REQUEST FOR BID
BID NUMBER 240805

ADDENDUM NO. 1

Date: May 30, 2024

Re: DEER PARK SUBSTATION TRANSFORMER

To: ALL PROSPECTIVE BIDDERS

This Addendum No. 1 forms a part of the Contract Documents and modifies the original bidding documents dated May 15, 2024. This Addendum is issued to clarify, revise, add to, or delete from the original bidding documents. Bidders shall determine the work affected by the Addendum items.

This Addendum consists of:

MODIFICATION TO SECTION III - SPECIFICATIONS

SECTION III – SPECIFICATIONS has changed

1.) **The primary transformer voltage specifications from 114kV to 115kV.**
2.) **The shipping height restriction has been removed.**

This addendum consists of nineteen (19) pages. **THIS ADDENDUM SHEET MUST BE ACKNOWLEDGED IN BID SUBMITTAL ON SECTION II - PROPOSAL.**

REVISED SECTION III

SPECIFICATIONS FOR MATERIAL
BID NUMBER 240805

1. GENERAL

These specifications cover a 3-phase power transformer rated 20/26/33 MVA with LTC in accordance with the following descriptive specifications. The equipment shall conform to the latest applicable IEEE, ANSI, and NEMA standards. All equipment furnished shall be guaranteed for a period of not less than one (1) year after the unit has been energized or eighteen (18) months after receipt, whichever comes first. In addition, any defect in the design or manufacture discovered by the manufacturer and/or the purchaser in the warranty period shall be corrected to the purchaser's satisfaction at no cost to the purchaser. The equipment manufacturer must have service and repair facilities capable of complete overhaul. The equipment is required to meet OSHA standards.

2. TYPE

Three-phase, outdoor, 60 Hertz, oil-immersed 55°C average winding temperature rise, 80°C hot spot winding temperature rise, rated for elevation up to 3,300 feet. The unit shall be shipped with oil. Provision shall be made for the carrier to deliver on Monday thru Thursday, except for District recognized holidays, between 7 a.m. and 3:00 p.m., and arrival date must be specified two (2) weeks prior to arrival.

3. RATING

Number of Phases	Three (3)
Coolant	Oil
Frequency	60 Cycle
Capacity: Self-Cooled - 55°C Rise First Stage Forced-Cooled Second Stage Forced-Cooled	 20,000 kVA 26,667 kVA 33,334 kVA
High Voltage	115,000 Volts Delta
High Voltage BIL	450 kV
Low Voltage	12,470 / 7,200 Volts Wye
Low Voltage BIL	110 kV
Impedance @ 12,000 kVA or 20,000 kVA Base	8.5%
Polarity	Subtractive

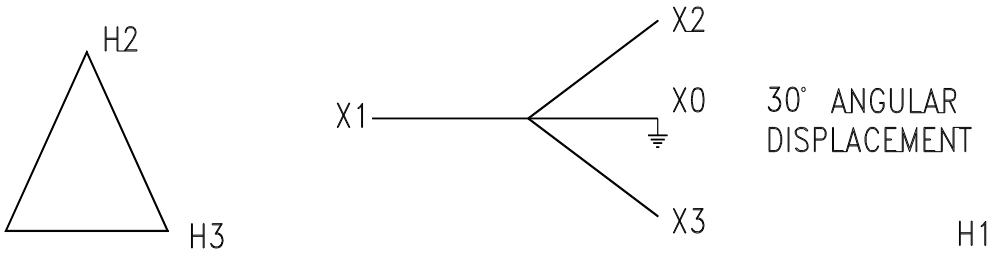
All ancillary devices including all leads, and bushings, shall be sized to 150% of 30˚C ambient rating of the transformer.

4. HIGH-VOLTAGE WINDING

Rated Voltage	115,000 Volts Delta

The high-voltage winding shall be rated for 115,000 volts delta with a BIL of 450 kV.

A high-voltage tap changer for de-energized operation with operating handle brought outside the tank will vary the winding from 5% above rated voltage to 5% below rated voltage in five 2.5% steps. The angular displacement between the high-voltage and low-voltage windings shall be as indicated below:



5. LOW-VOLTAGE WINDING

Rated Voltage	12,470 / 7,200 Volts Wye

The low-voltage winding shall be rated for 12,470 Y/7,200 volts with a BIL of 150 kV.
The three phase automatic-manual load tap changer shall be designed to vary the 12.47 kV winding from 10% above rated voltage to 10% below rated voltage in thirty-two 5/8% steps. (Taps shall be per ANSI C57.12.00). All taps below 12.47 kV shall be for use at a current equal to the transformer current at full rated KVA and 12.47 kV. All taps above 12.47 kV shall be full KVA rated. Tap changer design shall be vacuum reactor 3 phase on-tank, Reinhausen Vacutap RMV-II or equivalent.

6. WITHSTAND REQUIREMENTS FOR WHICH WINDING INSULATION SHALL BE DESIGNED

	Terminal H_1, H_2, H_3	Terminal H_0	Terminal X_1, X_2, X_3	Terminal X_0
a. Full wave impulse	350 X 450	NA	110	110
b. Chopped wave impulse	400 X 520		130	130
c. One-minute app. pot.	140 X 185		34	34
d. 7200-cycle ind. pot. L-G	140 X 185		34	
e. 7200-cycle ind. pot. L-L	140 X 185		34	

Note: (a) and (b) are kV crest, between terminal and ground; (c) is kV rms, to other windings and ground; (d) is kV rms, between terminal and ground; (e) is kV rms, between terminals of adjacent phases.

7. CONSTRUCTION

The transformer shall be constructed of only the highest quality materials. All insulation material shall be of the thermal upgrade type. All blocking material shall be high-density pressboard. The winding tube shall be made of a high-strength and high-temperature material. The Bidder shall state the origin and winding tube material in their proposal.

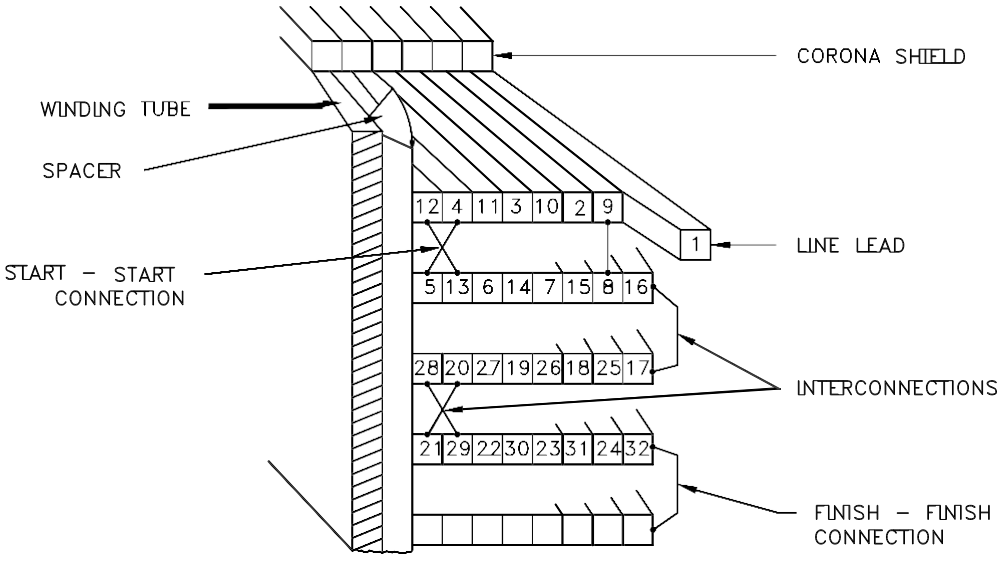
The Bidder shall be able to demonstrate the design of the insulation system employed through finite element methods. An acceptable demonstration would be the availability of static voltage plots for each of the voltage configurations.

The coils will be disc- or helical- type, pre-sized, clamped, and braced to provide adequate short-circuit strength. The Bidder shall submit with the bid a drawing or picture showing the coil bracing system to be used in the transformer.

Vertical clamping force shall be uniformly applied to the entire horizontal surface of the one-piece upper and lower pressure plates. Any system using jacking bolts to apply pressure to the coils shall not be allowed. The inter-disk spacers shall have keys on both the inner and outer ends of the spacers.

The ampere turns per unit height of all windings including, but not limited to, high voltage, and low voltage windings, shall be equal from the top to the bottom of the winding. Rectangular winding shall not be allowed by the District. Only round windings with copper conductor shall be allowed by the District.

The Bidder shall submit with the bid a drawing showing the coil winding and interconnections of the type shown below. (This drawing is only to show the type of drawing required and does not indicate that this type of winding configuration is necessarily preferred by the District.)



When the winding of the coil is complete and prior to assembly on the core, the coil will be pre-sized. The pre-sizing process will consist of drying the individual coils, and then the individual coils will be pre-sized by hydraulically pressing the coil to the calculated pre-loading stress to determine the height of the coil. All coils will be sized to the same height. Preference will be given to a manufacturer that individually dries the coils via the vapor-phase process and

impregnates the coils with insulating fluid while the coils are under full vacuum.

The core shall be circular, built with the highest quality grain-orientated silicon core steel, and the core shall be epoxy-coated to help reduce the noise level of the transformer. Each layer of the core steel shall be sequentially cut and stacked in the same order as the core steel is cut. The top and bottom yolks of the core shall be single sheets of steel that run the full length of the yolk to minimize the number joints in the core. Scrap-less mitered cores shall not be allowed.

The core will be supported with a combination of epoxy and blocks of high-density and high-temperature material. The insulation between the core and the end-frames to support the core laminations and distribute the top and bottom frame pressure will be blocks of high-density and high-temperature material.

8. INTERNAL FRAMES AND BRACING

The core-and-coil assembly shall be positively located in the bottom of the tank. The top frame of the core-and-coil assembly shall be bolted to all four tank walls or braced to all four tank walls and the transformer cover to prevent movement in both the vertical and horizontal directions. Slotted bolt holes shall not be employed. No welding will be allowed in the tank once the core-and-coil assembly is placed in the tank.

9. INTERNAL CONNECTIONS

All connections of windings to leads shall be made by brazing or a full-circumference crimp connection to ensure a tight bond with the conductor. All power leads shall be routed through high-density tubing for straight runs of distances greater than 12 inches. All leads shall be rigidly clamped within a lead support structure that fully supports the weight of the leads and the forces exerted on then during a short-circuit condition. Leads shall not be attached to inter-phase barriers.

Lead support structures shall be attached to end-frames on supports welded to the end-frames. No studs shall be shot on the end-frames without fully welding around the perimeter of the stud. No ties of nylon or other plastic material shall be used. Lead support structures and insulation shall be connected by non-conducting fiber bolts. Fiber bolts shall be epoxy-locked or use two (2) nuts on each to ensure against loosening. No black iron or steel bolts shall be used.

10. TANK

All tanks shall be made of steel. The tank shall be designed for a maximum pressure of 15 psi and to withstand full vacuuming. The tank wall reinforcement shall be fully enclosed with all seams, joints, and end plates continuously welded on flat surfaces of the tank. All tank seam welds shall fully penetrate to the inside of the tank. Only stainless steel studs shall be used on the tank and the studs shall be completely welded around the perimeter of their base. All bolted hardware shall be stainless steel, silicon-bronze, or brass.

The tank cover and external features shall be designed to prevent the collection of water. Doming the tank cover by flexing and welding it to the main tank or any other means that places stress on the cover weld or main tank shall not be allowed except where the top frame of the core-and-coil assembly is rigidly connected to the transformer cover. All external devices that are connected to the top of the transformer via a gasketed connection shall have the gasketed connection elevated a minimum of one (1) inch above the cover of the tank via a collar continuously welded to the top of the tank. The completed tank shall be tested to ensure the tank

can hold the maximum pressure for a period of 24 hours.

11. BUSHINGS

High-voltage line bushings will be located on the transformer cover in ANSI Segment 3. All high-voltage bushings shall have a minimum current rating of 400 amperes with transformer draw-leads. All high-voltage bushings shall have a minimum 550 kV BIL rating and a minimum creepage distance of 79 inches. All porcelain bushings shall be liquid-filled with liquid level indication, and all porcelain portions of the bushings shall be one-piece; i.e., porcelain portions made up of two pieces of porcelain with a porcelain-to-porcelain seal will not be allowed.

Three (3) LV phase and one (1) LV neutral bushing shall be mounted on the transformer cover in ANSI Segment 1.

All low-voltage bushings shall have a minimum current rating of 1,200 amperes with transformer draw-leads. All low-voltage bushings shall have a 150 kV BIL rating and a minimum creepage distance of 17 inches.

All bushings will meet all requirements of the latest ANSI Standard C 76.1 for bushings for power circuit breakers and outdoor transformers. All bushings shall be ANSI 70 Light Gray in color. All bushings shall be Hubbell PCORE.

12. IMPEDANCE

Impedance shall be 8.5 percent at rated voltage and rated self-cooled kVA in accordance with the latest ANSI C57.12.10 (impedance specified is for 115 kV connection).

13. COOLING

The transformer shall be designed for continuous self-cooled operation. The self-cooled winding temperature rise by resistance shall not exceed 55°C, and hottest spot winding temperature rise shall not exceed 80°C.

The transformer shall be capable of being loaded continuously to 22,400 kVA self-cooled and to 37,333 kVA with two stages of forced cooling without exceeding 65°C average winding temperature rise by resistance and 80°C hottest spot winding temperature rise. Such operation shall be available without any decrease in the normal life expectancy of the insulation. The nameplate shall indicate this extra capacity.

The complete transformer, including external components (bushings, etc.), as well as internal components, shall be suitable for overload operation in accordance with ANSI C57.92, NEMA TR-98, and IEEE 5071D5.

Cooling class of transformer with self-cooled rating only shall be ONAN. Cooling class of transformer with self-cooled rating and one forced-cooled rating shall be ONAN/ONAF. Cooling class of transformer with self-cooled rating and two forced-cooled ratings shall be ONAN/ONAF/ONAF, ONAN/ONAF/OFAF, or ONAN/OFAF/OFAF.

The cooling equipment shall be controlled from winding hot-spot temperature. Winding temperature equipment shall be furnished as follows (necessary current transformers shall be in addition to the current transformers specified in Item 17):

a. Each set of equipment specified shall include a dial-type temperature-indicating relay; dial indicator design and mounting arrangement shall permit reading from ground level near the transformer.

b. Two-winding transformer, or three-winding with tertiary buried: one set, to simulate the hot-spot temperature in the low-voltage winding. Three-winding transformer with tertiary terminals brought out: three sets, one to simulate the hot-spot temperature in each winding (corresponding contacts of the three relays shall be wired in parallel).

c. Transformer with self-cooled rating and one forced-cooled rating: each relay shall have three contacts to start initial or future forced-cooling equipment at 70°C, actuate District's alarm at 95°C, and trip District's switching device at 110°C, respectively. Transformer with self-cooled rating and two forced-cooled ratings: each relay shall have four contacts to start first stage initial or future forced-cooling equipment at 70°C, start second stage initial or future forced-cooling equipment at 75°C, actuate District's alarm at 95°C, and trip District's switching device at 110°C, respectively. All contact settings shall be adjustable. There shall be a fan stage selector switch so that the stage 1 and stage 2 fans can be alternated to extend the life of the fans.

   Each winding temperature relay shall be provided with means to check calibration of the relay.

d. For all transformers with self-cooled rating to 10,000 kVA and above (three-phase or single-phase), all radiators shall be removable. In conjunction with removable radiators, manufacturer shall furnish suitable valves on the transformer side of the radiator mounting flanges, and top and bottom pipe taps with plugs (minimum 1/2-inch) on the radiators, to permit draining and removal of the radiators without draining oil from the transformer tank. Removable radiators shall be equipped with lifting eyes, and so designed that they can be handled without the addition of special bracing.

e. If cooling equipment includes oil circulating pumps, oil flow indicator with alarm contact shall be furnished for each pump to indicate low oil flow; if pumps are future, necessary provisions shall be furnished for future installation of oil flow indicators. Oil pumps, initial or future, shall be located near foundation level; manufacturer shall furnish suitable valves on both sides of each pump (or each location of a future pump), and pipe tap with plug (minimum 1/2-inch) at the lowest point on the pump section between the valves, to permit draining, removal, and reinstallation of pump (or installation of future pump) without draining oil from the radiators or the transformer tank. The power supply to pumps shall not be made through connectors that must also seal the oil system.

f. Cooling fans, initial or future, shall be located only on the sides or bottom (not on the top) of the radiators to provide maintenance accessibility with adequate safety clearances from transformer live parts.

g. For all transformers with self-cooled rating 5,000 kVA and above (3-phase or single-phase), an auxiliary relay shall be furnished to provide alarm indication of loss of power to the cooling equipment, with 30-second time delay to avoid alarming for momentary loss of power; if forced-cooling is future, necessary provisions shall be furnished for future installation of the auxiliary relay.

h. Weatherproof compartment shall be furnished on the transformer to house initial or future auxiliary (loss-of-power) relay, control contactors, switches, etc.; center of compartment shall be approximately five (5) feet above foundation level. If cooling equipment is

specified to be initially installed, manufacturer shall also furnish all necessary wiring, including connections between the cooling equipment control compartment and the terminal box (Item 16); if cooling equipment is to be added in the future, manufacturer shall furnish conduit only for future wiring. The compartment shall be a minimum size of 24" x 24" x 6" with a piano hinge and 3-point latch on door(s). In addition to the items mentioned above, the compartment shall contain an OFF-AUTO-HAND switch for each stage of cooling, and the compartment shall be furnished with thermostatically controlled heater.

14. LOAD TAP CHANGER

The transformer shall be provided with automatic tap changing under load equipment to give 16 approximately 5/8-per cent taps above and below each low voltage rating.

Per ANSI standards, the transformer will be capable of supplying rated KVA at nominal voltage, and all steps above nominal voltage and current equal to rated KVA at nominal voltage for all steps below nominal. The load tap changer shall be designed to supply 500,000 operations regardless of which tap position those tap changes may occur.

The tap changer shall be of the vacuum-diverter reactive design. The Bidder shall list in the Proposal section the type and electrical rating of the tap changing equipment the Bidder will provide.

Each tap of the regulating winding shall be fully distributed over the entire coil height and wound such that the amp-turn per height ratio of the high voltage winding, the low voltage winding, and each tap of the regulating winding are all equal.

All arcing contacts of the tap changer shall be in a separate compartment. The compartment shall be oil-filled with oil level gauge and pressure control contact that closes if there is an unusual pressure rise within the tap changer compartment. In addition, the tap changer compartment shall be able to withstand a full vacuum.

The tap changer shall have a direct-drive position indicator, with electrically resettable drag hands. The position indicator shall be easily read from the ground with opening all doors. Any control cabinets required for the LTC shall meet the requirements of Item 16 of these specifications.

The automatic static controls shall include the following:

(1) External source connection terminals.
(2) Voltage source switch.
(3) Control power circuit breaker (or equivalent).
(4) Band width adjustment (1.0-6.0 volts).
(5) Neutral indicating light.
(6) Electrical reset button for drag hands.
(7) Resistance compensator.
(8) Polarity switch.
(9) Reactance compensator.
(10) Compensator polarity switch.
(11) Voltage level adjustment (adjustable 106-135 volts).
(12) Automatic-manual transfer switch.
(13) Operation counter.

(14) Band edge indicator.
(15) Voltage test terminal.
(16) Time delay - continuously adjustable 5 to 120 seconds.
(17) Complete integrity controls for vacuum bottle interrupter only.
(18) Upper voltage limit control, adjustable from 104 volts to 120 volts, and lower voltage limit control, adjustable from 120 volts to 136 volts.
(19) Over-current blocking.
(20) Reverse Power Flow Indicator and automatic LTC shutdown on the existing LTC position when a reverse power flow condition is detected and the LTC remains shut down until the reverse power flow condition is no longer present, together with a customer-usable contact for remote indication that a reverse power flow condition exists.
(21) The LTC control shall be furnished with serial (Fiber) and ethernet data port that is designed to be connected to a Remote Terminal Unit (RTU) via DNP 3.0.
(22) The LTC control shall be furnished with remote motor operation that allows automatic control of the LTC motor to be disabled and allows manual control and shutdown of the LTC motor.
(23) The LTC control shall have an RS-232c communication port over which the tap position shall be remotely available.

Data Package with liquid crystal display with the following capabilities:

(1) Present power factor including leading or lagging designation, together with most lagging and most leading power factor.
(2) Present and maximum current.
(3) Present together with maximum and minimum voltage
(4) Present compensated voltage.
(5) Diagnostics codes.
(6) Minimum and maximum reset button.

The tap changer compartment shall be equipped with the following accessories:

(1) Oil drain valve, sampling device, and filter press connections.
(2) lnternal motor power supply and terminals for external motor power supply.
(3) oil filter system for resistive type under load tap changer. The system shall be of an anti-siphon design and will include the following:
    (a)1 1S-volt single-phase reversible pump motor and a 3-way valve for draining the filter through reverse motor action for quick, no-mess, filter change-out.
    (b)Heavy-duty, self-priming, positive-displacement pump with built-in pressure relief valve.
    (c)Internally and externally epoxy-coated filter vessel housing a 112 micron water-removing filter cartridge and an air vent.
    (d)Stainless-steel ball valves for the isolation of the system and the isolation of the filter vessel for filter cartridge change-out.
    (e)Filter vessel will be equipped with a differential pressure switch with reset and indicator light.
    (f) A flow switch with reset, delay timer, and indicator light.
    (g) A manual/automatic control switch with indicator light.
    (h) Seven-day programmable timer.
    (¡) The system will be housed in a NEMA 13 or NEMA 4 control box with thermostatically controlled cabinet heaters and louvers and dust filters.
(4) The load tap changer compartment breather will be equipped with maintenance-free silica gel breather. The maintenance-free breather will contain 1,100 grams of silica gel dessicant that is

automatically dried on demand, Messko MTRAB DB100 or similar.

15. GASKETS

All manhole openings, bushing busses, or risers and any other areas where bolting is necessary will be provided with machined surfaces with a gasket groove to limit compression of the gasket material. All gasket material shall be reusable nitrile.

16. TERMINAL BOX AND CONTROL WIRING

a. All auxiliary power and control wiring shall consist of highly stranded copper switchboard wire, 600-volt class, with insulation (or outer covering over the insulation) that is flame-retardant and heat-, oil-, and moisture-retardant. Wiring runs shall be in conduit except for short flexible leads from conduit boxes to fans, pumps, and relay and alarm devices; each of these leads shall be furnished with separable, weatherproof connector. Both ends of all wires and all terminal block points shall be clearly marked with the designation shown on manufacturer's wiring diagrams.

b. All devices shall be identified with permanently attached labels that correspond to the wiring drawing provided by the manufacturer. All wiring shall be connected to the devices, which includes all terminal blocks, with non-insulated ring type compression lugs of the appropriate size.

c. Auxiliary equipment and all relay contacts shall be suitable for the District's motor and control power supply voltages of 120/240 volt single-phase A.C. motor and control power and 48 volts D.C. control power.

d. Weatherproof terminal box shall be furnished containing terminal blocks for terminating all auxiliary equipment wiring, including wiring from cooling equipment control compartment, all alarm and relay contacts, and all current transformer secondary loads (separate short-circuiting type terminal block shall be furnished for the wiring from each current transformer). District will bring all external auxiliary power and control wiring in conduit to the terminal box; removable bottom plate shall be furnished on the terminal box for drilling by District. Center of terminal box shall be approximately five (5) feet above foundation level.

e. Alarm and relay contacts shall be normally open, ungrounded. Both sides of each contact shall be isolated from all other contacts and independently wired to the terminal box.

f. All relays supplied or installed by the transformer manufacturer shall be Square D Type XO.

g. The weatherproof terminal box shall be a minimum size of 24" x 24" x 6" with a piano hinge and 3-point latch on door(s). The terminal box shall be aluminum or stainless steel construction. In addition to the items mentioned above, the compartment shall be heated by a thermostatically controlled heater.

h. Control circuit wire size shall not be less than 12 AWG except when wiring to customer-specified devices that will not accept 12 AWG. In this case, the largest wire size that the device will accept shall be used. All power circuit wiring shall be sized and protected for the current and voltage required.

i. All current transformer secondary wiring shall be 10 AWG.

17. CURRENT TRANSFORMERS

The three (3) high-side bushings shall be furnished with 600:5 multi-ratio bushing current transformers with fully distributed windings and a minimum relaying accuracy class of C400, fully distributed windings, and a rating factor of 2.0.

The high-side current transformers shall be of the 5-lead type with ratios as listed in ANSI C57.13-1968, Table 8.

The four (4) low-side bushings shall be furnished with 1200:5 busing current transformers with fully distributed windings and a minimum relaying accuracy class of C400 and a rating factor of 2.0.

All wiring between the C.T.s and the terminal box shall be in rigid conduit, seal-tight flexible conduit, or shielded cable.

18. OIL PRESERVATION

The transformer will be provided with a sealed tank design which the space above the insulating fluid is purged and filled with dry nitrogen.

The transformer shall have sealed tank construction with welded cover. During welding of the transformer cover, an asbestos or similar inorganic gasket will be permanently located between the cover and the tank flange to prevent the entrance of weld spatter into the tank. Transformer tank shall be designed for full-vacuum filling of the transformer.

The manufacturer shall furnish the necessary quantity of insulating oil. Manufacturer shall make every effort to see that the oil furnished is not contaminated with other substances and certify that the oil contains 0 ppm of PCB.

The mineral oil shall be inhibited against oxidation with 0.3 percent by weight of DBPC.

The transformer shall be supplied with a constant pressure system. The constant pressure system shall consist of a nitrogen bottle, 3-stage regulator, pressure gauge, and alarm contacts. The system shall always maintain the nitrogen pressure in the transformer tank between 0.5 psi and 5 psi. The alarm contacts shall be set so that the low-pressure alarm contacts close whenever the tank pressure drops below 0.2 psi, the high-pressure alarm contact closes whenever the tank pressure exceeds 6 psi, and the low-cylinder-pressure alarm contacts close whenever the cylinder pressure drops below 200 psi.

The nitrogen inlet line and the gas space sampling line shall be positioned at opposite end of the tank. This allows for correctly measuring the oxygen content of the transformer while simultaneously filling the gas space with nitrogen.

For transformer designs that use a conservator oil-preservation system, the constant pressure system described above will not be required. The conservator oil-preservation system shall use an expansion membrane to avoid direct contact between the transformer oil and the ambient air. The conservator oil-preservation system will also include a Buchholz relay between the transformer tank and the conservator. The air pipe between the conservator and the ambient air

shall be equipped with a Waukesha Electric System maintenance-free air dryer Part No. 1030-011K.

19. TRANSFORMER DRYING

The core-and-coil assembly shall be dried via the vapor phase process.

20. CORE GROUND

The core ground connection shall be made within the tank, but accessible through the hand-hole and/or the manhole, and removable without lowering the oil level within the tank.

21. TRANSFORMER GAUGES AND FITTINGS

The following standard accessories shall be furnished with location in accordance with the latest ANSI Standards. Dial-type gauges and valves shall be grouped together on the LV side of the transformer for easy accessibility and maintenance. None of these items shall protrude beyond the floor space determined by the radiating surfaces. All gauges over 96 inches from the floor shall have their faces tilted down at an angle of 30° from the vertical. All gauges shall be tropical/high humidity rated (IP65 or better). Wells for thermometer bulbs and liquid level gauge floats shall be outside the main tank so as not to require removal for untanking.

a. Magnetic liquid level gauge (with alarm contacts) set to close at minimum safe operating level and with trip contacts set to close at a level 2 inches below the alarm contacts.

b. Dial-type oil thermometers (one indicating top oil temperature and one indicating hot spot temperature). The top oil thermometer shall have three (3) adjustable contacts; one set to close at 65°C, one set to close at 80°C, and the third one set to close at 95°C, and adjustable up to 110°C. The winding thermometer shall have four (4) adjustable contacts; one set to close at 70°C, one set to close at 75°C, one set to close at 95°C and the fourth one set to close at 110°C, and adjustable up to 140°C.

c. Pressure vacuum gauge with alarm contacts to indicate high and low transformer gas pressure.

d. Purge valve on the constant pressure system, together with low N_2 cylinder pressure alarm.

e. Globe-type combination drain and lower filter valve (2" screw end) with sampling device (3/8"). The drain valve and the oil sampling valve shall be located so as to allow draining or sampling from the bottom surface of the tank.

f. Glove-type upper filter valve, 1" screw end.

g. Lifting eyes for cover only or for the cover together with the core-and-coil assembly.

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h. Facilities for lifting core-and-coil assembly from tank without a spreader bar.

i. Lifting lugs for lifting complete transformer.

j. Base designed for rolling, provision for pulling in both directions of centerlines of segments.

k. Jacking provisions at four corners of the base.

l. Two (2) ground pads with two (2) tapped holes for tank grounding on diagonally opposite corners of the tank.

m. Neutral bus from the neutral bushing to the ground pad.

n. One (1) or more hand-holes or manholes in the cover.

o. Cover-mounted mechanical pressure relief device with automatic resealing-resetting operation and mechanical signal for indication of device operation. Indicator design and mounting arrangement shall provide visibility from ground level near transformer.

p. QualiTROL rapid-pressure relay mounted on cover with latching relay mounted in terminal box.

q. Stainless steel diagrammatic nameplate with etched (not painted) surface.

r. A 3M DBI-SALA Uni-Anchor mounting plate shall be welded on top of the transformer in a central location.

s. All gaskets shall be of reusable nitrile rubber or equivalent with means provided for controlled compression.

22. PROVISIONS FOR FUTURE INSTALLATION OF A HYDRAN

A 1-1/2” ball valve with 1-1/2” NPT female thread shall be provided on a radiator return (lower manifold) for the future installation of a Hydran.

The output end of the valve shall be not more than 6-1/2 inches from the oil flow.

If the valve is installed on a manifold that has a cooling pump, the valve shall be located on the outlet side of the pump.

A threaded cap shall be provided for the valve.

A clear space approximately 24” vertical by 12” horizontal shall be provided on the tank wall in the vicinity of the valve for the future installation of the electronic unit. Mounting brackets shall be provided in this space.

The mounting brackets shall consist of two 6” lengths of 3” C-channels welded to the tank with the “C” on both channels facing the bottom of the tank with 15-3/8 inches between the tops of the two C-channels (or something similar).

23. CLEANING AND PAINTING TRANSFORMER

All surfaces of the transformer, tanks, covers, panels, etc., shall be thoroughly cleaned by de-

greasing and abrasive blasting to remove grease, scale, rust, and corrosion. All surfaces shall then be given at least one (1) primer coat.

The exterior surface of the transformer tank, covers, metal barrier, and the interior and exterior of panels, etc., shall be given two (2) coats of finish enamel. Color - ANSI No. 70 Sky Gray, low-gloss, Alkyd Resin Enamel.

The interior of all control cabinets and the tank shall be painted white.

24. TESTS

Transformer will receive all routine and optional tests in accordance with ANSI C 57.12.90, C 57.12.10, and C 57.15, including the following tests:

a. Cold resistance test on each winding on the rated voltage connection.

b. Polarity and phase relation tests on the rated voltage connections.

c. No-load loss and exciting current shall be measured both at nominal rated voltage and at 110 percent of nominal rated voltage, both before and after impulse tests if impulse tests are specified. Values of no-load loss and exciting current measured after impulse tests, if impulse tests are specified, will be the values used in determining compliance with manufacturer's performance guarantees; these values shall not exceed the values measured before impulse tests by more than 5 percent.

   In addition, after the impulse test, no-load loss tests shall be performed on the unit at rated voltage, together with load loss tests at rated current (22.4 MVA) and at rated voltage.

d. H-winding to X-winding positive sequence impedance shall be measured at nominal rated voltage.

e. Zero sequence impedances shall be measured if transformer is 3-phase core form; impedances shall be recorded in equivalent-T form if applicable.

f. The following shall be calculated, based on measured losses and impedances: regulation at 1.0 and 0.8 power factor, and efficiency at 1.0 power factor and 0.25, 0.5, 0.75, 1.0, and 1.25 times rated load.

g. Temperature test data shall be furnished for an exact duplicate unit, if such a test record is available; data shall include the ratings and serial number of the tested transformer and the date of the tests, in addition to the test results. If such a test record is not available, temperature test shall be performed at the maximum forced-cooled rating (if two or more duplicate units are ordered for manufacture at the same time, the District may elect to require temperature test on only one of such units); dissolved gas analysis shall be performed on transformer oil samples taken immediately before and immediately after temperature testing.

   Manufacturer shall calculate hot-spot winding temperature rise corresponding to the highest measured value of average winding temperature rise at the maximum forced-cooled rating.

h. Capacitance, insulation resistance, and insulation power factor between windings and between each winding and ground shall be measured.

i. Control wiring and contacts shall be tested with 60-hertz potential of 1,500 volts applied for 60 seconds.

j. One-hour 3-phase induced potential and corona test shall be performed. The test voltage to be applied shall be 110 kV rms phase-to-phase and an enhancement voltage level of 125 kV. The test shall be applied for a period of one (1) hour. Test shall be accompanied by continuous monitoring of partial discharge level; level shall be recorded at 5-minute intervals. Measured partial discharge level shall not exceed 100 micro volts (including background).

k. NEMA audible sound level tests without forced-cooling equipment in operation, and with forced-cooling in operation as it will be in service for each forced-cooled kVA rating, may be required if specified by the District (See Section II).

l. Applied potential tests.

m. Induced potential tests.

n. Impulse test on line terminals.

o. Temperature test(s) shall precede all dielectric tests, including impulse and switching surge tests if specified. In accordance with ANSI C57.12.90, impulse and switching surge tests, if specified, shall precede the low-frequency dielectric tests.

p. Manufacturer's test report shall include diagrams showing winding connections (including windings or terminals not being tested) and voltages applied for impulse and switching surge tests, if specified, and for 7200-cycle induced tests.

q. Equipment and general method for corona test, if specified, shall be in accordance with IEEE Transformer Committee Report, IEEE Transactions PAS-86 No. 12, December 1967, "Tests for Damaging Corona on Oil-Insulated Power Transformers."

r. Insulation resistance shall be measured at 2.5 kV DC. Test report shall include actual readings; readings corrected to 20°C, a polarization index for each test connection (the radio of the 10-minute reading to the 1-minute reading); and the make, model, and serial number of the measuring instrument. For measurements between windings, the tank and windings not being tested shall be "guarded". For measurements between windings and ground, test report shall show the condition of windings not being tested (whether "guarded" or grounded).

s. Test for unintentional core grounds shall be performed after loading for shipment.

t. After the transformer is filled with oil at the manufacturer's plant in preparation for performance of transformer tests, a sample of oil shall be taken from the transformer and analyzed to determine the level of polychlorinated biphenyl contamination, if any.

Prior to shipment, the assembled transformer will be liquid-filled and pressure-tested for at least eight (8) hours at the maximum operating pressure for detecting the presence of leaks.

The manufacturer shall notify the District Engineer listed in Section I – Notice and Instructions to Bidders, of the dates the above-referenced tests shall be performed four (4) weeks prior to performing any of the tests and allow for the District to send a representative to witness the testing.

25. EQUIPMENT IDENTIFICATION

The Contractor shall suitably mark all relays (protective, control, auxiliary), control switches, auxiliary transformers, terminal blocks, etc. to conform to markings on wiring diagrams.

26. SHORT-CIRCUIT CAPABILITY

The transformers furnished under this specification shall be so designed and constructed as to be capable of withstanding, without damage, the mechanical and thermal stresses caused by a short circuit imposed on the secondary windings with rated voltage maintained on the primary windings.

The transformer shall be designed to withstand, without damage, five (5) maximum short-circuit current faults per phase limited only by the transformer's self-impedance when connected to an infinite bus and with the current fully offset.

The transformer shall be designed to withstand the above-described test. Any manufacturer not meeting the design criteria listed above or able to supply the test results listed below for a similar 115 kV unit shall submit with their bid, drawings of all design methods used to provide adequate core-and-coil assembly strength to meet the short-circuit requirements stated. If the manufacturer considers these drawings to be proprietary information, the Bidder should seal the drawings in an envelope inside the quotation documents, labeled “Proprietary Information.” These drawings will be examined only by the evaluating engineer and will be returned to the manufacturer after the bid award and without any copies having been made.

The District may reject any bid when, in the judgment of the Engineer, the Bidder has not taken sufficient steps to meet the mechanical short-circuit requirements as listed in the paragraphs above.

The transformer covered by this specification shall meet the Short-Circuit Qualification Requirements given in IEEE Standard 262A-1974 entitled "Distribution and Power Transformer Short-Circuit Test Code" prepared by IEEE Transformer Committee as an amplification of ANSI Standard C57.12.00, Section 10, entitled "Short-Circuit Characteristics."

Performance of short-circuit tests may be considered as a possible additional requirement. The vendor will include, as an alternate, a quotation for the performance of such tests, including the system conditions under which the tests will be performed and the test procedures to be followed. The District will advise the vendor at any time during the engineering and manufacturing cycle whether such tests will be required, but not later than two (2) weeks prior to shipment.

In addition to the above, each bidder shall submit with his proposal a complete listing of all full-sized transformers of his manufacture, in ratings 501 through 50,000 kVA, which have been short-circuit tested. The list shall include all full-sized units tested, whether they were development tests or tests of customer units. The list shall indicate if the test was a development test or a customer test. All development tests shall include all pressures and forces measured

during the test and the values calculated for these same measured pressures and forces. All customer tests shall include a listing indicating if the unit passed on the first test and, if not, the cause of the failure and the type of repair or redesign. Complete ratings shall be given of each unit, and each shall be noted as to whether copper or aluminum windings were used for comparison with that winding material offered on this bid.

In the case of units tested for or by the ultimate customer, indication shall be given on each unit as to whether the test was successful or unsuccessful and, if tested more than once, each subsequent test shall be so listed and appropriate comments given as to design changes made, if any.

27. CONTRACTOR'S DRAWINGS, DATA, AND INSTRUCTIONS

Information to be forwarded after receipt of contract order:

a. Approval Drawings

Manufacturer shall furnish three (3) prints each of outline drawings of the transformer and connection, including bushing stud size, and schematic drawings of the transformer for approval to the District Engineer. All dimensions and quantities shall be designed and given in the United States Standards; pounds, gallons, inches, etc. Fabrication of any material or part prior to receiving approval of the drawings shall be at the Contractor's sole risk and expense.

Each drawing supplied by the successful bidder shall bear identification showing the District's contract number, the date of the drawing release, and whether the drawing is for approval or approved for construction. These shall be provided within twenty-one (21) days after receipt of the order.

b. Final Drawings

One (1) each of all drawings, correctly revised in accordance with all approved revisions, shall be furnished to the District, together with AutoCAD copy of all the drawings, within 90 days after receipt of order. To establish a uniform system of manufacturer's drawings, these shall be 24" x 36" in size. Where manufacturer's standard drawing sizes are less than the 24" x 36" size, more than one drawing may be grouped and reproduced to make one 24" x 36". Brown-line or sepia transparencies will not be acceptable.

1) Outline drawings showing location and dimensions of frames and tanks or porcelain enclosures and support, housing, oil or gas drain and fill connections, control cabinet, bushings, potential and current transformers other than bushing type when furnished, terminal connectors, operating mechanism, conduit connections and ground connections, and weight with oil. Drawings shall show minimum vertical or tight-string distance to the bottom of the bushings.

2) Nameplate drawing (including identification of type of winding connection and conductor material used in each winding).

3) Bushing outline drawings.

4) Terminal fitting drawings.

5) Schematic and wiring diagrams showing number, size, and power requirements of fans and pumps; fan and pump control; alarm and relay connections; and current transformer connections.

6) Complete point-to-point wiring drawings shall be supplied for all electrical circuits installed on the transformer by the manufacturer.

7) Three (3) instruction manuals covering receiving, handling, installation, operation, and maintenance of transformer and all auxiliary equipment.

   a) Complete instructions and data for ordering of all parts and accessories.

   b) Complete instructions covering installation, assembly, operation, maintenance, and adjustment of the transformer and all associated equipment. Cuts or drawings or descriptive information shall be provided showing all points where adjustments may be made.

   c) Bushing capacities values for [1] conductor to ground, [2] conductor to potential tap, and [3] potential tap to ground.

   d) Complete instructions for maintenance of bushings, including any special instructions required for disassembly and assembly of the bushing or its parts.

   e) Complete parts list, including a breakdown of all assemblies, including name or description, catalog number, quantity used, and reference by item number on included drawings.

   f) Spare parts list as recommended by the manufacturer, including the information listed in the preceding paragraph.

   g) One set of the following curves and data for the bushing current transformers furnished: [1] for Class C relaying current transformers, typical excitation current curves for each required ratio showing excitation current and voltage applied to the secondary terminals, in accordance with ANSI C57.13, Section 4.9.2(4); [2] approximate resistance at 75°C of the secondary windings, including leads to the first available terminal block, and the number of turns on each tap; and [3] mechanical and thermal short-time current ratings.

   h) A list of the special tools, if applicable, being provided by the manufacturer.

8) Test circuit diagram, calibration curves, and complete factory test data for winding hot-spot temperature equipment.

9) Certified test reports (for each transformer) including loss tests. Losses will be measured using the three wattmeter method with 0.1 percent accuracy for instruments, transformers, and meters. Instruments, transformers, and meters used in the loss testing shall have been calibrated to NBS within the last year from the date the unit is tested. The loss test system used to measure the transformer losses shall be capable of measuring the losses within 5 percent at

the power factor represented by the transformer.

28. SHIPMENT

Shipment will be by road with all oil-filled equipment full. Proper measures will be taken to protect the equipment, accessories, and spare parts from moisture and damage in transit. A sweep frequency response test shall be supplied for comparison with field results. The shipping papers shall include the District's contract number, together with the ambient temperature and gas pressure at the time of shipment.

Overweight/oversize restrictions may be in effect and the shipping company must verify this when planning their route.

Provisions shall be made for the carrier to deliver the transformer Monday through Thursday, except for District-recognized holidays, between 7:00 a.m. and 3:00 p.m. The delivery date must be specified two (2) weeks prior to arrival by contacting project manager listed in Section I – Notice and Instructions to Bidders.

29. SUPERVISION AT START-UP

The successful bidder shall supply an experienced representative, factory-trained, for technical guidance, advice, and counsel in the assembling and installation of this transformer to ensure its proper operation. The representative shall witness the initial energization of the substation and make appropriate checks to make sure that the substation is in proper operating condition and educate the District's personnel in the proper operation and maintenance of the gear. The per-diem rate of such supervision shall be stated at a daily rate, but not included as part of the equipment bid. Actual installation and assembly of this gear shall be done by others and is not a part of this Contract.