



## The IP66\* | ABCD modular compact outdoor switchboard



Introducing the first arc-flash containment modular outdoor switchboard system, NATA tested and certified, fully designed, developed & manufactured in Australia.

**Arc-Blast Containment & Diffusion** technology

OUTDOOR MODULAR SAFETY SWITCHBOARD



Arc fault incidents generate intense energy that can maim and kill. Higher safety awareness and WH&S legislation drives the need for safer switchboards.

## Eliminating the risk and danger from Arc-Blasts

### Unpredictable Arc Fault Explosions

The result of an arc fault is a massive electrical explosion with unpredictable characteristics. The total incident energy is likened to tens of sticks of dynamite. An arc fault results from either a phase-to-ground or a phase-to-phase fault caused by occurrences such as accidental contact with electrical systems, build-up of conductive dust, corrosion, dropped tools, aging or poorly maintained equipment and improper work procedures.

The blinding UV and IR light and heat generated by the explosion is the 'arc-flash', where the temperature can reach 22,000°C. This releases hot plasma toxic gases and concentrated radiant energy which melts metal and causes severe radiation burns, damage eyesight, and can result in fatalities.

The 'arc-blast' is the accompanying 165dB pressure waves that can damage hearing and/or brain function. It readily blows the doors off switchboards, and sends loosened equipment, machinery and shrapnel debris flying at supersonic speed to cause further injuries to people nearby and more damage to equipment.

The arc-flash incident energy available within LV switchboards is often underestimated. "Safe" is defined as 1.2 cal/sqcm or "survivable second-degree burns".

USA reports 5-7 hospital admissions every day to burn centres for people suffering severe burns from arc-flash incidents; there may be hundreds each year in Australia.

### Safe Work and Health Legislation

Directors and officers of organisations have a legal duty to eliminate and minimise risks as far as "reasonably practical"; meaning within the available knowledge of the hazard, means of reduction and their relative cost to implement.

The increasing accountability is characterised by Queensland's 2017 'industrial manslaughter' legislation.

### Managing Risk

Requiring staff to wear bulky PPE (sometimes 'bomb suits') is the lowest order risk mitigation method, relying on administrative controls is the next level. However the arc fault containment ABCD technology is a higher order engineering control that's both cost effective and desirable.

Outdoor switchboards are often overlooked as a safety risk to employees and the public, yet they are the most exposed to environmental deterioration, entry by rodents and snakes and the least attention.

PTAS has re-engineered the outdoor switchboard to contain the arc-flash and blast energy of the explosion inside the switchboard. Modern risk mitigation thinking.





ABCD modular switchboards manufactured for certification testing, in aluminium and stainless steel and IP66 & IP56 versions. Containment control is achieved at escutcheon level.

## Containing the arc-flash and diffusing its energy

### Arc Fault Containment

The technology developed and applied by PTAS to contain the destructive components of the arc-flash and arc-blast is incorporated in the design of its ABCD Modular Compact Outdoor switchboard.

Containment of the electrical explosion energy within the switchboard enclosure requires a robust and sophisticated manufactured design that provides the structural capability to withstand extreme destructive conditions without dangerous exposure outside.

Detail engineering of internal components including the energy diffusion devices and escutcheon interface with the electrical equipment are particularly important to withstand the internal forces generated by the transient pressure waves of the arc-blast.

### Escutcheon Level Control

The PTAS design delivers its primary arc-blast containment function at the escutcheon level. External doors provide the security and IP66 weather proofing.

This unique design enables persons to readily access the switchboard safely while it is energised; MCCB, DB, metering and RTU/PLC equipment is all accessible and safe to operate with outer doors open. Optimising asset utilisation by streamline maintenance tasks and fault finding of the switchboard when in service.

### Arc-blast Energy Diffusion

Diffusion of the intense arc-blast incident energy occurs within the overall ABCD switchboard structure.

The board diffuses the arc-flash energy via a suite of unique diffuser device structures developed by PTAS located between each operating module. These devices shield, direct and absorb the explosive gas stream as it transitions within the overall enclosure.

Hot, loud, destructive and toxic blast gases remain safely contained within the ABCD switchboard, negating the significant risk of using traditional external venting – “chimney design” in an uncontrolled fashion in public spaces.

### Compact IP66\* Rated Enclosure

PTAS has included its well proven, tested and certified IP66 door seals into the exterior door of each module.

To accommodate the arc flash energy levels, the containment and diffusion technology of the ABCD enclosure only increases by just 75mm per section compared to a typical enclosure.

It remains a very compact switchboard because there is no requirement for cable ducts or secondary devices to make safe. It presents a clean safe exterior, ideal for deployment in public spaces, especially in aggressive tropical, coastal and marine environments.



\*If equipment requires ventilation, like VSDs, then IP56 applies.





ABCD test modules were designed to be scaled up into many different industry and utilities outdoor switchboard configurations.

## Engineering design to deliver in-field safety

### Modular Design Strategy

The strategy for a modular design for the ABCD board was required because it's impossible to test for arc fault containment for every variation in general arrangements for outdoor switchboards employed by industry and public utilities.

The test unit had four different sized modules, a wide range of functional escutcheons and two variants of exterior doors.

Each module is representative of module dimensions accommodating switchboard functions used in 95% of outdoor switchboards built by PTAS for its heavy industry, resources and utilities customers.

The test unit designs were built and fitted out with VSD and Soft Starter, Distribution section, MCCBs, external button controls, meter enclosures, RTU/PLC sections. This enables PTAS to build a wide variety of switchboards that easily scale up to incorporate combinations of these tested and certified modules.

Testing was also done with an ABCD board with the minimum number of modules. This represented a worst-case condition for the containment and diffusion technology to endure.

It proved to be a challenge for the PTAS engineering team - but their attention to detail delivered the necessary results for arc flash containment certification.

### Durable Construction Materials

PTAS built, tested and certified the design in two materials; marine grade aluminium and stainless steel. Tests proved our belief that these materials would perform differently; it is impossible to verify the effects of destructive energy release by calculation or even extrapolation from a single test. We know what works.

PTAS has raised the standard of detail and quality control in manufacturing the enclosures; the ABCD design has numerous details that assure strength and performance. The enclosures fulfill a safety function and purpose beyond just a standard switchboard enclosure.

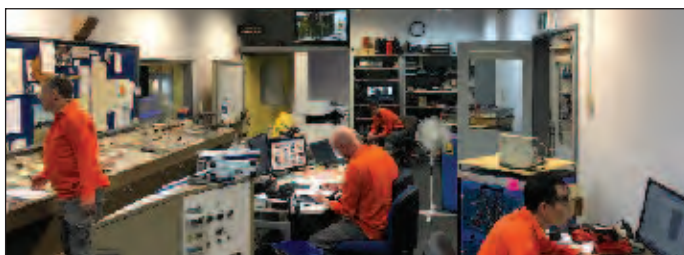
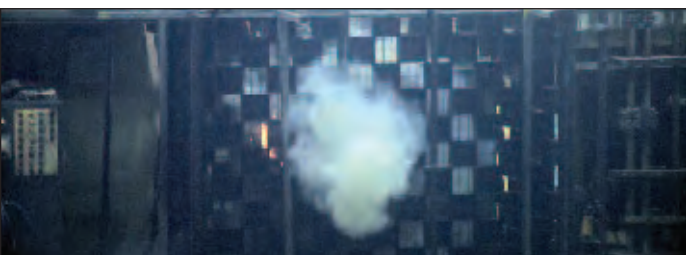
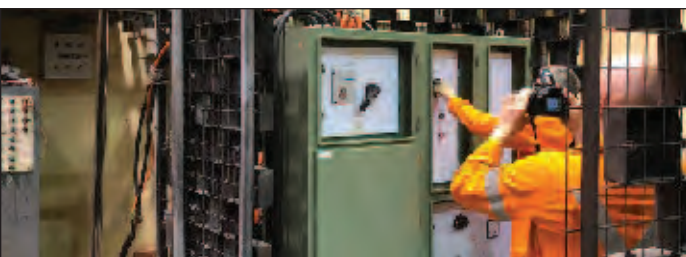
Service life reliability and durability of structure was a high priority in the design consideration, as well as reducing lifecycle cost of the switchboard.

### Options

A range of alternate doors and internal fittings have been tested to provide variations for different equipment or applications that require sunshields and ventilation cowlings.

The ABCD modular design offers customers a wide range of possible switchboard general arrangements; switchboards can be built as longer units for a wide range of internal equipment, and/or double-sided. Like-for-like replacements is an option with similar footprint and size as an outdated board reaching the end of its service life.





24 arduous tests over three days were completed to confirm all four modules, in both AI and SS materials, complied with arc-flash containment standards.

## Testing validated performance

### Validation by Testing

While many switchboard characteristics can be verified by calculation or by extrapolation of an existing design, AS61439.1 requires that certain features can only be certified by testing; like arc-fault containment.

Tests proved the ABCD switchboard design can endure an internal arc-fault incident and be returned to service very quickly with only minor rectification works required.

This involves;

- Strength of materials and parts
- Clearances & creepage distances
- Protection against electric shock and integrity of protective circuits
- Dielectric properties
- Mechanical operation

### 95% of Outdoor Applications

High public exposure risks - Switchboards in this category service 95% of outdoor public utility pump stations and heavy industry equipment.

For durability, the enclosure is manufactured from either aluminium or stainless steel sheet metal. Our decision to test both materials validated the expected differences in structural performance of both materials.

Testing is expensive, and not every test goes to plan. However, the team at PTAS was ultimately rewarded with success, the new design is proven and achieved NATA Certification (IEC/TR 61641:2014)

### Results Complied:

Verification and Certification by testing conducted at Lane Cove, NSW testing facility during March 2018, was for 20,000A for 0.3 sec duration, on both line and load side of all protective devices.

PTAS tested to the new AS/NZS 61439.1 standard and is a certified solution for outdoor switchboards (Stainless Steel and Aluminium) with certification on arc fault containment (IEC/TR 61641:2014) and IP66 ingress protection which is a first for an Australian designed and manufactured switchboard.

	IEC/TR 61641:2014 – Protection of Personnel Criteria Requirements After Arc-flash Incident	Test Result
✓ 1	Doors and covers did not open	Complied
✓ 2	No parts flew off	Complied
✓ 3	No holes were formed in the accessible parts of the enclosure	Complied
✓ 4	Vertical indication did not ignite (no external flash)	Complied
✓ 5	Equipotential bonding arrangement of accessible parts remained effective	Complied
✓ 6	No propagation of arc to other areas of the assembly	Complied
✓ 7	Satisfied the dielectric test	Complied

*"I would like to inform you all tests although extremely arduous were completed and complied with arcing due to internal fault (IEC/TR 61641:2014) All protection devices were tested for both load and line side including the main incomer MCCB."*

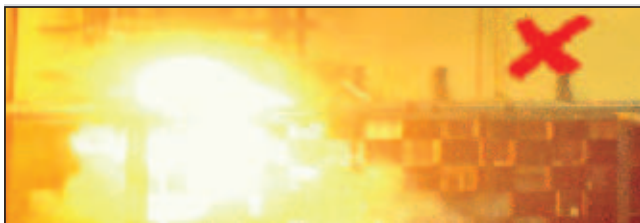






Photographs of ABCD modular switchboards in coated marine grade aluminium and stainless steel.

## Setting a new standard for outdoor switchboards



### No Arc Fault Containment

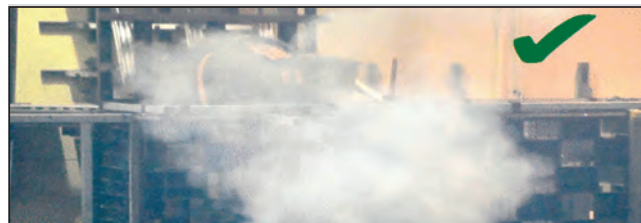
Basic, low cost enclosures designed to keep the rain and inquisitive fingers out. Many are open (Form 1 or 2) boxes with minimum safety segregation.

Less than 5% cost saving (over new ABCD equivalent). Significant increased risk to employees and public.

Switchboard likely inoperable or require an extensive shutdown for refurbishment works. When energised a licenced electrician must support the operator for various tasks.

Cannot contain the arc fault energy. Exposes personnel to the arc flash hazard and requires wearing of bulky PPE to access while energised. The Arc-blast energy often damages adjacent compartments in the switchboard and can render the entire switchboard unserviceable and prevents emergency operations.

Exposes company directors and officers to liability under increasingly arduous WH&S legislation; eg. Queensland's 2017 "industrial manslaughter" law.



### ABCD Technology Contains Arc Fault

Highly engineered modular design. Investment in R&D sets new benchmark for outdoor switchboards.

Compact footprint allows flexible configurations to suit a wide range of applications. Available in both marine grade aluminium and stainless steel SS316.

Meets and exceeds IEC TR 61641:2014 for personal protection for arc-fault containment. Validation by testing fulfills new AS/NZS 61439.1 standards.

Structural design of enclosure and escutcheons contains and diffuses arc-blast energy behind the escutcheons. Outer doors provide an IP66 weather seal and ingress security. Best practice from PTAS's industry experience.

Minimises risk to employees and public. Reduces risk to directors and officers - fulfills duty of care.

Reduced cost of ownership. Safer and simpler to operate with reduced reliance on PPE

Optimises asset use and requires less employee supervision and administrative controls.





PTAS investment in switchboard development has been ongoing, delivering innovations in serviceability, durability and productivity, while improving safety.

## Lowering cost of ownership and improving safety

### Less reliance on PPE

By implementing engineering controls to reduce the arc flash hazard risk, managers are less reliant on their workers to follow work procedures and wear the correct types of PPE for the tasks.

The ABCD design approach of testing for the escutcheon as the primary blast barrier offers enhancements and flexibility by elimination of the arc-blast hazard from persons accessing the escutcheon panel controls. Traditionally switchboards tested for arc fault containment rely on the external switchboard doors as the blast barrier and no protection is recognised by the escutcheon.

### Public safety assurance

Switchboards in public spaces, like parks, footpaths and shopping areas, can now be specified cost effectively to meet an enhanced level of safety that mitigates the arc flash hazard risk.

Large exclusion zones around switchboard and often requiring perimeter security fencing to restrict public access can be eliminated, with less disruption and constraints on switchboard locations.

### Employee productivity

The opportunity to rethink outdoor IP66 switchboard design enabled PTAS to add design features that makes it easier to work while increasing safety. Designing for ease of access now makes it safe for maintenance and operating staff to work from the



switchboard internal escutcheons, without shutdown nor requiring attendance of licenced electricians.

Systems can be safely kept on-line during maintenance. Less downtime.

### Assurance - Peace of mind

PTAS tenders provide test certificates compliant with AS/ NZS 61439.1 supporting IEC TR 61641:2014, arc-fault containment.

Flexibility for applications using combinations of multiple tested modules to support heavily legislated industry sectors; public infrastructure, mining, dangerous environments

*"PTAS's innovative ABCD arc-flash containment modular outdoor switchboard are essential for organisations that have duty of care for safety of employees and the general public."*

Video Intro Link



<https://youtu.be/vx70JhcRFc4> ABCD Arc-fault Outdoor Arc fault containment switchboard







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