



**ISRAEL RAILWAYS LTD.
INFRASTRUCTURE DIVISION**

**Technical Specification
For
RAILWAY CRANE
150 ton**

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**1. Definition**

- 1.1 **"Machine"** – Railway crane which is self propelled in working mode and towed in train formation.

2. General

- 2.1 The machine should be used for rescue work, construction work of bridges and heavy elements as well as track maintenance and plain track and turnouts laying.
- 2.2 No prototype shall be offered .
- 2.3 The machine should be designed to operate under hot and dusty conditions (as mentioned in ANNEX 2).
- 2.4 The machine should fully comply with the relevant UIC codes and EN norms for railbound machines , hydraulic telescopic cranes and EN standards and UIC codes regarding environment and safety protection (like: noise, pollution, etc.).
- 2.5 Manufacturer shall have EN 15085-2 certificate for the welding of railway vehicles and components as well as EN ISO 3834-2 certificate for the manufacture of pressure equipment as defined in Pressure Equipment Directive 97/23/EG
- 2.6 The machine should be designed to provide easy and safe access to all the systems in order to perform maintenance and running checks in the track line and in the depot.
- 2.7 The machine cabin should be mounted at the superstructure in direction of the boom
- 2.8 The machine is limited to a self propelled speed of up to 30 km/h in possessions only. Therefore it does not require an "INDUSI" – System, nor a "dead-man" safety device and there are no specific requirements regarding driver visibility.
- 2.9 The machine shall be provided with a means of transportation for the crane's counterweight, if necessary. The price of aforesaid shall be comprised in the price of the machine.
- 2.10 The machine shall include data logger (black box) .

3. Operating Characteristics

- 3.1 The machine should have the following operating characteristics:

Operation Characteristics			
3.1.1	Track gauge		1435 [mm]
3.1.2	Max travel speed – self propelled and without load	up to	20 [km/h]
3.1.3	Max travel speed – self propelled towing 2 cars each weighing 80 tons on 10‰ slope rail	at least	5 [km/h]
3.1.4	Max travel speed – towed in train formation	at least	100 [km/h]
3.1.5	Min curve radius on shunting area		80 [m]
3.1.6	Min curve radius on track line		140 [m]
3.1.7	Max gradient		35 ‰
3.1.8	Max superelevation		160 [mm]



3.1.9	Ability to turn boom while counterweight stays in track line	max.	30 [°]
3.1.10	distance between the centre of the parallel tracks	min.	4,5[m]

3.2 The machine should fully comply with ISR loading gauge parameters [Annex 1]

4. **Crane Performances**

4.1 The machine is a hydraulic slewing crane with telescopic boom.

4.2 The machine shall be able to turn the boom up to 30° while the counterweight remain in track line.

4.3 The machine has to work under overhead lines and in tunnels and as such must be able to work with horizontal boom. While working with horizontal boom, the boom must be able to telescope in and out with full load in order to position the load.

4.4 The crane has a load moment of 1300 [tm] (150 t at 8 m radius)

4.5 The crane should have the following operating characteristics:

Operation Characteristics			
4.2.1	Max. lifting capacity of crane	at least	150,0 [metric tons]
4.2.2	Working radius 360°	at least	28,5 [m]
4.2.3	Working radius in front of buffer	at least	21,0 [m]
4.2.4	Continuous rotation	at least	360 °
4.2.8	Lifting capacity at 21m in front of buffer slewing up to 30° and also driving with the load at 0° slewing angle	at least	40,0 [metric tons]
4.2.9	Lifting capacity at 8,0m radius slewing full 360°	at least	125,0 [metric tons]
4.2.10	Slewing speed	at least	0-1 [rpm]
4.2.11	Hoisting speed (Rope speed)	at least	0-40 [m/min]
4.2.12	Speed of telescoping boom	at least	0-5 [m/min]

4.6 Free on wheels lifting capacity should be same for super-elevation from 0 to 160mm without any derating.

4.7 The Machine should be able to drive with load on the hook.

5. **Hoist System**

5.1 Single drum on heavy duty sized bearings.

5.2 Power up and power down with automatic safety brake.

5.3 Brake will be applied automatically when hoisting or lowering lever is in off position

5.4 Brake sized to the relevant EN standards

5.5 The system will be equipped with upper end and lateral limit switches

5.6 The system will include a load moment measuring and protection system

5.7 The safe load indicator also takes into account the inclination of the rails.



- 5.8 Range of lift: Above rail min. 20 m.
- 5.9 While working, height of boom can be limited by electronic means in order to work under overhead lines or in tunnel.
- 5.10 Solution for preventing the hook hitting the boom tip by putting one more sensor which stops the hook in its final position

6. **Slewing System**

- 6.1 Crane super structure will rotate on a roller bearing (slewing ring) with external toothed gear
- 6.2 For independent slewing of boom and counterweight there is a second roller bearing (slewing ring)
- 6.3 Rotary column between undercarriage and superstructure to transfer hydraulic oil, air and electricity
- 6.4 Lubrication of the system shall be accessible from the side of the machine
- 6.5 Slewing will be continuous over 360°
- 6.6 Adjustable automatic brake and pedal operated brake shall be provided
- 6.7 Brake sized to DIN standard
- 6.8 Superstructure will be mechanically locked (in two positions) for traveling in train formation.
- 6.9 Slewing angle can be limited by electronic means.

7. **Boom Construction**

- 7.1 Telescopic boom with telescopic sections on sliding plates.
- 7.2 The boom can be retracted or extended under load, whether in horizontal or steep position,
- 7.3 Hydraulic cylinder serve to raise (or lower) the boom from horizontal to steepest position
- 7.4 Equipment - Hook block ramshorn type
 - 2 Lifting beams: one for rescue and another one for track and turnout work with variable lengths up to 28 meters and 44 tons lifting capacity .

8. **Greasing System**

- 8.1 Central greasing points for manual greasing will be provided at well accessible points
- 8.2 Automatic central greasing system of boom and counterweight telescope

9. **Machine Construction**

- 9.2 Frame - welded box type frame of high tensile steel
- 9.3 Propping
 - propping base I 6,6 m



propping base II	5,6 m
propping base III	4,6 m

The bidder shall provide the machine with a propping system and various steps for the propping base as to ensure efficient operation of the machine according to the work to be done and the track characteristics .

Outriggers and propping cylinders will be operated hydraulically.

Can be operated from both sides of the undercarriage. Horizontal position controlled by level indicators at the undercarriage.

Hydraulically locked during crane operations. Additional mechanical lock of outriggers and propping cylinders in hauling position.

The moving of outrigger arms will be electronically blocked (additional sensors) when mechanical lock is still in place.

Stroke of propping cylinder at least 500 mm

10. **Bogie**

No. of bogies 2

Max permissible axle load 20 T

The bogie frame will be of welded construction, designed for heavy crane duties while traveling with suspended loads.

Spring blocking shall be provided for working mode

Wheel material preferably R7T

Wheel diameter preferable 730mm

Buffers and draw gear mounted on bogie frame and selected according to UIC regulation

11. **Brake system**

11.1 mechanical - disc brakes on all wheelsets with 4 brake discs per wheelset

11.2 Brake parts according to UIC standards.

11.3 When hauling: automatic air brake, design: KE-GP-4x10.

11.4 When self-propelled driving: Direct pedal operated air brake in the cab. Additionally a control-device for the operating of the indirect train-brake, to be used for hauled wagons. Electrically operated emergency brake valve.

11.5 Hand brake: Crane brakes safely hold on slope of 40 ‰. The hand brake shall be operated from both sides of undercarriage.

12. **Compensation of curve superelevation**

The crane shall be equipped with a fully automatic levelling device which levels the crane when travelling and work into an elevated track section. The system shall operate also in twisted track section. The maximum super-elevation to level the crane automatically shall be 160 mm.

The leveling device guarantees to keep the crane's centre of gravity point in the centre line of rail track. So that, the lifting capacity



remains unchanged even in elevated curves.
The vertical wheel loads shall remain same as on level tracks.

13. **Engine**

- 13.1 Preferred engine manufacturers: Cummins, Deutz, Caterpillar
- 13.2 The machine shall be powered by at least 200kW
- 13.3 The engine should be water cooled and turbo charged
- 13.4 The cooling system should enable continuous safe operation of the engine at the ambient temperature given in paragraph Annex 2
The loss in heat transfer efficiency due to the hot and dusty environment should be taken into consideration.
- 13.5 The exhaust gas limits shall be at least according to EU 97/68/EG stage IV .
- 13.6 Air intake will be at least 2.5 meters above rail level . System shall include a double filter system: First stage - cyclonic filter - self cleaning Second stage - dry type replaceable filter element
- 13.7 The fuel tank capacity shall be at least 1000 litres
- 13.8 Hydraulic pumps are flanged to the engine through a gear in order to feed various hydraulic oil circuits with pressurized oil.
- 13.9 An engine protection system shall be provided to protect the engine against
 - High coolant temperature.
 - Low coolant level.
 - Low oil pressure.
 - Engine shall be protected against exceed allowed RPM's

14. **Auxiliary Engine**

- 14.1 Shall be used in emergency operation to return the crane back into transport position in case the main drive system fails.
- 14.2 The system shall include a control panel to operate the crane in emergency case. The auxiliary engine shall be operated from the operator's desk in order to put the crane in transport position in emergency case

15. **Hydraulic System**

- 15.1 The hydraulic system should be designed as to provide efficient operation in the ambient conditions given in paragraph 2.5
- 15.2 The hydraulic system should be equipped with oil cooling system.
- 15.3 Performance controlled axial piston variable displacement pumps to feed the main circuits

16. **Compressed Air System**

- 16.1 The compressed air system should provide the necessary pressure for integrating the machine in train formation according to UIC codes.
- 16.2 The compressed air system should assure the pressure for full operation of braking system and other auxiliary needs.



- 16.3 To provide pressure for indirect train-brake, to be used for hauled wagons.
- 16.4 The system should include an air dryer, water separator and a full flow replaceable filter elements.
- 16.5 On request of the buyer some selected valves may be installed outside the crane in order to allow for easy access. Those valves will be covered for preventing damage during train formation.
- 16.6 Drainage of air reservoirs with easy access form outside
- 16.7 The machine shall be supplied with lubricator for the air system.
- 16.8 The air dryer shall be located outside of engine room.

17. Electrical System

- 17.1 The machine should include electrical system capable of energizing all needed systems including the lighting and re-charging of batteries.
- 17.2 The machine batteries should be maintenance free type.
- 17.3 The batteries should not produce emission of toxic gases.
- 17.4 Lights in train formation according to appropriate Railway regulations.
- 17.5 Spot light mounted on cabin, facing in direction of boom, adjustable by the operator.
- 17.6 The boom shall be equipped with an adequate lighting system so as to ensure an optimal illumination of the working area.
- 17.7 Illumination of cab, and machinery house.
- 17.8 The electric box shall be mounted on hinge to permit access to the parts behind the electric box .
- 17.9 The alternator shall be positioned to ensure easy access .

18. Cabin

- 18.1 The machine shall be controlled by one operator from the cabin
- 18.2 Comfortable cabin with sliding door, positioned on superstructure but mounted on rubber pads.
- 18.3 The cab shall be noise insulated and noise level inside the cab shall not exceed the level mentioned in EN regulations.
- 18.4 The cab shall be equipped with one operator seat and one small auxiliary seat in the back.
- 18.5 Multi-adjustable operator's seat with head rest.
- 18.6 Equipped with all levers, switches and push buttons to operate and control all crane motions, hydrostatic traction drives and the Diesel engine.
- 18.7 Monitor displays the data measured by the automatic overload computer, working modes, lifting capacity values, outreach and other values. Monitor shows engine data and all control system values.
- 18.8 The cabin's windows shall be made of safety glass according to the EN standards and will enable the view of the boom, hook and the work site
- 18.9 Equipped with heating and air condition independent from Diesel engine.



- 18.10 Electric wipers, window washer unit, defroster and sunblind.
- 18.11 Video-system with monitor in driver's cab and camera mounted on counterweight to monitor reverse movements.
- 18.12 Electric sockets for 24 V and 12 V.
- 18.13 Radio communication system will be provided by Israel Railways
- 18.14 The windows shall ensure sun protection

19. **Safety Systems**

- 19.1 Control system shall be state of the art. Supplier shall ensure at least 10 years design life and 15 years availability of components.
- 19.2 Electronic load moment processor with indication of radius and actual permissible load comparison.
- 19.3 Limit switches for lowest and highest hook position. Pressure limiting valves, lowering-retardation check valve and safety valves.
- 19.4 Limiting of jib height when working under catenary, under bridges or in tunnels.
- 19.5 Limiting of slewing angle for operation within loading gauge. The operator is able to limit the computer with different slewing angles for various track centers.
- 19.6 Locking devices arrest any movement of all crane parts; to stay within the loading gauge while the crane is hauled in train formation.
- 19.7 Safety devices prevent hauling the crane when the:
 - springs are blocked
 - travelling gear is still engaged
 - levelling device is not lockedThe safety device opens the main air pipe as long as these 3 functions have not been set correctly.
- 19.8 Special lifting capacity and propping load computer program to read propping loads and wheel loads, respectively.

20. **Documentation Requirements**

Documentation Package

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

1. System description
2. Operator's Manual for the machine and all systems
3. Maintenance Manual for the machine and all systems which shall include all the preventive maintenance activities and repairs
4. Engineering documentation including special processes for overhauling maintenance

5. Pneumatic, hydraulic and electrical detailed diagrams and integrative drawings
6. Illustrated parts catalog for all levels of repairs
7. Fault diagnosis and troubleshooting charts for each system/sub-system
8. Inspection procedures and maintenance standards
9. Table of service tools & equipment
10. Complete periodic maintenance plan

Operators manual

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

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

Maintenance manual

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

10. Front Cover Page.

11. Opening Pages (list of revisions, table of contents, list of figures, list of tables, abbreviations and acronyms, safety conventions etc.)
12. Chapter 1 – General Description: Scope, Overview, System Introduction, General Structure, Theory of Operation, General Block Diagram, Functional Description, Interfaces, Technical Data.
13. 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.
14. Chapter 3 – Maintenance Guidelines: Includes Maintenance Activities Policy, Crew Level Maintenance Activities Policy.
15. 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.
16. 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.

System Description manual

The System Descriptive Manual should include the following information:

17. Front Cover Page.
18. Opening Pages (list of revisions, table of contents, list of figures, list of tables, abbreviations and acronyms, safety conventions etc.)
19. Main systems detailed description (engine, fuel, oil, pneumatic etc.).
20. Software main modules description (power up, BIT etc.).
21. Hardware main modules description (EMDEC, Control cards etc).
22. Appendixes.

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



Documentation Formats

Documentation will be provided in the following formats:

1. 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).



Training Package Requirements

Training Package

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

1. Training schedule.
2. Theoretical lessons.
3. Practical lessons.
4. Job Aids.
5. Evaluation package.

Training Package Formats

The Training Package will be provided in the following formats:

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

Manufacturer Training Courses

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

1. Operators Course
1. 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 Manual

The manufacturer shall propose the optimal training period to ISR approval



ANNEX 2

B1

Climate and Environmental Conditions

**Climate and Environmental Conditions**

Max. Ambient temp.	47 °C (shade)
Min Ambient temp.	Minus 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 m³ atmosphere)**

	Maximum Half-hour Value	Maximum Daily Value	Average
NOx	1064	560	71
SO2	780	260	21
O3	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		SO4	
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

ANNEX 2

B2

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