PRACTON ES

ELECTRICAL SERVICES

EC12088

PRACTON GROUP PTY LTD

2MVA Type Tested
Arc Fault Protected
Outdoor IP56 Substation

Practical Solutions for your Power Problems

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Introduction

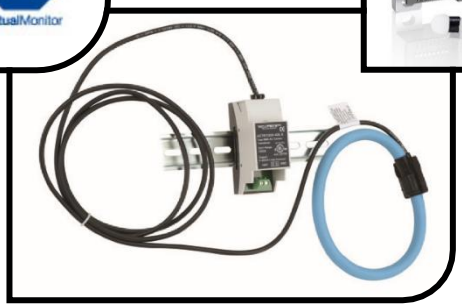
Background

Practon Group is a licensed electrical contractor with extensive experience working within the Western Australian mining industry. We have an in depth understanding of the requirements of underground mining and have identified and corrected some common issues with the design of electrical switchboards and substations.

We have made significant investments integrating the latest in switchboard and substation technology into our designs. By leveraging from the latest innovations in modular switchboards, we ensure our products not only comply with the latest standards but exceed them. Our switchboards are electrically compliant to IEC 61439-2 with the objective to ensure all personnel are safe in the operation of switchgear even in the event of a fault.

Additionally, the implementation of arc fault detection modules are utilised to ensure any arc fault event will trip the main incoming supply, this can be configured at the low voltage incoming supply or the high voltage supply. All faults detected are then logged on the integrated control system for future investigation.

Australian industry is constantly searching for safer ways to manage the many hazards of doing business. In most cases, local and international standard organisations play a pivotal role in driving equipment selection, hazard quantification and risk management practices. In the electrical sector, Australian Standards, underpinned by harmonisation policy to IEC standards, provides pathways to achieve consistent positive engineering outcomes.



Key Considerations

Arc Flash Hazards

It can be assumed that all asset owners and operators of electrical infrastructure would want to inform and protect their electrical workers against the many hazards of arc faults including:

- Electric shock
- Burns trauma from arc plasma, radiated heat, molten metal
- Physical trauma from flying debris and pressure waves
- Respiratory trauma from toxic gases

In order to manage these hazards, they need to be understood by workers, so the appropriate action and countermeasures can be applied.

Arc Guard Protection

Reducing the consequences of arc faults is all about time. This is why the ABB TVOC-2 (Arc Guard System™) reacts in just a couple of milli-seconds, thereby over-ruling standard protection time delays when tripping breakers.

The main benefits of the Arc Guard System™ are:

1. Saves lives
2. Saves equipment
3. Minimises downtime
4. Increases the life of switchgear

All this comes together to increase safety and save your business time and money.

** With ABB TVOC-2 Arc Guard protection

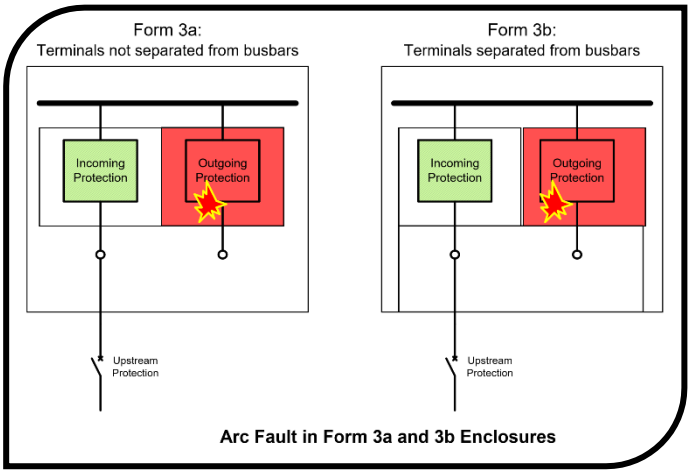
** Without Arc Guard protection

Type Tested Assemblies

AS/NZS 3439.1 and IEC 61439-2 outline the forms of segregation for switchgear assemblies. Primarily, these forms describe the varying configurations for separation of functional units of switchgear from each other.

Whilst the voluntary LV arc containment type-tests should drive responsible practices in purchase of new switchboards, for existing switchgear assemblies the identification of arc-fault clearing location is tied to the issue of arc propagation. It is not the case that the physical barriers in the forms of separation are necessarily effective in arresting arc propagation and where designed to do so, this must be verified by type-testing. This is relevant with the current methods of fabricated sheet metal switchboards.

Only in the case of Form 3a and Form 3b segregation, where the arcing fault is within the outgoing unit compartment, is the fault cleared by the incomer device. This statement is made on the assumption that the arcing fault may propagate to the line side of the switchgear but not beyond the compartment itself.



Arc Fault in Form 3a and 3b Enclosures

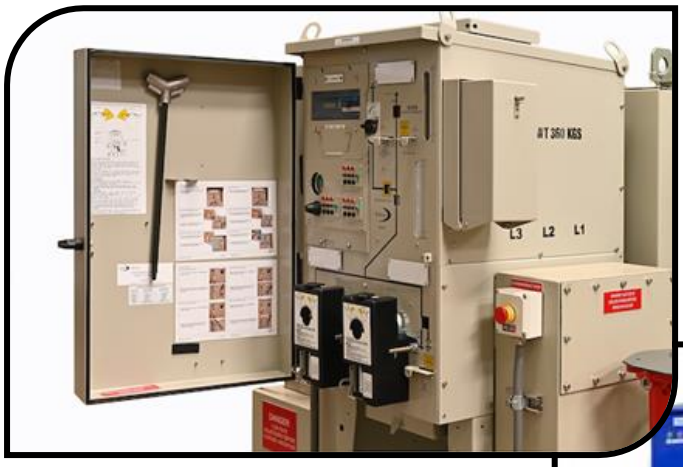
Overview

General specifications include:

- 2 MVA 11/1kV oil type transformer
- Type tested Form 4a switchboard
- Arc fault protected TVOC2
- Remote switching of high voltage ring main unit via HMI panel
- Remote switching of main 1kV incomer via HMI panel
- Remote switching of six (6) outgoing feeders via HMI panel
- Inbuilt SCADA and data logger
- Hot dip galvanised skid base with oil retention, lifting points and wheel mount plates
- 24VDC control with battery back up
- 24VDC external area lighting ready with external marshalling enclosure

Custom Client Specifications

The specifications in this document are our standard inclusions, we can customise the specifications to client specific requirements on request.



Switchboard Specifications

General

The switchboard enclosure system is designed, tested and certified for outdoor applications. It has an outer shell that is made from marine grade aluminium adapted to suit the steel modular framework. It is designed to meet all current IEC 61439-2 standards. The switchboard has an IP rating of IP56 and is type tested Form 3b. All tests have been conducted to suit most major switchgear manufacturers including ABB.

Modular Board Features

This Modular board features:

- Modular system based on 200mm grid
- Zirconium nano pre-treatment of steel
- Smooth powder coated finish
- Suitable for extreme climate conditions
- High strength, low weight
- Design verified and tested up to 7100A
- Short circuit rating up to 100kA
- IP56 as standard
- Internal arc fault protection electronic
    - Future arc fault containment ratings
- Seismic test according to IEC 68-3-3
- Designed and tested to IEC 61439
- Type tested Form 4a/3b

Ingress Protection Features

- EPDM rubber closed cell foam material to suit outdoor applications
- Temperature rating -40^{0}C to 105^{0}C continuous (120^{0}C intermittent)
- Ozone/UV resistant, non-toxic and flame retardant
- Water tightness achieved at 10% compression
- Front doors are provided with pad lockable (SS316) swing handles, 2 per door
- Side and rear doors are provided with 3 point lockable double notched lock

Ratings

Rated operational voltage (U_e)	415V / 690V / 1000V
Rated insulation voltage (U_i)	690V / 1000V
Rated frequency (f)	50Hz
Rated impulse voltage (U_{imp})	Up to 12 kV
Rated current (In) for TM panels (U_{imp})	Up to 3200A
Rated short time current (I_{cw})	Up to 100kA/1s & 80kA/3s
Earthing systems	TN-C, TN-S, TN-C-S, TT, IT
IP rating	56
Form factor	3b/4a

Approvals

IEC 60439-1, IEC61439-1 & 2, IEC60529 & IEC 61641
UL/ cUL Mark for TM panels and components
Lloyds register type approval
ABS type approval certificate
Russian Maritime Register of Shipping (RS) type approval
Bureau Veritas (BV) type approval certificate
Det Norske Veritas (DNV)
Seismic test according to IEC 68-3-3

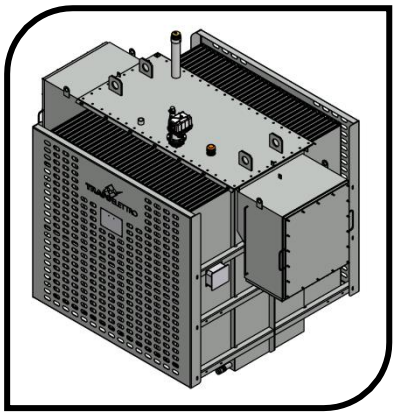
Substation Specifications

Practon Standard - IEC61439 & AS Specification

Outdoor Ring Main Unit

- Remote switching
- 2 x 11kV 800A bolted adaptors
- Lucy Sabre VRN2a or 6a
- WIP-1-2-11-E1 protection relay

2MVA Oil Immersed Transformer



- Hermetic type
- DMCR 3.0 protection relay
- Analog temperature monitoring
- Italian build quality

Low Profile Switchboard

- Type tested, form 3b/4a
- IP 56 (outdoor)
- Rescue kit cubicle

1000VAC Switchgear ABB

- 1 x 1250A 30kA electronic E2N circuit breaker (MAIN)
- 3 x 400A 20kA electronic T5V circuit breakers (FEEDER)
- 3 x 250A 20kA electronic T4V circuit breakers (FEEDER)
- Motor operators on all 1000VAC switchgear with lockout device

Earth Leakage Relays

- 6 x Outgoing feeders with leakage monitoring
- 1 x Earthing reactor with leakage monitoring
- 240V injection test point for current and time testing utilising standard RCD tester.

Arc Fault Protection

- 1 x 1250A main circuit breaker
- 3 x 400A feeder circuit breakers
- 3 x 250A feeder circuit breakers
- Control power panel

Current Control and Monitoring

- 3 x 400A feeder circuit breakers
- 3 x 250A feeder circuit breakers

Advanced PLC

- Datalogging to SD card

SCADA Interface

- Circuit breaker control via SCADA panel
- Monitoring of values
- Alarming

VR Training Module

Virtual Reality

Provided with the substation is our, inhouse developed, interactive virtual training manual which focuses on the high voltage switching operations of the Lucy Sabre ring main unit.

This technology has been proven to improve trainee engagement and information retention whilst removing the hazards of operating live equipment, such as electrocution and arc flash.

This module can be customised with site specific procedures, programs and functions. Additionally, the training experience can be enhanced with the use of commercial grade VR hardware, which provides greater resolution and dexterity for the end user.

Furthermore, this technology can be expanded to any type of switchgear and procedure. Our website has a number of case studies and videos which detail how VR is currently being utilised and the fantastic benefits it can bring to your business.

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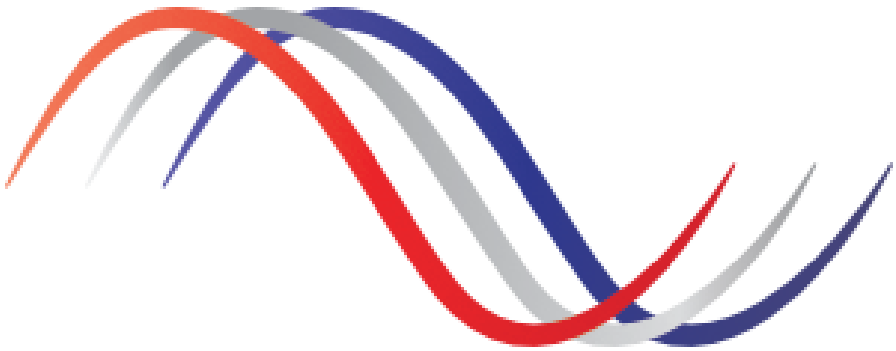
Thank You



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