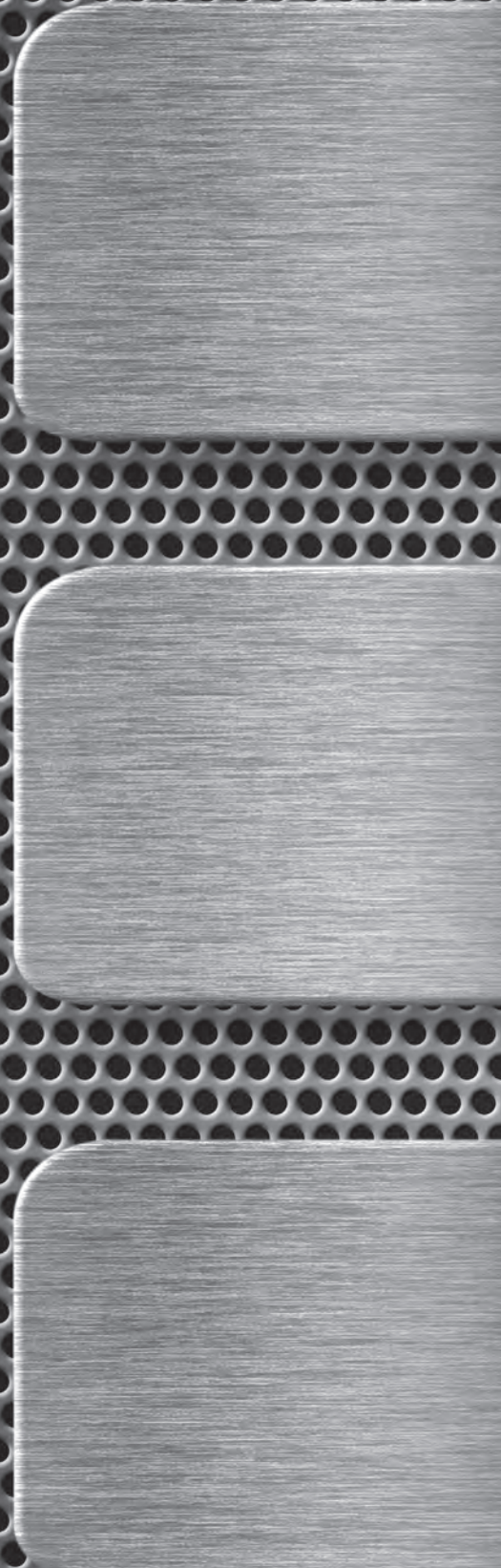




AUTOMATIC POWER FACTOR CORRECTION

Technical Specifications





GENERAL

The following is a general description of the Powerhouse Systems standard Automatic Power Factor Correction system and the components used.

The Powerhouse Systems Power Factor Correction equipment is based on many years of experience with the application and installation of automatic power Factor correction equipment in Australia for Australian conditions and using the latest Australian and Overseas standards.

The following Standards are used in the Powerhouse Systems equipment:

IEC 831 - Part 1 and 2 - Manufacturing Standard for Power Factor Correction Capacitors

AS 1013 - 1971 - Shunt Capacitors - Where applicable

AS 3000 - 2007 - Wiring rules

AS 3008 - 1.1.1998 - Selection of Cables

AS 2005 - Fuses

AS 1028 - Reactors and Transformers

ISO 9000 - Quality standards

Local Supply Authority - Service and installation Rules

RATING

The kVAr rating of the Powerhouse Systems Power factor correction equipment are based on -

Volts	- 415 Volts (+10%)
Phase	- 3 Phase plus Earth + Neutral
Frequency	- 50 Hz
Temperature	- 45°C Continuous Maximum Ambient



DESIGN

The basis of the Powerhouse Systems Power Factor Correction equipment is safety and reliability.

All equipment is front accessible and modular in construction

A freestanding 2mm sheet steel, powder coated cubicle is supplied to house all equipment.

Forced ventilation, designed to extract air from the top of the cubicle via base screened vents is included. Two(2) High reliability ball bearing cooling fans, thermostat controlled, are mounted in the roof and provide a minimum airflow rate of 710m³/h each.

Highest quality capacitors are mounted in a separate enclosure, attached to the standard enclosure. This cubicle is separately ventilated.

Modular Concept

The design utilizes a Modular concept with 100kVAr withdrawable modules containing all required parts. The modules can be removed and replaced within 30 minutes.

CAPACITORS (Supplies reactive current)

Standard - IEC 831-1/2

"As capacitors are the major component of a Power Factor Correction System, many hours of testing and evaluation have been invested in their selection and physical mounting within the cubicle"

Capacitors are highest quality German Manufacture mineral oil impregnated (or Dry Type) in cylindrical Aluminum cans complete with overpressure disconnection device and discharge resistors (to meet AS3000). Capacitors are self-healing polypropylene film with maximum 65 Deg C case temperature rating. Rated current is 1.5 times maximum in the presence of 10% Overvoltage and Harmonics. Power Loss is <0.25 Watts per kVAR

Detailed Specifications of Capacitors

Standards

- IEC 831 1+2/88, VDE 560-46+47 3/95

Overvoltages

- +10% (8 hours daily)
- +15% (30mins daily)
- +20% (up to 5 mins)
- +30% (up to 1 min)

Overcurrent

- 1.3In
- 1.5 In with 10% Overvoltage , 15% over capacitance and harmonics included, continuous operation.

Test Voltages

- Terminal/ Terminal - 2.15 Ucn AC 2 Seconds
- Terminal/ Casing - 4800 VAC, 2 Seconds

Temperature

- Category - -25/D (max. 55 Deg C) To IEC 831
- Max Case Temp. 65 Deg C

Inrush Current

- maximum 200 Times Rated Current

Rated Capacitor Voltage - Ucn:

- Standard - 440Volts (& 480 Volts)
- Detuned - 525 Volts

Capacitors are mounted in a separately ventilated cubicle, away from reactors, contactors and any heat generating equipment.



CONTACTORS

(Switches individual capacitor steps via Reactive control Relay)

Standards - IEC 947-4-1 - AS3947-3

Contactors designed especially for switching low inductive capacitive loads are used. These contactors are used for switching capacitors mentioned above and are protected against contact welding for a prospective current of 200 x I e . i.e. 200*72 Amps.



Contactors have magnetically switched early make contacts and damping resistors. These reduce the inrush current to <70 x I e
Contactor I e rating = 100 Amps

SWITCHES - FUSES

(Protects and isolates Capacitor Steps)



Standards - IEC947-3

Fully shrouded fused isolators are used to isolate and protect either the Power Factor Correction system and/or the individual steps. These are busbar mounted and contain DIN fuses suitably rated for protection of each capacitor step and connecting cables (125 Amp for 50kVAr and 63 Amp for 25kVAr steps).

Switching ratings -

- Step Switch-Fuse - 160 Amp
- Making Capacity - 40kA
- Impulse Voltage - 8kV

Main Isolator - 400 Amp , 630 Amp, 800, 1250 Amp

- Making capacity - 100kA
- Impulse Voltage - 12kV
- Fuses - DIN - To IEC 269-2-1 Breaking Capacity 120kA (size 00-2)

AUTOMATIC POWER FACTOR CORRECTION

REACTIVE CONTROL RELAY

(Monitors power factor and controls capacitor steps)

The reactive control relay is mounted on the front door of the cubicle and monitors the incoming voltage and current from the main switchboard. Based on target power factor and actual switchboard power factor, it switches capacitor steps in or out of circuit ensuring that connection and reconnection times are met.



Reactive Controller Features

- Microprocessor Based
- Digital Display of Power Factor, step Number operating and all setup information.
- Circular switching i.e. all capacitor steps are equal duty shared.
- Zero Voltage Tripping i.e. On mains failure, all steps are switched out and , upon mains restoration capacitors are switched in again only after the correct blocking delay
- High resistance to faults due to mains harmonics i.e. input circuits have a band pass filter fitted
- Alarm output and indication of
 - (a) Failure to achieve target power factor.
 - (b) Mains failure
 - (c) Temperature
 - (d) Harmonic levels (voltage and Current)
 - (e) Voltage and Current levels
 - (f) Display of Volts, Amps, Kw, KVA, KVA, KVA, Harmonics, temperature, Contactor switchings and duration of contactor operation
 - (g) All maximums data logged for future reference
- **Options** - serial output RS485, RS232 (profibus and Modbus)
- **Front Panel protection** - IP 54

HARMONIC DETUNING REACTORS

(Where fitted, Tunes Capacitor Bank below Harmonics)

Standard - AS 1028

Harmonic detuning reactors are placed in circuit prior to capacitors to "detune" the capacitor bank to below harmonic frequencies e.g. 5th (250Hz) 7th (350Hz) 11th (550Hz) etc. which are usually caused by power switching devices e.g. Variable speed drives, UPS Systems, Arc Furnaces etc.



Type	- Dry Type, Air Cooled
Tuned Frequency	- 189 Hz (7%) detuning
Current Rating (Min)	- 70 Amps I1, 51 Amps I5, 86 Amps I total, 100A
Flux Density	- < 0.80Tesla
Winding Temp rise	- Not more than 40°C
Q factor	- 38
Insulation Class	- Class H - 180°C
Dielectric Strength	- 3kV for 1 Minute to IEC 76/3
Core Type	- High Permeability silicon Grain Oriented Laminated Core.
Losses	- 86Watts/50kVAr Step
Conductor and Termination	- Copper and busbar connection

Mounting

Wiring to reactors is via single flexible lugged cables. Reactors are mounted on non-magnetic brackets (Aluminium) to Eliminate eddy currents and reduce noise and heat loss.

CUBICLE CONSTRUCTION

(To house all components and provide environmental protection)

Standard - AS3439.1 - IP31 standard, IP54 Optional.

Cubicle construction is sheet steel minimum thickness 2mm, powder coated X15 orange to AS2700 (any other colour to AS2700 powder coat available).

Features

- 100mm (or 75mm) heavy duty Galvanized Plinth
- Door mounted screened vents on all doors
- Three(3) point locking on doors above 1200mm
- Gland plate, 3mm thick, non-magnetic fitted to roof of cubicle, positioned over incoming connections. Bottom cable entry available
- Dust proof seals are mounted on all doors



TESTING AND COMMISSIONING

Before dispatch, all power factor correction systems are tested as follows

- Insulation check – 2,000 Volt for 15 Seconds ph-ph and Earth
- All connections and joints checked
- Capacitance and wiring check of each step
- Reactive relay setup and test
- Full load current check of each step including harmonic checks
- Completion of test/commissioning report.



INSTRUCTION MANUAL

A complete instruction manual is included with each system shipped, which includes the following major items:

- General Description of Power Factor and Installation
- Description of Equipment with Specifications and test reports
- Commissioning instructions
- Component detailed data sheets and performance specifications.
- Schematic and wiring diagrams
- Maintenance Instructions



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