Electricity Distribution

nationalgrid

Company Directive

ENGINEERING SPECIFICATION

EE SPEC: 136/1

Ancillary Electrical Equipment for Use in Conjunction with Switchgear and Protection/Control Panels

Summary

This document provides a list of Equipment such as control and alarm relays, transducers and other Ancillary Equipment that are approved for use within National Grid Electricity Distribution's network

Author: **Daniel Price**

Implementation Date: **June 2024**

Approved by:

Carl Ketley-Lowe
Head of Engineering Policy

Date: **11th June 2024**

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 Ancillary Electrical Equipment for use in conjunction with Switchgear and Protection and Control Panels.**
Impact of Change	**Amber – this document includes additional options for Multifunction Transducers for use within National Grid Electricity Distribution's Network**
Planned Assurance checks	**None**

IMPLEMENTATION PLAN

Introduction

This document specifies the ancillary equipment to be used in conjunction with switchgear and protection / control panels.

Main Changes

An additional option for a Multifunction Transducer has been approved for use within National Grid Electricity Distribution's Network.

Impact of Changes

From the date at which this document is issued, ancillary equipment for use within Switchgear and Protection and Control Panels shall comply with this document.

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 Ancillary Electrical Equipment for use in conjunction with Switchgear and Protection and Control Panels.**
Impact of Change	**Amber – this document includes additional options for Multifunction Power Transducers for use within National Grid Electricity Distribution's Network**

Implementation Actions

Managers shall ensure that all staff involved with the specification, installation and maintenance of HV, EHV and 132kV switchboards and protection / control / alarm panels are aware of and adhere to the requirements of this document.

Implementation Timetable

This document shall be implemented on issue for the specification of new or replacement ancillary equipment.

REVISION HISTORY

Document Revision & Review Table		
Date	**Comments**	**Author**
June 2024	• Document has been reformatted • All references to Western Power Distribution and WPD have been replaced with National Grid Electricity Distribution • CEWE DPT-643 has been added to the approved Transducers list • Appendix B updated to include new multifunction transducer and additional information and requirements.	Daniel Price
June 2017	This is a new document that replaces the requirements for ancillary equipment included in other EE Specification documents. The most significant changes are listed below: • i5M transducers have been introduced • Incandescent lamps have been replaced by LED clusters	Andy Hood

Contents

1.0 INTRODUCTION

1.1 This document details the ancillary equipment to be used in conjunction with switchgear and protection/control panels.

2.0 PROTECTION AND ALARM RELAYS

2.1 Protection, alarm and control relays shall comply with ENATS 48-4, ENATS 48-5, BSEN 60255, IEC 60255, BSEN 61810 and BSEN 61811 as applicable and be of a type and make approved for use within National Grid Electricity Distribution.

2.2 The approved relay list is contained within the current version of Engineering Specification EE SPEC: 98.

2.3 Alternative relays can be submitted to the Technical Policy Manager for evaluation.

3.0 AUXILIARY RELAYS AND CONTACTORS

3.1 Auxiliary relays and small contactors shall comply with ENATS 50-18.

3.2 Datasheets for auxiliary relays used for telecontrol purposes are provided in Appendix A.

3.3 Relays operated by National Grid Electricity Distribution's telecontrol system are switched in both the +ve and -ve circuits. Unless otherwise specified, relays shall be suitable for use with the D.C. auxiliary supply voltage/s specified on the Switchgear Enquiry / Ordering Schedule. 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.

4.0 CONTROL AND SELECTOR SWITCHES

4.1 Control and selector switches and their handles shall meet the requirements of ENATS 50-18 and BS EN 60947-3 and shall be adequately rated for the application. Switches used within trip or close circuits shall as a minimum satisfy the following requirements:

- Category AC22A (switching of mixed resistive and inductive ac. loads): 32A at 250/415V
- Category AC23A (switching of motor loads or other highly ac. inductive loads): 28A at 250/415V
- Category DC21 (switching of resistive dc. loads): 3.5A at 110V

5.0 TRANSDUCERS

5.1 All transducers shall comply with BS EN 60688 and shall be self-powered unless otherwise specified in the schedule. They shall be located to allow easy access for testing and removal. The following general requirements also apply:

- Temperature reference range: 0^{o}C to 50^{o}C
- Operating temperature range: -10^{o}C to $+55^{o}$C
- Output voltage: 25Vdc (open circuit voltage)
15Vdc (compliance voltage)
- Burden on output: 1000 ohms (maximum)
100 ohms (typical)
- Resistor in outstation: 333.3 ohms (15mA at 5V)
- Output load: Compliance voltage/maximum rated output.

5.2 Where programmable transducers are provided they shall be pre-programmed by the panel supplier in accordance with the data sheets provided in Appendix B of this document.

6.0 PUSH BUTTONS AND LED LAMPS

6.1 Push button switches shall meet the requirements of ESI Standard 50-18 unless otherwise modified by this document. Switches shall be Class I or higher.

6.2 Switching system shall be snap action.

6.3 Contact terminals shall be screw type.

6.4 Contacts shall be hard silver.

6.5 The voltage supply for LEDs shall be both 110V AC and DC. The supply may be manually switched from AC to DC.

6.6 Data sheets and drawings for push button switches and lamps are provided in Appendix C.

APPENDIX A

AUXILLIARY RELAY DATA SHEET

Relay Function:
1) Circuit Breaker Open
2) Circuit Breaker Close
3) Tap-change Control Auto
4) Tap-change Control Manual
5) Tap-change Raise
6) Tap-change Lower

Reference: AR1

Relay Coil: 48V DC or 24V DC (as specified in Enquiry/Ordering Schedule)
Continuous rating with transient suppression diode

Relay Type: Self Reset

Approved Relays

Manufacturer: Arteche

Reference: 48V DC: RD-2SYDI 48VDC OP.00001
24V DC: RD-2SYDI 24VDC OP.00001

Relay Socket: DN DE IP10

Relay Retaining Clip: E-41

Terminal Allocation:

Terminal No.	Description of Function
1 – 2	Relay coil with diode Terminal 1 –ve, Terminal 2 +ve
3 – 5 – 7	3 – 5 normally open contact
	3 – 7 normally closed contact
4 – 6 – 8	4 – 6 normally open contact
	4 – 8 normally closed contact

AUXILLIARY RELAY DATA SHEET

Functions:
1) SEF In / Out of Service
2) Instantaneous In / Out of Service
3) Auto Reclose In / Out of Service
4) Tap-change Control 3% Voltage Reduction In / Out
5) Tap-change Control 6% Voltage Reduction In / Out
6) Tap-change Control Independent / Manual
7) Tap-change Control Raise Inhibit

Reference: AR2

Relay Coil: Operate Coil:

48V DC or 24V DC (as specified in ordering schedule)
Continuous rating with transient suppression diode

Reset Coil:

48V DC or 24V DC (as specified in ordering schedule)
Intermittent rating with transient suppression

Relay Type: Latching

Operating Convention: When the relay is reset the function is “In Service” and when the operate coil is energised the function is “Out of Service”.

Approved Relays

Manufacturer: Arteche

Reference: 48V DC: BF-3BB 48VDC
24V DC: BF-3BB 24VDC

Relay Socket: FN DE IP10

Relay Retaining Clip: E-31

Terminal Allocation:

Terminal No.	Description of Function
10 - 14	Main relay coil with diode and normally closed contact. Terminal 14 +ve, Terminal 10 -ve
1 - 2	Reset relay coil with diode and normally open contact. Terminal 1 -ve, terminal 2 +ve
7 - 3 - 11	7 – 3 normally open contact
	3 – 11 normally closed contact
8 - 4 - 12	8 – 4 normally open contact
	4 – 12 normally closed contact
9 - 5- 13	9 - 5 normally open contact
	5 – 13 normally closed contact

AUXILLIARY RELAY DATA SHEET

Functions: 1) Auto Reclose Counter Reset
2) Protection Reset

Reference: AR3

Relay Coil: 48V DC or 24V DC (as specified in Enquiry/Ordering Schedule)

Continuous rating with transient suppression diode

Relay Type: Self Reset

Approved Relays

Manufacturer: Arteche

Reference: 48V DC: RD-2SYDI 48VDC OP.00001
24V DC: RD-2SYDI 24VDC OP.00001

Relay Socket: DN DE IP10

Relay Retaining Clip: E-41

Terminal Allocation:

Terminal No.	Description of Function
1 – 2	Relay coil with diode Terminal 1 –ve, Terminal 2 +ve
3 – 5 – 7	3 – 5 normally open contact
	3 – 7 normally closed contact
4 – 6 – 8	4 – 6 normally open contact
	4 – 8 normally closed contact

AUXILLIARY RELAY DATA SHEET

Function: Arc Suppression Coil Shorting Switch Auto/Non-Auto

Reference: AR4

Relay Coil: Operate Coil:

48V DC or 24V DC (as specified in ordering schedule)
Continuous rating with transient suppression diode

Reset Coil:

48V DC or 24V DC (as specified in ordering schedule)
Intermittent rating with transient suppression

Relay Type: Latching

Operating Convention: When the relay is reset the function is in “Auto” and when the operate coil is energised the function is in “Non-Auto”.

Approved Relays

Manufacturer: Arteche

Reference: 48V DC: BF-3BB 48VDC

24V DC: BF-3BB 24VDC

Relay Socket: FN DE IP10

Relay Retaining Clip: E-31

Terminal Allocation:

Terminal No.	Description of Function
10 - 14	Main relay coil with diode and normally closed contact. Terminal 14 +ve, terminal 10 -ve
1 - 2	Reset relay coil with diode and normally open contact. Terminal 1 -ve, terminal 2 +ve
7 - 3 - 11	7 – 3 normally open contact
	3 – 11 normally closed contact
8 - 4 - 12	8 – 4 normally open contact
	4 – 12 normally close contact
9 - 5- 13	9 - 5 normally open contact
	5 – 13 normally closed contact

AUXILLIARY RELAY DATA SHEET

Function:	Protection Trip Status Relay
Reference:	AR5
Relay Coil:	Current Operated. Wound with conductor of minimum cross-sectional area of 1.5 sq. mm
Min. Operating Current:	Type A: 0.4A, duration 40 to 120 milliseconds*
	Type B: 0.15A duration 40 to 120 milliseconds*
Relay Contact:	Reed relay, one normally open contact Contact Rating, 1.0 to 20mA 48V DC
Other Details:	Insulation Test 2kV, 50Hz for 1 minute

Relay to be enclosed in a mild steel case covered by a heat shrink plastic sleeve. The magnetic screening shall be sufficient to prevent spurious operations by the passage of fault current through adjacent metalwork.

The security of the connections to the coil winding is of paramount importance and the coil winding wire shall be used to form the connection tails without intermediate joints. The coil windings shall have the positive tail clearly marked.

Relay requires a separate terminal block.

Approved Relays

Manufacturer:	Control Engineering Ltd
Reference:	892 Type A (0.4A)
	892 Type B (0.15A)

Note: For most switchgear an operating current of 0.4A is applicable.

AUXILLIARY RELAY DATA SHEET

Function: AC/DC Indication Auxiliary Relay

Reference: AR6

Relay Coil: 110V AC continuous rating

Relay Type: Self Reset

Approved Relays

Manufacturer: Arteche

Reference: RF-4SY 110VAC OP00001

Relay Base: FN-DE-IP10

Relay Retaining Clip: E-40

Terminal Allocation:

Terminal No.	Description of Function
1 – 2	110V AC relay coil
7 – 3 - 11	7 – 3 normally open contact
	3 – 11 normally closed contact
12 – 4 - 8	8 – 4 normally open contact
	4 – 12 normally closed contact
13 – 5 – 9	9 – 5 normally open contact
	5 – 13 normally closed contact
14 – 6 – 10	10 – 6 normally open contact
	6 – 10 normally closed contact

AUXILLIARY RELAY DATA SHEET

Function: ASC SEF Enable / Disable

Reference: AR7

Relay Coil: Operate Coil:

48V DC or 24V DC (as specified in ordering schedule)
Continuous rating with transient suppression diode

Relay Type: Self Reset

Approved Relays

Manufacturer: Arteche

Reference: 48V DC: RF-4SYDI 48VDC OP.00001

24V DC: RF-4SYDI 24VDC OP.00001

Relay Socket: DN DE IP10

Relay Retaining Clip: E-41

Terminal Allocation:

Terminal No.	Description of Function
1 – 2	Relay coil with diode Terminal 1 –ve, Terminal 2 +ve
3 – 7 – 11	3 – 7 normally open contact
	3 – 11 normally closed contact
4 – 8 – 12	4 – 8 normally open contact
	4 – 12 normally closed contact
5 – 9 – 13	5 – 9 normally open contact
	5 – 13 normally closed contact
6 – 10 – 14	6 – 10 normally open contact
	6 – 14 normally closed contact

AUXILLIARY RELAY DATA SHEET

Function:	Tap-change Control Lockout Relay
Reference:	AR8
Relay Coil:	Operate Coil: 110V AC Continuous Rating Reset Coil: 110V AC Continuous Rating
Relay Type:	Latching
Operating Convention:	When the relay is reset the scheme is reset and when the operate relay is energised the scheme is locked out

Approved Relays

Manufacturer:	Arteche
Reference:	BF-4 110VDC
Relay Socket:	FN DE IP10
Relay Retaining Clip:	E-31

Terminal Allocation:

Terminal No.	Description of Function
B1 – 2	110V AC operate relay coil
1 – 2	110V AC reset relay coil
3 – 7 – 11	3 – 7 normally open contact
	3 – 11 normally closed contact
4 – 8 – 12	4 – 8 normally open contact
	4 – 12 normally closed contact
5 – 9 – 13	5 – 9 normally open contact
	5 – 13 normally closed contact
6 – 10 – 14	6 – 10 normally open contact
	6 – 14 normally closed contact

TRANSDUCER DATA SHEET

Function:	Current Transducer (1 ampere)
Reference:	TD1
Input Current:	1.0A AC (nominal) 1.5A AC (full scale continuous)
Output Current:	0 to 10mA DC (nominal) 15mA DC (full scale) 25mA DC (maximum)
Accuracy:	Class 0.2
Excessive Input:	Transducer shall withstand: • 3x rated current continuously • 4x rated current for 5 minutes • 25x rated current for 3 seconds • 50x rated current for 1 second

Approved Transducers

Manufacturer:	GE Grid Solutions
Model:	iSTAT i5MC
Order Code:	i5MCX2H1CLNRX

Note: Transducer shall be supplied pre-programmed by the panel supplier in accordance with the above requirements

TRANSDUCER DATA SHEET

Function:	AC Voltage Transducer (110 Volts AC)
Reference:	TD2
Input Voltage:	110V AC (nominal) 132V AC (full scale continuous)
Output Current:	0 to 2mA DC for input voltage of 0 to 88V AC 2 to 10mA DC for input voltage 88V to 132V AC
Accuracy:	Class 0.2
Excessive Input:	Transducer shall withstand: • 1.5x rated voltage continuously • Shall withstand 2x rated voltage for 10 seconds

Approved Transducers

Manufacturer:	GE Grid Solutions
Model:	iSTAT i5MV
Order Code:	i5MVX2H1CLNRX

Note: Transducer shall be supplied pre-programmed by the panel supplier in accordance with the above requirements

TRANSDUCER DATA SHEET

Function:	Multifunction - Amps / Volts / Watts / VARs Transducer
Reference:	TD4
Input Current:	1.0A AC (nominal) 1.5A AC (full scale continuous)
Input Voltage:	110V AC (nominal) 132V AC (full scale continuous)
Output:	Amperes: 0 to 10mA DC (nominal) 15mA DC (full scale) 25mA DC (maximum)
	Voltage: 0 to 2mA DC for input voltage 0 – 88V a.c. 2 to 10mA DC for input voltage 88V to 132V a.c.
	Watts: -10mA D.C. to 0 to +10mA D.C. (nominal) Reverse power flow produces negative output Forward power flow produces positive output
	Vars: -10mA D.C. to 0 to +10mA D.C. (nominal) Leading Vars produce negative output Lagging Vars produce positive output
Accuracy:	Class 0.2 for current and voltage measurements Class 0.5S for power measurements
Excessive Input:	Transducer shall withstand:

- 2x rated current continuously
- 20x current for 1s
- 1.2x rated voltage continuously
- 2x rated voltage for 10s

Approved Transducers

Option 1

Manufacturer:	GE Grid Solutions
Model:	iSTAT i5MT
Order Code:	I5MTX2H1NCLLLLRX

Option 2

Manufacturer:	CEWE
Model:	DPT300
Order Code:	DPT 643-12F

Note: Transducers shall be supplied pre-programmed by the panel supplier in accordance with NGED Standard Technique ST: TP19A

TRANSDUCER DATA SHEET

Function:	Tap Position Indication (TPI) Transducer
Reference:	TD5
Auxiliary Supply:	110V AC (nominal) 80V AC (min) 130Va.c. (max.) 3VA burden
Input:	Chain Resistance 150 to 10,000 ohms
Output:	0 to 10mA DC
Accuracy:	≤ 2% of full scale reading

Approved Transducers

Manufacturer:	Fundamentals Ltd
Reference:	FTPT/2

TRANSDUCER DATA SHEET

Function: DC Voltage Transducer

Reference: TD6

The transducer auxiliary supply range, input voltage and output current shall be in accordance with the following table:

Battery Voltage (DC Volts)	24		30		48		110		220	
Auxiliary Supply Range (DC Volts)	19 to 70		19 to 70		19 to 70		70 to 300		70 to 300	
	Min.	Max.	Min.	Max	Min.	Max	Min.	Max.	Min.	Max.
Input Voltage (DC Volts)	20V	29V	25V	36V	40V	58V	80V	140V	160V	280V
Output Current (mA DC)	0mA	10mA	0mA	10mA	0mA	10mA	0mA	10mA	0mA	10mA

Accuracy: +/- 0.5% or less

Approved Transducers

Manufacturer: GE Grid Solutions

Model: iSTAT i5MV

Order Code: I5MVX2L1CLNRX (19 to 70V DC Auxiliary Supply)

I5MVX2H1CLNRX (70 to 300V DC Auxiliary Supply)

APPENDIX C

PUSH BUTTON SWITCH AND LAMP DATA SHEET

Switch Functions:

1) Auto Reclose In
2) SEF In
3) Instantaneous Protection In
4) ASC Shorting Switch Non-Auto
5) Tap-change Control Independent
6) Tap-change Control Parallel

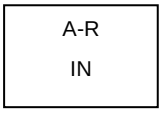
Reference: PB1

Button Description: Clear Button / Lens with 110V lamp and guard

Contact Arrangement: 2x NO contacts, 1x NC contact

Engraving Requirements:

1)



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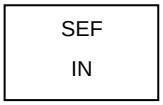

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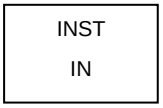

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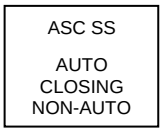

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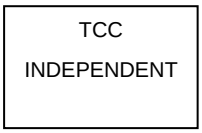

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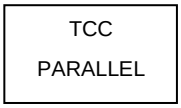

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Approved Components

Manufacturer: EAO (Elektro-Apparatebau Olten AG)

Details:

Manufacturer's Reference	Description
704.030.7	Illuminated Clear Push Button
704.600.7	Extended Ring
704.900.3	Contact Block 2 N/O
704.900.2	Contact Block 1 N/C
RS 208-841	130V AC/DC BA9 LED Cluster

PUSH BUTTON SWITCH AND LAMP DATA SHEET

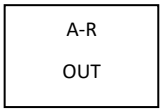
Switch Functions:
1) Auto Reclose Out
2) SEF Out
3) Instantaneous Protection Out
4) ASC Shorting Switch Auto

Reference: PB2

Button Description: Clear Button / Lens with 110V lamp and guard

Contact Arrangement: 2x NO contacts, 1x NC contact

Label Engraving:

1) 

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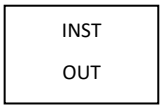
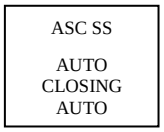
3) 

4) 

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Approved Components

Manufacturer: EAO (Elektro-Apparatebau Olten AG)

Details:

Manufacturer's Reference	Description
704.030.7	Illuminated Clear Push Button
704.600.7	Extended Ring
704.900.3	Contact Block 2 N/O
704.900.2	Contact Block 1 N/C
RS 208-841	130V AC/DC BA9 LED Cluster

PUSH BUTTON SWITCH AND LAMP DATA SHEET

Switch Function:
1) Auto Reclose counter reset
2) Auto Reclose lockout reset
3) ASC Scheme Lockout Reset

Reference: PB3

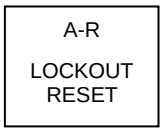
Button Description: Black button with guard

Switch Contact Arrangement: 2x NO contacts

Label Engraving:

1)

2)



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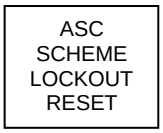

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Approved Components

Manufacturer: EAO (Elektro-Apparatebau Olten AG)

Details:

Manufacturer's Reference	Description
704.010.0	Black Push Button
704.600.7	Extended Ring
704.900.3	Contact Block 2 N/O

PUSH BUTTON SWITCH AND LAMP DATA SHEET

Switch Function: ASC shorting switch test close

Reference: PB4

Button Description: Black button with guard

Switch Contact Arrangement: 2x NO contacts, 2x NC contacts

Label Engraving:

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Approved Components

Manufacturer: EAO (Elektro-Apparatebau Olten AG)

Details:

Manufacturer's Reference	Description
704.010.0	Black Push Button
704.600.7	Extended Ring
704.900.3	Contact Block 2 N/O
704.900.4	Contact Block 2 N/C

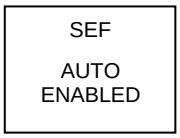
PUSH BUTTON SWITCH AND LAMP DATA SHEET

Indication Lamp Function: SEF Auto Enabled

Reference: IL1

Description: Clear Lens Indicator

Label Engraving:



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Approved Components

Manufacturer: EAO (Elektro-Apparatebau Olten AG)

Details:

Manufacturer's Reference	Description
704.002.7	Clear Indicator
RS 208-841	130V AC/DC BA9 LED Cluster

PUSH BUTTON SWITCH AND LAMP DATA SHEET

Indication Lamp Function:
1) Circuit breaker closed, or
2) ASC shorting switch closed

Reference: IL2

Description: Red Lens Indicator

Label Engraving:

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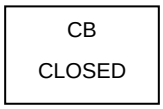

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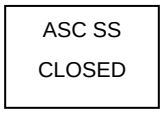

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Approved Components

Manufacturer: EAO (Elektro-Apparatebau Olten AG)

Details:

Manufacturer's Reference	Description
704.002.2	Red Indicator
RS 208-841	130V AC/DC BA9 LED Cluster

PUSH BUTTON SWITCH AND LAMP DATA SHEET

Function:
1) Circuit breaker open, or
2) ASC shorting switch open

Reference: IL3

Description: Green Lens Indicator

Label Engraving:

1)

CB
OPEN

2)

ASC SS
OPEN

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Approved Components

Manufacturer: EAO (Elektro-Apparatebau Olten AG)

Details:

Manufacturer's Reference	Description
704.002.5	Green Indicator
RS 208-841	130V AC/DC BA9 LED Cluster

PUSH BUTTON SWITCH AND LAMP DATA SHEET

Indication Lamp Function: Circuit Breaker Springs Charged

Reference: IL4

Description: Blue Lens Indicator

Label Engraving:

Black Lettering on white background

Approved Components

Manufacturer: EAO (Elektro-Apparatebau Olten AG)

Details:

Manufacturer's Reference	Description
704.002.6	Blue Indicator
RS 208-841	130V AC/DC BA9 LED Cluster

PUSH BUTTON SWITCH AND LAMP DATA SHEET

Indication Lamp Function: ASC Alarm

Reference: IL5

Description: Amber Lens Indicator

Label Engraving:

1)

Black Lettering on white background

Approved Components

Manufacturer: EAO (Elektro-Apparatebau Olten AG)

Details:

Manufacturer's Reference	Description
704.002.4	Yellow Indicator
RS 208-841	130V AC/DC BA9 LED Cluster

APPENDIX D

SUPERSEDED DOCUMENTATION

This document supersedes Engineering Specification EE SPEC: 136 dated June 2017 which has now been withdrawn.

APPENDIX E

ASSOCIATED DOCUMENTATION

ST: TP19A	Relating to Settings Requirements for 3 Phase Power Transducers
EE SPEC: 87	Protection, Alarm and Control Panels associated with 36kV and 72kV Outdoor Switchgear, 33kV and 66kV Transformers and Control Panels associated with Arc Suppression Coils
EE SPEC: 98	Approved Protection, Voltage Control and Alarm Relays and Test Access Blocks

APPENDIX F

RECORD OF COMMENT DURING CONSULTATION

No comments received.

APPENDIX G

IMPACT ON COMPANY POLICY

This document is relevant to all staff involved in the specification, purchase, installation and commissioning of 132kV 66kV, 33kV and 11kV circuit breakers, transformers and associated protection and control systems.

APPENDIX H

KEY WORDS

Circuit Breaker, Panel, Cubicle, Protection, Alarm, Transducer, Telecontrol, Auxiliary Relay.