Technical Specification for Ballast Regulator Machine

E—001-- 2016
January 2016 August 2016
## Table of Content

<table>
<thead>
<tr>
<th>Para.</th>
<th>Paragraph Name</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>General Requirements one</td>
<td>55</td>
</tr>
<tr>
<td>1.1</td>
<td>Applicable Standards</td>
<td>55</td>
</tr>
<tr>
<td>2</td>
<td>Operating Conditions</td>
<td>66</td>
</tr>
<tr>
<td>2.1</td>
<td>The ballast regulator shall have the following operating conditions:</td>
<td>66</td>
</tr>
<tr>
<td>2.2</td>
<td>Loading gauge</td>
<td>72</td>
</tr>
<tr>
<td>3</td>
<td>Vehicle Construction</td>
<td>72</td>
</tr>
<tr>
<td>3.1</td>
<td>Frame</td>
<td>72</td>
</tr>
<tr>
<td>3.2</td>
<td>Wheel-sets and Suspension</td>
<td>72</td>
</tr>
<tr>
<td>3.3</td>
<td>Braking System</td>
<td>87</td>
</tr>
<tr>
<td>4</td>
<td>Propelling System</td>
<td>88</td>
</tr>
<tr>
<td>4.1</td>
<td>Engine</td>
<td>88</td>
</tr>
<tr>
<td>4.2</td>
<td>Engine Cowling</td>
<td>88</td>
</tr>
<tr>
<td>4.3</td>
<td>Fuel System</td>
<td>98</td>
</tr>
<tr>
<td>4.4</td>
<td>Air Intake</td>
<td>99</td>
</tr>
<tr>
<td>4.5</td>
<td>Engine Protection System</td>
<td>99</td>
</tr>
<tr>
<td>4.6</td>
<td>Transmission</td>
<td>99</td>
</tr>
<tr>
<td>5</td>
<td>Electrical System</td>
<td>1110</td>
</tr>
<tr>
<td>5.1</td>
<td>Electrical Power Supply</td>
<td>1110</td>
</tr>
<tr>
<td>6</td>
<td>Cabins</td>
<td>1111</td>
</tr>
<tr>
<td>6.1</td>
<td>Design guidelines</td>
<td>1111</td>
</tr>
<tr>
<td>6.2</td>
<td>Driver Visibility</td>
<td>1114</td>
</tr>
<tr>
<td>6.3</td>
<td>Cabin Equipment</td>
<td>1114</td>
</tr>
<tr>
<td>6.4</td>
<td>Cabin Windows</td>
<td>1211</td>
</tr>
<tr>
<td>6.5</td>
<td>Noise Level</td>
<td>1211</td>
</tr>
<tr>
<td>6.6</td>
<td>Cabin Amenities</td>
<td>1212</td>
</tr>
<tr>
<td>6.7</td>
<td>Control Panel</td>
<td>1212</td>
</tr>
<tr>
<td>7</td>
<td>Safety Systems and Equipment</td>
<td>1515</td>
</tr>
<tr>
<td>7.1</td>
<td>Automatic Vigilance Device</td>
<td>1515</td>
</tr>
<tr>
<td>7.2</td>
<td>INDUSI System</td>
<td>1615</td>
</tr>
<tr>
<td>7.3</td>
<td>Safety Equipment</td>
<td>1616</td>
</tr>
<tr>
<td>8</td>
<td>Lighting Systems</td>
<td>1616</td>
</tr>
</tbody>
</table>
8.1  External lighting  
8.2  Internal Lighting  
9   Faults Monitoring System  
10  Documentation  
10.1 Operation and Maintenance Manuals and Spare Parts Catalogue for the following systems:
10.2 Manuals Content  
11  Production Process  
11.1 Quality Control  
11.2 Manufacturing Schedule  
12  Handing-over Procedure  
12.1 At the manufacturing plant:  
12.2 At destination:  
13  Training Package Requirements

**List of Attachments**

<table>
<thead>
<tr>
<th>Att.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Climate and Environmental Conditions</td>
</tr>
<tr>
<td>B</td>
<td>Loading Gauge ISR</td>
</tr>
<tr>
<td>C</td>
<td>INDUSI System Brochure</td>
</tr>
<tr>
<td>D</td>
<td>Compliance Table</td>
</tr>
</tbody>
</table>
Ballast Regulator Machine

Definitions

"Vehicle" Self-propelled track vehicle.

List of Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRM</td>
<td>Ballast Regulator Machine</td>
</tr>
<tr>
<td>EN</td>
<td>European standards for products and services</td>
</tr>
<tr>
<td>ISR</td>
<td>Israel Railways</td>
</tr>
<tr>
<td>UIC</td>
<td>Union Internationale des Chemins de Fer (International Union of Railways)</td>
</tr>
<tr>
<td>CWR</td>
<td>Continuous Welded Rail</td>
</tr>
<tr>
<td>IEC</td>
<td>International Electrotechnical Commission</td>
</tr>
<tr>
<td>IETM</td>
<td>Interactive Electronic Technical Manual</td>
</tr>
<tr>
<td>OCS</td>
<td>Overhead Catenary System</td>
</tr>
</tbody>
</table>
1 General Requirements

The ballast regulator shall be self-propelled and will be used on ISR railway network for the track construction and maintenance work.

1.1 Applicable Standards

1.1.1 The vehicle shall comply with the latest edition of:
- EN 12663: Structural requirements of railway vehicle bodies
- EN14033-1: Rail bound construction and Maintenance Machines
  Technical requirements for running.
  The vehicle shall meet “Category 1” requirements.
- EN14033-2: Rail bound construction and maintenance machines - Technical requirements for working
- EN 14033-3: Railway applications - Track – Rail bound construction and maintenance machines - General safety requirements
- EN 50155:2007 Railway Applications - Electronic Equipment Used on Rolling Stock
- IEC 61991 Ed. 1.0 Railway applications - Rolling stock - Protective provisions against electrical hazards
- All EN and UIC mentioned in this technical description.

1.1.2 The ballast regulator design shall follow the EN regulations and UIC codes for environment protection like: noise; pollution; etc…)

1.1.3 The machine shall be able to work on single and double line track and between station platforms. The machine shall work in plain track and shall be used also for work in turnouts.

1.1.4 The ballast regulator 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 Attachment A.

1.1.5 The ballast regulator shall be designed to operate on tracks with gradient up to 35%.

1.1.6 The ballast regulator shall be designed to operate on main and secondary lines with minimum curve radius of 140 meter and travel on shunting area with minimum curve radius of 75 meter.

1.1.7 The ballast regulator shall include an "INDUSI" (Inductive signal protection) system.

1.1.8 Since ISR intends to introduce an ETCS Level 2 signaling system, the manufacture will ensure enough space for future installing of required equipment.
Ballast Regulator Machine

1.1.9.1 The ballast regulator 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.

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

1.1.11.1 The ballast regulator 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, 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.

1.1.12.1 The BRM shall fully comply with requirements for OCS. (25kV AC)

1.1.13.1 The driver cabin arrangement and visibility angles while sitting in the driver seat facing traveling direction shall comply with UIC 651 code. The ballast regulator crew shall have panoramic view on the track.

1.1.14.1 The BRM shall have about 1 cubic meter (side plow/wing) ballast capacity.

1.1.15.1 The BRM shall ensure working with one wing as well as working with two wings.

1.1.16.1 The BRM 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.

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

2 Operating Conditions

The completed ballast regulator must conform to all system clearances and track conditions. The ballast regulator must be tested and inspected on rail to ensure conformance with all system clearances and track conditions, and compliance with all specifications.

2.1 The ballast regulator shall have the following operating conditions:
Ballast Regulator Machine

2.2 Loading gauge

The ballast regulator shall comply with ISR loading gauge parameters [Attachment B].

3 Vehicle Construction

3.1 Frame

The frame shall consist of one part. All work units shall be arranged on one rigid frame.

The frame shall be made from standard rolled steel.

The following are provided on the frames:
- Handrails or grab irons
- 4 lifting hooks for handling
- One guard-irons on both sides of each wheel
- Side steps; the lowest step used for boarding the machine shall not exceed the loading gauge.
- Kick board shall be provided to prevent crew entry into potentially hazardous areas.
- All floor walking areas shall be made from anti slipping and wear resistant material.

3.1.1 Coupling and Buffers

Each headstock shall be fitted with UIC type coupling system and buffers, namely:

- 1 central Draw Gear to UIC 520 with an elastic draw system;
- 1 Draw Hook to UIC 520 OR with a breaking force of 1,000KN;
- 1 Screw coupler to UIC 520 OR with a breaking force of 850KN;
- 2 side buffers with a stroke of 105 mm to UIC 526-1;
- 1 brake hose with valve.

3.2 Wheel-sets and Suspension

The axles shall be of unalloyed carbon steel in accordance with UIC 811 and shall meet the requirements of EN 13104.
3.3 Braking System

The braking system shall comply with UIC 540 standard.

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

The brake system shall comprise of:

- 1 direct and automatic compressed air brake, acting on the four wheels of the vehicle through cast iron shoes
- 1 emergency compressed air brake operated by a valve near an access door acting on the same linkage as the direct brake
- parking brake according 14033-1.

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

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

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

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

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

4 Propelling System

4.1 Engine

The BRM shall be equipped with engine of the latest generation.

The vehicle shall be powered by at least 450 [hp] liquid cooled diesel engines.

The engine shall be EURO 5 or updated rating STAGE III/B rating according to the European Emission Standard requirements for rail engines (provide technical specifications).

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

4.2 Engine Cowling

A cowling shall protect the drive, engine and transmission lines.
Ballast Regulator Machine

This cowling shall have doors that will provide easy access to all elements.

4.3 **Cooling System**

The cooling system shall enable continuous safe operation of the engine at the ambient temperature given in Attachment A. The loss in heat transfer efficiency due to the hot and dusty environment shall be taken into consideration.

4.3 **Fuel System**

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

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

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.

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

4.4 **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.

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

4.5 **Engine Protection System**

Engine protection system shall protect the engine against:

- High coolant temperature;
- Low coolant level;
- Low oil pressure;
- High oil temperature.

4.6 **Transmission**

The BRD shall be equipped with hydrostatic transmission that acting each axle.

The hydrostatic transmission shall provide two range of speed in both driving / work direction.

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

The system shall enable transmission system disconnecting.

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

Stainless steel shall be used for all exhaust components.

All exhaust piping shall be properly braced to eliminate shocks at all junctions, and at the interfaces between the manifold and muffler. Vibration dampeners may be used if necessary. The system shall provide for expansion, contraction, vibration, and stress produced by operation of the machine. The system shall comply with the latest EURO 5 emission standards.

### 4.8 Hydraulic System

The hydraulic system shall be designed as to provide efficient operation in the ambient conditions given in Attachment A.

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

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.

Access panels large enough for complete cleaning, inspection, maintenance, and servicing of sump filters with an accessible means to empty the reservoir in the event the fluid is to be drained.

The Hydraulic system shall be equipped with oil cooling system.

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

### 4.9 Compressed Air System

The compressed air system shall comply with EN 14033.

The compressed air system shall stand in the necessary pressure for integrating the Machine in railway arrangement according to UIC codes.

The compressed air system will assure the pressure for working, braking and other auxiliary needs. It's preferable that the compressed air system manufacturer will be KNORR.
5 Electrical System

5.1 Electrical Power Supply

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

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

The batteries shall not produce emission of toxic gasses.

All electrical components shall meet EN and IEC safety requirements.

All electrical cables shall meet the requirements of UIC 895.

6 Cabins

6.1 Design guidelines

The cabin shall be designed and equipped following the guidelines in EN 14033

All operations for transfer and work shall be controlled from cabin.

The access to the cabin shall be via steps with hand rails and safety platform from both sides.

The cabin shall be equipped with sun protection roller blinds.

Front windows for travel shall be made of 15 mm safety glass and electrically heated

Air-conditioning System

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

Heat generated by the equipment shall be taken in the calculation of the air-conditioning unit.

6.2 Driver Visibility

The driver visibility sitting in the driver seat facing traveling direction shall fully comply with UIC 651 paragraph 3.

6.3 Cabin Equipment

The ballast regulator 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.
6.4 **Cabin Windows**
The cabin windows and windows accessories such as wipers washers and sunshades shall comply with UIC 651 paragraph 2.7.

6.5 **Noise Level**
The noise level in the cabin shall meet the requirements of UIC 651 paragraph 2.10.

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

6.7 **Control Panel**
6.7.1 The driver control panels in both driver posts shall include at least following instruments:

6.7.1.1 Tachometer;
6.7.1.2 Hour meter;
6.7.1.3 Ammeter;
6.7.1.4 Fuel control indicator;
6.7.1.5 Engine coolant temperature indicator;
6.7.1.6 Coolant level indicator;
6.7.1.7 Transmission oil temperature indicator;
6.7.1.8 Transmission oil pressure gauge;
6.7.1.9 Engine oil temperature indicator;
6.7.1.10 Engine stop push-button;
6.7.1.11 Horn push-button pneumatic + electric;
6.7.1.12 Battery charge indicator;
6.7.1.13 Portable lamp plug;
6.7.1.14 Outside lighting switches;
6.7.1.15 Inside lighting switches;
6.7.1.16 "DEAD MAN" pedal + push button on the panel of a cabin;
6.7.1.17 Electrical sockets 24 VDC
6.7.1.18 INDUSI control panel on both traveling direction.

6.7.2 All Panel labels shall be in English, except some that shall be dual language English/Hebrew. Translation will be provided by ISR. Hebrew letter characters will be according to ISO/IEC 8859-8:1999.

7. Working elements
The machine shall be equipped with the following working units:

+ Center plough
+ Shoulder ploughs
+ Front plough (at both ends)
+ Sweeper units –sweeper unit(s) for wooden and concrete sleepers
  - rotating sweeper brooms for fastenings
+ Ballast hopper
+ Spraying units

1. Centre plough

A plough, which is adjustable in height by hydraulics to adapt to the level of the sleepers, shall be fixed in the central part of the machine (between the axles). This plough shall be made of strong steel sheets to be capable of moving the ballast as needed.

The blades of the plough shall be protected by wear resistant dismountable plates.

The following ballast movements shall be possible in one single passage in the zone of the ballast crown.

- from the right rail to the left one
- from the left rail to the right one
- from the shoulder to the centre
- from the track centre to the shoulders

The guide sheets of the centre plough shall be positioned hydraulically via push buttons in the cabin.

The centre plough shall be equipped with welded-on tunnels for rail fastenings protections during the ploughing operation.

The design of the centre plough shall allow working with the machine in both directions with the same efficiency.

2. Shoulder ploughs

The shoulder ploughs shall be fixed between the axles on both sides of the machine.
Ballast Regulator Machine

They shall be adjustable both horizontally and vertically and shall allow the adjustment for any shoulder angle up to 45° downwards and about 10° upwards.

Each shoulder plough shall have a lateral reach of 3.5 meters adjustable in infinite variations.

The machine shall be equipped with a deployment control device – computer assisted – that will prevent the plough to interfere with the adjacent track traffic and obstacles such as signage posts, signals, catenary poles etc.

The shoulder ploughs shall ensure the capability to avoid obstacles on the shoulder, such as signage posts, catenary supports, fix points, etc., in such a manner as to prevent ballast from heaping up and the angle to change.

The BRM shall ensure working with only one or with both shoulder ploughs.

All adjustments of the shoulder ploughs shall be hydraulically and computer controlled.

The shoulder ploughs shall be of an articulated construction as to allow them to form a box-shape for the transport ballast in longitudinal direction.

The shoulder ploughs shall allow working in both directions.

3. Front plough

The ploughs, which are adjustable in height by hydraulics to adapt to the level of the sleepers, shall be fixed in the front part of the machine on both sides.

This plough shall be made of strong steel sheets to be capable of moving the ballast as needed.

The ploughs shall be equipped with welded-on tunnels for rail fastenings protections during the ploughing operation.

The front ploughs shall be used to push aside heaps of ballast on newly laid lines or during ballasting existing lines in order to facilitate the access of the machine to the working site.

These ploughs shall be able to push the excess ballast outward.

3. Sweeper unit

The sweeper unit shall be fixed to the rear part of the machine. A hydraulically driven rotating brush shall sweep the ballast from the
Ballast Regulator Machine

sleepers. Surplus ballast shall be picked-up to a conveyor to the hoper.

The sweeper unit shall have variable rotating speed and will be able to change the rotating direction.

The height adjustment of the brush shall be completely controlled by operator from both the cabin and outside by means of joysticks on both sides of the sweeper unit.

The sweeper unit shall be compatible with work in plain line and turnouts and with concrete and wooden sleepers as well.

4. Rail fastening broom.

The BRM shall have rotating brooms system, for each side of the track for fastening cleaning.

The brushes will be adjustable in such a way as to enable work in turnouts.

5. Ballast hopper

The machine shall be equipped with a ballast hopper with a capacity of approx. 5 cubic meters and a conveyer which will transport the surplus ballast from the sweeper unit to the conveyer.

The hopper will be provided with adjustable hydraulically or pneumatically flaps permitting to discharge the ballast on the sides or between the rails.

The discharge channels shall be individually controlled.

The ballast from the hopper will be placed in front of the central plough.

6. Spraying Units

The spraying units shall provide water mist to reduce the dust propagation.

7 Safety Systems and Equipment

The ballast regulator shall be equipped with following safety systems:

7.1 Automatic Vigilance Device
An Automatic Vigilance Device (Dead-Man Device) shall be provided and shall comply with UIC 641 and UIC 651 paragraph 4.3.2.6. Activation shall be by pedal and desk button.

7.2 **INDUSI System**

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

In the working mode INDUSI system shall allow lifting to avoid damages.

7.3 **Safety Equipment**

The following safety equipment shall be installed on the BRM:

7.3.1 1 Rotating beacon on the cabin roof
7.3.2 2 Electro-pneumatic warning horns (one to each direction).
7.3.3 2 Fire extinguishers according to the relevant standards
7.3.4 2 Fire alarm system with Temperature and smoke detectors
7.3.5 4 Engine stop push buttons on each corner of the vehicle frame (outside the cabin)

8 **Lighting Systems**

8.1 **External lighting**

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

8.2 **Internal Lighting**

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

9 **Faults Monitoring System**

The vehicle shall be equipped with a fault monitoring system.

The system shall diagnose and monitor faults that may occur in each one of the following vehicle systems: Drive line, electric; hydraulic pneumatic.

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

10 **Documentation**

The following technical data shall be provided **with the vehicle at least 60 days before Delivery of the BRM**: 
10.1 **Operation and Maintenance Manuals and Spare Parts Catalogue for the following systems:**

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

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

10.2 **Manuals Content**

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

10.2.1 Safety precautions

10.2.2 Systems description;

10.2.3 Operation instructions.

That shall include: Pre-operation checks, Start-Up procedure, Operating procedures (operation limitations should be stated clearly and in bold letters), Shut-down procedure, Emergency procedures, Troubleshooting.

10.2.4 Preventive maintenance instructions;

10.2.5 Adjustments instructions;

10.2.6 Components replacement procedures;

10.2.7 The spare parts catalogues shall include illustrated parts breakdown (sub-contractor items included) with a set of section drawings or axonometric/"blow-up" drawings and a list for each one of the drawings including the following data elements:

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

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

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

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

- End-user access control;
- Annotations and bookmarks;
- Easy navigation between documents titles and sub-titles;
- Combined Boolean full-text search;
- Nested querying - up to 4 nesting search levels;
- Compound documents viewer (text, tables, raster/vector images, audio, video, etc.);
- Multi-target hyperlinks;
- External executable links;
- Exporting images in their native format; exporting text.

11. Production Process

11.1 Quality Control

Together with the proposal the contractor shall submit to ISR a copy of his quality control manual. The following procedures must be included in the manual:

11.1.1 Tests Plan

Listing all the tests that will be performed by the contractor on the vehicle during the production, including test at major sub-contractors. Submit a sample test plan. The actual test plan shall be submitted 15 days after contract award.

11.1.2 Final Test Details
The final test of the vehicle shall be conducted following the guidelines of EN 14033-3. Submit a sample final test plan. The actual test plan will be submitted one month before commencement of the test.

11.1.3 Deficiencies Tracking Procedures
The quality control manual will show the procedure how the contractor tracks and closes deficiencies that were discovered during the manufacturing process. The deficiencies will include among other parameters at least the following:
- Deficiency Description;
- Remedial Plan.

11.2 Manufacturing Schedule
Within 15 days after contract award the contractor shall present his manufacturing schedule. The schedule shall show the timing and duration for the following tasks that will take place with the participation of ISR personnel:

11.2.1 Design Review
11.2.2 Foreign acceptance test at manufacturer’s premises
11.2.3 Final vehicle systems tests at ISR premises and tracks

12111 Handing-over Procedure
The handing-over procedure shall include the following tasks:

12.1.1 At the manufacturing plant:

12.1.1.1 Visual check of the vehicle and its systems for compliance with the specifications drawings and the submittals.

12.1.1.2 Checking of all test reports which were issued during the production for compliance with the test plan.

12.1.1.3 Running test of the vehicle and its systems
A representative of the certified body will participate in this test and will certify that all propulsion, driving, braking, towing; visibility; vigilance and the INDUSI systems meet the EN and the UIC codes and are functioning properly according to EN 14033.

The certification price shall be included in machine price.

12.1.1.4 Checking of all the hard copies of the operation and maintenance manuals, parts breakdown and drawings sets for compliance with the specifications requirements,
Checking of all the Interactive Electronic Technical Manual (IETM) of the operation and maintenance manuals, parts breakdown and drawings sets for compliance with the specifications requirements and its hyperlinks and search capabilities.
12.1.5 After approval of all the tests by ISR the vehicle shall be sealed, protected and prepared by the contractor for the sea transportation.

12.2.1 At destination:

Tasks to be performed by the contractor

12.2.2.1 Removal and cleaning the vehicle packaging and inhibiting materials

12.2.2.2 Functional tests of all vehicle systems.

12.2.3.2 Operators and maintenance personnel training – 15 working days for operators and 15 working days for maintenance team.

The manufacture will submit a proposal for the training as mentioned above for ISR approval.

13. Training Requirements

13.1.1 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
6. Training Aids and Simulators

13.1.2 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)

13.1.3 Manufacturer Training Courses

The Manufacturer is requested to conduct several training courses in the English language.
Ballast Regulator Machine

1. Operators Course
2. Maintenance Course

The courses will include both theoretical and practical aspects. Course outlines should be approved by ISR Training department in order to ensure that all aspects are covered. There is no special need for materials to be supplied in the course except for the Operating / Maintenance Manuals.
Attachment A

Climate and Environmental Conditions

Max. Ambient temp. +50 °C (shade)
Min Ambient temp. -5 °C
Relative humidity 10% to 90%
Altitude - 400 m to +800 m
Sunny hours per year 3300
UV Radiation MJ/m² per year 360-600
Rainfall mm/year 400-800

Dust Conditions in the atmosphere
(Microgram per m³ atmosphere)

<table>
<thead>
<tr>
<th></th>
<th>Maximum Half-hour Value</th>
<th>Maximum Daily Value</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx</td>
<td>1064</td>
<td>560</td>
<td>71</td>
</tr>
<tr>
<td>SO2</td>
<td>780</td>
<td>260</td>
<td>21</td>
</tr>
<tr>
<td>O3</td>
<td>312</td>
<td>143</td>
<td>84</td>
</tr>
<tr>
<td>Suspended Dust</td>
<td>350</td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

Suspended Particulate Matter (SPM)
Particle size to 0.5-1 micron

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

<table>
<thead>
<tr>
<th>Salt Element</th>
<th>Na</th>
<th>Cl</th>
<th>SO4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Season</td>
<td>Season</td>
<td>Season</td>
</tr>
<tr>
<td></td>
<td>Dry</td>
<td>Wet</td>
<td>Dry</td>
</tr>
<tr>
<td>Sea Air at Coast Line</td>
<td>7.3</td>
<td>16.0</td>
<td>12.0</td>
</tr>
<tr>
<td>600 m from Shore</td>
<td>3.1</td>
<td>4.8</td>
<td>4.2</td>
</tr>
<tr>
<td>6000 m from Shore</td>
<td>1.1</td>
<td>1.4</td>
<td>1.5</td>
</tr>
</tbody>
</table>
Loading Gauge

Standard gauge ISR

1. 800 m - for permissible speed greater than 160 km/h up to 250 km/h.
2. 300 m - for speed greater than 60 km/h up to 160 km/h.
3. 000 m - for speeds up to 60 km/h on the secondary lines, stations, and marshalling yards.
4. Dimensions for new rolling stock for existing rolling stock high and wide of maximum loading gauge for coaches/rolling stock - 4.75 m and 1.66 m.
5. Dimensions for infrastructure gauges.
6. Area between tracks or outside of track for signaling equipment.

Notes:
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 passenger platforms in relation to terminal tracks (see technical program for passenger stations ISR).
4. All basic dimensions of the ISR infrastructure reference profile follows the EN 15223 standard.
5. The ISR infrastructure gauge refers to GC Reference Profile.
The Alcatel 6411 AlTrac is an inductive automatic train protection system for enhanced safety.

**Description**

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

**Main Functions**

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

The main feature is the compact design of the central processing unit.

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

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

A Special evaluation software package can be used to read out the data stored in the data storage unit. The software runs on a standard PC. Depending on requirements the data can be either displayed, printed out or transferred to other data media.

**Essential Benefits**

- Compact and cost effective
- Operates with existing trackside equipment
- Extended display and operation elements
- Implements speed monitoring
- Uses commercially available computers
- Maintenance friendly through fault detection
- Improved information through the extended diagnosis and evaluation facilities.

---

Transport Automation Systems · Lorenzstr. 10 · D-70435 Stuttgart · Germany
Tel: +49 711 821 44492 · Fax: +49 711 821 46813 · www.alcatel.com