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| Version | Date | Description of Revisions |
| 1 | August 30, 2006 | Approved final document. |
| 2 | February 19, 2010 | Modified ‘Related Sections’ |
| 3 | March 15, 2011 | Minor changes from Legal reviews |
| 4 | June 25, 2013 | Final Draft – Consolidated Comments Spec Update Project. Incorporation of new Commissioning and Computerized Maintenance Management System Data Requirements Specification cross references. |
| 5 | July 30, 2014 | Changes to reflect renaming of commissioning specification and final review (AV) |
| **6** | **February 4, 2015** | **Finalized Specification – Reference eDOCS #5630504 v7 (AV) with updated standards** |
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NOTE:

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**The on-line copy is the current version of the document.**

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## Related Sections

#### Section 01250 – Substitutions

#### Section 01300 - Submittals

#### Section 01425 - Computerized Maintenance Management System Data Requirements

#### Section 01810 – Equipment Testing and Facility Commissioning

#### Section 16010 – Electrical General Requirements

## References

### Canadian Standards Association (CSA)

#### CAN/CSA C802.2-2012 Minimum Efficiency Values for Dry-Type Transformers

#### CAN/CSA-C22.2 No.47-13, Air-Cooled Transformers (Dry Type).

#### CAN/CSA C9-2 (R2011), Dry-Type Transformers.

#### NFPA 70E/CSA-Z462-15, Workplace Electrical Safety (ARC Flash Standard)

### National Electrical Manufacturers Association (NEMA)

#### NEMA Premium® guidelines (2007)

#### NEMA ST20-2014, Dry Type Transformers for General Applications

#### NEMA TP 1-2002, Guide for Determining Energy Efficiency for Distribution Transformers

#### NEMA TP 2-2005, Standard Test Method for Measuring the Energy Consumption of Distribution Transformers

#### NEMA 250-2014, Enclosures for Electrical Equipment (1000 V Maximum)

#### IP65/NEMA 4 rated enclosures

### NFPA

#### NFPA (Fire) 70 (2014) National Electrical Code (NEC)

##### NFPA 70E, Standard for Electrical Safety in the Workplace (2012)

### Canadian Regulations

#### SOR/94-651 Canadian Energy Efficiency Regulations

### UL, ULC

#### UL 1561 Dry-Type General Purpose and Power Transformers

### IEEE

#### C57.12.91-2011 - IEEE Standard Test Code for Dry-Type Distribution and Power Transformers

#### C57.110-2008 - IEEE Recommended Practice for Establishing Liquid-Filled and Dry-Type Power and Distribution Transformer Capability When Supplying Non-sinusoidal Load Currents.

#### 259-1999 (R2010), IEEE Standard Test Procedure for Evaluation of Systems of Insulation for Dry-Type Specialty and General-Purpose Transformers

### Department of Energy (US) CSL 3 class efficiency.

### Ontario Electrical Safety Code, 28th Edition, 2021.

## Measurement and Payment

### All costs associated with the work of this Section shall be included in the price(s) for Item No(s). \_\_\_ in the Bid Form.

## Submittals

### Submit the following Product data for each type and size of transformer indicated in the Contract Documents:

#### Physical: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features.

#### Product warranty.

#### Details of contributions to LEED, including energy and atmosphere credits.

##### Provide proposed energy savings in Annual kWh and Peak Demand kW compared to a NEMA TP-1 (2002) efficiency baseline for the transformers on the project.

#### Efficiency Data

##### No load and full load losses in accordance with NEMA TP 1-2002.

##### Linear load Efficiency data at 1/6, 1/4, 1/2, 3/4, and full load.

##### Linear Load Efficiency at 35% loading tested in accordance with NEMA TP-2 (2002).

##### Efficiency under K7 load profile at 15%, 25%, 50%, 75%, 100% of nameplate rating.

### Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

#### Wiring Diagrams: Power, signal, and control wiring.

### Qualification Data: Contractor shall provide the Consultant with the testing agency qualifications that prove the company is capable of performing required tests on the transformer(s).

### Source quality control test reports from the manufacturer.

### Field quality-control test reports.

### Operation and maintenance data for transformers to include in emergency, operation, and maintenance manuals.

### Submit in accordance with Section 01300 – Submittals.

## Source Quality Control

### Testing Agency Qualifications: An independent agency, approved by the Consultant, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association (NETA) or is a nationally recognized testing laboratory (NRTL).

### Source Limitations: Obtain each transformer type from a single manufacturer.

### Electrical Components, Devices and Accessories: Listed and labelled as defined in Article 100 of NFPA 70 and in accordance with Canadian Electrical Code (CEC) by a testing agency acceptable to the authorities having jurisdiction (including but not limited to the Electrical Safety Authority (ESA)), and marked for intended use.

### Comply with the requirements of IEEE C57.12.91 2011, Test Code for Dry-Type Distribution and Power Transformers.

### Comply with IEEE C57.110-2008, IEEE, IEEE Recommended Practice for Establishing Liquid-Filled and Dry-Type Power and Distribution Transformer Capability When Supplying Non-sinusoidal Load Currents.

### Test procedures shall be in accordance with 259-1999 (R2010), IEEE Standard Test Procedure for Evaluation of Systems of Insulation for Dry-Type Specialty and General-Purpose Transformers.

## Field Quality Control

### Perform tests and inspections and prepare test reports.

#### Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

### Tests and Inspections:

#### Perform each visual and mechanical inspection and electrical test stated in the NETA Acceptance Testing Specification. Certify compliance with test parameters.

#### Test transformers for losses and efficiency. Verify that the results are consistent with the loss data provided on the submittal documenting compliance with DOE CSL 3 class efficiency (US Department of Energy).

### Remove and replace units that do not pass tests or inspections and re-test as specified above.

### Infrared Scanning: Two months after Substantial Performance of the Work, perform an infrared scan of transformer connections.

#### Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration to Consultant.

#### Perform two follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Substantial Completion.

#### Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

### Test Labelling: On completion of satisfactory testing of each unit, attach a dated and signed “Satisfactory Test” label to tested component.

### All reports and equipment information shall be in accordance with Section 01425 - Computerized Maintenance Management System Data Requirements.

## Submittals for Review/Approval

### The following shall be submitted to the Consultant:

#### Test reports on transformers in accordance with IEEE C57.12.91 2011.

#### Factory Sound-Level Tests: Sound-level test reports on equipment for this Project.

# PRODUCTS

## Transformers

### Design.

#### Open delta configuration not permitted.

#### Type: ANN.

#### 3 phase, 45 kVA, 600 V input, 120/208 V output, 60 Hz.

#### Voltage taps: Four (4) 2½% full capacity primary taps, 2-FCAN and 2 FCBN. All taps brought out to a suitable tap changing board.

#### Insulation: Class 185°C temperature rise - 80°C over an ambient of 40°C.

#### Basic Impulse Level (BIL): 10kV.

#### Hi pot: standard.

#### Average sound level: 45 dB max. up to 45kVA.

#### Enclosure: CSA # 2 (Drip proof).

#### Mounting: floor.

#### Finish: in accordance with Section 16010 – Electrical General Requirements.

#### Rating: 45 kVA

#### Winding – Copper – delta connected primary wye connected secondary with neutral grounding provision.

#### Efficiency performance shall meet the NEMA Premium® guidelines; 30% lower losses than U.S. DOE 10 CFR Part 431 (and/or TP 1-2002) and the Canadian Energy Efficiency Regulations SOR/94-651 (and/or C802.2) efficiency standards when measured under a linear load profile.

#### Description: Factory-assembled and tested, air-cooled units for 60 Hz service.

#### Cores: Grain-oriented, non-aging silicon steel.

#### Coils: Continuous windings without splices except for taps.

#### Internal Coil Connections: Brazed or pressure type.

#### Coil Material: Copper.

## Equipment Identification

### Label size: 7.

### Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

# EXECUTION

## Installation

### Mount dry type transformers up to 75 kVA as indicated in the Contract Documents.

### Mount dry type transformers above 75 kVA on the floor.

### Ensure adequate clearance around the transformers for ventilation.

### Install transformers in a level upright position.

### Remove shipping supports only after the transformer is installed and prior to putting the transformer into service.

### Loosen isolation pad bolts until no compression is visible.

### Make primary and secondary connections in accordance with the wiring diagram.

### Energize transformers after installation is complete.

* 1. Commissioning

### For all commissioning activities on systems where components of this Section are integral to functionality, refer to Section 01810 – Equipment Testing and Facility Commissioning. All inspection and testing activities shall be completed in accordance with the commissioning plan that shall be provided to the Consultant and get approved prior to the commencement of commissioning activities.

**END OF SECTION**