Technical Specification
for
Manufacture and Supply of
Railbound Vehicle
with Rail Surface Defects Elimination System
No. E-04-0004
January 2017
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1. **SCOPE**

1.1 This document described the technical requirements for the Railbound Vehicle with Rail Head Defects Elimination System ("RSDEV").

1.2 The RSDEV shall be designed to eliminate Rail Surface Defects and Reprofiling rails on both rails simultaneously or separately in track.

1.3 Unless otherwise and to the extent specified hereafter, the RSDEV shall comply in every aspect with the latest edition of EN 14033 parts 1-3, EN 13231-3 and prEN 13231-5.

1.4 The RSDEV and all its systems shall be designed to carried out the operation on all track types of track found on ISR track network to include:
   a. Main lines;
   b. Station tracks;
   c. Level crossings;
   d. Guarded track to include track with guard or check rails;
   e. Jointed track to include track with standard or insulated joints;
   f. Tracks with axle counters;
   g. Tracks with lubricators systems;

1.5 The RSDEV 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 RSDEV shall has the capabilities to perform the following rail reproufiling strategies:
   a) Initial Reprofiling;
   b) Preventive Cycle Reprofiling;
   c) Corrective Reprofiling;
   d) Wear Reducing Profiles;
   e) Gauge Widening Profile;
   f) The ISR Target Profiles, (see section 4.4 and Technical Appendix D).

1.7 The RSDEV shall has the capabilities to eliminate the following rail surface defects:

1.7.1 Head Checking;
1.7.2 Belgrospi;
1.7.3 Squats;
1.7.4 Flaking;
1.7.5 Spalling;
1.7.6 Transverse profile deformation;
1.7.7 Flattened transverse profile;
1.7.8 Side cutting;
1.7.9 Periodic defects on longitudinal profiles;
1.7.10 Short pitch corrugation;
1.7.11 Short wave corrugation;
1.7.12 Long wave corrugation;
1.7.13 Imprints;
1.7.14 Wheel burns;

1.8 The RSDEV and all its systems shall be designed to operate on the following rail types:

<table>
<thead>
<tr>
<th>GRADE (*)</th>
<th>PROFILE (*)</th>
<th>R350HT</th>
<th>R320cr</th>
<th>R260</th>
<th>R220</th>
</tr>
</thead>
<tbody>
<tr>
<td>50E6 (U50)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>54E1 (UIC54)</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>60E1 (UIC60)</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>60E2</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

(*) in accordance with EN13674-1

1.9 The RSDEV layout design shall ensure clear and safe travelling and operation on single and double track/s as well as between station platforms and in tunnels, in reference to ISR loading gauge specified in Technical Appendix C and tunnel cross sections specified in Technical Appendix D, layout drawing shall be submitted.

1.10 The RSDEV shall be designed to ensure the highest efficient and uniform operation performances, on track with the gradient of
0%–35‰ at minimum, with the RSDEV maximum travelling and operation speed.

1.11 The RSDEV propulsion and brake systems shall be available at both ends to enable bi-directional travelling and operation.

1.12 The RSDEV design shall enable a well-trained operator to execute the works in accordance with the acceptance of the work requirements described in EN 13231-3 section 4.3 – CLASS 1; and section 5.3 – CLASS Q.

1.13 The RSDEV shall include the following measurement systems: Longitudinal Profile Measurement System, Transverse Profile Measurement System, Head Check Measurement System and Rail roughness measurement, which shall be an integral part of the Rail Surface Defects Elimination System and synchronized one with the other.

1.14 The RSDEV shall be designed to operate with the same efficiency near high voltage electrical wire line, on electrified track with 25k VAC and on non-electrified track with CWR and jointed track. The relevant technical documents and certificates approving it, shall be submitted.

1.15 The Rail Surface Defects Elimination System equipment shall be designed to conform to the noise reduction, vibration while working or traveling requirements specified in 14033-3. A special attention must be focused on the metal waste collector system to ensure maximum environment protection, relevant documents on total waste collection.

1.16 Axle counter operation shall not be interrupted by any means while operating the RSDEV.

1.17 The RSDEV shall be designed to provide easy access to all the vehicle systems in order to perform maintenance tasks and inspection.

1.18 In accordance to ISR regulations each vehicle driven on-track has to be equipped with 2 different telecommunication systems and antennas, see Technical Appendix H.

1.19 The 2 different telecommunication systems and antennas, will be provide by ISR before the foreign test.

The manufacture shall be responsible to install them on the vehicle but not connect them, the final connection shall be carried out in Israel. The vehicle will be ready in advance for the
installation, (no extra holes drilling or cutting shall be needed after the foreign test).

2. **REFERENCE DOCUMENTS**

CEN/TR 15172-1  Whole-body vibration - Guidelines for vibration hazards reduction - Engineering methods by design of machinery;

EN 12663  Structural requirements of railway vehicle bodies;

EN 13103  Railway applications - Wheelsets and bogies - Non powered axles - Design method;

EN 13104  Railway applications - Wheelsets and bogies - Powered axles - Design method;

EN 13231-3  Railway applications - Track - Acceptance of works - Part 3: Acceptance of rail grinding milling and planing work in track;

prEN 13231-5  Railway applications - Track - Acceptance of works - Part 5: Procedures for rail reprofiling in plain line switches crossing and expansion devices;

EN 13260  Railway applications - Wheelsets and bogies - Wheelsets - Product requirements;

EN 13261  Railway applications. Wheelsets and bogies. Axles. Product requirements;

EN 13262  Railway applications - Wheelsets and bogies – Wheels - Product requirements;

EN 13674-1  Track - Rail - Part 1: Vignole railway rails 46 kg/m and above;

EN 13715  Railway applications - Wheelsets and bogies - Wheels - Tread profile;

EN 13979-1  Railway applications - Wheelsets and bogies - Monobloc wheels - Technical approval procedure - Forged and rolled wheels;

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

EN 14033-3  Railway applications - Track - Railbound construction and maintenance machines - Part 3: General safety requirements;

EN 14813-1  Railway applications. Air conditioning for driving cabs – Part 1: Comfort parameters;

EN 14813-2  Railway applications. Air conditioning for driving cabs– Part 2: Type tests;

EN 15016-1  Technical Drawings - Railway Applications - Part 1: General Principles;

EN 15016-4  Technical drawings - Railway applications - Part 4 Data exchange;

EN 15153-1  Railway applications. External visible and audible warning devices for trains. Head, marker and tail lamps;

EN 15153-2  Railway applications. External visible and audible warning devices for trains. Warning horns;

EN 16186-1  Railway applications. Driver's cab. Anthropometric data and visibility;

EN 16186-3  Railway applications. Driver's cab. Design of displays;

ISO 5006  Earth-moving machinery -- Operator's field of view -- Test method and performance criteria;

ISO/IEC 8859-8  Information technology. 8-bit single-byte coded graphic character sets. Latin/Hebrew alphabet;

SI 60309-1  Plugs, socket-outlets and couplers for industrial purposes. General requirements;

SI 60309-2  Plugs, socket-outlets and couplers for industrial purposes. Dimensional interchangeability requirements for pin and contact-tube accessories;
<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UIC 510-2</td>
<td>Trailing stock: wheels and wheelsets. Conditions concerning the use of wheels of various diameters;</td>
</tr>
<tr>
<td>UIC 520</td>
<td>Wagons, coaches and vans - Draw gear – Standardisation;</td>
</tr>
<tr>
<td>UIC 526-1</td>
<td>Wagons - Buffers with a stroke of 105 mm;</td>
</tr>
<tr>
<td>UIC 534</td>
<td>Signal lamps and signal-lamp brackets for locomotives, railcars and all tractive and self-propelled stock;</td>
</tr>
<tr>
<td>UIC 540</td>
<td>Brakes - Air brakes for freight trains and passenger trains;</td>
</tr>
<tr>
<td>UIC 554-1</td>
<td>Power supply to electrical equipment on stationary railway vehicles from a local mains system or another source energy at 220 [V] or 380 [V], 50 [Hz];</td>
</tr>
<tr>
<td>UIC 641</td>
<td>Conditions to be fulfilled by automatic vigilance devices used in international traffic;</td>
</tr>
<tr>
<td>UIC 651</td>
<td>Layout of driver's cabs in locomotives, railcars, multiple-unit trains and driving trailers;</td>
</tr>
<tr>
<td>UIC 895</td>
<td>Technical Specification for the supply of insulated electric cables for railway vehicles;</td>
</tr>
<tr>
<td>Directive 97/68/EC</td>
<td>Measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery - including all its amendments;</td>
</tr>
</tbody>
</table>

**Note** – the latest edition of the referenced document should be considered

3. **DEFINITIONS**

3.1. Effective Date as defined in the Agreement;

3.2. Gauge Widening Profile as defined in EN13231-3, section 6.3.2.2;

3.3. ISR Israel Railways Ltd.;

3.4. Measurement Systems Longitudinal Measurement System,
3.5. Metal Removal Elements

Transverse Measurement System,
Head Check Measurement System,
Roughness Measurement System;

grinding stones/ planning tools/milling tools;

3.6. Rail Surface Defects Elimination System/ The System

All the systems which are used in performing the Rail Surface Defects Elimination System operation:
1) Rail Surface Defects Elimination System,
2) Longitudinal Measurement System,
3) Transverse Measurement System,
4) Head Check Measurement System,
5) Rail Roughness Measurement System,
6) Metal waste collector system,
7) Fire protection system (if applicable),
8) Odometer,
9) Onboard Database Computer Server,
10) Synchronization Unit,
11) Software,
12) DGPS/RTK System,
13) Interface to SAP,
14) Support GIS functionality.

3.7. Rail Surface Defect as defined in prEN13231-5, section 5;

3.8. Reprofiling Zone as defined in EN13231-3, section 3.25;

3.9. Wear Reducing Profile as defined in EN13231-3, section 6.3.2.2.
4. RAIL SURFACE DEFECTS ELIMINATION SYSTEM - GENERAL REQUIREMENTS

4.1. The ISR Railways Tracks Data, which are specified in the Technical Appendix B shall be taken into consideration during the RSDEV design process, including but not limited the ISR rail inclination 1/30 and curves with radius down to 140[m] travelling; and 150 [m] operation, and gradient of up to 35 ‰.

4.2. The Israeli climate with hot and dusty environmental conditions, specified in Technical Appendix A shall be taken into consideration during the RSDEV design process.

4.3. The Rail Surface Defects Elimination System shall be designed to be adjusted in order to avoid specific track equipment such as axle counters and similar devices.

4.4. The Rail Surface Defects Elimination System shall be designed to enable the following rail surface elimination types:

a) Initial Reprofiling – for elimination of mill scale or decarburized (decarbonized) layer from new rail and defects high welds, ballast marks and defects up to 0.2 [mm];

b) Preventive Cycle Reprofiling - Periodically surface defects elimination and on Reprofiling Zone of rails. Grinding of rails with defect depth equal or greater than 0.20 [mm] and up to 0.3 [mm].

c) Corrective Reprofiling – due to severe rail surface defects depth equal or greater than 0.3 [mm];

d) Change in Rail Head due to:
   - Producing Wear Reducing Profiles on-curves with excessive lateral wear on high rails;
   - Producing Gauge Widening Profile (The transition from the original profile towards the new one shall be made by a 70° inclined facet at the gauge side, as described in prEN 13231-5, section 6.3.2.3);
   - Producing ISR Target Profiles.

4.5. The Rail Surface Defects Elimination System shall be computer controlled, it shall monitor the pressure and position of the Metal Removal Elements and designed to ensure consistent metal removal and uniform manner form the rail head on two rails simultaneously or on a single rail along the track. The Works
shall be carried out, without adversely affecting the metallurgical structure of the rail and its surface, no gouging or significant bluing of the rail is permitted.

4.6. The Rail Surface Defects Elimination System shall be designed with the ability to lift the Metal Removal Elements with minimize work disruption near obstacles, while operating within the full operation speed range.

4.7. The RSDEV operation shall be designed to enable been operated by one qualified operator.

4.8. The Surface Defects Elimination System operation and the Measurements Systems operation shall be done by a computerized system. The full measured data shall be recorded and stored.

4.9. The RSDEV shall be equipped with sufficient number of Metal Removal Elements with sufficient power capacity to guaranty working output capacity of not less than:

a) **Initial Reprofiling** - minimum 1500 [m] of track per hour;

b) **Preventive Cycle Reprofiling** – minimum 400 [m] of track per hour;

c) **Corrective Reprofiling** – minimum 250 [m] of track per hour.

4.10. The System shall be designed to enable the operator computerized manage and control pattern and change sequencing from the operator’s cabin.

4.11. The Rail Head Defects Elimination System shall have the capabilities to eliminate defects and reprofiling rail head efficiently and continuously from the entire reprofiling zone (i.e. 70 degrees on the gauge side to 5 degrees on the field side, or wider zone.

In addition The Rail Head Defects Elimination System shall have the capabilities to produce the Wear Reduction Profile, Gauge widening profile and ISR Target Profiles.

4.12. The Rail Head Defects Elimination System shall be equipped with a gauge referencing system to provide a positive reference point to insure that surface defects eliminating and reprofiling are accurately placed, and remain consistent on the rail head regardless of curve elevation or changes in track gauge.
4.13. Fire Protection System (if applicable)

4.14. An adequate Fire Protection System shall be part of the System and shall include the following features:

   a. Efficient capacity of water to operate continuously and safety during at least 10 hours net (not including break time).

   b. Separately controlled sleeper and ditch sprays front and rear.

   c. Water cannon or hoses with reach of no less than 15 [m] and throughput sufficient to extinguish any fire that will be encountered.

   d. Metal Removal Element and spark guards must be of sufficient size and strength to contain broken elements and sparks.

5. **RAIL SURFACE DEFECTS ELIMINATION SYSTEM - MEASUREMENT SYSTEMS PARAMETERS**

5.1. The Measurement Systems shall be designed to enable measurement and recording data on both rails simultaneously (on Continuous welded rails (CWR), fish plated and rail joints tracks).

5.2. The Measurement Systems shall include synchronization unit to enable comparing present measurement with previous measurements even if the measurement was perform in the opposite direction.

5.3. The Measurement Systems shall enable consistent measurement sampling interval regardless the vehicle speed, (based on the odometer operation).

5.4. The Measurement Systems shall be integrated with the vehicle odometer and DGPS/RTK system to ensure the continuous longitudinal position in reference to the track km-posts and to display on-screen, and also record and store the measured data, also with the current Km mark location online.

5.5. The Measurement Systems shall be designed to enable localization of the measurements and defect with longitudinal location accuracy of up to ±0.1 [m].
5.6. The Measurement Systems components mounted underneath the frame shall be waterproof and sealed to avoid metal waste, dust, mud, grease and damp penetration.

5.7. The Measurement Systems optical systems shall not be influenced by ambient light (reflection from sun light), and shall fully operate during daylight and in the dark. The laser beam accurate work shall be ensured while operating in desert zone.

5.8. The Measurement Systems shall include an integrated control console, it shall allow an operator to start and stop the whole Measurement and recording system with a single button or to start and stop each subsystem and application individually.

The integrated control console shall show the status of each subsystem and warn the operator of subsystems malfunction. The integrated control console shall also provide single point of entry of track number, Km-Posts, line class and various track features for the whole system. The integrated control console shall also allow the operator to specify direction of motion, reconfigure the system or change exception thresholds.

The Measurement System recording equipment shall be capable of documenting the work undertaken and its quality shall enable minimizing the need to check the result by additional staff walking on the track.

5.9. The Measurement Systems instrumentation shall be designed as a modular and expandable architecture allowing future additions of new and upgraded measurement and data analysis systems.

5.10. Rail Transverse Profiles Measurement System

5.10.1. The Measurement requirements:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>≤0.5[mm]</td>
</tr>
<tr>
<td>Sampling rate</td>
<td>15 measurements/sec.</td>
</tr>
<tr>
<td>Sampling step</td>
<td>~2 [m]</td>
</tr>
<tr>
<td>Accuracy up to</td>
<td>±0.127[mm]</td>
</tr>
</tbody>
</table>

5.10.2. The Rail Transverse Profiles Measurement system output shall be at minimum described: (provide sample report)

- Rail type;
- Rail profile;
• Vertical wear;
• Horizontal wear;
• Rail inclination;
• Metal / lip flow;

5.11. **Rail Longitudinal Profile Measurement System**

5.11.1. The Rail Longitudinal Profile Measurement System based on short chord with non-contact laser sensors tracking the top of each rail.

5.11.2. The Rail Longitudinal Profile Measurement System shall be able to measure short deviations in rail surface with wavelength from 10 [mm] to 1000 [mm] in accordance with EN 13231-3.

5.11.3. The Rail corrugation system shall report for each rail the corrugation amplitude on four ranges (10-100 [mm]; 30-100 [mm]; 100-300 [mm]) of wavelengths simultaneously.

5.11.4. The sampling interval shall be no greater than 1 mm and the digitization increment no greater than 1 [µm] at the speed from zero to the maximum operation speed.

5.11.5. The Rail Longitudinal Profile Measurement System shall report any exceptions from predefined corrugation limits. Predefined corrugation limits shall be adjustable, sample report shall be submitted.

5.12. **Head Check Measurement System**

5.12.1. The Head Check Measurement System shall detect, analyze and record inspection results of the following parameters:

• Crack depth, and
• Crack length.

All at the same efficiency and accuracy at varying speed.

5.12.2. The Head Check Measurement System shall be equipped with at least 4 independent channels with one probe for every channel. The probes shall be installed to cover rail head inspection area of at least 20 mm (see sketch below).
The Head Check Measurement System shall enable head checking crack depth measurement of up to 3 mm underneath the running surface. The maximum positive and negative permitted deviations shall not exceed the limits of ±0.1 [mm].

5.12.3. The Head Check Measurement System shall enable detection of cracks in new rails and in used rails with wear in accordance to the following table:

**Maximum wear of the rail head**

<table>
<thead>
<tr>
<th>Maximal horizontal wear [mm]</th>
<th>Maximal vertical wear [mm]</th>
<th>Minimal height of the rail [mm]</th>
<th>Height of the new rail [mm]</th>
<th>Type of rail</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>13</td>
<td>140</td>
<td>153</td>
<td>50E6 (U-50)</td>
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<tr>
<td>17</td>
<td>14</td>
<td>145</td>
<td>159</td>
<td>54E1 (UIC-54)</td>
</tr>
<tr>
<td>18</td>
<td>17</td>
<td>155</td>
<td>172</td>
<td>60E1 (UIC-60), 60E2</td>
</tr>
</tbody>
</table>

5.12.4. The detected cracks parameters and the depth/angle of cracks and crack length, for each of the 4 sensors including the amount of cracks per meter shall all be displayed on a screen online.

5.13. Rail Surface Roughness system

5.13.1. On board measurement system capable to measure the rail roughness to comply with the requirements of EN 13231-3, section 7.

6. HARDWARE

6.1. The System shall be designed to fully and efficiently operate under the climate and environmental conditions, dust conditions in the atmosphere, sea salt concentrations in the atmosphere in accordance to the data provided in Technical Appendix A.
The electrical and computerized equipment shall be of industrial type, including an appropriate card cage and high speed bus, suitable to operate in the vibration and temperature conditions existing.

6.2. The System shall be controlled with a single, industrial strength computer to significantly reduce the MTBF of the overall System. The computer server with capability to handle a big amount of data will manage the operation and measuring, database, storage, processing and analyze database.

6.3. To prevent the interruption of the operation of the system and the loss of measurement recorded data in case the hardware power supply fails, an adequate uninterruptible power supply (UPS) shall be provided as part of the System, for safe closing of the System.

6.4. For backup storage and offline use the recorded measurements data shall be transferable using removable storage media, and a network or radio link with an industry standard.

6.5. One A3 color printer shall be included as part of the system hardware.

6.6. The computer on the vehicle shall have storage capacity which enable to store measurement data of 800 [km].

7. SOFTWARE

7.1. The system computers shall be operated by Linux or Microsoft state of the art operating system. Front-end computers shall have Microsoft operating system.

7.2. The System Software shall include at least the following analysis features:

7.2.1. An algorithms with adaptive threshold;

7.2.2. Track rail head longitudinal profile graphs;

7.2.3. Track rail head transverse profile graphs;

7.2.4. Track rail head checks graphs;

7.2.5. A measurement exception report;

7.2.6. Display and store of current longitudinal position (on track odometer and DGPS position) and speed of measurement on operator screen and in the recorded file;
7.2.7. Simultaneous display and store of all types of data in any combination (transverse rail profile, longitudinal rail profile, head check measurement, reports, etc.);

7.2.8. Data export to external media.

7.2.9. Software module to compare two measurement runs, not depends on vehicle driving direction;

7.2.10. Configuration of displayed distance;

7.2.11. The System will be able to be in operating mode within five minutes after the system has been turned on.

7.2.12. The On screen display shall be in the Hebrew language.

7.3. The user-interface shall be customizable.

7.4. The measurement data files shall be stored as flat files. There will be no restrictions of any kind to open/use/change/modify the files.

7.5. The contractor shall deliver in addition to the on-board software relevant off-board software for used with at least 5 unlimited time licenses to enable ISR employees access to all of the stored measurement data. In addition unlimited viewer software with unlimited time licenses to enable ISR employees access to the measurement data shall be delivered.

7.6. The off-board software shall include all the data processing, analyzing capabilities and reports processing as the on-board software, and provide additional analysis and reporting functions.

8. **DATA PROCESSING**

8.1. The System shall include at minimum the following features:

- Storing line names km marks definition database as will provide by ISR;
- List of rail profile, rail inclination, curve radius, rail section, reprofiling patterns for the specific section, etc; database as will provide by ISR;
- Comparing of different on field rail section with different rail section, pattern, target templates;
- Presentation of transverse profile data in 2D modes;
- Automatic generation of report:
  - Charts of continuous parameters,
• List of characteristic points,
• 2D drawings for each characteristic point

9. PRODUCTION REPORTS

9.1. The System shall be designed to automatically generate the reports for every track section in which rail surface defects elimination and reprofiling has been carried out.

9.2. The following minimum parameters shall be included in the reports:

- Report for each track section,
- Longitudinal Rail Profile graph for every corrugation wavelength, (before starting operating, during, and after finishing),
- Transverse Rail Profile comparing on site rail profile vs. operating target profile, (before starting operating, during, and after finishing),
- Head Check defect depth, (before starting operating, during, and after finishing),
- Report chronological number,
- Date of measurement service,
- Track section name/number,
- Traveling start point in km and meters,
- Traveling end point in km and meters,
- Total meters traveled,
- Working from start point in km and meters,
- Working to end point in km and meters,
- Total meters worked,
- Total meters not worked,
- Working direction,
- Measurement from start point in km and meters,
- Measurement to end point in km and meters,
- Total meters measured,
- Total meters not measured,
- Left/Right rail,
Railprofile;
➢ Rail inclination;
➢ Vertical wear;
➢ Horizontal wear;
➢ Wear angle;
➢ Metal/ lip flow;
➢ longitudinal rail profile Defect height
➢ longitudinal rail profile Defect position,

9.3. Where the condition is such that transmission is restricted or interference occurs at the interface signal, a report shall be provided by the system. The report shall clearly identify the location, length of rail work and measurement not carried out.

9.4. The operator shall have the ability to generate an After Working Shift Report in a daily basis it could be include all the parameters aforementioned;

9.5. Supplier shall submit with its Proposal sample reports regarding measurement.

9.6. Supplier shall submit to ISR a draft of the final structure of the reports, and such draft shall be subject to ISR's approval.

10. LOCALIZATION PLANING AND MAPPING
10.1. The System shall be designed to enable the following:
10.1.1. Automated process of localization;
10.1.2. Accurate curve start and end point localization;
10.1.3. Finding the correct data belonging to the track section;
10.1.4. Comparing different measurements;
10.1.5. Using any kind of measurements of the same location;
10.1.6. Specifying the sizes of profiles at exact locations; with detailed definitions to be provided by Israel Railways;
10.1.7. Building up history for trend analysis;
10.1.8. Every Track shall have a linear ID;

11. RSDEV REQUIRMENTS
11.1. The RSDEV will have the following basic operating characteristics:
### Operation Characteristics

<table>
<thead>
<tr>
<th>5.4.1</th>
<th>Track gauge nominal</th>
<th>1435 [mm]</th>
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</thead>
<tbody>
<tr>
<td>5.4.2</td>
<td>Track gauge maximum</td>
<td>1470 [mm]</td>
</tr>
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<td>5.4.3</td>
<td>Track gauge minimum</td>
<td>1426 [mm]</td>
</tr>
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<td>5.4.4</td>
<td>Travel speed – self propelled</td>
<td>100 [Km/h]</td>
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<tr>
<td>5.4.5</td>
<td>Travel speed – towed</td>
<td>100 [Km/h]</td>
</tr>
<tr>
<td></td>
<td>Measurement speed</td>
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<td>5.4.6</td>
<td>Max gradient</td>
<td>35 %</td>
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<tr>
<td>5.4.7</td>
<td>Min curve radius for travelling</td>
<td>140 [m]</td>
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<tr>
<td>5.4.7</td>
<td>Min curve radius for operating</td>
<td>150 [m]</td>
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<tr>
<td>5.4.8</td>
<td>Max superelevation</td>
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<tr>
<td>2.1.9</td>
<td>Max total vehicle length (from buffer to buffer)</td>
<td>25000 [mm]</td>
</tr>
</tbody>
</table>

### 11.2. The Frame Coupling and Buffers

11.2.1. The Frame shall consist of one part. All work units shall be arranged on one rigid frame made from standard rolled steel.

11.2.2. The Frame design shall be in accordance with the requirements of EN14033-1, section 6.2.

11.2.3. The Frame shall be equipped with Coupling and Buffers as follows:

- 1 central Draw Gear with an elastic draw system, in accordance with UIC 520;
- 1 Draw Hook with a breaking force of 1,000 [KN], in accordance with UIC 520;
- 1 Screw coupler with a breaking force of 850 [KN] in accordance with UIC 520;
- 2 side buffers with a stroke of 105 [mm], at height of 1060 [mm], in accordance with UIC 526-1;
- 1 brake hose with valve.

The Frame shall be equipped with the following items:

- Handrails or grab irons;
- 4 lifting hooks for handling;
- One guard-irons on both sides of each boogie;
- Side steps; the lowest step used for boarding the machine; shall not exceed the loading gauge.

### 11.3. Running Gear
11.3.1. The RSDEV running gear shall be designed in accordance with EN 14033-1 section 7, unless specified otherwise.

11.3.2. The Running Gear shall be able to negotiate the horizontal and vertical radii given in technical Appendix B.

11.3.3. The Wheels shall comply with the requirements of EN 13262 and EN 13979-1.

11.3.4. The Wheels shall be made of mono-block steel, category ER7 EN13262.

11.3.5. The Wheel Profile shall comply with the requirements of EN 13715, and shall have wheel nominal diameter of 920 [mm].

11.3.6. The Wheelsets shall comply with the requirements of EN 13260, EN 13103 and EN 13104. The design of the Wheelsets shall additionally take into account the forces generated when working.

11.3.7. The Axles shall comply with the requirements of EN 13261, EN 13103 and EN 13104. The design of the Axles shall additionally take into account the forces generated when working.

11.3.8. The Axles and Wheelsets Shape and dimensions of the shall be in accordance with the requirements of EN 14033-1, section 7.5

- Axe boxes shall have roller bearings. They are fitted with 12% manganese steel wear slides as well as axle guards.
- Hydraulic shock absorber on each axle box shall be provided.

11.3.9. The Axles arrangement and axle load shall comply with the requirements of EN 14033-1, section 7.6.

The Axle shall be of unalloyed carbon steel comply with the requirements of EN 13261, EN 13104 and EN 13103 (if applicable).

11.3.10. The Design for longitudinal compressive forces shall comply the requirements of EN 14033-1, section 7.7 and EN 15839 for running the RDDEV in any position in regular hauled freight trains.

11.3.11. The RSDEV frame, suspension, propelling system and braking system shall be designed to enable safe operation with maximum traveling speed and at gradient of up to 35‰. As a single vehicle as well as in train formation.

(Maximum braking distance - 800 meters at 100 km/h).
11.4. **Propelling System**

11.4.1. **Engine**

11.4.1.1. The RSDEV shall be equipped with liquid cooled diesel engine.

11.4.1.2. The Engine emission shall be Stage III RC B, for category railcar engine in accordance with European Directive 97/68/EC and all its amendments. Technical description shall be submitted.

11.4.1.3. The vehicle shall enable direct access to the engine without entering the cabin.

11.4.2. **Engine Cowling**

11.4.2.1. A cowling area shall protect the gear, engine and transmission lines and shall ensure low noise level and vibration reduction.

11.4.2.2. This cowling shall have doors that will provide easy access to all elements from in the vehicle and from the outer side of the vehicle. These doors shall be of openwork design for cooling the driveline.

11.4.3. **Engine Cooling System**

11.4.3.1. The Engine Cooling System shall enable continuous safe operation of the engine at the ambient temperature given in Technical Appendix A

11.4.3.2. The loss in heat transfer efficiency due to the hot and dusty environment shall be taken into consideration.

11.4.4. **Fuel System**

11.4.4.1. The fuel system shall include two tanks: the master tank with 1000 [liter] capacity and the slave tank 500 [liter] capacity.

11.4.4.2. Fuel system shall be provided with a sediment bowl and a full flow replaceable element filter. (Provide brochure)

11.4.4.3. The fuel tanks shall be equipped with Todo-Matic 1.5" (male) couplings and diesel fuel tank filler neck with cap (locked with key) vertically positioned on both side of the RSDEV.

11.4.4.4. Refueling points shall be provided on both sides of the vehicle.

11.4.5. **Air Intake**

11.4.5.1. Air intake shall include a double filter system. (Provide brochure)

11.4.5.2. The air filter for the engine shall be of adequate size of recommended by the engine manufacturer and be equipped with a highly visible air filter restriction indicator. The air filter shall be
positioned to be readily accessible and shall operate with unrestricted outside air.

11.4.6. **Engine Protection System**

   Engine protection system shall protect the engine against:

11.4.6.1. High coolant temperature;
11.4.6.2. Low coolant level;
11.4.6.3. Low oil pressure;
11.4.6.4. High oil temperature.

11.4.7. **Hydrostatic Transmission**

11.4.7.1. The RSDEV shall be equipped with Hydrostatic Transmission system that acting each axle.

11.4.7.2. The Hydrostatic Transmission system shall provide two range of speed in both driving / work directions.

11.4.7.3. The Hydrostatic Transmission system shall enable traveling in train formation. For towing purposes, the system shall be provided to permit easy disengagement of the transmission.

11.4.7.4. The system shall enable transmission system disconnecting.
   - Operating control shall be provided by:
     - 1 pressure gauge and
     - 1 red warning indicator in the event of low pressure.

11.4.8. **Exhaust System**

11.4.8.1. The Exhaust System shall be so located that it will cause no adverse temperature rise in any other part of the equipment and so that a minimum of heat and exhaust gas can reach the operator. The exhaust system shall utilize a catalytic converter.

11.4.8.2. Stainless steel shall be used for all exhaust components.

11.4.8.3. All exhaust piping shall be properly braced to eliminate shocks at all junctions, and at the interfaces between the manifold and muffler. Vibration dampeners may be used if necessary. The system shall provide for expansion, contraction, vibration, and stress produced by operation of the machine. The system shall comply with the Directive97/68/EC and all its amendments.

11.4.9. **Hydraulic System**
11.4.9.1. The hydraulic system shall be designed as to provide efficient operation in the ambient conditions given in Technical Appendix A.

11.4.9.2. The Hydraulic system shall be equipped with oil cooling system.

11.4.9.3. The hydraulic system shall provide a separate line for each field of application.

11.4.9.4. 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.

11.4.9.5. 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.

11.4.9.6. The Hydraulic system shall be equipped with oil cooling system.

11.4.9.7. Where failure of the power plant or pump can immobilize components in a position which would prevent moving of the regulator, a battery operated emergency pump shall be provided in the circuit to allow normalization of all equipment components within 10 minutes, for movement of the RSDEV to a proper location.

11.5. Pneumatic System (including Braking System)

11.5.1. The Pneumatic System shall include an air dryer, water separator and a full flow replaceable filter elements.

11.5.2. The Pneumatic System, air reservoirs shall be equipped with an automatic moisture drain valve.

11.5.3. The Pneumatic System shall provide the necessary pressure for braking, integrating the vehicle in train formation according to UIC code 540 and 14033-1; 2; 3, and all other auxiliary elements needs (horns, doors, etc.).

11.5.3.1. The Pneumatic System will assure the pressure for working, braking and other auxiliary needs. It’s preferable that the compressed air system manufacturer will be KNORR.
11.5.3.2. The system will include an air dryer, oiler and a full flow replaceable filter element.

11.6. **Braking System**

11.6.1. The Braking System shall comply with UIC 540.

11.6.2. The Braking System, braking power shall be calculated in accordance with UIC 544-1.

11.6.3. The Braking System shall comprise of:

11.6.3.1. A direct and automatic compressed air brake, acting on the four wheels of the vehicle through cast iron shoes;

11.6.3.2. An emergency compressed air brake operated by a valve near an access door acting on the same linkage as the direct brake

11.6.3.3. A parking brake according 14033-1; 2; 3.

11.6.4. Override and bypass components in the Braking System will be protected to prevent accidental or inadvertent venting of the charged Braking System.

11.7. **Electrical System**

11.7.1. **Electrical Power Supply**

11.7.1.1. An engine mounted generator shall supply stabilized electrical power, regardless of engine speed, to energize the equipment and all other vehicle systems. The vehicle shall have 50% spare capacity.

11.7.1.2. The RSDEV batteries shall be maintenance free type. The batteries capacity shall not be less than 200 [Ah].

11.7.1.3. The batteries shall not produce emission of toxic gasses.

11.7.1.4. The RSDEV shall be equipped with an auxiliary power generator to enable full operation of the inspection system when the main generator is shut off.

11.7.1.5. All electrical components shall meet EN and IEC safety requirements.

11.7.1.6. All electrical cables shall meet the requirements of UIC 895.

11.7.1.7. The vehicle shall be equipped to receive power supply from a local mains system or another source of energy at 220 V or 380 V, 50 Hz. System shall meet the requirements of UIC 554-1.

11.7.1.8. The Plugs, socket-outlets and couplers shall comply with the SI 60309-1 and SI 60309-2 (Israeli standards based on the IEC
11.7.2. **Air-conditioning System**

11.7.3. The cabin shall be fully air-conditioned providing cooling, heating and ventilation. The system shall operate efficiently in ambient conditions given in Technical Appendix A, cooling by water is prohibited.

11.7.4. The system shall meet the requirements of EN 14813-1; 2 and UIC 651, section 2.9, Heat generated by the equipment shall be taken in the calculation of the air-conditioning unit.

11.7.5. All electronic systems, measurement equipment components, computers hardware etc. shall be in temperature controlled area.

11.8. **Cabins**

11.8.1. **Design guidelines**

11.8.1.1. The cabin shall be designed and equipped following the requirements of EN 14033-1; 14033-2.

11.8.1.2. The cabin shall be equipped with sun protection roller blinds. Front windows for travel shall be made of 15 mm safety glass and electrically heated

11.8.2. **Driver Visibility**

11.8.2.1. The driver visibility sitting in the driver seat facing traveling direction shall fully comply with EN 14033-1, 2, 3, and EN 16186-1.

11.8.3. **Visibility of working tools and working areas**

11.8.3.1. The RSDEV working tools and working area visibility shall be in accordance with the requirements of EN 14033-3, section 5.10.

11.8.4. **Visibility of the track ahead of the machine in the direction of movement**

If the movement along the track is controlled from a working cab the following shall apply: either the track shall be in the visibility sector A according to ISO 5006:2006, Table 1 otherwise it shall be possible to observe the track by monitor in which case the speed shall be limited to a speed appropriate to the performance of the monitoring system and braking capabilities of the machine, otherwise devices shall be placed at the machine end where the direct or indirect visibility is insufficient, which stop the
movement, if persons or obstacles in the movement area are detected. All in accordance with EN14033-3, section 5.11.

11.8.5. **Cabin Windows**

11.8.5.1. The cabin windows and windows accessories such as wipers washers and sunshades shall comply with UIC 651 paragraph 2.7.

11.8.6. **Cabin Equipment**

11.8.6.1. The RSDEV cabin shall be fully equipped with driving, operating and analyzing control panels, ergonomically fitted to enable effective operation in both directions for long working periods. The driver desk and main operating equipment and control panels shall comply with EN 14033-1, 3 and EN 16186-3.

11.8.7. **Noise Level and vibrations in the RSDEV**

11.8.7.1. The noise level in the RSDEV in the operation areas and cabin and the tests to measure it shall comply with the requirements of EN 14033-3, EN 16186-1 and UIC 651 (the same restriction shall be for the cabin and the operation areas).

11.8.7.2. The working positions shall be designed so that the vibration emission value is as low as possible.

11.8.7.3. The manufacturer shall design the RSDEV to reduce vibration values in areas that could have persons present, as far as reasonably practical in accordance with CEN/TR 15172-1. Relevant documents shall be submitted.

11.8.7.4. The manufacturer shall design the machine to reduce vibration values of hand held components as far as reasonably practical.

11.8.8. **Communication**

11.8.8.1. The RSDEV shall be equipped with proper devices to enable reliable continuous communication, between the different cabins and working areas.

11.8.9. **Cabin Amenities**

11.8.9.1. The cabin shall be equipped with small refrigerator, as recommended in UIC 651 paragraph 2.11.2.

11.8.10. **Control Panel**

11.8.10.1. The driver control panels in both driver posts shall include at least following instruments:

   ○ Tachometer;
11.9. Environment Protection

11.9.1. The RSDEV shall be designed to keep the environment protection of: noise; pollution, laser, vibration; etc. in accordance with the relevant standards and regulation. Documents approving compliance with requirements shall be submitted.

11.10. Safety Systems and Equipment

The RSDEV shall be equipped with following safety systems and equipment:

11.10.1. Automatic Vigilance Device

An Automatic Vigilance Device ("Dead-Man" Device) to stop the vehicle in case the driver is unable to continue operating shall be provided and shall comply with UIC 641 and UIC 651 paragraph 4.3.2.6. Activation shall be by pedal.
11.10.2. **INDUSI System**

An INDUSI system shall be installed in RSDEV that shall fully comply with the system used by ISR, namely, Alcatel 6411 AlTrac system, Inductive Automatic Train Protection (INDUSI I60R) produced by ALCATEL Germany (See Technical Appendix G). The magnets of the INDUSI system shall be installed on the left hand side of the vehicle, and shall not interrupt the other systems on the RSDEV and the axle counter system on the track.

11.10.3. 2 Rotating beacons (one to each direction).

11.10.4. 2 Electro-pneumatic warning horns (one to each direction).

11.10.5. Portable Fire extinguishers containing dry powder at the amount of which is suitable for the RSDEV configuration, shall be provide and placed in the RSDEV. The manufacture shall indicate the amount in the layout drawings.

11.10.6. The RSDEV which when working present a risk of fires shall be equipped with fixed equipment to extinguish the fire produced by it.

11.10.7. Automatic fire extinguishing based on FM-200 gas in the hardware system racks.

11.10.8. Fire alarm system with Temperature and smoke detectors

11.10.9. 4 Horn push buttons on each corner of the vehicle (outside the cabin).

11.10.10. 4 Engine stop push buttons on each corner of the vehicle (outside the cabin).

11.10.11. The RSDEV shall be designed with lifeguards at both ends in front of the outer axles. They shall be installed with the aim of reducing as far as reasonably practicable the risk of derailment due to impact with small obstacles on the line, in accordance with the requirements of EN 14033-1, section 7.8.

11.11. **Internal Lighting**

11.11.1. Internal Lighting in the cabin shall provide effective working conditions during night operation.

11.11.2. The lighting shall be such that all instruments required for driving are clearly visible.

11.11.3. The light intensity on the driver’s desk shall be 60 lx.
11.11.4. The minimum light intensity in all other areas of the cab shall be 30 lx but shall not be so high as to obscure the driver’s and his assistant’s external visual range.

11.11.5. The indicator lamps shall not cause any irritating reflections in the window panes.

11.11.6. The control instruments shall be provided with adjustable instrument lighting.

11.11.7. Auxiliary additional lighting shall not dazzle the driver or his assistant nor shall surface finishes cause any irritating light reflections.

11.12. **External lighting**

11.12.1. External lights shall be according to UIC 534 and will be led lamps. Headlamps shall be arranged according to paragraph 2.7 of UIC 534.

11.13. **Faults Monitoring System**

11.13.1. The RSDEV shall be designed with faults monitoring and diagnostic system for: Braking System, Propelling System, Cooling System, Fuel System, Air Intake, Hydraulic System, Pneumatic System, Electrical System and Air-conditioning System. This system will recognize faults and malfunctions of the aforementioned systems and indicate the reason of the malfunction and the immediate action to be taken.

11.13.2. The faults diagnosing and monitoring shall be displayed by computerized system which hardware and software shall be supplied as an integral part of the RSDEV.

12. **DGPS/RTK SYSTEM**

12.1. The System shall have an onboard DGPS/RTK system. (The RTK technology is available using dual frequency antenna for GNSS and GLONAS GPS systems.

12.2. The DGPS/RTK system shall be operate in correlation with the Israeli Transverse Mercator.

12.3. The DGPS/RTK data provider is Survey of Israel (it is the government agency for mapping, geodesy, cadaster and geoinformatics), which is not a free public service, that provides accurate latitude and longitude coordinates for every measurement sample. A subscription to the DGPS service will be provided by ISR.
12.4. The DGPS/RTK system shall provide accurate coordinates even when DGPS satellites are temporarily blocked by bridges, tall buildings, and dense foliage or when going through tunnels. The coordinates shall be used to tag start, end, and maximum value for every detected exception. The coordinates shall also be used to tag manually entered km-posts and track features.

12.5. The DGPS/RTK system shall also be able to accurately detect km-Posts and other track features based on their coordinates in the system database, and synchronize with the odometer.

12.6. The DGPS/RTK system minimum Performance:
   - RTK accuracy Horizontal: 1 [cm] or less;
   - RTK accuracy Vertical: 1.5 [cm] or less;
   - DGPS accuracy (post processing) 0.25 [m] or less;
   - DGPS accuracy (real-time) < 0.5 [m] or less;
   - Real-time heading accuracy - approximately 0.004/L [rad] RMS, where L is the antenna separation in [m]

12.7. The DGPS/RTK system shall have the ability to transfer position coordinates to a Geographical Information System (GIS) database.

12.8. The DGPS/RTK system shall have the ability to use geographical and geodetic coordinates.

12.9. The DGPS/RTK system shall include 3G & 4G Cellular Modem with SIM card.

The inspection system shall have an onboard database and a flexible report generator that allows the operator to specify the content of the desired report. The operator shall be able to specify a segment of track of interest (for example, subdivision ABC, from km-Post xx to km-Post yy), type of data of interest (for example, geometry, rail wear, ride quality, or all), desired severity of defects (for example, only high level defects or all defects), and other query parameters as needed. The operator shall be able to print those reports.

The bidder shall provide with his proposal a specification and the required content of the database that ISR will have to prepare to load the system with the base database.

The Bidder shall attach to his proposal reports samples.
12.10. Technical description and layout of the RSDEV and each of its sub-system shall be submitted. Including operation, maintenance, calibration and safety instructions (especially safety of laser products).

13. **DOCUMENTATION**

At least 60 days before Delivery of the RSDEV, Supplier shall submit the following documents:

13.1. **Operation and Maintenance Manuals and Spare Parts Catalogue** for the following systems:

13.1.1. Vehicle;
13.1.2. Rail Head Defects Elimination System;
13.1.3. Measurement Systems;
13.1.4. Engine system;
13.1.5. Transmission system;
13.1.6. Hydraulic System
13.1.7. Pneumatic System
13.1.8. Drive Axles;
13.1.9. Air-conditioning system;
13.1.10. Electrical system
13.1.11. Electronic System.

13.2. **Manuals Content**

13.2.1. The operation and maintenance manuals shall include at least the following chapters:

13.2.1.1. Safety precautions;
13.2.1.2. Systems description;
13.2.1.3. Operation instructions – That shall include:

   Pre-operation checks, Start-Up procedure, operating procedures (operation limitations should be stated clearly and in bold letters), Shut-down procedure, Emergency procedures, troubleshooting.

13.2.1.4. Preventive maintenance instructions;
13.2.1.5. Adjustments instructions;
13.2.1.6. Components replacement procedures;
13.2.1.7. The spare parts catalogues shall include illustrated parts breakdown (sub-contractor items included) with a set of section drawings or axonometric/”blow-up” drawings and a list for each one of the drawings including the following data elements:

- Item number on the drawing;
- Item name;
- Contractor’s part number;
- Sub-contractor’s part number (for subcontractors parts);
- Sub-contractor name;
- Quantity per assembly.

13.2.1.8. All the documentation mentioned above shall be comprehensive to the extent that in the event of a failure of a working part of any manufactured component, maintenance personnel shall be able to refer the parts data books to obtain the model number of the component and order the required part without being compelled to dismantle the component.

13.2.1.9. This documentation should be utilized in training inexperienced personnel for operation and maintenance and should be based on the operation, maintenance and illustrated spare parts catalogue manuals specification.

13.2.1.10. The technical documentation shall be arranged as an interactive electronic technical manual (IETM), namely a high-quality database product. This IETM shall allow for multiple methods of accessing the data using full-text searching tool, or access to the required paragraphs or drawings using the table of contents hyperlinks, as well as for interactive cross-reference within each publication, and between different but related publications (e.g. cross-references between Maintenance Manual and Parts Catalogue). The IETM user interface shall be in English. The IETM should support the following features (non-comprehensive list):

- End-user access control;
- Annotations and bookmarks;
- Easy navigation between documents titles and sub-titles;
- Combined Boolean full-text search;
- Nested querying - up to 4 nesting search levels;
13.3. Four hard copies and two magnetic copies (DVD) shall be provided of all listed data. All documents shall be in English.

14. **RSDEV APPROVAL**

14.1. **Foreign Tests**

Passing foreign tests in accordance with the requirements in this technical specifications and the Agreement.

14.2. **Acceptance Tests**

Passing Acceptance tests test in accordance with the requirements in this technical specifications and the Agreement.

14.2.1. ISR will perform driving safety checks with the RSDEV when all the systems are operates the test system is installed:

14.2.2. ISR shall check and approve braking abilities in regards with ISR regulations (based on EN and UIC norms).

14.2.3. ISR shall check and approve proper operating near axle counters.

14.2.4. ISR shall check proper operation of telecommunication systems.

15. **RAIL SURFACE DEFECTS ELIMINATION SYSTEM APPROVAL (including Measurement System)**

15.1.1. The RSDEV shall be operated together with all its systems at the maximum operation speed.

15.1.2. A section of maximum 1 [km] shall be reprofiled to Wear Reducing Profiles or ISR Target Profiles with spark time of 4 [hour].

The rail surface defects elimination system working output capacity shall be checked in accordance with the requirements of section 4.10.

15.1.3. The system and all its sub system shall work without any malfunction.

15.1.4. The measurement system shall operate. Measurements shall be perform in maximum speed at varying speed and in the opposite direction. The measurements test of the longitudinal and transverse rail profiles shall be perform in accordance with the
requirements of EN 13231-3, annex B. results repeatability and reproducibility shall be 95% or higher.

15.1.5. All the reports are in accordance with the requirements of this technical specification.

15.1.6. The working results in accordance with acceptance criteria in sections 15.2 and 15.3 hereinafter.

15.1.7. Following the successful passing the aforementioned requirements ISR shall approve it as "RSDEV fit for starting the practical training".

15.2. Acceptance criteria for longitudinal profile

15.2.1. Acceptance criteria for longitudinal profile shall be in accordance with EN 13231-3, section 4.3.

15.2.2. The number of irregularities shall not exceed the limits given in EN 13231-3, Table 1 – Class 1; and Table 2.

15.2.3. After operation, high welds should be less than 0.1 mm.

15.3. Acceptance criteria for transverse profile

15.3.1. Acceptance criteria for transverse profile shall be in accordance with EN 13231-3, section 5.3.

15.3.2. The percentage of measurements for which the deviation exceeds the stated range of 0.6 [mm] shall not exceed the value given in EN 13231-3, Table 3 – Class Q.

The maximum positive and negative permitted deviations shall not exceed the limits of ±0.1 [mm].

15.4. Acceptance criteria for eliminate head check defect

15.4.1. Acceptance criteria for transverse profile shall be in accordance with section 5.12.

15.5. Acceptance criteria for rail surface roughness

15.5.1. Acceptance criteria for Surface roughness shall be in accordance with EN 13231-3, section 7. The Roughness measurement results - Rₐ shall not exceed 10 [μm].

Other Acceptance criteria

15.5.2. The works shall be carried out, without adversely affecting the metallurgical structure of the rail and its surface, no gouging or significant bluing of the rail is permitted.
15.5.3. Where facets are produced by the reprofiling operation, the maximum facet width shall be as follows:

i. Gauge corner 4 [mm];

ii. Shoulder 7 [mm];

iii. Crown of rail 10 [mm].

The maximum variation in facet width over a 100 mm length of rail shall be 25 % of the maximum width of the facet.

There shall not be continuous bluing in the reprofiling zone.

15.5.4. The ISR shall accept completed working sections on the basis of the compliance of the computerized records, in accordance with this technical specifications, as well as on the basis of visual inspection. ISR may check the working section with its own measuring car.

TECHNICAL APPENDIX A - ISRAEL CLIMATE AND ENVIRONMENTAL CONDITIONS

A.1 Climate and Environmental Conditions
Max. ambient temperature 50 °C (shade)
Min. ambient temperature -5 °C
Relative humidity 10 to 90 %
Altitude -400 to +800 meter
Sunny 3300 hours per year
UV Radiation 360 to 600 MJ/m² per year
Rainfall 400 to 800 mm/year

A.2 Dust Conditions in the atmosphere

<table>
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<th>Maximum Half Hour Value*</th>
<th>Maximum Daily Value*</th>
<th>Average</th>
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<tr>
<td>NOx</td>
<td>1064</td>
<td>560</td>
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<tr>
<td>SO₂</td>
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<td>O₃</td>
<td>312</td>
<td>143</td>
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<td>Suspended Dust</td>
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<td>100</td>
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</table>

*(Microgram per m³ atmosphere)

A.3 Suspended Particulate Matter (SPM)
Particle size to 0.5-1 micron
A.4  Sea Salt Concentrations in the Atmosphere

<table>
<thead>
<tr>
<th>Salt Element</th>
<th>Na*</th>
<th>Cl*</th>
<th>SO₄*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
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<tr>
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* (Micrograms per m³ atmosphere)

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.

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<tr>
<th>Speed [km/h]</th>
<th>$V_{\text{max}} \leq 100$</th>
<th>$100 &lt; V_{\text{max}} \leq 160$</th>
<th>$160 &lt; V_{\text{max}} \leq 200$</th>
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<tr>
<td>Maximum cant deficiency [mm]</td>
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<td>$\leq 100$</td>
<td>$\leq 60$</td>
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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.
TECHNICAL APPENDIX C – ISRAEL RAILWAYS LOADING GAUGE

Attached separately
TECHNICAL APPENDIX D – ISR TUNNELS CROSS SECTIONS

Attached separately
TECHNICAL APPENDIX E – ISRAEL RAILWAYS RAIL RE-PROFILING TARGET PROFILES

**E.1 - Target profile Tangent Track for 54E1 profiles**

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Tangent Track
### E.2 - Target profile Curved Track for 54E1 profiles – High Rail

#### Curved Track – High Rail

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E.3 - Target profile Curved Track for 54E1 profiles – Low Rail

Curved Track – Low Rail

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### E.4 - Target profile Tangent Track for 60E profiles

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**E.5 - Target profile Curved Track for 54E1 profiles – High Rail**

Moderate Curves – High Rail

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E.6 - **Target profile Curved Track for 60E profiles – Low Rail**

**Moderate Curves – Low Rail**

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### TECHNICAL APPENDIX F - THE TECHNICAL DESCRIPTION OF ISR AXLE COUNTERS

**F1 - Axle counter Zp30C-NT**

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Figure 4 – Rail contact

Figure 2 – Mounting holes

Tolerances of the individual dimensions:

- \( a = \pm 2 \) mm,
- \( a_1, a_2, a_3 \) must not differ by more than 1 mm from each other
- \( b = 13 \) mm \( \pm 0.2 \) mm
- \( c = 148 \) mm \( \pm 0.2 \) mm
- \( h = \) chimney height
G2- Axle counter AZL70

2. AXLE COUNTER AzL 70 GENERAL ARRANGEMENT

The basic units of the AzL 70 are:

- the outdoor equipment (Detection Point ZP30) with one or more detection points
- the transmission path (2-wire transmission)
- the indoor equipment (evaluation and relay interface)
3.2 Rail Mounting Holes

It is important that the mounting holes are drilled in the correct position. If this is not the case, it may not be possible to correctly adjust the Tx heads. As can be seen overleaf, the position "a" of the mounting holes depends largely on the rail height.

**Approximation formula:**

\[ a = (0.467 \cdot h) - k \]

- **h** = height of rail (in unworn condition)
- **k** = 6 mm
- **b** = 13 mm ± 0.2 mm
- **c** = 148 mm ± 0.2 mm
- Tolerance for a ± 1 mm
INDUSI System Brochure

Alcatel 6411 AlTrac
Inductive Automatic Train Protection (INDUSI I60R)

The Alcatel 6411 AlTrac is an inductive automatic train protection system for enhanced safety.

Description
The Alcatel 6411 AlTrac is an inductive automatic train protection system for enhanced safety. Under normal conditions the Alcatel 6411 AlTrac does not influence the driver's control. It activates the automatic application of the train brakes if the driver responds incorrectly or not at all to stop signals or warning signals.

Main Functions
The system has been divided into two main components. The trackside devices and the on-board equipment in the locomotive. The electronic components of the Alcatel 6411 AlTrac have greatly improved the operational safety.

The on-board equipment makes the implementation of semicontinuous monitoring possible. The trackside equipment of the Alcatel 6411 AlTrac comprises passive track magnets and devices for the adaptation to the fixed line side signals. The track magnets are mounted at the side of the rail and are direction dependent. Contacts operated by the signals set the magnets to the appropriate frequency if the signal aspect is restricted. The on-board equipment is constructed in a very compact manner. The components consist of a central processing unit, the peripherals and the operating and display elements.
The central processing unit consists of the analogue unit which generates frequencies, detects inductive coupling and has interfaces with the computer port, the digital unit which contains the central microprocessor with integrated train data IO board and finally the data storage unit which stores all relevant operational data.

The main feature is the compact design of the central processing unit. The peripheral is composed of the Alcatel 6411 AlTrac vehicle magnets and the brake actuator as an interface to the pneumatic brakes. A speed indicator determines the actual speed and the distance traveled. The software of the Alcatel 6411 AlTrac consists of a program packet for the computer and a packet for the data storage cassette which is driven by a separate computer.

The program package contains sections for the train data input and display, the operation program, the programs for detecting faults and programs for continuous data exchange with the data storage unit.

The operation program monitors the speed of the train. The Alcatel 6411 AlTrac automatically detects faults in the central processing unit and the peripherals. The driver is informed by a yellow indicator lamp and an alarm that a fault has occurred. At the same time a numbered fault message is transferred to the data storage unit. The PC based test device can then read out the stored fault number, test all Alcatel 6411 AlTrac functions automatically or via a keyboard and even simulate and test interfaces. Maintenance personnel can enter specific data into the computer using the test device for testing functionality.

A special evaluation software package can be used to read out the data stored in the data storage unit.

The software runs on a standard PC. Depending on requirements the data can be either displayed, printed out or transferred to other data media.

**Essential Benefits**

- Compact and cost effective
- Operates with existing trackside equipment
- Extended display and operation elements
- Implements speed monitoring
- Uses commercially available computers
- Maintenance friendly through fault detection
- Improved information through the extended diagnosis and evaluation facilities.
TECHNICAL APPENDIX H – ISR TELECOMMUNICATION SYSTEMS AND ANTENNAS

Attached separately