



SPOORNET

A division of Transnet limited

**TECHNICAL
RAILWAY ENGINEERING**

WELDING SPECIFICATION

POINTS RODDING

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1. SCOPE:

- 1.1 This document covers the procedure that must be used to weld points rodding components manufactured from structural steel plate to the most recent edition of BS 4360 specification:
- Grades 40A, 40B, 40C, 40D and 40EE
 - Grades 43A, 43B, 43C, 43D and 43EE
 - Grades 50B, 50C, 50D, 50DD and 50EE
- 1.2 Any welding to the points rods shall be done according to the structural welding code ANSI/AWS D1.1-92 or any similar welding code approved by the Principal Engineer of SpoorNet Engineering Track Technology, or any person lawfully acting on his behalf. The specific weld requirements given in section 2 to 9 will apply.
- 1.3 The contractor requires written approval from SpoorNet to deviate from any of the requirements given in sections 2 to 9.

2. PROCESS:

- 2.1 To achieve a good quality arc weld, a shielded-metal arc welding (SMAW) or Metal inert gas welding (MIG / CO₂) technique is recommended.
- 2.2 If the electric flash butt welding technique is used to join rod ends, process qualification tests are required. For these tests, the following parameters shall be recorded:
- 2.2.1 The current drawn during the various stages of the welding process.
- 2.2.2 The pressure applied between the butt ends during the various stages of the welding process.
- 2.2.3 The upset distance of the heated butt ends.

3. ELECTRODE AND WIRE:

3.1 MIG welding:

- a) A welding wire according to specification AWS A5.18 ER 70S-6 (SABS 145 Grade A) must be used.
- b) The supplier's storage and handling recommendations should be strictly adhered to.

3.2 Stick welding:

- a) Welding electrode according to specification AWS A5.1 E7018-1 must be used.
- b) The electrode preheat and storage requirements (recommended by the electrode manufacturer) must be strictly adhered to.

4. PREHEATING OF WORK AREA AND INTERPASS TEMPERATURE:

The pre-heating requirements for the steel is dependent on the carbon equivalent (see below) as follows:

Carbon equivalent (%)	Preheat Temperature (°C)
Up to 0.45	Preheat is optional
0.45 to 0.60	90 to 200
Over 0.60	200 to 400

The carbon equivalent of the specific steel grade is derived from the chemical composition by using the formula:

$$CE (\%) = \%C + \frac{\%Mn}{6} + \frac{\%Cr}{5} + \frac{\%Mo}{5} + \frac{\%V}{5} + \frac{\%Ni}{15} + \frac{\%Cu}{15}$$

5. WELD AND JOINT TYPE:

Full penetration groove welds are to be welded as specified on the relevant drawings.

6. POST HEAT TREATMENT:

No post heat treatment is necessary but the component must be left to cool slowly to room temperature.

7. OVERHEATING:

Care must be taken to restrict the heat input to the minimum as to minimise the size of the heat-affected zones.

8. WELDER:

8.1 Arc welding

Only suitably certified artisan welders may perform the welding. Welder qualification tests are to be conducted according to the structural welding code ANSI/AWS D1.1-92 or any similar welding code approved by the Principal Engineer of SpoorNet Engineering or any person lawfully acting on his behalf. The minimum tests required are:

- 1 x tensile test, longitudinally through the full penetration groove weld.
- 1 x Macro etch of a longitudinal section through the weld.

The results of these tests shall conform to the acceptance criteria of section 5.12 of the structural welding code ANSI/AWS D1.1-92.

8.2 Electric flash butt welding

Only qualified artisans may perform the welding. Acceptable sample welds, approved by the Principal Engineer of SpoorNet Engineering shall qualify the welding procedure, the welding equipment and the welding operator. The minimum tests required are:

- 1 x tensile test longitudinally through the butt weld - The tensile strength of the weld shall not be less than 90% of the minimum specified tensile strength of the parent rod steel.
- 1 x Macro etch of a longitudinal section through the weld - the macrostructure shall be free from porosity, lack of fusion or any other detrimental microstructural effects.

9. SPOORNET QUALITY REQUIREMENTS

9.1 All welds will be visually inspected by the manufacturer and will conform to the requirements of section 9.25.1 of the structural welding code ANSI/AWS D1.1-92.

9.2 Arc welding

9.2.1 The manufacturer will do radiographic inspection of one of each type of weld on at least one set of finished components per welder per batch. In the event where a batch exceeds 10 sets, the radiographic inspection will be performed per every

10 sets. These results will conform to the requirements of section 9.25.2 of the structural welding code ANSI/AWS D1.1-92.

9.3 Electric flash butt welding

9.3.1 The manufacturer will apply a tensile force of 3.0 ± 0.1 ton to a randomly selected sample of 10% of the welds produced by each welder. Any fracture or cracking at or around the weld joint shall deem the weld as unacceptable.

9.4 In the event of non-conforming welds being encountered during the tests mentioned in par 9.2 and 9.3, the weld preceding and following the non-conforming weld will be tested until confidence in the production is established.

9.5 Spoornet reserves the right to audit the welding/manufacturing facility before the allocation of the contract and during the contract period.

10 DOCUMENTATION

10.1 Each batch of points rods will be accompanied by a test certificate providing at least the following:

10.1.1 Proof of certification of the welder and results of the qualification tests performed by the welder.

10.1.2 Analysis and test certificates of the steel used as the base metal.

10.1.3 The welding process/technique that was applied (e.g. MIG or SMAW)

10.1.4 The type of welding consumable that was used.

10.1.5 The preheating used during welding if any.

10.1.6 A certificate from the radiographic inspection body stating the results as required in section 9.2.

10.1.7 A certificate from the galvaniser stating the test results according to the requirements of SABS1461.

10.1.8 In the case of electric flash butt welding, the number of welds that were tensile tested and any non-conformances encountered must be recorded.