

VOLTAGE DIVIDERS

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PURPOSE AND SCOPE

This document describes the technical requirements for User’s equipment directly connected to the England and Wales Transmission system and located within NGET’s busbar protection zone operating at nominal voltages of 400 kV, 275 kV, 132 kV and 66 kV unless otherwise agreed with the user as defined in the Bilateral agreement. The principles of this document applies to equipment connected at other voltages”.

PART 1 – PROCEDURAL

1 GENERAL REQUIREMENTS

Informative: Voltage dividers with analogue voltage outputs referenced in this specification are intended for applications where a precision voltage measurement with a wide bandwidth is required.

As an alternative to the AC voltage output, consideration will be given to dividers offering digital outputs compatible with IEC 61850 bay process bus requirements

- 1.1 Voltage dividers shall comply with TS 1 (RES), TS 2.02 (RES) and BS EN 60358.
- 1.2 All connections and links shall be suitable for their required purpose regarding rating, reliability and environmental conditions.
- 1.3 The nominal output shall be $110\text{ V} / \sqrt{3}$ when forming part of an NGET protection scheme.
- 1.4 The rated transformation ratio shall be as shown in table 1 when forming part of an NGET protection scheme.
- 1.5 Voltage dividers shall be intrinsically safe and shall incorporate failsafe protection to protect personnel from malfunction of the divider e.g. supervised voltage clamps.
- 1.6 The Voltage Divider supplier shall recommend a suitable supplier of armoured cable type for secondary connections and provide a wiring diagram showing termination and earthing of core screens, overall screens and armouring and spare cores. The cable capacitive burden shall be suited to cabling distances of between 20 and 400m. In instances where the divider bottom end has to be tuned to the cable capacitance in order to achieve the performance requirements, the tuning range shall accommodate this range of cabling distances

Highest Voltage of Equipment U_m (r.m.s.) kV	Rated transformation ratio
420	3600:1
300	2500:1
145	1200:1

Table 1 - Rated Division Ratio

2 PERFORMANCE REQUIREMENTS

- 2.1 At nominal frequency and at reference temperature, the phase and magnitude errors shall satisfy the requirements of BS EN 61869-3 class 0.2 at unity power factor
- 2.2 When forming part of an NGET protection scheme the burden shall be $200 \pm 20\%$ M Ω
- 2.3 When forming part of an NGET protection scheme the ratio error shall be within $\pm 1\%$ over the frequency range 48 Hz to 3 kHz, for the operating temperature range as given in TS 1 and a $\pm 10\%$ variation of burden and capacitance of cable occurring in combination.
- 2.4 When forming part of an NGET protection scheme the phase displacement of the output with respect to the input shall not exceed 40 minutes over the frequency range 48 Hz to 3 kHz, for the operating temperature range as given in TS 1 (RES) and a $\pm 10\%$ variation of burden and capacitance of cable occurring in combination.

3 TEST REQUIREMENTS

Type Tests

- 3.1 Voltage dividers shall be tested in accordance with the type test requirements of BS EN 60358.
- 3.2 Voltage dividers shall be tested in accordance with the measuring and protective requirements given in BS EN 61869-3. The rated burden will be at unity power factor (range I).
- 3.3 The manufacturer shall propose and perform tests to demonstrate that the applicable requirements of clauses 2.3 and 2.4 (accuracy requirements) are met.
- 3.4 The manufacturer shall demonstrate the performance over the frequency range 10 Hz to 48 Hz.
- 3.5 Radio interference voltage tests shall be performed in accordance with BS EN 62271-1.
- 3.6 Voltage Dividers shall be subject to a multi chopped impulse test in accordance with TS 3.02.05 (RES).
- 3.7 Routine tests shall be performed before and after all type tests.

Routine Tests

- 3.8 The voltage dividers shall be tested in accordance with the routine test requirements of BS EN 60358.
- 3.9 The voltage dividers shall be tested in accordance with the measuring and protection requirements given in BS EN 61869-3.
- 3.10 The voltage divider shall be tuned to the cable length and burden where necessary by the voltage divider supplier using primary injection, over the specified frequency range to obtain the frequency characteristic.

Routine Test Reports

- 3.11 Routine test reports shall include details of all routine measurements made in accordance with this specification.
- 3.12 Specifically for partial discharge (PD) tests, the values of measured PD at the specified partial discharge test voltage shall be recorded together with PD extinction voltages.

Informative: Extinction voltage is defined as the voltage level at which measurable PD is extinguished upon decreasing test voltage. The background PD level at the time of the test should also be recorded in the report.

Commissioning Tests

- 3.13** When forming part of an NGET protection scheme having established the frequency characteristic as in Clause 3.10, the performance at 50Hz, 0.2% accuracy shall also be established by capacitance ratio measurement of the complete installation (C1 and C2 measurements inclusive of cabling.)

4 FORMS AND RECORDS

None

PART 2 - DEFINITIONS AND DOCUMENT HISTORY

5 DEFINITIONS

The definitions used in TS 1 (RES) and TS 2.02 (RES) apply.

6 AMENDMENTS RECORD

Issue	Date	Summary of Changes / Reasons	Author(s)	Approved By (Inc. Job Title)
1	September 2016	New document	Martin Carpenter	GCRP

6.1 Procedure Review Date

5 years from publication date.

PART 3 - GUIDANCE NOTES AND APPENDICES

7 REFERENCES

7.1 International, European and British National Documentation

This document makes reference to or should be read in conjunction with the documents listed below. Where a Standard has been harmonised into a Euronorm, only this latter reference is given. The issue and date of the documents detailed below shall be that applicable at the time of issue of this specification unless a specific issue date is given.

BS EN 60358	Coupling capacitors and capacitor dividers
BS EN 61869-3	Instrument Transformers – Part 3 : Additional requirements for inductive voltage transformers
BS EN 62271-1	High-voltage switchgear and controlgear – Part 1: Common specifications

7.2 RES Technical Specifications

The following TS documentation is relevant to capacitor dividers and should be read in conjunction with this document.

TS 1(RES)	Ratings and General Requirements for Plant, Equipment, Apparatus and Services for use on and Direct Connections to the National Grid Transmission System
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TS 2.02 (RES)

Switchgear for use on, and at Connection Points to, the National Grid System

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