

## ELECTRICAL ENGINEERING SAFETY | INFORMATION SHEET NO.3

# Welding machine overhaul specification

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Information Sheets are developed by the inspectors of electrical engineering in response to issues identified during site electrical engineering audits at extractive mines and questions raised by the mine operators. They are provided as guidance material for mine operators in the development of electrical safety standards.

### Purpose

To provide an overhaul specification that will result in a welding machine that conforms to the original equipment manufacturer's (OEM) design and the Australian Standard for Welding Power Sources, AS 60974.1.

The mechanical section of this specification does not include requirements for mechanical overhaul of diesel/petrol-driven welding machine engines or associated components.

### Pre overhaul

- a) Inspect and report on the physical condition of the welding machine. Itemise all faults, defects and damage.
- b) Carry out electrical tests:
  - Insulation of primary and secondary windings of the welding machine.
  - Earth continuity of primary power supply cable.
- c) Record the electrical test results.
- d) Power the welding machine, test the operation through the full range of voltage /current settings and record the results.
- e) Clean the external areas of the welding machine.
- f) Remove all covers and guards.
- g) Clean the internal compartment(s) of the welding machine.
- h) Remove, clean and assess the suitability for reclaiming and reuse of components for the overhaul (relays, indicator lights, terminals, terminal bushings, terminal shrouds, control wiring, power cabling etc).
- i) Assess the condition of the coils and cores for transformer-type welding machines.
- j) Assess the condition of the electronics and associated circuitry for inverter type welding machines.

### Electrical overhaul

The electrical overhaul of welding machines is to conform to the original equipment manufacturer's design specifications and specific requirements including:

- a) Supply and install replacement components required for the overhaul.
- b) The electrical enclosure(s) is to be cleaned.
- c) Replace all dust/moisture seals fitted to electrical enclosures where required.
- d) The electrical enclosure(s) is to be treated and protected against corrosion.
- e) Confirm suitability of insulation materials and replace as required i.e. terminal bushings, terminal shrouds, and protection covers for meters, push buttons etc.)
- f) Clean coils and cores of transformer type welding machines.
- g) Clean printed circuit boards and associated components for inverter-type welding machines.
- h) Check and adjust core lamination securing bolts for transformer-type welding machines.
- i) Confirm the operation/suitability of all electrical protection devices. Defective devices are to be replaced as required.

- Manual metal-arc welding machine output is to be connected via a voltage reduction device. The operation of the unit is to be checked against the voltage reduction device manufacturer's specifications. The voltage reduction device is to conform to the requirements of AS 60974.1 and reduce the electrode lead voltage when the welding circuit exceeds 200 Ohms.
  - The hand trigger switch assembly fitted to MIG-type welding machine is to be disassembled, serviced/repaired/replaced, reassembled and operation confirmed.
  - Confirm fuses are of the correct type and are correctly rated for their application.
  - Confirm circuit breakers are the correct type and correctly rated for their application.
- j) Service, repair or replace primary power supply plug and cable. The supply cable is to be, as a minimum, 2 m in length from the exit point of the enclosure to the power supply. The electrical rating of the cable and plug assembly is to be not less than the maximum effective supply current for the welding machine.
  - k) The supply cable is to conform to AS/NZS 3191 and the plug assembly is to comply with AS/NZS 3112. (Note plug assemblies will need to match the "I1eff" as detailed on the welding machine nameplate, and the power supply sockets where the welding machine is to be used)
  - l) All electrical connections are to be checked for suitability and replaced where required.
  - m) The welding machine is to be assembled to conform to the OEM specifications for pollution degree rating, IP rating.
  - n) All exposed non-electrical conductive material is to be equipotential bonded to the main earth connection. The conductor size to be used is to be equivalent to the earthing conductor in the supply cable. A continuity test is to be carried out to confirm an effective equipotential bonding system.
  - o) All fasteners used to effect earthing are to be of non-corrosive material, i.e. brass or stainless steel.

**Note:** Stainless steel must not be used if the fastener is required to carry current.

- p) Any associated electrical welding components are to be checked and serviced/ repaired/replaced as required, i.e. electrode holders, work and electrode leads etc.
- q) The electrical protection device(s) is to have the trip values set up to provide protection for the respective circuit.
- r) Auxiliary power supplies are not to be installed to the welding machine.
- s) Electrical schematic diagram(s) are to be updated.
- t) The labelling of electrical components is to have the same description as shown on the electrical drawing(s).

### Operational checks

The welding machine, when reassembled, is to be powered and operated to:

- a) Confirm the satisfactory operation of the welding machine through its full range of operating voltages/currents.
- b) Confirm the temperature rise on the welding machine winding(s), commutator or slip rings is within the limits specified in AS 60974.1

### Mechanical overhaul

A mechanical overhaul of the welding machine is required to retain the OEM design and specification for:

- a) strength and rigidity.
- b) isolation barrier / guarding from live electrical circuits.
- c) guarding of moving components within the assembly.
- d) providing a solid structure for the assembly of the components used to create a welding machine.
- e) the structure providing an adequate level of protection against environmental contaminants, i.e. dust and moisture.

The mechanical overhaul of welding machine is to conform to the OEM design specifications and specific requirements that include:

- a) any damaged or deformed structural sections are to be repaired or replaced.

- b) any damaged or deformed covers and / or panels are to be repaired or replaced. The covers and/or panels are required to provide the level of IP rated protection specified by the OEM and is not to be less than a minimum IP rating of IP21S for indoor welding machines and IP23 for outdoor welding machines.
- c) any cable that passes through metallic parts of the welding machine is to be terminated through brass compression type cable glands.
- d) all connection terminals for flexible supply cables are to be provided with a cable anchor that will relieve the electrical connection from mechanical strain. All cable anchors for this purpose are to conform to the requirements of AS 60974.1.
- e) the outer case of the welding machine is to be treated and protected against corrosion. i.e. remove and treatment for rusted areas and paint.
- f) all dust/water seals fitted to covers or panels are to be replaced.
- g) all affixing fasteners are to be of none corrosive material, i.e. stainless steel, zinc coated, brass.
- h) the welding machine is to be fitted with lifting points.

### Environmental conditions

The welding machine is to be overhauled to retain, as a minimum:

- a) The OEM design specification for contamination of electrical insulating properties referenced as "pollution degree".
- b) The OEM design and specification for IP rating.

### Signs and labelling

Where necessary, the welding machine is to have signs and labelling repaired or replaced so that the welding machine is supplied with securely fitted, durable and legible signs and labelling that will provide information relating to the electrical characteristics of the welding machine to enable the comparison, correct selection and safe use of the welding machine.

The signs and labelling is to conform to the requirements of AS 60974.1 and is to include:

- A rating plate – The rating plate is to be a clearly and indelibly marked plate fixed securely to or printed onto the welding machine that is readily accessible. The rating plate is to be divided into sections containing information and data conforming to AS 60974.1, and include:
  - Electrical schematic drawing number
  - Direction of rotation (for rotating welding machines).
  - VRD - internal or external.
- Warning sign: "Read instruction manuals before operating and serving this equipment".
- Labelling that identifies work lead terminal and electrode lead terminal.
- Labelling that identifies the welding machine earth terminal.
- Labelling identifying the function of all control push buttons and switches.
- Labelling identifying the function of all meters – i.e. voltmeter, ammeter.
- Signs or labelling for the indication of variable voltage or current output setting in volt, ampere or an arbitrary reference scale is to be fitted either on or by the controls. The accuracy of the voltage or current indication shall conform to AS 60974.1.
- Labelling that stipulates the Pollution Degree rating of the welding machine. To be positioned in a prominent and clearly visible location.

### Documentation

A complete set of detailed reports are to be supplied to the mine as detailed within this specification:

- 1.) Pre-overhaul inspection report that includes:
  - Condition of machine
  - Electrical test results
  - Functional test results
- 2.) List of components fitted to the welding machine including cables and plugs details.
- 3.) Test report for Hazard Reduction Device – VRD or handle switch assembly.
- 4.) Compliance statement .i.e. compliance with OEM design specifications and Australian Standards.
- 5.) Table of electrical protection device ratings and settings.
- 6.) Updated electrical drawing(s).
- 7.) Final functional test report including temperature rise test results.
- 8.) A project deviation report that details the variations to the contract specification.

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