



GUAM POWER AUTHORITY
AGANA, GUAM

SPECIFICATION No. E-037

REVISION: 2
November 20, 1998

PREPARED BY THE ENGINEERING DEPT.

GUAM POWER AUTHORITY
P.O. BOX 2977
AGANA, GUAM 96932

TRANSMISSION & DISTRIBUTION SPECIFICATION

SPECIFICATION NO. E-037

FOR

STATION GROUNDING TRANSFORMER

EFFECTIVE DATE: 11/21/98

ISSUED: *Constantino*

APPROVED: *HC*



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STATION GROUNDING TRANSFORMER

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1.0 SCOPE

This specification covers GPA's requirements for three-phase station grounding transformers and accessories.

2.0 SERVICE CONDITIONS AND OPERATIONS

- 2.1 The grounding transformer is intended for use in tropical weather with a corrosive, salt air environment.
- 2.2 Sustained Wind Strength: 155 mph with gusts to 180 mph
- 2.3 Seismic requirement: Zone 4
- 2.4 Ambient Temperature: 50° to 104° F.
- 2.5 The transformer will be used for grounding of a 34.5 kV sub-transmission system.

3.0 APPLICABLE PUBLICATIONS

- 3.1 The grounding transformer shall meet the requirements of the following standards and specifications, including the latest revisions with respect to material, design and tests.

American National Standards Institute (ANSI)

Institute of Electrical and Electronics Engineer (IEEE)

International Electrotechnical Commission (IEC)

National Electrical Safety Code (NESC)

American Institute of Steel Construction, Inc. (AISC)

National Electrical Manufacturers Association (NEMA)

American Society for Testing and Materials (ASTM)

National Fire Protection Association (NFPA)

Underwriter's Laboratories, Inc. (UL)

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- 3.2 If there are conflicts between the listed codes and standards, the GPA Manager of Engineering will determine which codes and standards shall apply.

4.0 DEVIATIONS AND NON-CONFORMANCE REQUIREMENTS

- 4.1 Deviations from this specification or changes in materials or design after the Purchase Order has been placed must be approved by the GPA Engineering Department and acknowledged by a Purchase Order Amendment issued by GPA.
- 4.2 Units received with deviations or non-conformances that are not acknowledged per Section 4.1 are subject to rejection. The Supplier of rejected units is responsible for any corrective action including but not limited to materials, labor and transportation necessary to dispose of or make the units conform to the specification.
- 4.3 Notification of defective units discovered before or after installation that are believed to be inherent to manufacturing problems or workmanship shall be made and forwarded to the Supplier. The description of the item, documentation of the problem and the described information, disposition and/or follow-up (as appropriate) that GPA expects from the Supplier will be specified. The Supplier's response shall be made within thirty (30) days unless an extension is acknowledged and approved in writing by the GPA Manager of Engineering.

5.0 WARRANTY

The Supplier shall warrant the satisfactory and successful operation of the apparatus furnished under this specification at the rating, under the conditions, and for the service specified. The Supplier shall further warrant the apparatus against defects of design, material and workmanship. Equipment shall have a minimum warranty of five (5) years.

6.0 SUBMITTALS

- 6.1 The Bidder shall provide with his bid the following data:

- a. Transformer type
- b. Voltage rating and type
- c. Kilovolt-ampere rating and class
- d. Guaranteed no-load loss at rated voltage
- e. Guaranteed maximum auxiliary power loss
- f. Guaranteed no-load loss at 110% voltage
- g. Guaranteed exciting current at 100% voltage
- h. Guaranteed exciting current at 110% voltage
- i. Guaranteed percent impedance

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- j. Calculated zero-sequence percent impedance
- k. Guaranteed maximum average audible sound level for each stage of cooling in decibels using the "A" Weighing scale
- l. Type of oil preservation system
- m. Method of mounting radiators: Removable or Integral with the tank
- n. Shipping data:
 - 1. Shipping weight
 - 2. Shipping dimensions
 - 3. Oil or gas filled
- o. Earliest possible shipping date
- p. Type of transformer winding material used for all windings
- q. The bidder shall quote as a separate item the per diem rate for a field service engineer

6.2 An outline drawing shall be provided with each bid quotation. This drawing shall include the following information:

- a. Projected floor space of the transformer, including radiators and expansion tanks
- b. Height of the transformer from floor level to top of voltage bushing
- c. Height of the transformer from floor level to top of neutral bushing
- d. Height of the transformer from floor level to top of tank, and to the highest non-removable part
- e. Weight of the core and the windings
- f. Weight of the tank and the radiators
- g. Number of gallons of oil and total weight of the oil
- h. Total weight of the assembled transformer including oil
- i. Power requirements for all control and auxiliary equipment

6.3 Within ten (10) weeks after award of contract, the successful bidder shall provide the following drawings for GPA approval:

6.3.1 Nameplate drawing, including all current transformer ratios.

6.3.2 Outline drawing including the following:

- a. Accessories and accessory locations
- b. Weight with and without oil
- c. Shipping center of gravity, shown on two items
- d. Installed center of gravity, shown on two views
- e. Anchoring requirements

6.3.3 Base drawings, including anchor bolt locations and complete detailed dimensions from equipment centerlines.

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6.3.4 Additional drawings required:

- a. Bushing outlines including size of stud, thread size and thread length
- b. Surge arrester outlines
- c. Location of radiators
- d. Control elementary and wiring diagrams.
- e. Current transformer elementary and wiring diagrams
- f. Current transformer ratio correction factor and secondary excitation curves.

6.3.5 The supplier shall provide three (3) sets of prints for the above requirements and a drawing list indicating the drawing number and title of each drawing.

6.4 Drawing Approval

6.4.1 GPA shall be allowed three (3) weeks to review and approve drawings provided in Section 6.3 without affecting the shipping date. Delays in delivery due to drawings that are disapproved during this review period are the responsibility of the Supplier.

6.4.2 Drawings returned to the Supplier as approved shall be considered authorization to proceed with the work. The approval of GPA shall in no way abrogate the requirements of this specification.

6.5 Certified Reproducible

6.5.1 At least three (3) weeks prior to shipment of the equipment, the Supplier shall furnish GPA with one complete set of final certified reproducible vellum drawings for each transformer purchased. Under no circumstances will "Typical Drawings" be accepted. This includes both schematic and wiring diagrams.

6.5.2 Final certified reproducible vellum drawings shall be submitted on full size, right reading, photographic mylar. The following information shall be shown on each drawing submitted:

- a. GPA Purchase Order
- b. Supplier's Name
- c. Description of Drawing

6.6 Instruction Books

6.6.1 At least three (3) weeks prior to delivery the Supplier shall furnish GPA five sets of complete operating and instruction books for each transformer.

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6.6.2 One additional instruction book shall be attached to each transformer.

6.6.3 Each manual or instruction book shall include the following:

- a. Schematic and wiring drawings. No typical drawings are acceptable.
- b. List of parts that were shipped loose from the transformer to be installed in the field.
- c. A replacement parts list that includes part number identifications.
- d. A list of recommended spare parts and a complete packing list of accessory items.
- e. Instruction manuals covering step-by-step installation and assembly instructions with illustrative drawings. Each separate part shall be marked with an identification system to aid installation.
- f. Manual recommending proper storage procedures.
- g. Operating and "troubleshooting" manual for the transformer.
- h. List of all special tools needed for installation and maintenance.

7.0 TESTING AND TEST REPORTS

7.1 The Supplier shall make his plant available to GPA Personnel to inspect the transformer during construction, testing and packaging for shipment.

7.2 Four (4) copies of certified test reports shall be supplied for the following tests:

- a. The routine tests listed in the latest revision of ANSI C57.12.00, performed for each stage of cooling.
- b. A sound level test at the full induced-test voltage level. The RIV shall not exceed 150 microVolts. Testing equipment and the general method used shall be in accordance with IEEE Transformer Committee Report, IEEE Transactions, PAS Vol. 86 pp. 1592-1595, December 1967, "Tests for Damaging Corona on Oil Insulated Power Transformers."

7.3 The Supplier shall state in his proposal whether or not impulse and corona tests are included among the quality assurance tests.

7.4 The Supplier shall include the following information in the test report:

- a. Winding Thermal Time Constant
- b. Type of material used in the primary and secondary winding

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8.0 RATINGS

8.1 Description

The transformer shall be a 3-phase, oil-immersed, outdoor type unit with a zigzag winding configuration for use on a 60 hertz grounded system.

8.2 Operations and Environment

The transformer is to be used for grounding operations, in a salt air environment near sea level with ambient temperatures ranging between 75 and 100 degrees F.

8.3 Voltage Rating

The transformer shall be rated 34,500 volts line to line nominal; 36,500 volts maximum.

8.4 Current Rating

The transformer shall be able to carry 90 amps neutral current continuously without exceeding 55 degrees C rise and shall be able to provide 1,000 amperes of line to ground fault current at the 34.5 kV Bus for one (1) minute without exceeding a final temperature of 200 degrees C.

8.5 Winding Insulation Class

34.5 kV, 200 kV Basic Impulse Level for both phase and neutral ends.

8.6 Sound Level

The average sound level of the transformer shall be of a standard sound level or a reduced sound level. The standard sound level shall not exceed 70 dB based on the transformer rating in accordance with NEMA TR-1-1971 Standards. The reduced sound level transformers shall be 12db below the standard and shall not exceed the level of 58 dB for OA rating. The transformer sound level shall be reduced by reducing the flux density of the core.

The Supplier shall state in his bid the cost difference between a standard sound level and a reduced sound level transformer.

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9.0 CONSTRUCTION

9.1 Transformer Bushings

9.1.1 Phase voltage bushings shall be of the paper "capacitor" type, ANSI Standard Inter-changeable, with a visible oil level gauge at the top of each bushing. Each bushing shall be provided with a power factor test tap. The bushing color shall be ANSI 70 light gray. Threaded studs for connection of the bushings to cables or straps shall be silver-plated.

9.1.2 The neutral bushing shall be of the dry-type, a one-piece porcelain body, or an acceptable condenser type. A threaded stud for connection of the bushing to a cable or straps shall be silver-plated. The bushing color shall be ANSI 70 light gray.

9.1.3 Bushings provided with the transformer shall be in accordance with the following:

<u>Bushing</u>	<u>Voltage Class</u> (kV)	<u>Minimum</u> <u>BIL (kV)</u>	<u>Minimum Voltage</u> <u>Creepage (in.)</u>	<u>Location</u>
Phase	35	200	40	Cover Mtd.
Neutral	35	200	40	Cover Mtd.

9.1.4 Spare bushings shall be provided one each for both the phase and neutral bushings.

9.2 Bushing Current Transformer

9.2.1 Standard multi-ratio current transformers reserved for GPA's use are required as follows:

Each Phase Bushing - Two (2) 1200/5 , relay accuracy class C400.

Neutral Bushing - Two (2) 1200/5, relay accuracy class C400.

9.2.2 All secondary tap leads (a total of five for each CT) shall be brought out of the top or side wall of the transformer through a gas and oil tight compartment and wired to identified circuit shorting terminal blocks in the transformer control cabinet. All connections between CT's and GPA connection points shall be bolted or crimped. No soldered, split or disconnecting lugs shall be used.

9.2.3 The manufacturer shall provide accuracy curves for the current transformers furnished.

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9.2.4 Bushing CT nameplates shall be provided showing connections and the ratio for each tap of each current transformer. These nameplates shall be mechanically fastened and located adjacent to GPA's connection terminals.

9.3 Surge Arresters

Provide three (3) surge arresters designed and manufactured for operation in an outdoor environment with high humidity and a high salt air environment.

9.3.1 Type: Outdoor, station class, metal oxide, gapless

9.3.2 Ratings:

- | | |
|--|----------------|
| a. Nominal voltage: | 34.5 kV |
| b. Maximum voltage: | 36.2 kV |
| c. Duty cycle voltage: | 27 kV |
| d. Maximum continuous operating voltage (MCOV) | 22 kV, minimum |

9.3.3 Color: ANSI No. 70, Light Gray.

9.4 Drain, Isolating, Vacuum and Filter Valves

A two-inch, globe type, combination drain and lower filter valve shall be provided. This valve shall have a built-in 3/8-inch sampling device. A one-inch upper filter valve shall also be provided.

If the transformer is designed for vacuum filling, provisions shall be made on the top of the tank for a vacuum connection.

Isolating valves and other necessary devices shall be provided to allow ready installation and removal of radiators, and drainage of oil from radiators without draining oil from the main tank. Drain, filter and vacuum valves and their handwheel shall be made of bronze.

9.5 Lifting Facilities

Lifting facilities shall be provided for lifting the cover separately and for lifting the core and coil assembly from the tank using four lifting cables. Lifting facilities shall also be provided for lifting the complete transformer using four slings. The bearing surface shall be free from sharp edges.

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9.6 Jacking Facilities

Jacking facilities shall be located near the extreme ends of the junctions of the transformer segments. Minimum dimensions and clearances for jacking provisions shall be specified on the outline drawing.

9.7 Pulling Facilities

Pulling eyes shall be provided for pulling the transformer along the centerline.

9.8 Transformer Base

9.8.1 The transformer base shall be designed to permit rolling or skidding of the transformer in any direction. The base shall be designed so that the transformer center of gravity, as normally prepared for shipment, shall not fall outside the base support for a tilt of the base of 15 degrees from the horizontal, with or without oil in the transformer.

9.8.2 The base shall be fabricated with an adequate number of anchor bolt holes designed to put the transformer base in direct contact, shear and tension, with the transformer concrete foundation at all anchor bolt locations. Anchorage shall be designed to utilize simple ASTM A-307 anchor bolts with heads embedded 12 inches in concrete and with an ultimate compressive strength of 3000 pounds per square inch.

9.9 Nameplate

A diagram nameplate shall be furnished and shall be located near eye level above the base of the transformer. The information furnished shall be in accordance with ANSI C57.12.00, Section 5.12. The Supplier shall also stamp on the nameplate the GPA P.O. Number.

9.10 Liquid Thermometer

The transformer shall have top oil gauges with alarm contacts. A 0-1.0 mA output shall be provided for top oil temperature.

9.11 Liquid Level Indicator

9.11.1 Provide a magnetic level indicator to indicate the level of the insulating liquid. Two electrically separate, normally open alarm contacts shall be provided to indicate both high and low liquid levels.

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9.11.2 A third contact shall be provided to trip for low liquid level. This contact shall be electrically isolated from the alarm contacts and shall be set so that the trip operation is at a lower liquid level than the low-level alarm.

9.12 Sudden Pressure Relay

A sudden pressure relay shall be provided. This relay shall be factory calibrated for the transformer on which the relay is to be used. The relay shall be provided with two electrically separated contacts for alarm and control. The sudden pressure relay shall be provided with an auxiliary lockout relay with hand reset. The auxiliary relay shall have a normally closed contact from the sudden pressure relay, shunting the operating coil of the auxiliary lockout relay. The relay shall be suitable for 125 VDC operation. The relay assembly and location shall allow for removal with the transformer energized.

9.13 Mechanical Pressure Relief Device

A self-sealing, mechanical pressure relief device shall be located on the cover. The relief device shall be furnished with alarm contacts and a visual operation indicator. The indicator shall be resettable with hot-sticks from ground level without the necessity of de-energizing the transformer.

9.14 Core Ground

It is preferred that the core ground connection be above the oil and accessible from the manhole to facilitate testing of the core to tank insulation without lowering the oil. The connector shall be the slotted type with a captive nut connection. The location of the core ground shall be indicated on the transformer outline drawing.

9.15 Auxiliary Power Source

9.15.1 The auxiliary power will be single-phase 120/240 VAC, 60 Hz. The Supplier shall design the transformer controls and accessories to operate on both voltages. The Supplier shall inform GPA of the power requirements needed at the transformer. The terminals provided by the Supplier shall be adequate to receive GPA furnished service conductors.

9.15.2 A 120 VAC, 15-ampere convenience outlet with ground fault protection shall be provided.

9.15.3 Provisions shall be made for an underground 125 VDC incoming supply. All tripping, alarms, and associated devices shall be rated for 125 VDC operation.

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9.16 Centralized Termination and Control Devices Requirement

9.16.1 All equipment alarms, controls, protection and current transformers shall be brought to individually identified terminals centralized in a weather-proof control cabinet mounted on the equipment tank. Adequate hinged doors shall be provided with weatherproof latching facilities. The latching assemblies shall be operated by handles that can be reached by an operator standing at ground level. Each handle shall have provisions for padlocking and be acceptable for weather-proofing the doors in the closed position.

9.16.2 All meters and instruments that require resetting shall be mounted less than six (6) feet above the base of the transformer.

9.16.3 Alarm contacts shall be electrically separated, open during normal conditions, self-resetting and suitable for closing 5 amperes, carrying 3 amperes continuously, and opening 3 amperes at 125 VDC.

9.16.4 Control contacts shall be electrically separated, open during normal conditions, self-resetting and suitable for closing 30 amperes, carrying 10 amperes continuously, and opening 3 amperes at 125 VDC.

9.17 Instrument and Control Wiring

9.17.1 THW or THWN wires used by the Supplier shall be of the machine-tool type with 3/64" polyvinyl chloride insulation rated 600 Volts, 90 degree C. Other wires with insulation having characteristics that equal or exceed the above requirements for machine-tool type wire are acceptable. The control wire used shall be suitable for wet and dry locations, flame retardant and moisture and heat resistant.

9.17.2 All secondary wire, regardless of type, shall be stranded. The wire shall have adequate current-carrying capacity. #14 AWG shall be used for control circuits, #10 AWG for CT circuits and #18 AWG for SCADA indication.

9.17.3 Those portions of any secondary wiring in the control box, or those portions of any secondary or control wiring or cable that pass through conduit, shall not be spliced. However, junction boxes with terminal blocks as specified above may be used to extend secondary wiring passing through conduits.

9.17.4 Ring-tongue terminals shall be used for secondary wiring. Spade, slotted spade, flanged spade, and hook terminals are not acceptable. Ring-tongue terminals shall be sufficiently strong to prevent their breakage under conditions of vibration inherent in the equipment in which they are installed.

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- 9.17.5 Terminals shall have insulated ferrules whenever either the spacing between the terminals, or their projection above or below the terminal board, or both is such that they can make contact with one another.
- 9.17.6 All wires for external connections shall be properly identified and terminated at conveniently located, easily accessible terminal blocks. All terminal blocks furnished by the supplier shall have No. 10 screws. The screws shall be secured directly into the contact strips and not into nuts embedded in the terminal blocks. The contact strips shall have sufficient thickness to assure that torque applied to the No. 10 screws to hold the terminal to the contact strips will not damage the threads in the tapped holes. The screws shall be firmly secured to the blocks and shall be separated by insulated barriers. Terminal blocks with clamp type fittings are not acceptable.
- 9.17.7 Ring-tongue terminals shall be fastened to the contact strips of terminal blocks with machine screws. Barriers shall separate the contact strips. All circuits shall be protected by molded case circuit breakers. Breakers are to be ambient compensated. The breaker size, supplier's name and catalog numbers are to be shown on the drawings.
- 9.17.8 All control, power, alarm, and auxiliary equipment shall be completely wired at the factory.
- 9.17.9 Hinge wiring and wiring that will be subjected to bending during maintenance or other operations shall be arranged such that the bending or twisting will be around the longitudinal axis of the wire.
- 9.17.10 Wiring shall not be spliced or tapped. All connections shall be made at the device terminals or on terminal blocks.
- 9.17.11 All future, spare and unused contacts and devices shall be wired to terminal blocks.
- 9.17.12 A minimum of ten percent (10%) spare terminal points shall be provided.
- 9.17.13 All wiring external to enclosures or cabinets shall be in rigid steel conduit.
- 9.17.14 All wiring from the transformer components to the cabinets, which may require removal for shipment, shall be installed in place and in such a manner that it is only necessary to connect the wires to the cabinets after they are installed on the transformer.
- 9.17.15 Wiring Format
- a) All terminals shall be numbered, and the numbers shall correspond to the numbers on the wiring diagram.

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- b) All wires shall be identified at their termination points with opposite end designation identification by labeled plastic sleeves or equal. Identification shall correspond to the lettered device, numbered terminal format of the wiring diagrams.

9.17.16 System Phase Rotation

The system phase rotation for the island-wide power system is GPA C-B-A or NEMA 1-2-3 and all equipment purchased under this contract shall be wired and connected NEMA 1-2-3. All phase markings shall be NEMA 1-2-3. The instrument and relay arrangement shall be 1-2-3 left to right with neutral relays underneath phase groupings. GPA will make the external connections of the incoming and outgoing lines such that GPA C-B-A is connected to NEMA 1-2-3. Phase markings C-B-A shall be reserved for GPA's use.

10.0 TANK

- 10.1 The main transformer tank shall be designed to withstand, without permanent deformation, pressures 25% greater than the maximum operating pressures resulting from the system of oil preservation used. The maximum operating pressures (positive and negative) which the transformer tank is designed to withstand shall be indicated on the nameplate.

10.2 Vacuum Filling

If the tank is designed for vacuum filling (essentially full vacuum), radiators and auxiliary compartments such as expansion tanks, when not designed for full vacuum filling, shall be so designated and isolating valves shall be provided.

10.3 Manholes

Provide one or more circular handholes and at least two circular manholes in the transformer top with neoprene or better gasketing material and bolted covers. These facilities must be of sufficient size to allow for the removal of bushing current transformers and to allow for the entrance of a person into the transformer tank (18-inch minimum manhole).

10.4 Ground Pads

In addition to the surge arrester ground pads, two ground pads, drilled and tapped for NEMA four-hole (1/2 inch bolts on 1-3/4 inch centers) connectors, shall be installed on diagonally opposite corners of the base. If the base is removable, the two pads shall be installed on the transformer tank wall near the base. Ground pads shall be copper-faced steel, stainless steel, or non-ferrous pads brazed or welded to the transformer.

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11.0 TRANSFORMER OIL

The Supplier shall furnish an adequate quantity of oil for the first fill of each transformer. Oil designated as "10-C" by the General Electric Corporation, or equivalent, that may be freely mixed with either, shall be used in the transformer. All oil furnished shall be inhibited with DBPC (D1 TERT BUTYL PARA CRESOL). The oil shall have the following characteristic:

- a. Flash Point: Cleveland Open Cup 132 Degrees C
- b. Fire Point: Cleveland Open Cup 145 Degrees C
- c. Specific Gravity at 60 Degrees F: 0.865 to 0.910
- d. Viscosity: Saybolt Universal at 100 Degrees F - 55 - 63 sec
- e. Acidity: 0.02 Mg KOH/gm 0.1 max
- f. Pour Point: -40 Degrees F
- g. Corrosive sulfur: None
- h. Dielectric Strength (ASTM D877): 26 kV Min
- i. Power Factor at 68 Degrees F: 0.0% Max
- j. Interfacial Tension: 40 Dynes/CM
- k. Non-PCB (Polychlorinated Biphenyl) Contaminated:
The manufacturer must mark in a permanent manner that the dielectric fluid is "Non-PCB."
Certified test reports on residual oil remaining in the transformer after factory testing must be provided indicating that the oil is free of PCB.

12.0 TRANSFORMER COOLING

12.1 Heat Exchangers

Heat exchangers must have sufficient capacity to prevent a temperature rise in excess of the specified rating of the transformer. Due to severe corrosion problems, GPA requires heat exchangers made of stainless steel tube and stainless steel fin construction. Aluminum or Copper heat exchangers are not acceptable. Heat exchangers shall be removable from the main tank without the need to drain oil from the main tank.

12.2 Radiators

No accessories or pipes shall be installed above the radiators for easy installation and removal of the radiators during maintenance.

13.0 LOSS EVALUATION

- 13.1 Each bidder shall submit with his bid the guaranteed average load and no-load losses on each transformer submitted on this bid. Guaranteed load losses shall be provided at the transformer's self-cooled (OA) rating and a reference temperature of 85 degrees C (65 degree rise + 20 degrees

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C ambient). The requirements and definitions of ANSI Standard C57.12.00-1987, Sections 5.9 and 9.3, shall apply unless excepted by this specification.

- 13.2 Guaranteed losses will be evaluated by the Authority in accordance with the Bidding Schedule to determine the equivalent first cost for owning and operating each bid item. Guaranteed transformer losses will be evaluated at \$6,640/KW for excitation (no load) losses.
- 13.3 The contractor shall test each transformer for no-load losses. This test data shall be certified as correct and submitted to the Authority prior to or at the time of shipment.
- 13.4 The Authority will review and consider actual no-load losses for each transformer. In the event that the average evaluated losses for like units exceeds the average guaranteed losses; the Contractor will be penalized at the above rate for the difference. No-load loss penalties will be assessed independently. Bonuses will not be awarded for actual average losses that are less than guaranteed. In addition, the Authority may reject any transformer with no-load losses greater than the tolerances indicated in ANSI Standard C57.12.00-1987, Section 9.3.

14.0 CLEANING, PRESERVATION AND PAINTING

All metal surfaces shall be thoroughly cleaned of rust, welding scale, and grease, and shall be treated to effect a bond between the metal and paint to prevent the formation of rust under the paint. A priming coat shall be applied immediately after the bonding treatment. A final finish shall consist of two coats of paint. The exterior final coat shall be ANSI 45 light green.

15.0 QUALITY CONTROL

The Supplier shall have a quality control program to ensure compliance with the requirements of this specification. The program shall be documented and available for GPA's review if requested.

Documentation of the quality control program shall indicate where in the production and manufacturing process the quality checks are taken, describe the purpose of the checks, and describe the nature of the checks, i.e. if the checks are visual only or if electrical or mechanical testing is used.

16.0 SHIPPING REQUIREMENTS

- 16.1 Because of severe transportation conditions, the Supplier shall pay particular attention to the proper packaging and bracing of the apparatus to assure its safe arrival.
- 16.2 The Supplier shall prepare all materials and equipment for shipment in such a manner as to protect from damage in transit. All small parts and unit components shall be separately boxed or bundled to prevent galling due to rubbing of one part against another. Each item, box or bundle

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shall be plainly and individually identifiable for content according to item number, GPA P.O. Number, and Supplier's Identifying Number.

- 16.3 A complete itemized Bill of Lading, which clearly identifies and inventories each assembly, sub-assembly, carton, package, envelope, etc., shall be furnished and enclosed with each item at the time of shipment.
- 16.4 Openings in the transformer tank or radiators resulting from the removal of parts for shipment shall be identified and securely sealed against the entrance of moisture and foreign materials. Covers shall be of sufficient strength to resist puncture.

EFFECTIVE DATE: 11/20/98

ISSUED:

Christian [Signature]

APPROVED:

JE [Signature]