

1.0 **GENERAL**

1.1 **Coordination Requirements**

- .1 UBC Energy & Water Services
- .2 UBC *Facilities Electrical*

1.2 **Description**

- .1 UBC requirements for Substation Transformers.

2.0 **MATERIAL AND DESIGN REQUIREMENTS**

2.1 **Primary Bussing**

- .1 15 KV primary copper bussing, minimum capacity 600 amps, 300 MVA bracing.

2.2 **Surge Arrestors**

- .1 Provide three 15.3 kV MCOV distribution class surge arrestors. Install immediately upstream of transformer primary connection. Ground arrestors directly to ground bus with 4/0 copper.

2.3 **Transformer Connection**

- .1 Flexible copper braid connections at both primary and secondary connections of transformer.
- .2 Grounding ball studs shall be affixed to the primary transformer bus and meet accessibility requirements as per section 26 11 13 2.1.

2.4 **Cast Coil Transformer**

- .1 Substation transformer(s) to step down voltage from 12.48 KV to 347/600V or 120/208V shall be cast coil type, Class F insulation.
- .2 Cast coil transformer with fan cooling to provide 50% additional load capacity. The transformer cubicle shall contain transformer core and cast coils, fans and controls, temperature measuring assembly, neutral/ground CT, primary and secondary busses and ground bus.
- .3 The transformer shall be designed and built in accordance with the current issues of CSA Standard C9 and ANSI Standard C57.12.00.
- .4 Losses shall be in compliance with or exceed CSA Standard C802 requirements.

Transformer Size (KVA)	No. Load Losses (Watts)	Load Losses (Watts)
750	2,300	7,500
1000	2,900	9,000
1250	3,250	10,100
1500	3,800	12,100
2000	5,200	14,300
3000	5,700	19,500

- .5 The transformer shall be a 3 phase core type with cast epoxy coils fiber glass reinforced, type AN with forced air cooling. To provide 50% additional capacity both HV and LV coils shall be cast under a hard vacuum in steel moulds and the cores shall be mitered.
- .6 Insulation system shall be Class F (185 °C) but the average winding temperature rise shall be 80 °C maximum, at rated voltage and full load.
- .7 Windings shall be copper. Aluminum shall not be used.
- .8 Each LV winding shall be equipped with embedded temperature sensors connected to the detection system temperature relay unit with separate output dry contacts for fan operation, remote alarm and tripping corresponding to 80% and 95% and 105% of rated operating temperature.
- .9 Provide a digital readout for each phase and constant memory of the highest temperature with readout on demand.
- .10 Provide remote contacts for high temperature monitoring wired to outlet box at roof of transformer.
- .11 Mount temperature relay unit and thermometer on a hinged panel of a barrier instrument compartment on the side of cubicle. Connect tripping contacts to trip the primary vacuum breaker. Extend 1-NO and 1-NC alarm contact to terminal blocks in a six inch outlet box on the roof of the transformer enclosure.
- .12 Power supply for cooling fan shall be supplied from power source in transformer cubicle (secondary connection).
- .13 Provide design data and shop drawings for all transformer characteristics for approval by the consultant before proceeding with manufacture.
- .14 The core shall be protected against corrosion by a coating of epoxy resin not less than 1 mm thick. All steel parts other than the core shall be hot dip galvanized with a minimum coating thickness of 0.1 mm or epoxy painted.
- .15 After manufacture, the transformer shall be partial discharge and sound level tested in addition to standard production tests list in CSA Standard C9 to verify the specified ratings. The partial discharge shall not exceed 15 pico coulombs at a corona extinction voltage of 120% of rated voltage when energized by induction from a three phase, 60 HZ or higher frequency source. A certificate issued by the Testing Engineer shall be provided verifying the results of all factory tests.
 - .1 Continuous (XXX) KVA rated output.
 - .2 (XXX) KVA fan cooled rated output.
 - .3 Insulation Class - F 185 °C maximum winding temperature.
 - .4 Temperature Rise Design - 80 °C average winding temp rise.
 - .5 Frequency – 60 Hz.
 - .6 Rated Primary voltage – 12,480V.
 - .7 Rated secondary voltage 347/600V or 120/208V.
 - .8 Connections - delta / grounded Wye.
 - .9 Impedance 5% min. to 7% max.
 - .10 Off load taps - 4 - 2 1/2%, 2 FCAN, 2 FCBN.
 - .11 Basic Impulse Level – 95 KV.
 - .12 Available fault current rating - 300 MVA sym.
 - .13 Number of phases is three (3).
 - .14 Maximum noise level 65 dBA at full load at one meter.

- .16 Approved Manufacturers are:
 - .1 LG Industrial Systems.
 - .2 ABB Resibloc Cast Resin.
 - .3 LSIS
 - .4 Jinpan International
 - .5 Hammond EnduraCoil
 - .6 Rex Power Magnetics

- .17 Provide the Following Features for the Transformer:
 - .1 Access doors key interlocked with primary circuit breaker.
 - .2 Engraved transformer nameplates including connections, voltage ratings, impedance, and other data as required by CSA, one on core and coils and one on exterior of enclosure.
 - .3 On completion of manufacture, but prior to shipment, the following tests shall be performed and results certified by a registered Professional Engineer.
 - .1 All CSA C9 tests, including losses.
 - .2 Partial discharge test – Factory Test.
 - .3 Sound level test – Factory Test.

- .18 Three copies of these results shall be forwarded to the Consultant for approval prior to transformer shipment from the factory.

2.5 Transformer Neutral

- .1 Transformer secondary neutral shall be solidly grounded to ground bus mounted in transformer cubicle.
- .2 Connect grounding bus in transformer cubicle with ground bus in 12 KV switchgear.

2.6 Ground Bus

- .1 Provide a ground bus capable of terminating all ground and neutral connections. Allow for 3 spare 4/0 lugs and space for 6 future lugs.

2.7 Ground Fault Protection

- .1 Current Transformer
 - .1 Ground fault sensor current transformer sized to match requirements of ground fault relay up to full load current rating of transformer.
- .2 Ground Fault Relay (51G)
 - .1 Provide a secondary over current ground fault relay 50/51M with current pick-up range (0-XXX) amps, 0 - 10 seconds, adjustable definite time, with current transformer sensor in the neutral conductor of the transformer relay. Ground fault conductor shall trip main vacuum breaker.

2.8 Temperature Relay

- .1 Transformer temperature relay with 3 temperature sensors, one for each winding. Relay shall have three contact settings to be set at:
 - .1 80 °C Alert.
 - .2 100 °C Alarm.
 - .3 120 °C Trip.

2.9 UBC Energy and Water Services Revenue Meter

- .1 Revenue meters shall be switchboard mounting, 3 element watt hour demand type, Schneider Electric PM8240 meter with i/o module.
- .2 Multifunction Meter with Ethernet capability. Refer to Section 26 27 13 Metering.

2.10 System Monitoring

- .1 The following monitor points and contacts shall be wired out to a terminal block located in a junction box on the unit substation roof for future connection to UBC BMS system to monitor:
 - .1 Circuit breaker #1 status.
 - .2 Circuit breaker #2 status.
 - .3 SEL Relay health status.
 - .4 DC Battery System – AC power loss.
 - .5 DC Battery System – Charger failure.
 - .6 DC Battery System – DC power loss.
 - .7 Transformer fan on transformer temp 'alert'.
 - .8 Transformer temp 'alarm'.
 - .9 Three (3) spare spaces.
- .2 Refer to Section 25 05 00 Building Management Systems (BMS) Design Guidelines for technical requirements of BMS.

2.11 Interlocking

- .1 Safety interlocks shall be provided as required, equal to Kirk or FPE. Load break switches shall be interlocked with the transformer tap door. Refer to interlocking diagram.

2.12 Vibration Isolation Requirements

- .1 Particular attention shall be paid to the installation of the transformer to reduce the noise level in the transformer room.
- .2 Supply transformers generating a space average noise level in the transformer room not exceeding 60 decibels measured in any third octave bank between 50 Hz and 1000 Hz based on a 300 KVA transformer.
- .3 Other sizes shall meet equivalent noise level with noise correction based on 10 Log KVA re. 300 KVA.
- .4 Supply vibration isolation such that the airborne noise isolation provided by the building structure is not limited by structure borne noise transmission. The following are minimum isolation requirements:
 - .1 Mount the transformer core on 25 mm deflection spring isolators, including in series neoprene elements with an effective deflection of 2.5 mm, and restraints meeting the National Building Code with respect to seismic requirements.
 - .2 For a slab on grade installation, use neoprene isolators sized for a minimum 2.5 mm deflection, with seismic restraints.
 - .3 If the transformer core is mounted on separate transverse steel supporting members, independent of the transformer enclosure, size the members for a 140 Hz cantilever resonant frequency under the dead load of the member (0.013 mm dead load cantilever deflection) and the spring stiffness.

- .4 Provide sufficient flexibility in the braided connectors on both the low voltage and high voltage sides of the transformer such that the vibration isolation provided by the spring/neoprene isolator supports is not limited by the braided connectors. If such flexibility is impractical, isolate the cabinets on neoprene isolators with 2.5 mm deflection and isolate the conduit.
- .5 Within the electrical room, provide neoprene hangers with 0.1" static deflection in threaded rod supports for all new conduit, cable trays, etc. Avoid rigid connections to the structure. Avoid any contact of electrical equipment to drywall partitions where transformer rooms are located adjacent to occupied spaces.
- .5 Submit shop drawings detailing proposed isolation.

*****END OF SECTION*****