IMPORTANT!
READ ALL OF THESE INSTRUCTIONS

To assure the best performance from your Corrpower Cathodic Protection Rectifier, please give special attention to all **WARNING, INSTALLATION** and **OPERATING** instructions supplied with this unit.

WARNING! ELECTRICAL EQUIPMENT

Direct all installation and servicing to properly trained and qualified personnel. Failure to correctly install or service this electrical equipment may expose you to dangerous voltage points or other risks resulting in injury or death.

Refer to the manual for further instructions.

INSTALLATION INSTRUCTIONS

INSPECTION

Inspect the packaging as well as the inside and outside of the rectifier for shipping damage. DO NOT attempt to install or operate damaged equipment.

Inspect and tighten any hardware or wiring that may have come loose during shipment.

INSTALLATION - THE ENCLOSURE MUST BE PROPERLY GROUNDED

Be sure AC voltage and phase correspond to the AC rating of the unit. That rating is on the serial number label on the inside of the front door. If the rectifier has dual ratings, be sure the Hi/Low voltage change buss bar is set for the input voltage.

Anodes should be wired to the (+) terminal; Structure to the (-) terminal.

Set voltage taps on the lowest settings (A-1), 3-phase models must have each phase set to the same coarse and fine position. For start-up of Automatic rectifiers, see manual.

If oil cooled, be sure oil is to the cold fill line and that VOLT-ESSO 35 or equivalent NEMA grade 10C uninhibited oil is used.

If air cooled, be sure there are no obstructions blocking the air vents, louvers, or screen.

START-UP

Turn the AC breaker to "ON" and check the output via DC meters. If the breaker trips or if overheating is observed, turn the breaker off and refer to the users manual for troubleshooting.

Adjust taps up one step at a time until desired DC current or voltage is obtained.
DO NOT EXCEED RATED OUTPUT OF RECTIFIER!

For further information, refer to the enclosed manual.

File: WARNING CDR

CORRPRO
CANADA INC

ONE YEAR GUARANTEE ON ALL CORRPOWER CATHODIC PROTECTION RECTIFIERS

Unless otherwise specified, all products designed and manufactured by the CORRPOWER Rectifier Division are guaranteed against defects in material and/or workmanship for a period of one (1) year, from date of purchase by the original purchaser. The obligation of the CORRPOWER Rectifier Division under this guarantee is limited to repair, adjustment or replacement at our factory of any rectifier, or parts thereof, which may, after being returned with transportation charges prepaid, be found defective in material and/or workmanship upon detailed examination. CORRPOWER reserves the right to make any change in design or specification that it deems an improvement, with no liability to make same changes on existing equipment. This guarantee is in lieu of all other guarantees or warranties, expressed or implied, which might otherwise exist. The purchaser is relying only upon this guarantee and not upon any representations not herein expressed. This warranty is void if any damage is caused by vandalism, misuse, incorrect installation, or any alterations to the product by un-authorized personnel. This warranty does not cover damage caused by lightning, flooding, or any other acts of God. Any materials being returned to the factory must first have a return materials authorization number (RMA) from the CORRPOWER Rectifier Division repair department, for an RMA number please contact (780) 447-4565 extension 381.

CORRPOWER
RECTIFIER DIVISION

CORRPOWER
RECTIFIER DIVISION

OPERATING MANUAL

FOR

MANUAL CONSTANT VOLTAGE CATHODIC PROTECTION RECTIFIERS

CORRPOWER RECTIFIER DIVISION

WARRANTY STATEMENT

CORRPOWER DESIGNS

CORRPOWER POLICY

- CORRPOWER extends a one-year guarantee on all rectifier units designed by CORRPOWER engineering staff.
- CORRPOWER reserves the right to make any change in design or specification that it deems an improvement, with no liability to make same changes on existing equipment.
- This guarantee is in lieu of all other guarantees or warranties, expressed or implied, which might otherwise exist. The purchaser is relying only upon this guarantee and not upon any representations not herein expressed.
- Any materials being returned to factory must first have return authorization from the CORRPOWER Rectifier Division.

ONE YEAR GUARANTEE ON ALL CORRPOWER CATHODIC PROTECTION RECTIFIERS

Unless otherwise specified, all products designed and manufactured by the CORRPOWER Rectifier Division are guaranteed against defective material and/or workmanship for a period of one (1) year, from date of purchase by the original purchaser. The obligation of the CORRPOWER Rectifier Division under this guarantee is limited to repair, adjustment or replacement at our factory of any rectifier, or parts thereof, which may, after being returned with transportation charges prepaid, be found defective in material and/or workmanship upon detailed examination.

CUSTOMER DESIGNS

CORRPOWER POLICY

- It is recognized that many of our customers prefer to purchase rectifiers manufactured to their own design and/or specification due to special job requirements. As such, the CORRPOWER Rectifier Division has manufactured many rectifiers to customer specific designs, if economically feasible, and will continue to follow this practice.
- This guarantee is in lieu of all other guarantees or warranties, expressed or implied, which might otherwise exist. The purchaser is relying only upon this guarantee and not upon any representations not herein expressed.
- Any materials being returned to factory must first have return authorization from the CORRPOWER Rectifier Division.

ONE YEAR GUARANTEE ON ALL CORRPOWER SPECIAL CATHODIC PROTECTION RECTIFIERS MANUFACTURED TO CUSTOMER SPECIFICATIONS

Unless otherwise specified, the guarantee on products manufactured by, but not designed by, the CORRPOWER Rectifier Division, will be limited to a guarantee against defective material and/or workmanship only, and not performance or electrical characteristics, for a period of one (1) year from date of purchase by the original purchaser. The obligation of the CORRPOWER Rectifier Division under this guarantee is limited to repair, adjustment or replacement at our factory of any rectifier, or parts thereof, which may, after being returned with transportation charges prepaid, be found defective in material and/or workmanship upon detailed examination.

REV 06/00

TABLE OF CONTENTS

A. INTRODUCTION

This Operation Manual has been prepared for the specific rectifier as identified by the serial number on the unit. It is recommended that it be kept inside the rectifier enclosure for quick reference. Store it in the space provided. Do not place it so that it will impede air flow through the enclosure.

CORRPOWER Rectifiers are built by skilled personnel and are designed by an engineering staff with years of experience. Every effort has been made to use the latest in reliable components, so that these rectifiers are of the highest quality consistent with reasonable costs.

CORRPOWER maintains a file on every rectifier by serial number only. Therefore, the **SERIAL NUMBER** must be specified when requesting information, or ordering parts, for this rectifier unit.

B. DELIVERY INSPECTION

If damage has occurred during shipment, **FILE A CLAIM WITH THE CARRIER IMMEDIATELY.** Even if the rectifier unit is not being installed at the field site immediately, the rectifier should still be removed from the carton and inspected for shipping damage prior to storage of the unit. If it is necessary to contact your supplier or the manufacturer concerning damaged or missing components, be sure to include all information such as Serial Number, Purchase Order Number and Invoice Number. This will ensure that you obtain proper and expeditious service.

C. STORAGE

If units are to be stored prior to use for extended periods of time, it is recommended that they be stored in a dry area, preferably indoors. However, if this is not possible, cardboard wrapping should be removed from around enclosures designed for outdoor use to prevent holding rain or snow moistened packing against the enclosure. Indoor designed enclosures should have, at least, the benefit of some overhanging protection or be covered with a moisture-proof material.

D. INSTALLATION

Proper rectifier installation procedures are necessary to ensure the integrity of the cathodic protection system. These procedures are as follows:

1. Check all electrical connections to make sure they are tight. Though this is done at the factory, it is a good idea to re-tighten all connections, especially those that carry electrical current.

2. Select the mounting site for the rectifier; paying special attention to accessibility, proper ventilation, shielding from sources of high ambient temperatures, and most importantly, convenience to A.C. and cathodic protection connections.

3. Mount rectifier securely on mounting pad, wall or post (as applicable).

4. Have a qualified electrician make electrical connections, following the electrical and local codes. A disconnect switch is required ahead of the A.C. input to the rectifier. We do not recommend connecting the rectifier to the same AC circuit as other large pieces of equipment (such as a pump-jack motor) that may cause the AC power input to fluctuate.

5. **BEFORE ENERGIZING**, double check to ensure the rectifier is appropriately sized for the A.C. input being applied.

6. **ENSURE CORRECT POLARITY ON D.C. CONNECTIONS**, connecting negative to the structure being protected and positive to the anode leads.

7. **BEFORE** turning on the input breaker, ensure the taps are at the lowest setting: **COARSE "A" & FINE "1".** Tap adjustments should always be made from the lowest setting to prevent damage to the rectifier or prematurely blowing the rectifier fuse. For variable transformer adjusted units, ensure the adjustment knob is at the "0" setting.

8. On three phase units, ensure that all three sets of adjustment taps are set alike.

9. Initially set the rectifier to approximately half of the required output current by moving the tap bars, or variable transformer adjustment knob, as required. Increase the **COARSE** adjustment bar position by one step (from A to B), energize the unit, and check the rectifier output (as displayed on the panel meters). Repeat as required until the rectifier output current is close to half the required output. The rectifier should be left energized for several minutes to allow for examination. If operation appears normal, the **COARSE & FINE** adjustment bar can then be further increased until the required rectifier output current has been achieved.

10. The rectifier should be operated at the required D.C. output current for about one hour to determine that there are no defects in the connections. Shut the A.C. power **OFF** at the disconnect switch and immediately feel all current carrying connections to see that none of them are overheating. Connections may be warm, but should not feel excessively hot.

11. Air-cooled rectifiers utilize natural air convection for cooling and are typically manufactured with screened openings on the top and bottom of the enclosure. Ensure these vents are not obstructed by plugged screens or by placing the rectifier manual over the bottom vent.

12. Periodically monitor the rectifier, re-adjusting as necessary to maintain the level of cathodic protection current required.

E. MAINTENANCE

C.P. rectifiers rarely have moving parts other that the indicating meter movements and therefore, maintenance is largely of a preventative nature. Bear in mind there are primarily three conditions that will affect the life of a C.P. rectifier:

1. Excessive component temperatures.
2. Voltage surges and lightning.
3. Excessive current output.

Maintenance can be the best deterrent against rectifier failure due to excessive temperatures. Regular checks for blocked venting and/or heat from a man-made source should be undertaken. Periodic re-tightening of electrical connections is good insurance against future trouble.

CAUTION: **Hazardous voltages are present within the rectifier. ALWAYS interrupt the A.C. power at the nearby disconnect. The rectifier A.C. breaker DOES NOT totally remove all incoming A.C. power from the rectifier.**

If excessive heating of rectifier components and/or wiring is suspected, a temperature probe is a very useful maintenance tool. The following is a guide for maximum temperatures. These temperatures are based on a 45°C ambient. The difference between 45°C and the ambient temperature at time of testing should be subtracted from the readings in this table:

COMPONENT TEMPERATURE TABLE

COMPONENT	MEASUREMENT POINT	MAX. TEMPERATURE
Moulded Bridge	Moulded Body	110°C
Silicon Diode	Body	115°C
Main Transformer	Primary Winding	160°C
Filter Inductor (Choke)	Winding	160°C
Filter Capacitor	Case	80°C
Secondary / Output Fuse	Metal End Cap	130°C

Current Shunt	Center Element	75°C (See Note 1)
Electrical Connections	Bolt Body	90°C
Electrical Wiring	Wire Harness	90°C

(Note 1: Based on a typical vented, air-cooled type rectifier unit.)

Maintenance against voltage surges is largely one of ensuring the lightning and surge protection supplied with the unit is intact. Keep large motor driven equipment (such as pump-jack motor) or similar surge producing electrical equipment from being attached to the same A.C. power line as the rectifier, whenever possible. Lightning rods may prove invaluable in excessive lightning areas.

Maintenance against excessive current output requires monitoring of rectifier output and logging the data to enable the operator to predict when an over current situation may occur. If a protective device (input breaker or rectifier fuse) has operated, it is an indication of overload or component failure. If a fuse has operated, always replace it with the rating and type as indicated on the rectifier Specification / Parts Listing (included with this manual) or as shown on the damaged fuse itself. Prior to re-energizing the unit, the rectifier diode bridge should be tested (as per Step 7 of the Troubleshooting section) to ensure that if there were a shorted diode in the bridge, it would be found and replaced prior to damaging the newly installed fuse.

Meter readings should be verified with an external Digital Voltmeter. A quick calibration for ammeter accuracy can be made by measuring the millivolt drop across the shunt. This should be done with a high input impedance meter set to the "mV" range. The actual reading is given by:

$$I(DC) = \frac{V \times I(SHUNT)}{50}$$

Where:
- I (DC) = Actual D.C. Current Output (amperes)
- V = Voltage Reading Across Shunt Element (millivolts)
- I (SHUNT) = Shunt Current Rating

Meter accuracy should be within 2% of the full-scale deflection of the meter combined with an allowance for temperature of 0.85% per 10°C for temperatures other than 25°C.

A periodic check of rectifier conversion efficiency will also indicate if the rectifier is functioning properly. If a portable A.C. wattmeter is unavailable, the utility pole mounted watt-hour meter could be used. This, of course, is if no other electrical loads are drawing power when the A.C. draw is being determined.

$$\text{A.C. Power (Watts)} = \frac{3600\ KN}{T}$$

Where: K = Watt-hour meter constant (shown on meter face)
N = Number of revolutions of watt-hour meter disk
T = Time in seconds for the number of revolutions

D.C. Power is the product of the measured D.C. Voltage X D.C. Amperage

Rectifier conversion efficiency will be:

$$\frac{\text{D.C. Power Out}}{\text{A.C. Power In}} \times 100 = \%\ \text{conversion efficiency}$$

For manual, constant voltage, full-wave silicon diode bridge rectifiers, conversion efficiencies of approximately 75% for single phase will indicate a properly functioning rectifier.

F. TROUBLE SHOOTING

Although quality construction and preventative maintenance will reduce rectifier down time, failures will occasionally occur. A good knowledge of rectifier operation will enable a potential problem to be quickly traced and repaired.

RECTIFIER TEST EQUIPMENT:

The following equipment is essential for basic rectifier trouble-shooting.

1.	Electronic Multi-Meter:	preferably with a 750 VAC and a diode check range. (Fluke 70 or 20 series)
2.	Clamp-on A.C. Ammeter:	must have low current D.C. measurement capability. (Fluke or Amprobe recommended)
3.	Resistive Load:	2-5 ohms with a 1000 Watt capacity recommended.
4.	Misc. Hand Tools:	1/4" - 3/4" S.A.E. combination wrenches; 1/4" - 1/2" S.A.E. nut-drivers; 3/16", 1/4" and 5/16" blade screwdrivers; #1, #2 and #2 long socket screwdrivers; 3/8" drive S.A.E. socket set with deep sockets.

5. Temperature probe: (Optional) must have a range of -50° to +150° C. (Fluke 80T-150U)

TROUBLE SHOOTING PROCEDURE:

The majority of rectifier faults are easy to diagnose. They include loss of A.C. input, blown fuses, loose terminals, faulty meters, blown M.O.V. suppressors, open circuits, faulty cathodic load connections, and lightning damage. Visual inspection and smell can be very useful for the initial examination of a faulty rectifier for the above faults.

The initial inspection should be followed by a systematic isolation of various rectifier components to determine the cause of non-operation. This should be conducted as follows (refer to the schematic for test point locations).

CAUTION: Beware of hazardous electrical voltages and where they are present in the rectifier. If doing any work on a rectifier other than taking voltage or current measurements, **DISCONNECT THE A.C. POWER**, preferably at the rectifier disconnect, not just using the rectifier circuit breaker.

1. Check whether A.C. voltage is present at the rectifier input terminals and that it is the correct level for the rectifier input rating. Provided the input breaker has not tripped **OFF**, this voltage check should be done with the rectifier **ON**. This will eliminate any static voltage reading such as might be experienced if only one A.C. line entering the rectifier is broken.

2. If the input breaker continues to trip **OFF** when energized, this usually indicates a short circuit within the rectifier. Proceed as follows;

   a) Remove both tap bars (shown by Coarse & Fine taps on schematic) to isolate the bridge. Again, energize the breaker. If the breaker now holds, the problem is a shorted diode(s) in the bridge assembly. Check the bridge assembly and replace defective diode(s). (See #7 below)

   b) With the rectifier disconnected from the A.C. supply, do an ohmmeter check between ground lug and the load side(s) of the input breaker (right side of CB1 on schematic). Any detectable resistance will indicate a primary to ground breakdown. A "Megger" test instrument is preferred for this test if available. Any fault will necessitate replacement of the transformer.

   c) Visually inspect the transformer for any signs of burned or shorted windings.

d) Check for shorted A.C. lightning arrestors.

3. An intermittent voltage reading nearly always indicates a loose or burned connection.

4. Verify there is transformer secondary voltage. A measurement of the voltage across **COARSE 'E' to FINE '5'** should be 1.35 to 1.6 times the D.C. output voltage rating of the rectifier.

5. Verify the **COARSE** steps as being approximately 20% of the measurement (item 4 above) and that the **FINE** steps are approximately 20% of the voltage of each **COARSE** step.

6. Measure the A.C. voltage at the diode bridge assembly (same as connection points of MOV1 on schematic). It should be the same as measured across the tap bars, otherwise the fuse has operated or the wire is burned or broken.

7. Conduct a diode check of the bridge assembly as follows:

   a) Disconnect power from the rectifier and remove the tap bars.

   b) With the multimeter set to the diode check range, place the **POSITIVE** (Red) lead on the bridge negative terminal (negative side of shunt on the schematic) and touch the **NEGATIVE** (Black) lead to the bridge A.C. terminals (same as connection points of MOV1 on schematic). A good diode will measure between 0.3 & 0.6 and the Fluke meter will give a single BEEP. This will check diodes D3 and D4. An open (OL with no beep) or short circuit (0.0 with a continuous beep) reading will indicate a faulty diode.

   c) Similarly, place the **NEGATIVE** meter lead on the bridge positive terminal (connection point between D1 & D2 on schematic) and now touch the other lead to the bridge A.C. terminals. This will check diodes D1 and D2.

   d) Replace faulty diodes with the same type and polarity. Do not over-tighten stud mount diodes. Recommended torque is 30 inch-pounds for a ¼" Stud device.

8. Check for the presence of voltage at the D.C. positive and negative terminals of the bridge and at the rectifier D.C. output lugs. If the voltage is present at the stack but not at the terminals, check for open circuits in the wiring (or a blown D.C. fuse).

NOTE: With no load, a sensitive electronic meter may read a static potential which is much higher that the actual D.C. voltage. It may be necessary to place a small test load across the rectifier output lugs that will eliminate the false reading of the electronic voltmeter.

9. **If the correct D.C. voltage is measured at the rectifier D.C. output terminals but no D.C. output current is measured, there is an open circuit in the D.C. output circuit.** This open circuit could be either in the cables leading to the C.P. load or in the connection to the C.P. load.

10. Ensure to verify rectifier panel meter readings with an external Digital Voltmeter (DVM). Rectifier meters may indicate a rectifier fault when no actual fault exists.

11. Meter switches are often a source of meter reading faults, especially in corrosive or H_2S environments. If the rectifier switches are a continuous problem, environmentally sealed switches should be used to replace normal types. The added cost for these may save future repair work and rectifier troubleshooting time. Jumpers carefully placed across the closed contacts of a suspect switch will reveal any high resistance contact problems that may exist.

12. Lightning and surge suppressors can be checked for shorts by removing their connections from the rectifier circuit and checking them with an ohmmeter. Normally these should exhibit an open circuit (infinite resistance).

If you require any assistance when troubleshooting the rectifier, please contact the local Corrpro office or the factory for technical assistance. A few minutes of technical help can, in many cases, save many hundreds of dollars in on-site time or repair freight charges.

G. SAFETY

Cathodic protection rectifiers do present electrical shock hazards to personnel unfamiliar with the operation and/or components of a rectifier unit. Electrical safety can be enhanced by following a few guidelines:

1. When approaching a rectifier to inspect or repair, always remember to touch the case latch with the **BACK** of your hand first. If you feel any voltage 'Tingle' **DO NOT** grab the lock or latch with your hand as you may not be able to let go. You should turn off the A.C. power at the external disconnects and call an electrician.

2. Understand where potential hazards exist so as not to contact them bodily or with tools.

3. When working on energized equipment, use a rubber mat to stand on and, if possible, work in pairs.

4. When taking readings use only one hand, if possible.

5. Lock out the supply disconnect or circuit breaker to prevent accidental re-energizing of the circuit.

6. Wear safety glasses when soldering any connection.

8. When in doubt on a particular test procedure, contact an experienced technician or the factory.

CORRPOWER
RECTIFIER DIVISION

RECTIFIER SPECIFICATION SHEET

CUSTOMER : RTS001 (CORRPOWER) **P.O. : STOCK** **DATE : MAY 8, 2003**
MODEL No. : CAYSE 40-28 **CRD PART No.: CE-4028-00**
S.N. : C-031859 **M.S.O.: 51232**

A.C. VOLTS :115 / 230 **D.C. VOLTS : 40** **PH. : 1** **FREQUENCY: 60** **INPUT V.A. : 1,755**
A.C. AMPS :15.2 / 7.6 **D.C. AMPS : 28** **O/P CCTS. : SINGLE** **TYPE : TAP-ADJUST**

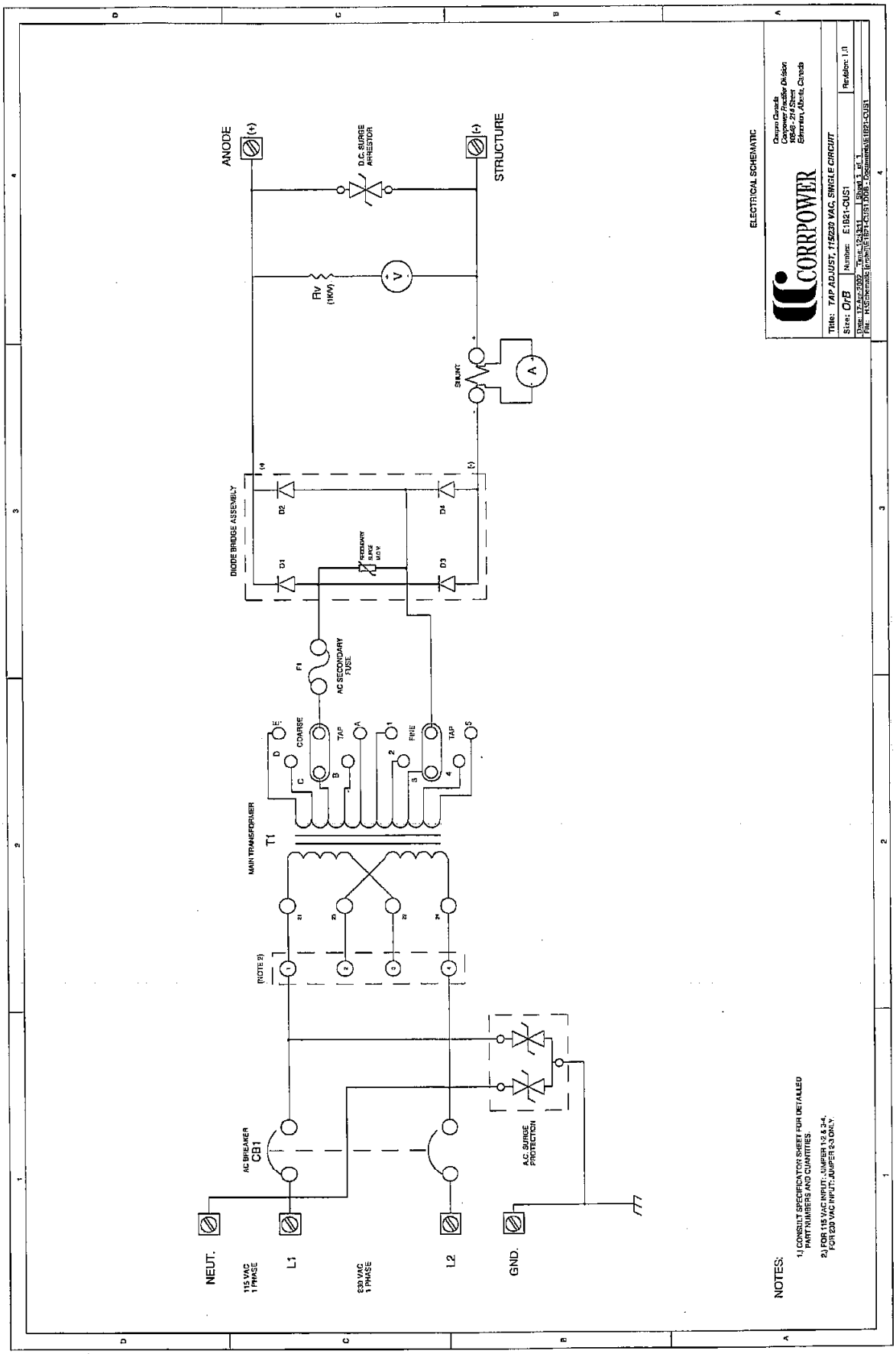
QTY.	ITEM	CRD P/N	DESCRIPTION
1	A-2 ENCLOSURE	62-A-0020	12 GAUGE MILL GALVANIZED STEEL, WHITE
1	A-2 FRAME, LEFT	62-A-0170	12 GAUGE MILL GALVANIZED STEEL, WHITE
1	A-2 FRAME, RIGHT	62-A-0180	12 GAUGE MILL GALVANIZED STEEL, WHITE
1	A-2 FRONT PANEL	AP-A-0200	NEMA "XX", 1/4" x 13.125" x 16.25"
1	A-2 AC INPUT PANEL	AP-A-0210E	NEMA "XX", 1/4" x 10.75" x 3.00"
1	A-2 STACK PANEL	AP-A-0220	17-40 AMPERE STACK PANEL
1	TRANSFORMER	A1-T-4028-E	115/230 VAC; 25 STEPS; 5-COARSE & 5-FINE TAPS
1	VOLTMETER	41-C-0020	0 - 50 VOLTS F.S.D., / 40V RED LINE
1	AMMETER	41-C-0020	0 - 35 AMPERES F.S.D., / 28A RED LINE
2	DIODE FORWARD	00-P-0010	40 AMPERE, 400 VOLTS PIV
2	DIODE REVERSE	00-P-0020	40 AMPERE, 400 VOLTS PIV
2	HEATSINK	75-P-0010	ALUMINUM, ANODIZED
1	AC BREAKER	32-H-0110	20.0 AMPERE, 480 VAC, 1-POLE
1	AC BREAKER	32-H-0090	10.0 AMPERE, 480 VAC, 1-POLE
1	SHUNT	43-B-5035	35 AMPERE, 50 mV TYPE "SW"
1	A.C. SURGE	08-L-7001	120/240 VAC, 1-PHASE, 3-WIRE
1	D.C. SURGE	08-L-8100	60 VOLTS, 2-TERMINAL
1	SECONDARY SURGE	07-S-3130	MOV, 130 VOLTS, 74 JOULE
2	FUSE CLIP C-11	38-C-0060	PLATED, FOR 11/16" DIAMETER FUSE
2	AC SECONDARY FUSE	36-A-0070	35 AMPERE, 130 VOLTS AC
2	DC LUGS	89-C-0030	XT 1/O-6, PLATED, (1) POSITIVE (1) NEGATIVE

NOTES:

1.) RECTIFIER EQUIPPED WITH SINGLE DC OUTPUT CIRCUIT.

AC WIRE SIZE : #14 TEW **AC SEC. / DC WIRE SIZE : #12 TEW**

4/17/03 REV. 0.0


ELECTRICAL SCHEMATIC
CORRPOWER
Corrpower Canada
Corrpower Rectifier Division
1654B - 214 Street
Edmonton, Alberta, Canada
Title: TAP ADJUST, 115/230 VAC, SINGLE CIRCUIT
Size: OrB
Number: E1821-CUS1
Revision: 1.01
Date: 17-Apr-2002
Time: 12:13:11
Sheet 1 of 1
File: H:\Schematic [crop]\E1821-CUS1\DGB - Documents\E1821-CUS1
ANODE
STRUCTURE
D.C. SURGE ARRESTOR
Rv (1KW)
SHUNT
DIODE BRIDGE ASSEMBLY
D1
D2
D3
D4
SECONDARY FUSE 40A
AC SECONDARY FUSE
F1
COARSE
FINE
TAP
MAIN TRANSFORMER
T1
(NOTE 2)
AC BREAKER
CB1
A.C. SURGE PROTECTION
NEUT.
L1
L2
GND.
115 VAC 1 PHASE
230 VAC 1 PHASE
NOTES:
1.) CONSULT SPECIFICATION SHEET FOR DETAILED PART NUMBERS AND QUANTITIES.
2.) FOR 115 VAC INPUT: JUMPER 1-2 & 3-4.
FOR 230 VAC INPUT: JUMPER 2-3 ONLY.