



# **General Electrical Specification**

## **For Conveyor Installations.**

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## **1.0 Scope of Specification**

This specification is intended for use in circumstances where Translink Australia Pty Ltd is engaged to perform work on any site and details the minimum general requirements for the supply, design, manufacture, and installation of equipment.

## **2.0 Compliance with Electrical Authorities**

All work and equipment shall comply with the Australian Standard AS3000 *Electrical Installation* - known as the *SAA Wiring Rules*.

## **3.0 Design Criteria**

### **3.1 General**

Australian made products will be used as preferred electrical equipment wherever possible and economical.

### **3.2 Preferred Equipment**

Translink Australia Pty Ltd shall use the electrical equipment listed in Appendix A, or use the relevant preferred supply listing by the company.

### **3.3 Safety Requirements**

All equipment provided shall be protected in accordance with the requirements outlined in the current Australian Standard *AS4024 Safeguarding of Machinery and AS1755 Conveyors*. The nature of the safety device or devices used shall be appropriate to the hazard, and should be selected to provide long term operation and reliability. All gates, guards, and hinged covers on a machine, which are readily removed or opened, shall be electrically interlocked with a safety device which cannot be easily defeated. These switches shall prevent the machine from operating electrically whilst the gate, guard, or hinged cover is not securely closed.

## **3.4 Control System**

### *3.4.1 Supply Voltage*

The design supply voltage shall be 415 Volts 50 Hertz, 4 wire system, 3 phase and neutral. The machine shall be designed to operate within the nominal voltage specification  $\pm 10\%$ .

### *3.4.2 Control Voltage*

Unless specified otherwise, the control voltage for motor control circuits, general control circuits, Programmable Logic Controller inputs / outputs, and all circuits interlocking separate control panels shall be 24 VDC.

### *3.4.3 Circuit Protection*

Where practicable, for control circuits, circuit breakers shall be used in preference to fuses, and these circuit breakers must comply with the provisions of the current version of AS3000. All circuit breakers shall have a minimum 6 kA fault rating, and Translink Australia Pty. Ltd. shall ensure appropriate discrimination in the installation.

### *3.4.4 Motor Contactors and Protection*

All motors shall be protected by a resettable thermal or electronic overload device. Motor protection and safety devices should not be capable of being bypassed when the motor is operated manually.

### *3.4.5 Operating Conditions*

The electrical installation shall be designed to operate reliably in an ambient temperature range from 5 °C to 40 °C. Control circuits, apparatus and its application to the equipment will be of sound design for industrial usage with long operational life and reliability. In areas of safety to personnel or equipment, electrical circuits and equipment shall be designed to operate in a failsafe manner.

### 3.5 Pushbuttons

Pushbutton operators shall be of following type and colour (illuminated pushbuttons may be used) -

<i>Function</i>	<i>Colour and Type</i>
Emergency Stop	Red mushroom head maintained position
All other Stop Functions	Red flush head
Jog, Inch	Yellow flush head
All Start Functions	Green flush head
Reset	Blue flush head

### 3.6 Annunciation

Annunciating pilot lights shall be 24 VDC and shall be of the following colour, unless specified otherwise -

<i>Function</i>	<i>Colour and Type</i>
Motor Running	Green
Motor Fault	Red
All other "On" indicators	S.O.A.

### 3.7 Solenoids

Solenoids and solenoid valve coils shall be rated at 24 VDC unless otherwise specified.

### 3.8 Power Supplies

The power supply(s) for electronic equipment and 24 VDC control circuits shall be liberally rated to accommodate twenty five (25) percent possible future additions, and to operate in the specified temperature and voltage variations. If DC power supplies are used, they shall provide 24 VDC from switch mode DC power supplies utilising an overload and short circuit protection, and shall have the negative side grounded at the power supply. The grounded side shall not be fused.

### **3.9 Programmable Logic Controllers**

#### *3.9.1 Selection*

The selection of the Programmable Logic Controller, together with the input / output devices will be selected by Translink Australia Pty Ltd. Provision shall be made for an additional spare ten (10) percent digital inputs and outputs, and a minimum of twenty-five (25) percent spare rack space and memory capacity.

#### *3.9.2 Safety Equipment Interlocks*

Safety equipment interlocks shall operate entirely independent of the Programmable Logic Controller circuits, but indication of the operation of any safety device shall be an input to the Programmable Logic Controller as part of its sequence control.

#### *3.9.3 Power Supply*

If requested Programmable Logic Controller and other electronic devices shall be supplied from a device incorporating transient protection, such as a power line filter or power conditioner. The supply voltage to these devices shall be single phase 240 VAC.

#### *3.9.4 Connections*

All terminals on Programmable Logic Controller inputs and outputs shall contain a maximum of two wires. Any links between terminals must be made on an external terminal strip.

#### *3.9.5 Inputs and Outputs*

Any DC device, which drives a Programmable Logic Controller input such as sensors, programmable limit switches, and the like, shall have PNP type outputs.

### **3.10 PLC Programming Format**

The structuring of PLC programs is an important aspect of programming. A structured program allows the software to be easily read and understood by others and to be maintained and modified.

Obviously, there are many ways in which programs can be structured and no single method is correct. Our method of structuring PLC programs can be discussed further on request to assist engineering and maintenance personnel to follow general system guidelines. This method can also be adapted to any other manufactured PLC with different programming capabilities. All PLC programs shall be adequately documented.

### **3.11 Variable Speed Drives**

#### *3.11.1 Operation and Control*

All variable speed drives shall be designed to operate with a control signal of 4 - 20 mA current loop. Selection and installation of variable speed drives shall be in accordance with standards and codes relating to electromagnetic compatibility requirements.

#### *3.11.2 Size Selection*

The variable speed drive shall be of a sufficient rating to adequately satisfy the nature of the load. In all instances, the installation shall be within the manufacturer's recommendations, including providing adequate ventilation in cases where the unit is mounted inside an enclosure. Where more than one motor is to connect to a single drive, the design shall ensure that all of the motors are of similar ratings and characteristics, and that the drive is of sufficient size to cope with the connected motors running at full load current.

### **3.12 Power Supply Connection**

#### *3.12.1 Disconnection Means*

A load break switch shall be provided as the main disconnecting means. This main disconnecting means shall disconnect all ungrounded conductors of the supply circuit simultaneously. The interrupting fault capacity of the switch shall be a minimum of 10 kA at 415 Volts. The load break switch shall be padlockable in the off position where possible.

#### *3.12.2 Terminations*

The incoming supply conductors shall terminate at the main disconnecting means with no connection to terminal blocks or other devices ahead of the disconnecting means.

#### *3.12.3 Isolation*

The main disconnecting means will have provision for padlocking in the off position.

#### *3.12.4 Source of Supply*

The source of supply for control circuits shall be taken from the load side of the main disconnecting means, except in circumstances where statutory regulations pertaining to part(s) of the installation expressly state otherwise.



### 3.12.5 *Neutral and Earth*

Appropriately sized and numbered Neutral and Earth bars shall be supplied.

### 3.12.6 *Enclosure Single Phase Outlet*

A single phase 240 VAC power point shall be provided in the main control cabinet and mounted near the Programmable Controller protected by a ELCB.

## **3.13 Motor Isolation**

### 3.13.1 *Requirement*

Motor isolation shall comply with the provisions of AS3000, and each motor will have a separate isolator mounted adjacent to it.

### 3.13.2 *Construction*

For all motors, the isolator shall be a three pole device with a rating sufficient to handle the motor current. The switch will have provision for a padlock or similar locking device in the off position. The switch shall be PVC type or similar and have a rating of not less than IP55.

## **3.14 Meters**

In instances where an ammeter is required, the current transformer used shall have a 5 Amp secondary. The minimum size for the meter shall be 48 mm x 48 mm. For ammeters used in main distribution board applications, the meter shall also have a maximum demand indication.

## **3.15 Labelling**

All control and power devices shall be plainly marked and permanently identified.

All equipment mounted on the front of electrical enclosures shall be labelled or numbered with engraved white traffolyte, black lettering. Warning or cautionary labels are to be white lettering on red background.

## **3.16 Ingress Protection**

All electrical equipment used in any situation where it may be exposed to water, dust, cleaning fluids, grease, or weather shall have a minimum rating of IP56.

## **4.0 Enclosures**

### **4.1 Construction**

All enclosures for electrical parts (main control cabinet, main junction box, push-button stations, etc.) shall be totally enclosed, dust proof, manufacture (IP55). The main control cabinet shall be constructed of 1.5 mm minimum thickness, folded sheet steel. The cabinets are typically of the modular design or stand-alone and are finished in RAL 7035 polyester powder structure paint.

All holes that are cut in the main control panel shall be used or plugged in such a manner as to maintain the IP rating of the panel. Where floor mounted enclosures are installed the enclosures shall be mounted on a plinth of a minimum height of 100 mm. The overall height of the enclosure and the plinth shall not exceed 2100 mm. Cable entering cabinets will be from the bottom, via manufactures cable entry. A drawing holder shall be fitted inside the door of the enclosure.

### **4.2 Locks**

To prevent unauthorised access, cabinet doors are to be provided with three point latching mechanisms with manufactures standard locking system.

### **4.3 Equipment Mounting**

#### *4.3.1 Door Mounting*

All door mounted equipment shall be at a convenient operating height and shall be arranged so that adequate clearance to fixed equipment is maintained on the full travel of the door.

#### *4.3.2 Earthing*

All equipment mounting panels, covers, etc., carrying electrical devices and all doors shall be earthed to the main earthing system. No part of the machine or of the enclosures may serve as ground continuity "conductor". Earthing shall be done as required by the current edition of AS 3000. The metal shield of shielded cables shall only be connected to earth at the main cabinet terminal strip.

### **4.4 Spare Capacity**

The main control cabinet shall contain 20% unused space.

Each junction box, including the main control cabinet, shall have at least 20% unused terminals.

## 5.0 Wiring Requirements

### 5.1 Three Phase Circuits

Three phase circuits shall be wired in phase rotation - Red, White, and Blue. Conductors to the line side of the contactor shall be phase coloured and a minimum size of 0.6/1kV PVC insulated single core 1.5mm<sup>2</sup> 7/0.50 cable.

### 5.2 Conductor Size

Earth wiring shall have a minimum size of 2.5 mm<sup>2</sup> (7/0.67) and, where connected to doors and other moveable panels, shall have a minimum of 24 strands.

All control wiring shall be 0.5mm<sup>2</sup> (minimum) single core 0.6/1kV PVC insulated cable, and colour coded in accordance with clause 5.3.

### 5.3 Colour Code

All control wiring shall be colour coded as detailed below -

Three phase power and motor wiring	Red, White, and Blue (in phase rotation)
240 VAC active	Red
240 VAC neutral	Black
24 VDC positive	Brown
24 VDC negative	Light Blue
24 VAC active	Orange
24 VAC neutral	Grey
Earth conductor	Green/Yellow

## **5.4 Earthing**

The grounding conductors will be treated as continuous conductors. Branch connections in machine junction boxes are only allowed to connect metal parts to earth. Bare copper earth or bonding conductors will not be used.

## **5.5 Shielded Cable**

Where required, electronic devices shall be connected with shielded cable terminated in the main junction box and / or main control cabinet. The shield shall be treated as a separate conductor and grounded only at the main control cabinet.

## **5.6 Terminals**

### *5.6.1 Links*

Where required, terminals will be linked with linking bars supplied by the terminal manufacturer.

### *5.6.2 Segregation*

All electrical devices shall be wired with wires terminating on terminal strips in a junction box located and / or in the main control cabinet. Where possible, terminal strips shall be mounted vertically and separated with wiring ducts.

### *5.6.3 Conductor Identification*

All wires shall be identified (labelled by a legible number corresponding to that shown on the wiring diagram). Each conductor shall be labelled within 50 mm of its termination.

### *5.6.4 Wire Looms*

Where wires form a loom, they will be protected from damage by plastic spiral banding or similar.

## **6.0 Installation**

### **6.1 Conduit Installations**

#### *6.1.1 Mounting*

Conduits will be neatly run and installed so that they are free from mechanical stress, and located so that they do not interfere with access to parts of the machine or impede the operations of production personnel. Bends will be of a large radius and will be formed with approved formers. All conduits will be adequately supported and fastened with approved saddles. Where practicable, all conduits and flexible conduits will enter the bottom of all enclosures, junction boxes, pushbutton stations, and operator consoles. Conduits smaller than 20 mm in diameter will not be used.

### **6.2 Cable Duct Installations**

#### *6.2.1 Construction*

Installation using PVC cabling will be enclosed in a combination of conduit and cable ducts. Cable duct will be constructed of 1.6 mm Galvabond with clip on lid.

#### *6.2.2 Mounting*

The duct will be adequately supported and installed so as not to interfere with access to parts of the machine.

#### *6.2.3 Spare Capacity*

Cable duct shall be adequately sized to provide thirty (20) percent spare cable space for possible future additions.

### **6.3 Cable Ladder Installation**

#### *6.3.1 Type*

Cable ladder shall be galvabond "Burndy" LT type or similar.

#### *6.3.2 Mounting*

The cable ladder system will be adequately supported and robust enough to withstand a full compliment of cables to the manufacturer's requirements. The maximum distance between supports shall be 3000 mm unless specified otherwise.

### 6.3.3 *Cabling*

Cable ladders will be sized so as to allow for thirty (30) percent free cable space. Cables shall enter control junction boxes, electrical field equipment, and the like through watertight poly glands (bottom entry).

## **6.4 Field Equipment Installation**

### 6.4.1 *Mounting*

Limit switches, proximity switches, photoelectric switches, and other such field devices will be mounted in such a manner that they can be replaced without disturbing the setting. Brackets supporting switches and associated reflectors will be bolted or clamped to the machine to allow for subsequent repositioning. All electrical equipment will be mounted so that it is readily accessible for inspection and maintenance, and so it does not impede operations of production personnel. Where practicable, all equipment will be mounted so that wiring is bottom entry.

### 6.4.2 *Motor Isolators*

Motor isolator switches will be mounted as close as practicable to the driven mechanism.

## **7.0 Documentation**

Translink Australia Pty. Ltd. will provide the following information as soon as possible after receipt of order. All CAD drawings will be supplied suitable for use in AutoCAD (version as requested by the client).

The standard size of electrical drawings shall be metric size A4.

## **8.0 Acceptance of Installation**

Translink Australia Pty Ltd is responsible for the satisfactory management of the installation, testing, and commissioning according to the relevant statutory and standard requirements, and to the requirements of the client.

## Appendix A Preferred Electrical & Instrumentation Equipment

<i>Item</i>	<i>Manufacturer / Supplier</i>
Cables	Olex cables/or equivalent
Cable marking	Brady / or equivalent
Cable duct	Burndy / Unistrut / ACS / Ezystrut
Cable tray	Burndy / ACS / Ezystrut
Circuit Breaker - Motor	Sprecher + Schuh KTA7-25 Telemecanique
Circuit Breaker - Power	Merlin Gerin / Terasaki
Conduit - flexible	PVC Corrugated grey
Contacto	Sprecher + Schuh CA4 / Telemecanique
Control enclosure	Eldon / Rittal / B & R Minimum rating of IP55
Enclosure fan / filter	Rittal / NHP
Glands	Poly black
Light curtain	Erwin Sick / Balluff-leuze / Omron
Load break switch - distribution board	NHP Stromberg / Clipsal
Limit switch	Balluff-Leuze
Motor isolator	NHP / Clipsal
Panel meters	IME
Photoelectric device	Omron / NHP / Erwin Sick / Balluff-Leuze
Power supply	ADM / Phoenix
Programmable Logic Controller	Omron/Allen Bradley
Proximity switch	Erwin Sick /Balluff-Leuze
Relay	NHP Finder
Safety switch	Guard Master
Uninterruptible Power Supply (control)	Powerware / APC
Variable speed drive	Danfoss / Schneider / Omron
Terminals	NHP / Weidmuller