Technical Specification for Rail-Road Mobile Flash-Butt Welding Machine

No. E-003-0010

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CONTENTS

1. General ................................................................................................................. 3
2. Relevant Standards (non exhaustive list): ......................................................... 3
3. Terms and Definitions.......................................................................................... 5
4. General Requirements.......................................................................................... 7
5. Limiting Parameters for Traveling and Working on the Working Track............ 9
6. Elements of the Machine .................................................................................... 9
7. Stowing of Moveable Parts in Running Configuration......................................... 14
8. Movement Limiting Devices ................................................................................ 15
9. Continuing the Railway Traffic on the Adjacent Line ...................................... 15
10. Working Limit on the Lower Area ..................................................................... 15
11. Working Limit in the Upper Area ..................................................................... 16
12. Interaction with the Infrastructure ..................................................................... 16
13. Lifting and Jacking Points ................................................................................. 13
14. Rail Wheels ........................................................................................................ 13
15. Braking ............................................................................................................... 13
16. Visibility and Audibility of the Machine ............................................................ 16
17. Electrical Equipment and Earth Bonding ......................................................... 16
18. Electromagnetic Compatibility .......................................................................... 16
19. Operation of Axle Counters and Treadles ......................................................... 17
20. Failure Recovery Condition of the Machine ...................................................... 17
21. On and Off Tracking of the Machine ................................................................. 17
22. Exhaust ............................................................................................................. 17
23. Production Process ............................................................................................ 17
24. Technical Documentation ................................................................................... 20
25. Documentation Package ..................................................................................... 20
26. Training Package Requirements ....................................................................... 23
27. Certification of the Machine .............................................................................. 23

ANNEX A ................................................................................................................... 25
ANNEX B .................................................................................................................... 26
1. **General**

1.1. This document described the technical requirements for the Rail-Road Mobile Flash-Butt Welding machine ("RRWM").

1.2. In order to perform the welding on various of rail types (60E1; 60E2; 54E1; 50E6) and various rail grades (R260; R350HT) in accordance with EN 14587-2 for operating on site on building lines and for maintenance operating lines.

1.3. The RRWM shall Mobile Welding System shall be capable to perform closure welds, deburring and stress neutralization, all in one, without extra equipment.

1.4. Unless otherwise and to the extent specified hereafter, the RRWM shall comply in every aspect with the latest edition of EN15746-1, EN15746-2, EN 14587-2.

1.5. The RRWM and all its systems shall be designed to travel and operate safely in tunnels without any special procedures by ISR during the operation. Details on operation in tunnels shall be submitted.

1.6. The welding process shall be automatic, computer-controlled and with data recording storage and shall include computer report of the weld parameters for each and every weld, which shall be submitted to the IPM after the welding operation is completed.

2. **Relevant Standards (non exhaustive list):**

The machine shall fully comply with the latest edition of:


2.2. EN 14033-1 : Railway applications-Track- Railbound construction and maintenance machines –part 1: Technical requirements for running.
2.3. EN 14033-2 : Railway applications - Track - Railbound construction and maintenance machines –Part 2: Technical requirements for working.

2.4. EN 14033-3 - Railway applications – Track - Railbound construction and maintenance machines - Part 3 General safety requirements.

2.5. EN 14363 - Railway applications – Testing for the acceptance of running characteristics of railway vehicles – Testing of running behavior and stationary tests.


2.7. EN 14587-2 Railway applications – Track – Flash butt welding of rails.


2.10. EN 50238 - Railway applications - Compatibility between rolling stock and train detection systems

2.11. European Directive 97/68/EC

2.12. All EN and UIC mentioned in this technical description and the above EN standards.

2.13. Note – the latest edition of the referenced document shall be considered
1. **Terms and Definitions**

1.1. **RRWM** – Road Rail Vehicle with Mobile Welding System.

1.2. **Road-rail machine** – self-propelled machine that can run on rails or ground.

1.3. **Trailer** – non self-propelled vehicle that can be hauled on road wheels.

1.4. **Flash-Butt Welding System** – system to perform flash-butt welding process on short and long rails at a high quality in perfect alignment with high integrated welding force for mechanical stress neutralization to produce continuous welded tracks with a completely independent deburring unit.

1.5. **General attachment** – components or assembly of components which can be mounted onto the RRWM or equipment for a specific use.

1.6. **Railway specific attachment** – equipment capable of being temporarily fixed to and/or powered from the machine, but specifically excludes lifting accessories.

1.7. **Host vehicle** – basic road vehicle or machine which is converted to run additionally on rails.

1.8. **Manufacturer** – body that designs and constructs a rail-road machine, and/or designs and converts the original machine/vehicle to a road-rail machine.

1.9. **Running configuration** – state of machine when it is on the rail and all movable parts are stowed and secured within the applicable ISR loading gauge in accordance with technical appendix A.

1.10. **Working configuration** – state of machine as soon as any part of the machine or of its equipment is away from the running configuration.
1.11. **On and off tracking configuration** – configuration of the machine when it is in a state that enables it to be on or off track.

1.12. **Running** – moving the machine in running configuration along the track.

1.13. **Operating track** – track corresponding to the criteria of the infrastructure manager on which vehicles may run under normal signaling arrangements (with or without speed limits).

1.14. **Working track** – track being maintained for which the geometrical parameters may reach the limiting values as specified in EN 14033-2:2008, annex F and for which special operational restrictions may apply.

1.15. **Railway infrastructure** – all installations required for the running of railway vehicles.

1.16. **Operator** – person who handles the controls of the Flash-Butt Welding System in order to perform the functions of the weldings.

1.17. **Driver** – person who handles the controls of the RRWM in running configuration along the track, and on the road.

1.18. **Type testing** – examination of the first RRWM of a new type, for build conformity to the requirements of EN 15746-1; 2.

1.19. **Type conformance testing** – procedure to verify that the RRWM conforms to the design of the first machine of the type that has been approved.

1.20. **Type approval certificate** – document issued after the checking of documents and testing of the RRWM comply with EN 15746-1;2 and EN14587-2 and this technical specifications.

1.21. **Visual test** – exam to establish whether all elements of the machine, system or component are present and that documents and drawings correspond to the requirements.
1.22. **Measurement test** – test to establish whether the stated measurable parameters have met the requirements such as geometric dimensions, safety distances, insulation resistance of the electric circuits, noise, vibrations etc.

1.23. **Functional test** – test to establish whether, in unloaded working conditions, the machine including all safety devices, works as intended and all functions comply with the requirements of the technical documentation.

1.24. **Load test** – test to establish whether the strength and stability of the equipment under load together with all safety devices and adjustments meets the requirements of EN 15746 (all parts).

2. **General Requirements**

4.1 The RRWM Host Vehicle shall be a category 9A machine according to the EN15746-1/2, built on the basis of a road carrier able to perform all the tasks mentioned in this technical specifications. The RRWM shall be designed to enable fast entry to/and exit from the track.

4.2 The machine shall be able to travel and work on OCS - electrified lines 25000 V AC.

4.3 The travel speed on track shall be 40 km/h in forward direction and 20 km/h in reverse direction on 35 ‰ gradient. The driving speed on the road shall be at least 120 km/h.

4.4 The RRWM shall be equipped with an Automatic Trailer Coupling on both ends for road and rail towing purposes.

4.5 The RRWM shall have the capability of towing a rail trailer with a total weight of approximately 20 ton with a speed of 20 km/h on a gradient of 40‰.

4.6 The RRWM host vehicle and the general attachments shall have local service representatives capable of providing maintenance for the specific system.

4.7 The RRWM host vehicle and Mobile Welding System shall be of the latest type in production at the time of award.
4.8   The Host Vehicle shall be new.

4.9   The Host Vehicle shall not be a prototype.

4.10  Components of the RRWM and of all systems which are obsolete, nearing end of production or out of production shall not be used.

4.11  All components shall remain and be readily available for the ISR to purchase for a minimum of fifteen (15) years from the date of Final Test.

4.12  The Host Vehicle engine shall comply with the EURO 6 category of engine emissions or newest, in accordance with European Directive 97/68/EC and all its amendments. Technical description shall be submitted.

4.13  The RRWM shall have a fuel system that ensure at least 48 working hours and 500 km road traveling.

4.14  The Host Vehicle shall have 2 (two) data recording (tachographs), separate for road and rail.

4.15  The Host Vehicle shall have frame and suspension configurations designed to work both on and off-road.

4.16  The bogies or axles intended for traveling on rail will be activated by hydrostatic motors.

4.17  The visibility of the driver when driving and working shall comply with EN 15746-1; 2.

4.18  For driving in the reverse direction, a CCTV according to EN 15746-2 shall be provided.

4.19  When running on railway wheels, the road wheels will be positioned 115 mm higher than the top of the rail. For the requested loading gauge see Annex A. For the cross section of the tunnel see Annex B.

4.2  The operating parameters in ISR running track are:

<table>
<thead>
<tr>
<th>4.2.1.</th>
<th>Track nominal gauge</th>
<th>1435 [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2.2.</td>
<td>Track travel speed - self propelled</td>
<td>At least 40 [km/h]</td>
</tr>
<tr>
<td>4.2.3.</td>
<td>Max gradient</td>
<td>40 [%]</td>
</tr>
</tbody>
</table>
4.2.4. Min curve radius on shunting area 75 [m]
4.2.5. Min curve radius on main and secondary track line 140 [m]
4.19.6. Max superelevation 170 [mm]
4.19.7. Electrification system OCS 25 kVAC
4.19.8. Standard height of contact cable 5.5 [m]
4.19.9. Minimum OCS height 5.1 [m]
4.19.10. Maximum OCS height 5.6 [m]

3. Limiting Parameters for Traveling and Working on the Working Track.

3.1. The limiting geometric parameters for machine travelling and working in working track are the parameters mentioned in annex F of EN14033-2 namely:

<table>
<thead>
<tr>
<th>Track geometry parameter</th>
<th>Limiting value for working track</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1.1. Twist on base of 3 m</td>
<td>10 mm/m</td>
</tr>
<tr>
<td>5.1.2. Twist on base of 9 m</td>
<td>5 mm/m</td>
</tr>
<tr>
<td>5.1.3. Cant</td>
<td>170 mm</td>
</tr>
<tr>
<td>5.1.4. Length of ramp</td>
<td>≥ 5 m</td>
</tr>
<tr>
<td>5.1.5. Ramp gradient</td>
<td>≤ 20:1000</td>
</tr>
<tr>
<td>5.1.6. Lateral radius of curvature</td>
<td>≥ 50 m</td>
</tr>
<tr>
<td>5.1.7. Over 10 m chord</td>
<td>50 mm (peak to peak)</td>
</tr>
<tr>
<td>5.1.8. Lateral displacement of the track</td>
<td>500 mm / 20 m</td>
</tr>
</tbody>
</table>

The twists according 5.1.1 and 5.1.2 shall be take into consideration during the RRWM construction design.

4. Elements of the RRWM

4.1. The RRWM consist in a Host Vehicle, rail drive unit with bogies and Flash-Butt Welding System.

4.2. The Flash-Butt Welding System shall be mounted onto the host vehicle chassis on a rigid walls cabin (behind the driving cabin) ("Welding Equipment Cabin"), consisting of an entirely closed cabin which houses and protects all systems and controllers. The Welding Equipment Cabin shall have two compartments:
- Energy supply aggregates compartment in the front;
- Welding compartment containing Flash-Butt Welding System on the rear.

4.3. The Host Vehicle shall be assembled from the following elements:
4.3.1. The host vehicle will be a regular road carrier which will be converted for travelling on the track by means of suitable railway bogie with railway type wheels.
4.3.2. The railway wheels shall not interfere with the correct functioning of the axle counters.
4.3.3. The Flush–Butt welding rail system.

4.4. The RRWM shall have rail axle monitoring system to ensure that all rail axles are properly lifted (road travel) or lowered (rail travel).
4.5. The RRWM shall be driven in working mode by remote control at a creeping speed of 3 to 5 km/h.
4.6. The RRWM shall have operating hours and km-counter for rail drive.
4.7. The RRWM shall have in the rear bogie a swiveling system for easy entry/exit on track operation.
4.8. The RRWM shall have emergency release system in case of engine or/and hydraulic failure.
4.9. The RRWM shall have an auxiliary fuel engine to power the emergency system.
4.10. The RRWM shall have a hydraulic aggregate for emergency operation of all vital hydraulic functions in case of a main hydraulic system failure.
4.11. The RRWM shall have on the rear area monitoring HD camera(s) for driving backward including color screen in the driver’s cabin.
4.12. The RRWM shall have mounted on all four corners of the vehicle according EN 14033 buttons for: emergency shutdown, emergency brake, railway signal horn.
4.13. The host vehicle shall have automatic transmission.
4.14. Driver cabin and welding equipment cabins shall be painted yellow RAL 1018 or a color(s) later agreed between parts.
4.15. Chassis shall be painted black RAL 9005 or later agreed between parts.

4.16. The driving cabin
4.16.1. The Host Vehicle shall have a cabin fit to transport 3 people (driver/operator and two additional seats).
4.16.2. The cabin shall be equipped with a tropicalized air conditioning system able to provide the necessary air conditioning for the crew and for the correct functioning of the electric and electronic systems mounted in the cabin conform to EN 14033.
4.16.3. The driver's controls shall comply with EN 15746-2.
4.16.4. A driver vigilance system (SiFa) shall be provided for driving position in rail mode.
4.16.5. The driver and assistant will be protected against solar radiation by means that will not change perception of signal color.

4.17. The Welding Equipment Cabin
The RRWM shall have mounted onto the host vehicle chassis rigid walls cabin (behind the driving cabin), entirely closed and protected all welding equipment and auxiliaries.
- The cabin shall ensure noise vibration and ambient insulation.
- The floor shall be anti-slipping.

4.18. Lighting
4.18.1. The RRWM shall have a LED lighting system according with EN 15746.
4.18.2. The RRWM shall have additional a LED lighting system suitable for efficient illuminating the work place during the night.

4.19. Hydraulic System
4.19.1. The Hydraulic System shall be energized by the diesel engine of the carrier via its accessory hydrodynamic system. The Hydraulic System is used to operate the rail system, stabilizing lifting devices, bogie lifting device, Flash-butt Welding System and its peripherals.
4.19.2. The Hydraulic System shall be designed as to provide efficient operation in the ambient conditions given in Technical Appendix A.

4.19.3. The Hydraulic System shall be equipped with oil cooling system.

4.19.4. The Hydraulic System shall provide a separate circuit for each field of application: rail running system, Flash-butt Welding System, energy system, etc.

4.19.5. All hydraulic reservoirs shall be designed and constructed to prevent entry of foreign matter, including water, and sized to protect the hydraulic system against excessive heat or thermal conditions. Reservoir shall include: baffles to separate intake and return lines to facilitate the separation of air and foreign matter from the hydraulic fluid, separate pump inlet from the settling portion of the tank and shall direct flow toward tank walls for maximum heat dissipation.

4.19.6. Access panels large enough for complete cleaning, inspection, maintenance, and servicing of sump filters with an accessible means to empty the reservoir in the event the fluid is to be drained.

4.19.7. Where failure of the power plant or pump can immobilize components in a position which would prevent moving of the RRWM, an independent engine operated emergency pump shall be provided in the circuit to allow normalization of all equipment components and for movement of the RRWM to a proper location.

4.20. Hydraulic stabilizing lifting device:

4.20.1. The RRWM shall be equipped with hydraulic stabilizing lifting devices to support/raise the machine during the welding process, while the welding/ or closure weld is being made. This system shall ensure safety machine operation.

4.20.2. The Hydraulic stabilizing lifting devices shall be equipped at the ends with support plates.

4.20.3. Lifting and jacking points shall be fitted as per section 5.8.2 of EN 15746-1.
5. **Rail Wheels System**

5.1. The RRWM shall have a complete re-railing integrated equipment: 2 (two) bogies for rail driving / working on the track ("Rail Wheels System").

5.2. Rail wheels System shall be suitably loaded and support to provide good rail guidance at all times.

5.3. Any failure of the suspension system shall not make the machine unstable when operating at the limits of its rated load and/or reach.

5.4. The rail wheels shall be in accordance to EN 13715. Rail wheel diameter: minimum 330 mm.

5.5. Rail drive system is consisting of:

   - Hydraulic bogie lifting lowering device for the rail drive system.
   - On the front bogie, disk brake system on both axles.
   - On the rear bogie, hydrostatic drive gear on both axles.
   - Traction and disk brake system activating on both rear axles.
   - Spring loaded parking brake, activating on two bogies.
   - Adequate suspension.

Remote control with the functions:

   - Lowering and lifting rail bogies
   - Locking / unlocking the vehicle's suspension spring system
   - Emergency cut-out button.
   - Steering wheel lock during rail travel

5.6. In rail drive mode and working mode the road axles shall be hydraulically and mechanically locked.

6. **Braking**

6.1. The machine shall comply with the braking requirements given in EN 15746-2 section 5.24.

6.2. The machine shall also comply with the braking requirements of the Host Vehicle when in road mode.

6.3. The stopping distances shall comply EN 15746-2 section 5.24.1

6.4. A parking brake capable of operating and function without power from the machine shall be provided capable of holding the machine
in rail configuration on a gradient of 40% with factor of safety of 1.4 according to EN 15746-2 section 5.24.3.

7. **Pneumatic system**
   7.1. The machine pneumatic system shall ensure full operation of braking system and other auxiliary needs.
   7.2. The system shall include an air dryer, water separator, and a full flow replaceable filter elements, lubricating oil system.
   7.3. Compressed air connections shall be provided on both machine sides.

8. **Current Generator**
   8.1. The RRWM shall have a three phase 400 VAC / 50 Hz last generation current generator to supply electric energy for rail welding operations.
   8.2. The generator is driven from main engine via hydrostatic or hydrodynamic transmission.
   8.3. The generator shall equipped with two sides sockets 220VAC/ 50 Hz 16 A output on both sides.
   8.4. The RRWM shall be IT protected by an electric governor.

9. **External AC power supply inlet**
   9.1. The RRWMS shall be equipped with two sides sockets for 3 X 400 VAC / 50 Hz to supply electric current to the machine in emergency cases or standby.

10. **Flash Butt Welding System**
    10.1. The Flash Butt Welding System shall be an automatic, programmed welding sequence. It shall ensure automatic rail clamping, pulling, aligning, welding process, cooling, deburring and unclamping in one cycle.
    10.2. The Flash Butt Welding System shall be designed and fully accessorized to perform flash butt welding and closure welding on
various of rail types (60E1; 60E2; 54E1; 50E6) and various rail grades (R260; R350HT)

The RRWM shall contain at least the following:
- Welding head;
- Welding process control unit, an industrial PC and Operation system for the automatic sequences procedures, including data management, and storage, output welding reports on screen and external memory stick (at least USB 3);
- Operation panel on the welding head with HD touch screen and sun protection, and remote control;
- Hydraulic manipulator for lifting and positioning the welding head, including crosswise freedom;
- Hydraulic system enable flash-butt welding and closure welding processes;
- Long life trimming device;
- Air cooling device for head hardened rails welding process;
- Water cooling aggregate.

11. **Stowing of Moveable Parts in Running Configuration**

When the machine is in running configuration any movable equipment which has the capacity to go outside the gauge shall be stowed in a safe manner according to EN 15746-1 section 5.5.2.1.

12. **Movement Limiting Devices**

Where operation of the machine or any device or attachment mounted on the machine exceeds the working limits, the accidental intrusion in the dangerous zones should be prevented by movement limiting devices conform to EN15746-1 section 5.2.3.2.2.

13. **Continuing the Railway Traffic on the Adjacent Line**

The machine will be designed so as to allow continuing the rail traffic operation on the adjacent track.

14. **Working Limit on the Lower Area**
The machine shall be designed and built so as not to damage infrastructure elements, such as axle counters etc., during work.

15. **Working Limit in the Upper Area**

15.1. All metallic parts of the machine shall be equipotential bonded to rail according to EN 15446-1, section 5.17.1.

15.2. The machine shall have the possibility to travel on electrified lines but **will not be allowed** to work under live catenary.

16. **Interaction with the Infrastructure**

The interaction with the infrastructure shall comply with EN 15746-1, section 5.4, and the relevant sections of EN 14033-2 for category 9A machines with speed less than 60 km/h on track.

17. **Visibility Audibility and warning systems of the Machine**

The visibility, audibility and warning systems of the machine in working and running modes shall comply with EN 15746-1, sections 5.15 and 5.16.

18. **Electrical Equipment and Earth Bonding**

18.1. Equipotential bonding shall comply with EN 15746-1 section 5.17.

18.2. Antennae shall comply with EN 15746-1 section 5.17.2.

19. **Electromagnetic Compatibility**

The machine shall meet the requirements of EN 15746–1, section 5.18 of concerning emissions from the machine and immunity of the machine from railway equipment.
20. **Operation of Axle Counters and Treadles**
   The machine shall not have any metal parts, other than the wheel flanges in the axle counter detection area. The interference zone according to EN 50238 shall be kept free.

21. **Failure Recovery Condition of the Machine**
   The machine shall have adequate means to be moved in case of failure, including emergency devices which will be part of the tool kit of the machine.

22. **On and Off Tracking of the Machine**

   22.1. The system of placing the machine on the track or to remove it from the track shall comply with EN 15746-1 section 5.22 of.

   22.2. There will be a possibility of achieving the running mode even with failure of main power source. To this aim, an auxiliary power source may be installed.

23. **Exhaust**

   23.1. The exhaust gases shall not be directed to catenary nor to the working places of the operators.

   23.2. The machine shall be equipped to minimize the emissions of internal combustion engines.

24. **Protection from the risks of fire**

   24.1. The RRWM shall have a built-in fire extinguishing system to permit personnel a safe exit from the machine.

   24.2. The RRWM shall have a fire extinguisher system easily accessible to the operator.
25. **Production Process**

25.1. **Quality Control**

Together with the proposal the contractor shall submit to ISR a copy of his quality control manual. The following procedures must be included in the manual:

25.1.1. **Tests Plan**

Listing all the tests that will be performed by the contractor on the vehicle during the production, including test at major sub contractors. Submit a sample test plan. The actual test plan shall be submitted 15 days after contract award.

25.1.2. **Final Test Details**

The final test of the vehicle shall be conducted following the guide lines of EN 15746 .

Submit a sample final test plan. The actual test plan will be submitted one month before commencement of the test.

25.1.3. **Deficiencies Tracking Procedures**

The quality control manual will show the procedure how the contractor tracks and closes deficiencies that were discovered during the manufacturing process. The deficiencies will include among other parameters at least the following:

- Deficiency Description;
- Remedial Plan.

25.2. **Manufacturing Schedule**

25.2.1. Within 15 days after contract award the contractor shall present his manufacturing schedule. The schedule shall show the timing and duration for the following tasks that will take place with the participation of ISR personnel.

25.2.2. Design review.

25.2.3. Foreign acceptance test at manufacturer's premises.

25.2.4. Final vehicle systems tests at ISR premises and tracks.
25.3. **Handing-over Procedure**

The handing-over procedure shall include the following tasks:

25.3.1. **At the manufacturing plant:**

- **a.** Visual check of the vehicle and its systems for compliance with the specifications drawings and the submittals.
- **b.** Checking of all test reports which were issued during the production for compliance with the test plan.
- **c.** Running test of the vehicle and its systems.
  A representative of the Notified Body will participate in this test and will certify that all propulsion, driving, braking, towing, visibility, vigilance meet the EN and the UIC codes and are functioning properly according to EN 15746.
- **d.** The certification price shall be included in machine price.
- **e.** Checking of all the hard copies of the operation and maintenance manuals, parts breakdown and drawings sets for compliance with the specifications requirements.
- **f.** Checking of all the Interactive Electronic Technical Manual (IETM) of the operation and maintenance manuals, parts breakdown and drawings sets for compliance with the specifications requirements and its hyperlinks and search capabilities.
- **g.** After approval of all the tests by ISR the vehicle shall be sealed, protected and prepared by the contractor for the sea transportation.

25.3.2. **At destination:**

Tasks to be performed by the contractor

- **a.** Removal and cleaning the vehicle packaging and inhibiting materials.
- **b.** Functional tests of all vehicle systems.
- **c.** Operators and maintenance personnel training – 15 working days for operators and 15 working days for maintenance team.

The manufacture will submit a proposal for the training as mentioned above for ISR approval.
26. **Technical Documentation**

The manufacturer will provide the technical documentation requested in section 8.2 of EN 15746-2 and section 7 of EN 15746-1 and annex---of this technical sp20. Documentation Requirements.

27. **Documentation Package**

27.1. The documentation will be provided in English and in Hebrew, both in softcopy and hardcopy formats. The documentation package will include:

27.1.1. System description.
27.1.2. Operator’s Manual for the machine and all systems.
27.1.3. Maintenance Manual for the machine and all systems which shall include all the preventive maintenance activities and repairs.
27.1.4. Engineering documentation including special processes for overhauling maintenance.
27.1.5. Pneumatic, hydraulic and electrical detailed diagrams and integrative drawings.
27.1.6. Illustrated parts catalog for all levels of repairs.
27.1.7. Fault diagnosis and troubleshooting charts for each system/sub-system.
27.1.8. Inspection procedures and maintenance standards.
27.1.9. Table of service tools & equipment.
27.1.10. Complete periodic maintenance plan.

27.2. **Operators manual**

The User Handbook / Operator’s Manual should include the following information:

27.2.1. Front cover page.
27.2.2. Opening pages (list of revisions, table of contents, list of figures, list of tables, abbreviations and acronyms, safety conventions etc.)
27.2.3. Chapter 1 – General Description: Scope, Overview, System Introduction, General Structure, Theory of
Operation, General Block Diagram, Functional Description, Interfaces, Technical Data.

27.2.4. Chapter 2 – Detailed Description: Detailed description per sub-system and assembly, including general information, general structure, main functions, technical data.

27.2.5. Chapter 3 – Controls, displays and HMI.

27.2.6. Chapter 4 – System Operation: All operating sequences, steps before placing the system in service, system operation, system shutdown and steps after taking the system out of service.

27.2.7. Chapter 5 – Maintenance Guidelines: Includes Maintenance Activities Policy, Crew Level Maintenance Activities Policy.

27.2.8. Chapter 6 – Troubleshooting: For both BIT and symptom-based troubleshooting, includes all troubleshooting instructions, charts etc.

27.2.9. Chapter 7 – Maintenance: Includes all maintenance activities of the user.

27.3. Maintenance manual

The Maintenance Manual for each level of repair should include the following information:

27.3.1. Front Cover Page.

27.3.2. Opening Pages (list of revisions, table of contents, list of figures, list of tables, abbreviations and acronyms, safety conventions etc.).

27.3.3. Chapter 1 – General Description: Scope, Overview, System Introduction, General Structure, Theory of Operation, General Block Diagram, Functional Description, Interfaces, Technical Data.

27.3.4. Chapter 2 – Detailed Description: Detailed description per sub-system and assembly, including general information, general structure, main functions, theory of operation (General Block Diagram, Functional Description), interfaces, technical data.

27.3.5. Pneumatic, oil, fuel, electrical and other systems will also be described according to their functional circuits.
27.3.6. Chapter 3 – Maintenance Guidelines: Includes Maintenance Activities Policy, Crew Level Maintenance Activities Policy.

27.3.7. Chapter 4 – Troubleshooting: Both BIT and symptom-based troubleshooting, including all troubleshooting instructions, screens, charts, fault diagnosis and use of any special maintenance tools ("Special Tools") or testing equipment.

27.3.8. Chapter 5 – Maintenance: Includes all maintenance activities for Preventive Maintenance and Corrective Maintenance, such as inspections and maintenance tasks, repair procedures, material used, procedures for assembly and disassembly of sub-systems, assemblies and sub-assemblies, calibrations, topping of consumables etc.

27.4. System Description manual

The System Descriptive Manual should include the following information:

27.4.1. Front Cover Page.

27.4.2. Opening Pages (list of revisions, table of contents, list of figures, list of tables, abbreviations and acronyms, safety conventions etc.).

27.4.3. Main systems detailed description (engine, fuel, oil, pneumatic etc.).

27.4.4. Software main modules description (power up, BIT etc.).

27.4.5. Hardware main modules description (EMDEC, Control cards etc).

27.4.6. Appendixes.

27.5. NOTE: The Template for the ISR technical manual will be provided on demand.

27.6. Documentation Formats

Documentation will be provided in the following formats:

27.6.1. All the documentation shall be supplied as:

   a. Hard copies in the quantities detailed hereafter.
   b. Source files (MS Office, Indesign etc.).
28. **Training Package Requirements**

28.1. **Training Package**

Training materials shall be provided for operation, maintenance, in the English language, both in softcopy and hardcopy formats. The training package shall include:

28.1.1. Training schedule.
28.1.2. Theoretical lessons.
28.1.3. Practical lessons.
28.1.5. Evaluation package.

28.2. **Training Package Formats**

The Training Package will be provided in the following formats:

28.2.1. User Handbook / Operator’s Manual, Maintenance Manuals will be supplied as:

   a. PowerPoint files for Theoretical Lessons.
   b. WORD files for Practical Lessons.
   c. PDF files (unlocked and data-copy-enabled).

28.3. **Manufacturer Training Courses**

28.3.1. The Manufacturer is requested to conduct several training courses in the English language:

   a. Operators Course.
   b. Maintenance Course.

28.4. The courses will include both theoretical and practical aspects. Course outlines should be approved by ISR Training department in order to ensure that all aspects are covered.

29. **Certification of the Machine**

29.1. The manufacturer shall propose and ISR shall approve a Notified Body that will perform the certification of the machines according to EN 14033 and EN 15746.
29.2. The notified body will perform a type testing for the first machine and will provide a test type certificate and will perform type conforming testing for the remainder of the machines.

29.3. The cost of the testing will be included in the price of the machines.
ANNEX A

Loading Gauge

Standard gauge ISR

---

1. 3.800 m - for permissible speed greater than 160 km/h up to 250 km/h.
2. 3.300 m - for speed greater than 60 km/h up to 160 km/h.
3. 3.000 m - for speed up to 60 km/h on the secondary lines, station and marshail yard lines.
5. Dimensions for old rolling stock.
6. Dimensions for Rolling stock static gauge.

A. Area between tracks or outside of track for signaling equipment.
B. Area for passenger platforms, ramps and signaling systems.

Comments:
1. Dimensions on this sketch for straight line only.
2. Calculation of this dimensions in curve (see technical rules ISR).
3. Location of structures on the passengers platforms in relation to terminal tracks (see technical program for passenger station ISR).
4. All basic dimension of the ISR infrastructure reference profile follows the EN 15273 standard.
5. The ISR infrastructure gauge refers to GC Reference Profile.
ANNEX C

Climate and Environmental Conditions

Climate and Environmental Conditions
Max. Ambient temp. +50 °C (shade)
Min Ambient temp. -5 °C
Relative humidity 10% to 90%
Altitude - 400 m to +800 m
Sunny hours per year 3300
UV Radiation MJ/m² per year 360-600
Rainfall mm/year 400-800
Dust Conditions in the atmosphere
(Microgram per m³ atmosphere)

<table>
<thead>
<tr>
<th></th>
<th>Maximum Half-hour Value</th>
<th>Maximum Daily Value</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx</td>
<td>1064</td>
<td>560</td>
<td>71</td>
</tr>
<tr>
<td>SO2</td>
<td>780</td>
<td>260</td>
<td>21</td>
</tr>
<tr>
<td>O3</td>
<td>312</td>
<td>143</td>
<td>84</td>
</tr>
<tr>
<td>Suspended Dust</td>
<td>350</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Suspended Particulate Matter (SPM)
Particle size to 0.5-1 micron
Sea Salt Concentrations in the Atmosphere
(Micrograms per m³ atmosphere)

<table>
<thead>
<tr>
<th>Salt Element</th>
<th>Na</th>
<th>Cl</th>
<th>SO₄</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position:</td>
<td>Season</td>
<td>Season</td>
<td>Season</td>
</tr>
<tr>
<td></td>
<td>Dry</td>
<td>Wet</td>
<td>Dry</td>
</tr>
<tr>
<td>Sea Air at Coast Line</td>
<td>7.3</td>
<td>16.0</td>
<td>12.0</td>
</tr>
<tr>
<td>600 m from Shore</td>
<td>3.1</td>
<td>4.8</td>
<td>4.2</td>
</tr>
<tr>
<td>6000 m from Shore</td>
<td>1.1</td>
<td>1.4</td>
<td>1.5</td>
</tr>
</tbody>
</table>
Attachment D

Clarifying Technical Details after Clarifications Process

(Representing an Integral Part of the Technical Specifications)

1. The electric systems shall be designed in accordance with the relevant EN standards. Systems operates by means of alternating current (AC) shall designed and installed in accordance with Israel Electricity Law.

2. At least the following systems shall have representative and service facilities in Israel:

3. Diesel engine, Diesel generator, Brake system, Transmission system, Air condition system, cooling system, Engine cooling system, Hydraulic System, Pneumatic System, Cranes.

4. The representative and service and facility shall be listed.

TECHNICAL APPENDIX B – ISRAEL RAILWAYS TRACKS DATA

ISRAEL RAILWAYS TRACK SUPERSTRUCTURE

B.1. ISR railway network has CWR track with flash-butt and aluminothermic welds, and tracks with insulated joint rails and fishplates.

B.2. Rail profiles: 60E1, 60E2, 54E1, 50E6, 49E1 and 46E2 in accordance with EN13674-1.


B.4. Switches: 1/8, 1/9, 1/12, 1/20, scissor-crossovers, double slips and expansion switches.

B.5. Standard track gauge: 1435 mm (-2, +5).


B.7. Type of sleepers: Universal monoblock concrete sleepers, Frank-vagon sleepers, wooden sleepers, steel sleepers.

B.8. Minimum number of sleepers of one km of track: 1667.

B.9. Minimum horizontal curve radius:

- Main line: 141 m;
- Secondary line: 120 m.
B.10  **S-Curve:** In some lines there are S-curves with short tangent section (6 m) and there are some without tangent.

B.11  **Minimum vertical curve:** 3000 m.

B.12  **Vertical geometry:** Maximum gradient 30%. 

B.13  **Maximum cant (superelevation):** 150 mm.

B.13  **Maximum cant deficiency:** 150 mm.

<table>
<thead>
<tr>
<th>Speed [km/h]</th>
<th>V&lt;sub&gt;max&lt;/sub&gt; ≤ 100</th>
<th>100 &lt; V&lt;sub&gt;max&lt;/sub&gt; ≤ 160</th>
<th>160 &lt; V&lt;sub&gt;max&lt;/sub&gt; ≤ 200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum cant deficiency [mm]</td>
<td>≤ 110</td>
<td>≤ 100</td>
<td>≤ 60</td>
</tr>
</tbody>
</table>

**ISRAEL RAILWAYS TRACK LOAD**

B.14. **Maximum axle load:** 22.5 ton.

B.15. **Maximum traffic speed:** 160 km/h.

B.16. **Potential Traffic load:** 20 MGT per year.

**ISRAEL RAILWAYS WHEEL TRACK INTERACTION**

B.17. **Wheels back to back dimension:** as defined in EN15313, section 6.2.1.5.

B.18. **Wheel profile dimensions:**
    - According to EN 13715 S1002, h=28, e=32.5, reverse slope 15%;
    - According to UIC 510-2, appendix B1;
    - Wheels of Ø850 with profile DSB 82-1.
Attachment E

The protection is by a circuit breaker as we can see in page 173 in the wiring diagram.
- Here mentioned that from the wiring diagram parts that I have, I can't see the source of relay (points D1,D2 – May be from an emergency push button.

The system Earthing that offers by the manufacturer supply a high current in one phase to ground short circuit that runs the protection (it is right also for all the short circuit cases).

TN- is Prohibited for use in Israel

2. The protection systems:

The protection systems that can be taking in account, but are not practically to use are the TN-S system (need an electrode and the max electrode resistance to the ground of 20.0 ohm) and the leakage current monitor (also need an electrode and the max electrode resistance to the ground given by the formula Re = Uph/I (Ω))

These Methods are not practically to use.
The System:
A crane railcart for use in the Israel railways Ltd., in the crane electronic and electrical systems, include service outlets in the outside of the crane, charging system, rectifiers system, generator as the main power supply, excluding times when the crane "on board" in the garage.

The Goal: Recommendations about the protection against electric shock method to use in the crane.

1. Description of the system components (that relevant to the issue):
According to our conversation and the wiring diagram of the crane systems, the type of the supply in the crane is the TN system (the neutral of the generator connected to the crane body that is separate from the earth-Ground). This method prohibited for use in Israel.
Because of the isolation between the crane and the ground we can't see the system as TN-S.
And the use of ground electrode is not practical in this case.

The power supply: 3 phases generator which connected to a switchboard with 4 pole circuit breaker (NSX100-B-4P).
The main power wiring diagram (page 172):

3. The recommended system: the IT system:
The aim of the system is to prevent a close loop throw a man body in case of fault to the ground.
This system is characterized by not connecting the generator neutral to the ground (crane body – steel) and the use of an Insulation Monitor.

When the crane in the garage and get the supply from a local board one have to make a by-pass connection to the Insulation Monitor.

This Method is commonly in rail cart as we can see in the appendix.

To use the IT system we have to:

a. Put an Insulation Monitor in the generator ports or in front of the switchboard after the generator ports (if the Probability of short circuit in that section is low).
It is recommended to connect the outlets through RCD's to protect the workers against a second fault to the ground.

b. Use the crane body as an equipotential bonding.

c. To put a sign in the main board that will note the system method (like: "Take care, the system protection methods is IT")

d. To put a bypass selector to the Insulation Monitor so one can connect the supply from the garage board.

It is highly recommended to put a sign in front of the generator that says: "Do not connect/runs or use as a power supply the generator while the crane is in the garage"