



SPOORNET

A DIVISION OF TRANSNET LIMITED
PLANNING AND TECHNOLOGY
RAILWAY ENGINEERING

SPECIFICATION CONTROL PAGE

**COMPACT MECHANISED WELDING UNIT FOR
 HARDFACING AND REPAIR OF PROFILES AND
 CROSSINGS**

Statement of authorisation:

There is no SABS specification available for similar material / equipment and as far as can be ascertained no other specification / standard suitably covers Spoornet requirements. The specification has been compiled in a manner which shall favour / encourage local manufacture of material / equipment to a maximum degree.

Author: Chief Engineering Technician
 Locomotive Electrical Power
 Supplies

J. Rothman

.....

Approved: Senior Engineer
 Locomotive Electrical Power
 Supplies

L.O.Borchard

.....

Authorised: Principal Engineer
 Locomotive Electrical Power
 Supplies

W.A Coetzee

.....

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6.0 TECHNICAL DESCRIPTION OF EQUIPMENT

Although the equipment will be made up of separate individual modules such as the wire feed unit engine-driven welder, automatic programmable equipment and welding gun. For purposes of the specification, the system shall be considered to be one unit and shall be tendered for as such, with the successful tenderer being responsible for the supply installation commissioning and supply of a full back up service.

- 6.1 The system consists of a diesel engine driven welder coupled to a continuous wire feed unit with a maximum wire spool capacity of 18 kg.
- 6.2 It is intended to utilise a 500 amp air cooled welding gun and resin cored AWC welding wire for high carbon steel rails as well as a welding wire suitable for high manganese 13% Austenetic steel.
- 6.3 The welding gun will be fitted to a compact programmable unit, which will have a minimum of four specifically adapted programmes and control via a remote control unit with pushbuttons.
- 6.4 The system furthermore comprises of two snap fasteners, an aluminium rail profile, a carriage control electronics, a weaving unit and remote control which are synchronised to enable a number of weaving patterns to be programmed.
- 6.5 The programmed weaving movements start from a laterally adjusted Zero-line either on the outer or innerside of the rail. The Zero line can also be moved laterally during welding. Different speeds must be able to be used to produce the most consistent weld metal thickness.
- 6.6 The rail profile is flexible and can be fixed to the rail in several different ways namely magnets, screws, or vacuum suction cups.
- 6.7 Standard lengths of profile should be approximately 2,5 metros in length and adjustable.

7.0 TECHNICAL SYSTEM REQUIREMENTS

- 7.1 The technical requirements will be broken up into various operating modules namely:

- Diesel engine driven welder
- Wire feed unit
- Welding gun
- Welding electrodes
- Welding cable
- Automatic programmable unit

7.2 DIESEL ENGINE DRIVEN DC WELDER

The welder shall be of the constant current and constant voltage type.

7.2.1 DC welding constant current

The current range (continuous) shall be in the range from a minimum of 20 Ampere to 350 Ampere, as required open circuit voltage.

The minimum open circuit voltage shall be 60 V

7.3 DUTY CYCLE (INTERMITTANT)

The intermittent welding duty cycle shall be at least 350A at 35%, 320A at 60% and 270A at 100% i.e. continuous welding.

Electrode diameter:

The electrode diameter shall be able to vary from 2 mm to 5 mm.

7.4 DC WELDING CONSTANT VOLTAGE

The current in the constant voltage range shall be 270A at 100 % duty cycle.

The constant voltage range shall vary between approximately 15 – 35 volts as required.

7.5 AC GENERATION

The generation shall be by means of an asynchronous, three phase, self-excited self-regulated brushless machine, with class H insulation.

7.6 THREE PHASE GENERATION

While welding at the continuous rated value the machine shall generate at least 12 kVA at 400 volts three phase.

7.7 SINGLE PHASE GENERATION

The machine shall generate a minimum of 7 kVA at 230 volt, which can be utilised for power tools, and other general requirements.

7.8 PLUGS

The successful tenderer shall supply two 400 V, 3 phase plugs and two single phase 230 volt plugs for power tools and auxiliaries as required.

7.9 EARTH LEAKAGE RELAY

The welder shall be equipped with an earth leakage relay, which will protect against earth faults on the machine or at the plugs.

7.10 DIESEL ENGINE

The engine shall be diesel powered 4-stroke water cooled with an output of at least 16,6 kilowatts at sea level.

7.11 GENERAL ENGINE AND FUEL TANK CAPACITY SPECIFICATIONS

The fuel tank capacity shall be sufficient to ensure that the diesel engine has at least a 10-hour running time at 60 % loading. It is expected that the tank will be 30 litres or more.

7.11.1 The mass of the diesel engine driven welder shall not exceed 550 kg to ensure handling capability and ease of transport.

7.11.2 The tenderer must include the supply of skids and a supporting frame for transporting the Diesel engine on the back of a vehicle.

7.12 STANDARD EQUIPMENT

The Diesel engine generator shall have the following equipment and functions as standard:

- Electronic regulation of welding current
- Water cooling

- Electric starter
- 12/24 v battery, protected against accidental short circuits
- Battery charger indicator
- Hour meter
- Engine protection, auto idle, which ensures that the engine returns to idle revolutions after welding
- Oil pressure indicator
- Low fuel indicator
- Warning light for pre-heating
- Sufficiently rated central lifting eye for crane or host
- Stick or MIG-MAG switchable welding facility
- Asynchronous alternator
- Earth leakage relay
- One 400 volt EEC socket
- One 230 volt EEC socket
- Overtemperature thermal cut off
- Voltmeter
- 400v EEC socket – on request
- 230v EEC socket – on request

7.13 AUXILLARY VOLTAGE SUPPLIES

The welder shall supply the wire feed unit and the automatic programmable equipment with approximately 42 VAC and 30 to 46 volt AC / 36-60 volt DC as required. This value may vary from system to system.

The voltages shall be connected to the wire feed unit and programmable unit by high quality quick connect, quick release plugs and sockets and shall not be permanently connected.

7.14 CONTROL PANEL AND MARKING

All the various functions shall be clearly marked and engraved to enable ease of operation. High quality materials shall only be used for the control panel.

The potentiometers for voltage and current shall be of the highest quality and wire wound potentiometers are preferred.

7.15 WEATHERPROOFING

The control panels shall be weatherproofed and dust proofed to prevent ingress of moisture or dust into the control panel.

8.0 WIRE FEED UNIT

- 8.1 The wire feed shall be suitable for semi-automatic and programmable equipment for the welding and repair of rails.
- 8.2 The wire feed unit shall be rugged, portable and totally enclosed and shall be air-cooled
- 8.3 The maximum wire spool capacity shall not be less than 18 kg with a 300mm spool.

8.4 WIRE FEED SETTINGS

- 8.4.1 All the necessary settings shall be made on the feeder unit front panel.
- 8.4.2 The voltage settings shall be logarithmic to provide precise voltage in the low ranges
- 8.4.3 The wire feeder shall be equipped with 2/4 stroke, pre and post gas flow, adjustable backburn time, creep start and crater filling as standard functions.
- 8.4.4 The wire feed shall be equipped with quick-locking connections to enable a very short set-up and connection time.
- 8.4.5 To ensure that solid stable wire feeding occurs the wire feed shall have a 4-wheel feeder mechanism.

The wire feed unit shall have an adjustable backburn time to ensure that the correct length of welding wire is always sticking out in preparation for welding.
- 8.4.6 The wire feed unit shall be equipped with a digital volt/ammeter for indicating and control purposes.

8.5 TECHNICAL DATA

- 8.5.1 The connection voltage shall be between 40 v – 45 v AC
- 8.5.2 Wire spool capacity shall be a maximum of 18 kilogram.

The outside spool diameter shall be a maximum of 30 centimeters.
- 8.5.3 Wire feed speed:

The feed speed shall be between 2,0 to 25 m/min adjustable by means of a potentiometer.
- 8.5.4 The backburn time:

The backburn time shall be between 0 to 0,5 seconds. This will ensure correct stickout of the welding wire.
- 8.5.5 Crater filling facility:

The wire feeder shall have a crater filling facility as standard and shall be adjustable from 0-5 seconds.
- 8.5.6 Weight:

To ensure that the wire feeder is portable the weight of the feeder shall not exceed 15 kilogram.
- 8.5.7 Torch connection:

The torch connection shall be the Euro connection method.

9.0 WELDING GUN SYSTEM

- 9.1 The successful tenderer shall supply a self-cooled welding gun rated at 500 ampere at 60% duty cycle with an Argon Mixture.
- 9.2 The welding gun shall be able to weld with welding wire with diameters varying from 1,0 mm to 2,4 mm in diameter or more.
- 9.3 The welding hose length which shall be connected with a Euro connection not less than 3 metro in length. If any other connection is offered Spoornet staff shall take the decision as to its acceptance.
- 9.4 To ensure a more efficient contact with the welding wire Spoornet requires the "Helix" type of contact tip with adapter. The tenderer shall provide for one "Helix" contact tip per welder in the initial quotation.

10.0 TUBULAR CORED WELDING ELECTRODE WIRE

Spoornet intends to repair both carbon steel and high manganese austenetic steel rails and requires the correct tubular cored electrode wire for both applications. Both electrode type polarities shall be DC positive, (DC(+))

10.1 CARBON – STEEL ELECTRODE WIRE

The carbon steel rail will require a chromium–nickel-molybenum alloyed weld metal with a martensitic-bainitic structure.

- 10.2 The chemical composition of the weld metal shall be within the following percentages:

Carbon 0,12 – 0,18%	Manganese 0,9 – 1,3%
Chrome 0,75 – 1,25%	Nickel 2,0 – 2,5%
Molybenum 0,4 – 0,6% and	Alluminium 1,0 – 1,8%
Traces of Silicon, Phosphorous and	Sulphur will be acceptable.

10.3 FILL TYPE

The fill type shall be slag forming, basic fluourspar

10.4 ALLOY TYPE

Surfacing alloy: martensitic steel weld metal.

10.5 HIGH MANGANESE (13%) AUSTENETIC STEEL

The high manganese rail will require a work-hardening austenetic weld material which has high wear and impact resistance.

- 10.6 The chemical composition of the weld metal shall be within the following percentages:

Carbon 0,25 – 0,35% Silicon 0,35 – 0,75% Manganese 12,5 – 14,5% Chrome 13,5 – 15,5%
 Nickel 1,0 – 2,0% Molybdenum 0,5 – 1,0% Vanadium 0,2 – 0,6% and traces of Phosphor and Sulphur.

10.7 FILL TYPE

Low slag rutile

Alloy type

Surfacing alloy: 14% Mn 14% Cr steel weld metal.

11.0 WELDING CABLE

The successful tenderer shall supply high quality correctly rated 15 metre long welding cables, terminated with the correct fittings, connectors or plugs as required for the welding system.

The rating of the welder: duty cycle (intermittent) shall be in the order of 350A – 35%, 320A – 60% and 270A – 100%

12.0 PROGRAMMABLE EQUIPMENT FOR THE HARDFACING AND REPAIR OF RAIL PROFILES

- 12.1 The system shall comprise of two rail fasteners, a stable aluminium profile, a carriage with a weaving unit, control electronics and remote control panel.
- 12.2 The weaving unit and control electronics shall be fully synchronised to enable the weaving programs to be pre-programmed.
- 12.3 The weaving movements shall start from a laterally adjustable zero-line, either on the outer side or the inner-side of the rail. This zero-line must also be able to be moved laterally during welding.
- 12.4 The equipment shall be fitted with different variable speed adjustments, which can be used in each program to produce a consistent weld thickness.
- 12.5 The remote control unit shall enable the welding personal to have full control of the machine without lifting his welding helmet.
- 12.6 Spoornet requires the following performance specification:

TECHNICAL DATA

Power supply	30 – 50 v AC
Weight of equipment excluding rail	7 – 10 kg
Welding speed	100 – 1500 mm/min
Quick transport movement, rapid	1500 mm/min
Weaving speed	300 – 3000 mm/min
Weaving width	1 – 80 mm
Zero line adjustment	25 mm (+/- 12,5)
Edge length	60 – 990 mm
Crater filling time	0 – 9,00 seconds

12.7 NUMBER OF PROGRAMS

The successful tenderer shall incorporate 4 pre-programmed welding programs in the equipment. The programs shall be fixed, and shall be embedded in the unit by means of Firm ware, F F Proms or Proms.

12.8 FORMAT OF PROGRAMS

- Program 1 – (P1) Shall be a normal weaving program
- Program 2 – (P2) Shall be trapesoidal with both positive and negative inclinations of 45 degrees. Normal weaving shall be possible

Program 3 – (P3)	Positive inclination with desired slope and normal weaving.
Program 4 - (P4)	Facility to program a unique program with desired pattern and motions.

12.9 The programs shall be installed in the unit prior to the delivery of the equipment.

12.10 SELECTION OF PROGRAM

Each individual program shall be selectable from an electronic weaver unit and travel unit control box.

13.0 ELECTRONIC WEAVER UNIT

The weaver unit control panel shall have facilities for:

Weaving speed: In % of maximum speed (adjustable)

Menu selection: For different menus for programming of weaving unit.

Weaving unit on/off: LED indicators

Zeroline position: Setting of the zero line automatically

13.1 The weaving unit shall have suitably dimensioned digital displays which will indicate: The programme number, weaving width in mm dwell time in seconds, zero line, straight weld, normal weaving and positive and negative inclinations.

14.0 ELECTRONIC TRAVEL UNIT

The programmable unit shall be equipped with a facility to control the speeds and travel direction, and shall be adjustable by means of a menu and keyboard control. The electronic unit control panel shall have facilities for:

14.1 SPEED/WEAVING DISTANCE

If programmed for a straight weld the speed shall be programmed in cm/minute. When welding with weaving, the distance between each stroke shall be programmed in steps of 0,1 millimeter.

14.7 PROGRAMME SELECTION

A choice of 4 programmes shall be able to be selected (P1 – P4)

14.2.1 Direction

The unit shall select the running direction of the carriage.

14.2.2 Welding on/off

Selects if welding is on or off.

14.2.3 Rapid speed

If the rapid speed button is depressed the carriage shall run at maximum speed.

15.0 REMOTE CONTROL BOX

The programmable welding equipment shall be fitted with a remote control box, which shall be able to initiate the following functions.

15.1 Selection of the direction of movement

In both normal programmable speed plus rapid traverse if selected.

15.2 SELECTION OF DIRECTION OF WELD

Selection of the direction, of the weld shall be possible by means of pushbutton.

15.3 WELDING SPEED AND WEAVING STROKE

Shall be able to increase/decrease the welding speed or the weaving stroke distance after start.

15.4 WEAVING WIDTH

The remote control box shall be able to adjust the weaving width smaller and wider.

15.5 ZERO LINE ADJUSTMENT

The remote control box shall have facilities for the Zero-line both inwards and outwards.

15.6 POSITIVE AND NEGATIVE INCLINATION

The remote control shall have facilities to start welding with both negative and positive inclination.

15.7 RAPID RETURN

The remote control unit shall have facilities for impulse start of welding after rapid return and impulse rapid return after welding.

15.8 START/STOP

The remote control unit shall be able to start or stop unit without welding.

16.0 RAIL PROFILE

16.1 The programmable unit consists of a travel carriage, which runs on an aluminium profile bar. A minimum of two different types of attachment namely a cross slide attachment for "x" and "y" adjustment (forward and forward reverse) and an electronic operated weaver device with a linear slide (forward weaver and forward reverse weaver) shall be able to be fitted to the profile.

16.2 The rail profile shall be able to be attached to the rail in various different ways, namely: magnets, screws or vacuum cups. The successful tenderer shall supply the required attachments. The standard length of the aluminium profile shall be between 2 metres and 2,5 metres long.

16.3 The rail profile system shall include a universal torch holder, torch cable relief, magnetic brackets with release mechanism, and sufficient locking screws as required.

17.0 TRAINING

17.1 The cost of training shall be included in the supplier's quotation for the programmable welding equipment.

17.2 The training shall contain sufficient practical and theoretical content to enable staff to carry out basic level one repair and adjustments.

17.3 The training shall enable staff to troubleshoot down to module level, interpret displays, emergency and fault conditions and other necessary functions.

17.4 The supplier shall submit a proposed training schedule, duration and any special requirements required.

18.0 DOCUMENTATION AND DIAGRAMS

- 18.1 The supplier shall supply 3 full sets of relevant diagrams, documentation and operating manuals to the relevant Spoornet staff.
- 18.2 The content of the diagrams and documentation shall have fault finding, flow charts, and faultfinding methods to assist with maintenance of the system.
- 18.3 The documentation shall have a full description of the operation of the equipment as well as all the displays on panels, remote panels, pushbuttons as well as any operational function, which enables the unit to work.

19.0 METHOD OF TENDERING

- 19.1 The tenderer shall submit with his tender a schedule of compliance with every clause of this specification and clearly indicate the extent of the compliance in the case of non-compliance

20.0 QUALITY ASSURANCE AND INSPECTIONS

- 20.1 Spoornet reserves the right to inspect the tenderers facilities prior to awarding the contract.
- 20.2 The issuing of acceptance certificates will be authorised by the Quality Assurance section of Spoornet.

21.0 GUARANTEE

- 21.1 The contractor shall guarantee the equipment against faulty workmanship faulty operation or operation of the equipment outside of specification.
- 21.2 Disputes shall be settled between Spoornet staff and the supplier with Spoornet retaining the right to make final decisions on guarantee issues.

22.0 SPARES

The successful tenderer shall supply a comprehensive spare parts catalogue, and make recommendations as to what Spoornet should hold as emergency spares.

The successful tenderer shall guarantee that he will supply backup and hold spares for the equipment for a period of not less than 10 years.

23.0 LIST OF COMPANIES AND RAILWAYS WHICH EQUIPMENT HAS BEEN PREVIOUSLY SUPPLIED TO

- 23.1 The tenderers shall supply a comprehensive list of clients to which the equipment has been supplied. Dates of installation and how the system is being utilised shall be supplied.

END