C&D TECHNOLOGIES

Power Solutions

Single-Phase,
Controlled Ferroresonant,

REDUCED-HEIGHT RECTIFIERS

for Telecommunications and Utility

THE HRT SERIES

- 24- and 48-volt models
- 15- to 200-ampere output
- Three reduced heights: 12.25,17.5 and 24.5 inches
- Compact design permits more power in the same rack space
- All pc boards and user operating controls accessible through front panel
- Ferroresonant design features voltage regulation, high efficiency, high power factor, low noise levels, current limiting, low maintenance, and low operating costs
- Battery eliminator operation standard

HRT Reduced-height Float Rectifiers

Controlled ferroresonant rectifiers have many inherent advantages, including voltage regulation, short-circuit protection, low operating costs (high efficiency and high power factor), and low maintenance.

HRT float rectifiers combine these inherent advantages with state-of-the-art circuitry, user-oriented packaging, and a compact size. The HRT Series float rectifiers are easily adjusted to meet your special operating requirements. Their quality and craftsmanship provide years of trouble-free service.

INPUT

All transformers are dual wound for 120-, 208-, and 240-volt, single-phase, 60 Hz operation.

REGULATION

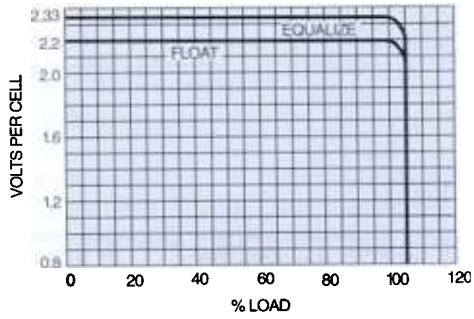
DC voltage regulation is maintained within the limits set forth in NEMA PE-7 at any load from no load to full load at:

- ±1/2 percent regulation over the ambient temperature range of 32F (0C) to 122F (50C).
- One percent (±1/2%) regulation with ac input variations between +6 /-12 percent of nominal input voltage and frequency variations between 57 to 63 Hz while floating/equalizing the rated number of cells.

INPUT VOLTAGE RANGE

Nominal Voltage	Minimum	Maximum
120	106V	127V
208	184V	220V
240	212V	254V

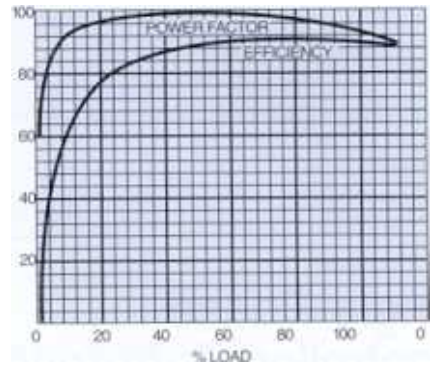
REGULATION CURVE



Control is accomplished with a single control board for all ratings of chargers and does not require modification for operation of battery.

During operation, the maximum voltage transient does not vary more than five percent of the initial steady state voltage for sudden load changes between 20 percent and 100 percent of rated output. Recovery takes less than 200 milliseconds, and all transient behavior disappears within 500 milliseconds. Operation of the battery is stable within stated limits under all conditions of line and load.

TYPICAL EFFICIENCY AND POWER FACTORS



Turn-on under all conditions of line and load has a "soft-start" characteristic without overshoot. The output voltage and current are increased gradually to the rated level over a 10-second interval.

ELECTRICAL NOISE

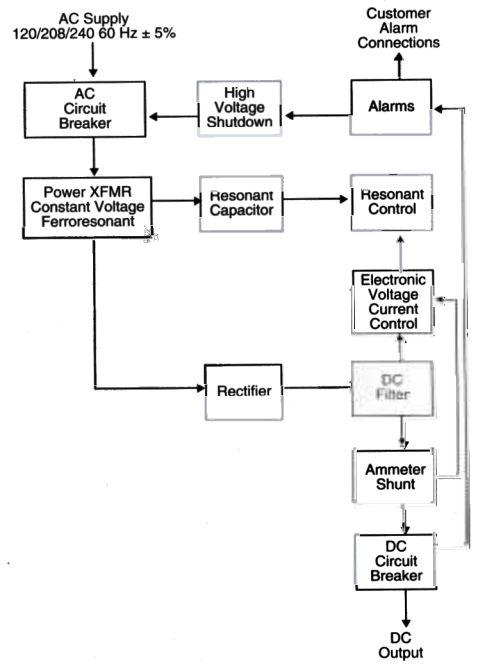
Filtered to less than 30 millivolts (rms) with electrical noise less than 22 dBrn with C message weighting on 3A noise measuring set when connected to a battery with an eight-hour capacity rating of four times the charger current rating. Electromagnetic interference (EMI) limits also meet FCC Part 15, Subparagraph J for Class A compliance.

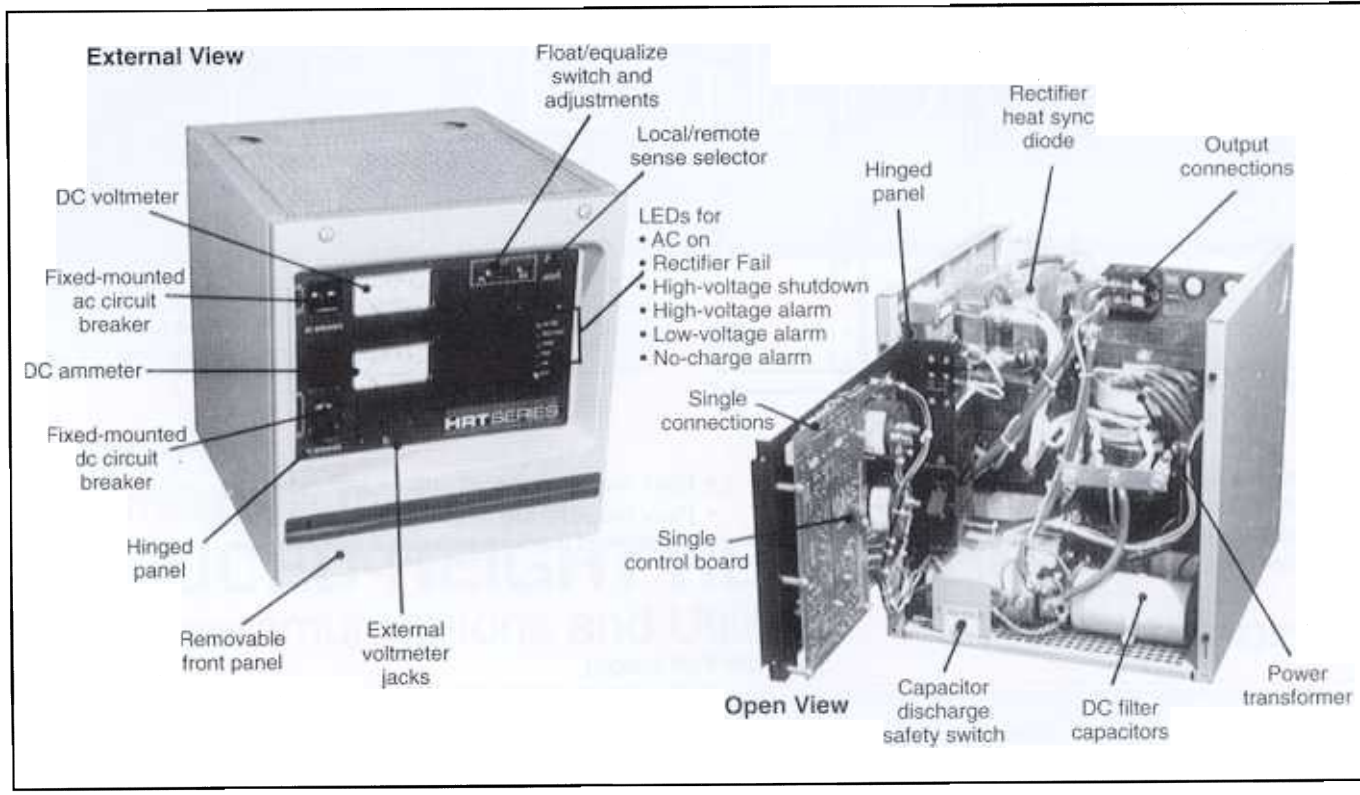
Under rated conditions, the TIF does not exceed 30.

PRINCIPLES OF CONTROLLED FERRORESONANT OPERATION

The controlled ferroresonant transformer has inherently good regulation of output voltage against wide variations of input voltage. Its high reactance also provides protection against overload and short circuit of the output. However, the output does vary with changes in load and frequency. The output winding is on the same leg of the core as the resonant winding, and the resonant capacitor acts to maintain this core section at a high level of saturation, resulting in a fairly constant voltage. To provide a precise constant voltage, it is necessary to control this level of core saturation. This is accomplished in HRT Series rectifiers by shunting the resonant circuit with a switching device in series with an inductor.

As shown in the block diagram, the HRT circuit senses the start of the resonant capacitor charge cycle and switches the thyristor on to interrupt the cycle. The point of interruption is delayed by a signal fed back from the output to allow the voltage to rise to the pre-set level. If the current exceeds a pre-set level, the signal from the ammeter shunt overrides the voltage regulator to limit the current. Thus, precise control of voltage and current is maintained. If a fault occurs, allowing a higher voltage to develop, a sensing circuit causes the ac input breaker to shut down the rectifier.





CURRENT LIMITING

Current limiting circuitry is factory set at 105 percent of rated dc output but can be adjusted down to 80 percent. This feature automatically protects the charger even if the output terminals are accidentally shorted.

FLOAT AND EQUALIZATION VOLTAGES

To accommodate different kinds of batteries, both the float and equalize voltages are continuously adjustable (no taps) over the nominal voltage range of 2 to 2.35 volts per cell. For 24-volt models, the range is 24 to 28.2 volts; for 48-volt models, 48 to 56.4 volts. Float and equalize adjustments are not interactive. They can be set independently.

CIRCUIT PROTECTION

A two-pole, UL-recognized, shunt-trip ac circuit breaker is provided for input protection and rectifier shutdown in the event of a high dc voltage condition. A single-pole, UL-listed, dc circuit breaker is provided in the appropriate leg for output protection for telecommunications models.

A summary alarm relay will indicate any combination of high-voltage alarm, low-voltage alarm, no-charge alarm, high-voltage shutdown, or rectifier failure alarm. A dc no-charge alarm typically is set to operate when the output current is less than two percent of the rated current but may be adjusted for other threshold values.

AMBIENT OPERATING TEMPERATURES

All HRT rectifiers will operate, at current limiting, continuously in ambient temperatures from 32F (0C) to 122F (50C). These units can be safely stored for up to one year at temperatures from -40F (-40C) to 185F (85C).

BATTERY ELIMINATOR OPERATION

HRT rectifiers are provided with standard filtering to reduce ripple to 30 mv rms or less for operation as a battery eliminator. The electrical noise level for battery eliminator operation is less than 32 dBrnc.

LOAD SHARING

Load sharing is standard on all HRT rectifiers. Units will share the load within five percent of the rating of the largest rectifier and between 10 percent and 100 percent of their combined ratings.

MECHANICAL FEATURES

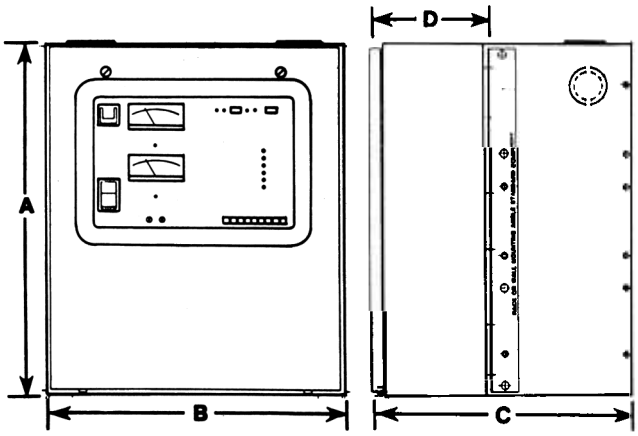
- All controls and adjustments are recessed to prevent accidental operation.
- Removable front panel gives access to all service adjustments while providing maximum protection against electrical shock.
- Circuit breakers are mounted in a fixed position, eliminating the need for hinged ac and dc power cables.
- Hinged control panel provides easy access to all operator controls and adjustments.
- All cabinets can be relay rack or wall mounted. Large cabinets also can be floor mounted.
- Cabinets have a baked epoxy powder finish (ANSI-61 gray).

STANDARD EQUIPMENT

- Recessed instrument panel which includes dc voltmeter and ammeter, indicating LEDs, and ac and dc circuit breakers
- Multi-turn float and equalize pots with equalize switch
- Positive or negative ground
- Integrated alarm module provides summary relay for dc high- or low-voltage, no-charge (low current), and ac power loss, and LED displays for:
  - AC power on
  - Rectifier failure
  - High-voltage shutdown
  - High-voltage alarm
  - Low-voltage alarm
  - No-charge alarm

OPTIONAL EQUIPMENT

- Digital metering
- Electronic equalize timer, 0-99 hours
- Lightning protective device
- Individual alarm contacts for:
  - DC high voltage
  - AC power loss
  - DC low voltage
  - No charge



Cabinet	A	B	C	D
12	12.25 in (311 mm)	16.5 in (419 mm)	14.0 in (356 mm)	6.4 in (163 mm)
17	17.5 in (445 mm)	16.5 in (419 mm)	18.0 in (457 mm)	8.4 in (213 mm)
24	24.5 in (622 mm)	20.5 in (521 mm)	18.0 in (457 mm)	8.4 in (213 mm)

- 16.5" wide (419 mm) cabinets can be used in 19" (483 mm), 23" (584 mm), or 30" (762 mm) racks.
- 20.5" (521 mm) wide cabinets can be used in 23" (584 mm) or 30" (762 mm) racks only.
- Rack angles mount at rear for wall mounting.
- Floor brackets are available for the 20.5" wide models but must be ordered with rectifier.

SPECIFICATIONS

24-Volt output

Model	Input Volts	AC Amps	DC Amps	Cabinet	DC Lug Size	Circuit Breakers DC	Approx Ship Wt. Lbs	Approx Ship Wt. Kgs
HRT24AC25E	120/208/240	8/5/4	25	12	14-1/0	35	105	48
HRT24AC50E	120/208/240	15/9/8	50	12	14-1/0	70	135	61
HRT24AC100E	120/208/240	32/19/16	100	17	14-1/0	125	225	102
HRT24AC200E	120/208/240	58/33/29	200	24	6-250mcm	250	385	175

48-Volt output

Model	Input Volts	AC Amps	DC Amps	Cabinet	DC Lug Size	Circuit Breakers DC	Approx Ship Wt. Lbs	Approx Ship Wt. Kgs
HRT48AC15E	120/208/240	9/5/4	15	12	14-1/0	20	105	48
HRT48AC30E	120/208/240	18/10/9	30	12	14-1/0	40	135	61
HRT48AC50E	120/208/240	32/19/26	50	17	14-1/0	70	225	102
HRT48AC100E	120/208/240	58/33/29	100	24	14-1/0	140	385	175

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