

Equipment Technical Specification

11kV and 22kV enclosed load break switches

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EQUIPMENT TECHNICAL INSTRUCTION

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ETS 0067 11kV and 22kV enclosed load break switches

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1.0 PURPOSE

To set out in detail the minimum requirements for the selection of 11kV and 22kV enclosed load break switches for use in Endeavour Energy's 11kV and 22kV distribution network.

2.0 SCOPE

The scope of work shall consist of the design, manufacture, testing at manufacturers' works and delivery of the 11kV and 22kV enclosed load break switches. It is not intended to specify the manufacturing, testing and material requirements in detail. However, the enclosed load break switches **must** be manufactured to the highest quality standards.

All supplied load break switches and associated equipment must be manufactured and tested to the standards with the year of publication listed in 3.0 below. In some circumstances based on local network conditions and experience, this specification is more stringent or is inclusive of requirement not covered in Australian and International standards; in this circumstance the requirements of this specification will take precedence.

The tenderer shall state any non-compliance with the specification in the tender submission and any alternative offers may be submitted in full and separately from the main offer. Any proposed variations from this specification must be referred to Network Substations Manager for approval prior to acceptance.

3.0 REFERENCES

Internal

- Company Policy 9.2.2 - Network Protection
- Company Policy 9.2.5 - Network Asset Design
- Company Policy 9.2.10 - Network Asset Ratings
- Company Policy 9.7.1 - Network Asset Constructions
- Company Policy 9.8.3 - Network Operations
- Company Policy 9.8.3 - Network Asset Maintenance
- Company Procedure GRM 0003 – Risk Management
- Company Procedure GSY 0026 – Work Health and Safety Risk Assessment
- Company Form FSY 0138 – Risk Register
- Branch form FAE 3085 – 12kV and 24kV enclosed load break switch product approval and audit form
- Network Management Plan December 2013 Review
- Earthing Design Instruction EDI 100 – Distribution earthing design, construction and test
- Environmental Management Standards EMS 0001 – Environmental impact assessment and environmental management plans
- Substation Design Instruction SDI 120 – Testing and commissioning of distribution systems
- Substation Maintenance Instruction SMI 101 - Minimum requirements for maintenance of distribution equipment
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External

- *Electricity Supply Act 1995* (as amended)
- *Work Health and Safety Act 2011 (NSW)*
- ENA DOC01-2008 National Electricity Network safety code
- AS ISO 1000:1998 - The international system of units (SI) and its application
- AS 1824.1:1995 - Insulation coordination – Definitions, principles and rules

- AS 1852:1988 - International Electrotechnical vocabulary
- AS 1931.1:1996 - High voltage testing techniques – General definitions and test requirements
- AS 2067:2008 - Substations and high voltage installations exceeding 1kV ac
- AS 2629:2008 - Separable insulated connectors for power distribution systems above 1kV
- AS 2700S:1996 - Colour standards for general purposes
- AS 60038:2000 - Standard voltages
- AS 60529:2004 - Degrees of protection provided by enclosures (IP Code)
- AS 62217:2007 - Polymeric insulators for indoor and outdoor use with a nominal voltage > 1000 V – General definitions, test methods and acceptance criteria
- AS 62271.1:2012 – High voltage switchgear and controlgear Part 1: Common specifications
- AS 62271.201:2008 - High voltage switchgear and controlgear Part 201: AC insulation-enclosed switchgear and control gear for rated voltages above 1kV and up to and including 52kV.
- AS/NZS 2344:1997 - Limits of electromagnetic interference from overhead a.c. power lines and high voltage equipment installation in the frequency range 0.15 to 1000MHz
- AS/NZS 3000:2007 - Electrical Installations (known as the Australia/New Zealand wiring rules)
- AS/NZS 4680:2006 - Hot dip galvanised (zinc) coatings on fabricated ferrous articles
- AS/NZS 60137:2008 - Insulated bushings for alternating voltages above 1000V
- AS/NZS 60265:2001 - High voltage switches Part 1: Switches for rated voltages above 1kV and less than 52kV
- ITU-T V.24 - List Of Definitions For Interchange Circuits Between Data Terminal Equipment (DTE) And Data Circuit-Terminating Equipment (DCE)
- ITU-T V.24- Electrical Characteristics For Unbalanced Double-Current Interchange Circuits
- EIA Standard RS-232 - Interface Between Data Terminal Equipment and Data Communication Equipment Employing Serial Data Interchange

4.0 DEFINITIONS AND ABBREVIATIONS

For definitions refer to AS 1852-1988.

ABC	aerial bundle cable
AC	alternating current
CCT	covered conductor thick
CT	current transformer
DC	direct current
GPS	global positioning system
HV	high voltage
LBS	load break switch
LV	low voltage
NATA	National Association of Testing Authorities
RTU	Remote terminal unit
SCADA	Supervisory control and data acquisition
SF6	sulphur hexafluoride
Shall	Indicates a statement is mandatory
UV	ultra violet

VT voltage transformer

XLPE cross linked polyethylene

5.0 ACTIONS

5.1 General

The two (2) types of enclosed load break switches in this specification are:

Type	Features
Manual	Manual hook stick operated switch without any provision to retrofit with a local/remote electrical operation at a later date.
Automated	Manual hook stick operated switch complete with local/remote electrical operation, communication, SCADA interface for control from Endeavour Energy's SCADA system.

The supplier shall include all items that are necessary for the operation of the equipment, whether specified or not, and shall include all mounting, operating, control, indication and communication features, as specified.

Unless there are significant cost advantages, it is preferable that the 11kV and 22kV enclosed switches are interchangeable without any modifications, except for a change in the operating settings.

It is therefore necessary to submit complete details of the enclosed switch, particularly the changes required to be made if the operating voltages were to change from 11kV to 22kV or vice versa.

5.2 Service conditions

The switches shall be suitable for use on Endeavour Energy's 11kV and 22kV 3-phase 50Hz system. The neutral point of the 11kV and 22kV system is effectively earthed. The highest system voltages are 12kV and 24kV RMS respectively. The switch insulation shall be designed accordingly.

The equipment **must** be designed for operation in the following conditions:

Service condition	Criteria
Altitude	<1000m
Maximum ambient temperature	45 deg. C
Minimum ambient temperature	-10 deg. C
Average annual lightning ground flash density	3 strikes per km ²
Solar radiation- maximum	1.1 kW/m ²
Average index of mean relative humidity: 9:00am	95%
Seismic acceleration coefficient (maximum)	0.09
Pollution level	Level IV in accordance with AS4436:1996
Wind speed	34m/s

All ratings and equipment shall be suitable for this environment.

5.2.1 Switchgear environment

All ferrous parts shall be treated to provide acceptable surface finish and protection. The manufacturer shall provide full details of the surface finishing and tests conducted on all component parts.

The insulation level shall be in accordance with the technical requirements stated. All insulation shall be of a type and quality that will give a minimum life of 40 years without deterioration.

All equipment shall be enclosed to the extent that there is no safety hazard to operating personnel. The equipment shall be fully shrouded to prevent inadvertent short circuiting due to human error, flying objects, or rodents.

5.3 Health, safety and environment (HSE) requirements

5.3.1 Special environmental requirements - toxicology safety

The supplier must provide with the offer, full details, including composition and toxicological information, regarding the health and safety aspects of all the materials offered in their offer or supplied equipment regardless of content.

Recommended procedures must be provided for the safe handling, safe operation and maintenance of products supplied. The means of disposal of the materials must be clearly stated.

Material safety data sheets (MSDS) shall be provided for materials that are supplied and subject to safety considerations in handling and use.

All equipment, packaging and all other accessories provided shall be asbestos free.

The above information is required as part of the offer and will be reviewed as part of the tender process.

5.3.2 Noise levels and radio interference voltage (RIV)

The LBS may be installed in a residential area in close proximity to residences. Therefore, it is necessary to confirm the noise level complies with this specification and the radio interference is $17\mu\text{V/m}$ for 11kV and $22\mu\text{V/m}$ for 22kV, as specified in AS/NZS 2344:1997. The sound power level while operating the switch must be less than 50dBA.

5.3.3 Fire and blast hazards

The LBS and its components must be designed in a manner to reduce the risk of rupture and explosive failure and subsequent fire risk. All equipment must be designed so that there is no safety hazard to operating personnel.

5.4 Technical requirements

Description		11kV	22kV
Applicable standards		AS 62271.1 and AS/NZS 60265.1	AS 62271.1 and AS/NZS 60265.1
Rated voltage	U_r	11kV	22kV
Highest system voltage	U_m	12 kV	24 kV
Rated frequency	f_r	50 Hz	50 Hz
System earthing		Effective earth	Effective/non-effective earth

Description		11kV	22kV
Indoor/outdoor		Outdoor	Outdoor
No. of poles		3	3
Rated current	I_r	630 A	630 A
Rated short circuit withstand current	I_k	16 kA	16 kA
Rated duration of short circuit	t_k	1 sec	1 sec
Rated peak withstand current	I_p	40 kA	40 kA
Rated mainly active load breaking current	I_1	630 A at 0.7 pf	630 A at 0.7 pf
Rated closed loop breaking current	I_{2a}	630 A at 0.3 pf	630 A at 0.3 pf
Rated no load transformer breaking current	I_3	6.3 A	6.3 A
Rated cable charging breaking current	I_{4a}	10 A	16A
Rated line charging breaking current	I_{4b}	1 A	1.5A
Rated short circuit making current	I_{ma}	40 kA	40 kA
Insulation level: Power freq. withstand: - ph-E - across the open contacts		28 kV for 1 min 28 kV for 1 min	50 kV for 1 min 50 kV for 1 min
Lightning impulse withstand		95 kVp	125 kVp
General purpose switch class		E2	E2
Mechanical endurance offload on/off operations		M1(1000 operations)	M1(1000 operations)
Current interrupting medium (preferred)		Vacuum / <i>others will be considered.</i>	
Insulation medium		Solid dielectric / <i>others will be considered.</i>	
Operation		Manual: using hook stick	
		Automated: Electrical local / SCADA remote	
Altitude		< 1000 m	
Pollution level		Very heavy	
Insulators		Porcelain / Silicone / cycloaliphatic epoxy resin	
Minimum creepage distance		31 mm/kV	
Degree of protection:		IP 65	
	LBS	IP 55	
	Control cubicle		
Communication (only for automated LBS)		Refer to section 5.7.6	
External connections		Bare, HVABC or CCT connection	
Fittings		Refer to section 5.5	

5.5 Switch construction requirements

5.5.1 General

The enclosed LBS shall be of *dead tank* stainless steel construction with the primary connections made through six (6) bushings. Endeavour Energy's preference is for the use of switchgear that does not contain SF₆ gas given its associated costs for management and global warming potential (GWP) where alternative cost-effective technologies are available. Cost-efficient offers of equipment containing SF₆ will be considered however weighting will be applied in the evaluation process to preference equipment with no or minimal SF₆. SF₆ management, environmental impact and disposal costs will be considered in the evaluation process.

For SF₆ designs, it is preferable that the unit operates with low gas quantities and pressure. Leakage rates shall not exceed 0.1% by weight a year. The tank shall be provided with a reliable pressure relief system. The tank **must** be vacuum rated.

The tank shall be manufactured from 304/316 marine grade stainless steel or equivalent material. If burst disc are made of stainless steel, it shall be 316 stainless steel. All support structures and associated bolts and nuts with these parts shall be hot-dip galvanised. Precautions shall be taken to prevent corrosion due to the use of dissimilar materials. If single phase units are supplied, they shall be gang operated.

Two (2) M12 studs complete with a nut, locknut and washer, shall be provided on the enclosed switch tank for earthing. The earthing studs shall be on diagonally opposite sides. A facility to install a surge arrester below each bushing shall be provided. The LBS shall be able to be free standing on the floor with the surge arrester mounted.

A manual operating lever shall be located in a position that allows operation from the ground using an appropriate operating stick.

5.5.2 Mounting

The enclosed LBS shall be suitable for both mid-pole and pole top mounting. Lifting eyes of adequate strength shall be provided to enable the enclosed switch to be lifted using a crane for erection on poles or on the ground. These lifting eyes shall be clearly marked.

A safe working load (SWL) sticker shall be placed on each LBS. The supply shall include all necessary hardware and instructions needed to mount the switch on a wood, concrete, steel or composite pole.

5.5.3 Bushings

The bushings shall be outdoor type using materials such as porcelain, silicone rubber or cycloaliphatic epoxy resin. Complete bushing details, such as a general arrangement drawing, electrical and mechanical characteristics, sealing arrangement with the tank, pollution performance and test certificates, shall be submitted for approval.

Each enclosed LBS shall be supplied with a rigid bare terminal two-hole flat palm bushing arrangement and six (6) vermin cover bushing boots to cover the lugs and palms. The vermin cover bushings shall be UV rated and not easily breakable.

5.5.4 Earth attachment

A suitable earth connection point shall be provided that can be fitted to the two-hole palm bare terminal of each bushing to accommodate earthing equipment and to confirm effective switch isolation. The connection point shall consist of a galvanised steel 2-hole palm fitted with a stirrup of at least 16mm diameter, with a straight connection of a minimum 100mm, and clear of any vermin cover, designed to achieve a fault rating of 16kA for one (1) sec.

A typical earthing attachment arrangement is shown in Figure 1.

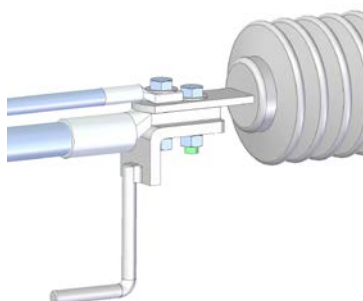


Figure 1 – Earthing attachment

5.6 Operational requirements

5.6.1 Common requirements for manual and automated switches

- All local controls and indications shall be accessible in adverse weather conditions.
- The enclosed switch shall be provided with external levers to permit manual operation, using an insulated operating stick, to open/close the switch from ground level. Where these operations can be performed at the control cabinet, it shall be necessary only to provide a mechanical means to open and lockout the enclosed switch using an insulated operating stick.
- The manual enclosed switch shall be supplied with a mid pole operating mechanism located approximately 5m above the ground. The down rod shall be insulated to a minimum of 3m from the LBS. A facility needs to be provided for adjusting the operating mechanism mounting height. Dependant on the length of pole used for the mounting of the switch, the distance between the switch and the operating mechanism may vary between 5.5m and 7.0m. The operating mechanism shall have a locking device that provides an operation to open or close the switch reliably.
- The switch shall be provided with a locking lever/device to manually lock the switch mechanism in both the closed and open positions. The locking lever/device shall be operated from the ground using a hook stick. This locking device shall provide an operation to open or close the switch and be locked and unlocked with a suitable operating key. This is required to prevent unauthorized switch operation.
- The enclosed switch status shall be clearly visible from ground level (close to the pole) without the aid of a visual aid. Open shall be indicated with a green O. A red I shall indicate closed. Alternative indications may be approved by the Network Substation Manager upon application.
- The LBS shall lock out in the event of low SF6 gas.
- Pressure relief facilities shall be provided to enable the enclosed switch to safely withstand the effects of excessive pressure rise due to an internal fault.
- Malfunction of the enclosed switch shall not pose a safety hazard to the operator due to the recoil or backlash of items such as external operating rods, cranks and levers.
- Provision shall be made to securely attach a danger tag/notice to the switch near its operation mechanism. This is required to warn against unauthorised switch operation.

5.6.2 Requirements of Automated switches

In addition to the common requirements listed above, the switch shall be fitted with all the facilities as specified to enable it to be operated electrically. Facilities for local/remote operation shall be provided. LBS with automatic sectionalizing capabilities is preferred.

5.7 Control and indication – Automated switches

5.7.1 Control cubicle

Where required, a cubicle shall be provided to house the control and communications equipment, including batteries and chargers. The cubicle shall be constructed of 316 marine grade stainless steel or equivalent material.

The degree of protection shall be IP 55 or better. The equipment housed in the cubicle shall withstand the heating effect due to internal heat generation and external solar heating. All connections into the cubicle shall be waterproof and the cubicle designed to avoid condensation. An M12 stud, complete with nut, locking nut and washer, shall be

provided on the cubicle for the termination of an earth. The door of the cubicle shall have an earth strap installed to bond the door to the main control cubicle.

Provision shall be made to padlock all the doors. The cubicle shall be suitable for mounting on a wood or concrete pole. The cubicle doors shall open to the left.

Provision shall be made in the cubicle for the bottom entry of three (3) cables using two (2) x 21mm and one (1) x 32mm diameter pre-punched holes. The holes shall be suitably blanked off.

The door of the cabinet shall be fitted with a robust fastening arrangement that is capable of being secured by a padlock with a shackle of 8mm diameter. The cubicle shall also be easily removable for workshop repair purposes.

The cubicle shall be connected to the enclosed switch by a screened, flexible cable. The scope includes the supply of a seven (7) metre long ultraviolet radiation resistant flexible cable to connect the switch tank to the control cabinet. It shall be possible to disconnect the cable, both at the enclosed switch and at the control cubicle end, while the switch is connected in the system, without damage or any mal-operation.

It is therefore necessary that the cable be provided with secure detachable connectors on both the ends. Care **must** be taken to **determine** that the CTs, if any are used, are not open circuited.

The control circuitry shall not suffer any damage if one or more poles of the switches fail to respond to either a trip or a close command. The electronic control module shall perform continuous diagnostic monitoring and contain hardware and software watchdog checking, which shall raise an alarm in the event of a failure.

5.7.2 Local control and indication

The minimum specification of local controls and indications are as follows:

Item	Features	Remarks
Local control	Local/remote	Two (2) position key switch
	Switch open	Secure control
	Switch close	Secure control
Local indication	Local/remote	
	Switch --- open	
	Switch --- closed	
	Switch --- lock-out	
	Controller not healthy	
	AC fail	
	DC abnormal	
	DC fail	
	Charger fail	
	Over current and earth fault	

Switches used for local control shall offer the type of control described above, that is, secure or toggled control.

Electronic keypad controls shall offer quick key [maximum of one (1) keystroke] access to the controls if not implemented with switches.

5.7.3 Remote control and indication

The minimum requirements of remote controls and indication are:

Item	Features	Remarks
Remote control	Switch open Switch close	Secure control Secure control
Remote indication	Local/remote Switch --- open Switch --- closed Controller not healthy AC fail DC abnormal DC fail Charger fail Over current and earth fault	

Notes

1. The *Controller not healthy* indication shall indicate the control equipment not healthy (watchdog) function operated. It shall not operate during the normal pole-mounted switch operating cycle. This indication **will** remain active until the unhealthy state that initiated it returns to normal.
2. The two-position switch (labeled as below) shall allow the switch controller to be set in the following modes:
 - **Remote**
In this mode, a local operator can open or close the switch and change the mode. A remote operator can open or close the switch and change configuration parameters. All reporting functions are active.
 - **Local**
In this mode, a local operator can open and close the switch and change configuration parameters. Only monitoring functions are available to remote operators. The local and remote positions shall be indicated separately.

5.7.4 Local engineering

The controller shall be provided with the following:

1. A real time clock that can be set both locally and remotely. The accuracy of the clock **will** be subject to approval. Time synchronisation mechanisms, such as by GPS system, DNP3 or IRIG B, **must** be provided.
2. A facility for selecting all the operating and communications characteristics shall be locally available in the control cabinet. Optional password protection against unauthorised changes shall be available.
3. The facility to clear the event record.
4. An event recorder shall monitor the operations and provide the following as a minimum:
5. The type and time of any local control operations by remote or operator interface.
6. All events shall be time and date stamped with a resolution of at least 1 ms relative to the onboard real time clock.

7. The software necessary for downloading event data shall be supplied free of charge on a site basis.
8. It must be capable of operating on Microsoft Windows 7 or above. It must be possible to alter individual settings using a personal computer (PC) without having to transfer all settings to or from the controller.
9. The software must be capable of creating a file without it being necessary to connect to a controller. The file created must stand alone, and not be part of a database.
10. The ability to communicate with the control from a PC using a standard terminal emulator with an ASCII protocol is desirable.

5.7.5 Tele-control requirements

The switch controller shall detect and report disconnection of the control cable between the controller and switch. It shall be possible to operate the switch, and turn switch capabilities ON/OFF.

5.7.6 Communications

5.7.6.1 Remote terminal unit

The switch controller shall offer an integrated remote terminal unit (RTU) supporting remote communications using DNP3.0 protocol up to and including level 3.

5.7.6.2 RS232 or Ethernet ports

As a minimum, two (2) independent RS-232 or RJ45 Ethernet communication ports, which allow for simultaneous operation, shall be provided and shall be used as follows:

1. RS232 ports conform to TIA/EIA RS232 or ITU-T V.24/28 specification(s) for electrical performance having DB9 connectors (as set out in RS232 specification).
2. One port RS232 configured as Data Communications Equipment (DCE- DB9 female) to connect with a personal computer for up/down loading data into the Enclosed Switch non volatile memory.
3. The other RS232 port configured as Data Terminal Equipment (DTE-male) to allow integrated RTU to connect with a Data Communications Equipment (DCE) specified by Endeavour Energy (for example: radio modem ER450 from Trio™).
4. As a minimum, it shall be possible for these RS232 ports to operate at 9600bps, supporting asynchronous operation. Refer to ITU-T V.24 for details.
5. It shall be possible to disconnect the RS-232-to-modem interface to allow local protocol and communications troubleshooting. Alternatively, a low-level protocol monitor shall be integrated in the software and be accessible through the diagnostic port.
6. Where RJ45 Ethernet port is offered, it shall be capable of operating at 10/100Mbps and the load-break switch controller shall offer a changeable default IP version 4 address for initial login and subsequent site specific customization.

5.7.6.3 Special radio requirements

The control enclosure shall have

- sufficient room to allow mounting of two (2) radio or Mobile data Modem, nominal size 200 x 150 x 50mm.

5.8 Power supplies

All equipment required to supply the auxiliary power needed for operations, such as open/close of the switch, control and communications equipment shall be provided. This

shall include auxiliary transformer, rectifier, batteries and associated equipment. The control cubicle shall be able to accept the input supply of 230Vac and 120V dc.

For pole mounted switches, a step down voltage transformer (optional) shall be supplied to supply the auxiliary power needs of the switch. The voltage transformer (11kV/22kV) will step down to 230V. Preferably, the transformer shall be mounted on the switch tank.

All necessary HV connection cable, lugs and silicon rubber bushing covers shall be provided. Single phase to ground transformer shall not be used. However, a phase to phase voltage transformer with adequate output can be used for this purpose. Alternative proposals can be submitted for consideration. Full details of the voltage transformer shall be supplied and must be approved by the Network Substation Manager.

Where the enclosed switch can be supplied with 230V, single phase 50Hz AC supply from an adjacent substation or from the street feeder, step down transformers/VT's shall not be required.

The auxiliary power supply shall use a storage battery of adequate capacity with a suitable constant voltage battery charger, to provide a standby power for at least 10 open/close operations in the event of AC power loss.

The storage batteries shall be sealed type requiring no maintenance over their life. All batteries shall have a maintenance-free life of at least five (5) years. A label showing the year of manufacture and recommended replacement year must be affixed to each battery. Full details of the battery included shall be submitted for approval.

Power supply to the radio shall be 12V, 8A peak, 4A continuous (based on a 100% duty cycle) with battery backup suitable for four (4) amp-hours capacity. Low battery indication is to be provided locally and remotely. Remote *low battery* indication is to be initiated prior to the failure of the radio due to low voltage. The switch must not close when insufficient energy is available to open the switch.

5.9 Rating plate

Each enclosed LBS shall be provided with a rating plate of an intrinsically corrosion-resistant material (stainless steel 316), indelibly marked with the sea-level rating for which the equipment has been type tested.

The rating plate shall be indelibly marked with the information as required in AS 62271.1:2012. The nameplate shall provide the following minimum information.

- Manufacturer's name
- Continuous current rating
- Rated voltage
- Month and year of manufacture
- Specification number
- Designation of type
- Mass
- Lightning impulse withstand voltage
- Rated short circuit making current
- Rating short time withstand current
- Rated make and break current

5.10 Additional information

The following information shall be submitted.

Details of the maintenance and operating equipment and procedures needed and a detailed parts list of the various components, including:

- A description of the switch operation, with instruction and maintenance manuals, including maintenance schedules.

- A list of recommended spares and tools, with the prices and availability of each item.
- Details of technical back-up facilities available.
- Details of the low gas pressure alarm/lock-out operation, if applicable.
- Recommendations for the disposal of SF6 gas enclosed switch, if applicable.
- Details of LV trip/close coil if available as an option.
- Power requirements for a close operation.
- The maximum achievable separation between the control unit and the LBS.
- Full details of the SCADA protocol implementation and the complete I/O point mapping table.

5.11 Tests

5.11.1 General

The manufacturer shall provide one (1) copy of certified test reports for type and routine tests.

All tests **must** be carried out by a testing authority holding appropriate accreditation:

- by NATA Australia; or,
- by an accreditation authority recognised by NATA Australia.

Tests from other testing authorities, such as KEMA, may be accepted at the discretion of Network Substations Manager, Endeavour Energy.

Type tests more than five (5) years old may be acceptable at the discretion of the Network Substations Manager.

All type and routine test cost will be borne by the manufacturer/supplier.

Endeavour Energy reserves the right to witness type and routine testing for which at least two (2) weeks' notice **will** be given.

5.11.2 Type tests

The enclosed LBS shall be of a type-tested design in accordance with the requirements of AS 62271-2012 and AS/NZS 60265.1-2001:

No.	Type test	Acceptable value	Test method reference
1.	Dielectric tests including lightning impulse withstand tests, power frequency voltage withstands tests, and power frequency withstand test on auxiliary circuits	No failure	Clause 6.2 of AS 62271.1:2012
2.	Temperature rise test	<65K	Clause 6.5 of AS 62271.1:2012
3.	Measurement of resistance of the main circuit	The measured resistance shall not be >20% of before test.	Clause 6.4 of AS 62271.1:2012
4.	Short time withstand current and peak current withstand current tests	The switch is operable. The measured resistance shall not be	Clause 6.6 of AS 62271.1:2012

No.	Type test	Acceptable value	Test method reference
		>20% of before test.	
5.	Tests to prove ability of the switch to make and break the specified currents	No failure and the switch is operable.	Clause 6.101 of AS/NZS 60265.1:2001
6.	Tests to prove satisfactory mechanical operation and endurance	All parts in good condition and shall not show excessive wear.	Clause 6.102 of AS/NZS 60265.1:2001
7.	Verification of the protection	LBS: IP 65 Control cubicle: IP 55	Clause 6.7 of AS 62271.1:2012
8.	Tightness tests	0.1% for sealed pressure systems	Clause 6.8 of AS 62271.1:2012
9.	Electromagnetic compatibility tests	RIV <2,500µV and complies to sub-clause 6.9.2.5 of AS 62271.1:2012	Clause 6.9 of AS 62271.1:2012

5.11.3 Routine tests

The routine test shall be conducted on each unit in accordance with the requirements of AS 62271-2012 and AS/NZS 60265.1-2001:

No.	Routine test	Acceptable value	Test method reference
1.	Dielectric test on the main circuit	Meets the requirement of section 5.3 of this specification.	Clause 7.1 of AS 62271.1:2012
2.	Tests on auxiliary and control circuits	Complies to sub-clauses 7.2.1, 7.2.2, 7.2.3 and 7.2.4 of AS 62271.1:2012.	Clause 7.2 of AS 62271.1:2012
3.	Measurement of resistance of the main circuit	The measured resistance shall not exceed 20% of the resistance value before the temperature rise test.	Clause 7.3 of AS 62271.1:2012
4.	Tightness test	Complies to Clause 7.4 of AS 62271.1:2012.	Clause 7.4 of AS 62271.1:2012
5.	Design and visual checks	Verified by the manufacturer.	Clause 7.5 of AS 62271.1:2012
6.	Mechanical operating test	Meets the	Clause 7.101 of

No.	Routine test	Acceptable value	Test method reference
		requirement of Clause 7.101 of AS/NZS 60265.1:2001	AS/NZS 60265.1:2001
7.	Partial discharge test	$\leq 10\text{pC @ }1.1 \text{ Um}$	Clause 7.201 of AS/NZS 60265.1:2001

Duplicate copies of routine test certificates shall be supplied with each piece of equipment.

5.11.4 Submission of test result

The following information in printed or electronic (printable) format **must** be submitted for all the tests that need be performed.

- The test method used. This may be a reference to an AS/NZ, IEC, IEEE or BS standard or to authenticated document or book or a method acceptable to Endeavour Energy.
- Clearly stated and descriptive document with necessary diagrams, sketches, circuit diagrams and photographs etc. describing the test method.
- Test results.

Endeavour Energy reserves the right to inspect the manufacturing facilities of the switches prior to awarding the contract, or at any time during the contract period. This inspection **will** be carried out by **Asset Standards & Design** staff.

5.12 Maintenance requirements

5.12.1 Spare parts and maintenance

The supplier must supply a list of recommended spare parts, special tools and appliances required for the whole of life operation and maintenance of the LBS installation. The list, together with prices, must be indicated in the appropriate schedule. The supplier must also provide details (if required) of the recommended maintenance and the frequency at which it must be carried out. Details of the manufacturers repair capability and options must be provided.

5.12.2 Failure mode analysis and preventative maintenance

The supplier must indicate and provide updates to Endeavour Energy the mean time between failures (MTBF) of the LBS and its components including the recommended maintenance regime and maintenance tasks and intervals. This regime must be based on the mean time between failure (MTBF) and the critical failure modes identified by the failure mode, effects and criticality analysis (FMECA) of the equipment. Details substantiating the FMECA analysis must be included in the offer.

5.13 Quality assurance

Quality assurance certification is required to establish the manufacturer's ability to design and consistently manufacture load break switches to this specification. The supplier and all its contractors must have a quality system which complies with the requirements of AS/NZS ISO 9001 or other comparable Australian or International equivalent.

All nominated drawings and documents that have to be reviewed by Endeavour Energy are to be submitted as complete packages using document controls systems such that all the relevant information to enable the design to be reviewed is available. Design

suitability approval will not relieve the supplier of its responsibilities for the correctness and appropriateness of the design or their responsibility to conform to this specification.

5.13.1 *Quality assurance plan*

A quality assurance plan is a document subject to approval of Endeavour Energy and must contain as a minimum the following information:

- The supplier's organisational structure for the works.
- A planned outline meeting the requirements and all stages of the scope and specification.
- An index showing all existing procedures, inspection and test plans and drawings.
- AS/NZS ISO 9001 certification for itself and subcontractors.
- A plan detailing the design, ordering of materials, manufacturing and test plans.

5.13.2 *Quality Inspection and Test Plan (QITP)*

A quality inspection and test plan must be developed and agreed which contains sufficient details of the workflow so that Endeavour Energy can review and / or make visits. The test plan will be prepared in accordance with AS/NZS ISO 9001.

5.14 **Product approval**

5.14.1 *Product approval and audit forms*

Complete information of the LBS shall be provided on Branch Form FAE 3085.

5.14.2 *Product approval process*

The Network Substations Manager will approve the equipment/components for use on the network. The LBS shall be evaluated under the product approval process set out in PAE 1004.

6.0 **AUTHORITIES AND RESPONSIBILITIES**

General Manager Asset Management has the authority and responsibility for:

- approving this Specification, including any variations;
- making all decisions concerning compliance in respect to this Specification;
- nominating Endeavour Energy's representative(s) for either the manufacturing facility inspection and/or witness testing; and,
- delegating any of these authorities and responsibilities to the Manager Asset Standards & Design.

Manager Asset Standards & Design has the authority and responsibility for:

- reviewing this specification and making recommendations to the General Manager Asset Management; and,
- making recommendations concerning compliance in respect of this Specification; and
- making nominations of Endeavour Energy's representatives.

Network Substations Manager has the authority and responsibility for:

- reviewing all type and routine test reports and alternative proposals submitted for evaluation, and making recommendations to the Manager Asset Standards & Design.
- clarifying all the technical aspects of this specification to the stakeholders; and
- approving the relevant actions required and outlined in this specification.

SCADA and Program Manager will be responsible for updating the relevant sections related to SCADA.

Telecommunications Manager will be responsible for updating the relevant sections related to communications.

Contractor Operations Manager, Network Connections will be responsible for ensuring that all load break switches installed by Level 1 Accredited Service Providers comply with the requirements of this specification.

Commercial Manager has the authority and responsibility to certify that the load break switches purchased through the tender process complies with the requirements of this specification.

Manufacturers/suppliers will be responsible for:

- establishing awareness of their responsibilities under this specification;
- providing suitable training to their staff or contractor/s under their control to safely perform works to this specification;
- implementing an effective safety, environmental and quality auditing system; and,
- implementing this specification and keeping Endeavour Energy or other responsible equivalent officers informed of any factors that may prevent them from accepting responsibility for its full implementation.

7.0 DOCUMENT CONTROL

Documentation content coordinator: Network Substations Manager

Documentation process coordinator: Standards Process Coordinator