Electricity Distribution

nationalgrid

Company Directive

ENGINEERING SPECIFICATION
EE SPEC: 87/8

Protection, Alarm and Control Panels Associated with 36kV and 72kV Outdoor Switchgear, 33kV and 66kV Transformers and Control Panels Associated with Arc Suppression Coils

Summary

This document provides specifies the requirements for Protection, Alarm and Control Panels approved for use within National Grid Electricity Distribution's 33kV and 66kV network

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Implementation Date: **February 2025**

Approved by:

Craig Sharp
Engineering Policy Manager

Date: **17th February 2025**

Target Staff Group	**NGED staff, inclusive of Engineering Design, Local Planners, Engineering Specialists, Project Engineers and Procurement; Contractors and Independent Connection Providers (ICPs) involved with the specification, design, installation and/or replacement of Protection, Alarm and Control Panels.**
Impact of Change	**Green – No impact on current working practices**
Planned Assurance checks	**None**

IMPLEMENTATION PLAN

Introduction

This document specifies the requirements for protection panels associated with 36kV and 72kV outdoor switchgear and 33kV and 66kV transformers. This document also specifies the requirements for 33kV and 66kV full scheme busbar protection panels and 36kV and 11kV arc suppression coil (ASC) control panels.

Main Changes

Minor updates have been made to this document to accommodate updates to ENA standards and a reduced subset of standard panel types.

Further information is included in the document review and revision table.

Impact of Changes

These changes are relevant to all staff, contractors and Independent Connection Providers involved with the design, specification, tendering, installation, commissioning and maintenance of 33kV and 66kV substations, switchgear, transformers, ASCs and the associated protection, alarm and control systems.

Implementation Actions

Managers, including Managers of Independent Connection Providers (ICPs) shall ensure that all of their staff and contractors involved in the design, specification, tendering / purchasing, installation, commissioning and maintenance of 36kV and 72kV switchgear, 33kV and 66kV transformers, ASCs and their associated protection, alarm and control panels are aware of, and follow, the requirements of this specification.

Implementation Timetable

This document will be used as part of the 2025 tender process Protection, Alarm and Control Panels for 33kV and 66kV systems and shall be implemented on issue.

Items currently on order/under an active quotation, to EE87/1 shall continue to be acceptable to National Grid Electricity Distribution so long as the order was placed before 1st August 2025 but the unit is to be commissioned after 1st August 2025.
Exception to this may be made by National Grid Electricity Distribution Engineering Policy team upon formal request.

REVISION HISTORY

Document Revision & Review Table		
Date	**Comments**	**Author**
Feb 2025	• Document has been reformatted • All references to Western Power Distribution and WPD have been replaced with National Grid Electricity Distribution • All references to ENA TS 41-36 have been replaced with that of ENA TS 41-40 • All references to SF6 have been replaced with that of IIG (Interrupting Isolating Gas) • Schedule A and Schedule B standard panel types have been edited to a reduced subset of previous schedules. This is inclusive of the removal of 36C5, 36C7 and amendments to 36C1	Daniel Price
Dec 2017	• References have been updated • Guarantee requirements have been added • Ancillary equipment including auxiliary relays, control / selection switches, transducers, push buttons and lamps have been moved to EE SPEC: 136 • Schedule A – circuit types have been renamed and circuit 36C6A, 36C7A, 36C11A and 36C12A have been added • Schedule B – circuit types have been renamed and circuit 36C6B, 36C7B and 36C12B have been added	A Hood

Contents

1.0 INTRODUCTION

1.1 This document specifies the requirements for protection panels associated with 36kV and 72kV outdoor switchgear and 33kV and 66kV transformers. This document also specifies the requirements for 33kV and 66kV full scheme busbar protection panels and 36kV and 11kV arc suppression coil (ASC) control panels.

1.2 Protection and ancillary equipment provided in/on 36kV and 12kV indoor switchgear is outside of the scope of this document (see EE SPEC: 182 and EE SPEC: 185).

1.3 Requirements for tap-change control panels are outside of the scope of this document (see EE SPEC: 86).

1.4 Unless otherwise specified in writing at time of Tender all equipment offered shall be compliant with this document.

2.0 REFERENCES

2.1 References are in accordance with ENA TS 50-18 and ENA TS 41-40 with the following additions in Table 1.

2.2 It is important that users of all standards and technical specifications ensure they are applying the most recent editions together with any amendments.

2.3 Whilst the IEC base document is listed for information, the prime document that shall take priority is the British Standard enacting the European Standard (EN) or European Harmonisation Document (HD)

BS No.	**Title**	**IEC / ISO base**
BS EN 60255	Specification for Electrical relays and protection equipment	IEC 60255
BS EN 61000-6-5	Electromagnetic compatibility (EMC). Generic standards. Immunity for equipment used in power station and substation environments	IEC 61000-6-5
BS EN 61000-6-4	Electromagnetic compatibility (EMC) Generic standards – Emission Standard for industrial environments	IEC 61000-6-4
BS EN 61439	Low-voltage switchgear and controlgear assemblies	IEC 61439
BS IEC 61508	Functional safety of electrical/electronic/programmable electronic safety-related systems	IEC 61508
ENA TS 48-3	Instantaneous High Impedance Differential Protection	
ENA TS 48-4	DC Relays Associated with a Tripping Function in Protection Systems	
ENA TS 48-5	Environmental Test Requirements for Protection and Control Equipment and Systems	
ENA EREC S15	Standard Schematic Diagrams	

Table 1 Additional References

3.0 GUARANTEE

3.1 The supplier of the plant / equipment covered by this specification shall provide a guarantee for that equipment. The guarantee period that the supplier warrants will be a minimum of five (5) years from the date of completion of commissioning of the relevant plant / equipment. Note, this requirement applies to plant / equipment purchased by Independent Connection Providers (to be adopted by National Grid Electricity Distribution) as well as equipment purchased directly by National Grid Electricity Distribution.

4.0 REQUIREMENTS

4.1 General

4.1.1 Suppliers and Manufacturers shall satisfy the requirements of BS EN ISO 9000 and BS EN ISO 9001 for all products supplied.

4.1.2 All equipment and systems shall satisfy requirements of the EMC directive. EMC emissions and immunity requirements shall, satisfy the requirements of the generic emission standard for industrial environment, BS EN 61000-6-5, the generic immunity standard for power station and substation environments, BS EN 61000-6-4 and all relevant EMC product standards.

4.1.3 The equipment shall be suitable for use within three phase systems in which the neutral is earthed either solidly or through a resistance or reactance of low value or through a reactor or arc suppression coil. It should be noted that parts of National Grid Electricity Distribution's network employ arc suppression coil (ASC) earthing.

Where ASC are specified, Tenderers are advised to consider carefully the implications of this, with particular emphasis on the phase to earth voltages during earth fault conditions.

4.1.4 All equipment shall be suitable for the service conditions defined in BSEN 61439-1 for indoor installations.

4.2 Cubicles

4.2.1 Cubicles shall be floor standing and shall either be front access or rear access as specified at the time of tender. Cubicles shall, unless otherwise agreed at the time of tender, have the following external dimensions:

2275mm high x 610mm wide x 610mm depth

Further details are included in National Grid Electricity Distribution's general arrangement drawings.

4.2.2 Cubicles shall be constructed from sheet steel having a minimum thickness of 2mm and bracing shall be provided to prevent whipping. Cubicles shall comply with ENA TS 50-18 and shall be suitable for indoor use.

4.2.3 Inter panel cut outs shall be provided on each side of each cubicle that align with adjacent cubicles for bus-wiring and earthing. End panels shall have provision for future extension and any holes not used initially shall be blanked off. The position and size of these cut-outs is defined in the associated general arrangement drawings.

4.2.4 Cubicles shall, as a minimum, include cut-outs and fixing facilities for mounting 6 rows of relays, each row being 177mm (4U) high and 414mm wide. Any unused cut-outs shall be covered with removable blanking plates.

4.2.5 Each compartment shall have an access door that shall open within the width of the cubicle to allow panels to be butted together. Doors shall be fitted with one central lockable fastening handle, unless otherwise agreed at the time of tender.

4.2.6 Relays, with the exception of auxiliary relays without flag indication, shall be mounted (flush or semi-projecting) on the front of the relevant compartment, and positioned to allow free access to all terminals without disassembly.

4.2.7 Cubicles shall be suitable for both top and bottom entry multicores. The gland fixing arrangement shall be such that additional cables may be added at a future date without need to disturb the wiring of existing cables. The gland fixing arrangement shall provide an effective anti-vermin barrier.

4.2.8 The exterior of the cubicles shall be coloured light grey, colour reference 697 to BS381C – semi gloss. The interior shall be coloured white – semi gloss.

4.2.9 In order to provide some resilience against flooding all live parts including cable terminations shall be located at least 400mm above floor level.

4.3 Earthing

4.3.1 Cubicle earthing requirements and earthing of small apparatus shall be in accordance with ENA TS 50-18. An earth bar of not less than 25mm x 3mm copper shall be provided internally with separate bolted earth bars/links that may be used to connect the earth bar between adjacent cubicles. The internal earth bar shall be provided with a means to connect the earthing of small apparatus within each compartment.

4.4 Auxiliary Supplies

4.4.1 Auxiliary supplies for protection, alarm panels shall be suitable for 110Vd.c. auxiliary supplies unless otherwise specified.

4.4.2 Equipment shall operate correctly over the voltage ranges specified in ENA TS 48-5 and ENA TS 50-18 as applicable.

4.4.3 Tele-control auxiliary supplies are either 48Vd.c. or 24Vd.c depending on the site. The tele-control auxiliary supply requirements for a particular installation are specified by National Grid Electricity Distribution at the time of order.

4.5 Protection, Alarm and ASC Control Relays

4.5.1 Protection, alarm and arc suppression coil control relays shall be chosen in accordance with the schedules at the end of this document and in accordance with National Grid Electricity Distribution's standard schematic drawings. Relay types shall be agreed with National Grid Electricity Distribution at the time of tender.

4.5.2 On a given suite of cubicles, protection, alarm and trip relays shall be obtained from one relay manufacturer unless otherwise specified and agreed by National Grid Electricity Distribution at the time of tender. The types of relays and their position shall be consistent across the suite of cubicles.

4.5.3 Protection, control and alarm relays shall comply with BSEN 60255, IEC 60255, ENA TS 48-4, ENA TS 48-5, BSEN 61810 and BS EN 61811, as appropriate. All relays shall be a type, make approved by use by National Grid Electricity Distribution and shall utilise firmware and software that is approved for use within National Grid Electricity Distribution. A list of approved relays and relay test blocks is included in National Grid Electricity Distribution Specification EE: SPEC98

4.5.4 Alternative relays may be submitted to the Technical Policy Manager for evaluation.

4.5.5 Relays that are designed to be set / programmed via a personal computer (PC) shall be provided with an accessible connection facility (e.g., a USB socket). This shall either be mounted on the front of the relay itself or on a separate connector mounted on the front of the relay panel.

4.5.6 Alarm indication (flag) functions, such as Buchholz alarm, IIG low alarm and winding temperature alarm indications may either be provided by programmable LEDs (located on protection relays) or by separate alarm indication relays. Detailed requirements are defined in National Grid Electricity Distribution's standard drawings.

4.5.7 Circuit breaker open/closed status and springs charged indication (where applicable) shall be provided on separate indication lamps, as specified in Appendix D.

4.5.8 Relay inputs shall be derived from the 110Vd.c. battery supply unless otherwise specified. Relay inputs used for tripping purposes shall satisfy the high burden requirements of ENA TS 48-4.

4.5.9 Unless otherwise specified, relays shall be suitable for 1A CT inputs and 110V VT inputs. If there is any doubt over the required relay ratings the tenderer shall confirm the requirements with National Grid Electricity Distribution at the time of tender.

4.6 Full Scheme Busbar Protection

4.6.1 Full scheme busbar protection is required on all new indoor 33kV and 66kV switchboards and also on outdoor busbars where all the circuits are controlled by a dedicated, local circuit breaker (see POL: SD3).

4.6.2 National Grid Electricity Distribution standard schemes utilise high impedance circulating current relays. Alternative schemes that can be demonstrated by the tenderer, at the time of tender, to perform the equivalent functions may be acceptable subject to agreement prior to placement of the contract.

4.7 Small wiring and Terminals

4.7.1 Small wiring and terminals shall comply with ENA TS 41-40 with the following additions:

- The application of small wiring, ancillary electrical equipment and protection shall in general follow the principles in Engineering Recommendation S15.
- A.C. and D.C. secondary wiring shall comprise of:
    - A.C. wiring: 2.5mm^2 (minimum) copper stranded cable with PVC insulation to BS6231 Type BR, or equivalent tri-rated cable complying with BS6231.
    - D.C. wiring: 1.5mm^2 (minimum) copper stranded cable with PVC insulation to BS6231 Type BR, or equivalent tri-rated cable complying with BS6231.
    - Transducer output wiring: 1.0mm^2 (minimum) stranded copper twisted pair cable with PVC insulation.
- The insulation of A.C. and D.C. wiring shall be coloured white in all circuits, except earthing which shall be coloured green/yellow. A.C. and D.C. wiring shall be terminated with crimped connections in accordance with ENA TS 50-18.
- Terminal blocks used for protection, alarm and control circuits shall be screw clamp with spring type, in accordance with ENA TS 50-18 Type B. Terminal blocks for 24Vd.c. and 48Vd.c. telecontrol wiring, and for transducer output wiring shall be screw clamp type, to EATS 50-18 Type C with a hinged link for isolation purposes. Sufficient space shall be allowed so that connections can be tightened or un-tightened and wires removed and re-inserted. Spare cores shall be terminated at the terminal blocks furthest from the cable gland.

4.8 Fuses and Links

4.8.1 Secondary fuse-links, links and fuse carriers shall be in accordance with EATS 50-18, BS HD 60269-2 reference A. Fuses and fuse holders up to 20A rating shall be in accordance with BS HD 60269-2 reference A1.

4.8.2 The fuse holders and bases shall be coloured as follows:

- 2A, 4A, 6A, 10A fuses: black (colour 642 of BS 381C)
- 16A fuses: green (colour 216 of BS 381C)
- Solid links: white

4.8.3 Eaton Bussmann or Mersen Red Spot fuse holders shall be provided unless otherwise agreed at the time of tender.

4.8.4 All fuses and links shall be mounted vertically, grouped logically and consistently on the front of the panel and shall be clearly labelled. The label shall show the function of the fuses/links and include the fuse/link number as specified on the schematic drawings. Where a double row of fuses and links is required, the labelling of the bottom row may need to be mounted on a stand-off bracket to ensure they are clearly visible. Fuses shall, as far as possible, be positioned consistently across the suite of panels and cubicles.

4.8.5 Fuse terminals shall be suitably shrouded to minimise electric shock hazards. The incoming (supply) side of each circuit shall be connected on the bottom terminal of the fuse/link.

4.9 Ancillary Equipment

4.9.1 Requirements for ancillary equipment including relays, contactors, control / selector switches, transducers, push buttons and lamps are specified in EE SPEC: 136.

4.10 Instruments

4.10.1 Instruments, where specified, shall satisfy the requirements of ENA TS 50-18 with the following exception:

- Where dual ratio CTs are specified, ammeters shall include reversible scales suitable for each ratio

4.11 Drawings

4.11.1 The manufacturer shall provide the following drawings for approval within one month of the commencement date of the contract or by mutually agreed date at the placement of the order. One paper copy of each drawing, prepared in accordance with ENA TS 50-18 and not exceeding A1 size and one electronic copy in .pdf format shall be supplied for approval.

- General Arrangement of each circuit breaker / cubicle
- Schematic Diagram for each circuit breaker / cubicle
- Wiring diagram for each circuit breaker / cubicle

4.11.2 Upon written drawing approval, one further paper copy and one electronic copy in .pdf format shall be supplied. After on-site installation and commissioning of the cubicles has been completed the manufacturer shall incorporate any alterations within 3 months of the drawings being returned for correction. The manufacturer shall provide final drawings in .dwg CAD format.

APPENDIX A

STANDARD PROTECTION / ALARM FUNCTIONS

Reference	Description
A	Alarm indication relay (used for buchholz alarm (BA), winding temperature alarm (WTA), IIG pressure low alarm (IIGA) etc.)
AR	Auto-reclose
AR(CSYNC)	Auto-reclose with check synchronizing facilities
AR(LLDBC)	Auto-reclose with live line, dead bus charge
ASC	ASC Control Relay
AX	Auxiliary relay
AXF	Auxiliary relay with hand reset flag
BBCK	Busbar protection check relay
BBCKA	Busbar protection check auxiliary relay
3BBOC	3 element busbar overcurrent (high impedance)
BD	Biased differential
BEF	Balanced earth Fault
CD	Current Differential (unit protection)
CTS	CT supervision
DEIT	Directional IDMT earth fault
3DOCIT	3 elements directional IDMT overcurrent
3DOCIT(LB)	3 elements directional IDMT overcurrent with load blinding
3DOCIT(VC)	3 elements voltage controlled directional IDMT overcurrent
E	Instantaneous earth fault
EIT	IDMT earth fault
3HOC	3 element high set overcurrent
IT	Intertrip send/receive system
NVD	Neutral voltage displacement
2OC	2 element instantaneous overcurrent
3OC	3 element instantaneous overcurrent
3OCIT	3 element IDMT overcurrent
3OV	3 element overvoltage
PW	Pilot wire protection (unit protection)
RTB	Relay test block
SBEF	Standby earth fault
SBEF1	Standby earth fault stage 1
SBEF2	Standby earth Fault stage 2
SEF	Sensitive earth fault
TCS	Trip circuit supervision
TI	Trip indication relay (used in series with trip coil or trip relay coil, e.g., buchholz trip (BT), winding temperature trip (WTT) etc.)
TRS	Trip relay supervision
TDS	Trip relay with 2.5s time delay reset contact and hand reset flag
TE	Trip relay with electrically reset contacts and hand reset flag
TH	Trip relay with hand reset contacts and flag
TS	Trip relay with instantaneous self reset contacts and hand reset flag
TSS	Trip Supply Supervision
VTS	VT supervision
Z	Distance protection

APPENDIX B

SUPERSEDED DOCUMENTATION

This document supersedes EE SPEC: 87/7 dated December 2017 which has now been withdrawn.

APPENDIX C

ASSOCIATED DOCUMENTATION

ENA TS 41-40 Ground Mounted Major Substation 12 to 36 kV Rated Indoor Fixed Pattern Switchgear

ENA TS 41-24 Guidelines for design, installation, testing and maintenance of main earthing systems in substations

ENA TS 50-18 Application of ancillary electrical equipment

EE SPEC: 10 Specification for 12kV and 36kV outdoor overhead conductor connected switchgear and VTs

EE SPEC: 98 Approved protection, voltage control and alarm relays and test access blocks

EE SPEC 136 Ancillary electrical equipment for use in conjunction with switchgear and protection / control panels

EE SPEC: 182 33kV indoor primary circuit breakers

ST: SD4O Standard HV Connection Arrangements

APPENDIX D

KEY WORDS

Circuit Breaker, Panel, Cubicle, Protection, Alarm, Transducer, Telecontrol

Schedule A Protection Cubicles for 36kV and 66kV Circuits at Primary Substations - Part 1						
Description	**Further Details**	**36C1A** T/F feeder circuit without intertripping	**36C2A** T/F feeder circuit with intertripping	**36C3A** T/F feeder circuit with local tripping	**36C4A** Circuit with distance protection	**36C6A** Circuit with current differential protection
Standard drawings	Single Line Diagram: Schematic Diagram: General Arrangement:	SL36C1/OD SPC36C1/OD SPC36C1-GA	SL36C2/OD SPC36C2/OD SPC36C2-GA	SL36C3/OD SPC36C3/OD SPC36C3-GA	SL36C4/OD SPC36C4/OD SPC36C4-GA	SL36C6A/OD SPC36C6A/OD SPC36C6A-GA
Circuit breaker control switch and handle	Clause 4.9	1	1	1	1	1
Remote/supervisory switch and handle	Clause 4.9	1	1	1	1	1
Telecontrol CB open, interposing relay	Clause 4.9	AR1	AR1	AR1	AR1	AR1
Telecontrol CB close interposing relay	Clause 4.9	AR1	AR1	AR1	AR1	AR1
Terminal blocks	Clause 4.7	As required	As required	As required	As required	As required
Fuses and links	Clause 4.8	As required	As required	As required	As required	As required
Relay test block	Clause 4.5	As specified on the schematic drawings	As specified on the schematic drawings	As specified on the schematic drawings	As specified on the schematic drawings	As specified on the schematic drawings
Telecontrol auto-reclose in/out relay	Clause 4.9	AR2			AR2	
Telecontrol auto-reclose in/out push buttons	Clause 4.9	PB1 PB2			PB1 PB2	
Indication Lamps CB Open CB Closed Springs Charged	Clause 4.9	 IL2 IL3 IL3	 IL2 IL3 IL3	 IL2 IL3 IL3	 IL2 IL3 IL3	 IL2 IL3 IL3
Current/Voltage/MW and MVAr transducer	Clause 4.9	TD4	TD4		TD4	TD4
Protection relay 1	Clause 4.5	3HSOC / 3OCIT / 3DOCIT EIT / DEIT NVD / AR BBCK[3] TCS / VTS	3HSOC 3OCIT EIT TCS	3HSOC 3OCIT EIT TCS	Z 3DOCIT DEIT AR BBCK[3] TCS VTS	CD 3DOCIT DEIT BBCK[3] TCS VTS
Protection relay 2	Clause 4.5	VTS[2]	VTS[2]	VTS[2]	VTS[2]	VTS[2]
Protection relay 3	Clause 4.5					

Schedule A Protection Cubicles for 36kV and 66kV Circuits at Primary Substations - Part 1						
Description	**Further Details**	**36C1A** T/F feeder circuit without intertripping	**36C2A** T/F feeder circuit with intertripping	**36C3A** T/F feeder circuit with local tripping	**36C4A** Circuit with distance protection	**36C6A** Circuit with current differential protection
ASC Earth Fault Detection Relay	Clause 4.5 Refer to EE: SPEC98	1[4]	1[4]		1[4]	1[4]
Trip/intertrip relays	Clause 4.5	TS	IT TDS TS (2 off)	TS TDS	TS	TS
Alarm / indication relays	Clause 4.5	A (IIG low)[1]	A (IIG low)[1]	A (IIG low)[1]	A (IIG low)[1]	A (IIG low)[1]

Notes:

Schedule A Part 1:

Note 1: IIG Low indication is only required where the switchgear utilises IIG gas.

Note 2: One outdoor busbar VT and an associated VTS relay is required per section of busbars.

Note 3: Busbar protection check output (BBCK) is only required where full scheme busbar protection is utilised and the circuit provides a major fault infeed into the switchboard.

Note 4: ASC earth fault detection relay is only required where ASC earthing is used (this typically applies to substations in Cornwall).

Schedule A Protection Cubicles for 36kV and 66kV Circuits at Primary Substations - Part 2

Description	**Further Details**	**36C11A** Incoming circuit with metering	**36C12A** Outgoing circuit with metering	**36B3A** Bus-section with 2 distance protection relays	**36B4A** Bus-section without distance protection
Standard drawings	Single Line Diagram: Schematic Diagram: General Arrangement:	SL36C11/OD SPC36C11/OD SPC36C11-GA	SL36C12/OD SPC36C12/OD SPC36C12-GA	SL36B3/OD SPC36B3/OD SPC36B3-GA	SL36B4/OD SPC36B4/OD SPC36B4-GA
Control / Relay Panel:					
Circuit breaker control switch and handle	Clause 4.9	1	1	1	1
Remote/supervisory switch and handle	Clause 4.9	1	1	1	1
Telecontrol CB open, interposing relay	Clause 4.9	AR1	AR1	AR1	AR1
Telecontrol CB close interposing relay	Clause 4.9	AR1	AR1	AR1	AR1
Terminal blocks	Clause 4.7	As required	As required	As required	As required
Fuses and links	Clause 4.8	As required	As required	As required	As required
Relay test block	Clause 4.5	As specified on the schematic drawings	As specified on the schematic drawings	As specified on the schematic drawings	As specified on the schematic drawings
Telecontrol auto-reclose in/out relay	Clause 4.9			AR2	
Telecontrol auto-reclose in/out push buttons	Clause 4.9			PB1 PB2	
Indication Lamps CB Open CB Closed Springs Charged	Clause 4.9	 IL2 IL3 IL3	 IL2 IL3 IL3	 IL2 IL3 IL3	 IL2 IL3 IL3
AC/DC indication interposing relay	Clause 4.9				1[3]
AC/DC/Off double pole control switch and handle	Clause 4.9				1[3]
Current/Voltage/MW and MVAr transducer	Clause 4.9	TD4	TD4	TD4 TD2	TD4

Schedule A Protection Cubicles for 36kV and 66kV Circuits at Primary Substations - Part 2

Description	**Further Details**	**36C11A** Incoming circuit with metering	**36C12A** Outgoing circuit with metering	**36B3A** Bus-section with 2 distance protection relays	**36B4A** Bus-section without distance protection
Protection relay 1	Clause 4.5	3HSOC 3OCIT EIT 3DOCIT DEIT NVD TCS VTS	3HSOC 3OCIT EIT 3DOCIT DEIT NVD TCS VTS	Z (2 off) DOCIT (2 off) DEIT (2 off) AR (2 off) TCS VTS (2 off)	3OCIT EIT TCS
Protection relay 2	Clause 4.5	VTS[2]	VTS[2]		
ASC Earth Fault Detection Relay	Clause 4.5 Refer to EE: SPEC98		1[4]		
Trip / intertrip relays	Clause 4.5	TDS	TS TDS	TDS (2 off)	TS (2 off)
Alarm / indication relays	Clause 4.5	A (IIG low)[1] TI	A (IIG low)[1] TI	A (IIG low)[1]	A (IIG low)[1]

Notes

Schedule A Part 2:

Note 1: IIG Low indication is only required where the switchgear utilises IIG gas.
Note 2: One outdoor busbar VT and an associated VTS relay is required per section of busbars
Note 3: AC/DC Control switch and interposing relay are required on one bus-section or interconnector
Note 4: ASC earth fault detection relay is only required where ASC earthing is used (this typically applies to substations in Cornwall)

Schedule B	**Protection Cubicles for 36kV and 66kV Circuits at Bulk Supply Points – Part 1**						
Description	**Further Details**	**36ITB** Incoming T/F circuit	**36C1B** T/F feeder circuit & without intertripping	**36C2B** T/F feeder circuit with intertripping	**36C3B** T/F feeder circuit with local tripping	**36C4B** Circuit with distance protection	**36C6B** Circuit with current differential protection
Standard drawings	Single Line Diagram: Schematic Diagram: General Arrangement:	SL36IT/OD SPC36IT/OD SPC36IT-GA	SL36C1/OD SPC36C1/OD SPC36C1-GA	SL36C2/OD SPC36C2/OD SPC36C2-GA	SL36C3/OD SPC36C3/OD SPC36C3-GA	SL36C4/OD SPC36C4/OD SPC36C4-GA	SL36C6B/OD SPC36C6B/OD SPC36C6B-GA
Circuit breaker control switch and handle	Clause 4.9	1	1	1	1	1	1
Remote/supervisory switch and handle	Clause 4.9	1	1	1	1	1	1
Telecontrol CB open, interposing relay	Clause 4.9	AR1	AR1	AR1	AR1	AR1	AR1
Telecontrol CB close interposing relay	Clause 4.9	AR1	AR1	AR1	AR1	AR1	AR1
Terminal blocks	Clause 4.7	As required	As required	As required	As required	As required	As required
Fuses and links	Clause 4.8	As required	As required	As required	As required	As required	As required
Relay test block	Clause 4.5	As specified on the schematic drawings	As specified on the schematic drawings	As specified on the schematic drawings	As specified on the schematic drawings	As specified on the schematic drawings	As specified on the schematic drawings
Telecontrol auto-reclose in/out relay	Clause 4.9		AR2			AR2	
Telecontrol auto-reclose in/out push buttons	Clause 4.9		PB1 PB2			PB1 PB2	
Indication Lamps CB Open CB Closed Springs Charged	Clause 4.9	 IL2 IL3 IL3	 IL2 IL3 IL3	 IL2 IL3 IL3	 IL2 IL3 IL3	 IL2 IL3 IL3	 IL2 IL3 IL3
Current/Voltage/MW and MVAr transducer	Clause 4.9	TD4	TD4	TD4		TD4	TD4
Protection relay 1	Clause 4.5	3DOCIT (LB & VC) TCS VTS BBCK	3HSOC / 3OCIT / 3DOCIT EIT / DEIT NVD / AR BBCK[3] TCS / VTS	3HSOC 3OCIT EIT TCS	3HSOC 3OCIT EIT TCS	Z 3DOCIT DEIT AR BBCK[3] TCS VTS	CD BBCK[3] TCS

Schedule B	**Protection Cubicles for 36kV and 66kV Circuits at Bulk Supply Points – Part 1**						
Description	**Further Details**	**36ITB** Incoming T/F circuit	**36C1B** T/F feeder circuit & without intertripping	**36C2B** T/F feeder circuit with intertripping	**36C3B** T/F feeder circuit with local tripping	**36C4B** Circuit with distance protection	**36C6B** Circuit with current differential protection
Protection relay 2	Clause 4.5		3OCIT EIT	3OCIT EIT	3OCIT EIT	3OCIT EIT	OCIT EIT
Protection relay 3	Clause 4.5		VTS[2]	VTS[2]	VTS[2]	VTS[2]	VTS[2]
ASC Earth Fault Detection Relay	Clause 4.5 Refer to EE: SPEC98		1[4]	1[4]		1[4]	1[4]
Trip/intertrip relays	Clause 4.5	TS	TS	IT TDS TS (2 off)	TS TDS	TS	TS
Alarm / indication relays	Clause 4.5	A (IIG low)[1]	A (IIG low)[1]	A (IIG low)[1]	A (IIG low)[1]	A (IIG low)[1]	A (IIG low)[1]

Notes:

Schedule B Part 1:

Note 1: IIG Low indication is only required where the switchgear utilises IIG gas.

Note 2: One outdoor busbar VT and an associated VTS relay is required per section of busbars.

Note 3: Busbar protection check output (BBCK) is only required where full scheme busbar protection is utilised and the circuit provides a major fault infeed into the switchboard.

Note 4: ASC earth fault detection relay is only required where ASC earthing is used (this typically applies to substations in Cornwall).

Schedule B Protection Cubicles for 36kV and 66kV Circuits at Bulk Supply Points – Part 2			
Description	**Further Details**	**36C12B** Outgoing circuit with metering	**36B4B** Bus-section without distance protection
Standard drawings	Single Line Diagram: Schematic Diagram: General Arrangement:	SL3612B/OD SPC3612B/OD SPC36C12B-GA	SL36B4/OD SPC36B4/OD SPC36B4-GA
Circuit breaker control switch and handle	Clause 4.9	1	1
Remote/supervisory switch and handle	Clause 4.9	1	1
Telecontrol CB open, interposing relay	Clause 4.9	AR1	AR1
Telecontrol CB close interposing relay	Clause 4.9	AR1	AR1
Terminal blocks	Clause 4.7	As required	As required
Fuses and links	Clause 4.8	As required	As required
Relay test block	Clause 4.5	As specified on the schematic drawings	As specified on the schematic drawings
Telecontrol auto-reclose in/out relay	Clause 4.9		
Telecontrol auto-reclose in/out push buttons	Clause 4.9		
Indication Lamps CB Open CB Closed Springs Charged	Clause 4.9	 IL2 IL3 IL3	 IL2 IL3 IL3
AC/DC indication interposing relay	Clause 4.9		1[3]
AC/DC/Off double pole control switch and handle	Clause 4.9		1[3]
Current/Voltage/MW and MVAr transducer	Clause 4.9	TD4	TD4

Schedule B Protection Cubicles for 36kV and 66kV Circuits at Bulk Supply Points – Part 2			
Description	**Further Details**	**36C12B** Outgoing circuit with metering	**36B4B** Bus-section without distance protection
Protection relay 1	Clause 4.5	3HSOC 3OCIT EIT TCS	3OCIT EIT TCS
Protection relay 2	Clause 4.5	3OCIT EIT	
Protection relay 3	Clause 4.5	VTS[2]	
ASC Earth Fault Detection Relay	Clause 4.5 Refer to EE: SPEC98	1[5]	
Trip / intertrip relays	Clause 4.5	TS TDS	TS (2 off)
Alarm / indication relays	Clause 4.5	A (IIG low)[1] TI	A (IIG low)[1]

Notes

Schedule B Part 2:

Note 1: IIG Low indication is only required where the switchgear utilises IIG gas.
Note 2: One outdoor busbar VT and an associated VTS relay is required per section of busbars
Note 3: AC/DC Control switch and interposing relay are required on one bus-section or interconnector
Note 4: TDS relay is only required where full scheme busbar protection is utilised.
Note 5: ASC earth fault detection relay is only required where ASC earthing is used (this typically applies to substations in Cornwall)

Schedule C Protection Cubicles for 66kV and 33kV Transformers

Description	**Further Details**	**36TX1** T/F panel with HV and LV protection with NVD without intertripping without HV CB control	**36TX2** T/F panel with HV and LV protection with NVD without intertripping with HV CB control	**36TX3** T/F panel with HV and LV protection without NVD with intertripping without HV CB control	**36TX4** T/F panel with HV and LV protection without NVD without intertripping with HV CB control	**36TX5** T/F protection panel with LV protection only without NVD without intertripping without HV CB control
Typical Application		Primary S/S with HV fault thrower fed from an O/H circuit	Primary S/S with local HV T/F CB, fed from an O/H circuit	Primary S/S with HV intertripping, fed from an U/G circuit.	T/F is in close proximity to the source HV switchboard. Panel provides HV and LV protection and HV CB control facilities	T/F is in close proximity to a source HV switchboard. Panel provides LV protection only
Standard Drawings	Single Line Diagram: Schematic Diagram: General Arrangement:	SL36TX1 SPC36TX1 SPC36TX1-GA	SL36TX2 SPC36TX2 SPC36TX2-GA	SL36TX3 SPC36TX3 SPC36TX3-GA	SL36TX4 SPC36TX4 SPC36TX4-GA	SL36TX5 SPC36TX5 SPC36TX5-GA
HV Protection Relay 1	Clause 4.5	3HSOC 3OCIT EIT NVD	3HSOC 3OCIT EIT NVD TCS	3HSOC 3OCIT EIT	3HSOC 3OCIT EIT	
HV Protection Relay 2	Clause 4.5				OCIT[1] EIT[1]	
LV Protection Relay 1	Clause 4.5	REF	REF	REF	REF	REF
LV Protection Relay 2	Clause 4.5	SBEF	SBEF	SBEF	SBEF	SBEF
Test Block	Clause 4.5	As specified on the schematic drawings	As specified on the schematic drawings	As specified on the schematic drawings	As specified on the schematic drawings	As specified on the schematic drawings

Schedule C Protection Cubicles for 66kV and 33kV Transformers

Description	Further Details	36TX1	36TX2	36TX3	36TX4	36TX5
		T/F panel with HV and LV protection with NVD without intertripping without HV CB control	T/F panel with HV and LV protection with NVD without intertripping with HV CB control	T/F panel with HV and LV protection without NVD with intertripping without HV CB control	T/F panel with HV and LV protection without NVD without intertripping with HV CB control	T/F protection panel with LV protection only without NVD without intertripping without HV CB control
Trip Indication Relay/s	Clause 4.5	TI (5 off) including: • Main buchholz • Aux. t/f buchholz • Tap changer buchholz • Pressure relief device • Winding temperature	TI (5 off) including: • Main buchholz • Aux. t/f buchholz • Tap changer buchholz • Pressure relief device • Winding temperature	TI (5 off) including: • Main buchholz • Aux. t/f buchholz • Tap changer buchholz • Pressure relief device • Winding temperature	TI (5 off) including: • Main buchholz • Aux. t/f buchholz • Tap changer buchholz • Pressure relief device • Winding temperature	TI (5 off) including: • Main buchholz • Aux. t/f buchholz • Tap changer buchholz • Pressure relief device • Winding temperature
Alarm Indication Relay/s	Clause 4.5	AI (5 off) including: • Main buchholz • Aux. t/f buchholz • Forced cooling • Breather fail • Winding temp	AI (5 off) including: • Main buchholz • Aux. t/f buchholz • Forced cooling • Breather fail • Winding temp	AI (5 off) including: • Main buchholz • Aux. t/f buchholz • Forced cooling • Breather fail • Winding temp	AI (5 off) including: • Main buchholz • Aux. t/f buchholz • Forced cooling • Breather fail • Winding temp	AI (5 off) including: • Main buchholz • Aux. t/f buchholz • Forced cooling • Breather fail • Winding temp
Trip and Intertrip Relay/s	Clause 4.5	TDS	TDS	TS TDS IT	TDS	TDS
SCADA Status On/Off Switch	Clause 4.9	1		1		1
Remote CB control switch and handle	Clause 4.9		1		1	
Remote/supervisory switch and handle	Clause 4.9		1		1	
Telecontrol CB open, interposing relay	Clause 4.9		AR1		AR1	
Telecontrol CB close, interposing relay	Clause 4.9		AR1		AR1	
IIG Gas Low	Clause 4.5		AI (IIG)[4]		AI (IIG)[4]	

Schedule C Protection Cubicles for 66kV and 33kV Transformers

Description	Further Details	36TX1 T/F panel with HV and LV protection with NVD without intertripping without HV CB control	36TX2 T/F panel with HV and LV protection with NVD without intertripping with HV CB control	36TX3 T/F panel with HV and LV protection without NVD with intertripping without HV CB control	36TX4 T/F panel with HV and LV protection without NVD without intertripping with HV CB control	36TX5 T/F protection panel with LV protection only without NVD without intertripping without HV CB control
Indication Lamps CB Open CB Closed Springs Charged	Clause 4.9		IL2 IL3 IL4		IL2 IL3 IL4	
Terminal Blocks	Clause 4.7	As required	As required	As required	As required	As required
Fuses and Links	Clause 4.8	As required	As required	As required	As required	As required
Wiring, labels, multi-core / multi-pair gland plates etc.	Clause 4.7 and 4.2	As required	As required	As required	As required	As required
Auto-reclose with dead line charge relay	Clause 4.5	AR(DBLLC)	AR(DBLLC)			
Auto-Reclose In/Out Relay	Clause 4.9	AR2	AR2			
Auto-reclose In/Out Push Buttons	Clause 4.9	PB1 PB2	PB1 PB2			

Notes

Schedule C:

Note 1: HV backup OCIT and EIT protection is only required at BSPs.

Note 2: IIG alarm indication relay is only required where switchgear utilises IIG gas.

Schedule D Busbar Protection Cubicles

Description	Further Details	36BP Full Scheme Busbar Protection
Drawings	Single Line Diagram: Schematic Diagram: General Arrangement:	SL36BP/OD SPC36BP/OD SPC36BP-GA
Protection Cubicle	Clause 4.2	1[2]
SCADA Status ON/Off Switch	Clause 4.9	1
Terminal Blocks	Clause 4.7	As Required
Fuses and Links	Clause 4.8	As Required
Wiring, labels, multicore / multipair gland plates etc.	Clause 4.7 and 4.2	As Required
Relay Test Block	Clause 4.5	As specified on the schematic drawing
Main Protection Relays	Section 7	3BBOC (1 per Zone) CTS (1 per Zone) BBCKA TSS

Notes

Schedule D:

Note 1: There may be some local differences between standard drawings and those used in certain National Grid Electricity Distribution areas.

Note 2: More than one cubicle may be provided where there is insufficient space.

Note 3: One RTB is required for each set of busbar protection CTs and one RTB is required for each protection relay and each CT supervision relay.

Schedule E ASC Control Cubicles

Description	Further Details	12/ASC Primary Substation ASC Control Panel	36/ASC BSP ASC Control Panel
Standard Drawings	Single Line Diagram: Schematic Diagram: General Arrangement:	SL12ASC SPC12ASC SPC12ASC-GA	SL36ASC SPC36ASC SPC36ASC-GA
Control Cubicle	Clause 4.2		
Test Block	Clause 4.5	As specified on the schematic drawing	As specified on the schematic drawing
Damping Resistor Open / Close Switch	Clause 4.9	1	1
ASC Auto-tune Auxiliary Relay	Clause 4.9	AR3	AR3
ASC Manual Tune Auxiliary Relay	Clause 4.9	AR3	AR3
ASC Shorting Switch(4A9) Open Interposing Relay	Clause 4.9	AR3	
ASC Shorting Switch (4A9) Auto/Non-auto Auxiliary Relay	Clause 4.9	AR4	
ASC Shorting Switch (4A9) Auto/Non-auto Push Buttons	Clause 4.9	PB1 PB2	
ASC SEF Enable Auxiliary Relay	Clause 4.9	AR7	
ASC Scheme Lockout Reset	Clause 4.9	PB3	PB3
Indication Lamps: • 4A9 Open (Green) • 4A9 Closed (Red) • SEF Auto Enabled (Amber)	Clause 4.9	IL3 IL2 IL5	
ASC Control Relay	Clause 4.5	ASC TI (1 off) - Buchholz Trip[1] AI (8 off)[1]	ASC TI (1 off) – Buchholz Trip[1] AI (8 off)[1]
SCADA Status ON/Off Switch	Clause 4.9	1	1
Terminal Blocks	Clause 4.7	As required	As required
Fuses and Links	Clause 4.8	As required	As required
Wiring, labels, multi-core / multi-pair gland plates etc.	Clause 4.7 and 4.2	As required	As required

Notes

Schedule E:

Note 1: Trip indication (TI) and alarm indication (AI) functions are provided by the ASC control relay. A blocking diode must be provided for each TI function.