Equipment Technical Specification

33kV/66kV/132kV outdoor disconnectors and earthing switches

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Equipment Technical Specification

ASSET STANDARDS & DESIGN

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ETS 0007 33kV/66kV/132kV outdoor disconnectors and earthing switches

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1.0 PURPOSE

To set out in detail the minimum technical requirements for 33kV/66kV/132kV outdoor disconnectors and earthing switches used in various transmission and zone substations in the company’s network.

2.0 SCOPE

This Specification covers the design, engineering, manufacture, testing and delivery of 33kV/66kV/132kV disconnectors and earthing switches. It is not the intention to specify all design, manufacturing and constructional details of the disconnectors and earthing switches. However, the equipment supplied must meet the highest standards of design, engineering and manufacturing practices.

The scope includes all accessories and equipment necessary and normally supplied for the safe operation of the equipment, whether specified or not. The requirement is for self-contained outdoor disconnectors and earthing switches complete with all control and operating mechanism enclosures and support structures.

The requirements of this document apply when a new 33kV/66kV/132kV outdoor disconnector and earthing switch is required to be installed to replace an existing disconnector or earthing switch in an existing substation, or to be installed in a new substation.

All supplied disconnectors and earthing 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 must take precedence.

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

3.0 REFERENCES

Internal

Company Policy 9.2.1 - Network Planning
Company Policy 9.2.5 - Network Asset Design
Company Policy 9.2.10 - Network Asset Ratings
Company Policy 9.7.1 - Network Asset Construction
Company Policy 9.9.1 - 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
Earthing Design Instruction EDI 516 – Major substation earthing design, construct and commissioning
Environmental Management Standards EMS 0001 – Environmental impact assessment and environmental management plans
Substation Design Instruction SDI 505 – Minimum design and construction requirements for transmission and zone substations and switching stations
Substation Design Instruction SDI 517 – Busbars and support insulators
Substation Design Instruction SDI 518 – Support structures
Substation Design Instruction SDI 527 – Clearances
Substation Design Instruction SDI 534 – Manuals, test reports and photographs
Network Management Plan December 2013 Review

External

Electricity Supply Act 1995 (as amended)
4.0 DEFINITIONS AND ABBREVIATIONS

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>company</td>
<td>Endeavour Energy</td>
</tr>
<tr>
<td>pcd</td>
<td>pitch circle diameter</td>
</tr>
<tr>
<td>NATA</td>
<td>National Association of Testing Authorities</td>
</tr>
<tr>
<td>RIV</td>
<td>Radio Interference Voltage</td>
</tr>
<tr>
<td>RMS</td>
<td>Root Mean Square</td>
</tr>
</tbody>
</table>

5.0 ACTIONS

5.1 General requirements

The disconnectors and earthing switches supplied must conform to all the current requirements of the relevant Australian and IEC Standards and this specification. Generally, all disconnectors and earthing switches are manually operated but an option for motorised units is specified in the tender documents.

Similar components of similar disconnectors and earthing switches must be capable of being interchanged.
The equipment supplied must meet the highest standards of engineering, design and manufacturing practices.

The supplier must provide everything necessary, including any special tools, usually supplied for the safe operation of the equipment, whether directly specified or not.

The insulation level must be in accordance with the technical requirements stated.

All connections must be terminated using crimp lugs and stainless steel or hot dip galvanised bolts as appropriate. Clamps or u-bolt connections are not allowed.

Metallic enclosures and operating mechanisms not mounted together with, and not electrically connected to, the metallic frame of the disconnector or earthing switch must be effectively earthed and enclosed in earthed enclosures.

All equipment must be designed so that there is no safety hazard to the operators, to prevent accidental shorts by human error, flying objects or rodents, and to prevent mechanical damage to the disconnector and earthing switch.

The design and construction must be in accordance with the technical requirements stated. All materials must be of a type and quality that will give a normal life expectancy of 45 years.

The manufacturer must provide details of the recommended maintenance procedures for the equipment.

**Note:** All values submitted to tender and in Product Approval Forms must be guaranteed values and will be treated as such in the evaluation, and when assessing whether the delivered equipment meets the specification.

### 5.1.1 Service conditions

The equipment must be suitable for use on the company’s 33kV/66kV/132kV 3-phase 50Hz system having the neutral point of the source effectively earthed, and the highest system voltages of 36kV, 72.5kV, 145kV RMS respectively. The equipment insulation must be designed accordingly.

The disconnector and earthing switch must be designed for use in outdoor, all-weather conditions and to operate in service conditions given in the table below:

<table>
<thead>
<tr>
<th>Service condition</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal service condition</td>
<td>Outdoor to AS62271.1</td>
</tr>
<tr>
<td>Altitude</td>
<td>≤ 1000m *</td>
</tr>
<tr>
<td>Maximum ambient temperature</td>
<td>45 deg. C</td>
</tr>
<tr>
<td>Minimum ambient temperature</td>
<td>-10 deg. C</td>
</tr>
<tr>
<td>Average annual lighting ground flash density</td>
<td>3 strikes per km²</td>
</tr>
<tr>
<td>Solar radiation- maximum</td>
<td>1.1kW/m²</td>
</tr>
<tr>
<td>Average index of mean relative humidity: 9:00am</td>
<td>95%</td>
</tr>
<tr>
<td>Seismic acceleration coefficient (maximum)</td>
<td>0.09</td>
</tr>
<tr>
<td>Pollution level</td>
<td>Level IV in accordance with AS4436</td>
</tr>
<tr>
<td>Wind speed</td>
<td>34m/s</td>
</tr>
<tr>
<td>Ice coating</td>
<td>1mm</td>
</tr>
</tbody>
</table>

Note * - Maximum altitude is 1200m in a small portion of the company’s network, which will be evaluated in accordance with the conditions in AS62271.1.
5.2 Health, safety and environment (HSE) requirements

5.2.1 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) must be provided for materials that are supplied and subject to safety considerations in handling and use.

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

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

5.2.2 Noise levels and radio interference voltage (RIV)

The disconnector and earthing switch may be installed in a residential area in close proximity to residences. Therefore, it is necessary that noise levels comply with AS1055.2 Level R1 and the radio interference does not exceed 2500µV, as specified in AS62271.1.

5.2.3 Fire and blast hazards

The disconnector and earthing switch and its components must be designed in a manner to reduce the risk of rupture and explosive failure and subsequent fire risk.

5.3 Technical requirements

Table 2 – Technical requirements

<table>
<thead>
<tr>
<th>Description</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicable standards</td>
<td>AS62271.102 and AS62271.1</td>
</tr>
<tr>
<td>Type (indoor/outdoor)</td>
<td>Outdoor</td>
</tr>
<tr>
<td>No. of poles</td>
<td>3</td>
</tr>
<tr>
<td>Primary mode of operation</td>
<td>Manual</td>
</tr>
<tr>
<td><strong>Optional mode of operation</strong></td>
<td>Motorised (only for disconnector)</td>
</tr>
<tr>
<td>Rated frequency ($f_r$)</td>
<td>50Hz</td>
</tr>
<tr>
<td><strong>Nominal voltage</strong></td>
<td></td>
</tr>
<tr>
<td>Rated voltage ($U_l$)</td>
<td>33kV 66kV 132kV</td>
</tr>
<tr>
<td>Rated current ($I_l$)</td>
<td>36kV 72.5kV 145kV</td>
</tr>
<tr>
<td>(only for disconnector)</td>
<td>1250A 2500A</td>
</tr>
<tr>
<td>Rated short time withstand current ($I_{ls}$)</td>
<td>31.5kA 31.5kA 40kA</td>
</tr>
<tr>
<td>Rated duration of short circuit ($t_{ls}$)</td>
<td>1 sec 1 sec 1 sec</td>
</tr>
<tr>
<td>Rated peak withstand current ($I_{lp}$)</td>
<td>79kA 79kA 100kA</td>
</tr>
<tr>
<td>Rated short circuit making current ($I_{ima}$)</td>
<td>79kA 79kA 100kA</td>
</tr>
<tr>
<td>(only for earth switch)</td>
<td></td>
</tr>
<tr>
<td>Rated short duration power frequency withstand voltage ($U_{d}$):</td>
<td>70kV 80kV 140kV 160kV 275kV 315kV</td>
</tr>
<tr>
<td>• Common value</td>
<td></td>
</tr>
<tr>
<td>• Across the isolating distance</td>
<td></td>
</tr>
<tr>
<td>Description</td>
<td>Requirement</td>
</tr>
<tr>
<td>-------------------------------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage ($U_i$):</td>
<td></td>
</tr>
<tr>
<td>- Common value</td>
<td>170kV 195kV</td>
</tr>
<tr>
<td>- Across the isolating distance</td>
<td>325kV 375kV</td>
</tr>
<tr>
<td></td>
<td>650kV 750kV</td>
</tr>
<tr>
<td>Rated value of the bus-transfer voltage at which the disconnector is capable of switching the rated bus transfer current.</td>
<td>- 100V r.m.s</td>
</tr>
<tr>
<td>Rated value of the induced current switching capability of earthing switches</td>
<td>- 50A r.m.s</td>
</tr>
<tr>
<td>Rated static mechanical terminal load:</td>
<td></td>
</tr>
<tr>
<td>- Straight load</td>
<td>500N</td>
</tr>
<tr>
<td>- Cross load</td>
<td>170N</td>
</tr>
<tr>
<td>Classification of disconnector for mechanical endurance</td>
<td></td>
</tr>
<tr>
<td>Classification of earthing switch for electrical endurance</td>
<td>E0</td>
</tr>
<tr>
<td>Designation</td>
<td>C10-200 C10-325 C12.5-650</td>
</tr>
<tr>
<td>Material</td>
<td>Porcelain Porcelain Porcelain</td>
</tr>
<tr>
<td>Colour</td>
<td>Light grey Light grey Light grey</td>
</tr>
<tr>
<td>Height</td>
<td>475±1mm 770±1mm 1500±2.5mm</td>
</tr>
<tr>
<td>Minimum creepage distance</td>
<td>1116mm 2250mm 4495mm</td>
</tr>
<tr>
<td>Minimum failing bending load</td>
<td>10kN 10kN 12.5kN</td>
</tr>
<tr>
<td>Minimum failing torsion load</td>
<td>2.5kNm 4kNm 6kNm</td>
</tr>
<tr>
<td>Fixing arrangement designation:</td>
<td></td>
</tr>
<tr>
<td>Hole size</td>
<td>4 x M12; 0.3mm oversize; depth 16mm</td>
</tr>
<tr>
<td></td>
<td>4 x M16; 0.3mm oversize; depth 20mm</td>
</tr>
<tr>
<td>Bolt</td>
<td>Galvanised – grade 8.8 or stainless steel</td>
</tr>
<tr>
<td></td>
<td>Galvanised – grade 8.8 or stainless steel</td>
</tr>
<tr>
<td>Mounting holes PCD</td>
<td>76mm 127mm</td>
</tr>
<tr>
<td>Power frequency withstand voltage</td>
<td>70kV 140kV 275kV</td>
</tr>
<tr>
<td>Lightning impulse withstand voltage</td>
<td>200kV 325kV 650kV</td>
</tr>
<tr>
<td>Applied voltage for RIV test</td>
<td>23kV 46kV 92kV</td>
</tr>
<tr>
<td>Corona extinction voltage</td>
<td>≥27kV ≥53kV ≥105kV</td>
</tr>
</tbody>
</table>
### Description vs. Requirement

<table>
<thead>
<tr>
<th>Description</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direction of operation of manual operating handle:</td>
<td></td>
</tr>
<tr>
<td>• Disconnector</td>
<td>Horizontal</td>
</tr>
<tr>
<td>• Earthing switch</td>
<td>Vertical</td>
</tr>
<tr>
<td>Rated supply voltage of closing and opening device and auxiliary and control circuit</td>
<td>120V DC / 230V AC</td>
</tr>
<tr>
<td>Number of available normally open auxiliary contacts for disconnector and each earthing switch</td>
<td>3</td>
</tr>
<tr>
<td>Number of available normally closed auxiliary contacts for disconnector and each earthing switch</td>
<td>3</td>
</tr>
<tr>
<td>Degree of protection for enclosures housing the operating mechanism and auxiliary circuit components</td>
<td>IP5XW</td>
</tr>
</tbody>
</table>

#### 5.4 Construction requirements

##### 5.4.1 Details of construction and fittings

The outdoor disconnector and earthing switch assemblies covered by this document must include the following construction:

- Disconnectors and earthing switches complete with blades, insulators, operating links and handles.
- Fully functional motor operated mechanism enclosure (optional).
- A fully integrated steel stand of certified mechanical strength suitable to mount a disconnector plus two (2) earthing switches and motor operated mechanism enclosures for the disconnector and each earthing switch.

The switch must be rotary double break type; both sides of the switch must be opened and closed simultaneously.

All operating linkages carrying mechanical loads must be designed for negligible deflections and mechanical clearances must be kept low to avoid excessive backlash during opening and closing.

Electrical clearances must meet the requirements as specified in SDI 527.

The switches must be designed so that the contacts register fully under normal operating and service conditions and so that all possibilities of misalignment or separation of contacts owing to bounce, springing, vibration, and short-circuit forces, whether during operation or in service, are eliminated. There must be ample overlap provided such that the making of all contacts over all ranges of operation is possible.

All rotating parts must be provided with self-lubricating bearings of approved design and backed by service experience.

Bolts, screws and nuts must be ISO metric. All bolts must be no longer than necessary. All bolts, nuts and washers used must be hot dip galvanised or stainless steel. All nuts used must be fitted with approved positive locking device.

Each operating handle must be supplied predrilled with a 14mm hole. This hole is for facilitating a single direct connection between the operating handles and the operator earth mats. The hole must be drilled near the pivot point of the operating handles to allow full operation of the disconnectors and earthing switches.
A predrilled 14mm hole must also be provided on the operating rods and operating mechanisms of all supplied disconnectors and earthing switches to facilitate equipotential bonding connection between the operating rods and mechanisms.

A 50x50x6mm stainless steel or galvanised tag with 14mm diameter hole must be welded to each support structure column approximately 500mm above ground level to provide facility for M12 bolted earth connection.

All holes must be drilled before the application of any coating for corrosion protection.

The details on equipotential bonding connections for disconnectors and earthing switches are included in EDI 516.

Sharp edges and corners must be rounded off to avoid risk of injury.

The general arrangement and configuration of individual components must allow for easy dismantling and removal without the need to dismantle other components. Welded surfaces must be free of scale, dirt, grease, paint or heavy rust. The welding sequence adopted must be to reduce distortion as much as possible.

All similar parts must be accurately machined so that they can be interchangeable. All surfaces that will be connected together or which have to be accurate for the purposes of sealing, levelling or setting up during erection must be accurately machined.

5.4.2 Earthing device

The earthing devices must be of a type that bolts onto the disconnector so as to enable the three phase terminals on one side of the disconnector to be earthed simultaneously by a ganged manual operating mechanism operated from ground level.

The design must be such that two earthing devices can be fitted to the one disconnector so one or both sides of the disconnector can be earthed individually as required. Both sides of the disconnector are to be manufactured so that earthing devices can be affixed without modification to the disconnector.

The main earth connection to the substation earth grid must be via tin plated flexible copper braid, flexible copper rope will not be acceptable.

5.4.3 Contacts and main terminal

The contacts must be self-aligning and self-cleaning type, and designed so that normal contact can be made after prolonged periods of time under the service conditions. The fixed contact plate must have slotted fixing holes for quick adjustments on site.

Contacts and springs must be designed so that reduction in contact pressure is kept to a minimum as a result of wear on the contact surfaces. Adjustment to maintain contact pressure must not be necessary throughout the life of the switch and each contact or pair of contacts must be independently sprung so that full pressure is maintained on all contacts at all times.

Contact springs must not carry current and must be insulated and ventilated as necessary such that they are not exposed to the heating effects. Where buttons are used, adequate lead-in must be provided on the moving contact and the buttons must be completely shielded from the initial impact forces. The contact pressure must be maintained by helical stainless steel springs, with material in accordance with AS1447. Contacts must be silver or silver faced and full details of the contacts must be submitted.

Contacts must be lubricated by an approved lubricant, which must reduce wear and scuffing of contacts, but must not provide a means of reducing the effort to operate the switch. The lubricant must be of high quality to provide extended performance. Details of the lubricant must be provided by the supplier.
5.4.4 **Busbar termination**

Termination palms must be supplied fitted to the disconnector connections to enable the company to complete the busbar connections.

Termination palms must suit the rating of the equipment. Terminal palm number 8 or 9 in accordance with AS62271:301 must be used. The material of the palm terminal must be aluminium alloy 6061-T6 in accordance with AS/NZS1734. The bolt hole size must be 18mm diameter. The company will only supply the connecting lugs and bolts.

The dimensions between the phase centres of the busbar terminations are as follows:
- 33kV: 1000mm
- 66kV: 1500mm
- 132kV: 2800mm

The company may consider alternative materials and dimensions provided full details are submitted.

5.4.5 **Outdoor station post insulators**

The station post insulators must be made of porcelain suitable for outdoor use. The insulators must be composed of the highest quality porcelain and must be free from defect, thoroughly vitrified and smoothly glazed. The insulators must be fitted with external cast iron caps on each end. Details of the glue/cement used between the insulator and its caps must be provided. Sulphur cement is not acceptable.

The glaze colour of the insulators must be light grey, similar to smoke blue (T33) in accordance to AS2700S. The insulators must meet the requirements of section 5.3 of this document and comply with the test requirements of AS4398.2.

Detailed information of the insulator must be provided, including, general arrangement drawing, electrical and mechanical characteristics, pollution performance, type of insulating material, method of construction, type tests, sample tests and routine tests.

5.4.6 **Support stands**

The disconnector and earthing switches must be mounted on a suitable steel stand. The stand must be designed to support the rated equipment and all its ancillary parts. As a minimum, the following loads must be considered when designing the support stand: live loads, dead loads, tension loads, maintenance and construction loads, wind loads, earthquake loads, operating and dynamic loads and fault current forces. The heights vary between 2.4m – 5.0m, however actual heights will be specified prior to purchase.

The manufacture/supplier must submit details of the mounting method. The support stands must be hot dip galvanised in accordance with AS/NZS 4680. The support stand must be designed and approved by a qualified structural engineer.

A typical support stand is shown in Drawing no. 365234.

5.4.7 **Nameplate of the disconnector and earthing switch**

The disconnector and earthing switch nameplate details must be stamped on stainless steel plates and attached to the operating handle and motor operated mechanism enclosure. The nameplate must be visible in the position of normal service and installation.

The nameplate for the disconnector and earthing switches must comply with the requirements of clause 5.10 of AS62271.102. The following information must be provided:
- name of manufacturer;
- designation of type;
- serial number;
• year of manufacture;
• rated voltage (U);
• rated lightning impulse withstand voltage (U);
• rated normal current (I) – only for disconnectors;
• rated short time withstand current (I);
• rated duration of short circuit (t);
• rated static mechanical terminal load (F);
• mechanical endurance class of disconnectors (M);
• electrical endurance class of earthing switch (E);
• mass; and
• company’s contract number.

5.4.8 Operation of disconnector and earthing switches

The disconnector and earthing switches must be capable of being operated by a manual operating handle, with an option for a motor operated mechanism enclosure. Operating handles must be provided for the manual operation of the disconnector and earthing switch. The manual closing and opening must be designed for horizontal operation of the disconnector and vertical operation of the earthing switch.

The force required for manual operation must not exceed 250N. Where a hand crank is used for more than one revolution, it must not be higher than 60N with a possible peak of 120N during a maximum of 10% of the total required revolutions.

The handle must be located for ease of operation by an average size person standing on the ground near the switch. A locking facility must be provided for padlocking the operating handle in both the open and close position. The handle of the earthing switch must be painted yellow.

The holes must be suitable for company's lock, which has an 8mm diameter shackle and 20mm opening.

A mechanical push button or similar device must be provided for closing and opening the motor operated disconnector and earthing switches.

Necessary provision must be made to prevent the operating motor from running continuously in the event of a failure in limit switches.

5.4.9 Motor operated mechanism enclosure

Optional motor operated mechanism enclosures must be provided for the operation of the disconnector or earthing switch, or both. The motor operated mechanism enclosure must consist of its operating and control mechanism, control circuits, switches and a cranking handle.

The motor operated mechanism enclosure must be manufactured of stainless steel of adequate strength and thickness. The enclosure must be supplied complete with a weatherproof hood and must be vermin proof. The degree of protection of the operating mechanism enclosure must be IP5XW.

The enclosure must be arranged to accept bottom entry cabling and must be provided with a 4mm thick aluminium or brass gland plate, suitably sized to accommodate all cabling whilst leaving at least 50% additional spare capacity.

The enclosure must be mounted so that the gland plate is no lower than 800mm above ground level and its top no higher than 2000mm (1800mm preferred) above ground level.

A vertically hinged door must be provided to allow access to all equipment in the enclosure. Each door must be full height and must not exceed 1000mm in width.

The door must open through 120° and must be provided with a device to secure the door in the open position. It must be secured by not more than two (2) hand-operated lockable handles suitable for Lockwood 234/45 (8mm shank) locks.
The enclosure must be provided with a low surface temperature thermostatically controlled anti-condensation heater and interior cubicle light.

All cubicles must be mounted so that there is clear unimpeded access to the cabinet and all equipment mounted in the cabinet.

The terminals of these devices must be segregated from all other terminals, shrouded against direct contact and provided with a red-white Traffolyte live connections warning label. Isolating switches must be provided in the enclosure to enable all control circuits in the cabinet to be isolated during maintenance. These switches must be Kraus and Naimer C26 or similar, as approved by the Substation Assets Manager.

The control cubicle must be fitted with a double general power outlet protected by a residual current device, and must comply with the requirements of AS 3000. All terminals must be shrouded and fitted with a warning label.

The mechanism enclosure must be provided with two (2) earthing studs on opposite sides of the enclosure for connection of 95mm² earthing conductor. All metallic components and enclosures that may be touched during normal operating conditions and are intended to be earthed must be connected to an earthing terminal.

5.4.10 Motor operation

Provision must be made for the company to order motor operation either at the initial installation or as a kit to convert the disconnector or earthing switches to motorised operation in the future.

The motor operating mechanism must be capable of manual operation. Electrical operation must be disabled during manual operation.

A 120V DC station battery, or 230V AC 50Hz supply, is available for closing, opening and operation of the spring charging motor. The actual voltage will be specified when an order is placed.

5.4.11 Auxiliary contacts and switches

All auxiliary contacts and switches supplied with the equipment must comply with the requirements of AS 62271.1, unless otherwise stated.

There must be 3 N/O and 3 N/C auxiliary contacts supplied for each disconnector and each earthing switch. These contacts must be suitable for making, carrying and breaking five (5) Amps at 120V DC and three (3) Amps at 230V AC in a typically inductive (magnetic coil) circuit. The auxiliary contacts must be solidly linked to the operating mechanism and must be suitable for mounting to the steel support pedestals.

Additionally, where a unit is fitted with motor operation, each motorised unit must be fitted with sufficient auxiliary switches to perform all the functions required for the switching operation. These switches must be of a proven type and must be rated to handle the currents and voltages required for the normal operation of the equipment.

The typical terminal rail connection diagram is shown in Drawing no. 364499.

All auxiliary contacts and switches must be enclosed in an enclosure with degree of protection of IP5XW.

The tenderer must include details of the manner of conversion to allow supervisory indication, and operational control.

5.5 Testing

5.5.1 General

The following clauses detail the testing requirements for the disconnectors and earthing switches. The tests must confirm the ability of the disconnectors and earthing switches to meet the technical requirements as laid down in clause 5.3.
The manufacturer must provide two (2) copies of certified test reports for type, routine and special tests.

At any time during the supply of the equipment, the Manager Asset Standards & Design may consider it necessary to confirm performance of the disconnectors and earthing switches by conducting any tests.

These tests will initially be carried out at the company’s expense, however, where it can be demonstrated that the equipment does not meet with the approved test results, the tests must be repeated in the presence of a company representative.

This and subsequent tests will be at the manufacturer’s expense.

Depending on the extent of these non-conformances, the company may remove or rectify equipment already in service. Refer to the contract commercial conditions for more details.

5.5.2 Accreditation and acceptability of testing authorities

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 the Substation Assets Manager.

However, routine tests carried out at the manufacturer’s testing facilities may be accepted provided the facilities are pre-qualified by the Manager Asset Standards & Design to perform the tests.

The pre-qualification requires an inspection of the manufacturer’s factory and the testing facility by a company representative as nominated by the Manager Asset Standards & Design.

The Manager Asset Standards & Design may accept test results of previously conducted type tests, provided the offered disconnector and earthing switch is exactly the same as the type tested disconnector and earthing switch, and type tested disconnector and earthing switch is in accordance with this specification.

Where the offered disconnector and earthing switch has not been successfully type tested, or the test results do not meet the technical requirements of this specification, fresh type tests must be conducted at the manufacturer’s expense.

Two (2) copies of type test reports must be submitted for the Manager Asset Standards & Design’s approval.

Test reports must not be more than five (5) years old from the closing date of the tender.

Test records (on identical equipment) in the form of validated copies of test certificates must be submitted for approval/information.

Copies of the test reports must be provided to the company. Reports written in any language other than English must not be accepted by the company unless such reports are translated into the English language by a sworn translator.

All type and routine test reports must be accompanied by copies of the accreditation certificate/s issued to the testing laboratory. The accreditation certificate/s must be valid for the relevant test/s and for the duration of the tests.

The company reserves the right to witness the type or routine tests, for which at least four (4) weeks’ notice must be given.
5.5.3 *Type tests*

The following type tests must be conducted on each type of disconnector and earthing switch offered according to the relevant standards:

**Table 3 – Type tests**

<table>
<thead>
<tr>
<th>No.</th>
<th>Type test</th>
<th>Acceptance criteria</th>
<th>Test method reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dielectric test (inclusive of short duration power frequency and lightning impulse withstand test)</td>
<td>No disruptive discharge. (refer to section 5.3 of this document)</td>
<td>Clause 6.2 of AS62271.1</td>
</tr>
<tr>
<td>2.</td>
<td>Radio interference voltage test</td>
<td>≤2500µV</td>
<td>Clause 6.9.1.1 of AS62271.1</td>
</tr>
<tr>
<td>3.</td>
<td>Measurement of resistance of main and control circuits</td>
<td>Main circuit resistance not &gt;20% from the value measured before the test.</td>
<td>Clause 6.4 of AS62271.1</td>
</tr>
<tr>
<td>4.</td>
<td>Temperature rise test</td>
<td>Temperature rise to be less than 65 Kelvin.</td>
<td>Clause 6.5 of AS62271.1</td>
</tr>
<tr>
<td>5.</td>
<td>Short time withstand current and peak withstand current tests</td>
<td>No mechanical damage. (refer to section 5.3 of this document)</td>
<td>Clause 6.6 of AS62271.1</td>
</tr>
<tr>
<td>6.</td>
<td>Verification of the IP coding for operating mechanism enclosure</td>
<td>• Correct and safe operation of the equipment</td>
<td>Clause 6.7.1 of AS62271.1</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> The company may consider alternative IP rating to that specified under section 5.3 based on proven experience to the company’s satisfaction</td>
<td>• No water on the insulation of the main and auxiliary circuits or any internal electrical components and mechanisms</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Water not retained in significant amounts by the structure or other non-insulating parts</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Tests to prove satisfactory operation and mechanical endurance</td>
<td>• Main circuit resistance not &gt;20% from the value measured before the test.</td>
<td>Clause 6.102 of AS62271.102</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Mechanical endurance: 2000 operating cycles.</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Tests to prove satisfactory operation at temperature limits</td>
<td>Complete three (3) operating cycles at minimum and maximum supply energy.</td>
<td>Clause 6.104 of AS62271.102</td>
</tr>
</tbody>
</table>
5.5.4 **Routine tests**

The following routine tests must be conducted on each disconnector and earthing switch supplied to the company according to the relevant standards:

**Table 4 – Routine tests**

<table>
<thead>
<tr>
<th>No.</th>
<th>Routine test</th>
<th>Acceptance criteria</th>
<th>Test method reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dielectric test on the main circuit</td>
<td>No disruptive discharge. (refer to section 5.3 of this document)</td>
<td>Clause 7.1 of AS62271.102</td>
</tr>
<tr>
<td>2.</td>
<td>Tests on auxiliary and control circuits</td>
<td>No disruptive discharge at 1kV for one (1) second.</td>
<td>Clause 7.2 of AS62271.1</td>
</tr>
<tr>
<td>3.</td>
<td>Measurement of the resistance of the main circuit</td>
<td>Main circuit resistance not &gt;20% from the value measured before the test.</td>
<td>Clause 7.3 of AS62271.1</td>
</tr>
<tr>
<td>4.</td>
<td>Design and visual checks</td>
<td>Verification to specification.</td>
<td>Clause 7.5 of AS62271.1</td>
</tr>
<tr>
<td>5.</td>
<td>Mechanical operating tests</td>
<td>No damage to parts.</td>
<td>Clause 7.101 of AS62271.102</td>
</tr>
</tbody>
</table>

5.6 **Documentation**

As part of the integrated system support requirements, the manufacturer/supplier must submit the following documentation prior to the delivery of the equipment to the company:

- Three (3) hard copies and one (1) electronic copy of the complete erection, operation and maintenance manual must be provided for each disconnector type according to its voltage rating, covered in a single contract. Each manual must relate specifically to the equipment supplied and must not contain any material that is not applicable. The manuals must be A4 size and all drawings must be suitably folded or reduced for filing within the manual. Each manual must include:
  - a hard cover to withstand normal handling;
  - a comprehensive index;
  - installation instructions;
  - operating instructions;
  - instructions for the routine maintenance of the equipment and associated auxiliary equipment;
  - copy of all detailed drawings;
  - pamphlets, drawings of auxiliary equipment;
  - a complete list of parts with serial numbers;
  - recommended maintenance schedules;
  - type test reports; and
  - routine test reports.
5.7 **Additional information**

The following information must also be submitted:

- A list of recommended spares and tools, with the prices and availability of each item.
- Details of technical back-up facilities available.
- Details of equipment operating history, including how many in service, where and for what period, plus reference contact names and numbers.

5.8 **Packing**

The supplier must suitably pack each disconnector and earthing switch in a wooden crate complete with all accessories such as bolts, nuts, operating shafts, links and operating enclosure. All measures must be taken to prevent damage during packing, transporting and dismantling.

The following must be written in BLACK lettering (75mm high) on each wooden crate:

- voltage rating of disconnector or earthing switch;
- current rating (for disconnector only);
- fault rating;
- company’s name;
- contract number;
- supplier’s name; and
- mass.

5.9 **Drawings**

The following drawings form part of this specification:

<table>
<thead>
<tr>
<th>No.</th>
<th>Drawing no.</th>
<th>Amnd no.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>364499</td>
<td>A</td>
<td>33/66/132kV outdoor disconnector/earth switch Endeavour Energy interface terminal rail connection diagram</td>
</tr>
<tr>
<td>2.</td>
<td>365234</td>
<td>A</td>
<td>Outdoor substation – Typical disconnector and earth switch steelwork stand arrangement</td>
</tr>
</tbody>
</table>

5.10 **Product approval**

5.10.1 **Product approval process**

The equipment must be evaluated under the product approval process set out in PAE 1004. Approval will only be given after a successful installation of the disconnector and earthing switch in the network.

5.10.2 **Product approval and audit forms**

Complete information of the equipment must be provided on Branch Form FAE 3131.

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 the company’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 the company’s representatives.

Substation Assets Manager has 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.

Commercial Manager has the authority and responsibility for:
• certifying that the equipment purchased through the tender process complies with the requirements of this specification.

Manufacturers/suppliers have the authority and responsibility for:
• establishing awareness of their responsibilities under this specification;
• determining the contractor/s under their control have provided suitable training for their employees;
• implementing an effective safety, environmental and quality auditing system is in place; and
• Implementing this specification and keeping the company 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: Substation Assets Manager
Documentation process coordinator: Standards & Process Administrator