SECTION 261216

DRY-TYPE, MEDIUM-VOLTAGE TRANSFORMERS

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**NOTE TO SPECIFIER**

*Use this Specification Section for Mail Processing Facilities.*

***This is a Type 1 Specification with completely editable text; therefore, any portion of the text can be modified by the A/E preparing the Solicitation Package to suit the project.***

*For Design/Build projects, do not delete the Notes to Specifier in this Section so that they may be available to Design/Build entity when preparing the Construction Documents.*

*For the Design/Build entity, this specification is intended as a guide for the Architect/Engineer preparing the Construction Documents.*

*The MPF specifications may also be used for Design/Bid/Build projects. In either case, it is the responsibility of the design professional to edit the Specifications Sections as appropriate for the project.*

*Text shown in brackets must be modified as needed for project specific requirements.* *See the “Using the USPS Guide Specifications” document in Folder C for more information.*

*The last date that USPS revised this standard specification section occurs in two places, at the end of this section and in the Table of Contents. If the date in this section matches the date in the Table of Contents, then you are using the latest version. Do not delete or revise the “last revised” date at the end of the section during the development of the Project Manual.*

*The footer in this section should be edited to replace the text, “USPS MPF SPECIFICATION” with the project name, and the blank date in the center should be replaced with the submission date, for interim design reviews, or the issue date of the completed Project Manual.*

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1. GENERAL
	1. Summary
		1. This specification provides the technical requirements for the design, manufacture, and test of cast coil-type secondary unit substation transformers. Provide all accessories and equipment as described herein and shown on Project Drawings as necessary for a complete installation.
		2. Related Documents: The Contract Documents, as defined in Section 011000 – Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
		3. Related Section include the following:
			1. Section 019113 - General Commissioning Requirements.
			2. Section 260500 - Common Work Results for Electrical.
			3. Section 260800 - Commissioning of Electrical Systems.
			4. Section 261116 - Secondary Unit Substations.
			5. Section 261313 - Medium Voltage Circuit Breaker Switchgear.
			6. Section 261317 - Medium-Voltage Interrupter Switchgear.
			7. Section 261414 - Infrared Viewing Panes (IR Windows).
			8. Section 262413 - Switchboards.
			9. Section 337173 - Electrical Utility Services.
	2. SUBMITTALS
		1. The manufacturer shall provide the following information for review and evaluation by the Engineer:
			1. Shop Drawings showing outline nameplate and connection diagrams.
		2. Manufacturer shall provide final, as- built drawings, recording the actual circuiting of panels. Installation, Operation and Maintenance manuals shall also be supplied.
	3. RELATED STANDARDS
		1. The ventilated dry-type transformers and protection devices in this specification are designed and manufactured according to latest revision of the following standards.
			1. ANSI C57.12.01, General Requirements for Dry-Type Distribution and Power Transformers Including Those with Solid Cast and / or Resin-Encapsulated Windings.
			2. ANSI C57.12.91, Test Code for Dry-Type Distribution and Power Transformers.
			3. ANSI N45.2-1977.
			4. CSA Z 299.3.
			5. ISO 9001.
			6. NRC 10CFR50 Appendix B.
			7. MIL-I-45208A.
			8. NEMA ST 20, Dry Type Transformers for General Applications.
			9. UL 1561 and 1562.
	4. QUALITY ASSURANCE
		1. The manufacturer shall have a well-documented quality assurance program, which includes procedures for all activities in order entry, design, material procurement, manufacturing processes, testing, shipping and post shipment. The manufacturer shall have specialized in the design, manufacture and assembly of dry-type distribution transformers for a minimum of 10 years. The transformer shall be manufactured by a company, which is certified ISO 9001, for design and manufacture of Power Cast Coil Dry-Type Transformers.
		2. The test floor shall have documented calibration program. All equipment shall receive regular calibrations. Calibration standards shall be traceable to National Bureau of Standards. Records of all equipment calibration shall be made available to the Buyer upon request. Measured values of electric power, voltage, current, resistance and temperatures are used in the calculations of reported data. To ensure sufficient accuracy in the measured and calculated date the test system accuracy requirements listed in ANSI C57.12.01 Table 3 shall be met as a minimum.
	5. DELIVERY, STORAGE AND HANDLING
		1. Handle and store equipment in accordance with manufacturer’s Installation and Maintenance Manuals. One copy of this document to be provided with the equipment at time of shipment.
2. PRODUCTS
	1. MANUFACTURERS
		1. Subject to compliance with project requirements, manufacturer’s offering Products which may be incorporated in the Work include the following:
			1. Eaton Corporation, Cutler-Hammer Products, Pittsburg, PA (800) 525-2000.
			2. General Electric Company (800) 626-2000.
			3. Siemens Energy and Automation, Alpharetta, GA (800) 964-4114.
			4. Square D Company, Palatine, IL (800) 392-8781.
			5. No substitutions permitted.
	2. TECHNICAL REQUIREMENTS
		1. Construction
			1. The transformer shall be vacuum cast epoxy resin construction and shall be mounted in a suitably ventilated indoor enclosure.
			2. The transformer shall be rated [\_\_\_\_\_] kVA with a primary voltage of [\_\_\_\_\_]kV [delta] [wye] connected and have a BIL rating of [\_\_\_\_\_]kV and a secondary voltage of 277/480V wye connected and have a BIL rating of [\_\_\_\_\_]kV.
			3. The transformer is to have an impedance of [\_\_\_\_\_]%IZ (per manufacture’s standards.)
			4. Primary terminations shall be bus connection inside transformer enclosure for close-coupling to high voltage load interrupter switch.
			5. Secondary terminations shall be bus connection inside transformer enclosure for close-coupling to the low voltage switchgear.
			6. Primary and secondary coordination bus assemblies, as required for connection to associated switchgear are to be of bolted construction.
		2. Core Design
			1. The transformer core shall be constructed of high-grade non-aging silicon steel laminations with high magnetic permeability and low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point. A step-lap mitered core joint shall be used to minimize losses, exciting currents and sound levels. The core laminations shall be clamped together with heavy steel members. The finished core and clamping structure shall be coated to protect against corrosion.
		3. Temperature Rise
			1. The average temperature rise of the transformer windings shall be rated at 80 degree C and shall be built utilizing Class 180 degree C turn insulations, regardless of the temperature rise specified. The insulating system used, including epoxy, shall be rated 180 degree C or higher. The transformer shall not exceed the specified temperature rise when the unit is operated continuously at full nameplate rating. The transformer shall be capable of carrying 100% of the nameplate rating in a 30 degree C average, not to exceed 40 degree C maximum ambient in any 24 hour period.
			2. The transformer shall be capable of continuous operation at 17% above nameplate rating. This overload capability shall be achieved on the AA and FA rating and will be accomplished by allowing the transformers’ ultimate rise to be 115 degree C. Customer specification must define the high capacity overloads.
		4. Coil Design
			1. The high voltage and low voltage windings shall be constructed using copper conductors. The high voltage and low voltage windings shall be vacuum cast in epoxy in a metal mold utilizing a proven casting process that insures the absence of voids. The vacuum cast coils shall also be reinforced with fiberglass mat.
			2. The transformer shall be constructed of individually cast primary and secondary coils, coaxially mounted. The low voltage windings shall be wound separately and of pressure injected, vacuum cast or hermetically sealed construction with foil or sheet conductors. The low voltage coils shall be hermetically sealed with epoxy and the coil shall be blocked radially to the core to ensure short circuit integrity.
			3. The finished primary and secondary coil must be hermetically sealed in epoxy utilizing a proven manufacturing system that demonstrates its ability to minimize hot spots and partial discharge. An induced partial discharge test shall be performed on each winding. The induced partial discharge test shall be performed by measuring partial discharge levels beginning at 80% rated voltage and continuing in 10% step increments through 200% rated voltage. Partial discharge inception and extinction levels are defined as levels above 10 Pico-Coulombs and shall be recorded. Acceptance criteria is Partial discharge extinction at or above 120% rated voltage. The low volt­age windings shall be wound separately and if not vacuum cast like the high voltage winding, shall be hermetically sealed in epoxy.
		5. Taps
			1. Transformer primary winding shall have four 2-1/2 percent full capacity taps; two above and two below rated nominal voltage. No load tap connections shall be made by re-connectable links on the face of the primary winding and shall be located behind removable panels on the front of transformer enclosure. Taps shall be for de-energized operation only.
		6. Dielectric Withstand
			1. The impulse rating of the transformer must equal or exceed the basic impulse level specified by ANSI for the applicable voltage class. The basic impulse level shall be inherent to the winding design and is to be obtained without the use of supplemental surge arrestors.
		7. Vibration Isolation
			1. The transformer shall have vibration isolation pads installed between core and coil assembly and enclosure base structures to prevent the transmission of structure borne vibration.
		8. Enclosure
			1. The enclosure shall be constructed of heavy gauge sheet steel and shall be finished in ANSI 61 paint color, applied using an electrostatically deposited dry powder paint system. All ventilating openings shall be in accordance with NEMA and NEC standards for ventilated enclosures. The base of the enclosure shall be furnished with ground pads located on opposite diagonal corners. The base shall have jacking pads and shall be constructed of heavy steel members to permit skidding or rolling in any direction. The core shall be visibly grounded to the enclosure frame by means of a flexible grounding strap.
			2. Transformer shall be certified to meet Uniform Building Code (UBC) Zone [1] [2] [3] [4] seismic requirements with seismic table validation.
		9. Nameplate
			1. Transformer shall be furnished with a non-corrosive diagrammatic nameplate per ANSI C57.12.01, permanently attached with non-corrosive hardware. The diagrammatic nameplate shall include the name of the transformer supplier as well as the location where the transformer was manufactured and tested.
		10. Forced Air Cooling
			1. Forced air cooling, when required, shall increase the continuous self-cooled rating of the transformer by 33 1/3%. The FA increase shall be possible with forced cooling without exceeding the specified maximum temperature rise. The forced air cooling shall be regulated automatically by sensors placed in the low voltage winding’s air ducts. Forced air cooling shall include: three phase electronic digital temperature monitor, fans, control wiring, control panel with test switch, indicating lights, alarm and alarm silencing switch.
	3. FACTORY TESTING
		1. After completion, each transformer shall undergo the following routine production tests per ANSI C57.12.01 and ANSI C57.12.91. Testing shall be accomplished using calibrated test equipment, which have recorded accuracy traceable to National Institute of Standards Technologies (NIST). Certification of Calibration shall be provided with test reports if requested.
		2. In addition to routine testing a 100% QC Impulse Test shall be performed on each transformer furnished.
		3. Routine Tests:
			1. Megger
			2. Ratio
			3. Resistance
			4. Phase relation
			5. Load Loss, Impedance and Regulation
			6. No Load Loss and Excitation Current
			7. Applied Potential Test
			8. Induced Potential Test
		4. A temperature rise test shall be performed on the first unit of each new design. The core and coil design and construction techniques shall be verified by a full short circuit test on similar or larger units in accordance with applicable ANSI standards.
		5. Provide certified production test reports for all manufactured transformers.
	4. infrared viewing panes (ir windows)
		1. Typically, the high voltage and primary tap connections are located on the high voltage side of a power transformer. A single, opaque, rectangular window (9 inch W x 5 inch H) shall be provided to view the high voltage power and tap connections on this side of the transformer. The secondary (low voltage) connections are typically made by bolted connections at the low voltage end of the transformer. A single, opaque, rectangular window (9 inch W x 5 inch H) shall be provided at the secondary side of the transformer to view these bolted connections. Refer to specification section 261414.
		2. Acceptable installers:
			1. IR viewing panes shall be factory installed by the switchgear manufacturer or field installed by a certified installer, as recommended by the IR viewing pane manufacturer.
			2. Installer shall be factory certified and trained by the IR viewing pane manufacturer.
	5. ACCESSORIES
		1. Standard transformer accessories shall include:
			1. Diagrammatic aluminum nameplate
			2. Step-lap mitered core
			3. Provisions for lifting core and coil assembly
			4. Base equipped with jacking pads and designed for rolling or skidding enclosure in any direction
			5. NEMA 1 heavy-gauge ventilated enclosure with removable panels front and rear
			6. Four full-capacity taps on HV winding, rated 2-1/2%, 2-FCAN and 2-FCBN
		2. Documentation for Owner’s review:
			1. Outline, nameplate and connection diagram drawings.
			2. Installation/Operation/Maintenance Manual
			3. Certified Production Test Report(s) containing minimum information per ANSI C57.12.91
3. EXECUTION
	1. INSTALLATION
		1. Install transformer as shown on Project Drawings and in accordance with manufacturer’s Instruction/Installation Manual.
		2. Provide concrete pad with sufficient structural support and in accordance with local codes and standards. Concrete pad requirements should be coordinated with transformer manufacturer.
		3. Grounding shall be per Project Drawings and in accordance with codes and standards and in compliance with the NEC.
	2. ADJUSTMENTS AND CLEANING
		1. Remove debris from job site and wipe dust and dirt from all components.
		2. Repaint marred and scratched surfaces with touch up paint to match original finish.
	3. TESTING
		1. Field-testing will be conducted at the expense of the Contractor for final acceptance.
	4. WARRANTY
		1. Equipment manufacturer warrants that all goods supplied are free of non-conformities in workmanship and materials for [12 months] [18 months] from date of initial operation.

END OF SEction

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