4.3 CP Form

Change Proposal – BSCP40/02	CP No: CP1586 *Version No: V0.4* *(mandatory by BSCCo)*

Title (mandatory by originator)

Specify requirements for CT ratios vs circuit capacity and minimum rated burden values

Description of Problem/Issue (mandatory by originator)

What is the issue?

Where appropriate Current Transformer (CT) ratios for the rated capacity of the circuit are not installed or selected, where multi-ratio CTs are used, it can have an impact on Settlement. Following the implementation of CP1553[1] on 30 June 2022 the Codes of Practice (CoPs) 1[2], 2[3], 3[4], 5[5] and 10[6]. specify an 'S' CT standard accuracy class as a minimum requirement that has a limit of ratio error and phase displacement down to 1% of the rated primary current (Ir) specified in the International Electrotechnical Standard (IEC) 61869-2[7]. The issue is when the prevailing load conditions of the circuit are typically below 1% Ir due to the magnitude of the CT ratio selected the accuracy of the Active Energy data may be outside of the defined limits.

The relevant IEC (61869-2 for CTs; 61869-3[8] for Voltage Transformers (VT); or 61869-4[9] for combined transformers) specifies standard values (in volt-amperes (VA)) for rated burden (rated output value). The IEC standard specifies the limits of ratio error and phase displacement at various load points and the measurement transformer must meet these limits where the burden can assume any value from 25 % and 100 % of the rated output. Calibration test certificates for measurement transformers include test points at 25% of rated burden and 100% of rated burden to confirm compliance with the IEC standard. Where equipment connected to the secondary side of the measurement transformer imposes a burden below 25% or above 100% of the rated burden the measurement transformer cannot be confirmed to be within the limits of ratio error and phase displacement specified in the relevant IEC standard and as such could make the energy recorded by the Metering System inaccurate.

Background

The metering CoPs detail the technical requirements for Metering Systems. This includes defining the overall accuracy limits for energy measurements used for Settlement purposes and the minimum requirements for CTs. A Metering System must remain within these error limits at, or referred to, the point of connection to the Total System. This is called the Defined Metering Point (DMP).

[1] CP1553: Meters and Current Transformers minimum accuracy classes
[2] Code of Practice 1 'The Metering of Circuits with a Rated Capacity exceeding 100MVA for Settlement Purposes'
[3] Code of Practice 2 'The Metering of Circuits with a Rated Capacity not exceeding 100MVA for Settlement Purposes'
[4] Code of Practice 3 'The Metering of Circuits with a Rated Capacity not exceeding 10MVA for Settlement Purposes'
[5] Code of Practice 5 'The Metering of Energy Transfers with Max Demand of up to (and including) 1MW for Settlement Purposes'
[6] Code of Practice 10 'The Metering of Energy via Low Voltage Circuits for Settlement Purposes'
[7] IEC 61869-2:2012 Instrument transformers - Part 2: Additional requirements for current transformers
[8] IEC 61869-3:2011 Instrument transformers - Part 3: Additional requirements for inductive voltage transformers
[9] IEC 61869-4:2013 Instrument transformers - Part 4: Additional requirements for combined transformers

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There has been a recent example for a 400kV connection where a 1200/1A CT ratio was installed. The maximum (assuming 100% Ir) MVA that this Metering System could measure is (400kV x 1.2kA x 3) 1,440 MVA. The prevailing conditions for Active Energy Import at the site have a typical value of 1.5MW which would be a primary current value of around 0.1%. This is a tenth of the lowest rated primary current specified in IEC 61869-2. This CT ratio is not an appropriate one for the Settlement of Active Energy.

The Issue 93[10] group discussed an aspect with the intent of defining appropriate CT ratios and specifying a minimum rated burden for measurement transformers in the CoPs.

Situations where Metering Systems could operate outside of the limits of errors specified in both the CoPs and the IEC standards or outside of the 25%-100% rated burden range include:

- Where Metering Equipment is rated for the level of Export but the same Metering System is required for measuring Import and the current is below 1% Ir
- Where a Metering System designer has selected an inappropriate CT ratio for the rated capacity of the circuit or the connected assets (or agreed capacity, if lower than the maximum rating of the connected assets) and the current can drop below 1% Ir;
- Where an intermittent renewable site (e.g. Photovoltaics) is in the hours of darkness sitting on soak (i.e., Reactive Energy being absorbed) and there is very little Active Energy Import operating at a PF outside of 0.8 lead to 0.5 lag range;
- Where a Metering System designer has selected an inappropriate rated burden value for the equipment connected, and the burden imposed by it, to the secondary side of the measurement transformer is below 25% or above 100% of the rated burden value.

The conclusion from the Issue 93 workgroup provided the below recommendations that were noted and agreed by the workgroup:

For minimum burden:

- Add text to the relevant CoPs to provide guidance on what factors need to be considered for choosing a typical burden for Settlement purposes; and
- Align across the CoPs that additional burden can be added to maintain overall accuracy.

For CT ratios:

- CTs should be assigned a 'S' accuracy class (e.g. 0.5S), which was already been implemented under CP1553; and
- A cautionary text will be added to the relevant CoPs to advise where a site can operate outside of specified limits the designer of the Metering System or Registrant should satisfy themselves that overall accuracy is still maintained within the relevant limits.

The recommendations were presented to, and noted by, the BSC Panel on 8 September 2022[11],

Proposed Solution (mandatory by originator)

[10] Issue 93 'Review of the BSC metering Codes of Practice'
[11] BSC Panel 330/08

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This CP will look to amend paragraph 4.3.1 of CoPs 1, 2, 3 and 5 to provide guidance on considering the full range of operating conditions when assessing the overall of accuracy of the Metering System is within the limits specified.

This CP will also clarify in CoPs 1, 2, 3 and 5 paragraph 5.1.1 that a suitable rated value of primary current for the CT should be chosen to ensure that the Rated Measuring Current (expressed as a percentage) does not fall below 1% or exceed 120% for all running conditions.

This CP will also clarify in CoP 1, 2, 3 and 5 paragraphs 5.1.1 and 5.1.2 that additional burden can be added to the secondary side of the measurement transformers to ensure overall accuracy of the energy measurements is within the limits of error in paragraph 4.3.1 by bringing the total burden within the value from 25 % to 100 % of the rated output that the limits of ratio error and phase displacement that are specified for in the relevant standard (BS EN/IEC 61869-2 for CTs and BS EN/IEC 61869-3 for VTs).

Justification for Change (mandatory by originator)

This CP will provide explicit clarity on the appropriateness of CT ratios to be used for Metering Systems and the appropriateness of the rated burden selected for CTs and VTs. It also clarifies that additional burden can be added to the secondary side of measurement transformers (i.e. CTs and VTs) to ensure that the Metering System is operating within the limits specified for overall accuracy in the CoPs (paragraph 4.3.1). This will improve Settlement accuracy by reducing the number of instances where an inappropriate CT ratio or rated burden value has been selected by a Metering System designer.

Additionally, this CP will provide guidance on considerations for when the Plant operating conditions mean the percentage of Rated Measuring Current and/or system power factor are outside the combinations specified in the overall accuracy tables specified in paragraph 4.3.1.

To which section of the Code does the CP relate, and does the CP facilitate the current provisions of the Code? (mandatory by originator)

Section L 'Metering'

Estimated Implementation Costs (mandatory by BSCCo)

<£2,000

BSC Configurable Items Affected by Proposed Solution(s) (mandatory by originator)

- Code of Practice 1 'The Metering of Circuits with a Rated Capacity exceeding 100MVA for Settlement Purposes';
- Code of Practice 2 'The Metering of Circuits with a Rated Capacity not exceeding 100MVA for Settlement Purposes';
- Code of Practice 3 'The Metering of Circuits with a Rated Capacity not exceeding 10MVA for Settlement Purposes'; and
- Code of Practice 5 'The Metering of Energy Transfers with Max Demand of up to (and including) 1MW for Settlement Purposes'

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Impact on Core Industry Documents or System Operator-Transmission Owner Code (mandatory by originator) No impact identified
Related Changes and/or BSC Releases (mandatory by BSCCo) Issue 93 'Review of the BSC metering Codes of Practice'
Requested Implementation Date (mandatory by originator) TBC
Reason: To allow enough time to consult the industry, update the relevant documents and implement this change as early as possible.
Version History (mandatory by BSCCo)
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Date: 7 November 2023
Attachments: Yes. CoPs 1, 2, 3 and 5

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