils and circuit rings, description of the insulation and corona suppression system, installation procedures, material safety data sheets, and shipping list of materials furnished.

2. Design Data.

3. Final drawings

4. Test Reports

5. Operation and Maintenance Instruction Manuals

d. Design - The following design information is provided for the existing armature winding and for the existing spare coils where appropriate:

The armature winding is rated 7,222 kilovolt amperes at 0.9 power factor, 4,160 volts, 60 hertz. There are 540 slots per generator, 4 parallels per phase, 45 coils per parallel. There are 4 turns per coil and 4 strands per turn. The strand dimensions are 0.086 X 0.277 inches. Average turn length is 69.667 inches. The core height is 17.5 inches with an inner diameter of 265 inches. Average coil cross sectional area is 0.703 X 1.019 inches (Finished Size). Coil span is 1 - 6. Resistance per phase at 75°C is 0.02888

ohms. Piled slot dimensions are 2.600 X 0.720 inches. The generator has a counterclockwise rotation when looking at the stator connection side or non-drive end of the unit

The new armature winding shall be for wye connection with three main leads and three neutral leads brought out of the stator frame. The main leads shall be suitable for connection to the existing generator voltage non-segregated phase bus structure. At the Contractor's option, the leads between the armature winding and the bus structure may be reused. The neutral leads shall pass through the existing current transformers and connect to the wye bus. The contractor may reuse the existing neutral lead extensions between the armature winding and the wye bus.

The Contractor shall apply new class F insulation throughout the entire length of the existing leads if they are reused. Existing leads shall include the terminations at the generator voltage segregated-phase bus structure. If the leads are replaced the terminations shall remain uninsulated. The armature winding will be protected by existing differentially connected current transformers and relays, for protection against ground and short-circuit faults. The main and neutral leads shall be from adequately balanced groups of each phase of the winding to facilitate relaying of turn-to-turn or ground faults.

The Contractor may reuse the existing circuit ring busses but must insulate them with class F insulation throughout. If the Contractor decides to replace the circuit ring busses, they shall be sized to prevent undue heating at a generator output of 7,222 kilovolt amperes and the current density in the bus shall not be greater than the current density in the existing bus. New circuit ring bus, if provided, shall be insulated after it has been formed to the necessary radius of curvature. Use of solvent-type varnish as a tape binder on the circuit rings, main and neutral leads, and coil interconnections will not be permitted.

The armature winding to be furnished under this contract shall be made up of multiple turn type coils. The individual strands shall be annealed copper, free from splinters, flaws, or rough spots and shall have a minimum nominal corner radius of .024 inches. The total cross sectional area of the copper conductors shall not be less than the cross sectional area of the existing conductors. At rated generator voltage, the dielectric stress from the conductor to ground (groundwall plus turn insulation) shall not exceed 60 volts per mil. There shall be sufficient space between coils in the end turn area and between jumpers to prevent electrical discharge or corona between coils.

Form-wound (multiple-turn) coils shall be of the same size and shape and shall be interchangeable. Each coil shall be separately numbered.

Each strand shall be individually insulated. The strand insulation shall be glass, dacron glass, or mica tape. The strands shall be tightly pressed and bonded together before the ground wall insulation is applied. Strand bonding resins shall have properties and characteristics to prevent bond failure due to the mechanical, thermal, and chemical effects associated with operation within the temperature limits of class F insulation systems. The turn insulation shall consist of mica tape and shall be completely impregnated or filled with a solventless epoxy or polyester resin.

Each turn shall be insulated with a minimum of two layers of half-lapped mica tape applied under constant tension.

Form-wound (multiple-turn) coils shall have at least one internal coil transposition in the coil shoulders or be transposed by an alternate method to reduce the losses (stray load), due to nonuniform current distribution, to a low value.

Before application of the ground insulation, the slot portions of the coils shall be impregnated and encapsulated with an epoxy or polyester resin bonding compound to fill and bond the transposed conductors to form a solid void-free structure.

The ground insulation shall be tape consisting of mica splittings or mica paper, and the necessary backing, binding, and filling materials. The same taping system and materials shall be used throughout the ground insulation of all power-carrying conductors, including coil interconnections. Mica splittings, if used, shall meet the requirements for NEMA grade C classification.

The ground insulation shall be completely impregnated or filled with a solventless epoxy or polyester resin using either the vacuum-pressure-impregnation process, or by means of a "B-staged" epoxy or polyester-impregnated tape. Regardless of the system used for impregnation, the insulation shall be a solid, dense structure with minimal voids or air pockets. The coils external surfaces, including the bend areas shall be smooth and free from wrinkles and surface irregularities. The coils shall be capable of being placed into position in the slots without damage to the insulation. The coils shall be treated so as to prevent permanent injury from temporary exposure to dampness. Use of solvent-type varnish as a tape binder on the circuit rings, main and neutral leads, and coil interconnections will not be permitted.

After the turn and/or ground wall insulation systems have cured, the overall coil insulation system shall not be disturbed other than replacing the protective covering (binder or armor tape).

The coils shall be provided with a protective covering and arranged or treated to reduce corona to the lowest practicable minimum. The slot portion shall be treated with a semiconducting compound to provide corona shielding. The corona shielding shall extend beyond the core and shall be graded outside each end of the core. The coils shielding shall be constructed utilizing one of the acceptable methods listed below:

1. Impregnated conductive tape is applied to cover the slot portion of the ground wall insulation and then cured. CRTV (conductive room temperature vulcanizing silicone rubber) and RTV (room temperature vulcanizing silicone rubber) are press-molded on each side of the bar/slot portion in longitudinal bands and then cured. The RTV/CRTV bands shall allow a zero clearance bar/slot interface on both sides of the bar.

2. Impregnated conductive tape is applied to cover the slot portion of the ground wall insulation through the use of "B-stage" treatments. The coils shall then have a zero clearance bar/slot interface on both sides of the bar.

The grading system shall be so constructed that no corona discharges shall exist between any two bars outside the core to cause the surface degradation at any normal operating voltages. As a minimum, the length of the conducting surface on the coil shall be long enough to ensure a separation of at least 1/4 inch at the point where the high resistance treatment begins, even when allowing for manufacturing variations. The grading system shall have been laboratory tested and proven at a voltage which is 2 kV higher than the maximum voltage between any two coils in a slot.

The coils shall be capable of being placed in the stator core slots without damage to the armor tape, semi-conducting system, or insulation system.

In order to ensure mechanical strength and to reduce the probability of hotspots, connections between coils and circuit rings shall include all strands in a common connection.

Preinsulated jumpers will not be permitted in making up series or group connections.

The Contractor shall be responsible for all the dimensions of the coils and other materials furnished new under this contract as to being correct and satisfactory for installation in the generators. Measurements shall be made on the existing generators as necessary to ensure that this requirement is met.

e. Materials - All materials used in the manufacture and installation of the new stator winding shall be compatible with each other and be rated ANSI Class F or better. The insulation shall have the capability of operating at a maximum average temperature of 120°C, which will allow for a temperature rise of 80°C over a 45°C ambient with normal service life. The insulation shall be fully cured before performance of the factory tests required by paragraph 4.02 (Factory Tests). Asbestos shall not be used in any of the insulation systems. Tapes using a polyester film (Mylar) backing will not be permitted in the insulation system. The bonding resins to be used shall have properties and characteristics, and chemical effects associated with operation within the temperature limits of the insulation system.

The Contractor shall furnish all blocking and lashing material, tape, supports, binding materials, new surge ring and surge ring insulating materials, slot fillers, slot corona treatment materials, and all other materials necessary for complete installation of the new armature winding in the stator. Spacers used in bracing the end turns at the top and bottom portions of the coils and surge rings shall be of either phenolic laminate or polyester glass laminate, and shall be covered with a material such as dacron felt. The material shall be thoroughly impregnated with a solventless epoxy or polyester resin of high insulation properties prior to its installation. Glass cord or tape shall be used to tie the blocking material and coils, and the cord or tape shall be saturated with a solventless epoxy or polyester resin prior to tying. A locking device or "figure 8" tie shall be used at the top and bottom of the slot to prevent slot materials from moving. The locking device or tie shall be located approximately one-half inch beyond the stator iron to allow limited migration of any loose slot materials as an aid to visual inspection for such migration. Blocks on the sides of coils, or other positive means, shall be provided to prevent movement of the coils. If blocks are used, they shall be tied to a straight portion of the coil at the point of exit of the coil from the core.

f. Installation - Installation of the armature windings shall be in accordance with the requirements listed in paragraph 3.05 (Winding Removal and Replacement)

g. Testing - Testing of the winding shall be in accordance with the requirements listed in paragraphs 4.02 (Factory Tests) and 4.03 (Field Tests).

h. Payment - Payment for furnishing and factory testing of the new armature winding for unit No. 1 shall be made at the applicable lump-sum price bid therefore in the schedule which price shall include the cost of all labor and materials necessary to perform the work required by this paragraph.

Payment for furnishing and factory testing 20 new armature winding coils for unit No. 2 and No. 3 shall be made at the applicable lump-sum price bid therefore in the schedule which price shall include the cost of all labor and materials necessary to perform the work required by this paragraph.

Payment for furnishing and factory testing 150 new armature winding coils to be used as spares for all three units shall be made at the applicable lump-sum price bid therefore in the schedule which price shall include the cost of all labor and materials necessary to perform the work required by this paragraph.

3.03 Wedges and Slot Fillers

a. General - Provisions shall be made for tightly wedging the coils in the slots with wedges and slot filler materials which will not shrink or buckle. Government-furnished wedges and slot materials have been furnished for units No.2 and No. 3 as noted in subparagraph 2.02 (Work and Materials to be Furnished by the Government). The Contractor shall furnish and install all wedge and slot materials for unit No. 1.

b. References;

NEMA LI 1 - 1989 Industrial Laminated Thermosetting Products
NEMA LI 6 - 1993 Relative Temperature Indices of Industrial Thermosetting Laminates

c. Submittals. - Submittals shall be in accordance with this subparagraph, paragraph 1.03 (Submittal Requirements) and 1.04 (Drawings and Data to be Furnished by the Contractor)

The Contractor shall submit the drawings and data listed below:

1. Approval drawings and data showing wedge and slot filler assembly details, samples of wedge and slot filler materials, and wedge and slot filler installation procedures.

d. Design - The contractor shall design the wedging system and slot filler system for unit No. 1 to be compatible with the existing installation. The Contractor is responsible for collecting all data and measurements necessary to manufacture wedges which will meet the requirements of this contract and which will perform as needed based on the design and ratings of the generators. For units No. 2 and No. 3, any additional materials needed to

supplement or replace Government-furnished wedges and slot material shall be provided as needed.

e. Materials -

1. Wedges shall be made from glass mat base laminate NEMA grade G-10, G-11 or better. All materials in the stator slot shall have class "F" rating. The wedges at the ends of the slot shall be of the locking type. Adhesive may be used: Provided, that the air vents are not blocked after the wedges are installed. As an alternate to the single-piece wedge, the Contractor will be permitted to furnish and install two-part, radial-pressure-type wedges: Provided, that the wedges are constructed with a positive means of measuring the amount of spring compression.

At least one wedge in each slot shall be installed with appropriately located gauging holes to provide a positive means of measuring the actual amount of spring compression.

2. Slot fillers - Slot filler strips and slot side fillers shall be fabricated from semiconducting material except the front filler strip may be constructed of non-conducting material. All materials in the stator slot shall have class "F" rating. The spring-type wedge filler material may be constructed of nonconducting material.

f. Installation - Flat filler strips of semiconducting material shall be installed at the bottom of the slot, between coils where no RTD is required and between the top coil in each slot and the spring-type wedge filler material. Side filler strips shall be tight within the slot so that a 0.002 inch feeler gauge will not enter any gap between the coil and slot sides. The 0.002 inch feeler gage "no-go" standard shall apply to at least 90 percent of the stacked core length; provided the remaining 10 percent has "go" lengths of less than 3 inches. For at least 90 percent of the machine, only one thickness of side filler shall be used and on the remaining 10 percent only two thicknesses glued together shall be used.

Spring-type wedge filler materials or other Contracting Officer-approved spring system shall be furnished and installed directly behind the wedges for providing a positive radial force on the coils. The spring compression shall be at least 150 percent of the maximum radial electromagnetic forces produced on the coils. Additionally, the amount of spring compression shall be at least 150 percent of the total amount of radial decrease of materials in the slot due to shrinkage or relaxation for the expected life of the armature winding.

The Contractor shall furnish all gauges and any other equipment required to determine the total spring compression and shall furnish instruction for using the gauges during installation and during future maintenance inspections. Care shall be exercised that blocking of the air passages cannot occur.

g. Cost. - The cost for furnishing and installing the wedges and slot filler materials as well as spring compression gauges shall be included in the lump-sum prices bid in the schedule to install the three separate windings, which price shall include the cost of all labor and materials necessary to perform the work required by this paragraph.

3.04 Indicating and Protective Devices

a. General - The Contractor shall furnish and install in each generator, 28 Resistance Temperature Detectors (RTDs). The RTDs shall be located in slots which will, as closely as possible, indicate the highest temperature obtained in operation. The RTDs will be connected to the existing terminal board by the Contractor.

b. References:

ANSI C50.10 - 1990 - General Requirements for Synchronous Machines
IEEE 119 - 1974 - Recommended Practice for General Principals of Temperature Measurement as Applied to Electrical Apparatus

c. Submittals - Submittals shall be in accordance with this subparagraph, paragraph 1.03 (Submittal Requirements) and 1.04 (Drawings and Data to be Furnished by the Contractor).

1. Approval drawings and data showing plan and sectional views of the RTDs , and a tabulated listing of RTDs and the slots they are located in.

2. Test reports.

d. Materials - The RTD's shall be standard 10-ohm-copper, 3-conductor, resistance temperature detectors. The copper detectors shall have a temperature coefficient of resistance of between 0.003830 and 0.003890 at a reference temperature of 25°C. The sensing element shall be encapsulated in a flexible heat-cured compound throughout the entire slot portion and for a short distance past the end of the slot. The leads shall be encapsulated in the same material or protected with acrylic resin-coated fiberglass sleeving.

The necessary wiring between the existing terminal board and the individual temperature detectors shall be provided and installed. The wiring shall comprise a 3-conductor, shielded cable which is oil, moisture, and heat resistant. The cable shall have armor protection against mechanical damage. The conductors shall be stranded, tinned, copper with an insulation system capable of operating at a temperature of at least 125°C. The shield of the conductor shall be grounded at one end.

e. Installation - The Contractor shall furnish and install two RTDs per parallel per phase in the armature winding located so as to indicate, as closely as possible, the highest temperature obtained in operation, with the remaining four RTDs spaced equally around the winding.

f. Testing - The required accuracy tests for the RTDs are described in paragraph 4.02 (Factory Tests)

g. Payment - Payment for furnishing, testing, and installing the RTDs shall be made at the applicable lump-sum price bid therefore in the schedule, which price shall include the cost of all labor and materials necessary to perform the work required by this paragraph.

3.05 Winding Removal and Replacement

a. General - All onsite work required to remove and replace the armature winding shall be completed in accordance with the detailed removal and installation procedure required by subparagraph 1.04 (Drawings and Data to be Furnished by the Contractor). The installation procedures shall be submitted by the Contractor within 45 days after award of contract and shall be approved by the Contracting Officer before the work is performed.

b. Removal of Existing Stator Winding - Prior to removing the existing armature winding, the Contractor shall locate and mark on the stator core the location of slot No. 1, all lead extensions, and all RTD locations. The Contractor shall remove the old armature winding including all coils, connections, and the circuit ring bus, in a manner that will not damage the stator core or other parts of the generator not being replaced. The circuit ring bus will be reinsulated and reused. The Contractor will be responsible for any damage caused in removal of the old winding.

All materials removed and not reused shall become the property of the Contractor, and shall be removed from the jobsite and promptly disposed of according to applicable regulations. Materials removed shall not be reused unless authorized by the Contracting Officer.

The Contractor shall furnish all installation materials that are not supplied by the Government. The Government-furnished installation materials are listed in paragraph 2.02 (Work and Materials to be Furnished by the Government)

The Contractor shall check the torque values of all core studs and re-torque all core studs that are loose. The Contractor shall lock the core nuts after retorqueing using an approved means so that they can not back off. The Contractor shall inspect the existing core for damage and make minor repairs. The Contractor shall check the core for localized looseness of iron and for any other condition which may contribute to heating or reduced output by the new winding. Any observed unsatisfactory conditions shall be reported to the Contracting Officer with a recommendation for the repair procedure the Contractor proposes to follow and an estimate of time and cost to complete the work.

If any additional repair work is authorized by the Contracting Officer, the Contractor shall furnish materials required and perform the work, for which he will be reimbursed for services and materials, (except for existing spare stator laminations) in accordance with FAR clause 52.232-11 entitled "Extras." The Contractor shall also be entitled to an extension in completion time for performing this work, as described in FAR clause 52.211-13 entitled "Time Extensions." The Contractor shall be responsible for the adequacy of the repairs. The method will be subject to approval by the Contracting Officer.

After the armature winding is removed from the stator core, the stator core shall be cleaned by means of a compressed air blasting procedure using an approved material (corn cob or walnut shell). The core and air slots shall be cleaned after blasting by means of compressed air and brushes as necessary.

Prior to installing the new armature winding, the Contractor shall clean and paint the existing stator core slots with a semiconductive compound to provide corona shielding. Application

of the compound by compressed air methods will not be permitted. As necessary, the Contractor shall reestablish the wedge locking grove.

c. Installation of armature winding - The Contractor shall install and connect the new armature winding complete throughout, shall connect the armature winding main leads to the generator voltage bus structure, and shall connect the armature winding for normal operation. Connections throughout the armature winding, except for bolted connections at the main and neutral leads, shall be brazed. Connections shall be brazed using a brazing filler metal having a melting temperature above 800°F (427°C). The brazing procedure shall be such as to ensure complete and thorough distribution of the brazing filler metal throughout the joint of the connection. Appropriate heat sinks shall be used on insulated conductors near the areas being brazed to prevent insulation damage from excessive heat. The heat sinks shall not use watersoaked materials in direct contact with these insulated conductors. Burned insulation or loss of the bond between the insulation and the conductor will result in rejection and replacement of the affected coil at the Contractor's expense. The coil interconnections shall be insulated with mica tape and impregnated with the solventless epoxy or polyester resin. No permanent bends shall be made in any part of the winding after insulation has been applied to that part. All work shall be performed under the technical direction of an erection engineer to be furnished by the Contractor. The installation supervisor shall be technically qualified to supervise the installation, preparation, and testing of the armature winding. The installation supervisor shall be present at the worksite during the entire installation period, and shall arrange for a representative to be present at all shifts, and shall report immediately, in writing to the Contracting Officer, any work not in accordance with the manufacturer's recommendation or any special conditions which may result in an unsatisfactory job.

The slot position of each coil shall be recorded and submitted when the rewind work is completed.

The Contractor shall furnish and install new top and bottom surge rings which are adequately insulated.

To check the adequacy of grounding of the coils in the slot, the Contractor shall measure and record the resistance between each coil side (top and bottom) and ground. The measurement method shall include the use of a 6-inch by 1/2-inch-wide woven copper strap or approved alternate, and the maximum allowable resistance shall be determined by the Contractor and shall be subject to the approval of the Contracting Officer. During and after installation of the new armature winding, but prior to reassembly of the generator, the Contractor shall dry out or cure the windings as necessary and conduct dielectric tests.

After installation is complete, the Contractor shall paint the exposed portion of the core and the wedges, the exposed portion of the coils above and below the core, series and pole jumpers, leads to the circuit ring buses, and the circuit ring buses with a epoxy enamel insulating varnish (beige color) combined with a catalyst. The total applied dry thickness shall not be less than 5 mils or exceed 15 mils. After the paint is dry, the Contractor shall locate slot No. 1 and shall number it and every tenth slot with a non-tracking, temperature resistant paint on the right and left stator packets at both ends of the core.

Government forces will reassemble the generator unit.

d. Payment - Payment for removing, preparing for disposal and disposal of the existing winding and installing the new replacement winding in unit No. 1 shall be at the applicable lump-sum price bid in the schedule, which price shall include the cost of all labor and materials necessary to perform the work required by this paragraph.

Payment for removing, preparing for disposal and disposal of the existing winding and installing the Government-furnished replacement winding in unit No. 2 shall be at the applicable lump-sum price bid in the schedule, which price shall include the cost of all labor and materials necessary to perform the work required by this paragraph

Payment for removing, preparing for disposal and disposal of the existing winding and installing the Government-furnished replacement winding in unit No. 3 shall be at the applicable lump-sum price bid in the schedule, which price shall include the cost of all labor and materials necessary to perform the work required by this paragraph

PART 4 - INSPECTION AND ACCEPTANCE

4.01 Factory Inspection

In addition to the requirements of this paragraph and the requirements listed in the "Inspection/Acceptance," paragraph of FAR Clause 52.212-4, Contract Terms and Conditions–Commercial Items, no material or equipment shall be shipped until all required tests, analyses, and shop inspections are completed, and permission is given to ship, or inspection at the shipping point is waived. Certified test reports, warranties, or other evidence of compliance with this solicitation shall be submitted and approved prior to shipment as provided in paragraph 1.03 (Submittal Requirements).

When specified or directed, the Contractor shall furnish to the Contracting Officer two copies each of mill or shipping orders, covering material or equipment required under this solicitation. All orders and reports shall quote the pertinent requirements of this solicitation and drawings, and shall state the place of manufacture, so that inspection by the Government can be performed, if required. The Contractor will be advised of those tests which will be witnessed by an authorized representative of the Contracting Officer.

Permission to ship material or equipment or waiving of inspection will not relieve the Contractor of the responsibility to conform to all of the requirements of this solicitation.

4.02 Factory Tests

References

IEEE P286 - 1998 - Recommended Practice for Measurement of Power-Factor Tip-Up of Rotating Machinery Stator Coil Insulation
IEEE 522 - 1998 - Guide for Testing Turn-to-Turn Insulation of Form Wound Stator Coils for Alternating-Current Rotating Electrical Machines

The new Contractor-furnished armature winding coils, resistance temperature detectors, and the spring filler materials shall be tested at the factory in accordance with subparagraphs (a), (b), (c), (d), (e), and (f) below. If more than one percent of the coils fail any test, production shall be stopped and the Government shall be notified. The cause of the failures shall be identified and corrected. The Contractor shall notify the Government of the intent to restart production and the Government must concur.

a. Strand test. - Each strand of each finished armature coil shall be tested for continuity and for strand-to-strand shorts at a minimum voltage of 120 volts rms using a procedure approved by the Contracting Officer at the time of drawing and data submission under paragraph 1.04 (Drawings and Data to be Furnished by the Contractor). This test shall demonstrate that each strand has maintained its electrical isolation from every other strand throughout the manufacturing process. The manufacturer shall submit the proposed test procedure to the Contracting Officer for approval. Finished coils failing the strand test shall not be reworked, but shall be rejected and not furnished as part of this contract.

b. Each coil of the armature winding shall be given dielectric tests at the factory after completion of manufacture and immediately prior to packing for shipment. Each armature coil shall be given an alternating-current test at 60 hertz, and 14,000 volts rms, for 1 minute.

Each coil shall be given an induced or applied dielectric test to demonstrate the ability of the coil turn insulation to withstand the dielectric stresses associated with traveling waves. The test voltage to be applied shall be in accordance with Figures (1) and (2) of Section 6, of IEEE 522. The Contractor shall furnish a description of the procedure and the test parameters for performing the test.

Coils failing either the high-potential ground wall or the turn-to-turn dielectric tests specified above shall not be reworked or refinished, but shall be rejected and not furnished as part of this contract.

c. The Contractor shall perform power factor tip-up tests at the factory in accordance with IEEE No. P286. The tests shall be made separately on each coil. The test shall be made by measuring the power factor (expressed in percent) at 600 and 2,400 volts rms, and determining the numerical difference in the values. If the numerical difference is greater than 1 percent (0.01 power factor), the coil shall be rejected. Measurements may be made by energizing the conductor and grounding the insulated slot portions by means of a clip attached to the center of each leg. The test value of tip-up shall be stamped, marked, painted, or noted by some other means on each coil so that the values can be easily identified at the time of installation. Any coil that fails the power factor tip-up test shall not be reprocessed without the Contracting Officer's approval.

Test reports, indicating the measured power factors of each coil tested, shall be furnished as required by subparagraph 1.04 (Drawings and Data to be Furnished by the Contractor).

d. In addition to the power factor tip-up test, every tenth coil produced shall be given a dissipation factor test. This test shall consist of subjecting the coil, using the same test setup as the power factor tip-up test, to ac voltages of 10 through 200 percent of rated line-to-ground voltage. To compensate for occasional measurement anomalies, the averaging of a single step value not meeting the specified criteria with the next highest step will be permitted. Should the two steps have different acceptance criteria, these also may be averaged. For each coil that fails the dissipation factor test, four additional coils shall be tested. The dissipation factor shall be measured as a function of voltage at 20 percent intervals of rated voltage, i.e., 20, 40, 60, 80, 100, 120, 140, 160, 180 and 200 percent. Dissipation factors shall not exceed the values given in the following table:

For each 20 % interval between			The dissipation factor shall not increase by more than
20%	and	60%	0.0015
60%	and	120%	0.003
120%	and	200%	0.004

e. Two percent of the spring type filler material to be used for the new installation shall be subjected to the test described in this paragraph. Failure to pass this test shall require the spring material to be redesigned and retested. The spring height is defined as the total height of the spring minus the material thickness (the distance the spring can be compressed). Samples of each size to be used in the new installation shall be tested. The force required for an 80 percent reduction in spring height shall be at least 110 pounds per square inch (psi). After this measurement, the test samples shall be conditioned by compressing them 100 percent (completely flat) between two plates. They shall be kept at 120°C for 168 hours. After conditioning, the force required for an 80 percent reduction in spring height shall be at least 70 psi. The uncompressed spring height shall have shrunk less than 20 percent. All test results shall be submitted at least 30 days prior to shipment of the springs.

f. Each resistance temperature detector that will be located in the armature winding shall be tested for accuracy by comparison with a suitable standard. Each detector shall be tested at 25, 80, and 120°C. The tests shall be made in the presence of a Government inspector. Test reports shall be furnished as required by subparagraph 1.04 (Drawings and Data to be Furnished by the Contractor).

g. Cost - The cost for factory testing the new armature winding for unit No. 1 shall be included in the appropriate lump-sum price bid in the schedule for furnishing the new armature winding and shall include the cost of all labor and materials necessary to perform the work required by this paragraph.

The cost for factory testing the new RTD's for all three units shall be included in the lump-sum price bid in the schedule for furnishing the RTD's and shall include the cost of all labor and materials necessary to perform the work required by this paragraph

4.03 Field Tests

References:

ANSI C50.10 - 1990 - General Requirements for Synchronous Machines
IEEE 115 - 1995 - Test Procedures for Synchronous Machines

a. Once every 24-hour period, the coils installed during that period, including final installation of slot filler and wedges, shall be given the following tests. In the event any coil fails during the tests, it shall be removed and replaced with a new coil by the Contractor at the Contractor's own expense.

(1) 15,850 volts direct current for 1 minute.

(2) The value of resistance to slot walls shall be measured on all coils after they have been properly tightened in the circumferential direction. Measurements shall be taken at three locations: at each end of the generator stator core and at the axial center. The acceptable range of contact resistance shall be noted on the report. If values outside of the range are measured, the coil seating shall be corrected. A report of the complete readings shall be submitted.

(3) Each coil shall be given either an induced or applied dielectric test. The test voltage shall be not less than two-thirds of either the test voltage required by subparagraph 4.02 b. (Factory Tests), or the test voltage determined by the Contractor as required by subparagraph 1.04 (Drawings and Data to be Furnished by the Contractor), whichever test voltage is the greater. This test shall be performed before the coil-to-coil connections are completed.

b. After the winding has been completely assembled, dried out, or cured, if necessary, and before installation of the rotor, the Contractor shall, at the Contractor's own expense, give each phase of the armature winding an alternating-current, 60-hertz dielectric test of 9,.320 volts rms for 1 minute, in accordance with ANSI C50.10.

The Contractor shall furnish a potential transformer and calibrated voltmeter to check the voltage applied by the alternating-current, high-potential test set. However, this equipment need not be furnished if the Contractor accepts the accuracy of the voltmeter supplied with the high-potential set. The Contractor must verify that the test voltage for any required test is at least as great as specified for that test.

After the Contractor successfully completes the alternating-current dielectric test, the Government will give each phase of the armature winding a direct-current dielectric test to 9,000 volts on a time-voltage schedule selected by the Government to demonstrate absorption values of the winding.

In the event any coils fail during the alternating- or direct-current dielectric tests, the Contractor shall locate and replace them at the Contractor's own expense.

After completion of each armature winding and prior to completion of the main lead connections, the Contractor shall measure the armature winding resistance in accordance with IEEE No. 115. The average temperature of all armature winding RTD devices, recorded within 30 minutes of the time the resistance measurements are taken, shall be used as the stator ambient temperature. This temperature shall be used to calculate the corrected stator winding resistance at 75°C. The Contractor shall also measure the field resistance at this time. The test instruments shall be appropriately calibrated.

The Contractor is reminded that these values of armature resistance will be used to determine compliance with the warranted losses.

c. After generator No. 1, including its auxiliary equipment, has been reassembled by the Government, it shall be tested by and at the expense of the Contractor, to determine if the Contractor's warranties and the requirements of this contract have been fulfilled. The tests shall be made in accordance with the applicable standards of IEEE and ANSI except as herein noted.

(1) Open-circuit saturation test.

(2) Short-circuit saturation test.

(3) Zero-power factor saturation test.

(4) Heat runs. - Heat runs shall be made to determine the temperature rise of the various parts of the generator when operating continuously at rated kilovolt ampere, rated power factor, 60 hertz, and at rated volts. When existing head conditions or other limitations will not permit operation at the full rating of the new winding, then three heat runs shall be conducted. One load shall be at 7,222 kilovolt-amperes or the maximum available turbine output, another load shall be at 90% load or 6,500 kilovolt-amperes, and the third load shall be at 80% load or 5,777 kilovolt-amperes.

The temperature rise of the armature winding shall be determined by embedded resistance temperature detectors, the temperature rise of the generator stator core by thermocouples or by resistance temperature detectors on the back and other accessible areas of the generator stator core, and the temperature rise of the field shall be determined by the resistance method. The average temperature indicated by the highest reading temperature detector during the period of stable temperatures shall be used to determine the temperature rise of the armature winding. The average temperature of the air leaving all the surface coolers of the generator during the period of stable temperatures shall be used as the ambient temperature upon which to base the determination of the temperature rise of the armature and field windings. Sufficient thermometers, thermocouples, or resistance temperature detectors shall be placed in the cooler air discharge path, between 6 to 10 inches from the surface coolers, to obtain accurate temperature information.

The following procedure shall be used for locating the temperature devices in the cooler air discharge in order to obtain accurate average temperature:

Not less than 20 temperature devices shall be installed in the path of the discharge air from one cooler. The devices shall be installed between 6 to 10 inches from the face of the cooler and shall be spaced at approximately equal intervals. With the generator operating under approximately rated load, temperature readings of all temperature devices on this one cooler shall be observed and recorded, and the readings shall be averaged. The average temperature so determined shall then be used to locate at least four temperature devices in the air discharge path from each cooler in positions which will represent average temperature. The average of all temperature devices (at least four per cooler) will then represent the ambient air temperature for the generator during the period of stable temperature. This value for ambient air temperature will also be used as the ambient temperature upon which to base the temperature rise of other various machine parts.

(5) Ozone concentration test via a pump.

(6) Deviation factor of waveform. - Oscillograms shall be taken of the waveform of the voltage of each phase of the armature winding when the generator is operating at rated voltage and open circuit.

(7) Balanced and residual component telephone influence factor (TIF) determination.

All tests other than those listed in subparagraphs a. and b. above shall be made at a time convenient to the Government, not to exceed 18 months following completion of installation of the armature winding.

The Contracting Officer will keep the Contractor advised of the time when these field tests can be conducted and will notify the Contractor 30 days in advance of the dates the tests are to be performed. The waiving of any test on the generator, by the Government shall not constitute relinquishment of the Contractor's responsibility to completely meet the requirements which were to have been demonstrated by that test. All instruments used for the tests shall be calibrated by and at the expense of the Contractor before and after the tests by comparison with suitable standards. All test reports shall be furnished as required by subparagraph 1.04 (Drawings and Data to be Furnished by the Contractor).

The Contractor's installation supervisor, or the supervisor’s representative, shall remain at the jobsite until a formal signed release from the representative of the Contracting Officer, verifying that the field tests required under this paragraph have been completed in accordance with this contract, is obtained by that person.

The Contractor shall provide field test reports as required by Table 1.03-1 (List of Submittals).

d. Cost - The cost for performing the field installation tests on the Government-furnished armature windings installed in units No. 2 and No. 3 shall be included in the applicable lump-sum price bid in the schedule for installing and testing Government-furnished windings, and shall include the cost of all labor and materials necessary to perform the work required by this paragraph.

The cost for performing the field installation tests and the field acceptance tests on the Contractor-furnished armature winding for unit No. 1 shall be included in the appropriate lump-sum price bid in the schedule for installing and field testing unit No. 1 winding, and shall include the cost of all labor and materials necessary to perform the work required by this paragraph.

4.04 Generator Inspections after Operation

During the 5-year warranty period, there shall be at least three inspections made during which the Contractor's armature winding specialist or specialists, and representatives of the Contracting Officer, shall participate together in a thorough inspection of all equipment and materials furnished by the Contractor. The Government will give the Contractor no less than 20 calendar days prior notice of the date for each inspection. The Government will make the unit available for the inspections and may at its option remove the rotor or sufficient covers to permit a thorough inspection, at no cost to the Contractor for each inspection period. The Contractor will be responsible for all expenses incurred by the Contractor's representative or representatives in connection with these inspections, including costs of reports of results of the inspections.

The inspection periods, after the unit is released for online service, are expected to be (1) between 6 months and 1 year, (2) between 2 and 2-1/2 years, and (3) prior to expiration of the 5-year warranty period. Inspections of the armature windings shall include those items listed in the method of periodical inspection and testing of the windings after installation, submitted by

the Contractor in accordance with subparagraph 1.04 (Drawings and Data to be Furnished by the Contractor) and the following items:

a. Determine that all coils and other materials are tight in the slot and have not moved.

b. Determine that all wedges, radial packing, blocking, and lashing are tight.

c. Inspect the stator frame and/or winding components for abnormalities which shall include, but not be limited to:

(1) Loose stator laminations, loose generator stator core clamping bolts, loose clamping fingers, and hot spots or paint discolorations.

(2) Presence of corona dust or powder or other deposits, which may be related to deterioration of the stator winding or to looseness of the generator stator core laminations.

(3) Unusual movement, cracking, or distortion.

(4) Deterioration of the ring buses and main leads.

d. Perform corona probe, programmable direct-current high-voltage ramped tests, coil-surface contact-resistance tests, and any other agreed-upon tests for possible internal slot or end-turn corona. The Government will furnish all test equipment for performing the corona probe and the programmable direct-current high-voltage ramped test, and for the coil-surface contact- resistance test. The Contractor shall furnish all test equipment required for other agreed-upon tests.

After each inspection, the Contractor shall furnish the required number of certified reports of the results of the inspection for approval of the Contracting Officer. Each report shall incorporate the method of checking the winding as described above. Any repairs found necessary shall be performed by the Contractor under FAR clause 52.246-18 entitled “Warranty of Supplies of a Complex Nature”.

e. Cost - The cost for performing generator inspections and providing inspection reports during the warranty period shall be included in the applicable lump-sum costs for installing and testing the armature windings for all three units and shall include all labor and materials necessary to perform the work required by this paragraph.

PART IV
CONTRACT DOCUMENTS, EXHIBITS, AND ATTACHMENTS

1. List of Attachments

(a) Drawings, General

The drawings of Headgate Rock Powerplant show the general arrangement of the plant and equipment. Except as otherwise provided, the drawings are not to be considered as defining the design of the equipment to be furnished, but are merely illustrative of the technical requirements. The Contractor shall design, furnish, and install equipment which is fully compatible with the illustrative design shown on the drawings. Approval from the Contracting Officer is required prior to using the proposed design.

In case of differences between the drawings and Technical Requirements, the Technical Requirements shall govern.

(b) List of Drawings

The following attached drawings are made a part of the specifications:

Headgate Rock Powerplant

1. 1117-D-2 - General Map
2. 1117-D-3 - Location Plan
3. 1117-D-4 - General Plan
4. 1117-D-7 - General Arrangement - Deck EL 373.00
5. 1117-D-11 - General Arrangement - Transverse Section & Unit 2
6. 45-301-7210 - Generator Coil and Slot Cross Section

Manufacturer's Drawings

7. 26E113005 - Generator Outline
8. 26E113037 - Stator Connections Assembly
9. 26E113045 - Stator Winding Diagram
10. 26D113054 - RTD Locations
11. 26D113285 - Wedge Assembly and Slot Content
12. 26C113286 - Stator Slot Wedge

Standard Drawings

13. 40-D-6234 - Standard Name Plates
14. 40-D-6568 - Title Blocks & Borders
15. 40-D-6569 - Title Blocks & Borders
16. 40-D-841 - Excitation System Performance
17. 104-D-968 - Electrical Installation - Stator Coil Diagram

Information Only Drawings

18. 557-D-3524 - Glen Canyon Powerplant - Units 1, 3, 5, and 6 - Electrical Installation - Armature Winding Layout