

FOREWORD

- The purpose of this standard is to unify electric arc repair welding of rails across Europe. The standard provides control systems for the approval and qualification of welding processes, welding procedures, welding consumables, contractors and welders for the successful delivery of welds in track.

Introduction

Restoration of rails by electric arc welding is a special process requiring the co-ordination of welding activities to establish confidence and reliability of the weldment and safety of the line. Controls must be in place from the design phase through to inspection.

Incorrect selection of materials, consumables or procedure may result in serious track welding failure. The correct application of the approved processes, the types of repairs permitted to be carried out on various rail components shall be strictly adhered to. Only consumables approved by the method described in this standard are to be used. The tasks and responsibilities of personnel involved in welding activities e.g. planning, executing, supervising and inspection shall be clearly defined.

Scope

This standard describes the approval systems for consumables and procedures used in manual metal arc and flux cored wire welding rail repair welding. The standard includes the quality-related tasks and responsibilities of personnel involved in the electric arc repair welding of rails in the grade ranges of R200, R220, R260 and R350HT. Permitted welding processes and their applications are described. This standard may be applied in situ, at line side or at out of track locations. The flash welded leg ends of AMS crossings are excluded from this standard.

4. General Systems

(Exempel)

Care of the Infrastructure

The contractor carrying out the welding restoration work is responsible for the care of the infrastructure with particular regards to :-

- Signalling systems
- Insulated joints
- Rail to sleeper fastening systems
- Sleepers
- Stray arcing
- Fire prevention
- All related environmental issues

Welders

The contractor shall employ welders who are in possession of a valid Permit to Weld, as defined in Part 6 of this standard, whether they are direct employees or contracted in.

Traceability

The contractor shall maintain a traceability system that shall include as a minimum :-

- **Date of installation**
- **Location, route, mileage/point kilometrique line, rail**
- **Rail profile and grade**
- **Consumable identification**
- **Contractor and welder identification**
- **WPS Number**
- **Any non conformances during weld production**
- **Welder's daily record**

Consumable and WPS Approval Tests for MMA electrodes and FCAW wires

The approval of consumable and WPS is broadly in line with the requirements of EN 288-8, but due to the special nature of the repair weld in terms of steel grade and use (rolling contact fatigue) the approval process shall follow this standard.

Consumable and WPS Approval Model

The following flow chart describes how consumable manufacturers may offer their consumables to the industry. The steps to approval sign off are shown.

Position of Preheat Measurement and sample size for Laboratory tests

Acceptance Criteria

- **When measured at magnification x 100, the sample shall exhibit no evidence of untempered martensite exceeding 400 HV.**
- **The porosity limit requirements for rail welding are much more stringent than those for general fabrication. This is due to the material chemistry and the cyclic loading experienced in service. The assessment of defect shall be carried out on the transverse section (sample 2) and over 100mm length on longitudinal section (samples 1 and 3)**

Criteria for defects

Table 1 Criteria for defects

Hardness requirements (surface and subsurface hardness testing)

Defect acceptance criteria for track trial deposits

a/ Rail Flatness Geometry

If after one day the rail flatness exceeds 0.2mm when measured over one metre the weld test sample is rejected. This criteria is only checked and recorded once.

b/ Surface Defects

No visible defects permitted when testing by DPI or MPI

c/ Preferential wear of weld

No running surface deviation more than 0.2mm measured over 1 metre shall be permitted when compared with the record of the one day test.

Any defect occurring after the test deposits are made that are not associated with the welding shall be excluded from measurements taken to sentence the deposit.

- **Inspection Frequency**

The period of in track testing shall be 12 months with inspections periods of 1 day, 1 month, 6 months, and 12 months as a minimum requirement.

Personnel and Qualification Requirements

Initial training and qualification in Electric Arc

Welding of Rails

The approval of track welders for restoration of rails should follow EN 287-1 as much as is reasonably practicable.

It is noted that 287-1 refers to joints throughout, the work in restoration of rails is based on re-surfacing. This Standards differs from 287-1 in the following points:

- The steel groups from 287 are not required as the material (rail) groups are clearly defined in the rail standards.
- Dimensions from 287 are not required as they are dealt with in the restoration standard under rail profiles and allowed excavation dimensions.
- Only two positions apply to rail welding PA and PC
- Joint types and associated tables are not applicable. The test piece is the rail sample.

- Four principle rail grades within the restoration standard R200, R220, R260 and R350HT. The approval test carried out on 260 grade steel shall be considered as an approval for the welding of other grades within this standard.
- The shape and dimension of the test piece is set out in this standard.
- The general rules of harder positions qualifying easier repairs can still be followed.

The initial training and testing shall be conducted, in a training establishment approved by the railway authority. For the purpose of the training the contractor shall provide welding procedures that are approved by the railway authority. Training content and duration shall be in accordance with the requirements of the welding procedures approving railway authority.

In addition to the welding procedures the initial training shall also include:

- Care and control of consumables
- Basic safety items relating to the process
- Cause and effect of operating out side of the correct procedures
- Rail grade identification
- Basic grinding
- Basic visual weld inspection

The training shall conclude with a test or tests so designed to confirm the trainees ability to carry out the electric arc welding of rails in accordance with the requirements of the welding procedures.

Upon the successful completion of training and testing the welder shall be issued with a Diploma in Electric Arc Welding of Rails by the training establishment.

The possession of the Diploma in Electric Arc Welding shall be a prerequisite to apply for the Permit to Weld.

The initial training Diploma in Electric Arc Welding of Rails shall be and remain the property of the welder.

Permit to Weld

- The Permit to Weld shall be and remain the property of the railway authority.
- The Railway Authority shall define any relevant condition/s relating to the training, testing, re-training, re-testing and the validity and renewal of the Permit to Weld as well as the extension of the welder's skills.
- Upon successful completion of the requirements and demonstration of the necessary competencies, which shall include railway authority tests if required, the welder shall be issued with a Permit to Weld by the relevant railway authority upon receipt of the relevant qualifying information from the employer. The issue of the Permit to Weld shall be via the welder's employer who shall maintain up to date records.

- The Permit to Weld shall include a unique identification relating to the particular welder and the employer.
- In any instance of a welder changing employment to another welding contractor or employer, the Railway Authority shall issue a new Permit to Weld on the request, and receipt of relevant qualifying proof, from the new welding contractor or employer.
- The railway authority shall, at any time, withdraw the Permit to Weld upon evidence of proven poor performance by the welder.
- The railway authority shall also withdraw the Permit to Weld upon documented notification from the employer.
- The Railway Authority shall renew the Permit to Weld, as may be necessary, to record the maintenance and/or extension of the welders skills. Such renewal shall require receipt of the relevant qualifying information from the employer.

Welder identification

- To identify the welder, each and every weld shall be marked by the stamp number allocated in the Permit to Weld.
- Movements of the welder across other railway authorities within Europe shall be managed by the relevant railway authority or authorities



