

Transformer Instruction Manual

GMX Ground Mounted Transformers



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Schneider
Electric[™]

Scope of This Document

This document describes the user configuration and application of GMX Ground Mounted Transformers.

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Disclaimer

The advisory procedures and information contained within this document have been compiled as a guide to the safe and effective operation of products supplied by Schneider Electric (Australia) Pty Ltd.

It has been prepared in conjunction with references from sub-assembly suppliers and the collective experience of the manufacturer.

In-service conditions for use of the products may vary between customers and end-users. Consequently, this document is offered as a guide only. It should be used in conjunction with the customer's own safety procedures, maintenance program, engineering judgment and training qualifications.

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Revision

1.1

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1.0 Safety Information

The following information is for the safe installation and operation of this equipment. Be sure to read and understand all cautions and warnings.

1.1 Hazard Statement Definitions

WARNING

Refers to hazards or unsafe practices, which may result in fatal or severe personal injury, and equipment damage.

CAUTION

Refers to hazards or unsafe practices, which may result in equipment damage or personal injury.

1.2 Safety Instructions

The following general warning and caution statements apply to this equipment:

WARNING

This equipment is not intended to protect human life. Follow all locally approved safety practices and procedures when installing or operating this equipment.

WARNING

Hazardous voltage. Follow all locally approved safety procedures when working around high voltage lines and equipment.

WARNING

A transformer must never be opened or serviced while it is energised, not earthed or connected to the system.

2.0 Introduction

This manual has been designed to assist in the installation, commissioning and maintenance of Schneider Electric Ground Mounted Three-Phase Distribution Transformers.

It is important that personnel using this manual is fully trained in high voltage and low voltage safe operating procedures. These instructions are not a substitute for proper training in the safe operation of the equipment described.

The manual details a number of accessories and fittings, which may not be fitted to the unit being installed. Please refer to the equipment nameplate and the scope of supply to determine applicability for optional items. If in doubt refer to your local Schneider Electric Office or Service Representative.

3.0 Initial Inspection

On delivery of the equipment a thorough inspection should be made to be certain it corresponds with your order. Check the characteristics indicated on the rating plate, i.e. capacity, voltage and tapings.

Transformers are delivered ready for installation, with accessories fitted or sent separately.

Prior to unloading, check the transformer has not been damaged during transport, i.e. tank damage or broken bushings. Also ensure that accessories ordered have been delivered.

If the transformer is damaged or if the accessories ordered are found to be missing, please contact your nearest Schneider Electric Representative.

4.0 Storage of Transformers

Transformers are intended for outdoor use and do not need to be protected from the elements. They should be stored on an adequate concrete base or similar stable flat surface.

5.0 PCBs in Transformer Oil

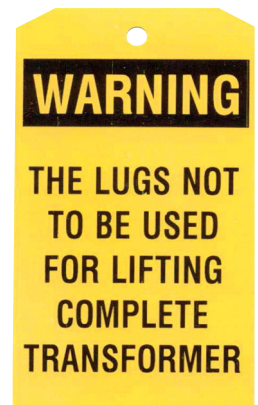
Schneider Electric uses only new transformer oil, purchased from suppliers who guarantee their oil to be free from PCB contamination. Schneider Electric does not handle any PCB contaminated transformers, so the chance of accidental cross contamination of new transformers is nil.

6.0 Lifting of Transformers

 WARNING
Improper use of lifting equipment can be fatal, or cause severe personal injury and transformer damage.

 WARNING
The following warning tag is fitted to lugs that must not be used for lifting of the complete transformer.

All lifting equipment should be checked prior to use and be used in accordance with the appropriate local legislation and regulations by appropriately qualified operators. The total mass of the unit is recorded on the unit nameplate.



7.0 Installation

7.1 Location

The transformer should be located on a concrete pad of sufficient strength to support the weight of the unit. The pad must be level. The location should provide adequate accessibility, ventilation and ease of inspection.

To position the transformer, a crane of sufficient capacity and reach must be used. Once in position, the HV and LV Bushings can be connected.

7.2 HV and LV Cable Supports

Cables must be mechanically supported to ensure their weight does not bear on the bushings. Cables should be aligned parallel to lug surfaces. Bolt-holes should be aligned and clamped into position before bolting on to the transformer or switchgear. Schneider Electric recommends that flexible connectors be used between the bushing palm and cable lugs when using heavy low voltage cables.

7.3 HV and LV Connections



WARNING

Earth all circuits before making any transformer connections.

Failure to observe precautions may result in exposure to high voltages.

Extreme care must be taken while connecting cables to bushings, to ensure that no undue pressure is exerted to the cables during the tightening of bolts. Consideration must be given to the expansion and contraction of cables.

Bushings must not be used to lever cables into place, as this can cause the bushings to leak or break.

Take care when backfilling cable trenches, to ensure that the fill or subsequent settling does not create stress on the bushing.



WARNING

Improper Earth connections may result in personal injury or damage to the equipment.

An effective and secure Earth connection is essential for protection. The transformer must be permanently Earthed by connecting an Earth cable/buss to the Earth lug, located on the transformer tank.

The following CAUTION label is attached to the inside of cable box :

CAUTION

MECHANICAL STRESS ON BUSHINGS CAN CAUSE OIL LEAKS. THEREFORE:

DO NOT USE BUSHINGS TO SUPPORT CABLE. THE WEIGHT OF THE CABLES MUST BE SUPPORTED FULLY BY CABLE GLANDS OR OTHER APPROVED METHOD.

DO NOT LEVER CABLE TERMINATIONS INTO POSITION. ALIGN CABLE TERMINATIONS WITH BUSHINGS BEFORE FITTING.

7.4 Specialised Labor

Connection of the transformer should only be done by qualified Cable Jointers and Electrical Fitters. The rating plate fixed to the transformer, details the transformer vector group, voltage ratio, kVA rating, tapping range, phase orientation, etc.

7.5 Off-Circuit Tap Changer



WARNING

Operation of the tap changer while energised, will cause flashovers inside the transformer tank, resulting in equipment damage and personal injury.

The tap changer must only be operated while the transformer is de-energised. Set the tap changer and insert location pin to lock in desired position, prior to energisation. Once pre-commissioning is complete, check output voltage, de-energises and Earth transformer, and adjust if required.

7.6 Dual Voltage Tap Changers



WARNING

Ensure dual voltage tapping switch is set on the correct voltage, as indicated on the name plate before energising. Failure to do so may result in equipment damage.

Schneider Electric Dual Voltage Transformers are factory set on the higher of the two voltages (unless instructed otherwise). Check your system requirement and adjust if necessary.

8.0 Pre-Commissioning Checklist

CAUTION

Where fitted, the following fittings must be attended to and in accordance with the warning tag attached. This must be done prior to putting the transformer into service.

Note: always reseal breather openings before relocating or moving the transformer. Failure to do so may result in oil spillage and environmental contamination.

8.1 Free Breathing with Breather Fitted to Oil

The cap sealing the filler/breather, must be removed after installation. This cap prevents spilling of oil in transport. The breather cap must then be replaced.

See attached warning tag:



8.2 Free Breathing with Breather Fitted to Breather Pipe

The cap sealing the breather inlet pipe, must be removed after installation. Care should be taken as oil spilling into the pipe during transport, will drain out when the cap is removed.

See attached warning tag:



8.3 Explosion Vent (Diaphragm Type)

The transport packer sealing the explosion vent, **must** be removed after installation.

This packer prevents rupture of the diaphragm during transport.

For explosion vents with an exterior metal plate over the packer, the following warning tag is fitted:

For other explosion vents, the outer flange **must** be removed, so the transport packer can then be removed. These explosion vents have the following tag fitted:



8.4 Sealed Transformers



A sealed transformer does not need any filler/breather cap to be replaced. The caps fitted on the transformer **should not be removed**.

See attached warning tag or sticker:



8.5 Hermetically Sealed Transformers



Hermetically sealed transformers are integrally filled with oil and free of air inside.

The caps fitted on the transformer **should not be removed**.

See attached warning sticker:



9.0 Recommended Pre-Commissioning Tests and Checks



9.1 Insulation Resistance Test

WARNING

The circuit undergoing test must be switched off, de-energised and isolated before insulation test connections are made.

Circuit connections must not be touched during an insulation test.

Turning the instrument off and manually discharging circuits on completion of tests, is recommended as standard procedure, before touching any connections.

Test leads (including crocodile clips) must be in good order, clean and with no broken or cracked insulation.

Measure insulation resistance between HV to Earth, LV to Earth and HV to LV, using a 2.5kV insulation tester.

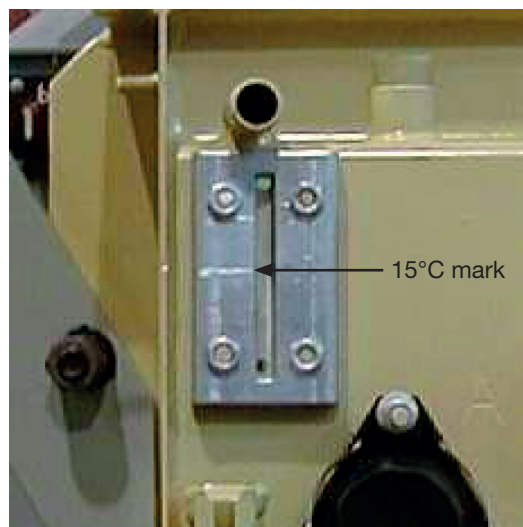
Before the testing, ensure that all bushings have been wiped clean and dry, and all connections to lines, busbars and lighting arresters have been disconnected.

Transformers are fully tested during manufacture; it is only necessary to “megger” the windings before connection, to ensure that no damage has occurred during transport or storage. The insulation resistance value should be at least 750MΩ.

9.2 Inspection Checklist

- All external connections have been properly made.
- All connections are tight and secure.
- All accessory contact circuits are operational and contact settings are correct.
- Tap changer is properly positioned.
- There are no windings Earthed that are not intended to be Earthed.
- The Earth and Neutral connections have been properly made.
- There are no tools left on top of or inside any enclosure.
- All protective covers are closed and bolted.
- Air should be bled from Buchholtz Integrated Safety Detector relays, before energising.
- The oil level is correct.

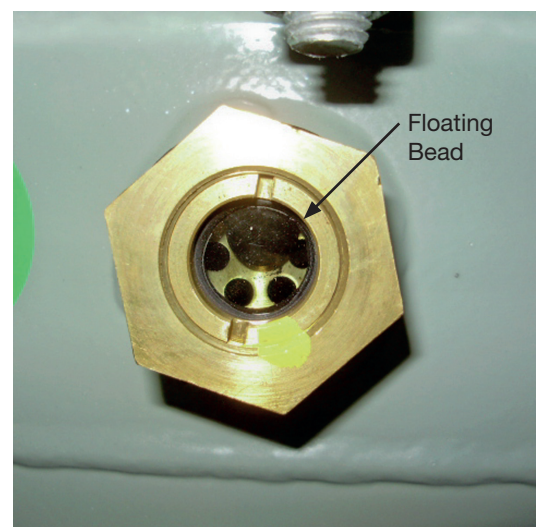
Free Breathing, or Sealed with Air Cushion



Oil Level Indicator

Oil level must be above 15°C mark.

Hermetically Sealed



Oil Presence Indicator

The floating bead must be at the top of the viewing window.

9.3 Inspection after Energisation

WARNING

**Secondary output may have dangerous voltage.
Check nameplate for correct rated voltage.**

After the transformer is energised, check for the following:

- Measure secondary no-load voltage. If adjustment is required, de-energise then Earth transformer before adjusting. Hint: (select a higher tap to lower the voltage or select a lower tap to increase the voltage. Example: 443 volts was measured on tap 3. 433V is the desired no-load voltage, so this is $443/433 \times 100 - 100 = 2.3\%$ too high, therefore move the tap changer to tap 2 [assuming tapping steps are 2.5%])
- Check for leaks around bushings and welded seams.
- Confirm there is no partial discharge around high voltage or low voltage terminations.
- After the transformer has been first energised, it should be kept under observation for the first few hours; an oil test should be taken after the first week of service.

See section 10.5 on Oil Sampling Procedure.

9.4 Loading

CAUTION

Prolonged overloading will cause premature aging and/or equipment failure.

To calculate allowable overloads under normal cyclic, long-time emergency cyclic, or short time emergency loading, refer to AS2374.7 “Loading Guide for Oil-Immersed Power Transformers”.

9.5 Torque Check on Bolted Connections and Fixings

Thermal cycling and mechanical forces due to load, wind or local vibration and shock can result in relaxation of gaskets and small oil leaks. Fixings and fasteners should therefore be periodically checked.

Item	Torque Setting
General M6 Steel Stud / Bolt HV Cable Box Cover	2Nm
General M8 Steel Stud / Bolt	16Nm
General M10 Steel Stud / Bolt	34Nm
General M12 Steel Stud / Bolt	54Nm
M16 Steel Stud / Bolt – Radiator Fixing	40Nm
M8 Bolt fixings on to LV Termination Bar	16Nm
M12 HV Terminal Stem	33Nm
M16 HV Terminal Stem	38Nm
M12 LV Monoblock Fixing (special order of fixing required)	24Nm (special order of fixing required)
Tank Lid Fixing M12	22Nm
Framed Liquid Gauge Fixing M8	5Nm
Prismatic Liquid Gauge Fixing M10	2Nm

Note

Some of the above items are on live metal or are not accessible from outside the transformer tank.

10.0 Maintenance

Generally, the following supervision schedule may be used as a guide to maintenance. However, provided an occasional check is made that: - (1) **there are no oil leaks** and (2) **the oil gauge is reading the correct level**, the transformer is relatively maintenance free.

10.1 Supervision Schedule for Hermetically Sealed Transformers

	Monthly	Annually	Ten years	When Required
Oil			Sample and test after one year, then every ten years.	Oil filtering.
Oil Level Indicator		Visual inspection.		Cleaning and examination.
Gas and Oil Operated Relay (Integrated Safety Detector)		Visual inspection and reading. Operating test.		Cleaning and examination.
Temperature Indicator (Integrated Safety Detector)	Visual inspection and reading.			Cleaning and examination.
Pressure Gauge	Visual inspection and reading.			Cleaning and examination.
Explosion Vent		Visual inspection. Operating test.		Cleaning and examination.
Winding Temperature Indicator	Visual inspection. Operating test.			Cleaning and examination.
Fans with Motors		Visual inspection. Operating test and lubrication.		Cleaning and examination.
Paint Work		Visual inspection.		Clean. Touch-up or repaint as necessary.
Bushings		Visual inspection.		Cleaning and examination.

10.2 Supervision Schedule for Free Breathing and Sealed with Air Cushion Transformers

Note: If relocating or moving free breathing transformers, always reseal breather openings. Failure to do so may result in oil spillage and environmental contamination.

Point Name	Monthly	Annually	Ten Years	When Required
Oil		Oil sample and test.		Oil filtering.
Oil Level Indicator			Visual inspection and reading.	Cleaning and examination.
Gas and Oil Operated Relay			Visual inspection and reading. Operating test.	Cleaning and examination.
Temperature Indicator	Visual inspection and reading.		Operating test.	Cleaning and examination.
Explosion Vent			Visual inspection. Operating test.	Cleaning and examination.
Dehydrating Breather	Visual inspection.			Recharging.
Winding Temperature Indicator		Visual inspection. Operating test.		Cleaning and examination.
Fans with Motors			Visual inspection. Operating test and lubrication.	Cleaning and examination.
Paint Work		Visual inspection.		Clean. Touch up or repaint as necessary.
Bushings		Visual inspection.		Cleaning and examination.

10.3 Recommended Spare Parts List

Transformers are static equipment and no spare parts are recommended. Please consult your local Schneider Electric Office or Service Representative, for replacements for all ancillary items such as gauges, breathers etc.

10.4 Trouble Shooting

10.4.1 Windings

Event	Possible Cause
Overheating	Continuous overload, poor ventilation, incorrect external connections or high harmonic current in load.
Zero or Low Voltage	Wrong tap changer setting, faulty tap changer, loose internal connections or shorted turns.
Excess Secondary Voltage	Wrong tap changer setting, input voltage high, faulty tap changer.
Insulation Failure	Continuous overloads, lightning surge, mechanical damage.
Breakers or Fuses Opening	High inrush current, short-circuit, overload, incorrect fuses or breaker setting.
Excessive Heating on Bushings	Loose bolted connections.

10.4.2 Core

Event	Possible Cause
Noise and Vibration	High input voltage, excessive harmonics in load, Active part loosened in shipment or handling.
Overheating	High input voltage
High Excitation Current	Shorted turns, high input voltage, low frequency.
High Core Loss	High input voltage or low frequency.
Insulation Failure	Excessively high core temperature due to high input voltage or low frequency.

10.4.3 Insulation

Event	Possible Cause
Overheating	Inadequate ventilation.
Pressure Relief Device Operation	Insulation failure.
Breakers or Fuses Open	Insulation failure.
Bushing Flashover	Abnormal voltage surge.
Insulation Resistance below 750MΩ	External circuits not disconnected during test, bushings damaged/dirty/damp, insulation damp, insulation damaged or insulation failure.

10.4.4 Other

Event	Possible Cause
Cracked Bushings	Stressed due to cables or mechanical handling.
Loss of Pressure	Leaking gaskets, cracked bushings or welds.

10.5 Oil Sampling Procedure

All new transformers are filled with oil accordance with AS1767.

Oil is supplied and handled in equipment used solely for transformer oil. If a sample is required, it can be taken from the valve at the bottom of the tank. A dielectric strength test in accordance with AS1767 may be performed. If samples are required for Dissolved Gas Analysis or other more specialised tests, special sample containers and procedures have to be followed, which are not given in this manual, Contact Schneider Electric Service Representatives for advice.

The procedure for taking a sample should be as follows: -

1. The utmost care should be taken to avoid contamination of the samples with external impurities such as dust and moisture. Sampling should not be undertaken in rainy weather.
2. The hands of the sampler should not come in contact with the sample.
3. Only cleaned glass sample containers should be used.
4. Lint-free material only (i.e. not cotton waste and other fibrous material) should be used to wipe containers drain valves or collection hoses.
5. The sample container should not be opened until immediately before filling with sample.
6. Take sample from drain valve. Let a small amount (~ 100ml) to run to waste before the next step.
7. Rinse the container several times with the oil to be tested before collecting the sample. Care should be taken to avoid aerating the sample while filling the sample container. Securely close the sample container immediately after completion.

11.0 Transformer Accessories*

11.1 Integrated Safety Detector

The Integrated Safety Detector combines the functions performed by a number of transformer accessories in a single, compact and reliable instrument. It is composed of a robust plastic body, watertight and resistant to extreme climates.

This device detects four functions:

1. pressure
2. temperature
3. oil level
4. gassing.

General Features:

- degree of protection (EN60529): IP66
- degree of shock tightness (EN50102): IK07
- temperature resistance: -40°C ÷ 120°C
- max. rated pressure: 500mbar.



**Models of items shown are indicative only.*

11.2 Buchholtz Relay

(found only on transformers with conservators)

The Buchholz relay has two oil-filled chambers with floats and relays arranged vertically one over the other. If faults occur within the tank, bubbles of resultant gas rise to the top of the tank. These rise through the pipe between the tank and the conservator. As gas bubbles migrate along the pipe, they enter the Buchholz Relay and rise into the top chamber. As gas builds up inside the chamber, it displaces the oil, decreasing the level. The top float descends with oil level until it passes a magnetic switch that activates an alarm.

The bottom float and relay cannot be activated by additional gas build-up. The float is located slightly below the top of the pipe so that once the top chamber is filled, additional gas goes into the pipe and on up to the conservator. Typically, inspection windows are provided so that the amount of gas and relay operation may be viewed during testing. If the oil level falls low enough (conservator empty), switch contacts in the bottom chamber are activated by the bottom float. These contacts are typically connected to cause the transformer to trip. This relay also serves a third function, similar to the sudden pressure relay. A magnetically-held paddle attached to the bottom float, is positioned in the oil-flow stream between the conservator and transformer tank. Normal flows resulting from temperature changes are small and bypass below the paddle. If a fault occurs in the transformer, a pressure wave (surge) is created in the oil. This surge travels through the pipe and displaces the paddle. The paddle activates the same magnetic switch as the bottom float mentioned above, tripping the transformer.

11.3 Oil Temperature Gauge

The temperature gauge indicates the top oil temperature in degrees celcius. The temperature gauge is mounted in a leak-proof well to allow removal of the thermometer, without lowering the oil level of the transformer. The gauge has an additional red pointer that indicates the maximum temperature reached since last reset.

Type 1 - this thermometer has no electrical contacts.

Type 2 - this thermometer is supplied with electrical contacts for high temperature alarm and trip functions, or energising a fan circuit.

Type 2 thermometer oil temperature settings are 95°C for alarm and 110°C for trip functions.



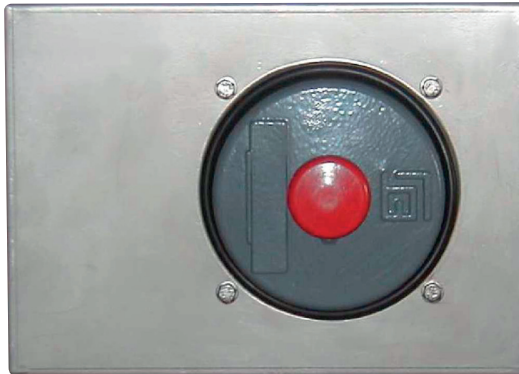
Type 1.



Type 2.

11.4 Pressure Relief Device

These devices consist of a spring-loaded diaphragm and a mechanical indicator. If the pressure inside the tank increases above that which the device is set, the pressure lifts the diaphragm and relieves the pressure quickly. After the pressure returns to normal, the device will reset and reseal the transformer. The mechanical indicator will protrude and must be reset manually. For units supplied with electrical contacts refer to wiring schematic supplied with transformer.



11.5 Winding Temperature Indicator

A temperature-sensitive device with a temperature probe mounted in a leak proof well, allowing removal of the probe without lowering the oil level. The well is heated by the transformer oil and a heater element, which is energised by a current transformer normally mounted on the transformer bushing, to simulate the hot spot winding temperature gradient. The combination of these temperatures is indicated on the gauge. The heating element is connected to the current transformer (CT) via a Matching Resistance or a Matching Unit, (pre-set at factory prior to dispatch) to allow setting the correct winding temperature gradient. The gauge has up to five electrical contacts for alarm and trip functions and fan control circuits.

Alarm and trip functions are factory set at:

Alarm: 120°C

Trip: 135°C



Winding temperature indicator

12.0 Warranty

Transformers supplied are all covered by the following warranty, unless alternative arrangements have been made at the time of order:

The following definitions apply to the below warranty statement.

- (a) "The Company" means Schneider Electric (Australia) Pty Limited ACN 004 969 304.
- (b) "The Purchaser" means the company, firm or persons to whom the Company's offer or invoice is addressed and includes successors in title and permitted assigns.
- (c) "Offer" means tender or quotation.
- (d) "Goods" means any product delivered pursuant to this agreement including software.
- (e) "Force Majeure" means events beyond the reasonable control of the Company and, without limitations includes strikes, lock-outs, slow downs, fire, riot, tempest, war, embargo, governmental act, regulation or request, accident, delay in transportation or inability to obtain necessary labour, materials or manufacturing facilities or default by any manufacturer, supplier, subcontractor to the Company preventing or hindering the Company in due performance and observance of its duties and obligations under this contract for sale of any equipment.

The Company will make good or repair or, at its option replace defects which, under proper use and in accordance with any instructions issued by it, appear in the equipment of its manufacturing within a period of 12 months after first placing it into service or 18 months after dispatch from the Company's control, or if dispatch is delayed through Force Majeure within the period of 18 months after the equipment is notified as ready for dispatch (whichever period expires the earlier) and which arise solely from faulty design, materials or workmanship **PROVIDED THAT:**

- A.** the Company is notified within 7 days of the alleged defect first coming to the Purchaser's notice and within the warranty period
- B.** the defective part(s) is returned promptly to the Company's works at the Purchaser's cost if the Company so requires and the Company shall return the repaired or replacement part(s) at the Company's cost to the original Contract delivery point unless otherwise arranged
- C.** any unauthorised repairs or alterations to the equipment shall invalidate this warranty.

12.1 Exclusions

The Company shall not be liable under any circumstances whatsoever for:

- (a) any injury, damage or loss, including consequential damage or loss (including without limitation loss of market, loss of profit or loss of contracts) whether to persons or property arising out of this sale or the Goods supplied pursuant to it including any defects therein or anything connected therewith or with repair or replacement or any other work related thereto and without limitation, the Company shall not be liable for any loss of profit or other special damage or consequential damages arising out of any latent or other defect in the Goods; or
- (b) any reduction in the Price for any shortages in any delivery, unless the shortage is noted by the Purchaser on the Company's delivery note for that delivery; or
- (c) any loss of or damage to the Goods whilst in transit. If liability may not be excluded by this sale and where the Goods to be provided by the Company are not of a kind ordinarily acquired for personal domestic or household use or consumption then the liability of the Company for a breach of a condition or warranty implied by the Trade Practices Act (other than a condition or warranty implied by Section 69) shall be limited to the repair of the Goods or at the Company's option, the replacement of the Goods or the supply of equivalent Goods. In no event will the Company be liable to the Purchaser or any third party, in contract or tort, for more than the Price.

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Australian Capital Territory

Canberra • 8 Brindabella Circuit, Majura, ACT, 2609

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Melbourne • 87 Ricketts Road, Mt Waverley, VIC 3149

Regional representatives located in: Geelong, Ballarat and Albury/Wodonga

Tasmania

Hobart • 309 Liverpool Street, Hobart, TAS 7000

Regional representatives located in: Launceston

South Australia

Adelaide • 33-37 Port Wakefield Road, Gepps Cross, SA 5094

Western Australia

Perth • 14 Kearns Crescent, Ardross, WA 6153 (Industrial Automation and Control)

• Unit 3, 26 Gibberd Road, Balcatta, WA 6021 (Electrical Distribution)

Northern Territory

Darwin • 16 Albatross Street, Winnellie, NT 0820

> Manufacturing sites

Benalla Medium voltage switchgear and transformer manufacturing and development

- Sydney Road, Benalla VIC 3672

Brisbane Medium voltage overhead distribution switchgear manufacturing and development

- 80 Schneider Road, Eagle Farm, QLD 4009

Adelaide Wiring accessories and low voltage switchgear manufacturing

- 33-37 Port Wakefield Road, Gepps Cross, SA 5094

Notes

Make the most of your energySM

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