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AIR COOLED MODULAR RECTIFIER

SPECIFICATION S-1800-A

MODULAR (REMOVABLE AND NON-REMOVABLE MODULES) AIR COOLED RECTIFIER

Standard output power range: 6 to 600 volts at 37 to 36,000 amperes

TECHNICAL SPECIFICATIONS

General

The following specification describes Controlled Power's modular "Draw-out" and "Non-draw" DC power supplies. All systems are designed and built to assure maximum reliability, flexibility, serviceability and performance. Controlled Power meets the individual needs of their customers through options and system customizing.

Standards

The D. C. Power Supply is designed and manufactured in accordance with the following:

National Electric Code (NEC) current edition American National Standards Institute (ANSI)
National Fire Protection Association (NFPA-70)
National Electrical Manufacturers Association (NEMA)

Performance Specifications

Input Voltage	Standard Voltages: 240 or 480 Volts, 3 Phase. Optional Voltages: 208, 380 or 600 Volts, 3 Phase.
Input Line Variation	Standard: ±5% from nominal. Optional wider ranges available.
Frequency	Standard: 60 hertz. Optional: 50 hertz.
Efficiency	Typically 85% to 93%
Power Factor	Typically 90% at full output
Reliability	16,598 hours (MTBF)
Voltage Regulation	± 0.5% of full rating
Current Regulation	± 0.5% of full rating
Ambient	0 º C (32 º F) to 40 º C (104º F) Maximum
Humidity	95% non-condensing.
Elevation	Maximum elevation 5000 feet (1524 meters).
Storage	-20° C (-4° F) to 50° C (122° F)

Regulation

Solid state regulation of the output power is accomplished by means of Thyristors (silicon controlled rectifier, SCR) a solid state device with extremely long life, high efficiency and superior power factor. Thyristor regulation provides full range control, with or without a load, affording maximum operating flexibility and minimum maintenance.

Transformers

All power transformers are protected with a dedicated circuit breaker.

The design of the power transformers section of this power supply is of the highest quality and reliability. The power transformers is a ventilated, dry type. The primary circuit is (3) three phase, ungrounded, delta connected. The secondary is either wye or double wye with or without interface as needed.

The transformer has separate primary and secondary windings, auto-transformer types are not used.

All electrical conductor material is high conductive electrolytic copper of not less than 98% of the international annealed standard for conductivity. Insulation is Class 200 (200° C rating), designed to operate within safety margins.

There is a double layer arc resistant barrier (nomex) between the primary, core and secondary windings to minimize the possibility of shorts.

All transformer leads are supported so that the weight is removed from the coils and they are securely braced to prevent damage in transit and during installation.

All cores are manufactured from a high-grade, grain oriented silicon steel with high-magnetic permeability, low hysteresis and eddy current losses. Magnetic flux densities are kept well below saturation to allow for a minimum of 5% over-voltage excitation. All laminations are free from burrs and stacked without gaps.

All transformer coils and connections are thoroughly braced for the magnetic stresses for short circuits of 18.0 times the rated base RMS symmetrical current, phase to phase, or phase to neutral for a period of 3.35 seconds. The transformer is constructed to be capable of withstanding, without damage, the mechanical stresses of an external short circuit or ground fault of this magnitude while rated primary voltage is maintained.

Rectifier Circuit

A wye secondary, ANSI circuit No. 23 standard 34.2 or a double wye with interphase transformer ANSI circuit No.35A standard 34.2 is used. Output rectification is by means of Diodes.

Diodes

Diodes have a minimum Peak Reverse Voltage rating of 2 ½ times the Maximum D. C. voltage. The design for maximum junction temperature is 80% of the manufacture's allowable rating.

Ripple

5% Rms. AC ripple at unit full output rating. Filtering can be added as an option to reduce the percentage of ripple if required.

Cooling

Cooling is accomplished by circulating ambient air across the heat generating components with axial fans.

Cabinet

The cabinets are all steel construction built to NEMA 1 standards. The metal is pre-treated with a phosphate coating and finished with a baked-on enamel paint to resist corrosion, marring or scratching.

Thyristors

The thyristors (SCR) are rated for continuous full load operation. An optional auxiliary sensing circuit is available to detect a phase imbalance in the unlikely event of a device failure. This circuit insures no fault load will be placed on the remaining devices.

The thyristor assembly is designed for a maximum junction temperature not to exceed 80% of the maximum rated junction temperature of the device to prolong the life of the device.

The peak inverse and forward voltage ratings of the devices are at least 2 ½ times the peak voltage of the AC supply.

The devices are mechanically clamped and mounted to an extruded heat sink in a manner which insures less than 10° C difference between the device and the heat sink.

The heat sink is designed to provide proper cooling and to limit the maximum temperature rise to 40° C. This design is in conjunction with the appropriate air CFM maintained on the heat sink. The heat sink is machined to exceed thyristor manufacture specifications.

Transient voltage surge protection limits the maximum transient voltage to less than 2.5 times the peak inverse voltage of the device. This protects each device from surges caused by switching and other alternating current variables.

Primary Protection

Primary protection is provided by means of an AC Thermal Magnetic Circuit Breaker. This breaker is sized to interrupt the fault current of normal installations. An optional fast acting AC current unbalance circuit which shuts the rectifier down under fault conditions is available.

System Protection

Circuit breakers in lieu of fuses are utilized throughout to protect the power circuits.

Module Protection

In the event of a transformer or diode short circuit failure, a magnetic circuit breaker will automatically disconnect the faulty power module from the incoming line. The power supply is automatically de-rated by the faulty increment so that the remaining power sections do not assume a larger than rated load.

Controls

The operator's control panel is on the door of the control enclosure and includes the volt meter, ammeter, control potentiometer, volt/amp switch, start/stop/power off push buttons and some option components may also be included.

Automatic Controls

MICROPROCESSOR BASED CONTROL SYSTEM

This system provides accurate repeatability and programmable features.

CONSTANT VOLTAGE CONTROL

This control maintains the preset output voltage constant to within ±0.5%. The control limits the output of the DC power supply to a safe level if an excessive load is placed on the power supply.

CONSTANT CURRENT CONTROL

This control maintains the selected output current constant to within ±0.5% over a 10-100% voltage range with varying input voltages and loads. If the load is removed, the voltage will rise to a preset limit value.

DC OVERLOAD

Digitally enhanced overload circuit allows selection of one of four settings from zero (0) to three (3) restart attempts once excessive output current is detected. Upon overload detection, the circuitry will disable the DC output, ramp the output back to it's set level within five (5) seconds and continue operation without interruption as long as the excessive load has cleared. Upon exceeding the selected number of restart attempts if the excessive load has not been cleared the unit will shut down. The overload level is factory adjusted for 5% over the units rated current output.

OPTIONAL CONTROLS

Fast acting AC current unbalance circuitry detects AC current unbalance and shuts down the DC power before serious damage may occur.

OPTIONAL CONTROLS continued

Automatic slope is digitally stepped to ramp the DC power at an adjustable rate. One (1) of two (2) standard time frames may be selected. Zero (0) to two (2) minutes or zero (0) to twenty (20) minutes. Optional longer times frames are available.

Signal conditioners fully isolate interface signals to control and monitor the DC output. One of the following signals can be specified 4-20 miliamp, 0-10 volt or 0-5 volt.

Amp Hour Counter allows the accumulated ampere-time product to be continually monitored for chemical replenishment or maintenance scheduling.

Parallel control circuit for balanced operation allows two (2) or more units to be operated in parallel for increased current output levels to a load.

Cycle timer with optional alarm for time controlled operation.

Gating Circuitry

SOFT START

The output voltage is ramped from zero (0) to the set value in a minimum of 300 milliseconds by electronic circuitry limiting damaging current surges at start-up.

SYNCHRONIZATION

A Phase Lock Loop circuit digitally produces synchronized gating signals for proper gating and insures that all phases are present before gating commences.

INHIBIT CIRCUITS (optional)

A potential free contact controlled circuit can disable the gate card to remove gate signals from the thyristors. (Contact closure enables the gate signals).

An automatic absolute zero gate inhibit circuit board will disable gate signals and suppress leakage whenever the output is set for zero (0) in voltage or current mode of control.

DC Output

The DC output of the unit is floating. Either terminal may be grounded. The output terminals are located inside the unit or covered when the output voltage is 50 volts or greater.

Warranty

The system is guaranteed against defects in material and workmanship for one (1) year from the date of shipment.