ISO Rule Section 502.11 (Substation) Workgroup Meeting – Proposed Agenda

Meeting Date: February 18, 2016 from 10:00 am to 3:00 pm
Meeting Place: AESO Boardroom 2539P, 25th floor of Calgary Place building (330 5th Ave SW, Calgary)

Agenda Item	Time	Presenter
1. Welcome	10:00	[AESO]
2. Action items from Jan 21 meeting: • Transformer overloading capability • Transformer testing requirements • Transformer monitoring requirement • Transformer tap changer – minimum voltage range requirement • Wording respecting Snow/icing/wind limits • Wording respecting FCBN requirement	10:00 – 10:30	All
3. Presentation from Jim on the minimum technical requirements for substations of 50+ ISOs/RTOs/TFOs in USA and Canada	10:30 – 12:00	[CANA]
4. Lunch break	12:00 – 1:00	
5. Discussions on the following topics • Shunt reactors and shunt capacitors • Instrument Transformers (CTs and PTs)	1:00 – 2:00	All
6. Summary presentation from [AESO] on • what WG has come up with since August 2015 • next steps	2:00 – 3:00	[AESO]

1. Action items from January 21 meeting

Action: The AESO is to discuss internally about the appropriate wording respecting overloading capability for certain power transformers (e.g. >1000 MVA)

Update:

The original question (from the AESO) was if it is practical to specify some minimum "free" overloading capability in the rule for every transformer or certain large transformers. Naturally, every transformer can take on some extra load without much increased degradation to the transformer life span, depending on such factors as ambient temperature, preloading level, oil temperature and other factors.

Upon internal discussions, the AESO would like to exercise caution in imposing mandatory minimum overloading requirements on power transformers, as this could lead to increased cost.

Going forward, the AESO will continue to specify, as necessary, overloading requirement for very large transformers on a project-by-project basis. In the future, TFOs will be required to report the overloading capability of generation and transmission facilities, including power transformers, through ARS FAC 008, in various defined durations. FAC-088 is currently under development.

Action: The AESO will discuss internally respecting the need to include transformer testing requirement (for BIL and SIL levels) in the rule

Update:

At this moment, the AESO does not contemplate to mandate the testing requirement on insulations (both factory test and ongoing tests such as Doble test) in the rule. Testing has been part of a TFO's equipment procurement practice and maintenance practice, and should continue to be so. The AESO will continue to set the minimum BIL requirements, and it is up to the TFOs to test the equipment to ensure compliance.

Action: The AESO to check with G/L standard and 502.1 rule and other rules for the minimum voltage range requirements.

Update:

The current G&L standard, effective since September 19, 2006, states:

2.6 (General) **Voltage Level and Voltage Range** – The nominal voltage, operating voltage range, and maximum and minimum voltages will be provided by the AESO in the AESO project functional specification for the interconnection. It is the applicant's responsibility to ensure the equipment complies with the AESO's specified voltage requirements. Typical operating voltages may be found in OPP 702 "Voltage Control".

3.1 (Generators) Voltage Regulation – Unit transformers must have a tapped range such that maximum unit output can be achieved throughout the system operating voltage range as specified in the project functional specification. At a minimum, unit transformers shall be capable of a ±5% voltage range in 2.5% increments. The combination of the generator and transformer capabilities shall allow for a total operating voltage range of ±10%.

4.2 (Load) Transformer Connection – The need for load tap changing will be specified in the AESO project functional specification.

The current 502.1 (WAGF Technical Requirements), effective since December 1, 2011), states:

Transmission System Step-Up Transformer
14(1) The voltage ratio, tap changer type, range and step size specifications for any transmission stepup transformer of any wind aggregated generating facilities must be such that the reactive power requirements specified in subsection 9 are fully available throughout the operating voltage range documented in the functional specification for the project.

(2) The connection of the wind turbine generator step-up transformer, transmission system stepup transformer or any combination of the two (2) transformers for any wind aggregated generating facilities must be designed to provide:
(a) a favorable circuit to block the transmission of harmonic currents; and
(b) isolation of transmission system and wind turbine generator side ground fault current contributions.

(3) The wind aggregated generating facilities must utilize an effectively grounded wye connection on the high side of the transmission system step up transformer.

Action: The AESO is to discuss internally about need for monitoring equipment (such as online DGA analyzer, mechanical monitoring equipment, etc.).

Update:

At this moment, the AESO likes to be silent on this requirement. Installation of necessary monitoring devices and systems in the transformers is always part of good utility practice.

Action: AltaLink to review this, and bring to next meeting recommended wording for dealing with snow/icing/wind limits in the design of substations, to be potentially included in the Information Document

Update: TBA

Action: AltaLink is to check into CSA C88 and recommends appropriate wording about this requirement

Update: TBA

2. Shunt Reactors and Shunt Capacitors

WG members are encourages to bring any additional points to the meeting.

Shunt capacitor bank

- Under what condition do we require a shunt capacitor to be connected to a diameter between buses?
- Shunt capacitor banks must be solidly grounded with the neutral grounded at a single point
- For multiple parallel capacitor banks which are switched back-to-back, each bank shall have a circuit breaker
- H-coupled capacitor banks must have unbalance protection, both alarm and trip function
- Should we require that a TRV study be done for each project having capacitor bank(s) to determine the use of series reactors or other schemes (such as pre-insertion resistors) to limit the switching transient overvoltage and resonance?
- Any other points from WG members

Shunt reactor bank

- For line connected shunt reactors – Should we prescribe minimum compensation level?
- Should we limit the construction types of reactors to either gapped core type or magnetically shielded air core having fixed impedance?
- Should we require reactor to have constant impedance up to, say, 1.5 times the rated voltage?
- Under what condition do we require a shunt reactor to be connected to a bus or a tertiary winding?
- For line connected shunt reactors – Auto reclosing of a transmission line with line shunt reactors is prohibited unless it can be assured that the fault is in the line section
- For line connected shunt reactors – Shunt reactors must be either solidly grounded or grounded through a neutral reactor
- For line connected shunt reactors – Under what condition do we require a four legged reactor (if not four legged reactor, a separate neutral reactor)?
- For tertiary winding connected reactors – There must be a circuit breaker connected
- Any other points from WG members

3. Instrument Transformers

Do we have any other technical requirements than the ones already specified in the current 502.3 rule as follows?

ISO Rule 502.3 – Interconnected Electric System Protection Requirements

Instrument Transformers

9(1) The **legal owner** of a **generating unit**, the **legal owner** of an **aggregated generating facility** and the **legal owner** of a **transmission facility** must ensure the facility uses protection class voltage and current transformers.

(2) Each **protection system** must have separate current cores and utilize separate secondary voltage transformer windings.

Voltage Transformers

10(1) Voltage transformers for a facility must be wire wound, capacitive or optical voltage transformers, and any other form of transformer is prohibited.

(2) For two hundred and forty (240) kV or higher voltage facilities, **protection system** devices that require voltage transformer inputs to provide protection functions must be connected to voltage transformers that are directly connected to the protected element.

(3) For one hundred and forty four (144) kV or lower voltage facilities that utilize simple bus design, the use of common bus voltage transformers is acceptable.

Fuse Failure Alarm for Voltage Transformers

11 A voltage transformer used for protective purposes, including synchronism checking, must have a loss of potential alarm.

Current Transformers

12(1) A current transformer used in a **protection system** must be either magnetic or optical, and must not be the limiting element in the transmission facility's rating.

(2) The maximum available current transformer ratio must be sized for the ultimate fault level of the facility as set out in the functional specification.

(3) A current transformer used in a **protection system** must meet the two point five (2.5L) low internal secondary impedance accuracy requirement as set out in *CAN/CSA-C60044-1:07, Instrument transformer – Part 1: Current transformers, Table 1B*, or an equivalent accuracy requirement at its maximum possible ratio, regardless of the ratio actually being utilized.

Breaker Failure Protection

35(7) For applications where free standing current transformers are used with live-tank breakers it is acceptable to have a breaker fail operation for faults located between the breaker and the current transformer.