PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This Specification outlines the electrical, mechanical, and safety requirements of three phase, 60 Hz, “less flammable” fluid-immersed, such as Enviro-Temp or BioTemp, 55°C/65°C rise self-cooled, tamper-resistant, radial connected, pad-mounted transformers having 12,470V or 4160V delta wound high voltage primary winding with primary disconnect and primary current limiting fusing, and 480Y/277V or 208Y/120V solidly grounded wye wound secondary winding. Voltage ratings to be as shown on plans.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Division 1 requirements.

B. High voltage cable, terminations, and splices: Section 26 05 13.

1.03 DESCRIPTION OF WORK

A. This Section includes Specifications for purchasing installing, testing and energizing the transformer and equipment. Contractor shall conform to all requirements of this Section, including quality assurance, submittals, product handling, and warranties, as applicable for the specific extent of furnishing or installing responsibilities. Contractor shall confirm and verify with Owner all installation conditions that may affect furnishing specified equipment. Contractor shall confirm and verify with Owner all characteristics (including specific models, types, and similar properties) and conditions of equipment that may affect installing equipment.

1.04 QUALITY ASSURANCE

A. Manufacturer’s qualifications: All manufacturers, if awarded a purchase order, are required to perform or provide ANSI tests on one transformer, representative of each VA size and secondary voltage to be furnished. Tests shall demonstrate 100% compliance with requirements of ANSI C57.12.00 and C57.12.90. The cost of tests and certified test reports shall be borne by manufacturer and be made a part of the quoted transformer price.
B. Workmanship and material:

1. The intent of this Specification is to secure for Owner apparatus of first-class workmanship in all respects. All components shall be manufactured, fabricated, assembled, and finished with workmanship of the highest quality throughout and in accord with the best recognized correct practice.

2. All materials shall be new, of first-class quality and suitable for conditions specified.

3. All materials used in manufacture of the apparatus shall conform to the latest standard of the American Society for Testing Materials (ASTM).

4. All electrical design, materials, tests, and construction shall conform to the latest applicable standards of the American National Standards Institute (ANSI), the National Electrical Manufacturers Association (NEMA), unless specifically excluded by this Specification. In case of conflicting requirements of these standards, the more stringent shall apply.

5. Manufacturer's agent shall notify Owner in writing if manufacturer has any reason for deviating from the above standards. Contractor shall state exactly the nature of the change and the reasons for making the change.

6. The finished product shall be complete in all respects and shall fully conform to the description thereof set forth in this Specification.

C. Reference standards: Except as otherwise specified herein, all construction, characteristics, requirements, test, definitions, terminology, VA, and voltage designations shall be in accordance with the latest edition of the following ANSI, NEMA, and Factory Mutual Standards. Transformers covered by this Specification shall conform to relevant sections of the latest revision of applicable industry standards, including but not limited to the following:

1. ANSI: C57.12.00 General Requirements for Liquid-Immersed Distribution and Power Transformers.

2. ANSI: C57.12.26 Requirements for Pad-mounted Compartmental-Type, Self-Cooled, Three Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, High-Voltage, 24940 grounded Y/14400 volts and below, 2500 KVA and smaller.


7. ANSI: C57.92 IEEE Guide for Loading Mineral Oil Immersed Power Transformers Up to and Including 100 MVA with 55 oC or 65 oC Average Winding Rise.


9. NEMA: TR1 Transformers, Regulators and Reactors.

10. Factory Mutual: Transformer Loss Prevention Data Sheet S-4/14-B.

1.05 SUBMITTALS

A. Procedure: In accord with Division 1 requirements.

B. Drawings:
   1. Manufacturer’s agent shall provide manufacturer’s certified drawings no later than 6 weeks after receipt of order. Drawings shall be identified with purchase order number and manufacturer’s control number.
   2. Record drawings shall be provided and include nameplate drawings and the transformer outline.

1.06 PRODUCT HANDLING

A. A transformer rated 45-1000 KVA shall be placed on a hardwood pallet with 4 in. x 4 in. minimum skids to facilitate handling with forklifts. The pallet cross members shall be bolted (not nailed) to the skids. The pallet assembly shall help protect transformer from damage when shipped on flatbed trailers. Side or rear loading shall be on the purchase order. Transformers rated 1500-5000 KVA shall be loaded and unloaded with an overhead crane and shall be shipped on flat bed trailers.

B. The apparatus shall be shipped in assembled units insofar as is consistent with good shipping practices.
C. When items must be disassembled for shipment, they shall be match-marked. All units and their containers shall be piece-marked and shall show the purchase order number.

D. Contractor shall notify Owner at least 7 days in advance as to when the apparatus is to be installed at the final location.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Three-phase, pad-mounted, “less flammable” fluid-immersed, such as Enviro-Temp or BioTemp, 55°C rise, 12,470V-480Y/277V or 12,470V-208Y/120V or 4160V-480Y/277V or 4160V-208Y/120V high voltage transformers:

1. General Electric.
2. ABB
3. Cooper Power Systems

2.02 MATERIAL AND FABRICATION

A. Ratings: The required transformer KVA shall be as indicated on Drawings and shall be one of the following KVA ratings:

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<tbody>
<tr>
<td>45</td>
<td>300</td>
<td>2000</td>
</tr>
<tr>
<td>75</td>
<td>500</td>
<td>2500</td>
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<tr>
<td>112.5</td>
<td>750</td>
<td>3750</td>
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<tr>
<td>150</td>
<td>1000</td>
<td>5000</td>
</tr>
<tr>
<td>225</td>
<td>1500</td>
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</tr>
</tbody>
</table>

B. All transformers shall be braced for seismic zone 4.

C. Cooling class: OA.

D. Primary voltage: 4160 volts.
E. BIL:
   1. 95 kV (12,000 volts primary delta windings).
   2. 60 kV (4160 Y/2400 secondary windings).
   3. 30 kV (480 Y/277, 480 delta volts and lower voltage secondary windings).

F. Taps, in addition to nominal voltage:
   1. 45-500kVA transformers: Four 2 ½%, two above and two below high voltage rating.

G. Winding connections: Primary windings shall be delta-connected and secondaries shall be wye-connected.

H. Impedance voltage:

<table>
<thead>
<tr>
<th>KVA Rating</th>
<th>% Impedance Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 - 500</td>
<td>4.75 (minimum)</td>
</tr>
<tr>
<td>750 - 5000</td>
<td>5.65 (minimum)</td>
</tr>
<tr>
<td></td>
<td>4.95 (nominal)</td>
</tr>
<tr>
<td></td>
<td>5.75 (nominal)</td>
</tr>
</tbody>
</table>

I. Transformer insulating fluid:
   1. Dielectric Fluid Oil furnished in the transformer shall be inhibited new oil such as Enviro-Temp or BioTemp and meet the minimum requirements as specified in Table 1, "Functional Property Requirements," of ASTM D3487 and ANSI C57.106.
   2. All transformer oil shall be bulk tested for polychlorinated biphenyls (PCBs) in accord with ASTM D4059 and certified, upon request, as having no detectable level of PCB.
   3. The transformer name plate should state that PCBs are "Less than 1PPM."
   4. Transformer oil shall be Factory Mutual Research Corporation (FMRC) approved as a "less flammable" transformer insulating fluid.
   5. Transformers shall be factory-filled and shipped complete to job site.

J. Pad-mounted enclosure:
1. The enclosure shall be designed to achieve a high degree of integrity. The pad-mounted transformer shall consist of the transformer tank with high- and low-voltage terminating compartments. Assemble all three of these components as an integral unit, tamper-resistant and weatherproof, suitable for mounting on a pad without additional housing, fencing, or other provisions to make the installation safe. There shall be no exposed screws, bolts, or other fastening devices that are externally removable. There shall be no opening where objects may be inserted to contact live parts. The completely assembled transformer will resist unauthorized entry.

2. A welded tank cover is acceptable provided it is equipped with handhole openings with the following dimensions:
   a. 45 - 500 KVA: One 14 in. x 24 in. opening.
   b. b) 750 - 5000 KVA: Two 14 in. x 24 in. hand holes (one centered behind high-voltage compartment and one behind low-voltage compartment).

3. A bolted tank cover may be furnished in place of handhole(s). The bolted cover assembly shall consist of a reusable nitrile gasket retained in place by a retaining strip welded to the interior of the tank flange. Carriage bolts shall be concealed by a wrap-around "nut guard" accessible from the interior of the cabinet.

4. Enclosure paint finish shall be in accord with Finishing Guidelines for Pad Mounted Equipment. The finish paint coat shall be green (Munsell 7GY 3.29/1.5).

5. Before coating, all welds shall be cleaned to remove welding flux and splatter. Surfaces shall be washed and prepared by a chemical-etching phosphate coating process, or be sand blasted, grit blasted or shot blasted.

6. The transformer cabinet, compartment door and sill and base frame shall be manufactured from 304L series stainless steel.

7. Stainless steel (or SS 304L) shall be identified on the nameplate.

8. The front plate shall be stenciled SS to denote stainless steel. Letter height shall be approximately 2 in. 9. Lifting lugs, door handles, latching assembly and all exposed hardware shall be constructed of noncorrosive material.

K. Windings: Transformer primary and secondary windings shall have copper conductors.

L. Transformer bushings:
1. High voltage bushings shall be Universal bushing wells without inserts. Bushing wells shall be suitable for bushing inserts and load break or non-load break separable connectors.

2. High voltage bushings shall be arranged for radial feed or loop feed as indicated on Drawings. Bushing assemblies shall be rated for full 200 amperes, momentary 10,000 amperes RMS 1/2 second, three-phase duty.

3. Bushings shall be externally removable and leads shall be of sufficient length to permit field replacement of bushings without opening the tank.

4. All primary bushings shall be installed with three stud external clamps.

5. Parking stands shall be welded to the tank wall beside bushings in accord with ANSI C57.12.26.

6. Low-voltage line and neutral bushings shall be one-piece epoxy or fiberglass polyester material with tinned plated copper or aluminum terminal spades provided with NEMA spaced holes. The minimum number of usable holes per phase shall be in accord with the following table:

<table>
<thead>
<tr>
<th>KVA</th>
<th>480 Y/277, 208Y/120, 480D</th>
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</thead>
<tbody>
<tr>
<td>45</td>
<td>4</td>
</tr>
<tr>
<td>75</td>
<td>6</td>
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<tr>
<td>150</td>
<td>6</td>
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<td>225</td>
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<td>750</td>
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<td>2500</td>
<td>10</td>
</tr>
<tr>
<td>3750</td>
<td>12</td>
</tr>
<tr>
<td>5000</td>
<td>12</td>
</tr>
</tbody>
</table>
7. The low-voltage bushing shall be bolted on and externally clamped.

8. Insulated, vertical, mechanical supports shall be installed on each 8, 10 and 12 hole low-voltage terminal spade and shall be attached to a horizontal steel support angle brace located above the spades. The support system shall be disconnected from each low-voltage terminal spade during shipment to prevent damage to the low voltage bushings.

9. The low voltage neutral bushing (where required) shall be the same insulation class as phase bushings.

M. Accessories:

1. The inside base of the transformer sill shall have a flange for anchoring the cabinet to the pad.

2. The transformer shall be equipped with an externally operated no-load tap changer. The operating handle shall give permanent visual indication of the voltage position and have a provision for securing it at the desired position.

3. A 25°C. oil level indicator shall be provided in the low-voltage compartment.

4. A dial-type liquid temperature gauge shall be provided in the low-voltage compartment.

5. A drain valve with a built-in sampling device shall be provided in the low-voltage compartment.

6. A 1 in. NPT upper plug (or cap) for filling and pressure testing shall be provided in the low-voltage compartment.

7. A captive and recessed hex-head bolt shall be provided for securing the high- and low-voltage compartment doors.

8. The BIL rating of the transformer and notation of current limiting and Bayonet fuses in the circuit diagram shall be included on the nameplate of fused transformers.

9. The transformer shall be equipped with a pressure relief device that will automatically relieve tank pressures that exceed 10 psig.

10. A pressure vacuum gauge shall be provided in the low voltage compartment.

N. Factory tests:
1. Certified test reports on a comparable transformer, showing compliance with the requirements of ANSI C57.12.00 and C57.12.90 shall be available on request.

2. The transformer shall be designed and manufactured to have audible sound levels equal to or less than those described by NEMA TRI. Certified test reports shall be available upon request for the unit supplied or for an essentially identical unit showing compliance to NEMA Standard TR-1.

3. Contractor shall provide manufacturer certified test reports for each transformer provided that include the following data:
Transformer Number (As indicated on Drawings)

Serial Number    Impedance
Catalog Number   No-Load Loss at 85° C.
KVA              Total Losses at 85° C.

Primary Voltage

4. Owner shall be allowed access to manufacturer’s shops and also to those of manufacturer’s suppliers to inspect the apparatus and workmanship, to witness tests, and to obtain other desired information. Inspectors representing Owner shall be given every facility to inspect the work during all stages of manufacture, testing, and shipment.

5. Inspection of the apparatus may be at manufacturer’s shops and/or those of its suppliers, or upon receipt at destination at the option of Owner. Inspection by Owner at the aforesaid shops will not be made except on special request by Owner. The waiving of inspection thereof shall in no way relieve manufacturer of the responsibility of furnishing apparatus in accord with this Specification.

6. Manufacturer shall inform Owner of the progress of the work and shall give Owner ample advance notice of appropriate times for inspections and/or tests. Specified tests will be approved and may be supervised by Owner.

7. Manufacturer shall furnish to Owner, if so requested and at no additional cost, shop and mill reports when specified.

8. Costs of all tests made in the shops are to be borne by manufacturer.

O. Guaranteed transformer losses:

1. No-load losses shall be calculated and provided to the owner.

2. Load losses shall be calculated and provided to the owner.

3. The transformer shall be a lower impedance low loss transformer. Loss data (estimated) shall be provided with the approval submittal.

P. Install a hook stick operable primary load break disconnect switch.

Q. Install primary fuse holders with current limiting fuses sized in accord with the transformer kVA rating and the project one line diagram and provide one spare set of fuses.
PART 3 – EXECUTION

3.01 GENERAL

3.02 INSPECTION

A. Examine area to receive transformers to verify there is adequate clearance for installation.

B. Examine surfaces for conditions that will adversely affect execution, permanence, and quality of work of this Section.

C. Do not proceed with work until unsatisfactory conditions have been corrected.

3.03 PRODUCTION TESTING

A. Each pad-mounted transformer unit shall be factory-tested in accord with ANSI Standard C57-12.90 and visually-inspected for looseness, defects in components and proper assembly, proper switch operation, etc. Manufacturer shall correct all deficiencies before shipment.

3.04 INSTALLATION

A. Install pad-mounted transformers plumb and in straight, horizontal and vertical alignment, anchored to precast floor slab with adequate concrete inserts and 5/8 in. anchor bolts.

B. Jacking provision: Suitable jacking pads or equivalent jacking facilities shall be provided on the tank for all sizes.

C. Rolling provision: The transformer base shall be so arranged for rolling in two directions - parallel to, and at right angles to the centerline of the high voltage bushings.

D. Lifting provision: Lugs of adequate strength and size shall be attached to the tank and so arranged to provide a balanced lift.

E. Mounting provision: The base of the transformer assembly shall be provided with a suitable flange to permit anchoring the unit on the pad from within the terminating compartment. Construct the transformer assembly for lifting, skidding, or sliding into
place without disturbing previously-installed entrance cables, accomplished by means of a removable sill bolted to the tank and removable only after gaining access to the compartment.

3.05 SITE TESTING

A. Performance tests made in the field are to be under conditions to be mutually agreed upon by Owner and Contractor.

B. Contractor shall provide certified copies of all performance tests to Owner.

C. When specific performance tests are required, the work on the apparatus involved shall not proceed beyond that point until Owner has reviewed and approved certified reports of all performance tests or waived such review and approval.

D. Provide all the services of an Independent Test Laboratory as required in Section 16030 and all acceptance necessary tools, cables, and equipment to perform the site performance tests from NETA ATS listed in Section 26 05 53.

3.06 WARRANTIES

A. Equipment furnished under these Specifications shall be guaranteed against defective parts and workmanship under terms of manufacturer’s standard warranty, but in no event shall it be for a period of less than 1 year from date of initial energization of system and shall include labor and travel time for necessary repairs at job site.

END OF SECTION 26 12 19