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**SERIES 70 Auto-Coat
Air Cooled MAC Power Supply**

**FRONT ACCESS, SINGLE TRANSFORMER, 6 PULSE RECTIFIER FOR
MODULAR ANODE CONTROL APPLICATIONS**

Standard DC output ratings: 400 – 450 Volts @ 200 or 400 Amperes

TECHNICAL SPECIFICATIONS

General

The following specification describes Controlled Power Company's Series 70 Auto-Coat rectifier, which is a single transformer, secondary thyristor (SCR) DC power supply designed for use with individual or multiple anodes. All systems are designed and built to assure maximum reliability, flexibility, serviceability and performance. Controlled Power Company meets the individual needs of their customers through product options and system customization.

Standards

The DC Power Supply is designed and manufactured in accordance with applicable portions of the following standards:

- 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 Voltage: 480 volts, 3 phase Optional Voltages: Consult Factory
Input Line Variation	Standard: $\pm 5\%$ from nominal Optional wider ranges available
Frequency	Standard: 60 hertz Optional: 50 hertz
Efficiency	95% typical (size dependent)
Power Factor	0.90 typical at full output
Reliability	65,000 + hours (MTBF)
Voltage Regulation	$\pm 0.5\%$
Current Regulation	$\pm 0.5\%$
Ambient Temp	0 ° C (32 ° F) to 40 ° C (104° F) maximum
Humidity	95% non-condensing
Elevation	Maximum elevation 5000 feet (1524 meters) without de-rating
Storage Temp	-20° C (-4° F) to 50° C (122° F)

Regulation

Solid-state regulation of the output voltage or current is accomplished by means of thyristors (silicon controlled rectifiers, SCRs), a highly efficient solid-state device with an extremely long life cycle. Thyristor regulation provides full range voltage control, with or without a load, affording maximum operating flexibility and minimum maintenance.

Main Transformer

The rectifier's main power transformer is a ventilated, dry type design, engineered for maximum reliability and performance. The primary circuit is (3) three phase, ungrounded, delta connected. The secondary is wye connected, per ANSI/IEEE C57.18.10 circuit No. 23. The transformer has separate primary and secondary windings. Auto-transformer types are not used.

All electrical conductor material is highly conductive electrolytic copper of not less than 101% of the international annealed standard for conductivity. Insulation is Class N (200° C rating), designed to operate within safety margins.

The primary is separated from the core and secondary by a double layer arc resistant barrier (Nomex) to minimize the possibility of short circuits.

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 high-grade silicon steel with high magnetic permeability, low hysteresis and low 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 stand-off or support insulators, used to support transformer leads and copper bus, are made of glastic material. Organic material is not used for bus or cable support due to possible deterioration.

All transformer coils and connections are thoroughly braced for the magnetic stresses resulting from 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 connected secondary, ANSI/IEEE C57.18.10 circuit No. 23 is used. Output rectification and regulation is accomplished using thyristors (SCRs).

Ripple

5% RMS AC ripple at full rated current, when operating at 25%-100% of the output voltage rating.

Cabinet

The rectifier cabinet requires front access only and is built to NEMA 1 standards. Cabinet sides and top are constructed from 14 gauge steel. The cabinet base is constructed from 12 gauge steel. An optional drip shield is available for NEMA 2 compliance. The metal is pre-treated with a phosphate coating and finished with a powder-coat paint to resist corrosion, marring or scratching. The cabinet can be installed against a wall and/or next to a second rectifier cabinet. No rear or side clearance or access is required. The cabinet includes top or bottom access for AC input landing and DC output connections to increase installation flexibility.

Dimensions

200A models: 29.5"W x 25"D x 60"H

400A models: 32.5"W x 31"D x 70"H

Note: Optional drip shield adds 4" to cabinet depth (D), and 8" to cabinet height (H)

Thyristors

The thyristors (SCRs) are rated for continuous full load operation. In the unlikely event of a device failure, an optional auxiliary sensing circuit will detect a phase current imbalance and shut down the DC power to prevent the overload of 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 2.5 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 a 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 suppression 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 with industry standard AIC ratings. An optional fused AC input contactor is available for on/off control.

Cooling

Cooling is accomplished by circulating ambient air across the heat generating components with axial fans. Fans are serviceable from the top of the cabinet.

DC Output

The DC output of the rectifier is divided into separate DC outputs with a common negative bus. Each output is capable of 100A and is designed to be connected to individual or multiple anodes. Each output is individually protected by means of a DC rated thermal magnetic circuit breaker. Two (2) output connections are provided on 200A models, and four (4) output connections on 400A models.

The DC output of the unit is isolated. Either the positive or negative output terminal may be grounded.

Anode Monitoring

Each dedicated DC output features integrated anode current and voltage monitoring. Output voltage and anode current values are available for digital export via Ethernet, Device Net or other required I/O, or via analog 4-20mA or 0-10V signals.

Controls And Monitoring

MAIN RECTIFIER CONTROL AND MONITORING

Rectifier control and monitoring functions are performed by a local or remote PLC via digital I/O. If analog controls are desired, optional potentiometers and meters are available. Electronic control circuitry within the rectifier is microprocessor-based.

CONSTANT VOLTAGE & CURRENT CONTROL

The Series 70 Auto-Coat has 2 modes of operation: constant voltage control or constant current control. Constant voltage control maintains the preset output voltage constant to within $\pm 0.5\%$. An adjustable maximum current setting limits the output of the DC power supply to a safe level and protects the system from an overload condition. Constant current control maintains the selected output current constant to within $\pm 0.5\%$ over a voltage range of 10% to 100%, with varying input voltages and loads. If the load is removed, the output voltage will rise to a preset limit value.

DC OVERLOAD

A digitally enhanced overload circuit allows the selection of zero (0), one (1), two (2), or 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 its 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 and if the excessive load has not been cleared, the unit will shut down. The overload level is factory adjusted for 5% over the unit's rated current output.

OUTPUT RAMPING

Automatic ramping (slope) is digitally controlled to ramp the DC output to a preset voltage or current setting, at an adjustable rate. One (1) of two (2) standard timeframes may be selected. The first timeframe is zero (0) to two (2) minutes, and the second is zero (0) to twenty (20) minutes. Optional longer timeframes are available. Ramping can be controlled via potentiometer settings, or an internal or external PLC.

Safety Equipment

MECHANICAL BREAKER INTERLOCK HANDLE

The rectifier features a door-interlocked safety mechanism which automatically opens the AC input circuit breaker before access can be gained to the inside of the rectifier cabinet.

ELECTRICAL INTERLOCKS (Optional)

In addition to the standard mechanical breaker interlock handle, optional electrical interlocks are available. In the event the rectifier door is opened, the AC input circuit breaker is shunt tripped.

PHASE IMBALANCE PROTECTION (Optional)

Fast-acting AC current imbalance circuitry is available. If imbalance limits are exceeded, the DC power will be shut off to prevent potential overload conditions.

SAFETY PLC (Optional)

For added safety, a password-protected safety PLC is available to prevent unauthorized tampering or changes to the PLC code.

PARALLEL OPERATION (Optional)

The Series 70 Auto-coat can be paralleled with other Series 70 units for balanced operation and increased output current capacity.

KIRK KEY INTERLOCKS (Optional)

Kirk Key Interlock Systems are available for added safety measures.

More optional equipment is available contact factory for details.

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 excessive current surges at start-up.

SYNCHRONIZATION

A phase lock loop circuit digitally produces synchronized gating signals for proper gating of the thyristors (SCRs), and insures that all phases are present before gating commences.

INHIBIT CIRCUITS (Optional)

A potential free contact controlled circuit will disable the gate card and remove gate signals from the thyristors.

An automatic absolute zero gate-inhibit circuit board disables gate signals to suppress leakage voltage and insure a zero power output whenever the output is set for zero (0) in the constant voltage or constant current mode of control.

Warranty

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