# KS-5651-02 RECTIFIER UNIT
# ELECTRONIC CONTROL
# OPERATING METHODS

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## 1. GENERAL

**1.01** This section covers the operation of a regulated metallic-type rectifier unit using a saturable reactor control. It was designed to provide regulated d-c power from an a-c power service. It is available in ratings of 44 to 65 volts, 100 amperes; 22 to 33 volts, 100 amperes; and 22 to 33 volts, 200 amperes d-c; and it is suitable for charging storage batteries. The input power requirement is 210 volts, ±8 percent, 3-phase, 3-wire, 60 cycles ±2 per cent, a-c, but, with transformers, it may be connected to nominal 230- or 250-volt power service. It is self-regulating within ±0.5 per cent and is suitable for use in room temperatures from 0°F to 104°F (-18 to 40C). Since this reissue is a general revision, no revision arrows have been used to denote significant changes. This issue does not affect the Equipment Test List.

***Danger: Voltages inside the rectifier case are over 150 volts to ground. Avoid all contact with terminals. Do not allow a test pick to touch two metal parts at the same time, or destructive or dangerous short circuits may occur. The door switches, when open, disconnect the 3-phase power from the transformers, but leave connected the incoming terminals of contactor AC. They also disconnect battery from the main rectifier elements, but leave connected the CHG fuse and certain other equipment. Battery voltage will be present on the terminals of switch S3 and elsewhere in the rectifier when fuse CHG is removed. The door switches are provided for the protection of personnel and should not be made inoperative.***

**1.02** This section is reissued to:

(a) Add information on the KS-20522 L2 and L3 controllers

(b) Update section in accordance with latest standards.

Revision arrows are used to emphasize the more significant changes. This issue does not affect the Equipment Test List.

**1.03** The electronic control circuit, on response to signals from the connecting circuits, connects itself to the ac supply and the battery charging leads and thereafter automatically regulates its battery charging output. Provision is made for manual operation when desired.

**1.04** The abbreviations cw and ccw, used herein, refer to clockwise and counterclockwise rotation, respectively.

**1.05** Keeping the ventilating passages and rectifier cells clean is especially important to prevent excessive heating.

**1.06** Routine checks are intended to detect defects particularly in infrequently operated parts

of the equipment, and insofar as possible to guard against circuit failures liable to interfere with service. Checks and adjustments, other than those required by trouble conditions, should be made during a period when they will cause the least unfavorable reaction to service.

**1.07** The instructions are based on the following drawing. SD-81115-01, Issue 9B, Fig. 1 and 2. For a detailed description of circuit operation, see the corresponding circuit description. If this section is to be used with equipment or apparatus that is associated with a later issue of the drawing, reference should be made to the SDs and CDs to determine the extent of the changes and the manner in which the section may be affected.

**1.08** More detailed information on the operation and maintenance of individual pieces of apparatus, such as instruments, switches, etc., is given in other sections and the attendant should, of course, be familiar with them. All apparatus is assumed to have been adjusted in accordance with these sections and with the circuit requirements table or the circuit description associated with the circuit drawing.

**1.09** Battery voltage readings called for herein may be made with the plant voltmeter, a KS-8039 volt-milliammeter, or a KS-20599 L4 volt-ohm-milliammeter, provided that the instrument is connected at the battery.

**1.10** The KS-20522 L2 controller (J option) may be substituted for the AR ammeter relay in X and Y option (Lists 2 and 3) rectifiers. The KS-20522 L3 controller may be substituted for the AR ammeter relay in Z option (List 1) rectifiers.

## 2. LIST OF TEST APPARATUS

| CODE OR SPEC NO. | DESCRIPTION |
|---|---|
| KS-20599 L4 | Digital Multimeter |
| KS-14510 | Volt-Ohm-Milliammeter |
| KS-8039 | Volt-Milliammeter |
| 35 Type | Test Set |

## 3. OPERATION

### *Manual Control*

**3.01** MAN potentiometer and resistor R11 form a potentiometer across the two plate supply voltages. They provide an adjustable voltage for use in testing various parts of the control circuit and for manual regulation. Three switches are provided to connect the cathodes of certain tubes to terminal 3 of potentiometer MAN, instead of their normal sources of potential in the automatic control circuit.

> ***Warning: The potentiometer should always be in its extreme ccw position before switching.***

Rotation cw increases the saturation current, raising the output. S5, in its TST1 position, affects tube V2. When in this position, it is used for manual control. S6, in its nonlocking TST2 position, permits testing the 6-7-8 half of V4, which is the final amplifier. S7, in its nonlocking TST3 position, permits testing the 6-7-8 half of tube V6, which is the second stage of the current control amplifier. All switches should remain in their locking NOR positions except when in use in testing.

**3.02** Aging taps are provided on transformers T1 to T3, for use when the main rectifier element has aged, usually after a long period of use. The connections should not be changed from taps 3 to taps 2 until the rated output cannot be obtained from the rectifier and until a thorough check has been made to be sure that there are no troubles.

> ***Note 1:*** If rated output can be obtained with manual control, it will indicate that the transformer taps do not need to be changed.
>
> ***Note 2:*** There is no similar provision of aging taps for varistors SR13-SR16 in the magnetic amplifier.

The varistors should be replaced when necessary, as is indicated by inability to obtain sufficient saturating current under manual control. After the new varistors are installed, it will be necessary to select the correct taps on transformer T14. To do this, operate the rectifier at no load (S3 switch on OPEN) under MAN control, with the MAN potentiometer in the extreme ccw position. Select

those taps which will give the lowest output voltage, as indicated by the OUTPUT VOLTS VM. This value will be considerably lower than normal output voltage.

***Danger: When changing taps, disconnect the rectifier from the power supply before touching the terminals.***

### *Preparing To Start*

**3.03** When putting the rectifier unit into service initially, check against the SD circuit drawing, to see that:

(a) The ON-OFF key is in the OFF position.

(b) Switches S5, S6, and S7 are in their NOR positions.

(c) If input transformers are provided, the taps used are correct for the power supply voltage.

(d) Correct tubes are in the sockets.

(e) The correct CHARGE and VM fuses are in place.

(f) The correct AC CONTROL fuses are in place in the rectifier, and the supply fuses are in the supply panel.

(g) Potentiometers COARSE ADJ VOLTS, OVER CHG, and MAN are each in their extreme ccw positions. Potentiometer CUR MAX is in its extreme cw position. Potentiometer ADJ VOLTS is in its approximate mid-position.

***Note:*** On rectifiers provided with KS-20522 controllers (J option), potentiometer L CONT should be positioned almost fully ccw and potentiometer H CONT should be positioned almost fully cw.

(h) CHG-FLOAT switch S2 is operated to the CHG position.

(i) Switch S3 is operated to that output lead which is connected to the emergency cells.

***Warning: Except as indicated in 3.02, do not start the rectifier unit with S3 on OPEN.***

(j) Covers and doors are tightly closed so that the door switches are operated.

(k) Circuit breakers, CONT and CHG ALM, are closed.

(l) There is available sufficient office load to load the rectifier fully, or a variable load of adequate capacity.

### *Initial Adjustments*

**3.04** Observe the directions in 3.03. Operate switch S5 to TST1 and ON-OFF key to ON. Allow several seconds for the tubes to heat. Rotate the shaft of the MAN potentiometer slowly cw, observing the SAT CURRENT milliammeter, and the OUTPUT CURRENT ammeter relay.

***Caution: Add load to the battery or reduce the output of other rectifiers supplying it, as required to avoid service reactions.***

Bring the output up to its full rated value. Reverse the operation, finally bringing potentiometer MAN to its full ccw position. Restore S5 to normal and the ON-OFF key to OFF.

**3.05** When preparing to adjust for ***float voltage,*** operate S2 to FLOAT and S3 to that output lead which is connected directly to the main battery. Operate the ON-OFF switch to ON, allow the tubes to heat, and rotate the shaft of the COARSE ADJ VOLTS potentiometer cw until, with the battery at float voltage, the rectifier is carrying its share of the load or, if there are no other rectifiers operating in parallel with it, until it is carrying the entire load on the battery. During this adjustment, the rectifier output current should be between 25 per cent and 75 per cent of full load.

**3.06** To adjust the CUR MAX potentiometer, place the rectifier on manual regulation and reduce the output current to 25 percent, or less, of full load. Allow the battery to discharge to 90 per cent of float voltage, or lower, by manually reducing the output of other rectifiers or charging generators supplying it, or by adding load. With the rectifier still on manual regulation, bring the output current up to about 120 per cent of full load and after about 5 seconds, switch to automatic regulation. Rotate the shaft of the CUR MAX potentiometer slowly ccw until the rectifier output

current stabilizes at about 110 per cent of full load when the battery voltage is between 94 per cent and 96 per cent of the float voltage. Using the KS-8039 volt-milliammeter with the 1.5-volt range connected across the AR shunt at terminals 2 and 3, output current of the value of 110 per cent of full load will be indicated by 0.275 volt on the instrument and 120 per cent of full load by 0.300 volt. As an alternative, use a 35-type test set, connecting its BAT and GRD terminals, respectively, to terminals 3 and 2 of the shunt. Bring up one of the sliders to somewhat more than 25 ohms and connect terminals T and R together. Under manual control, bring the rectifier output current to 90 per cent of full load, as indicated by the ammeter relay, and adjust the slider to give an indication of 9 milliamperes on the 15 mil-amps scale. Leave the slider undisturbed. A load of 110 per cent of full load will give an indication of 11 milliamperes and one of 120 per cent, an indication of 12 milliamperes.

**3.07** Adjust the ***overcharge voltage*** by rotating the shaft of the OVER CHG potentiometer cw, until the desired battery voltage is obtained. This setting should be rechecked when the output current is less than 3/4 load on the rectifier. Note that the potentiometer may be short-circuited by the connecting circuit and is ineffective in that event. See that such short circuit is temporarily removed.

**3.08** As a final step in the initial adjustments of the rectifier, set the ADJ VOLTS potentiometer to obtain the desired float voltage. The adjustment should be made with the battery fully charged, or nearly so, and with the rectifier carrying approximately its normal load, if known, otherwise with a load of one-quarter to three-quarters of full load. The regulation should then be checked by varying the load over the full range from no load to 80 percent load. It should remain within the working limits. If, at any time, it is necessary to reset the COARSE ADJ VOLTS potentiometer, the ADJ VOLTS potentiometer should first be restored to its mid-point.

> ***Note:*** On rectifiers provided with KS-20522 Controllers (J option), potentiometer designated L CONT should be set to provide ground at terminal 7 when the rectifier output is 5 percent of rated full load current and the H CONT potentiometer should be set to provide ground at terminal 8 when the rectifier output is at rated full load current.

***Routine Adjustments (Day-to-day Operation)***

**3.09** The rectifier unit is completely automatic in the regulation of float voltage and should require no routine adjustments. It is started and stopped by the operation of the ON-OFF key. If the load on the battery exceeds the safe capacity of the rectifier, it limits its output current, allowing the battery voltage to decrease. As the load diminishes, the rectifier brings the battery voltage to the float value and returns to voltage regulation. Operation of a key in the connecting circuit removes a short circuit from the OVER CHG potentiometer, causing the rectifier to operate under voltage regulation at a higher value, determined by the setting of the potentiometer. Never turn the rectifier ON under automatic control before the battery or load is connected (switch S3 on a terminal connected to battery) as, otherwise, the rectifying cells may be punctured and fail. The rectifier unit should start and build up its output in less than one minute. The amount of current in the regulating coils of the reactors is indicated on ammeter SAT CURRENT. A typical value at one-half load is in the order of 85 milliamperes, the extremes being about 15 to 225 milliamperes. The output voltage and current of the rectifier unit will be indicated on voltmeter VM and ammeter relay OUTPUT CURRENT.

**3.10** Switch CHG-FLOAT will normally be in the FLOAT position. Usually a boost charge of the battery can be made with the switch in the FLOAT position. The CHG position is required when the battery and emergency cells are charged in series. While regulation can be secured for normal operation with the switch in the CHG position, this is inadvisable as it results in a much poorer input power factor.

## 4. ROUTINE CHECKS

**4.01** Routine checks of the vacuum tubes should be made periodically with the vacuum tube tester available in the office, in accordance with the standard information on that tester.

**4.02** The relays should be inspected occasionally for adjustment and condition of contacts, making sure that they are in accordance with the circuit requirements and BSPs which apply.

## 5. TROUBLES

**5.01** This rectifier unit consists of a main power circuit controlled through an electronic regulating circuit whose input is the output voltage of the main unit. In addition, the drop in voltage across the output ammeter relay shunt is introduced into the regulating circuit, for the purpose of current limitation. The output of the regulating circuit is introduced into the main power circuit to effect the desired corrections in the power output. In the maintenance of intricate equipment, trouble must be localized in an orderly way. This is difficult in the case of a circuit having this feedback or loop arrangement because trouble anywhere in the loop will give faulty operation of other parts of the loop which may be trouble-free. In this rectifier unit, provision has been made for opening the loop by means of switches which permit checking the performance of each major subdivision of the equipment until the trouble is located. See 3.01 and 3.04.

***Warning: The MAN potentiometer should always be turned completely ccw before operating a test switch, to avoid excessive voltage and current.***

**5.02** The saturating current, although it may vary widely with extreme conditions, when observed in connection with daily routine and compared with operating experience, can serve as a guide to the causes of unusual operation or trouble conditions. The purpose of the saturating current milliammeter is to give a continual indication of the output of the regulating circuit, which output also controls the input to the main power rectifying circuit. The saturating current supply circuit and main power circuit are generally performing satisfactorily if increasing the amount of saturating current increases the rectifier output and decreasing the saturating current decreases the rectifier output. Provision is made to control this saturating current manually, in which case most of the features of the more complex regulating circuit are temporarily disabled. Three test switches provide for the application of a manually adjustable potential from potentiometer MAN in the grid-to-cathode circuits of certain tubes as follows:

| Switch | Tube |
|---|---|
| S5 | V2 |
| S6 | V4 (6-7-8 half) |
| S7 | V6 |

By their separate operation to their test positions (in each instance the other two switches remaining on NOR) the series tube, the final amplifier, and the second current control amplifier may be tested.

**5.03** When any kind of trouble is encountered, it is necessary first to decide whether to locate the trouble with the equipment operating or de-energized. This rectifier unit has been designed to make some parts accessible for testing with the power connected. The jacks are mounted in the face of the panel, which is accessible when the front doors are open. All parts over 150 volts to ground have been covered. Trouble is easier to find if the equipment can be fully energized, but if it is of a nature that causes excessive output from the equipment, it will be necessary to take the initial steps with the system de-energized, energizing it in subdivisions for short periods only while electrical measurements are made. Also, operation for more than a few minutes at a time while trouble exists, even though the output may not be excessive, may result in overheating of some component. It is essential when testing to be alert for the need for quickly shutting down the rectifier at any time until the trouble is localized and cleared.

**5.04** In general, the only items likely to become defective with use are the vacuum tubes which are subject to aging but should have long useful life. See 4.01.

**5.05** The control potentiometers, the KS-15119 switches, and the KS-5649 door switches should be replaced if they become defective in any respect.

**5.06** Varistors will age with use, and after a period of years may require changing the connection from the NEW to the AGED tap, where this arrangement is available. In other cases, varistor RV1, or any or all of varistors SR13 to SR16 must be replaced. See 3.02. Because it is not practicable to retighten the bolt to the original pressure, no attempt should be made to replace part of the rectifier cells in a stack or bolt assembly.

*Trouble Chart*

**5.07** Should any troubles develop, it is suggested that the possible cause be checked in accordance with the trouble chart in the order given. If the trouble is not found, look for loose or open connections or short circuits due to foreign matter lying across wiring terminals. If a check of the possible causes listed below or the use of the point-to-point voltage table does not lead to the location of the trouble, it is advisable to make resistance measurements with the circuit completely de-energized, comparing the measured values with the values shown on the circuit drawing.

## 6. POINT-TO-POINT VOLTAGES

**6.01** Point-to-point voltages are intended for use when unsatisfactory operation is encountered, in which case they may prove useful in locating the cause. They are not operating requirements to be checked in routine and are not needed while the rectifier unit is operating satisfactorily. As given in the tables, they are approximate and typical of a unit connected to normal power supply, adjusted to the float voltage of the battery and carrying load as indicated.

**6.02** High voltages, over 600 volts to ground, are present within the rectifier unit, and every precaution should be observed to avoid any contact with exposed metal parts or terminals when the rectifier unit is in operation.

***Danger: When using any portable instrument, the leads should be carefully examined to make sure the insulation is undamaged. They should be connected at the instrument before making contact with the circuit to be tested. If connections are to be changed from one instrument jack to another, the a-c should first be disconnected from the equipment being tested or, if test picks are being used, they should be removed from the equipment under test.***

**6.03** Readings may be made with the KS-14510, KS-8039, or KS-20599 L4 meters. In general, door switches are not intended for use in disconnecting power, but for convenience, they may be so used during the infrequent taking of point-to-point voltages.

**6.04** ***Tables of Point-to-point Voltages***

(a) Tube socket voltages are given below in volts, d-c, as read between jack GRD and the socket terminal number indicated. Viewed from the rear, the socket terminals, starting from the keyway or blank position, are numbered clockwise.

| TROUBLE | POSSIBLE CAUSE |
|---|---|
| No dc output current | Power failure<br>Blown ac supply or control fuse<br>Blown CHG fuse<br>Door switch open<br>Failure of tube V1, V2, or V4<br>Shorted capacitor C31-C35<br>COARSE ADJ VOLTS or ADJ VOLTS potentiometer out of adjustment<br>No saturating current<br>Relay AC, CA, or ST not operated<br>L CONT and H CONT potentiometers out of adjustment (J option) |
| Low dc output current<br>Low saturating current | Low line voltage<br>Tube V2 failure<br>Tube V1, V2, or V4 low emission or aged<br>Varistors SR13-SR16 aged<br>COARSE ADJ VOLTS or ADJ VOLTS potentiometer out of adjustment<br>Aged voltage reference tube V3<br>L CONT and H CONT potentiometers out of adjustment (J option) |
| Rated output current not obtainable with saturating current maximum, under MAN control | One of three line leads open or high resistance connection in line circuit<br>CHG-FLOAT switch on FLOAT when charging especially emergency cells<br>Main rectifier cells high resistance due to aging |
| High dc output current | COARSE ADJ VOLTS or ADJ VOLTS potentiometer out of adjustment<br>High line voltage<br>Aged varistor RV3<br>OVER CHG potentiometer not short-circuited in connecting circuit<br>Failure or low emission of tube V5<br>L CONT and H CONT potentiometers out of adjustment (J option) |
| Low dc output<br>High saturating current | Unbalance in ac line voltages<br>The ac voltages applied to the rectifying element (terminals AC1, AC2, AC3) differ by more than 5 percent<br>CHG-FLOAT switch on FLOAT when charging, especially emergency cells<br>Main rectifier cells high resistance due to aging |
| Output excessively noisy | The ac voltages applied to the rectifying element (terminals AC1, AC2, AC3) differ by more than 5 percent<br>Filter capacitors aged or defective<br>Filter capacitor connections loose or open<br>Defective cells in one or more of the stack assemblies constituting the main rectifying elements. |
| Cannot reduce dc output current to zero with saturating current minimum under MAN control | CHG-FLOAT switch on CHG instead of FLOAT<br>High line voltage |

## READINGS MADE WITH A 20,000 OHMS/VOLT OR GREATER INSTRUMENT – SEE NOTE

### RATED OUTPUT 100 AMP, 24 VOLTS

#### LOAD – 10 AMP

| TUBE | SOCKET TERMINAL NUMBER | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| V2 | — | 200 | 580 | 580 | 145 | — | 200 | — |
| V4 | — | 9 | — | 155 | — | 200 | 148 | 155 |
| V5 | — | 155 | 73 | 265 | — | — | 152 | — |
| V6 | — | 1.5 | 0 | 64 | — | 75 | 55 | 60 |

#### LOAD – 50 AMP

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| V2 | — | 190 | 550 | 550 | 145 | — | 190 | — |
| V4 | — | 9 | — | 150 | — | 190 | 145 | 155 |
| V5 | — | 155 | 85 | 265 | — | — | 150 | — |
| V6 | — | 1.5 | 0 | 66 | — | 85 | 60 | 60 |

### RATED OUTPUT 200 AMP, 24 VOLTS

#### LOAD – 20 AMP

| TUBE | SOCKET TERMINAL NUMBER | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| V2 | — | 200 | 570 | 570 | 145 | — | 195 | — |
| V4 | — | 9 | 1.5 | 155 | — | 199 | 148 | 155 |
| V5 | — | 155 | 73 | 260 | — | — | 152 | — |
| V6 | — | 1.5 | 0 | 60 | — | 75 | 55 | 60 |

#### LOAD – 100 AMP

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| V2 | — | 188 | 520 | 520 | 145 | — | 187 | — |
| V4 | — | 8.8 | 1 | 150 | — | 186 | 145 | 155 |
| V5 | — | 155 | 85 | 265 | — | — | 150 | — |
| V6 | — | 1.5 | 0 | 60 | — | 85 | 60 | 60 |

### RATED OUTPUT 100 AMP, 48 VOLTS

#### LOAD – 10 AMP

| TUBE | SOCKET TERMINAL NUMBER | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| V2 | — | 195 | 580 | 580 | 145 | — | 196 | 196 |
| V4 | — | 17 | 14 | 150 | — | 195 | 144 | 153 |
| V5 | — | 154 | 80 | 270 | — | — | 159 | — |
| V6 | — | 1.4 | 0 | 67 | — | 80 | 65 | 67 |

READINGS MADE WITH A 20,000 OHMS/VOLT OR GREATER INSTRUMENT – SEE NOTE

| RATED OUTPUT 100 AMP, 48 VOLTS (Contd) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| LOAD – 50 AMP | | | | | | | | |
| TUBE | SOCKET TERMINAL NUMBER | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| V2 | — | 187 | 550 | 560 | 145 | — | 192 | 192 |
| V4 | — | 17 | 14 | 150 | — | 192 | 144 | 153 |
| V5 | — | 153 | 87 | 270 | — | — | 150 | — |
| V6 | — | 1.4 | 0 | 68 | — | 89 | 65 | 68 |

*Note:* For the foregoing readings, use the smallest range which is applicable for the magnitude of the voltage being observed, except as follows:

V2 — Term 2 use 1000-volt range
V4 — Term 3 use 250-volt range
V6 — Term 7 use 1000-volt range

## TYPICAL VALUES OF VOLTAGE BETWEEN JACKS OR ACROSS ITEMS OF APPARATUS

| VOLTAGE ACROSS | INSTRUMENT CONNECTIONS +TERM APP | +TERM TERM | −TERM APP | −TERM TERM | AC/DC | 20,000 OHMS/V OR GREATER INST RANGE | VOLTS AT 10 AMP | VOLTS AT 50 AMP |
|---|---|---|---|---|---|---|---|---|
| **RATED OUTPUT 100 AMPS, 24 VOLTS** | | | | | | | | |
| Reg Leads | Jack | REG+ | Jack | REG− | D-C | 50 | 26 | 26 |
| Sat Ckt | Jack | S+ | Jack | S− | D-C | 50 | 8 | 12 |
| Reg plt sup | Jack | P | Jack | GRD | D-C | 250 | 145 | 145 |
| Unreg plt sup | Jack | B | Jack | P | D-C | 250 | 122 | 122 |
| Varistors SR13 to SR16 | T15 | 3 | T15 | 1 | A-C | 250 | 74 | 130 |
| | TS | 39 | TS | 40 | D-C | 250 | 32 | 80 |
| Main Rectifying Element | Term | AC1 | Term | AC2 | A-C | 50 | 19.5 | 20 |
| | Term | AC2 | Term | AC3 | A-C | 50 | 19.5 | 20 |
| | Term | AC3 | Term | AC1 | A-C | 50 | 19.5 | 20 |
| | Term | + | Term | − | D-C | 50 | 26.4 | 26.5 |
| **RATED OUTPUT 200 AMPS, 24 VOLTS** | | | | | | | VOLTS AT 20 AMP | VOLTS AT 100 AMP |
| Reg Leads | Jack | REG+ | Jack | REG− | D-C | 50 | 25 | 25.2 |
| Sat Ckt | Jack | S+ | Jack | S− | D-C | 50 | 10 | 16 |
| Reg plt sup | Jack | P | Jack | GRD | D-C | 250 | 145 | 145 |
| Unreg plt sup | Jack | B | Jack | P | D-C | 250 | 118 | 118 |
| Varistors SR 13 to SR16 | T15 | 3 | T15 | 1 | A-C | 250 | 70 | 142 |
| | TS | 39 | TS | 40 | D-C | 250 | 35 | 91 |
| Main Rectifying Element | Term | AC1 | Term | AC2 | A-C | 50 | 19.5 | 20 |
| | Term | AC2 | Term | AC3 | A-C | 50 | 19.5 | 20 |
| | Term | AC3 | Term | AC1 | A-C | 50 | 19.5 | 20 |
| | Term | + | Term | − | D-C | 50 | 25.5 | 26 |
| **RATED OUTPUT 100 AMPS, 50 VOLTS** | | | | | | | VOLTS AT 10 AMP | VOLTS AT 50 AMP |
| Reg Leads | Jack | REG+ | Jack | REG− | D-C | 50 | 49.2 | 48.1 |
| Sat Ckt | Jack | S+ | Jack | S− | D-C | 50 | 8.5 | 14 |
| Reg plt sup | Jack | P | Jack | GRD | D-C | 250 | 145 | 146 |
| Unreg plt sup | Jack | B | Jack | P | D-C | 250 | 124 | 123 |
| Varistors SR13 to SR16 | T15 | 3 | T15 | 1 | A-C | 250 | 70 | 140 |
| | TS | 39 | TS | 40 | D-C | 250 | 30 | 81 |
| Main Rectifying Element | Term | AC1 | Term | AC2 | A-C | 50 | 40 | 41.3 |
| | Term | AC2 | Term | AC3 | A-C | 50 | 40 | 41.3 |
| | Term | AC3 | Term | AC1 | A-C | 50 | 40 | 41.6 |
| | Term | + | Term | − | D-C | 50 | 49.5 | 49 |