



BASIC TROUBLESHOOTING

FOUR BASIC BUILDING BLOCKS OF A PLATING RECTIFIER:

1. ELECTRICAL CONTROLS
2. AC POWER CIRCUITS
3. DC POWER CIRCUITS
4. ELECTRONIC CONTROL

1. ELECTRICAL CONTROLS

START / STOP PUSHBUTTONS, PILOT LIGHTS, RELAYS, TIMER LIMIT SWITCHES, FLOW SWITCHES, THERMAL SWITCHES, AND OVERLOAD RELAYS.

TYPICALLY WIRED ON 120 V.A.C.; CHECK WITH VOLTMETER.

2. AC POWER CIRCUITS

INPUT LINE (TONG TEST) FOR BALANCE
CHECK SINGLE PHASING OR LOSS OF FUSE
SCR'S LOCATED IN THE PRIMARY
VARIABLE AUTO-TRANSFORMERS
TAP SWITCHES
POWER TRANSFORMER

3. DC POWER CIRCUITS

SILICON DIODES / FUSES; SHORTED OR OPEN
SECONDARY SCR'S / FUSES
BALANCED / SHARING LOAD
CHECK OUTPUT WAVEFORM / RIPPLE

4. ELECTRONICS

MEASURE SIGNAL OR CONTROL VOLTAGES
SCR GATE DRIVE
VOLTAGE & CURRENT REGULATOR

BASIC TROUBLESHOOTING

WHEN TROUBLESHOOTING A PLATING PROBLEM, YOU MUST FIRST DETERMINE IF, IN FACT, THE RECTIFIER IS AT FAULT. QUITE OFTEN THE PLATING BATH'S "CHEMICALS", BUS, RACKING, ETC., ARE AT FAULT.

EXAMPLE:

A COMMON PLATING PROBLEM IS LOW DC AMPERAGE DRAW.

IF THE RECTIFIER CAN DELIVER RATED NAMEPLATE DC VOLTAGE, THE PROBLEM MOST LIKELY IS EXTERNAL OF THE RECTIFIER.

EXAMPLE:

INTERMITTENT PLATING DEFECTS.

RECTIFIERS, AS A RULE, ARE EITHER GOOD OR BAD. VERY SELDOM WILL THEY OPERATE INTERMITTENTLY.

GENERAL RULE OF THUMB:

LOW DC CURRENT DRAW; FAULT IS EXTERNAL OF RECTIFIER

LOW DC VOLTAGE OUTPUT; FAULT IS IN THE RECTIFIER

PLATING DEFECTS: COULD BE EITHER THE RECTIFIER OR THE BATH, OR A COMBINATION OF BOTH.

ONCE THE PROBLEM HAS BEEN DETERMINED TO BE IN THE RECTIFIER, YOU MUST ISOLATE THE PROBLEM INTO ONE OF THE FOUR BASIC BLOCKS.

IT IS POSSIBLE THAT YOU MAY HAVE FAULTS IN MORE THAN ONE BLOCK AT THE SAME TIME.

KEEP AN OPEN MIND WHEN TROUBLESHOOTING RECTIFIERS.

BASIC TEST EQUIPMENT NEEDED:

1. FLASHLIGHT CONTINUITY TESTER
2. AC CLAMP ON AMP METER
3. DIGITAL VOLT METER
4. SOLENOID "WIGGINS" TESTER
5. "0" SCOPE

MAJORITY OF TROUBLESHOOTING SHOULD BE DONE "LIVE", UNDER A LOAD OF APPROXIMATELY 25% TO 50%.

TROUBLESHOOTING HINTS:

1. NEVER USE AN OHM METER TO TEST FUSES. USE A CONTINUITY FLASHLIGHT WHEN DEAD, OR SOLENOID VOLT TESTER WHEN LIVE.
2. IF DIODES ARE ALREADY IN THE RECTIFIER, TEST WITH AN AC AMP PROBE UNDER LOAD. (DON'T DISCONNECT AND TEST WITH AN OHM METER).

3. TEST SCR'S WITH A CONTINUITY FLASHLIGHT TESTER. (THIS IS A GOOD FIELD TEST, BUT NOT ALWAYS CONCLUSIVE).
4. ONCE RECTIFIER REPAIRS HAVE BEEN COMPLETED, ALWAYS AC CLAMP TEST (UNDER LOAD) THE AC LINES, SCR'S OR TAP SWITCHES AND DIODES. THEY SHOULD BE BALANCED AND EQUAL.
5. ONCE THE RECTIFIER IS BACK IN OPERATION, MONITOR IT FOR A FEW HOURS; WATCH FOR EXCESSIVE HEAT, AC BALANCE AND OUTPUT RIPPLE.

PREVENTATIVE MAINTENANCE:

1. GENERAL OPERATIONAL CHECK EVERY 30 DAYS.
2. BLOW OUT RECTIFIER WITH COMPRESSED AIR EVERY 6 MONTHS.
3. LUBRICATE CONTACTORS, RELAYS, CONTROL POTS, SWITCHES, ETC., WITH L.P.S. EVERY 12 MONTHS
4. CLAMP TEST (UNDER LOAD) THE AC LINES, DIODES, SCR'S OR TAP SWITCHES EVERY 12 MONTHS
5. CHECK OUTPUT METER ACCURACY EVERY 12 MONTHS
6. WATER COOLED RECTIFIERS SHOULD BE ETCH-CLEANED EVERY 24 MONTHS. THIS INCLUDES THE INDIRECT COOLING STYLE RECTIFIERS.

BASIC REPAIRS:

CAREFULLY MARK ALL CONNECTIONS TO THE DEFECTIVE DEVICE BEFORE REMOVAL.

SCR'S & DIODES:

SCR'S ARE TYPICALLY FOUND IN MODULAR, STUD MOUNT AND FLAT PACK CONFIGURATIONS, WHILE DIODES ARE USUALLY THE STUD MOUNT OR FLAT PACK STYLE. THE REPLACEMENT PROCEDURES FOR STUD MOUNT AND FLAT PACK SCR'S AND DIODES ARE VIRTUALLY IDENTICAL; WITH THE DIFFERENCE BEING THAT SCR'S WILL HAVE TWO ADDITIONAL SMALL LEADS TO BE ATTACHED.

TO REPLACE A MODULAR SCR, PERFORM THE FOLLOWING STEPS:

1. NOTE WHERE THE GATE AND INPUT / OUTPUT LEADS ARE ATTACHED.
2. MARK THE LEADS AND REMOVE THE SCR.
3. CLEAN THE BUS BAR SURFACE AND THE NEW SCR SURFACE.

4. APPLY HEAT SINK COMPOUND SPARINGLY TO BOTH SURFACES.
5. FASTEN THE NEW SCR TO THE BUS BAR.
6. REATTACH THE LEADS. REPLACEMENT IS NOW COMPLETE.

STUD MOUNT SCR'S AND DIODES:

STUD MOUNT DEVICES CAN BE MOUNTED ON EITHER AIR OR WATER COOLED HEAT SINKS AND ARE TYPICALLY FOUND WITH ½" OR ¾" DIAMETER STUDS. REPLACEMENT OF STUD MOUNT DEVICES IS THE SAME FOR BOTH AIR AND WATER COOLED SYSTEMS, FOLLOWING THE STEPS BELOW:

1. MARK AND REMOVE THE TWO SIGNAL LEADS FROM THE TERMINAL BLOCKS (SCR). ONE OF THESE IS THE GATE LEAD AND THE OTHER IS THE CATHODE SIGNAL LEAD.
2. REMOVE THE LARGE BRAIDED CABLE.
3. REMOVE THE NUT AND WASHERS AND REMOVE THE DEVICE FROM THE HEAT SINK.
4. CLEAN THE BUS BAR AND THE NEW SCR SURFACES.
5. SPREAD A SMALL AMOUNT OF THERMAL COMPOUND ON THE NEW SCR, TAKING CARE NOT TO GET ANY COMPOUND ON THE SCR THREADS.
6. INSERT THE STUD IN THE HEAT SINK, REASSEMBLE THE FLAT WASHER, THE STAR WASHER AND THEN TIGHTEN THE RETAINING NUT.
7. ATTACH ALL LEADS TO THE PROPER LOCATIONS, BEING SURE THAT ALL CONNECTIONS ARE TIGHT.

FLAT PACK SCR'S AND DIODES:

SOMETIMES REFERRED TO AS "HOCKEY PUCKS", THESE ARE USED IN HIGHER POWER RECTIFIERS. THEY RANGE FROM 2" THROUGH 4" IN DIAMETER. AS WITH STUD MOUNT DEVICES, THE ONLY DIFFERENCE BETWEEN A FLAT PACK SCR AND DIODE IS THE PRESENCE OF GATE AND CATHODE LEADS ON THE DEVICE.

A FLAT PACK DEVICE IS SECURED BETWEEN TWO CURRENT-CARRYING BUS BARS BY A CLAMPING MECHANISM. SOME CLAMPS HAVE INDICATORS BUILT IN, WHILE OTHERS DO NOT. WHEN REPLACING A DEVICE SECURED WITH A GAUGED CLAMP, NOTE THE READING BEFORE REMOVING THE DEVICE.

THE OTHER TYPE OF CLAMPS USED ARE EITHER 5,000 OR 10,000 POUND CLAMPS. THESE SYSTEMS CONSIST OF A PAIR OF CLAMPING BARS, CONNECTED BY TWO STUDS, BETWEEN WHICH IS SANDWICHED THE BUS BARS, A BELVILLE WASHER

SYSTEM, AND THE SEMICONDUCTOR DEVICE. REPLACEMENT OF SCR'S OR DIODES UTILIZING THESE TYPES OF CLAMPS REQUIRES THE USE OF MEASURING DEVICES. THE FOLLOWING STEPS SHOULD BE TAKEN TO REPLACE A FLAT PACK SCR OR DIODE.

1. NOTE THE CLAMPING ARRANGEMENT BEING USED. IF A GAUGE IS PRESENT ON THE CLAMP, RECORD THE INDICATION. MARK AND REMOVE THE GATE AND CATHODE LEADS IF REPLACING AN SCR.
2. UNIFORMLY AND SLOWLY LOOSEN THE NUTS ON THE CLAMP STUDS. REMOVE THE BELVILLE WASHER ASSEMBLY AND THE DEVICE. NOTE THAT THE BELVILLE WASHER IS MADE UP OF FOUR PARTS; A CENTERING SECTION, A FLAT WASHER, AND TWO CONCAVE WASHERS.
3. CLEAN THE SURFACES OF BOTH BUS BARS AND THE NEW SCR OR DIODE. CLEAN BOTH CLAMPING BARS AND CHECK THAT THE INSULATED SURFACES OF THE CLAMP HAVE NOT BEEN DAMAGED.
4. APPLY HEAT SINK COMPOUND SPARINGLY TO BOTH SURFACES OF THE DEVICE AND THE BUS BARS.
5. PLACE THE NEW FLAT PACK IN THE CLAMPING MECHANISM, ENSURING THAT THE DEVICE IS ORIENTED PROPERLY. CHECK THE OTHER DEVICES TO VERIFY THIS. THERE ARE TYPICALLY ROLL PINS IN THE BUS BARS THAT ALIGN DEPRESSIONS IN THE DEVICE. MAKE SURE THE ROLL PINS DO NOT DAMAGE THE FLAT PACK SURFACES.
6. FINGER TIGHTEN THE CLAMP NUTS, ENSURING ALL PARTS ARE SITUATED PROPERLY, AND THEN TIGHTEN THE NUTS WITH A WRENCH ONE-QUARTER ADDITIONAL TURN. CHECK THAT APPROXIMATELY THE SAME NUMBER OF THREADS ARE VISIBLE BEYOND THE NUTS ON EACH STUD.
7. USING A DEPTH GAUGE, MEASURE THROUGH THE CENTER OF THE HOLE IN THE BUS BAR AND BELVILLE WASHER SYSTEM. NOTE THIS READING.
8. TIGHTEN EACH NUT ONE-HALF TURN AND THEN RECHECK WITH THE DEPTH GAUGE. CONTINUE THIS TIGHTENING PROCEDURE UNTIL THE DIFFERENCE FROM THE ORIGINAL READING IS 0.048" +/- 0.004" FOR A 10,000 POUND CLAMP, AND 0.026" +/- 0.002 FOR A 5,000 POUND CLAMP.
9. REATTACH THE GATE AND CATHODE SCR LEADS.