Technical Specification for Track Motor Vehicle with Crane

Version 12

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1. **Definition**

"Machine" – track machine vehicle with crane used for construction, maintenance and inspection of track.

2. **General**

2.1 The machine shall be self-propelled, Category 1, and will be used on ISR railway network for track maintenance, carrying personnel, tools, equipment, rails, sleepers, etc.

2.2 The machine shall be incorporated into a train formation.

2.3 The proposal shall include a type of track motor vehicles with crane.

2.4 The Supplier shall be certified with ISO 9001:2008.

2.5 The machine shall be designed to operate under the climate and environmental conditions, dust conditions in the atmosphere, sea salt concentrations in the atmosphere according to the data provided in (as mentioned in Attachment A).

2.6 The machine shall fully comply with the relevant UIC codes and EN norms including EN standards and UIC codes regarding environment and safety protection (like: noise, pollution, etc.).

2.7 The machine shall be designed to provide easy and safe access to all systems in order to perform maintenance and running checks in the track line and in the depot, according to EN and UIC norms.

2.8 The machine cabin shall be at front end, and the crane in the rear end, the loading platform shall be between the cabin and the crane.

2.9 The machine shall include an "INDUSI" - Inductive signal protection (Attachment C).

2.10 The machine shall provide a cabinet for future ETCS Level 2 system installation.
2.142.10 The machine shall include a "dead-man" safety device to stop the vehicle in case the driver is unable to continue operating according to UIC 641 code.

2.142.11 The machine shall be provided with an additional emergency aggregate for hydraulics – operated by an independent combustion engine - to operate the machine's hydraulic system in the event of a full power failure or any hydraulic system failure.

2.142.12 An emergency system shall allow normalization of machine and all equipment components and movement the machine to a proper location when failure immobilize the machine. This normalization shall be continued for at least 30 minutes.

2.142.13 The driver cabin arrangement and visibility angles while sitting in the driver seat facing traveling direction shall comply with UIC 651 code and EN 14033 and guarantee excellent visibility and panoramic view on the track line.

2.142.14 The machine shall work in Overhead Catenary System (25KV AC).

2.142.15 The machine shall be designed with a complete fault monitoring system for: Braking System, Propelling System, Cooling System, Fuel System, Air Intake, Hydraulic System, Pneumatic System, Electrical System, etc.

2.142.16 The machine shall be designed with boom lifting limit and slewing limit with buzzer warning and automatic switch OFF.

2.142.17 The machine shall be equipped with subassemblies (propelling, hydraulic, pneumatic, brakes, air conditioning etc.) that have local representatives.

2.142.18 The machine shall be equipped with GPS tracking unit.

2.142.19 The cabin and platform doors shall be painted RAL 1018.

2.142.20 The machine shall be of the latest technology. Components which are obsolete, nearing end of production or out of production shall not be used. All components shall remain and be readily available for the ISR to purchase for a minimum of twenty (20) years from the date of FAT.

2.142.21 The machine shall be provided with remote control for crane operation and driving in working mode.

3. **Applicable Standards:**
The machine shall fully comply with the latest edition of:

3.1 EN12663: Structural requirements of railway vehicle bodies
3.2 EN14033-1: Rail bound construction and Maintenance Machines Technical requirements for running.
The vehicle shall meet “Category 1” requirements.
3.3 EN14033-2: Rail bound construction and maintenance machines - Technical requirements for working
3.4 EN 14033-3: Railway applications - Track – Rail bound construction and maintenance machines - General safety requirements
3.5 EN 50125-1:2003 Railway Applications - Environmental Conditions for Equipment - Part 1: Equipment on Board Rolling Stock
3.6 EN 50155:2007 Railway Applications - Electronic Equipment Used on Rolling Stock
3.7 IEC 61991 Ed. 1.0 Railway applications - Rolling stock - Protective provisions against electrical hazards
3.8 UIC 651
3.9 ISR requirements for electrical equipment – Attachment D, E.
3.10 All EN and UIC mentioned in this technical description.

4. Operating Characteristics

4.1 The machine shall have the following operating characteristics:

<table>
<thead>
<tr>
<th>Operation Characteristics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1.1 Track gauge</td>
<td>1435 [mm]</td>
</tr>
<tr>
<td>4.1.2 Max travel speed - self propelled (unload)</td>
<td>at least 100 [km/h]</td>
</tr>
<tr>
<td>4.1.3 Max travel speed - self propelled (load)</td>
<td>at least 100 [km/h]</td>
</tr>
<tr>
<td>4.1.4 Max travel speed - towed (unload)</td>
<td>at least 120 [km/h]</td>
</tr>
</tbody>
</table>
4.1.5 Max travel speed - towed (load) at least 100 [km/h]
4.1.6 Min curve radius on shunting area 75137 [m]
4.1.7 Min curve radius on track line 140 [m]
4.1.8 Max gradient 35 \%
4.1.9 Max superelevation 170 [mm]

4.2 The machine shall fully comply with EN 15273 GC – loading gauge (Attachment B).

5. **Crane Performances**

5.1 The machine shall have hydraulic multipurpose crane, with pivoting head. The crane shall be installed on the rear end of the platform.

5.2 The crane length shall be at least 10.5 meters beyond machine buffers.

5.3 The crane shall include a computer that contains software with programmable limits of crane for boom lifting limit and slewing limit.

5.4 The crane shall be designed with boom lifting limit and slewing limit with buzzer warning and automatic switch OFF.

5.5 The machine shall have proximity detection device for electric lines device mounted on a crane and designed to detect proximity to electric lines proximity to power lines.

5.6 The crane machine shall have a lifting moment at least 25 tm.

5.6.5 The crane shall have the following operating characteristics:

<table>
<thead>
<tr>
<th>Operation Characteristics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5.6.1 Loading capacity at 12 meters</td>
<td>at least 14 [t·m]</td>
</tr>
<tr>
<td>5.6.2 Loading cap. at 10.5 meters</td>
<td>at least 26.25 [t·m]</td>
</tr>
<tr>
<td>5.6.3 Total horizontal lengthening</td>
<td>at least 12[m]</td>
</tr>
<tr>
<td>5.6.4 Total vertical lengthening</td>
<td>at least 15 [m]</td>
</tr>
<tr>
<td>5.6.5 Continuous rotation</td>
<td>at least 400°</td>
</tr>
</tbody>
</table>
5.75.8 The crane shall be equipped with control panel. The control panel shall have all the needed elements to enable crane operation on standstill mode or working mode.

5.85.9 The crane shall be design as a multipurpose crane, with pivoting head. The following elements shall be delivered with the machine and could be assembled to the crane:
- Hook;
- Ballast grabbing device (especially between sleepers);
- Polyp Grab with half closing tines (250-350 liter)
- Basket.
- Clamshell buckets (150-200 liters).
- Graber device for sleepers handling.

The basket shall be designed for carrying personnel and equipment in a total weight of not less than 250 [kg] and the basket shall be equipped with rotated searchlight.
The basket shall include control panel which shall have all the instruments for crane operating and for driving and braking in working speed mode.
The basket control panel shall include electric and hydraulic plugs to enable connecting and operating of electrical and hydraulic instruments.
The cabin and the basket control panels shall include intercommunication system to enable direct communication between the two posts.

5.95.10 The machine stability during work shall be ensured with safety factor of at least 1.4. The machine shall be provided with hydraulic stabilize outriggers to improve safety operation.

5.105.11 The crane position shall not interfere driver view of track line according to UIC 651. If crane position blocks driver view of track line a camera shall be installed or other acceptable solution according UIC 651.

5.115.12 The machine shall be provided with remote control to enable crane operation and driving in working mode.
6. **Loading Platform**

6.1 The loading platform shall have the following operating characteristics:

<table>
<thead>
<tr>
<th>Operation Characteristics</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1.1 Useful load on the platform (not include weight in the cabin)</td>
<td>at least 7 [ton]</td>
</tr>
<tr>
<td>6.1.2 Useful loading area</td>
<td>at least 14 [m²]</td>
</tr>
</tbody>
</table>

6.2 The machine platform shall be arranged to carry long rails—48 meters—in safety a safe manner with a length that does not exceed the TMVC length. (at least one rail on each side of the machine).

6.3 The platform shall have detachable sidewalls. It shall be possible to access to the platform from both sides by stepping access with handles.

6.4 The platform shall be at height up to 1100 mm from head rail.

7. **Machine Construction**

7.1 Frame

7.1.1 The frame shall consist of one rigid construction.

7.1.2 The frame shall be made from electrically welded rolled steel to provide maximum strength.

7.1.3 The frame shall be provided with towing equipment: buffers, hooks couplers, drawbars and rubber hoses mounted to the frame on both sides of the machine according to UIC codes.

7.1.4 The frame shall be provided with towing equipment: buffers, hook couplers, drawbars and rubber hoses mounted to the
frame on both sides of the machine, according to UIC codes, which enable the machine to be towed in the train formation.

7.1.5 The frame shall provide lifting, jacking points and stowage points for transport on boats according with EN 14033.

7.1.6 The following are provided on the frames:
- Handrails or grab irons
- 4 lifting hooks for handling;
- One guard-irons on both sides of each wheel;
- Side steps; the lowest step used for boarding the machine shall not exceed the loading gauge.

7.1.7 - Kick board shall be provided to prevent crew entry into potentially hazardous areas.

7.1.8 - All floor walking areas shall be made from anti slidding and wear resistant material.

7.2 Underframe and Suspension

7.2.1 Axles made of steel according to UIC 811-1
7.2.2 Wheels monoblock steel according to UIC 812-3 wheel diameter preferable 920mm
7.2.3 Axle static load conform to EN 14033-1 recommendation: 22.5 ton
7.2.4 Suspensions according to UIC 517.
7.2.5 Axle boxes according to UIC 811-1. fitted with roller bearings.
7.2.6 Each headstock shall be fitted with UIC type coupling system and buffers, namely:
7.2.7 Buffers: according to EN 15551
7.2.8 Draw gear according to EN 15566
7.2.9 Draw Hook to UIC 520
7.2.10 Screw coupler to UIC 520
7.2.11 Brake hose with valve.
7.2.12 Automatic Trailer Coupling Ro*290.
7.2.13 The machine shall have cow catcher at both ends.

8. Propelling System
8.1 **Engine**
The machine shall be powered by at least 500 [hp], liquid cooled diesel engine.
The engine shall comply with latest Euro Step III B or updated rating according to the European Emission Standard requirements (provide technical specifications).
The machine shall enable direct access to the engine without entering the cabin.

8.2 **Engine Cowling**
A cowling shall protect the drive, engine and transmission lines.
This cowling shall have doors that will provide easy access to all elements.

8.3 **Cooling System**
The cooling system shall enable continuous safe operation of the engine at the ambient temperature given in paragraph 2.3.
The loss in heat transfer efficiency due to the hot and dusty environment shall be taken into consideration.

8.4 **Fuel System**
8.4.1 The fuel system tank capacity shall enable continuous operating of at least 100 working hours and have at least 1000 liters. (Specify tank volume)
8.4.2 Fuel system shall be provided with a sediment bowl, draining system and a full flow replaceable element filter.
8.4.3 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.
8.4.4 Refueling points shall be provided on both lateral sides of vehicle.
8.4.5 The fuel tank shall be fitted with venting equipment, which shall contain any overflow and prevent excessive pressure. All openings in the fuel tank shall be situated above the maximum fuel level.
8.4.6 The fuel tank shall have an indirect fuel level indicator.
8.4.7 The machine shall be equipped with an auxiliary fuel tank with at least 300 liter capacity.
8.5 **Air Intake**

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

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 (Attachment A).

Air intake shall include a double filter system.

- 1\(^{st}\) stage: cyclonic - filter self cleaning.
- 2\(^{nd}\) stage: dry type - replaceable filter element.

8.6 **Exhaust System**

8.6.1 The exhaust components shall be from stainless steel.

8.6.2 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.

8.6.3 The exhaust system shall utilize a catalytic converter.

8.6.4 All exhaust piping shall be properly braced to eliminate shocks at all junctions, and at the interfaces between the manifold and muffler. Vibration dampeners shall be used.

8.6.5 The exhaust system shall provide for expansion, contraction, vibration, and stress produced by operation of the machine. The system shall comply with the latest [EURO 5][1] or updated rating according to the European Emission Standard requirements.

8.6.6 The exhaust system shall provide an upper gas evacuation, above the cabin to avoid ambient contamination, according to the loading gauge.

8.6.7 The exhaust system shall be designed to avoid gas intake into the cabin.

8.7 **Engine Protection System**

Engine protection system shall protect the engine against:

- High coolant temperature;
- Low coolant level;
- Low oil pressure;
- High oil temperature.
- Low fuel level
- Exceed allowed RPM's
The engine shall be provided with dry air filter.

8.8 **Transmission**

8.7

8.8.1 The machine shall have a POWER – SHIFT type transmission that will allow changing of gears under load (provide technical specifications).

8.8.2 A fully automatic hydrodynamic drive system is also acceptable.

8.8.3 The machine shall have the following towing and braking abilities:

<table>
<thead>
<tr>
<th>Operation Characteristics</th>
<th>Speed</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.7.3.1 Towing and braking abilities in horizontal track</td>
<td>at least 50 [km/h]</td>
<td>300 [ton]</td>
</tr>
<tr>
<td>8.7.3.2 Towing and braking abilities in gradient of 25‰</td>
<td>at least 25 [km/h]</td>
<td>180 [ton]</td>
</tr>
<tr>
<td>8.7.3.3 Towing and braking abilities in gradient of 35‰</td>
<td>at least 5 [km/h]</td>
<td>90 [ton]</td>
</tr>
</tbody>
</table>

8.8.4 The transmission shall enable full operation regardless driving direction.

8.8.5 The machine shall enable traveling in train formation. For towing purposes, the system shall be provided to permit easy disengagement of the transmission and transmission system disconnecting.

8.8.6 The machine shall enable working combined with similar machines to increase towing abilities.

8.8.7 Traveling (not in working mode) shall be possible only while the crane is in traveling position.

9. **Braking System**

9.1 The machine shall be equipped with braking systems fully comply with EN 14033 and UIC codes.

9.2 The machine shall be equipped with pneumatic direct and indirect braking systems.
9.3 The machine shall be equipped with parking brake according EN 14033.

9.4 The machine shall enable operation of emergency brake from driver cabin.

9.5 The braking device shall comply with UIC 540 standard.

9.6 Braking power shall be calculated according to UIC code 544-1.

9.7 The compressed air system shall provide the necessary pressure for integrating the vehicle in train formation according to UIC code 540.

9.8 The compressed air system shall assure the pressure for full operation of braking system and other auxiliary needs.

9.9 The system shall include an air dryer, water separator and a full flow replaceable filter elements.

9.10 The air reservoirs shall be equipped with an automatic moisture drain valve.

9.11 Override and bypass components in the brake system will be protected to prevent accidental or inadvertent venting of the charged brake system.

9.12 It’s preferable that the braking system manufacturer will be KNORR.

10. **Hydraulic System**

10.1 The machine crane and stabilizer outriggers shall be hydraulically operated.

10.2 The hydraulic system shall be designed as to provide efficient operation in the ambient conditions given in paragraph 2.3.

10.3 The hydraulic system shall be equipped with oil cooling system.

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

10.5 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.
10.6 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.

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

11. **Compressed Air System**

11.1 The compressed air system shall provide the necessary pressure for integrating the machine in train formation according to UIC codes.

11.2 The compressed air system shall assure the pressure for full operation of braking system and other auxiliary needs.

11.3 The system shall include an air dryer, water separator and a full flow replaceable filter elements.

11.4 The machine shall ensure towing capacity for at least 28 braked wheels set.

11.5 The machine shall be equipped with four quick couplings for compressed air supply (6 bars) two for each machine side.

12. **Electrical System**

12.1 Electrical System according EN 50121, EN50155, E50215, EN 61373, IEC61991

12.2 The machine shall include electrical system capable of energizing all needed systems.

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

12.4 The batteries shall not produce emission of toxic gasses.

12.5 The machine shall be equipped with generator 230 / 400 Volt 50Hz A.C.

12.6 The 230 / 400 V 50Hz AC circuit shall supply be at least 20 KVA AC.

12.7 The machine shall have shore power with external connectors, for the AC circuit to be fed from an outside 400 Volt AC power source.
12.8 The 400V external supply connector (+CFL-X1) shall be located on both sides of the machine.

12.9 The machine shall be equipped with external sockets for 230/400V supply on both sides of machine.

13. **Cabin**

13.1 Design guidelines

The machine cabin shall be at the front end of the platform.
The cabin shall be designed and equipped following the guidelines in EN 14033
All operations for transfer and work shall be controlled from cabin.
The access to the cabin shall be via steps with hand rails and safety platform from both sides.
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.
The cabin shall have life line.
The floor shall be insulated against noise and made of non-slip material.
The floor shall be insulated against heat where a heat source is present under the floor.
The machine shall be equipped with intercom system.
The cabin shall have two driving posts, one to each driving direction.
The cabin shall be provided with extra seats facing the track for a second person (pilotman, guard or other person).

13.2 Air-conditioning System

The cabin shall be fully air-conditioned providing cooling, heating and ventilation. The system shall operate efficiently in ambient conditions given in Attachment A.
The system shall meet the requirements of EN 14813-1: “Railway applications - Air conditioning for driving cabs - Part 1: Comfort parameters” and UIC 651, paragraph 2.9
Heat generated by the equipment shall be taken in the calculation of the air-conditioning unit.

13.3 Cabin Equipment

The cabin shall be fully equipped with driving, operating and analyzing control panels. The driver desk and main operating equipment and control panels shall comply with UIC 651 paragraph 4.

13.4 Cabin windows

The cabin windows and windows accessories such as wipers, washers, demisters, defrosting equipment and sunshades shall comply with UIC 651 paragraph 2.7.

13.5 Noise Level

The noise level in the cabin shall meet the requirements of UIC 651 paragraph 2.10.

13.6 Cabin Amenities

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

The cabin shall be fully air conditioned providing cooling, heating and ventilation in the same system. This system shall operate efficiently on ambient conditions given in paragraph 2.4 regarding EN 14033.

13.7 Driver Visibility

The driver visibility sitting in the driver seat facing to traveling direction shall fully comply with UIC 651 and take into account that ISR signaling are left located.

It shall also provide suitable view of the surroundings near the vehicle additionally to UIC and EN norms.

13.8 The seats and equipment in each post shall be ergonomically fitted, multidirectional adjustable, as to enable effective operation in both directions for long working periods.

13.9 The cabin shall be equipped with at least 10 seats for personnel in addition to the driver seats with hand rails.

14. Control Panel

14.1 The control panel shall be curved to ensure optimal desk view and designed to ensure safety driving, control to all components, an optimal visibility, avoid sun influence
14.2 The control panel shall have a free horizontal surface of minimum dimension A4 landscape, for processing documents, etc.

14.3 A rack with a clip for timetable documents shall be installed close to the driver's desk and shall be lit separately.

14.4 The driver control panel shall include at least following instruments:

3.4.1 Tachometer;
3.4.2 Hour meter;
3.4.3 Fuel control indicator;
3.4.4 Engine coolant temperature indicator;
3.4.5 Coolant level indicator;
3.4.6 Transmission oil temperature indicator;
3.4.7 Transmission oil pressure gauge;
3.4.8 Engine oil temperature indicator;
3.4.9 Engine stop push-button;
3.4.10 Slow speed mode indicator;
3.4.11 Crane lock indicator;
3.4.12 Stabilize outrigger lock indicator;
3.4.13 Horn push-button;
3.4.14 Battery charge indicator;
3.4.15 Voltmeter
3.4.16 Amperemeter
3.4.17 Portable lamp plug;
3.4.18 Outside lighting switches;
3.4.19 Inside lighting switches;
3.4.20 “DEAD MAN” button and pedal;
3.4.21 Electrical sockets 12 and 24 V DC and 220 V AC;
3.4.22 INDUSI control panel on both traveling directions.

15. **Safety Systems**

The machine shall fully comply and equipped conform specification of EN14033-3 General safety requirements.

In additional the machine shall be equipped with following safety systems:

15.1 **Automatic Vigilance Device**
An Automatic Vigilance Device (Dead-Man Device) shall be provided and shall comply with UIC 641 and UIC 651. Activation shall be by pedal and desk button.
15.2 **INDUSI System** (Attachment C) installed in the machine shall fully comply with the system used by ISR (INDUSI system type I60R produced by THALES). The magnets of the INDUSI system shall be installed on the left hand side of the machine, and shall not interrupt the axle counter system. The INDUSI system shall be installed by the manufacturer and will be checked and inspected by supplier and representative of IRA in the manufacturer's plant.

16. **Lighting and Safety Arrangement**

16.1 The machine shall include at least following lighting:

16.1.1 Travel led lights according to UIC code.
16.1.2 Lighting in the cabin, on the crane post and adjustable projector in the basket as to provide effective working conditions during night.
16.1.3 2 light projectors for platform.

16.2 The following safety arrangements shall be provided:

16.2.1 The crane shall be provided with height, sides and moment limit devices – totally controlled by PLC with interface system.
16.2.2 2 Rotating beacon (one to each direction).
16.2.3 2 Electro-pneumatic warning horns (one to each direction);
16.2.4 4 Fire extinguisher.
16.2.5 Temperature and smoke detectors including alarm.
16.2.6 The machine control panels shall be design to gain control from only one panel at a time.
16.2.7 4 emergency push buttons for stopping the machine shall be located on each corner of the machine (outside the cabin).
16.2.8 4 Horn push buttons on each corner of the vehicle (outside the cabin).
16.2.9 Lighting all around machine.
16.2.10 Boom lifting limit and slewing limit with buzzer warning and automatic switch OFF.
16.2.11 Proximity detection device for electric lines device mounted on a crane and designed to detect proximity to electric lines proximity to power lines.

17. **Technical Data**

17.1 The bidder shall include with the proposal at least the following technical data:
17.1.1 Full description and draws of the following system:
- Crane;
- Stabilizer outriggers.

17.1.2 Full details on the safety equipment.

17.1.3 Breakdown of the maintenance cost:
- Cost of spare parts and men hours for 2000 operating hours.

17.1.4 Full information about operators and maintenance personnel training programs.

17.1.5 Spare parts list for 2000 operating hours.

17.1.6 Technical information of crane lifting abilities: Drawings, tables, and calculations. This data shall include the permitted lifting capacity all around the machine, also in slow speed mode.

17.1.7 Data on towing abilities: Calculations, graphs and tables of the machine towing abilities in different gradient from 0‰ to 35‰ and speed from 10 km/h to maximum speed shall be enclosed to the proposal (also in slow speed mode).

17.1.8 Data on braking distances: Calculations, graphs and tables of the machine braking distance in different gradient from 0‰ to 35‰ and speed from 10 km/h to maximum speed shall be enclosed to the proposal (also in slow speed mode).

17.2 The following technical data shall be provided with the machine:

17.2.1 Full Description and draws of the following systems:
- Machine;
- Transmission;
- Engine system;
- Air conditioning system;
- Electrical;
- Electronic;
- Pneumatic;
- Hydraulic;
- Mechanical.

17.2.2 Machine operation and maintenance manuals, safety instructions and spare parts catalogue:
- Maintenance manual shall include instructions and procedures for parts and components replacements, adjustments disassembly, assembly, and testing.
- Operation manual shall include instructions of machine operating.
- Safety instructions shall be included in these manuals.
- Spare parts catalogue shall include full list of manufacturer spare parts codes and costs.
  Four duplicates of all these data shall be supplied on hard copy and two on CD. All documents shall be in English language.

17.2.3 Certifications (measuring, testing, declarations, etc.) of the machine components abilities – Technical Passport.

17.2.4 Certifications by third party (representative of domestic railway authority or notified body) for functional suitability to the UIC codes of the following system: driving; braking; towing; visibility; Dead-Man; INDUSI.

17.2.5 All signs and labels shall be written both in English and Hebrew.

18. **Environment Quality**

18.1 The machine shall keep the specifications of up-to-date exhaust emissions directives.

18.2 The noise inside and outside the machine shall be according to the UIC codes.

19. **Faults and Diagnostic system**

The machine shall be equipped with computerized monitoring and faults diagnostic device. The system shall monitor faults that may occur in each one of the following systems: electronic, electric, hydraulic, pneumatic, mechanic, propelling etc. The hardware and software of the diagnostic and monitoring systems shall be supplied as an integral part of the machine.

20. **Tools**

The machine shall be equipped with a complete set of tools suitable for its maintenance.

21. **Faults Monitoring System**

The vehicle shall be equipped with a fault monitoring system.
The system shall diagnose and monitor faults that may occur in each one of the following vehicle systems: Braking, Propelling, Cooling, Fuel, Air Intake, Hydraulic, Pneumatic, Electrical, etc.

22. **Documentation**
The following technical data shall be provided at least 60 days before delivery of the machine:

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

- Vehicle;
- Engine system;
- Transmission system;
- Hydraulic System
- Pneumatic System
- Drive Axles;
- Air-conditioning system;
- Electrical system
- Electronic System.

Four hard copies and two magnetic copies (DVD) shall be provided of all the listed data. All documents shall be in English.

23. **Manuals Content**
The operation and maintenance manuals shall include at least the following chapters:

- Safety precautions
- Systems description;
- 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. Preventive maintenance instructions;
Adjustments instructions;
Components replacement procedures;
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.
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.
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.
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;
- Compound documents viewer (text, tables, raster/vector images, audio, video, etc.);
- Multi-target hyperlinks;
- External executable links;
- Exporting images in their native format; exporting text.

24. **Production Process**
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. **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.
26. **Final Test Details**
The final test of the vehicle shall be conducted following the guidelines of EN 14033 – 1,2,3.
Submit a sample final test plan. The actual test plan will be submitted one month before commencement of the test.

27. **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.

28. **Manufacturing Schedule**
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.
- Design Review
Foreign acceptance test at manufacturer's premises (FAT) shall be done by an Independent Safety Assessor and notified body with at least five years experience in domain. FAT tests shall be proceed in ISR representative presence.
The manufacturer shall provide to ISR notified body name to be approved, before performing FAT.
Final vehicle systems tests at ISR premises and tracks (FT).
29. **Handing-over Procedure**
The handing-over procedure shall include the following tasks:

At the manufacturing plant in the present of ISR representatives:
Visual check of the vehicle and its systems for compliance with the specifications drawings and the submittals.
Checking of all test reports which were issued during the production for compliance with the test plan.
Running test of the vehicle and its systems.
The manufacturer shall provide to ISR notified body name to be approved in advance by FAT.
A representative of the notified body will test the vehicle according to EN 14033 1,2,3 and will certify that the vehicle meet the EN 14033 -1,2,3 requirements .
The certification price shall be included in machine price.
Checking of all the hard copies of the operation and maintenance manuals, parts breakdown and drawings sets for compliance with the specifications requirements,
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.
After approval of all the tests by ISR and it's own tests the vehicle shall be sealed, protected and prepared by the contractor for the sea transportation.

At destination:

30. **Tasks to be performed by the contractor at ISR site**
Removal and cleaning the vehicle packaging and inhibiting materials
Functional tests of all vehicle systems.

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.

31. **Training Requirements**

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:

- Training schedule.
- Theoretical lessons.
- Practical lessons.
- Job Aids.
- Evaluation package.
- Training Aids and Simulators.

Training Package Formats

The Training Package will be provided in the following formats:

- User Handbook / Operator’s Manual, Maintenance Manuals will be supplied as:
  - PowerPoint files for Theoretical Lessons.
  - WORD files for Practical Lessons.
  - PDF files (unlocked and data-copy-enabled).

Manufacturer Training Courses
The Manufacturer is requested to conduct several training courses in the English language:

Operators Course

Maintenance Course

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. There is no special need for materials to be supplied in the course except for the Operating / Maintenance Manuals.
## Attachment A

### 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></td>
<td>100</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>SO₄²⁻</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>
## Water Quality

### Typical Water Quality in Israel.

<table>
<thead>
<tr>
<th>No.</th>
<th>Parameter</th>
<th>Unit</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hardness</td>
<td>ppm</td>
<td>220-450</td>
</tr>
<tr>
<td>2</td>
<td>PH</td>
<td></td>
<td>6.4-7.5</td>
</tr>
<tr>
<td>3</td>
<td>Chlorides</td>
<td>ppm</td>
<td>20-400</td>
</tr>
<tr>
<td>4</td>
<td>Alkalinity</td>
<td>ppm</td>
<td>100-300</td>
</tr>
<tr>
<td>5</td>
<td>Ca</td>
<td>ppm</td>
<td>45-100</td>
</tr>
<tr>
<td>6</td>
<td>Cr</td>
<td>ppb</td>
<td>app 3</td>
</tr>
<tr>
<td>7</td>
<td>Cu</td>
<td>ppb</td>
<td>app 3</td>
</tr>
<tr>
<td>8</td>
<td>Fe</td>
<td>ppb</td>
<td>app 68</td>
</tr>
<tr>
<td>9</td>
<td>K</td>
<td>ppm</td>
<td>2-5.7</td>
</tr>
<tr>
<td>10</td>
<td>Mg</td>
<td>ppm</td>
<td>20-30</td>
</tr>
<tr>
<td>11</td>
<td>Mn</td>
<td>ppm</td>
<td>app 6</td>
</tr>
<tr>
<td>12</td>
<td>HCO3</td>
<td>ppm</td>
<td>110-400</td>
</tr>
</tbody>
</table>
Attachment B

Loading Gauge

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. 5.000 m - for speed up to 60 km/h on the secondary lines, station and marshal yard lines.
4. Dimensions for new rolling stock. For existing rolling stock high and wide of maximum loading gauge for coach/loco - 4.750 m and 1.660 m.
5. Dimensions for infrastructure gauge.
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.
Attachment C

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 drivers 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 periphery 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.

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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
4. The representative and service facilities shall be listed.
Attachment E

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):

![Diagram of power wiring](image-url)
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 manufacture 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 $R_e = \frac{U_{ph}}{I_{L}}$ (T1))

These methods are not practically to use.

3. **The recommended system : the IT system:**

The aim of the system is to prevent a close loop threw 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 throw 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."

To disconnect

The Insulation Monitor will be put in one of this places.