

NEW ZEALAND GOVERNMENT RAILWAYS MECHANICAL BRANCH	INSTRUCTIONS FOR ELECTRIC ARC WELDERS	CODE No. 64 Page No. 1 of 2 Issue No 6 Date Issued 1/7/70
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1. GENERAL

This Code is to be drawn to the attention of all trainee, acting and fully qualified welders and a copy is always to be accessible for their perusal.

The Code is applicable to both alternating and direct current welding.

Drawing W30510 shows the symbols and edge preparation for various types of welds in common use. This drawing is based on B.S. 499 and B.S. 1856. Sub Foremen Welders and welders are to make themselves conversant with the contents of drawing W30510.

The type of weld shall generally be determined by the thickness, form and accessibility of the parts to be welded. When welding on locomotives, rolling stock or machines fitted with roller or ball bearings, the earth connection is not to be made so that current passes through any of these bearings.

With some metals, preheating is essential. This requirement should be determined before welding is commenced.

2. CLEANLINESS OF PARTS TO BE WELDED:

The surfaces of parts to be welded shall be free from paint, oil, rust, scale, slag from cutting torches or any other substance which could cause difficulty in obtaining a good weld. Should any of these be present, they must be removed from the fusion surfaces by wire brushing, chipping, shot blasting, grinding or flame cleaning before any welding is carried out.

Before cutting or welding operations are carried out on drums, fuel tanks, bulk oil storage tanks, or containers that have held inflammable liquids, whether they be of welded or riveted construction, the following procedure must be carried out.

- (a) Ensure that the vessel has been thoroughly scoured. Failing a supply of steam being available an alternative may be used by scouring with a solution of caustic soda, afterwards rinsing the vessel several times with water.
- (b) If the vessel has not been steam cleaned prior to using oxy-acetylene or electric arc equipment, fill the vessel with water to just below the area to be repaired. Make sure the space inside the vessel above the water level is ventilated to avoid the possibility of dangerous-gas pressure occurring.
- (c) See that the surrounding area is clear of any combustible material, such as wood, paper etc., which could be ignited by hot sparks falling in the area. A sound precaution prior to carrying out repairs to oil storage tanks would be to spread a solid layer of sand over the oil soaked parts of the floor of the compound.
- (d) Care should be exercised when working around oil control valves as a relatively small heat rise in the oil contained in the valve can cause considerable rise in pressure, which may fracture the pipe and allow a large quantity of oil to escape.
- (e) Keep fire fighting equipment readily available for use should an emergency arise.

3. HOLDING OF PARTS TO BE WELDED

Parts must be supported or clamped in correct alignment during welding. In the case of fillet welds, the parts shall be held in contact and with butt welds the parts shall be separated, as indicated on drawing W30510. Precautions shall be taken to obviate distortion and the welding sequence shall be such that stresses due to contraction are reduced to a minimum.

4. ELECTRODES:

Only those electrodes authorised by the Chief Mechanical Engineer are to be used.

Electrodes must always be kept in a dry condition, especially the low hydrogen type which must be fully dried in an oven immediately prior to use.

5. CURRENT:

Current must be adjusted to give the most satisfactory weld. Excessive current will cause undercutting, concave fillets, brittleness of weld metal, excessive spatter and overheating of the electrodes as well as an excessively deep crater at the termination of the weld. Insufficient current will reduce penetration and create a slag trap at the root of the weld and a shallow crater at the termination of the weld.

To maintain the desired current, neither of the leads is to be coiled because this appreciably reduces the current output from the machine.

As the current requirement varies for different types and gauges of electrodes, operators should be guided by the recommendations of the manufacturers. The nature of the work also limits the current to be used for correct penetration.

6. VENTILATION:

When welding is being performed in other than the open air, ventilation must be adequate to remove all fumes and dust arising from the work. With some electrodes the fumes may be toxic. Particular attention must be given to adequate forced ventilation when welding is being performed in an enclosed space.

NEW ZEALAND GOVERNMENT RAILWAYS MECHANICAL BRANCH	INSTRUCTIONS FOR ELECTRIC ARC WELDERS	CODE No. 64 Page No. 2 of 2 Issue No 6 Date Issued 1/7/70
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7. QUALITY OF WELDS:

Welds shall be of sound metal free from inclusions or porosity (see Mechanical Branch Code No. 65). After a weld has cooled, the slag is to be chipped off with a correctly shaped chipping hammer and the surface cleaned with a wire brush. Full penetration is essential to ensure complete fusion of the weld metal with the parent metal. There must be no break in the continuity of the weld between the end of one run and the beginning of the next. At the completion of a run, the electrode travel shall be delayed sufficiently to fill the arc crater to the full cross-section of the weld, the crater at the end of the weld being given special attention.

Fillet tack welds are to be the same size as the root weld and their length is to be four times the thickness of the thinner section being welded. The completed weld is to finish at one end of the tack weld and recommence at the opposite end. That is, tack welds must not be welded over.

The utmost care shall be taken to avoid under-cutting but where this occurs the reduction of the section at that point shall be built up with an additional run of weld metal.

When difficulty due to "arc blow" occurs it is advisable to try:

- (a) Reducing the current.
- (b) Making a full-sized tack weld and then welding towards it.
- (c) Changing the position of the earth clamp.
- (d) Changing the polarity (on direct current machines only).
- (e) Winding the electrode holder lead several times around the work.
- (f) Commencing the weld in a corner and welding outwards from it.
- (g) Using an alternating current machine for large gauge electrodes.

Briefly, successful welding depends of the following simple technique:

- (a) Selection of an electrode of the correct type and composition.
- (b) Selection of an electrode of the correct gauge for the work.
- (c) Selection of the correct welding current.
- (d) Correct edge preparation and support of the parts to be welded.
- (e) Correct length of arc. To be as short as possible.
- (f) Correct angle of electrode.
- (g) Correct speed of travel. Weaving is normally undesirable.

Operators must endeavour to maintain the highest possible standard of welding and all inferior welds must be chiselled out and rewelded.

Supervisory Officers should ensure that welders are provided with appropriate protective clothing, in the form of denim or canvas overalls or leather apron and leather gloves. Protective spectacles should be worn when chipping, cleaning or wire brushing, welding helmets and hand shields are to be fitted with correct filter lenses in accordance with B.S. 679.

8. WELDING EQUIPMENT:

All welding equipment must be of sufficient capacity to ensure that continuous welding may be carried out.

The length of leads to and from machines and to earth must be as short as convenient and all connections must be tight and clean. Slack or poorly made connections become severely overheated. The earth lead must be connected as close as possible to the region to be welded and the face of the clamp is to be clean and must be attached to an equally clean surface. An appreciable current loss will occur if steel bars or strips are used in place of a full length copper earth lead.

All equipment must be maintained in good condition and machines, particularly the rotary type, are to be blown out monthly with clean, dry compressed air at a pressure of about 30 pounds per square inch.

WARNINGS:

A welder should never stand on a damp surface or in rain while welding without properly insulated footwear. The practice of welding with the cable supported on the operator's shoulder or around the neck should be discouraged.

Electric welding inside wooden buildings, rolling stock, on wooden floors or near inflammable materials, must be discontinued at least one hour before work ceases for the day so that any smouldering material may be detected and smothered before the shop or depot is closed.