



**ISRAEL RAILWAYS LTD.
INFRASTRUCTURE DIVISION**

Technical Specification for Track Motor Vehicle with Crane

Version 1

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1. Definition

"Machine" – Railbound new track vehicle with crane used for rail track various tasks , construction, maintenance and track inspection .

2. General

- 2.1 The Machine shall be a bidirectional and self-propelled railbound vehicle , designed according with latest's EN 14033 -1,2,3, Category 1 type , and will be used in ISR railway network and in building tracks, for track maintenance, carrying tools, equipment, rails, sleepers, personnel, lifting tasks, etc.
- 2.2 Unless otherwise and to the extent specified hereafter, the Machine shall comply in every aspect with the latest edition of EN14033-1, EN14033-2, EN14033-3, ISO 12100, EN 16704-1, CEN-TR 17498, and Directive 2008/57 and it's amendments, Directive 2006/42, Directive 2016/1628, Directive 1302/2014, Directive 2014/68/EU.
- 2.3 The Machine shall have two bogies (2 axles on every bogie).
- 2.4 The Machine shall be incorporated into a train formation.
- 2.5 The proposal shall include a type of track motor vehicles with crane.
- 2.6 The Supplier shall be certified with ISO 9001, newest edition, in the scope of development, manufacture and supply rail vehicles.
- 2.7 The Supplier shall be certified with ISO 14001 .
- 2.8 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).
- 2.9 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.).
- 2.10 The Machine shall not be a prototype.
- 2.11 The Machine shall be designed to provide easy and safe access to all systems in order to perform maintenance and running checks , safely , with maximum effectiveness and ergonomics , in the track line and in the depot, according to EN and UIC norms. The arrangement of equipment and assemblies shall allow easy access in case of repair and maintenance. A sufficient and easy access to all

- major components and assemblies at the whole Machine (e.g. drivers' cabs, engine, hydraulic/pneumatic systems, Machine room underfloor area etc.) shall be ensured.
- 2.12 The Machine shall be designed to provide easy and safe execution of regular maintenance (monthly - semi yearly - yearly) by maximum two technician without using special lifting tools.
- 2.13 The Machine shall have two driver cabins at front and at rear ends.
- 2.14 One cabin Machine shall be at front end ; crane and the second cabin shall be in the rear end, the loading platform shall be between the cabins
- 2.15 The Machine shall include an "INDUSI" - Inductive signal protection (Attachment C).
- 2.16 The Machine shall equipped with ETCS system – Level2 – including homologation ; BL3 (the ETCS Tech Spec will be provided by ISR). System based on the standard ETCS On-board architecture including the integration of the STM INDUSI system in compliance with ETCS Baseline 3 Maintenance Release 1 specifications and ISR national requirements for STM INDUSI .
- 2.17 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.
- 2.18 The Machine shall be equipped for the emergency cases with a bypass to allow the vehicle movement to a nearby destination and of the railway traffic decongestion.
- 2.19 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 and to fold its parts in driving position - in the event of a full power failure or any hydraulic system failure.
- 2.20 The driver cabins 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.
- 2.21 The Machine shall be designed to operate with the same efficiency near high voltage electrical wire line, on OCS track with 25k VAC and on non-electrified track with CWR and jointed track.
- 2.22 The Machine shall be designed with a complete faults monitoring system for: Braking System, Propelling System, Cooling System, Fuel System, Air Intake, Hydraulic System, Pneumatic System, Electrical System, etc. The Machine intelligent computerization

- system will provide detailed indications of the operation or non-operation of each electrical element and its location.
- 2.23 The Machine crane shall be designed with presets parameters for boom lifting limits and slewing limits , lights , buzzer warning and automatic switch OFF. Additional limits can be programmed by accessing a security code .
- 2.24 The Machine shall be equipped with subassemblies (propelling, hydraulic, pneumatic, brakes, air conditioning etc.) that their manufacturers have local representatives in Israel.
- 2.25 The Machine superstructure shall be painted RAL 1018 (zinc yellow) and the understructure shall be painted RAL 7016 (anthracite gray).
- 2.26 The ISR name, logo, characters and symbols will be transmitted to manufacturer for further printing on the Machine.
- 2.27 The Machine shall be equipped with GSMR system (Attachment F) supplied by manufacturer and VHF system supplied by ISR .
- 2.28 The Machine shall have implemented a solution for remote condition monitoring of all systems , operation , faults ,location etc. , that allow real-time condition monitoring from a main office . This system shall allow real-time visualization and a secure remote access which will facilitate the technicians, remote analysis of all functions and faults .
- 2.29 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 twenties (20) years from the date of FAT.
- 2.30 The Machine supplier safety approach shall be consistent with that specified in EN 50126 Standards .
- 2.31 The Manufacturer shall perform the RAMS process according to EN 50126. The RAMS process includes both the definition of the requirements and the demonstration of compliance .
- 2.32 The detailed RAMS requirements shall be jointly defined between Israel Railways and the Manufacturer at the beginning of the project. The Manufacturer shall prepare a safety program plan to be submitted no later than 2 months after the Commencement Date.

3. Abbreviations:

Abbrevi ation	Explanation
AC	Alternating current
AFB	Automatic Drive-Brake-Control
ATP	Automatic Train Protection
ATC	Automatic Train Control
CEN	European Committee for Standardization
CAN bus	Controller Area Network bus
EN	European Standard
EP- brake	Electro-pneumatic Brake
ETCS	European Train Control System
HVAC	Heating Ventilation Air-Conditioning
FAT	Foreign Acceptance Test
GSM	Global System for Mobile Communications
HVAC	Heating Ventilation Air-Conditioning
ISO	International Organization for Standardization
IS	Israeli Standard
ISR	Israel Railways Ltd.
MOT	Israeli Ministry of Transportation
OCS	Overhead Catenary System
RAMS	Reliability Availability Maintainability Safety
SI	Israel Standard
TMVC	Track Motor Vehicle with Crane
TEVC	Track Electric Vehicle with Crane
TSI	Technical Specification for Interoperability (relating to Rolling Stock Subsystem - 'Locomotives and passenger Rolling Stock' of the trans-European conventional rail system)
TR	Technical Reports



TRACK MOTOR VEHICLE WITH CRANE

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Abbrevi ation	Explanation
UIC	International Union of Railways

Applicable Standards :

3.1. The Machine shall fully comply with the latest edition of:

CEN/TR15172-1	Whole-body vibration - Guidelines for vibration hazards reduction - Engineering methods by design of Machinery;
CEN-TR 17498	Railway applications - Infrastructure - Rail mounted railway maintenance and inspection Machines and associated equipment- Explanation of Machine type and compliance including acceptance;
EN12080	Railway applications – Axleboxes – Rolling bearings;
EN12663	Structural requirements of railway vehicle bodies;
EN12999	Cranes - Loader cranes
EN13103	Railway applications - Wheelsets and bogies - Non powered axles - Design method;
EN13104	Railway applications - Wheelsets and bogies - Powered axles - Design method;
EN 13155	Crane-Safety- Non-fixed load lifting attachments
EN13260	Railway applications - Wheelsets and bogies - Wheelsets - Product requirements;
EN13261	Railway applications - Wheelsets and bogies - Axles - Product requirements;
EN13262	Railway applications - Wheelsets and bogies - Wheels - Product requirements;
EN13674-1	Railway applications – Track - – Rail - Part 1 Vignole railway rails 46 kg_m and above;
EN13674-2	Railway applications - Track - Rail - Part 2 Switch and crossing rails used in conjunction with Vignole railway rails 46 kgm and above;
EN13715	Railway applications - Wheelsets and bogies - Wheels - Tread profile;
EN13749	Wheelsets and Bogies – Methods of Specifying Structural Requirements of Bogie Frame;

EN13979-1	Railway applications - Wheelsets and bogies - Monobloc wheels - Technical approval procedure - Forged and rolled wheels;
EN14033-1	Railway applications - Track - Railbound construction and maintenance Machines - Part 1: Technical requirements for running;
EN14033-2	Railway applications - Track - Railbound construction and maintenance Machines - Part 2: Technical requirements for working;
EN14033-3	Railway applications - Track - Railbound construction and maintenance Machines - Part 3: General safety requirements;
EN14363	Railway applications. Testing and Simulation for the acceptance of running characteristics of railway vehicles. Running Behaviour and stationary tests;
EN14813-1	Railway applications - Air conditioning for driving cabs – Part 1: Comfort parameters;
EN14813-2	Railway applications - Air conditioning for driving cabs - Part 2: Type tests;
EN15153-1	Railway applications - External visible and audible warning devices for trains. Head, marker and tail lamps;
EN15153-2	Railway applications - External visible and audible warning devices for trains. Warning horns;
EN15227	Railway applications - Crashworthiness requirements for rail vehicles;
EN15085-1	Railway applications–Welding of railway vehicles and components–Part 1: General;
EN 15085-2	Railway applications. Welding of railway vehicles and components – Part 2: Quality requirements and certification of welding manufacturer;
EN15085-3	Railway applications. Welding of railway vehicles and components – Part 3: Design requirements;

EN 15085-4	Railway applications. Welding of railway vehicles and components—Part 4: Production requirements;
EN15085-5	Railway applications. Welding of railway vehicles and components—Part 5: Inspection, testing and documentation;
EN15329	Railway applications. Braking. Brake block holder and brake shoe key for railway vehicles;
EN 15551	Railway Rolling Stock - Buffers;
EN15566	Railway applications. Railway rolling stock. Draw gear and screw coupling;
EN15663	Railway applications - Vehicle reference masses;
EN 15839	Railway applications. Testing for the acceptance of running characteristics of railway vehicles. Freight wagons; Testing of running safety under longitudinal compressive forces;
EN 16704-1	Railway applications — Track — Safety protection on the track during work — Part 1: Railway risks and common principles for protection of fixed and mobile work sites;
EN16186-1	Railway applications - Driver's cab. Anthropometric data and visibility;
EN16186-3	Railway applications - Driver's cab - Design of displays;
ISO5006	Earth-moving Machinery - Operator's field of view -- Test method and performance criteria;
ISO8501-1	Preparation of steel substrates before application of paints and related products -- Visual assessment of surface cleanliness - Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings;
ISO 8501-3	Preparation grades of welds edges and other areas with surface imperfections;

ISO8502	Preparation of steel substrates before application of paints and related products - Tests for the assessment of surface cleanliness;
ISO 9001	Quality management systems
ISO12100	Safety of Machinery — General principles for design — Risk assessment and risk reduction;
ISO12944	Paint and Varnish- corrosion protection of steel structures by protective paint systems;
ISO 14001	Environmental management systems
ISO/IEC8859-8	Information technology - 8-bit single-byte coded graphic character sets. Latin/Hebrew alphabet; SI60309-1 Plugs, socket-outlets and couplers for industrial purposes - General requirements;
SI4295	Pressure Vessels;
SI60309-2	Plugs, socket-outlets and couplers for industrial purposes - Dimensional interchangeability requirements for pin and contact-tube accessories;
UIC510-1	Wagons - Running Gear - Normalization; UIC520 Wagons, coaches and vans - Draw gear - Standardization;
UIC526-1	Wagons – Buffers with a stroke of 105 mm;
UIC533	Railway applications — Rolling stock — Protective provisions relating to electrical hazards;
UIC534	Signal lamps and signal-lamp brackets for locomotives, railcars and all tractive and self-propelled stock;
UIC541-1	Brakes — Regulations concerning the design of brake components;
UIC541-4	Brakes – Brakes with composite brake blocks – General conditions for certification of composite brake blocks;
UIC541-08	Brakes — Regulations concerning the manufacture of the different brake parts - Derailment detectors for wagons;

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|--------------------|--|
| UIC542 | Brake parts – Interchangeability; |
| UIC543 | Brake – regulations governing the equipment of trailing stock; |
| UIC554-1 | 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]; |
| UIC641 | Conditions to be fulfilled by automatic vigilance devices used in international traffic; |
| UIC651 | Layout of driver's cabs in locomotives, railcars, multiple-unit trains and driving trailers; |
| UIC895 | Technical Specification for the supply of insulated electric cables for railway vehicles; |
| Directive2016/1628 | Requirements relating to gaseous and particulate pollutant emission limits and type-approval for internal combustion engines for non-road mobile Machinery; |
| Directive2008/57 | Interoperability of the rail system, including all its amendments; |
| Directive2006/42 | On Machinery, including all its amendments; |
| Directive2014/68 | The harmonization of the laws of the Member States relating to the making available on the market of pressure equipment, including all its amendments; |
| Directive1302/2014 | Technical specification for interoperability relating to the 'rolling stock — locomotives and passenger rolling stock' subsystem of the rail system in the European Union, including all its amendments; |
- 3.2. EN 50125-1:2003 Railway Applications – Environmental Conditions for Equipment – Part 1: Equipment on Board Rolling Stock.
- 3.3. EN 50126 : The specification and demonstration of RAMS .
- 3.4. EN 50155:2007 Railway Applications – Electronic Equipment Used on Rolling Stock.
- 3.5. IEC 61991 Ed. 1.0 Railway applications – Rolling stock – Protective provisions against electrical hazards.

- 3.6. ISR requirements for electrical equipment – Attachment D, E
- 3.7. All other EN and UIC mentioned in this technical description.

4. Operating Characteristics

- 2.1 The Machine shall have the following operating characteristics:

	Operation Characteristics		
4.1.1	Track gauge		1435 [mm]
4.1.2	Max travel speed - self propelled (unload)	at least	120 [km/h]
4.1.3	Max travel speed - self propelled (unload) at 35 ‰ gradient	at least	90 [km/h]
4.1.4	Max travel speed - self propelled (load)	at least	120 [km/h]
4.1.5	Max travel speed - towed (unload)	at least	120 [km/h]
4.1.6	Max travel speed - towed (load)	at least	120 [km/h]
4.1.7	Min curve radius on shunting area		75 [m]
4.1.8	Min curve radius on track line		140 [m]
4.1.9	Max gradient		35 ‰
4.1.10	Max superelevation		170 [mm]
4.1.11	OCS		25 KV , AC , 50Hz

- 2.2 The Machine shall fully comply with EN 15273 GC – ISR 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 Machine.
- 5.2 The crane position shall be combined with rear driving cabin.
- 5.3 The Machine will be designed to facilitate the operation of the crane from the cabin located at the rear of the vehicle as well as from the remote control.
- 5.4 The hydraulic system will ensure the operation of the crane in the highest speed and at the same time the safeties movement parameters with and without loads .

- 5.5 The Machine shall be designed to allow the crane work ,deployment and folding within the limits of the gauge and without crashing the OCS line or other structural elements. (See “Loading Gauge”)
- 5.6 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, when operated in extreme conditions.
- 5.7 The Machine shall be designed to allow the crane work with the basket attached deployment and folding within the limits of the gauge and without crashing the OCS line or other structural elements.
- 5.8 The crane length shall be at least 10.5 meters beyond Machine buffers.
- 5.9 The crane shall include a computer that contains software with programmable limits of crane for boom lifting and slewing limits. When approaching the limits, there will be visual/lights and audible/buzzer warnings as well as the system stopping with the possibility of returning to safety margins .
- 5.10 The Machine shall be designed with an automatic anti-derailment system to prevent over turning vehicle when working with the crane.
- 5.11 The Machine crane and stabilizer outriggers shall be hydraulically operated and firmly secured in travel mode .
- 5.12 The crane shall have at least the following operating characteristics:

	Operation Characteristics		
a.	Max. lifting moment	at least	28.0 [mt]
b.	Loading capacity at 12 meters	at least	19 [mt]
c.	Loading cap. at 10.5 meters	at least	23 [mt]
d.	Total horizontal lengthening	at least	12[m]
e.	Total vertical lengthening	at least	15 [m]
f.	Continuous rotation	at least	400°

- 5.13 To guarantee reliable and safe operation, the crane can be operated from cabin and / or by remote control and / or from control panel .
- 5.14 The remote control can be wireless and with the option of being connected by wire to multiple sockets .
- 5.15 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.

- 5.16 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);
 - Basket ;
 - Clamp device for wood and concrete sleepers handling ;
 - Rail Handling Lifting Clamp .
- 5.17 The Machine will be designed with at least two home positions of the crane, one for traveling without auxiliary elements attached and the second with the basket attached .
- 5.18 The crane shall be design with approx. 700 mm height docking station for crane locking in traveling position .
- 5.19 Basket
- 5.19.1 The basket will be designed to ensure maximum safety operation .
- 5.19.2 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 rotating searchlight.
- 5.19.3 The basket shall include control panel which shall have all the instruments for crane operating and for driving and braking in working speed mode.
- 5.19.4 The basket control panel shall include electric and pneumatic plugs to enable connecting and operating of electrical and pneumatic instruments.
- 5.20 The cabin /or operator and the basket shall include intercommunication system to enable direct communication between the multiple posts.
- 5.21 The crane position shall not interfere driver view of track line according to UIC 651.

6. Loading Platform

- 6.1 The loading platform shall have the following operating characteristics:

	Operation Characteristics		Type
6.1.1	Useful load on the platform (not include weight in the cabin)	at least	10 [ton]

6.1.2	Useful loading area	at least	14 [m ²]
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- 6.2 The platform shall have detachable sidewalls. It shall be possible to access to the platform from both sides by stepping access with handles.
- 6.3 The platform shall be at height up to 1200 mm from the top of the 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, hook couplers, drawbars and double 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.
- 7.1.4 Position of the towed Machine in train formation shall be not limited.
- 7.1.5 The frame shall be equipped with lifting, jacking points and stowage points for transport on boats according with EN 14033.
- 7.1.6 The frame shall be equipped also with the following instruments :
- 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 ; If a lower step that intersects the Loading gauge is required, then it will be foldable and equipped with a safety system that prevents movement when lowered.
- 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 slipping and wear resistant material.

7.2 Underframe and Suspension

- 7.2.1 The two bogies shall be design according to EN 13749 , suitable for powered axle .
- 7.2.2 Axles made of steel according to EN 13103-1 and EN 13261 (product standards)
- 7.2.3 Wheels monoblock steel according to EN 13262 , EN 13979-1 wheel diameter preferable 1050 mm
- 7.2.4 Suspensions according to EN 13749.
- 7.2.5 The Suspension System shall be multi-stage type with suitable helical springs, dampers, shock absorbers and guides arrangement.
- 7.2.6 The Suspension System shall ensure an effective vibration reduction values during traveling and operation, according with EN 14033-3.
- 7.2.7 Axle boxes according to EN 12082 , fitted with roller bearings.
- 7.2.8 Each headstock shall be fitted with UIC type coupling system and buffers, namely:
- 7.2.9 Buffers: according to EN 15551 and will be covered with anti-slip material .
- 7.2.10 Draw gear according to EN 15566.
- 7.2.11 Draw Hook to EN 15566.
- 7.2.12 Screw coupler to EN 15566.
- 7.2.13 Four brake hoses with valve (direct and indirect braking) .
- 7.2.14 Automatic Trailer Coupling Ro*290.
- 7.2.15 The Machine shall have cowcatcher at both ends.
- 7.2.16 The Machine shall have 4 steps and handrails(1 step in every corner of Machine) to provide safety stand of worker during shunting operation travel and necessary handrails for it. The steps shall be located on minimal height according ISR loading gauge (Attachment B).
- 7.2.17 Frontal foldable steps with handles to facilitate cleaning and maintenance of the cabin front parts .
- 7.2.18 Gap between steps shall be no less than 20 cm and no more than 30 cm.
- 7.2.19 The underframe will contain a safe transport system of 4 rails, two on each side of the Machine , the maximum length of the rails being 18 meters and the minimum 6 meters .

8. **Propelling System**

8.1 Engine

The Machine shall be powered by at least 500 [hp], liquid cooled diesel engine.

8.2 The Engine emission shall be Stage V, for category railcar engine (or more advanced Stage) in accordance with European Directive 2016/1628 and all its amendments. Technical description shall be submitted.

8.3 The engine shall be equipped with a temperature monitoring system and firefighting system.

8.4 The Machine shall be designed to power on the engine in emergency situations, with a system to bypass the sensors, and ensure traveling to a proper destination.

8.5 The Machine design shall enable direct access to the engine without entering the cabin.

8.6 The engine shall be designed for a minimum of maintenance and ease of inspection and maintenance.

8.7 The Machine shall be designed with maintenance and diagnostic hardware and software modules for the diesel engine, providing full clear functional diagnostic of events, (each event status shall include literally description additional to the code).

8.8 The engine(s) shall feature an electric starter. The engine start-up shall feature suitable protection system against damage, e.g. by an engine purge system.

8.9 The engine power take off shall be coupled to the main gear box through an adequate coupling. The engine shall be mounted on suitable dumpers.

8.10 The engine(s) shall have attached suitable compressors and alternators.

8.11 The engine will be equipped with an air compressor that provides enough flow to supply the own brake system and at least 12 adjacent axles .

8.12 * Optional Track Electric (and diesel generator) Vehicle with Crane An OCS (25k VAC) electric traction based on pantograph and engine – generator power transmission shall be also considered (This option will be offered and bided in parallel : "Optional Track Electric (and diesel generator) Vehicle with Crane.

8.13 Engine Cowling

- 8.13.1 A cowling area shall protect the gear, engine and transmission lines and shall ensure low noise level and vibration reduction.
- 8.13.2 This cowling shall have doors, which 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.

8.14 Cooling System

- 8.14.1 The cooling system shall enable continuous safe operation of the engine at the ambient temperature given in Attachment A
- 8.14.2 The loss in heat transfer efficiency due to the hot and dusty environment shall be taken into consideration.
- 8.14.3 The cooling system shall be positioned so that it does not intake dirties.

8.15 Fuel System

- 8.15.1 The fuel system tank capacity shall enable continuous operating of at least 100 working hours and have at least 1200 liters. (Specify tank volume)
- 8.15.2 Fuel system shall be provided with a sediment bowl, draining system and a full flow replaceable element filter.
- 8.15.3 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.
- 8.15.4 Refueling points shall be provided on both lateral sides of vehicle.
- 8.15.5 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.
- 8.15.6 The fuel tank shall have an indirect fuel level indicator.

8.16 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); the system will be positioned so that it does not suck dirty .

The location of the filters will be in the upper part of the vehicle to avoid the impurities aspiration .

Air intake shall include a double filter system:

- 1st stage: cyclonic - filter self-cleaning.
- 2nd stage: dry type - replaceable filter element.

8.17 Exhaust System

8.17.1 The exhaust components shall be made from stainless steel.

8.17.2 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.

8.17.3 The exhaust system shall utilize a catalytic converter.

8.17.4 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.

8.17.5 The exhaust system shall be capable of withstanding the expansion, contraction, vibration, and stress produced by operation of the Machine. The system shall comply with the latest EURO 5 emission standards.

8.17.6 The exhaust system shall provide an upper gas evacuation, above the cabin, to avoid ambient contamination, and to affect at less as possible to people in vicinity of the Machine, according to the loading gauge.

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

8.18 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.

8.19 Transmission

The Transmission System shall ensure bidirectional traveling and operating in the same conditions and parameters.

8.19.1 Hydrodynamic Transmission

- 8.19.1.1 The Machine shall be equipped with Automatic Hydrodynamic Transmission System that acting on self-propelled mode.
- 8.19.1.2 This transmission shall have an adequate automatic gearbox to ensure optimum transmission of tractive effort between wheel and rail in the entire speed range.
- 8.19.1.3 This transmission shall act by cardan-shafts in multiple axes to obtain an efficient vehicle movement in desired parameters.

8.19.2 Hydrostatic Transmission

- 8.19.2.1 The Machine shall be equipped with Hydrostatic Transmission System that acting on operating mode.
- 8.19.2.2 The Hydrostatic Transmission system shall provide adequate range of speed in both work directions, and shall guarantee the adjustment of the speeds according to the working speed .
- 8.19.2.3 The hydrostatic transmission shall operate at least two axles to allow an efficient movement and maximum productivity.
- 8.19.2.4 The Hydrodynamic and Hydrostatic Transmission System shall enable traveling in train formation. For towing purposes, the Transmission System shall be designed to enable easy disengagement.

- 8.19.3 The Machine shall have the following towing and braking abilities (not includes self-weight):

	Operation Characteristics	Speed	Type
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8.7.3.1	Towing and braking abilities in horizontal track	at least 80 [km/h]	270 [ton]
8.7.3.2	Towing and braking abilities in gradient of 25‰	at least 25 [km/h]	180 [ton]
8.7.3.3	Towing and braking abilities in gradient of 35‰	at least 5 [km/h]	90 [ton]

8.19.4 The transmission shall enable full operation regardless driving direction.

8.19.5 The Machine shall enable traveling in train formation. For these towing purposes, the system shall be designed to permit easy disengagement of the transmission and transmission system disconnecting.

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

8.20 * Electric traction - Optional Track Electric (and diesel generator) Vehicle with Crane

8.20.1 * Optional Track Electric (and diesel generator) Vehicle with Crane An OCS (25k VAC) electric traction based on pantograph and engine – generator power transmission shall be also considered (This option will be offered and bided in parallel : "Optional Track Electric (and diesel generator) Vehicle with Crane. In the case of electric traction, the transmission system will be adequate .

9. Pneumatic - compressed air – System

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

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

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

9.4 The Machine shall ensure towing capacity for at least 28 braked wheels set, including efficient braking and releasing of towed wagons.

9.5 Air tanks drainage will be possible from the both Machine sides.

9.6 The Machine shall be designed with a compressor mounted on main engine for the individual braking requirements and for at least 12

additional axles. Complementary, for higher braking capacities and to ensure a backup solution an adequate system will be designed.

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

10. **Braking System**

- 10.1 The Machine shall be equipped with braking systems fully comply with EN 14033 and UIC codes.
- 10.2 The Machine shall be equipped with pneumatic direct and indirect braking systems.
- 10.3 The brake system shall at least provide the braking modes G, P related to the relevant UIC's.
- 10.4 The crane shall be equipped with compressed air brake KNORR KE-GP-A. Brake equipment shall be in accordance to UIC543.
- 10.5 The following brake equipment shall be made and supplied by KNORR (preferable Knorr Germany) : Headstock cocks type LH3 1 ¼"; On-off device (Hebrew name plates-Knorr).
- 10.6 The Braking System shall be equipped with a system which shall ensure liquids separation and its safety drainage and in additional a full flow replaceable filter elements .
- 10.7 The Braking System, air reservoirs shall be equipped with an automatic moisture drain valves.
- 10.8 The braking systems components shall comply with the requirements of EN15329 and UIC541-1.
- 10.9 The Machine braking system shall be a disc brake system, mechanical - disc brakes on all wheelsets shall apply 4 brake discs per wheelset.
- 10.10 The Machine shall be equipped with parking brake according EN 14033.
- 10.11 Override and bypass components in the brake system will be protected to prevent accidental or inadvertent venting of the charged brake system.
- 10.12 The braking system shall be equipped with the EP-brake features.
- 10.12.1 The Braking System shall comprise of:
- 10.12.2 A direct (two circuits) with anti-skid and automatic compressed air brake, acting on the wheels of the vehicle through brake cylinders and disc brakes;

- 10.12.3 An indirect-action brake system including adequate KE valves.
- 10.12.4 Emergency brake units integrated in driving / operating post.
- 10.12.5 A parking brake according 14033-1; 2; 3.
- 10.12.6 Program-controlled working-mode brake
- 10.13 The Machine shall enable operation of emergency brake from driver cabin.
- 10.14 The compressed air system shall provide the necessary pressure for integrating the vehicle in train formation according to UIC code 540.
- 10.15 The compressed air system shall assure the pressure for full operation of braking system and other auxiliary needs.

11. Hydraulic System

- 11.1 The hydraulic system shall be designed as to provide efficient operation in the ambient conditions given in Attachment A .
- 11.2 The hydraulic system shall be designed and built to provide a high level of reliability , operability , maintainability and control using modern technology.
- 11.3 The hydraulic system shall be equipped with oil cooling system.
- 11.4 The hydraulic system shall be equipped with oil filtration system.
- 11.5 The oil cooling system shall be positioned in a such place, to avoid as much as possible dust and dirties from track to cover the suction elements .
- 11.6 The hydraulic system shall provide a separate line for each field of application.
- 11.7 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.
- 11.8 Access panels shall be 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.
- 13.1.1 Where failure of the power plant or pump can immobilize components in a position which would prevent moving of the

regulator, an independent system , diesel engine operated , shall be provided in the circuit to allow normalization of all equipment components, for movement of the track motor crane to a proper location. subject to check during FAT .

- 11.9 Hydraulic oil reservoir shall have both a direct and an indirect oil level indicator.

12. Electrical System

- 12.2 Electrical System according EN 50121, EN50155, E50215, EN 61373, IEC61991
- 12.3 The Machine shall include electrical system capable of energizing all needed systems.
- 12.4 The Machine batteries shall be maintenance free type. The batteries capacity shall not be less than 200 [Ah]. The batteries will be mounted on a retractable device for easy access .
- 12.5 The batteries shall not produce emission of toxic gasses.
- 12.6 The Machine shall be equipped with generator 230 / 400 Volt 50Hz A.C.
- 12.7 The 230 / 400 V 50Hz AC circuit shall supply be at least 10 KVA AC.
- 12.8 The Machine shall have shore power with external connectors, for the AC circuit to be fed from an outside 400 Volt AC power source.
- 12.9 The 400V external supply connector (+CFL-X1) shall be located on both sides of the Machine.
- 12.10 The Machine shall be equipped with external sockets for 230/400V supply on both sides of Machine.

13. Cabin

13.1 Design guidelines

- 13.1.1 The Machine shall have two driving cabins: one – at the front end and second – at the rear end of the Machine.
- 13.1.2 The Cabins shall be designed and equipped following the requirements of EN 14033-1; 14033-2.
- 13.1.3 The driving cabs shall be fully enclosed and provide the best thermal , sound , noise and vibration insulation in the most extreme conditions.

- 13.1.4 For outside temperatures (on shade) above 35[°C], the HVAC cooling system shall be designed to maintain a maximum of 23[°C] when the maximum staff quorum is present and all systems are operating – subject to check during FAT .
- 13.1.5 The cabins shall be designed and equipped following the guidelines in EN 14033.
- 13.1.6 All operations for transfer and work shall be controlled from cabin.
- 13.1.7 The access to the cabin shall be via steps with hand rails and safety platform from both sides.
- 13.1.8 The cabins shall be designed with foldable access steps and handles for maintenance and front cleaning of the cabins .
- 13.1.9 The Cabins shall be equipped with high quality sun protection roller blinds.
- 13.1.10 Front cabin windows shall be electrically heated.
- 13.1.11 The cabin roofs shall have life line and will be covered with anti-slip material .
- 13.1.12 The floor shall be insulated against noise and made of non-slip material.
- 13.1.13 The floor shall be insulated against heat where a heat source is present under the floor.
- 13.1.14 The Machine shall be equipped with wireless headsets for communication with Noise Cancellation feature for each driver/ operator (at least 4 sets).
- 13.1.15 The Machine shall be equipped with intercom system.
- 13.1.16 The Machine 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, 2, 3 and EN 16186-3. The Machine shall be supplied with 6 complete sets of keys for all facilities.
- 13.1.17 Each cabin shall have one driving post. The driver shall sit in face to the direction of travel.
- 13.1.18 Each cabin shall be provided with extra seats facing the track for a second person (co-pilot, guard or other person).
- 13.1.19 When designing the driver posts, the positioning on the left side of the ISR signaling elements will be taken into account.

- 13.1.20 A docking station device for the driver's tablet with access to an electrical connection charging will be installed .
- 13.1.21 The cabin doors will open to the outside.
- 13.1.22 The main cabin will be arranged to ensure the transport in optimal conditions of at least 12 workers - apart from the driver - ensuring all the necessary social facilities (comfortable armchairs, table, refrigerator, etc.).
- 13.1.23 The cabin will be equipped with 2 rechargeable flashlights (white, green and red lights) with a range of at least 6 hours, including the recharging system .
- 13.1.24 The Machine shall be equipped with GSM 5G communication mobile data system .
- 13.1.25 The Machine shall be designed with free Team Viewer system to enable free video communication and remote control with the supplier in a safety manner.
- 13.1.26 The Machine shall be equipped with a fully equipped workbench. The Machine shall have four sets of tools fully equipped to ensure complete maintenance .
- 13.1.27 The Machine shall be equipped with a stainless steel water tank and sink.
- 13.1.28 The Machine shall be equipped, on both sides, with quick external connections for pneumatic and electric tools.
- 13.1.29 The Machine shall be equipped with two laptops, resistant to dust and moisture to IP67, anti-sun, drop to MIL-STD 810G and Microsoft corporation state of the art Operating System tasks .It will include adequate programs for : operator activity , maintenance and diagnostics programs and interactive libraries.
- 13.1.30 The Machine shall be designed with a online and continuous Machine condition monitoring system ; the system shall collect and transmit via GSM to a fleet central computer / and laptops from previous paragraph the traveling , driving , working , technical parameters , Machine status messages , location , etc. ; the system shall provide safety access from the fleet to Machine in emergency cases . The system shall provide long-term analysis parameters and recommend maintenance routine / intervention.

13.2 Noise Level and vibrations in the Machine

- 13.2.1 The noise level in the Machine 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). The Machine shall ensure low noise level when working in tunnels or closed spaces as well as in open track. The cabin insulation will ensure a very low noise level in all conditions.

13.3 Control Panel

- 13.3.1 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.
- 13.3.2 The control panel shall have a free horizontal surface of minimum dimension A4 landscape, for processing documents, etc.
- 13.3.3 A rack with a clip for timetable documents shall be installed close to the driver's desk and shall be lit separately.
- 13.3.4 The driver control panel shall include at least following instruments:
- a. Cruise control active ;
 - b. Communication systems;
 - c. Direct brake pressure gauge (digital or analog);
 - d. Main air reservoir pressure gauge;
 - e. Train brake line pressure gauge;
 - f. Speed throttle controller with lever;
 - g. Indirect braking lever (electro-mechanic);
 - h. All Panel labels shall be dual language: English & Hebrew. Translation will be provided by ISR. Hebrew letter characters will be accordance with ISO/IEC 8859-8.
 - i. Tachometer;
 - j. Hour meter;
 - k. Fuel control indicator;
 - l. Engine coolant temperature indicator;
 - m. Coolant level indicator;
 - n. Transmission oil temperature indicator;
 - o. Transmission oil pressure gauge;
 - p. Engine oil temperature indicator;
 - q. Engine stop push-button;
 - r. Slow speed mode indicator;
 - s. Crane lock indicator;
 - t. Stabilize outrigger lock indicator;

- u. Electro-pneumatic horn push-button;
- v. Electric warning horn button
- w. Battery charge indicator;
- x. Voltmeter;
- y. Amperemeter;
- z. Portable lamp plug;
- aa. Outside lighting switches;
- bb. Inside lighting switches;
- cc. High/low beam switch/button;
- dd. "DEAD MAN" button and pedal;
- ee. Electrical sockets 12 and 24 V DC and 220 V AC;
- ff. INDUSI control panel on both traveling directions.
- gg. ETCS control panel on both traveling directions .
- hh. At least two analog speedometer in every cabin (one for driver the second for co-pilot). This speedometer shall get data from tacho-generator of Indusi system.



ii.

13.4 Air-conditioning System HVAC

- 13.4.1 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
- 13.4.2 Heat generated by the equipment shall be taken in the calculation of the air-conditioning unit.
- 13.4.3 A cabin that holds more than 4 people shall have at least 2 separate A/C units.
- 13.1.31 For outside temperatures (on shade) above 35[°C], the cooling system shall be designed to maintain a maximum of

23[°C] when the maximum staff quorum is present and all systems are operating.

13.5 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.

13.6 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.

13.7 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 this Tech Spec .

13.8 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.

13.9 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.

13.10 At least one cabin shall be equipped with places for personnel with handrails. Total of at least 12 places for personnel in Machine cabins, in addition to the driver's and co-pilot's seats.

14. Video system

- 14.1 The Machine shall have adequate video system to provide good and helpful assistance for operators and drivers at any time and environmental conditions.
- 14.2 The video cameras shall provide quality visibility of every of working areas .
- 14.3 The Machine shall be equipped with at least 2 HD wide-angle video cameras – one for each driving direction. Viewing these cameras shall be possible from any driving post, including during the driving. Camera recordings must be kept for at least 100 hours of operation. It should also be possible to copy recordings from cameras to external media (for example, via USB).
- 14.4 Additional, cameras will be installed to cover all the areas around the Machine. The images will be displayed on a screen in front of the driver .

15. Lighting and Safety Arrangement**15.1 Internal Lighting**

- 15.1.1 Internal Lighting in the cabin shall be led yellow and blue type and provide effective working conditions during night operation.
- 15.1.2 The lighting shall be such that all instruments required for driving are clearly visible.
- 15.1.3 The light intensity on the driver's desk shall be 60 lx.
- 15.1.4 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.
- 15.1.5 The indicator lamps shall not cause any irritating reflections in the window panes.
- 15.1.6 The control instruments shall be provided with adjustable instrument lighting.
- 15.1.7 Auxiliary additional lighting shall not dazzle the driver or his assistant nor shall surface finishes causes any irritating light reflections.

15.2 External lighting

- 15.2.1 External lights shall be in accordance to UIC 534 and will be led type lamps. Headlamps shall be arranged in accordance to section 2.7 of UIC534.

- 15.2.2 Rotary projectors with cab control shall be installed on the cabs to improve visibility while working.
- 15.2.3 Working lights shall ensure optimal visibility regardless of visibility conditions.
- 15.2.4 The external flashing warning light for moving elements will be yellow / orange or blue only.
- 15.2.5 Shall not be possible for lighting to be confused with railway signals or to blind the drivers of rail vehicles on adjacent tracks.
- 15.3 The Machine shall include at least following lighting:
- 15.3.1 Travel led lights according to UIC code.
- 15.3.2 Lighting in the cabin, on the crane post, basket and adjustable projector in the basket as to provide effective working conditions during night.
- 15.3.3 4 light projectors for platform and one for each end of the Machine.
- 15.3.4 Lighting all around Machine.
- 15.3.5 Lighting at the access stairs

16. Environment Quality

- 16.1 The Machine shall keep the specifications of up-to-date exhaust emissions directives.
- 16.2 The noise inside and outside the Machine shall be according to the UIC codes.

17. Faults Monitoring System

- 17.1 The Machine 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, Electronic 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.
- 17.2 The faults diagnosing and monitoring shall be displayed by computerized system which hardware and software shall be provided as an integral part of the Machine.
- 17.3 Faults shall be recorded in a log book including the date, time, consecutive numbering and a fault text.
- 17.4 The Machine shall be designed with a complete activity monitoring system with the ability to provide activity reports. The Machine monitoring system will communicate with an external computer where

all the Machine performance will be monitored. The Machine shall have “Black-Box” that will document all the important parameters of the Machine and keep this data for at least 300 working hours for the purpose of locating and clarifying the causes of the fault if it occurs.

18. Tools

The Machine shall be equipped with four complete tool sets suitable for its maintenance.

19. 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:

19.1 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.

19.2 INDUSI System

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 ISR in the manufacturer's plant.

19.3 ETCS system

The Machine shall equipped with ETCS system; Level2; BL3, complete functional, homologated and commissioned. System based on the standard ETCS On-board architecture including the integration of the STM INDUSI system in compliance with ETCS Baseline 3 Maintenance Release 1 specifications and ISR national requirements for STM INDUSI.

Automatic Train Protection & Automatic Control Systems

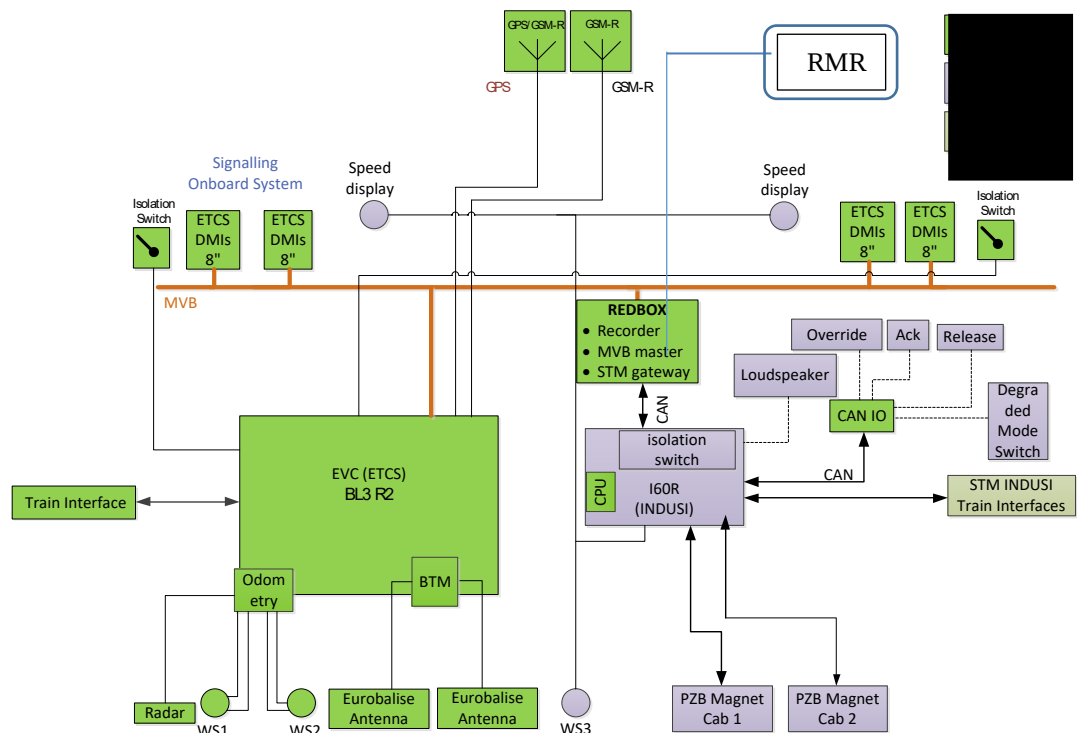
Considering the future ETCS Level 2 upgrade of the ISR network, the Machine shall be equipped with compatible ETCS and the ISR compatible INDUSI (INDUSI I60 R) as STM implementation.

The ETCS implementation of the offered Machine shall be based on software release (onboard unit: SRS 3.4.0, backward compatible with SRS 2.3.0d trackside components). Special focus shall be given on the proper integration of the ETCS related DMI display which shall be smoothly integrated into the driver's desk. The foreseen location of the DMI shall be agreed with ISR.

The ETCS on board unit need to be kind of system ATLAS ETCS platform by ALSTOM company or TRAIINGUARD200 platform by Siemens , compliant with ERA Baseline 3 [Maintenance Release 1 (SRS 3.4.0)] enabling ISR quick deployment, homologation and train-track interoperability tests.

The INDUZI I60R need to be kind of system INDUSI CANBUS by Thales company.

System Architecture



It must be possible to remotely download travel data and diagnostic data from the ETCS system and the INDUSI system, remote data download must be cyber protected on the locomotive side and with the approval of the protection component by the cyber department of Israel Railways

The ATP system must to management the NZ (Neutral Zone section) full automatic in two travel modes passengers train and freight train and according to the technical requirements document

The INDUSI STM functionally shall be adequate to the implementation on the ISR's existing push-pull trains.

The train protection system magnets of the INDUSI STM shall be fixed on the left side of each first bogie at the Machine taken into account to the instructions of THALES (ALCATEL). The height must be adaptable to different wheel diameters. The realisation and arrangement of light indicators, speed indicator, switches and buzzers shall be agreed with ISR.

The input of the relevant train parameters for the ATP system must be possible from the driver's cab.

I60R: Name of the on board signaling equipment for the implementation of **PZB90** for regional operation in Germany. The same equipment has been used for the implementation of **Indusi** in Israel

I60R "Legacy": historical name (marketing brand) of the I60R main rack to host On-board PZB90 and Indusi applications. This name is justified by the fact that "Legacy" is a commonly used terminology in the railway jargon to designate Class B system in their historical form (used as standalone systems, dating from times where ETCS was not existing).

I60R "Semi-STM": new name (marketing brand) of the I60R main rack to host On-board PZB90 and Indusi applications. This name is justified by the fact that the CPU has been empowered to host applications in a form where PZB90 or Indusi may be used as STM. The terminology "semi-" is justified by the fact that the I60R itself cannot be used as an STM compliant with Subset 035: the same functions can be done but using a proprietary interface.

On-board ETCS system: system constituted by a set of validated ETCS products (EVC, TRU, DMI,...) including interface with Indusi as STM

STM Indusi: Functional module / technical solution used to interface Indusi with ETCS in a dynamic way.

The Contractor is fully responsible to provide the fully ISR compatible ETCS and INDUSI STM including the system integration test to demonstrate the functionality at the ISR network. The detailed preparation measures shall be explained in the bid with full details.

The Machine shall fulfil the requirements of UIC 512 for assuring the compatibility with rail track circuits.

ISR track will be featured with axle counters of Type AzLM from Thales manufacturer where the de-sign is fully in compliance with EN standards. The Machine shall be compliant with related requirements of the standard family EN 50238.

The detailed requirements regarding components, parameters, implementation details and functions of the system are to be agreed with ISR during the design phase without derogating the responsibility of the Contractor.

19.4 Emergency brakes

Without conflict, but supplementing the paragraph "Brake system":
At least one emergency brake lever shall be in each driving cabin.
Emergency brake lever(s) shall accessible evenly for driver as well as for co-driver too.

Activation of emergency brake lever shall affect to braking system only. This action shall not be switch off any another system of Machine (such as: electric system), except traction power of Machine.

19.5 Emergency travel

In case of vehicle malfunction shall be an option for emergency travel, bypassing the driver's computer, Indusi and SiFa with a maximum speed of 20 km/h.

19.6 Video System (see chapter 14)

19.7 At least the following safety arrangements will be provided:

19.7.1 The crane shall be provided with height, sides and moment limit devices – totally controlled by PLC with interface system.

19.7.2 2 Rotating beacon (one to each direction).

19.7.3 2 Electro-pneumatic warning horns (one to each direction).

19.7.4 Electric warning horns (at least three, on front side, on rear side and in the middle of the Machine) to provide acoustic warning signal in closed indoors (for example garage) or in vicinity of workers on working site.

All of electric warning horns on Machine shall sound simultaneously during pressing on one of electric horn activation button.

19.7.5 4 Fire extinguisher.

- 19.7.6 Temperature and smoke detectors including alarm.
- 19.7.7 The Machine control panels shall be design to gain control from only one panel at a time.
- 19.7.8 4 emergency push buttons for stopping the Machine shall be located on each corner of the Machine (outside the cabin).
- 19.7.9 4 Horn push buttons for electric horn on each corner of the vehicle (outside the cabin).
- 19.7.10 Boom lifting limit and slewing limit with buzzer warning and automatic switch OFF.
- 19.7.11 Warning signals when the vehicle is moving in working mode or in reverse mode.
- 19.7.12 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.
- 19.7.13 Fire alarm system with temperature and smoke detectors.

20. PRODUCTION PROCESS

- 20.1 The Machine shall be designed and manufactured in accordance to a strict Quality Management System procedures following TSI, Directives, ISO9001, EN 14033-1; 2; 3, EN14363 and all other reference documents described in section 2, above.
- 20.2 A production process schedule shall be submitted as part of the QAP.
- 20.3 Quality Control and Quality Assurance Manual shall be submitted.
- 20.4 Safety Risk assessment and risk reduction Manual shall be submitted.
- 20.5 The Detailed Design Plan (DDP), shall be performed as defined in the Agreement.
- 20.6 The actual Inspection and Tests Plan (ITP), shall be performed as defined in the Agreement. It shall include all the tests that will be performed by the manufacturer on Machine during the production, including tests at major Subcontractors.
- 20.7 All parts for production including from the subcontractors, shall be checked and approved before assembling. All certificates shall be submitted. The Machine shall be examined by ISR technical team, before manufacturing completion.

20.8 Independent Safety Assessor (ISA)

20.8.1 Upon signing the contract with ISR the Bidder shall employ an **Independent Safety Assessor (ISA)** - a professional body which is not part of planning, development and production of the project. Its role is to assess and manage the risks of the project and monitor that the safety level and safety requirements of the vehicle are maintained *. The ISR Project Manager could also be assisted with those services during all the stages of the project.

This independent safety assessor must have professional knowledge and at least five years of experience in safety control, processes, examination and delivery to a customer of one or more rolling stock projects.

ISA shall submit, during the project, periodical reports and its final report shall be submitted at the completion and delivery of the vehicles.

20.8.2 The ISA will comply to (EU) 402/2013 (CSM RA) ,Annex II requirements and will be certified to EN ISO/IEC 17020 "Inspection Body" .

20.8.3 The ISA will certify whether the Machine design and manufacture are compliant with the safety requirements in accordance with CENELEC Standard EN50126.

20.9 Inspection Body

20.9.1 ISR will proceed to inspect the Machines and the production process, independently of the producer, through the **Inspection Body**.

20.9.2 The accredited Inspection Body undertakes construction inspections and vehicle acceptance according to requirements and quality standards of this Tech Spec.

20.10 Notified Body

20.10.1 The Machine shall be checked and supervised by a Notified Body ("**NoBo**"), in accordance with the TSI, Directives, ISO9001, TSI-Loc&Pas 1302/2014 and its amendments; EN14033-1;2; 3 EN13803, EN14363 and this Technical Specifications, as defined in the agreement.

20.10.2 Additional to the NoBo , ISA and Inspection Body statements , in order to apply for Serial Permit it is required :

- a. The supplier's declaration of conformity: The supplier will declare the entire wagon series met all the requirements of the production planning and the acceptance tests of the prototype.
- b. Confirmation by Inspection Body that the Machine series met all the production planning requirements and the acceptance tests in the same way as the prototype.
- c. Confirmation of the ISR project manager on behalf that the Machine series met all the requirements and can travel and operate in commercial operation on the line.

20.11 Notified Body Report

- 20.11.1 Before the FAT the NoBo shall prepare, a full report on the MACHINE production in accordance with these Technical Specifications, to be submitted during the FAT.
- 20.11.2 The Machine manufactured for ISR shall have validity for operation from a Railway European Authority, in the country of origin.

20.12 Foreign Acceptance Test

- 20.12.1 The Foreign acceptance test shall be carried out at manufacturer's premises (FAT) and on track in the country of origin.
- 20.12.2 The FAT shall be conduct by ISR technical team, and accompanied by NoBo by ISR request.
- 20.12.3 The Machine FAT shall comply with the requirements of TSI, ISO9001, TSI-Loc&Pas 1302/2014 and it's amendments, EN 14033-2; 3 and these Technical Specifications requirements.
- 20.12.4 The FAT process shall include the Machine testing topics: running, travelling, and braking abilities, working and safety, and in additional checking all linkage documentation (including NoBo documentation).
- 20.12.5 The working tests shall consist in verifying the ability of the Machine to work in the specified productivity parameters and in successfully performing all the tasks in accordance with these Technical Specifications.
- 20.12.6 All Manuals and Spare part list in final version;
- 20.12.7 RAMS report and documentation.

20.13 Final Acceptance Test – Machine Permit to Operate

- 20.13.1 Tasks to be performed by the manufacturer before testing:

- Removal and cleaning the vehicle packaging and inhibiting materials;
- Preparing the Machine for Running, Traveling, and working (including measurement)
- Functional tests of all Machine systems;
- All Manuals and Spare part list in final version;
- Operation and maintenance personnel training.

20.13.2 The Final Acceptance Test shall include at least the following testing topics at ISR site:

- Comply with ISR loading gauge including OCS;
- Running ,towing and braking abilities in regards with ISR regulations (based on EN and UIC norms);
- Running at least 200 Km in all conditions, and working capabilities for at least 100 effective hours, without failures and successfully performing all the tasks in accordance with these Technical Specification.

21 LIST OF DOCUMENTS TO BE SUBMITTED WITH BIDDER'S PROPOSAL

21.1 Technical description of the Machine and each of its sub-system.

21.2 Reference letters from last 2 (two) customers of similar Machine configuration, which described in these Technical Specifications including documents (graphs, tables pictures, etc.) proving working abilities and quality.

21.3 Validity for operation report from an European Railway Authority of similar Machine.

21.4 A sample of manufacturer quality control and quality assurance manual.

21.5 Sample of operation, maintenance, calibration and safety instructions manual.

21.6 A sample of manufacturer Inspection and Tests Plan (ITP).

21.7 A sample of Training Plan (TP).

21.8 The Machine layout drawing, including front section layout drawing, in reference to ISR loading gauge specified in Technical Appendix C and tunnel cross sections specified in Technical Appendix D.

- 21.9 Documentation that the Machine (including all its systems) can travel and operate safely in tunnels without any special procedures by ISR during the operation.
- 21.10 A statement approving that the Machine 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.
- 21.11 Technical details - on the Fire Protection System.
- 21.12 The technical description of Engine emission - Stage V, for category railcar engine (or more advanced Stage) in accordance with European Directive 2016/1628 and all its amendments.
- 21.13 Full details on the safety equipment.
- 21.14 Breakdown of the maintenance cost:
- 21.15 Cost of spare parts and men hours for 2000 operating hours.
- 21.16 Full information about operators and maintenance personnel training programs.
- 21.17 Spare parts list for 2000 operating hours.
- 21.18 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.
- 21.19 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).
- 21.20 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).

22 LIST OF DOCUMENTS TO BE SUBMITTED BEFORE AND DURING THE FOREIGN TEST

- 22.1 Documents approving compliance of the Machine design to keep the environment protection of: noise; pollution, vibration; etc. in accordance with EN14033-3 and other relevant standards and regulation.
- 22.2 NoBo report including all the documentation the manufacturer which will be submitted to the NoBo, shall be provided in softcopy;
- 22.3 Validity for operation certificate from a Railway European Authority, in the country of origin.
- 22.4 Parts certificates for production including from the subcontractors

22.5 Certificate for the welding of Machine and components, as defined EN 15085-2.

22.6 Certificate for the manufacture of pressure equipment as defined in Pressure Equipment ISO 3834-2 DIRECTIVE 2014/68. All FAT linkage documentation in hard copy and softcopy.

23 LIST OF DOCUMENTS TO BE SUBMITTED AT LEAST 60 DAYS BEFORE DELIVERY OF THE MACHINE

23.1 General Documentation Requirements

23.1.1 Documentation Package

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

- a. System description
- b. Operator's Manual for the Machine and all systems
- c. Maintenance Manual for the Machine and all systems which shall include all the preventive maintenance activities and repairs
- d. Engineering documentation including special processes for overhauling maintenance
- e. Pneumatic, hydraulic and electrical detailed diagrams and integrative drawings
- f. Illustrated parts catalog for all levels of repairs
- g. Fault diagnosis and troubleshooting charts for each system/sub-system
- h. Inspection procedures and maintenance standards
- i. Table of service tools & equipment
- j. Complete periodic maintenance plan

23.1.2 Operators manual

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

- a. Front cover page.
- b. Opening pages (list of revisions, table of contents, list of figures, list of tables, abbreviations and acronyms, safety conventions etc.)
- c. Chapter 1 – General Description: Scope, Overview, System Introduction, General Structure, Theory of Operation, General Block Diagram, Functional Description, Interfaces, Technical Data.
- d. Chapter 2 – Detailed Description: Detailed description per sub-system and assembly, including general information, general structure, main functions, technical data.
- e. Chapter 3 – Controls, displays and HMI.
- f. Chapter 4 – System Operation: All operating sequences, steps before placing the system in service, system operation, system shutdown and steps after taking the system out of service.
- g. Chapter 5 – Maintenance Guidelines: Includes Maintenance Activities Policy, Crew Level Maintenance Activities Policy.
- h. Chapter 6 – Troubleshooting: For both BIT and symptom-based troubleshooting, includes all troubleshooting instructions, charts etc.
- i. Chapter 7 – Maintenance: Includes all maintenance activities of the user.

23.1.3 Maintenance manual

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

- a. Front Cover Page.
- b. Opening Pages (list of revisions, table of contents, list of figures, list of tables, abbreviations and acronyms, safety conventions etc.)
- c. Chapter 1 – General Description: Scope, Overview, System Introduction, General Structure, Theory of Operation, General Block Diagram, Functional Description, Interfaces, Technical Data.
- d. Chapter 2 – Detailed Description: Detailed description per sub-system and assembly, including general information, general structure, main functions, theory of operation (General Block Diagram, Functional Description), interfaces, technical data. Pneumatic, oil, fuel, electrical and other systems will also be described according to their functional circuits.
- e. Chapter 3 – Maintenance Guidelines: Includes Maintenance Activities Policy, Crew Level Maintenance Activities Policy.
- f. Chapter 4 – Troubleshooting: Both BIT and symptom-based troubleshooting, including all troubleshooting instructions, screens, charts, fault diagnosis and use of any special maintenance tools or testing equipment.
- g. Chapter 5 – Maintenance: Includes all maintenance activities for Preventive Maintenance and Corrective

Maintenance, such as inspections and maintenance tasks, repair procedures, material used, procedures for assembly and disassembly of sub-systems, assemblies and sub-assemblies, calibrations, topping of consumables etc.

23.1.4 System Description manual

The System Descriptive Manual should include the following information:

- a. Front Cover Page.
- b. Opening Pages (list of revisions, table of contents, list of figures, list of tables, abbreviations and acronyms, safety conventions etc.)
- c. Main systems detailed description (engine, fuel, oil, pneumatic etc.).
- d. Software main modules description (power up, BIT etc.).
- e. Hardware main modules description (EMDEC, Control cards etc).
- f. Appendixes.

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

23.1.5 Documentation Formats

Documentation will be provided in the following formats:

All the documentation shall be supplied as:

- a. Hard copies in the quantities detailed hereafter
- b. Source files (MS Office, Indesign etc.)
- c. PDF files (unlocked and data-copy-enabled).

23.1.6 Training Package Requirements

23.1.6.1 Training Package

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

- a. Training schedule.
- b. Theoretical lessons.
- c. Practical lessons.
- d. Job Aids.
- e. Evaluation package.
- f. Training Aids and Simulators.

23.1.6.2 Training Package Formats

The Training Package will be provided in the following formats:

User Handbook / Operator's Manual, Maintenance Manuals will be supplied as:

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

23.1.6.3 Manufacturer Training Courses

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

- a. Operators Course
- b. 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.

23.1.6.4 **Technical** information, operation, maintenance, calibration and safety instructions and training packages shall be submitted in English and Hebrew.

23.1.6.5 **Operation** and Maintenance Manuals, including safety chapter and Spare Parts Catalogue for all integrated systems :

- 23.1.6.5.1 Vehicle;
- 23.1.6.5.2 Working Systems ;
- 23.1.6.5.3 Engine system;
- 23.1.6.5.4 Transmission system;
- 23.1.6.5.5 Hydraulic System
- 23.1.6.5.6 Pneumatic System
- 23.1.6.5.7 Drive Axles;
- 23.1.6.5.8 Air-conditioning system;
- 23.1.6.5.9 Electrical system
- 23.1.6.5.10 Electronic System.
- 23.1.6.5.11 Controllers System
- 23.1.6.5.12 Crane System ;

23.1.6.6 Manuals Content

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

- 23.1.6.6.1.1 Safety precautions;
- 23.1.6.6.1.2 Systems description;
- 23.1.6.6.1.3 Operation instructions – That shall include:
- 23.1.6.6.1.4 Pre-operation checks, Start-Up procedure, operating procedures (operation limitations shall be stated clearly and in bold letters), Shut-down procedure, Emergency procedures, troubleshooting.
- 23.1.6.6.1.5 Preventive maintenance instructions;
- 23.1.6.6.1.6 Adjustments instructions;
- 23.1.6.6.1.7 Components replacement procedures;
- 23.1.6.6.1.8 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:

- 23.1.6.6.1.9 Item number on the drawing;
 - 23.1.6.6.1.10 Item name;
 - 23.1.6.6.1.11 Contractor's part number;
 - 23.1.6.6.1.12 Sub-contractor's part number (for subcontractors parts);
 - 23.1.6.6.1.13 Sub-contractor name;
 - 23.1.6.6.1.14 Quantity per assembly.
- 23.1.6.7 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.
- 23.1.6.8 This documentation shall be utilized in training inexperienced personnel for operation and maintenance and shall be based on the operation, maintenance and illustrated spare parts catalogue manuals specification.
- 23.1.6.9 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 sections 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 shall 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.
- 23.1.6.10 Four hard copies and four magnetic copies (USB) shall be provided of all listed data. All documents shall be in English and Hebrew.

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

23.1.6.12 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.

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

24 **RAMS (Reliability, Availability, Maintainability, Safety)**

24.1 General

24.1.1 The Bidder shall perform the RAMS process according to EN 50126. The RAMS process includes both the definition of the requirements and the demonstration of compliance (see Annex D).

24.1.2 The detailed RAMS requirements shall be jointly defined between Israel Railways and the Bidder at the beginning of the project. The Bidder shall prepare a safety program plan to be submitted no later than 2 months after the Commencement Date.

24.2 Reliability

24.2.1 The reliability of the Machine shall be (under the condition that the maintenance is performed in accordance with the maintenance manual) as an average over the 25 years of service .

- 1 complete failure of a Machine (unit must be towed to the workshop)
- 5 failures of part of the Machine systems, the Machine can finish the duty cycle.

24.2.2 The Bidder shall fulfil an estimative MTBSF (Mean Time Between Sub-System Failures) data in hours for the systems defined in Annex D, section 1.4.

24.3 Availability

24.3.1 The daily availability of the Machine shall be better than 92 %, the average, determined over one month shall be better than 92 %. The availability is calculated daily at 06:00 a.m as follows :

24.3.1.1 Availability (entire fleet in %):

$$A = \text{number of wagons in operation} / \text{total number of wagons} * 100$$

24.3.1.2 Number of wagons in operation:

All wagons, with exception of the wagons which are taken out of service for the following activities:

- taking out of service for repairs (including transition time to workshop)
- taking out of service to perform warranty (including transition time)
- taking out of service for preventive maintenance of more than 3.0 hours working time
- taking out of service for reprofiling of the wheels, inclusive of the transition time to the respective workshop.
- The Bidder shall indicate the average Km. between reprofiling

24.3.1.3 Taking out of service is calculated at 1 days minimum.

24.3.1.4 Transition to a workshop must be taken into account if the wagon must be specially transferred.

24.3.1.5 The respective work in the workshop starts within 1 day.

24.3.1.6 Service and maintenance requiring less than 3.0 hours are planned into the revenue service and to not have to be considered in the availability calculation.

24.4 Maintainability

24.4.1 The following general rules are to be followed:

- All components shall be designed in order to achieve a 10 years of operation without special maintenance. No component shall require maintenance below one month operation / 150 operation hours.
- Components and wear-parts shall be installed easily accessible. Identical parts must be interchangeable, similar parts, which are not interchangeable must be keyed, so that they cannot be misplaced.
- Functional units shall be designed as easily exchangeable modules.

24.4.2 In addition to these maintainability requirements, the Bidder shall adhere to the following:

- Reduce the vehicle down-times by the "replacement" maintenance philosophy
- Design to minimize adjustment requirements
- Design to minimize maintenance personnel skills and training
- Design to minimize number of special tools

- Adjustment fittings, safety valves, etc. shall be easily accessible.
- Self-retaining fasteners shall be used
- Provide handles on heavy components or less accessible components for ease of handling
- Wherever possible, provide for visual inspection of equipment.
- Design to eliminate torque specifications for fasteners.

24.4.3 The maintainability figures for subsystems shall be indicated by the Bidder.

24.5 Safety

24.5.1 It must be possible to operate the wagon safely. All critical aspects of the operation of the wagon must be considered.

24.5.2 The following should be considered as a general philosophy

- a single order failure should not result in dangerous situation
- a second order failure should not result in a catastrophic situation

24.5.3 A safety analysis shall be performed by the Bidder.



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/m ² per year	360-600
Rainfall mm/year	400-800
Dust Conditions in the atmosphere (Microgram per m ³ atmosphere)	

	Maximum Half-hour Value	Maximum Daily Value	Average
NOx	1064	560	71
SO ₂	780	260	21
O ₃	312	143	84
Suspended Dust		350	100

Suspended **Particulate Matter (SPM)**

Particle size to 0.5-1 micron

Sea Salt Concentrations in the Atmosphere (Micrograms per m³ atmosphere)

Salt Element	Na		Cl		SO ⁴	
Position:	Season		Season		Season	
	Dry	Wet	Dry	Wet	Dry	Wet
Sea Air at Coast Line	7.3	16.0	12.0	22.0	5.3	7.0
600 m from Shore	3.1	4.8	4.2	7.9	1.9	2.0
6000 m from Shore	1.1	1.4	1.5	1.7	1.3	1.4



Water Quality

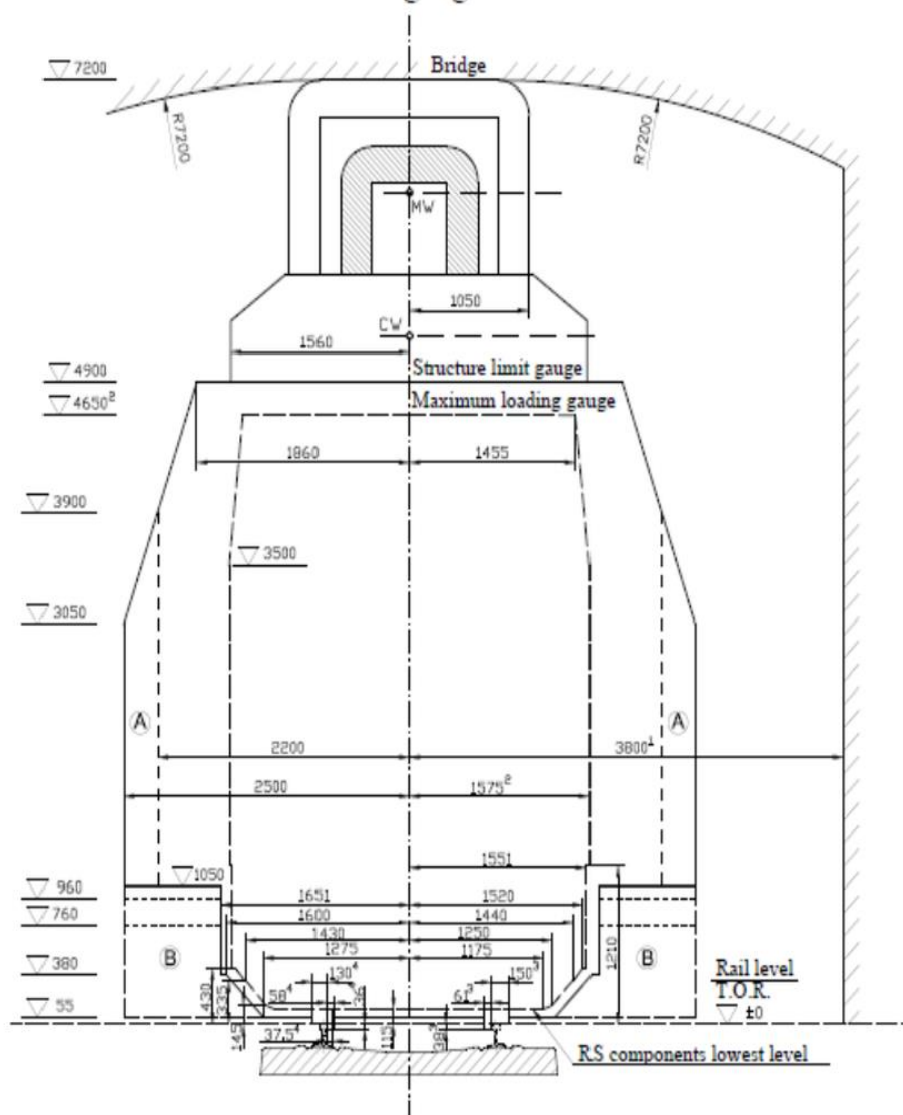
Typical Water Quality in Israel.

No.	Parameter	Unit	Range
1	Hardness	ppm	220-450
2	PH		6.4-7.5
3	Chlorides	ppm	20-400
4	Alkalinity	ppm	100-300
5	Ca	ppm	45-100
6	Cr	ppb	app 3
7	Cu	ppb	app 3
8	Fe	ppb	app 68
9	K	ppm	2-5.7
10	Mg	ppm	20-30
11	Mn	ppm	app 6
12	HCO ₃	ppm	110-400

Attachment B

Loading Gauge

Standard gauge ISR



- ¹ 3.800 m - for permissible speed greater than 160 km/h up to 250 km/h.
- ² 3.300 m - for speed greater than 60 km/h up to 160 km/h.
- ³ 3.000 m - for speed up to 60 km/h on the secondary lines, station and 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 AITrac 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 AITrac 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 AITrac 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 AITrac 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 facilities in Israel :
3. Diesel engine, Diesel generator, Brake system, Transmission system, Air condition system, cooling system, Engine cooling system , Hydraulic System , Pneumatic System

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):

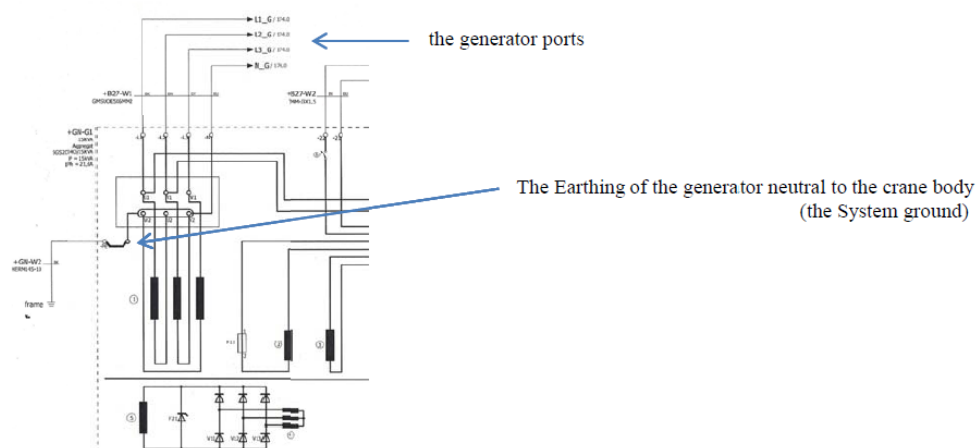
According to our conversation and the wiring diagram of the crane systems: the type of the supply in the crane is the TN system(the neutral of the generator connected to the crane body that is separate from the earth-Ground). This method Prohibited for use in Israel.

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):

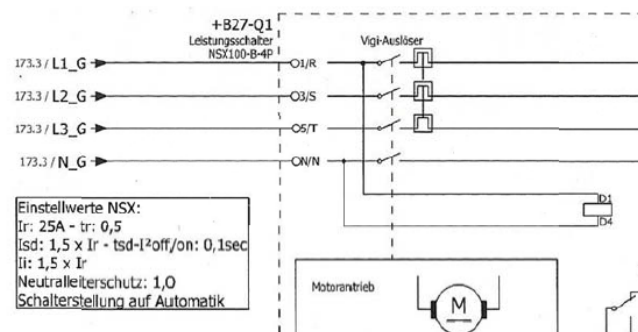


The protection is by a circuit breaker as we can see in page 173 in the wiring diagram.

- 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).

My recommendations are just because of the offered system – 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 $R_e = U_{ph}/I_{\Delta}$ [Ω])

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:

- 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).

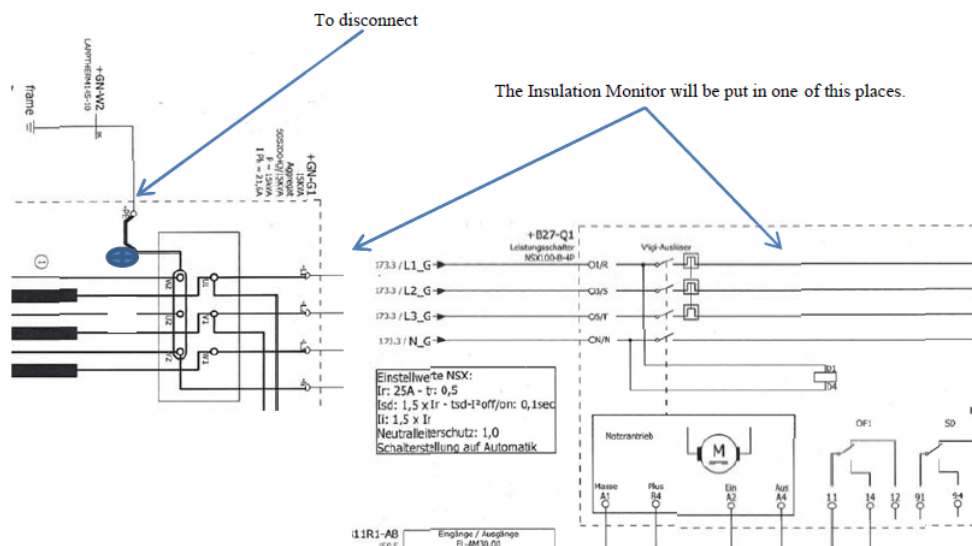
TRACK MOTOR VEHICLE WITH CRANE

No. E-03-0008 March 2026

It is recommended to connect the outlets threwh RCD's to protect the workers against a second fault to the ground.

- Use the crane body as an equipotential bonding.
- To put a sign in the main board that will note the system method (like: "Take care, the system protection methods is IT")
- 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"



My point of view was just from the Electrical safety only



Attachment F

ETCS L2 On-Board-Technical Specifications