TS RES - OUTSTANDING ISSUES

This document has been officially issued as DRAFT until the following outstanding issues have been resolved. At that time the document will be officially reissued as the next Issue number with the words DRAFT removed.

DOCUMENT DETAILS

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DETAILS

Clause	Details	Status	Date	Author
1.3.1 & 1.3.2	Further detailed discussion required regarding humidity ranges of plant and apparatus.	Ongoing		

RATINGS AND GENERAL REQUIREMENTS FOR PLANT, EQUIPMENT AND APPARATUS FOR THE NATIONAL GRID SYSTEM

This document is for Relevant Electrical Standards document only.

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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".

The requirements of this document apply to all plant, equipment and apparatus which is directly connected to the National Grid System. Requirements contained herein may be modified on a more specific basis by lower level specification however, unless such modifications are explicitly detailed, the requirements of this document apply.

Ratings are specified explicitly for plant with nominal voltages of 66kV and above. Derogation from the requirements of the RES will normally be permitted only where it can be demonstrated that the proposed derogation is not detrimental to the safety, reliability and availability of the Transmission System in England and Wales.

PART 1 – TECHNICAL REQUIREMENTS

1 ENVIRONMENTAL SERVICE CONDITIONS

1.1 General

Plant, equipment and apparatus shall be suitable for operation under the normal service conditions defined in IEC 61936-1 with the following additions/modifications.

Equipment housed outdoors in association with high voltage plant shall have a degree of protection of at least IP54 as defined in BS EN 60529.

1.2 Normal Service Conditions

1.2.1 Indoor

The temperature class shall be "-5 indoor".

1.2.2 Outdoor

The temperature class shall be "-25 outdoor".

The ice coating classification shall be "class 10" (10mm).

The environmental pollution level shall be "Class III – Heavy" as defined in Table 1 of 60071-2.

1.3 Special service conditions

1.3.1 Indoor

Equipment intended to be sited within a closely controlled environment shall be suitable for operation in the temperature range $+18^0$C to $+27^0$C and within the relative humidity range 20% to 75% (Class A1 of BSEN 60654-1). Critical functionality shall be maintained in the event of failure of the environmental controls i.e. under the Normal Service Conditions defined above.

1.3.2 Outdoor

For particular locations, which may be subject to severe coastal/industrial pollution, the environmental pollution level shall be "Class IV – Very Heavy" as defined in Table 1 of 60071-2.

2 ELECTRICAL REQUIREMENTS

2.1 System Voltage

Plant and Equipment shall satisfy their specified functional and performance requirements over the appropriate range of primary voltages given in Table 1.

Plant and equipment for use on the 400kV system shall also operate safely and without any degradation in performance when operated in the range 420kV to 440kV for not longer than 15 minutes.

Plant and equipment shall satisfy their specified functional and performance requirements with phase voltage unbalance up to a maximum of 1%.

Informative: Phase voltage unbalance up to 2%, on an infrequent, short duration basis, may be specified at some site) *and User's LV networks with an upper limit of 3% in special cases*

Plant and equipment shall satisfy their specified functional and performance requirements when exposed to harmonic distortion levels in the voltage waveform up to the compatibility levels specified in Appendix A of ER G5/4.

Nominal System voltage	400 kV	275 kV	132 kV	66kV
Rated voltage of plant	420 kV	300 kV	145 kV	72.5kV
Maximum continuous System voltage	420 kV	303 kV	145 kV	70kV
Minimum continuous System voltage	360 kV	247 kV	119 kV	62kV

Table 1 - System Voltage

2.2 Rated Insulation Level and Protective Gap Settings

Plant shall meet the requirements of Table 3 with regard to its rated insulation level.

Table 4 details protective gap settings commonly used by National Grid which should be taken into account.

2.3 System Frequency

Plant and Equipment shall satisfy their specified functional and performance requirements over the range of frequencies given in Table 2.

Plant and equipment shall also operate safely and without any degradation in performance within the following frequency ranges:

a) 47Hz to 47.5Hz for at least 20 seconds

b) 50.5Hz to 52 Hz continuous

Rated frequency	50 Hz
Maximum continuous frequency	50.5 Hz
Minimum continuous frequency	47.5 Hz

Table 2 - System Frequency

Nominal voltage (kV)	Rated voltage (kV)	Rated short-duration power frequency withstand voltage (kV)		Rated switching impulse withstand voltage (kV.pk)			Rated lightning impulse switching withstand voltage (kV.pk)	
		Common value*/ Phase to earth & between phases	Across open switching device and/or isolating distance	Phase to earth	Between phases	Across open switching device and/ or isolating distance	Common value*/ Phase to earth & between phases	Across open switching device and/ or isolating distance
400	420	520	610	1050	1575	900 (+345)	1425	1425 (+240)
275	300	380	425	850	1275	700 (+245)	1050	1050 (+170)
132	145	275*	315	N/A	N/A	N/A	650*	750
66	72.5	140*	160	N/A	N/A	N/A	325*	375
13	17.5	38*	45	N/A	N/A	N/A	95*	110

Table 3 - Insulation Level Requirements

Nominal voltage (kV)	Mid-line overhead line arcing gap setting (m)	Substation approach (1.6km) overhead line arcing gap setting (m)	Transformer & reactor screened co-ordinating gaps (m)	Cable sealing end co-ordinating gaps (m)	Unscreened gaps applied to existing transformers/ reactors (m)
400	2.8	2.5	1.5	2.54	1.68
275	2.13	1.9	1.2	1.9	1.22
132	1.1	1	0.66	1	0.66
66	N/A	N/A	N/A	0.54	0.54
13	N/A	N/A	0.1	0.1	N/A

Table 4 - Arcing & Co-ordinating Gap Settings

2.4 Earthing of System Neutral

Plant and Equipment shall satisfy their specified functional and performance requirements under the neutral earthing condition given in Table 5.

Nominal Voltage (kV)	Maximum Earth Fault Factor	Earthing Type
400, 275, and 132	1.4	Multiple direct
66	Site specific	Site specific impedance earthing
13 (tertiary)	Site specific	Site specific

Table 5 - Neutral earthing

2.5 Fault clearance time

Plant and Equipment shall be suitable for operation under the conditions detailed in Table 6.

Nominal Voltage(kV)	Target fault interruption time of main in-feeding circuit (ms)	Target total fault clearance time (all infeeds) (ms)	Target back-up clearance time (ms)
400	80	140	500 (1000*)
275	100	160	500 (1000*)
132	120	N/A	<1500
66	120	N/A	<1500
13	75 (of which 35ms max' protection time)	N/A	N/A

Table 6 - Target fault clearance requirements

**Informative: Fault clearance times for zone 3 distance protection and residual earth fault protection on feeder circuits of 1 second are acceptable.*

In the event of a circuit-breaker failure, circuit-breaker fail protection shall trip all necessary contiguous circuit-breakers which are capable of supplying a fault infeed within a target fault clearance time not exceeding 300 ms.

2.6 Primary Currents

Substation Plant and Equipment shall be suitable for operation under the condition detailed in Table 7.

System Voltage kV	Normal Current A	Short-circuit Current (3- and 1-phase) kA	Duration of short-circuit s	DC Time Constant ms
400	4000	63	1	45
275	3150	40	1	45
132*	2000	40	3	45
		31.5	3	135
66	2000	31.5	3	135
13	4000	50	1	96

Table 7 - Short-circuit and load current requirements

*132kV equipment is required to meet **both** short-circuit current ratings detailed in Table 7.

Note: If other nominal and short circuit current ratings are applicable to Users this is acceptable provided the equipment is fit for purpose. . As per IEC6227-1, 120ms will be accepted where it is adequate for site specific conditions.

3 DESIGN REQUIREMENTS

4 OPERATIONAL, MAINTENANCE AND MONITORING REQUIREMENTS

4.1 Multi-pole Opening/Tripping and Auto-reclosing

Plant and equipment shall be suitable for operation under the following circuit-breaker operating conditions:

a) Simultaneous three-phase opening/tripping.

b) Simultaneous three-phase auto-reclosing on overhead line feeder circuits.

5 SAFETY, HEALTH, ENVIRONMENT AND SECURITY REQUIREMENTS

Products supplied for installation on the National Grid System or property, and owned and operated by or on behalf of National Grid, shall comply with all relevant UK Health and Safety and Environmental legislation.

The National Grid system, in its entirety, complies with the Electromagnetic Compatibility (EMC) Directive (Statutory Instrument No. 2372 'The Electromagnetic Compatibility Regulations 1992') i.e. it is designed and constructed such that it does not introduce intolerable electromagnetic disturbances to its environment and is immune to electromagnetic disturbances in its environment. Equipment introduced into the system shall not detrimentally effect this compliance.

5.1 Date Proofing

All products shall be immune to failure or malfunction due to the presence of date sensitive elements.

Provision shall be made for all products to be clearly marked with their operational identity in accordance with TP109.

6 FORMS AND RECORDS

None.

PART 2 - DEFINITIONS AND DOCUMENT HISTORY

7 DEFINITIONS

7.1 Directly (Connected)

Connected in such a way that performance of the connected equipment directly affects the performance of the National Grid System. Typically this is limited to equipment within the coverage of National Grid busbar protection.

7.2 Plant

Primary (high voltage) elements of the National Grid System such as the circuit-breakers, transformers, overhead lines and cables.

7.3 Equipment

Secondary (low voltage) elements of the National Grid System such as those for control, measurements, protection and auxiliary supplies.

7.4 Apparatus

Physical components of, or associated with, the National Grid System which are required in support of the plant and equipment. Examples are substation structures, auxiliary plant and portable test equipment.

8 AMENDMENTS RECORD

Issue	Date	Summary of Changes / Reasons	Author(s)	Approved By (Inc. Job Title)
1	October 2014	New document	Mark Waldron/ Richard Poole	GCRP

8.1 Procedure Review Date

5 years from publication date.

PART 3 - GUIDANCE NOTES AND APPENDICES

9 REFERENCES

BS EN 60071	Insulation co-ordination
BS EN 60529	Degrees of protection provided by enclosures (IP Code)
BS EN 60654-1	Industrial – Process Measurement and Control Equipment Operating Conditions; Part 1 Climatic Conditions
IEC 61936-1	Power installations exceeding 1kV : Common rules
Engineering Recommendation (ER) G5/4	Levels of harmonic distortion
National Grid Safety Rules	