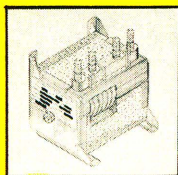
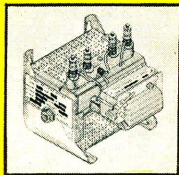


A G-R-S RECTIFIER FOR EVERY SIGNALING NEED



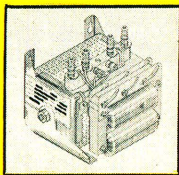
B & B3

Rectifier with no regulating means.



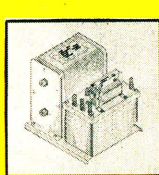
BX & B3X

Rectifier and adjustable reactor for regulating charge rate.



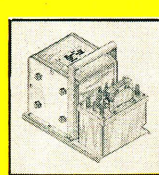
BT & B3T

Rectifier and adjustable reactive transformer.



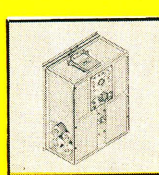
BQX

Rectifier and reactor and transformer with or without taps.



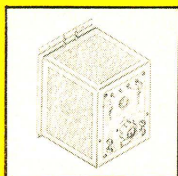
BQX Portable

Same as BQX, equipped with handle, snap-on connectors.



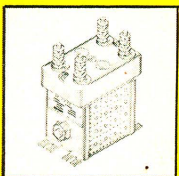
BP

Rectifier with control board, jacks, meters, rotary switch for adjusting charge rate.



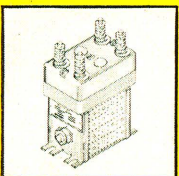
BPC

Rectifier with control board, jacks, meter, rotary switch, auto transformer for adjusting charge rate.



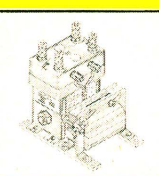
B1/2

Low capacity rectifier without transformer. No regulating means.



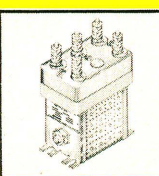
BQ1/2

Low capacity rectifier with transformer. No regulating means.



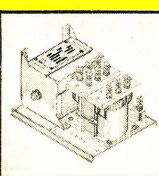
BQX1/2

Low capacity rectifier with transformer and adjustable reactor.



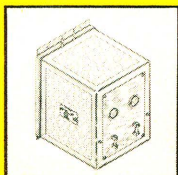
BQA1/2

Low capacity rectifier with transformer, center-tapped primary. No regulating means.



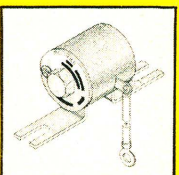
BK

Rectifier with transformer having tapped primary and secondary windings.



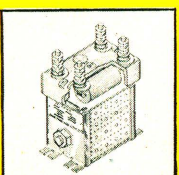
BPA

Rectifier, tapped transformer, voltmeter, ammeter, and fuses on board. To supply d-c. direct.



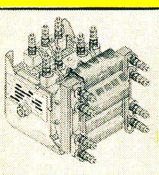
B1/4

Half-wave low capacity rectifier to operate d-c. power transfer relay direct from low voltage a-c.



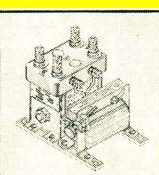
BR1/2

Low capacity rectifier and resistor for regulating charge rate.



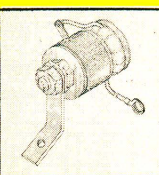
BBY & BB3Y

Rectifier and automatic transformer for use with primary track and line battery.



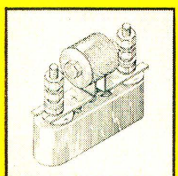
BX1/2

Low capacity rectifier and adjustable reactor without transformer.



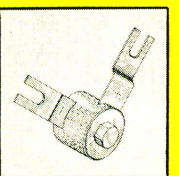
BS

Rectifier for snubbing d-c. signal motors.



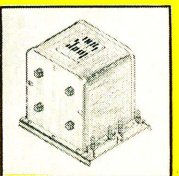
B1

Half-wave rectifier for use with Type B relays. To make slow release and select polarity of circuit.



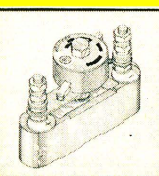
B1

Half-wave rectifier for mounting on Type K relay. To make slow release.



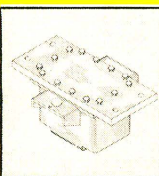
BA

Rectifier with no regulating means for switch machine operation. Requires separate tapped transformer and protective equipment.



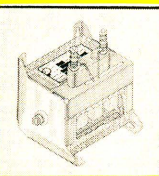
BB

Half-wave rectifier used with primary battery for track circuits with superimposed a-c. in train control territory.



B3VA

Half-wave rectifier for use in rectified a-c. track circuits. For mounting between ties and rails.



B3C

Half-wave rectifier for use in rectified a-c. track circuits. For mounting in housing.

NEED

TYPE

GENERAL INFORMATION

Note: All wattage ratings shown below are approximate maximum.

A. RECTIFIERS FOR BATTERY CHARGING

- | NEED | TYPE | GENERAL INFORMATION |
|---|-----------|---|
| 1. For low voltage battery charging where suitable low voltage secondary is available on an existing transformer, and an adjustable resistor or reactor is available for regulating the charge. | B3
B | Size 104—Up to 1 lead cell 6 watts
Size 116—Up to 6 lead cells 6 watts
Size 132—Up to 12 lead cells 11 watts
Size 232—Up to 20 lead cells 20 watts
Size 432—Up to 70 lead cells 35 watts
Any frequency. |
| 2. Same as No. 1, with an adjustable reactor provided as part of the rectifier assembly for regulating the charge. Micrometer screw adjustment on the reactor. | B3X
BX | Size 104—Up to 1 lead cell 6 watts
Size 116—Up to 6 lead cells 6 watts
Size 132—Up to 12 lead cells 11 watts
Size 232—Up to 12 lead cells 20 watts
Size 432—Up to 12 lead cells 35 watts
Frequencies of 25 and 60 cycles.
Furnished for 100 cycles, if specified. |

Much space may be saved in the above rectifier applications when several rectifiers can be connected to the secondaries of one transformer. A separate secondary winding should be provided for each rectifier, if their d-c. load circuits are interconnected.

- | | | |
|--|---|---|
| 3. For a self-contained unit to be directly connected to the a-c. supply. This unit has its own regulating means, an adjustable reactive transformer. Micrometer screw adjustment of laminated yoke. | B3T
BT | Size 104—Up to 1 lead cell 6 watts
Size 116—Up to 6 lead cells 6 watts
Size 132—Up to 12 lead cells 11 watts
Size 232—Up to 20 lead cells 20 watts
Size 432—Up to 60 lead cells 35 watts
Frequencies of 25, 40, 50, and 60 cycles.
110- and 220-volt primary winding.
Furnished for 100 cycles, if specified. |
| 4. For a rectifier with a wide range of adjustment. Obtained with a tapped transformer and an adjustable reactor, provided as part of the rectifier assembly. Coarse adjustment with transformer secondary taps; fine adjustment with micrometer screw of adjustable reactor. | BQX | Size 232—Up to 6 lead cells 20 watts
Size 432—Up to 6 lead cells 35 watts
60-cycle, 110- or 220-volt supply.
Furnished for 25 or 100 cycles, if specified. |
| 5. For a portable emergency charger. Supplied with a carrying handle, snap-on connectors. | BQX
Portable
Emergency
Charger | Size 432—Up to 6 lead cells 60 watts
Not rated for continuous service.
Primary winding provided with strap connectors for 110- 220-volt, 25- to 60-cycle supply. Furnished for 100 cycles, if specified. |
| 6. For use as a "Two-rate charger" to establish control of low and high rate charge. Tapped transformer and adjustable reactor. | BQX
BUX | Size 432—Up to 6 lead cells 35 watts
Size 248—Up to 14 lead cells 80 watts
60-cycle, 110- or 220-volt supply. |
| 7. For charging large ampere-hour capacity batteries, such as at interlocking towers. Panel to control charge rate; switches and fuses for a-c. and d-c. circuits; d-c. ammeter; four plug jacks and 15-point rotary switch connected to transformer secondary; 60 possible charge rate adjustments. | BP | Size 248—Up to 65 lead cells— 90 watts
Size 448—Up to 110 lead cells—135 watts
Size 648—Up to 80 lead cells—217 watts
Size 848—Up to 110 lead cells—270 watts
Size 1248—Up to 110 lead cells—405 watts
Size 1648—Up to 65 lead cells—720 watts
110- or 220-volt, 25- or 60-cycle supply.
Furnished for 100 cycles, if specified. |
| 8. For charging high voltage, low ampere-hour capacity CTC line or control batteries. Same features as Type BP with addition of a tapped auto transformer to increase range of battery voltages. | BPC | Size 280—Up to 70 lead cells — 8 watts
Size 480—Up to 115 lead cells — 19 watts
60-cycle, 110- or 220-volt supply. |

When ordering, give complete information about the type of battery, number of cells, maximum charging current, characteristics of battery load, frequency and voltage of a-c. supply.

B. RECTIFIERS TO OPERATE WITH D-C. RELAYS

- | NEED | TYPE | GENERAL INFORMATION |
|--|-----------------------------------|--|
| 1. To operate a d-c. track relay on an a-c. track circuit.
(a) on short track sections, non-electrified road, where there is no foreign current. Rectifier connected directly to rails. Has no regulating means.
(b) on non-electrified road track circuits subject to foreign current. An insulating transformer is built-in as part of the rectifier assembly. Connected between the relay and the rails.
(c) on non-electrified road track circuits, in parallel with one cell of primary battery. A transformer without taps and an adjustable reactor are included.
(d) on electrified road, d-c. propulsion, single rail track circuits using balancing impedance. The built-in transformer has a center-tapped primary winding. | B1/2
BQ1/2
BQX1/2
BQA1/2 | Any frequency. Output 12 volts d-c.
25- or 50/100-cycle. For 4-ohm and other resistance d-c. track relays.
Max. d-c. output 1 volt, 0.6 amp. 25- or 60-cycle, 110- or 220-volt supply.
25- or 60-cycle. Output 1.2 volts d-c. |

When ordering, give length of track circuit; kind of ballast, wet and dry resistance per 1000 feet of track; kind of bonding; weight of rail; resistance, working current, and type of relay; frequency of signaling current; maximum and average d-c. propulsion current per rail; propulsion voltage.

- | | | |
|--|---------|--|
| 2. To operate d-c. line relays direct from a-c. source.
(a) where a suitable step-down transformer is already available.
(b) where only 110- or 220-volt a-c. supply is available. Rectifier-transformer assembly; tapped primary and secondary windings. 25- or 60-cycle, 110- or 220-volt a-c. supply. | B
BK | See Paragraph A1 for ratings.
Size 116—d-c. output 12 volts 6 watts
Size 132—d-c. output 30 volts 11 watts
Size 232—d-c. 12 and 30 volts 20 watts
Size 432—d-c. 10 and 30 volts 35 watts |
|--|---------|--|

NEED

TYPE

GENERAL INFORMATION

- | | | |
|--|-----|--|
| (c) to supply d-c. direct to relay load with primary-battery reserve. Rectifier-transformer assembly; tapped primary and secondary windings. Voltmeter, ammeter, and fuses on panel. | BPA | Size 248—d-c. output 16 volts, 72 watts 25- or 60-cycle, 110-volt a-c. supply.
Size 448—d-c. output 12 volts, 144 watts 60-cycle, 110-, 220-volt a-c. supply. |
|--|-----|--|

When ordering, give complete information about the number of relays, type, resistance, and working current, whether in series or multiple or special combinations of series-multiple, maximum and minimum load, d-c. voltage and allowable voltage variation, a-c. voltage and frequency, and if line wires are in cable carrying a-c.

- | | | |
|--|------------|--|
| 3. To obtain selective operation of such devices as d-c. relays, lamps, or other indicators, on a d-c. polarized line. Half-wave rectifiers. | B1/4 | When ordering, give line voltage, current required by indicating device, also describe the device. |
| 4. To make a d-c. relay slow-release by connecting half-wave rectifier across coils. Approximately quarter-second slow release effect on 6, 8, 10, or 12 volts d-c. | B1
B1/4 | When ordering, give resistance and working current, and type of relay; slow release time desired. Not recommended for line relays subject to lightning. |
| 5. To operate a "light-out" relay on a-c. or d-c. in series with a signal lamp. The rectifier is designed for mounting across coils of G-R-S Type W Class E Relay. | B1/4 | When ordering, give resistance and type of relay, rated voltage and wattage of lamp, supply voltage, single or double filament, wattage of each filament, whether relay should release if one filament burns out. |
| 6. To operate d-c. power transfer relay direct from low voltage a-c. Designed for mounting across coils of G-R-S Type K2 relay or on terminal block for use with G-R-S Type B relay. | B1/4 | When ordering, give type of relay, resistance, and operating voltage. |
| 7. To operate a "light-out" relay on primary side of lighting transformer. | BR1/2 | Satisfactory operation depends upon a proper combination of transformer primary impedance and relay resistance. Give line voltage and frequency, length of line circuit, lamp voltage and wattage, kind and size of line wire. |

C. RECTIFIERS TO SHARE LOAD

- | | | |
|--|-----------------------------------|---|
| 1. To prolong the life of track and line primary batteries by sharing the load.
(a) by connecting, in multiple, a full-wave automatic rectifier. 115-volt 60-cycle supply. This rectifier increases its output as the load increases.
(b) by connecting, in multiple, a non-automatic rectifier. Includes transformer and adjustable reactor.
(c) by connecting a non-automatic rectifier with an adjustable reactor to an existing low voltage supply.
(d) by connecting a rectifier without a transformer directly to the load or in multiple with primary cells. Requires a separate a-c. power source. | BB3Y
BBY
BQX
BX
BX1/2 | Track circuit 1 volt 1.4 amp. d-c.
Line circuit 14.5 volt 0.30 amp. d-c.
See Paragraph A4 for ratings.
See Paragraph A2 for ratings.
5-, 10-, or 20-volts a-c. supply, 60 cycles. |
|--|-----------------------------------|---|

When ordering, give a-c. voltage and frequency, type of cell, ampere-hour capacity, number in series or multiple, approximate maximum and minimum current, characteristics of load.

D. RECTIFIERS TO SNUB MOTORS

- | | | |
|--|----|---|
| 1. For snubbing semaphore signal motors. Half-wave rectifiers. | BS | 8-, 10-, 20-, and 110-volt motors. Give type and voltage of signal mechanism. |
|--|----|---|

E. RECTIFIERS FOR SPECIAL APPLICATIONS

Consult us for recommendations and typical circuit applications.

- | | | |
|---|------|--|
| 1. To operate intermittently a single d-c. switch machine. 110-volt d-c. A-c. should be connected to the rectifier only when switch machine is operating. Separate transformer and circuit breaker necessary. | BA | Size 256—150 volts a-c. 90 volts, 4 amps. d-c. for 10 seconds.
Size 456—150 volts a-c. 90 volts, 8 amps. d-c., for 10 seconds.
When ordering, give type of machine, operating voltage, length and size of line wire. |
| 2. To operate intermittently switch machine master controllers. 110-volt d-c. Separate transformer and circuit breaker necessary. | BA | Size 472—150 volts a-c. 110 volts, 2 amps. d-c. for 10 seconds. |
| 3. To operate a single automatic stop. Separate transformer necessary. | BA | See Paragraph E1 for ratings. |
| 4. In continuous train control territory, to prolong the life of primary battery. Half-wave rectifier or valve connected in multiple with one primary cell thru track transformer. | BB | 1-volt, 1-amp. d-c. output. |
| 5. To obtain high shunting sensitivity and quick drop away on track circuits. A rectified half-wave track circuit. | B | Size 132—max. 12 volts a-c. 2.4 amps. d-c. |
| 6. For use in half-wave track circuits. To be mounted in a separate weatherproofed housing. | B3C | Size 102—max. d-c. output 5 volts, 2.2 amps. |
| 7. Same as E6 except rectifier housed in a weatherproofed steel case and mounted between the ties and rails. | B3VA | Size 102—max. d-c. output 5 volts, 2.2 amps. |

When ordering rectifiers for No. 4 and No. 5, give length of track circuit, kind of ballast, wet and dry resistance per 1000 feet of track; kind of bonding; weight of rail; resistance, type, and working current of relay; frequency of signaling current.

- | | | |
|--|------------|--|
| 8. Small rectifiers for valves in special d-c. circuits. | B1
B1/4 | When ordering, give total voltage of circuit, current, sketch and description of circuit, and describe the result desired. |
|--|------------|--|



GENERAL RAILWAY SIGNAL COMPANY

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G-R-S RECTIFIERS

The basic principle of the copper-oxide rectifier is the peculiar property of a copper disk with a coating of copper-oxide on one face imposing high resistance to an electric current in one direction and offering low resistance to a current in the opposite direction. The reason for this phenomenon has not been definitely determined, but it is a well known fact that, when copper-oxide has been formed on one face of a copper disk by special heat treatment, current flows more readily from copper-oxide to copper than in the opposite direction. Each disk, therefore, serves as an efficient electrical valve which allows current to flow in one direction and prevents its flow in the opposite direction. The valve action or rectification takes place at the junction of the copper and copper-oxide, and numerous tests in laboratory and field show conclusively that the action is entirely electronic without any chemical action or decomposition of the rectifier elements.

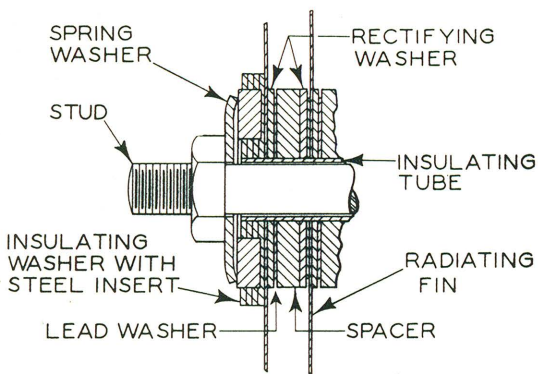


Figure 1. Make-up of Rectifier Unit

Each rectifier unit comprises copper-oxide disks or washers, lead washers, brass radiating washers or cooling fins, spacer and insulating washers assembled on an insulating tube over a bolt as shown in Figure 1. The number of copper-oxide disks and their connection in series or multiple depends upon the output voltage and current for which a particular rectifier is

designed. In order to secure full-wave rectification the disks in most of the rectifiers are connected to form a wheatstone-bridge circuit.

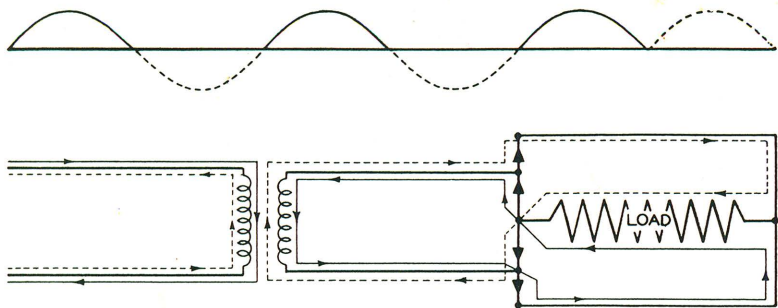


Figure 2. Flow of current in full-wave Rectifier

Figure 2 shows the manner in which the flow of current is directed by the valve action of four rectifying disks connected in a wheatstone-bridge circuit so that current from both halves of the a-c. wave flows through the load in the same direction.

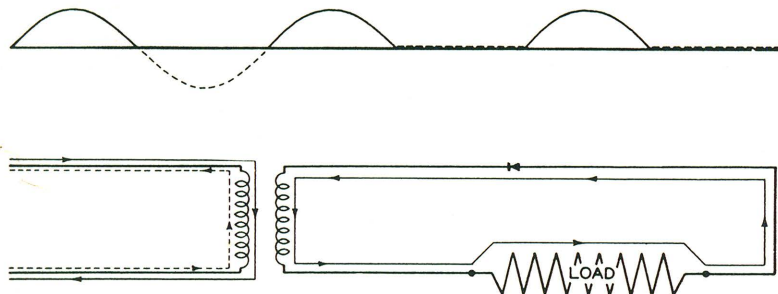


Figure 3. Flow of current in half-wave Rectifier

Figure 3 shows the circuit arrangement of a half-wave rectifier which prevents the flow of current in one direction so that current from only one-half of the a-c. wave flows through the load.

SELECT THE PROPER RECTIFIER FROM CHART ON OTHER SIDE
HANG CHART ON WALL FOR FUTURE REFERENCE

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