ROMAN MANUFACTURING / TRANSPOWER

TESTING INVERTER POWER SUPPLIES FOR TRANSFORMER OR DIODE FAILURES

November 23, 1999

A. Prerequisites

1. Only personnel familiar with electrical power systems, transformers and rectifiers will be allowed to service and test Inverter Power Supplies.

2. Only personnel familiar with safety and lock out procedures of electrical power systems will be allowed to perform the service and tests on Inverter Power Supplies.

3. The power system supplying the power supply has been checked for proper line voltage and frequency.

4. The welding control has been checked for proper functioning.

5. Make sure the secondary circuit of the welder is open without a part clamped in the tooling or by electrodes.

6. Any load testing of the power supply must be done with proper water cooling.

7. This procedure applies to power supplies equipped with hockey puck type diodes. These diode assemblies fail in a shorted condition.

8. This procedure cannot cover all possible symptoms or reasons for failure thus requiring an analytical approach to determine the problem.

B. Testing the Inverter Power Supply

1. Figure 1 (page 4) shows an Inverter Power Supply with a shorted diode in one leg of the rectifier.

2. Figure 2 (page 4) shows an Inverter Power Supply with a shorted diode in each of the two rectifier legs.

3. Figure 3 (page 4) shows an Inverter Power Supply with a primary to secondary or primary to case fault in the rectifier transformer.

4. Figure 4 (page 4) shows an Inverter Power Supply with a turn to turn short in the primary or secondary winding of the rectifier transformer.

   NOTE: Figures 1 through 4 are generic diagrams to show the location of the faults discussed in this procedure.

5. Set the Inverter Power Supply on the lowest voltage tap (if there are any available). Set the control on the lowest heat setting possible and a weld time not exceeding 3 cycles. Initiate the welder with the welding circuit open and without a part in the welder (see A.5). The primary current read out of the control should indicate a negligible current since it only measures the excitation current of the transformers. Repeat this test by gradually increasing to full heat setting. The primary current readout should continue to be negligible up to the full heat setting (99%). Terminate the test if the current exceeds 10 to 30 amperes depending on the size of the power supply. Excessive current indicates a failed power supply.

6. If the power supply fails the test described in B.5 the reasons below are the probable cause and the Inverter Power Supply must be removed for repair:

    a. A shorted diode or diodes (Figure 1 & 2)
    b. A short in the rectifier/bus system
    c. A transformer fault in form of a primary to secondary or primary to case short. This assumes a properly grounded machine including secondary circuit and grounded power system (Figure 3). In this case one side of the primary winding is always connected to line. Thus a short circuit exists without the control being initiated leading to tripping of the over-current protection as soon as power is applied to the control. In an ungrounded power system the over-current protection will not trip unless another ground fault exist in the system.
    d. A transformer fault in form of a turn to turn short in the primary or secondary winding of the rectifier transformer (Figure 4). Proceed to section C and D for rectifier bus, diode and transformer testing.

7. If the power Supply has passed the test in B.5 a load test should be performed to support the results of test B.5. Repeat the first test setting of B.5 (lowest tap, lowest heat setting, 3 cycles weld time) with a coupon firmly clamped in the tooling or by electrodes. Connect the probe of a memory scope across the coupon and initiate the welder. The scope should show a rectified wave form with two pulses per cycle of weld time. The pulses should be even in size, shape and spacing. If a continuous DC component exists the current will show an upslope during the first few cycles. A scope isolator might be required to obtain representative wave forms.

8. If the power supply passes the test in B.7 it is in operational condition.

9. If the power supply fails the test in B.7 proceed as follows. Verify first the prerequisites A.3 and A.4 and then the tests in B.5 before committing the power supply to removal from the welder for service. Proceed to section C and D for rectifier bus, diode and transformer testing.

C. Diode Testing

1. The large number of parallel diodes mounted in heat sinks with water cross over connections makes checking for a single shorted diode difficult. It is necessary to remove the rectifier output and collection bus system so that each rectifier leg can be tested separately. For Inverter Power Supplies the rectifier legs are not exposed, therefore, this testing must be performed by Roman Manufacturing / TransPower. You can, however, check the entire arrangement of diodes as shown below.

2. Connect the leads of a multimeter set in “diode check” position or a continuity tester with a 6 volt DC power source between the AC bus and the + DC bus to check the conduction in the “forward” and blocking in the “reverse” direction of the diodes in each rectifier leg. A shorted diode in a rectifier leg will show conduction in the forward and reverse direction. If a shorted diode is found the Inverter Power Supply should be removed and returned to Roman Manufacturing / TransPower for repair.

D. Transformer Testing

1. The insulation resistance between primary and secondary as well as primary to case must be tested. For this test a 500 or 1000 volt DC insulation tester should be used. Disconnect the power supply from the weld control (Figure 3). Any component such as primary terminal boards, switches, etc. become part of the insulation test unless they are disconnected from the transformer.

   CAUTION: The common and DC output pads must be connected together with a wire (#14 AWG Cu minimum) to assure that the test voltage cannot be accidentally applied to the diodes.

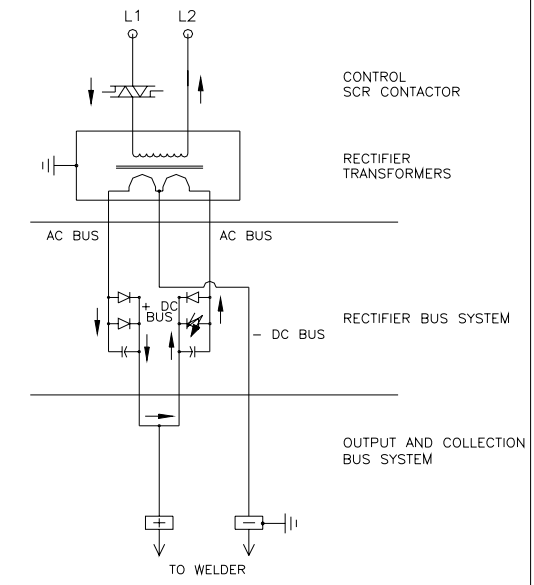
   A minimum insulation resistance of 10,000,000 OHMS should be measured between primary and secondary as well as primary to case at an ambient temperature not exceeding 30°C. If the insulation resistance is less, the integrity of the insulation is questionable which might require repair of the transformer. After the test make sure the wire is removed.

2. To test the transformer for a turn to turn failure energize the primary winding of the transformer with a low voltage variable AC power source. (VARIAC, 0 to 120 volt AC rated 10 amperes minimum) Slowly increase the primary voltage from zero and monitor the primary current. If the transformer has a turn to turn failure the primary current will rapidly increase as soon as voltage is applied. If the transformer is operational the primary current will be negligible after the available voltage is fully applied. (Since Inverter Power Supplies are designed to operate at typical frequencies of 1000 or 1200 Hz, DO NOT apply more than 75 volts or the magnetic core will saturate and it will act as if there is a turn to turn failure.) The transformer must be repaired if a turn to turn failure exists.

E. Reassembly

1. Install the Power Supply in the welder.

2. Repeat tests B.5 and B.7 after the Power Supply has been reinstalled. Only after the Inverter Power Supply passes tests B.5 and B.7 should it be returned to service.

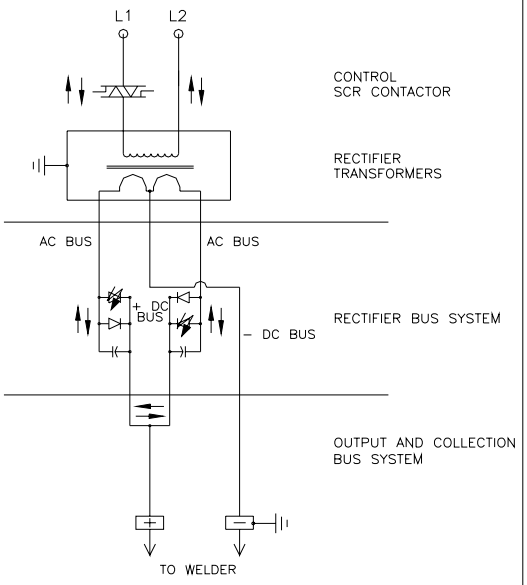


NOTE:

◄— INDICATES FLOW OF FAULT CURRENT

THE SHORTED DIODE REPRESENTS A SHORT CIRCUIT ON THE SECONDARY OF THE RECTIFIER TRANSFORMER DURING THE HALF CYCLE THE HEALTHY RECTIFIER LEG IS CONDUCTING

Fig. 1

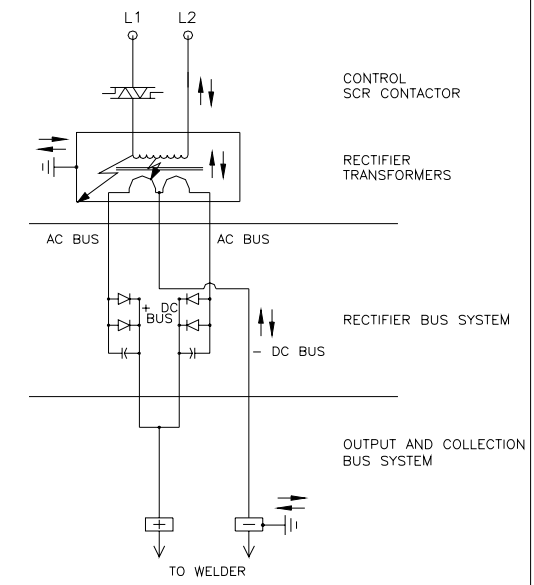


NOTE:

◄— INDICATES FLOW OF FAULT CURRENT

THE SHORTED DIODES REPRESENT A SHORT CIRCUIT OF THE RECTIFIER TRANSFORMER DURING THE POSITIVE AND NEGATIVE HALF CYCLE

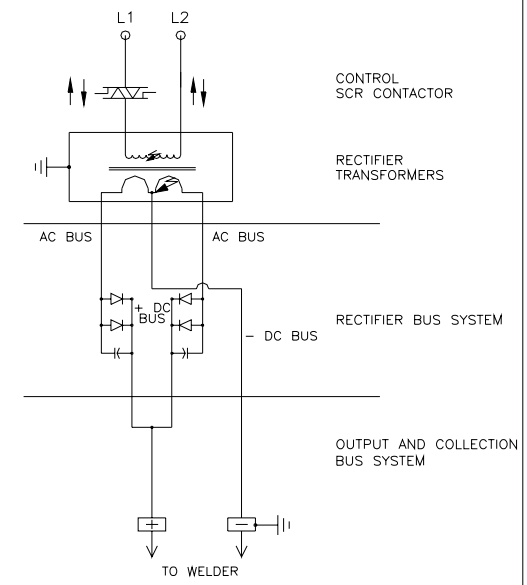
Fig. 2



NOTE:

◄— INDICATES FLOW OF FAULT CURRENT

Fig. 3



NOTE:

◄— INDICATES FLOW OF FAULT CURRENT

Fig. 4

Rev. A – Clarified overlapping lines that do not tie together. – 12–9–98

4/21/98