



Turntable for Locomotives Technical Specification



1. Version history

Revision:	Date:	Changed:	Reason of change
1.0	01.07.17		First Draft

2. Introduction

This document is intended to outline the concept of Turntable for Locomotives.

The purpose of the Turntable is:

- ✓ 180° rotation for the locomotive in both directions, back and forth.
- ✓ 180° rotation in case one side of the locomotive is not allowed for travel



Table of contents

1. Version history	1
2. Introduction	1
3. Overview	4
4. General requirements:	5
5. RAMS.....	5
6. FUNCTIONAL DESCRIPTION.....	6
7. TECHNICAL DATA	7
8. Main Components.....	7
9. Electrical requirements.....	10
10. INSTALLATION & acceptance tests	10
11. Warranty	שגיאה! הסימניה אינה מוגדרת.
12. Applicable standards	10
13. Quality Assurance Plan	12
14. Documentation.....	12
A Climate and Environment	13

3. Overview

Israel Railways has 40 freight locomotives with driver cab on one side of the locomotives and the engine on the other. Driving to the side where the engine is located is not safe and makes it difficult to operate the locomotive. Israel Railways plans to purchase two turntables for 180 degree rotation. The systems are designed for installation in the cargo division in Ashdod and Tzefa.



4. General requirements:

- 4.1 Robust and durable structure
- 4.2 Low-wear and maintenance-free components
- 4.3 Anti-friction bearings designed for a minimum of 20,000 operating hours
- 4.4 High quality standards through regular checks on material and workmanship
- 4.5 Simple operation
- 4.6 Easy access to all wear and service items such as running wheels, motors, gearboxes etc.
- 4.7 High Reliability above 99%
- 4.8 High availability above 99%
- 4.9 MTBF above 15,000 hours
- 4.10 All components and systems must work in safety manner to protect the workers & facility according to OHSAS 18001:2007, Safety Management Standard
- 4.11 The system should be protected from lightning strike, voltage fluctuations and power outages. The system must return to function correctly after completion of the event.
- 4.12 Friendly for use and easy for maintenance
- 4.13 The equipment should not cause any disturbing for the train's system.
- 4.14 Permissible ambient operating temperature: -5 °C to +70 °C (operation), -5 °C to +85 °C (storage)
- 4.15 Shock and vibration resistance: DIN EN 61373, Category 1, Class B

5. RAMS

RAMS (Reliability, Availability, Maintainability, Safety)

5.1 General

The RAMS process includes either the definition of the requirements and the demonstration of compliance.

System redundancy requirements shall be defined by the supplier in appropriate fashion to meet the RAMS targets defined according to EN 50126, EN 50128 and EN 50129. The list of applicable should be supplemented by the Standards EN 50126, EN 50128, EN 50129 and EN 61508-1.

5.2 Reliability

The reliability of the system shall be under the condition that the maintenance is performed in accordance with the maintenance manual.

The Reliability should be above 99%.

MTBF should be above 15,000 hours.

5.3 Availability

The daily availability of the system shall be above 99%.

5.4 Maintainability

The following general rules are to be followed:

- ✓ All components shall be designed in order to achieve a running time of 6 years without special maintenance. No components shall require maintenance below 1 year of running.
- ✓ Components 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. It should be possible to replace Faulty Components without the need to remove the rest of the assemblies.
- ✓ Functional units shall be designed as easily exchangeable modules.
- ✓ Design to minimize adjustment requirements
- ✓ Design to minimize maintenance personal skills and training
- ✓ Design to minimize number of special tools

6. FUNCTIONAL DESCRIPTION

The turntable shall be used for turning locomotives by 180° in order to enable safe driving with the locomotive in both directions. The turning action should initiated from a control panel on the turntable itself. The control panel shall be housed in protective cage.

After completing the round the device will locked in place automatically.

The rail vehicle can enter the turntable under its own power or it can be pulled on and off by using a shunting device.

The turntable shall include rotating flash lights on both sides, horn and emergency-STOP buttons.



7. TECHNICAL DATA

Turntable Load capacity: up to 150 ton

Max locomotive's length: 21 m

Max locomotive's wide: 3 m

Width of turntable: approx. 6,800 mm

Rail type on turntable: UIC – 60, UIC – 54, U – 50

Track gauge on turntable: 1,435 mm

Max Turning speed at outer diameter: up to 1 m/s.

Electrical motors - operating voltage: 380 V / 50 Hz (3 phases)

Control voltage: 230 V / 50 Hz

General Protection: IP 55

Ambient temperature: -5°C, +50 °C (in shade)

Climatic conditions are continental, dry, dusty, and rainy

Insulation issue: F

8. Main Components

8.1 SUPPORTING STRUCTURE

The structure shall made of hardened steel with torsion beam. All joined should be by heavy-duty screw connections. The structure shall includes jack-up points in case of a fault r for maintenance work.

8.2 RAIL TRACK on supporting structure

The running rails, R50, shall be mounted directly onto the bridging beams where they are held in place by rail clamps. The rail type R50 is in accordance to UIC60 with hardness not less than 340 HB. Track gauge is 1,435 mm.

8.3 CATWALKS at each side of the turntable

Catwalks shall be provided either side of and in between the rails. The catwalks shall be designed of non-slip grid galvanized panels. The grid elements should be designed for loads of up to 300 kg/m². Walkways for persons at the turntables, parallel to the track, furnished with grid floors, width 1 m, shall be outside of the loading gauge.

Safety hand rails at both sides must provided as fall-off protection complies with rules and directives for work safety.

8.4 CONTROL STAND – PROTECTIVE CAB

The control stand shall be located in protective galvanized steel housing, enabling the operator to operate in a safe manner. The operator cab should be protected from rain and equipped with electrical heater. It shall equipped with wall-mounted fan allow work even in the hot summer days. It shall equipped with lights for night work. Socket of 220V should be installed for general usage.

8.5 WHEEL PENDULUM

Heavy-duty pendulum twin-wheel assemblies, shall be align with the radius of the pit rail. Means for adjustment should be supplied. All lubricating points at pendulum assembly and wheels should be easily accessible for routine service. The running wheels should be easy to replace.

8.6 RUNNING WHEEL

Non-driven & driven wheels with outer bearings should be used. The wheels shall be made from 42CrMo4 with surface hardness of 56 HRC. The bearings should be industrial self-aligning, low maintenance & dust-proof.

8.7 ELECTRICAL DRIVE SYSTEM

The electrical drive system enabling the turning mod in the desirable speed to insure accurate and safe operation. The isolation level should be class F and the protection level should be IP 55. In case of failure the system should be be operated in an emergency mode. Normal braking wear-free should be used. In case of an Emergency-STOP situation or after a loss of electric power, spring-actuated brakes at the drive motors will engage and stop the turntable. In case of a fault, the brakes can be manually released and locked in this state. In case of a failure in the electric supply the turntable can be turned manually.

8.8 LOCKING OF TURNTABLE

Locking means should be guarantee accuracy of +/- 3 mm in relation to the rail center.

8.9 CENTRE SUPPORT BEARING

The vertical load is approx. 1/3 of the total load, 2/3 of the load will be taken from the outside running wheels. The horizontal load is in accordance with the maximum braking force of the locos.

8.10 PIT RAIL - RUNNING RAIL

The pit rail (turntable running rail) shall be single rail. The rail shall be fixed with suitable rail clamps.

8.11 SIGNAL DEVICES

- ✓ Horn plus Emergency-STOP buttons which are actuated from the cabin position.
- ✓ Yellow rotating flash lights at the approach and departure ends of the crossing track.
- ✓ Warning signs (No unauthorized persons allowed) at the approach and departure ends of the crossing track.
- ✓ Warning Lights In case of rail vehicle extends beyond the end of the turntable, Overweight, Blocked drive motor etc.
- ✓ Green light after completion of the turning, when ready to drive.

8.12 SWITCH CABINET, CONTROL SYSTEM, SAFETY DEVICES

The switch cabinet should be designed according to current industrial standards and should be installed in the protective cabin using vibration-dampening mounting elements. All electric mounts and terminals should be secured with rust-free or corrosion-resistant screws. The control stand shall include a programmable logic control - PLC for all drive units. It should have diagnostic features for status & faults reports.

In case of rail vehicle extends beyond the end of the turntable, Overweight, Blocked drive motor etc., the controller should stop immediately the turntable and operate the emergency lights.

9. Electrical requirements

The turntable and the electric installation shall be provided with filters and screened wires according to the "Directive for the electromagnetic compatibility CE 2004/108/EC".

Supply voltage with neutral conductor: 230 V; 3 x 400 VAC. Frequency 50 Hz All diagrams shall be detailed and indicate the manufacturer of each of the components assembled. The diagrams shall be enclosed with the panels, attached to the inside wall/door of the cabinet.

All circuits will be correctly marked, labels fitted on the front and side of the panel shall be arranged to allow unique identification of all of the elements.

To achieve good EMC characteristics separate cable ducts or cable plat-forms must be provided for power and control/measurement cables. Power cables must be laid with strict separation from control and measurement cables. The cable ducts should be sheet metal ducts with large surface conductive connection to one another over the entire length and grounded as necessary.

There should be a potential compensation between system parts.

The electric system shall design under CE rules, with sealed IP 52 metal protection, low voltage 24 volt controls.

10. INSTALLATION & acceptance tests

A detailed drawing of the turntable's foundation (pit) including mechanical, electrical, hydraulic & pneumatic schemas should be delivered by the supplier at least six months prior the shipping of the turntable. The supplier responsibility to mount and install the turntable.

The acceptance tests will be conducted according to procedure made by the supplier and approved by ISR.

11. Applicable standards

11.1 Machinery and steel construction

✓ Machinery Directive

2006/42/CE



- ✓ Impact on structures DIN EN 1991
- ✓ Design and construction of steel structures DIN EN 1993
- ✓ Design of steel structures and aluminum frameworks DIN EN 1090

11.2 Electrical engineering

- ✓ Erection of power installations with nominal voltages up to 1000 V VDE 0100
- ✓ Electrical equipment of machines IEC 60204-1
- ✓ Electromagnetic compatibility, noise emission for industrial applications DIN EN 61000-6-4
- ✓ Electromagnetic compatibility, immunity for industrial applications DIN EN 61000-6-2
- ✓ Electromagnetic Compatibility 2004/108/CE
- ✓ Low Voltage Directive 2006/95/CE
- ✓ Electromagnetic compatibility (EMC) -Product family standard for machine tools Part 1: Emission EN 50370-1:2005
- ✓ Electromagnetic compatibility (EMC) - Product family standard for machine tools Part 2: Immunity EN 50370-2:2003

11.3 Safety

Standard No	Standard's title
EN 953:1997	Safety of machinery – Guards General requirements for the design and construction of fixed and moveable guards
EN 1037:2008	Safety of machinery – Prevention of unexpected start-up
EN 1088:1995	Safety of machinery –Interlocking devices associated with guards- Principles for design and selection
EN 60204-1:2006	Safety of Machinery - Electrical Equipment of Machines Part 1: General Requirements
ISO EN 12100-1:2011	Safety of machinery - General principles for design - Risk assessment and risk reduction
ISO EN 13849-1:2008	Safety of machinery - Safety-related parts of control systems – Part 1: General principles for design
ISO EN 13849-2:2012	Safety of machinery – Safety - related parts of control systems – Part 2: Validation

ISR shall get a free license for the use and the maintenance (updating) after warranty of the IETM. The IETM shall include:

- Description of the main components: Technical data & drawings (mechanical, electronic & control, hydraulic & pneumatic)
- installation instructions: electrical installation: hardware schematics; auxiliary, connecting and assignment schematics; parts lists
- Control system/software: software modules; program description; operating and installation instructions for the control system.
- Operation & maintenance instructions (Preventive & Corrective maintenance)
- Safety requirements
- Setting: software; backup; updates; services
- Messages: interrupt, error and operational messages

Attachments

A Climate and Environment

A.1 Climate 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 h
- UV Radiation MJ/m² 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