

0425



<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 3	Date: 18/08/2015 Page 49 de 50

#### 4. Work lighting control

- The lighting of middle plough, sweeping, and diesel machine room.

#### 5. Auxiliary lighting control

- Front and rear headlamp could control alone, and cab brake lamp use pressure switch to control.
- Wiper, alarm lamp, horn, indoor illumination, washing, sweeping and middle plough flange use switch to control.

#### 6. Drive system control

- High-speed drive (must shut down the work switch)  
Turn the switch to the high-speed place. When the air pressure reach to the set pressure, and the middle plough as well as sweeping has been received, pressing the forward or backward button, and pressing the slow motion switch, the brake release. Changing gear to magnetic valve to get power, supply the oil to cylinder to change gear to low gear. Pushing the high-speed driving handle to start driving. (Pushing the driving handle would be invalid if the gear was not be changed successfully before.)
- Working drive  
Turn on the work switch and turn it to the work place. When the air pressure reach to the set pressure, pressing the forward or backward button, and pressing the slow motion switch, the brake release. Changing gear to magnetic valve to get power, supply the oil to cylinder to change gear to low gear. Pressing the slow motion switch after changing gear will be invalid. Pushing the low-speed driving handle to start driving. (Pushing the driving handle would be invalid if the gear was not changed successfully before.)

#### 7. Working electrical control system

- Working switch
- Engine speed control switch
- Lighting switch
- Driving lock
- Scram button
- Alarm instruction and buzzer warning
- Middle plough flange corner control
- Conveyor belt pneumatic, direction control
- The accumulator of electrical control system is a cascade of two storage batteries, and it used for providing the engine start.

<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 3	Date: 18/08/2015 Page 50 de 50

- Easily impact cables are all equipped with plastic sheath to avoid damage. The illuminance of headlamp will be capable of illuminating a person, located at the axis of the rail at 200 m.
  - Equipping with signal and alarm indication.
  - The insulation grade of all wire and cable is in accordance with the working voltage, and the sectional area is in accordance with the passed maximum current.
  - The arrange of wire and cable considered to prevent corroding by oil, water and other sewage. Wire is fixed by conduit and strapping tape, and the wiring tube is mounted securely as well.
  - Both ends of each wire (cable) is marked with number and in accordance with the drawing. The wiring conforms the color of electrician related standard. ("+", "-" pole etc.)
  - The cabin reserves AC220V socket, using for power supply of laptop to onboard wireless communication device. The external of the car adopts safe voltage hand lamp socket.
- 2) lighting and lamps
- The lighting and lamps, meeting the work requirement, includes: both ends long shot headlamp, close-up lamp, marker lamp, braking signal lamp, roof alarm lamp, ladder lamp, cabin lamp, engine room work lamp, bridge instrument lamp, and horn, etc. Enough lamps are also set in the external of the car and under the frame to make the replacement and maintenance of the equipment more convenient.
5. Paint mark – Refer to Annex-1

All the font type of logo and label could be ensured according to buyer's requirement.

0425



**ANNEX 4**

**RAIL CAR**



Yang Xuan, on behalf of Wang Xiaojian, Taiyuan.

A handwritten signature in black ink, appearing to be a stylized name, possibly "Wang Xiaojian".

<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	Date: 18/08/2015 Page 1 de 31



## Index

1. EQUIPMENT TECHNICAL SPECIFICATIONS.....	2
2. LIST OF FREE OF CHARGE ATTENDANT TOOLS FOR THE RAIL CAR.....	3
3. SPARE PARTS FOR ONE YEAR OPERATION OF RAIL CAR .....	3
4. TECHNICAL DOCUMENTS FOR THE RAIL CAR .....	4
5. TECHNICAL SERVICE PROGRAM FOR THE RAIL CAR.....	5
6. TECHNICAL TRAINING PROGRAM FOR THE RAIL CAR.....	5
7. DETAILED TECHNICAL DESCRIPTION OF THE RAIL CAR .....	6

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<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	Date: 18/08/2015 Page 2 de 31

**ANNEX 4**

**1. EQUIPMENT TECHNICAL SPECIFICATIONS**

**1.1. TRACK CAR**

**Technical data**

- Engine: Deutz
- Electrical motor starting
- Two synchronous control engine- for whole carriage
- Max. start feeding force: 95kN
- Total traction mass 2000t
- Power 2 x 330 kW
- Max. carrying capacity 5 tn
- Max. traveling 100km/h
- The total mass is less than 50 Tn
- Wheel diameter 915 mm – Refer to Annex-1
- Distance between axles 9000 mm
- Overall dimensions of the vehicle are to be confirmed after final design, to meet the clearance requirements of Argentina.
- Loading space is 1308 mm above rail surface.
- The cockpit can accommodate 12 people.
- The air-conditioner can ensure the comfortable environment in the cabin.
- Loading crane can be remote controlled by radio system.
- Towing hook of coupler lock system (Refer to Annex-1)
- Buffer (Refer to Annex-1)
- 4 Trucks cars gauge should be adjusted according to GVO 3234
- 1 Truck car gauge should be adjusted according to GVO 3236

*[Handwritten signature]*

<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	Date: 18/08/2015 Page 3 de 31

## 2. LIST OF FREE OF CHARGE ATTENDANT TOOLS FOR THE RAIL CAR

The following list is preliminary, for reference only, and the final list will be determined after final design is confirmed by the Principal.

### 2.1. TRACK CAR

The following chart is a free of charge tool list for one track car (for reference only)

No.	Name	Quantity
1	Open spanner	1set
2	Double offset ring spanner	1set
3	Socket spanner	1set
4	Side-cutting-jaw pliers	1
5	Needle nose plier with side cutter	1
6	Monkey spanner	1
7	Monkey spanner	1
8	Screw driver (flat)	1
9	Screw driver (crosshead)	1
10	Torque banner	1
11	Hammer	1
12	Pipe wrench	1
13	Allen wrench	1set
14	Single ended wrench	1
15	crowbar	1set
16	Triangle file (with handle)	1
17	Half-round file (with handle)	1
18	Flat file (with handle)	1
19	Grease gun	1
20	Lubricating oil gun	1
21	Pistol oil can	1
22	Pocket multimeter	1

The Principal require all special tools for maintenance, routine and light maintenance of all equipment systems, while TAIYUAN can only provide tools for routine and light maintenance.

## 3. SPARE PARTS FOR ONE YEAR OPERATION OF RAIL CAR

The Price of the Spare Parts for two years operation of the RAIL CAR is as listed in the Price Breakdown. Detailed list will be submitted at the presentation of the final Design of the RAIL CAR machine.

The value of parts and supplies must not exceed 6% of the overall value of the equipment, which may be used interchangeably.

<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	Date: 18/08/2015 Page 4 de 31

CMEC must ensure that spare parts and supplies of equipment are in the market for a period of 15 years.

#### 4. TECHNICAL DOCUMENTS FOR THE RAIL CAR

Technical documents delivered along with each set of machinery to the Principal are listed below. The following list of technical documents is preliminary while the final one will be confirmed two month after signing the contract.

Technical Documentation: All documentation submitted by CMEC will be Castilian in digital and paper, prefabrication of equipment. At least 5 copies printed per vehicle.

The technical documents delivered with the track car includes:

No.	Name
1	Operation manual
2	Maintenance manual
3	Assembly drawing
4	Test report (will be confirmed during the design meeting)

The provided drawings will be used for maintenance purpose only and enough, which include but not limited to the following:

- Plans and drawings electrical, hydraulic system.
- Maintenance of the hydraulic arm
- Schematic brake and pneumatic system
- Box rear axle and front axle changes
- Hydraulics principle diagram
- layout diagram of electrical appliances
- main diagram Diesel engine control
- Home Alarm System Diagram
- Air conditioning control principle diagram
- Operation console design drawing
- Wiring diagram control air lock
- Manual for safe operation
- Brake Specification
- Technical material attached diesel engine
- operating instruction air conditioning
- Parts, etc.

<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>		<b>0425</b> MINISTERIO DEL INTERIOR FOLIO 969
	ANNEX 4		Date: 18/08/2015 Page 5 de 31

## 5. TECHNICAL SERVICE PROGRAM FOR THE RAIL CAR

The following plan is a preliminary technical service program for the large-scale maintenance machinery while the final one will be confirmed during the technical meeting.

The warranty period of the equipment is 2 years, which shall take effect at the end of commissioning in Argentina.

5.1 CMEC will send technicians to the Principal's premise to supervise and guide the unloading, installation, commissioning, and acceptance of large-scale maintenance machinery, as well as to provide on-site technical service. The costs of travel, lodging and staff mobility will send CMEC charge

### 5.2 Services

- Static vehicle condition checking
- Guiding users to replace various oil
- On-site static and dynamic commission
- Running and working test
- Training in the basic principle, operation, safety and maintenance of the equipment
- Troubleshooting
- Car-following working

5.3 Within the guarantee period after delivering the maintenance machines, CMEC is in charge of sending technicians who meet the job requirements to provide after-sale services in Argentina. Service plan will be adjusted according to the actual working and using situation of different machines.

5.4 CMEC engineers will be responsible of technical training for end-user's local concerned people. For details, please refer to the technical training program.

## 6. TECHNICAL TRAINING PROGRAM FOR THE RAIL CAR

### 6.1 TRAINING OBJECTIVES

Helping the trainees to understand the principles, maintenance methods and some notes of each kind of large-scale maintenance machinery under the contract, letting the trainees get skilled at operating the equipment and preliminarily having emergency handling capability.

### 6.2 TRAINING MATERIAL AND DOCUMENTS

User's manual and maintenance.





<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	Date: 18/08/2015 Page 6 de 31

### 6.3 TRAINEE REQUIREMENT

Good health physique quality is required. In particular, college degree or above, preliminary or above technical title, and over 1-year related working experience are also required for the trainees.

### 6.4 TRAINING PLAN

The following training plan is a preliminary plan while the final one will be confirmed during the technical liaison meeting.

No.	Equipment	Training time
1	Rail car	Factory theory and hands-on training: 2 weeks/7people; On-site hands-on training: 4 weeks/20 people.

The costs for personnel designated by the SOF SE (passages, mobility, 5-star hotel accommodation, transfers, etc.) for training in China should be in charge of CMEC.

For training in China and Argentina CMEC will be in charge to include a translator for each course.

All training materials will be delivered in Castilian.

During training in China CMEC should schedule visits to the railways where equipments are being used.

CMEC will be responsible for all personal expenses (transportation, mobility, housing, etc.) during the training in Argentina.

## 7. DETAILED TECHNICAL DESCRIPTION OF THE RAIL CAR

### 7.1. APPLICATIONS AND DESIGN PRINCIPLES

GCY600(1676 gauge) and GCY600Z (1000 gauge) vehicle is of multi-function rail operating vehicle and mainly used to load and unload the materials along the track, and also transport the personnel and materials to designated railway stations, and also can be used as motor tractor to tow other vehicles on track.

The rail operating vehicle complies with Argentina wide gauge (gauge 1676 mm)/narrow gauge (gauge: 1000 mm) track conditions.

The rail operating vehicle meets the clearance requirements of Argentina wide gauge(gauge 1676 mm)/narrow gauge (gauge: 1000 mm) lines, and it will not exceed the clearance in any case and under specified wheel wearing conditions.



<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	<b>ANNEX 4</b>	
	Date: 18/08/2015 Page 7 de 31	

The rail working vehicles has the coupling towing function with the rescue locomotive in case of failure.

The rail operating vehicle has favorable availability, reliability and serviceability.

The rail operating vehicle has perfect safeguard measures.

## 7.2. APPLICABLE ENVIRONMENT:

### 7.2.1. Applicable climate environment:

Ambient temperature	-15°C~+°C50 (adjusted according to operation regions of vehicle)
Altitude	≤ 3000m (measured with the engine power below 1000 m)
Relative humidity	Monthly average value ≤ 90%; daily average value ≤ 95%
Maximum wind velocity	≤ 15m/s
Applicable place for equipment	Outdoor; able to withstand the attack by wind, sand, rain and snow.

### 7.2.2. Applicable track conditions:

	Comply with the code for clearance for Argentina national wide gauge/narrow gauge railway – GVO 3234 y GVO 3236.
Gauge	1676mm/1000mm – GVO 3234 y GVO 3236.
Min. radius of curvature	190 m for broad gauge / 120 m for narrow gauge.
Maximum superelevation	160 mm for broad gauge / 110 mm for narrow gauge.
Line maximum slope	25‰ for broad and narrow gauge

## 7.3. COMPLETE VEHICLE TECHNICAL PARAMETERS

- Gauge 1000 mm /1676mm
- Wheel diameter: 915 mm
- Axle number: 4
- Bogie axle number: 2
- Single axle weight: ≤20 Tn for broad gauge / ≤18Tn for narrow gauge.
- Maximum running speed: 100km/h



<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	Date: 18/08/2015
		Page 8 de 31

- Engine rated power: 330kW x 2
- Exhaust emission standard: Euro III
- Battery 200Ah x2
- Driving mode: Hydraulic transmission - Rexroth
- Braking mode: Air brake and hand brake
- Air brake: Refer to Annex-1
- Foundation brake: Locomotive unit brake
- Coupler device: Refer Annex-1
- Height of coupler center from the rail top face: Refer Annex-1
- Weight: less than 50 Tn
- Complete vehicle dimensions (Long x Width x Height)

16000 mm x 3120 mm x 3800 mm (gauge: 1676mm) – 8435 mm load zone

16000 mm x 2820 mm x 3800 mm (gauge: 1000mm) – 8435 mm load zone

Bending strength will be verified, a report will be generated. If the present structure does not verify the proper modifications will be made.

- Maximum startup tractive effort: 95 KN - for broad and narrow gauge
- Maximum traction tonnage: 2000 tn - for broad and narrow gauge

#### 7.4. MAIN COMPONENT STRUCTURES AND THEIR PERFORMANCE PARAMETERS OF EQUIPMENT

The rail operating vehicle system configuration includes the carbody, running gear, driver cab, power system, traction driving system, brake system, compressed air system, hydraulic system, electric system and other necessary auxiliary system.

There is a driver cab at front of carbody which can be operated in both directions; the air conditioning is installed indoors and it is configured with simple domestic installations for catering and rest of 12 persons seated; the carrying platform with side wall and end wall will be set at rear part all will be abatable; the foldable hydraulic crane is set at tail of carbody.

##### 7.4.1. Carbody

The carbody is of all-steel welding structure with adequate strength and rigidity, and without any damage or permanent deformation when subjected to Refer to Annex-1.



0425473

<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	
	<i>Date:</i> 18/08/2015	
		Page 9 de 31

The underframe will be subjected to various static strength calculation and test according to EN12663-2010 standard and be provided with the calculation and test report (only test the underframe for the first wide-gauge vehicle, Refer to Annex-1); the important locations shall be subjected to NDT inspection; this underframe is the proven product which has been verified by actual operation.

The carbody has the jacking point and can meet the jacking requirements with mobile jacking frame.

The carbody has the lifting point and jacking re-railing point, and can meet the requirements for integral lifting of single section, and lifting with both hooks.

#### Other design requirements for carbody

- All parts of driver cab and carbody cover have excellent sealing and rainproof design; no water ingress into driver cab is permitted under all climate conditions.
- The driver cab, carbody side wall and ceiling are filled with thermal insulating, inflaming retardant, non-toxic and environment friendly materials. Refer to Annex-1.
- Coupler and air duct
- The coupler used by rail operating vehicle can be reliably coupled with existing vehicles in Argentina (Refer to Annex-1).
- The rail operating vehicle has the air duct with standard joints (NEFA 563 and 907); the air duct joint is reliably sealed; when the rail operating vehicle is towed, the air will be supplied by the tractor vehicle.
- The coupler and air duct shall be designed to facilitate the coupling and decoupling by dispatching personnel.

#### 7.4.2. Composition and parameters of running gear

##### Running Gear structure

1. The vehicle running gear adopts bogie structure, axis arrangement is B-B, wheel diameter is 915 mm. The bogie is divided into: frame structure, single stage suspension, body supporting device, axle gearbox suspension and basic brakes.
2. Each bogie is composed of two driving axles.
3. Primary suspension adopts round spiral springs.
4. Vertical oil pressure damper.



<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	
	<i>Date:</i> 18/08/2015 Page 10 de 31	

5. Each axles box will adopt two sets of spiral springs. The weight of rail car is evenly distributed on the wheel sets though the springs of axle. Guidance is with Z type arms.
6. Secondary suspension adopts, horizontal oil pressure damper.
7. Basic brake adopt the monoblock unit brake.

(1) The running gear of this vehicle consists of hydraulic transmission, axle gearbox assembly and wheelset assembly. The running gear components of entire vehicle are installed symmetrically to the vehicle centerline. The proven tie rod is used between running gear and carbody to fulfill the transmission of tractive effort.

- Journal box assembly
- Axle gearbox assembly
- Wheelset assembly

(2) Driving mode of running gear: the engine connects with the hydraulic and mechanical gearbox via the torque converter; the hydraulic and mechanical gearbox connects with the axle gearbox via universal joint driving axle; the power output from the engine is converted into power to drive the wheel rolling through a series of driving components.

(3) Connection unit of running gear with bogie and suspension unit

The running gear axle box body is designed with tie rod base, spring seat and oil damper; the related upper tie rod base and lower tie rod base are designed on the carbody; the tie rod is aligned and installed between related tie rod bases; the suspension is of primary suspension unit consisting of flex coil spring and hydraulic damper to enable elastic location of wheelset and therefore ensure favorable lateral and longitudinal recovery rigidity between wheelset and carbody; the flex coil spring consists of inner spring and outer spring.

(4) Axle number of equipment: 4

(5) Number of driving axle: 4

(6) Wheelset: The wheelset consists of the axle and two wheels. The wheel is of integral rolling steel wheel. The oil-filling press installation is used for assembly for ease of overhaul and extension of wheelset service life. The driving gear is assembled with hot casing method; there is no keyway on the axle body to effectively avoid the occurrence of shaft breakage accident. The axle material is the LZ50 steel complying with TB/T2945-1999 standard.

(7) Axle box structure and positioning

<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	
	Date: 18/08/2015 Page 11 de 31	

The axle box adopts the axle box tie rod positioning structure for independent suspension; there are total 4 axle boxes for complete vehicle. It mainly consists of inner/outer end cover, axle box body, cylindrical rolling bearing and dust ring. The axle box body is of casting steel, mounted with new type bearing for maintenance and assembly. The journal box structure is as shown in figure 5:

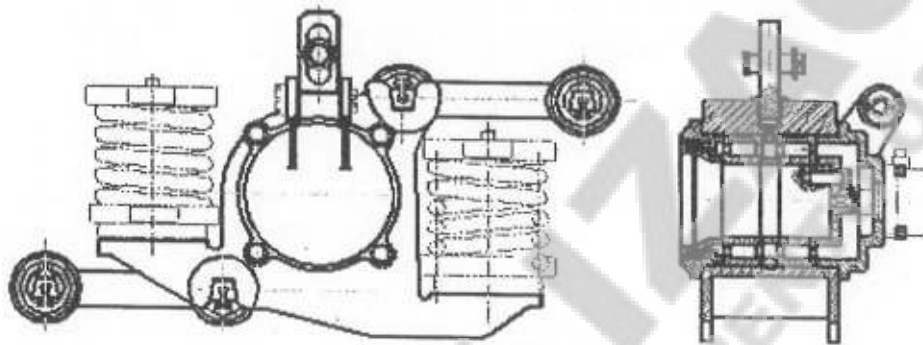
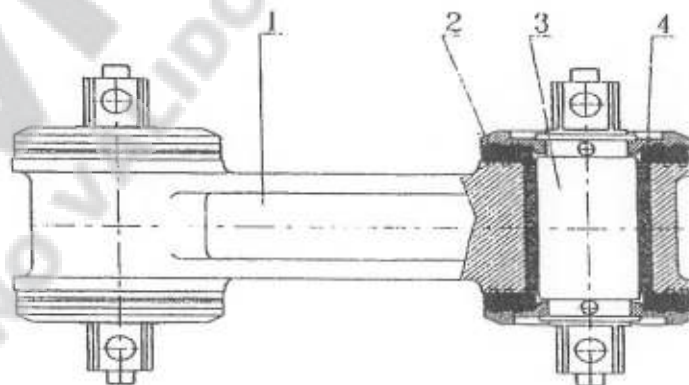


Figure 5 Journal box assembly

The speed/mileage sensor is mounted on front axle left end axle box cover; the special grounding device is mounted on front axle right end cover.

The axle box tie rod structure is shown in figure 6; there is rubber sleeve at tie rod pin junction and the rubber gasket at both ends of pin. Since the tie rod positioning method with rubber joint is used, the axle box can enable relative displacement in several directions through the radial, axial and torsional elastic deformation of rubber joint, and therefore enable the elastic coupling between wheelset and underframe.



1. Tie rod body      2. Rubber gasket      3. Mandrel      4. Rubber sleeve

Figure 6 Axle box tie rod

<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	Date: 18/08/2015 Page 12 de 31

(8) Bearing: Cylindrical rolling bearing

(9) Speed sensor: adopt the speed sensor special for rail operating vehicle.

(10) Axle gearbox

The axle gearbox is of horizontal double-stage gearbox. The bearing adopts gear pump forced lubrication method; the splash lubrication method is used for lubrication between gears. Driving stage number: 2 stages. The axle gearbox is as shown in figure 7:

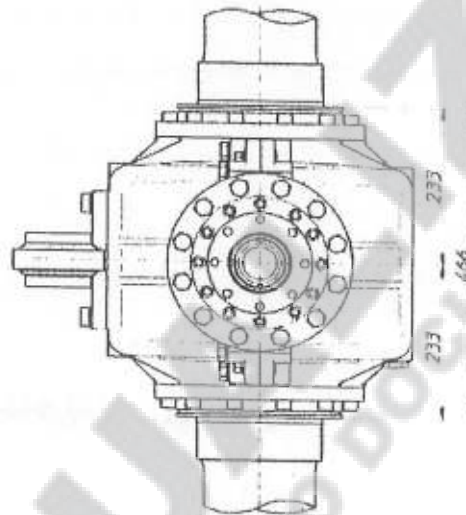


Figure 7 Axle gearbox

(11) Wheel and tread

The vehicle adopts monoblock rolling steel wheel; the wheel tread profile shall comply with the requirements of Party A and the detailed model will be determined during design liaison.

## 7.5. DRIVER CAB

### 7.5.1. Design requirements of driver cab

1. It can be operated at both ends; the driver position is at the left side and the co-driver position is at the right side.
2. A door is set at rear end of driver cab to the cargo carrying area.
3. Seating capacity: 12 persons (including driver).



<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	Date: 18/08/2015 Page 13 de 31

4. The safety glass is arranged for front/rear window and left/right door window of driver cab to meet the requirements for operation lookout by the driver; the windscreen adopts electric heating glass with sunshade roller shutter. Refer to Annex-1.
5. The water spraying type wipers are set at front and rear windows of driver cab.
6. The noise in driver cab after all doors and windows are closed shall be no more than 80dB, at normal load without trailed cars.
7. The electric fan is set above the driver seat. The embedded air conditioning with cooling and heating capacity is installed indoors; temperature range; 16°C-26°C.
8. The instrument lamp is set on driver cab instrument panel; the indications of driver cab instrument and indication lamp can be clearly visible at the driver operation position under the sunshine and with the indoor ceiling lamp closed at night.
9. The artificial lighting is configured in driver cab and its illuminance can meet the requirements for working staff inspection and driver operation.
10. Configure a tool box and prove a set of maintenance tools with the vehicle.
11. There is a superior sealing, sound insulation and thermal insulation environment in the vehicle; the thermal insulation materials in vehicle are of inflaming retardant materials.
12. The driver cab is of sound and thermal insulation; the thermal and sound insulation materials shall comply with the fireproof and safety requirements. Decorating materials and indoor air limit of harmful substance for railway locomotive and vehicle Refer to Annex-1. Technical specification of flame retardant materials for railway locomotive and vehicle, and be no harmful to the human body during operation and inspection. The thermal insulation materials for driver cab are those proven in railway applications; there is aluminum foil coating on outer surface of thermal insulation material; the thermal insulation materials also have the sound absorption performance.
13. There 2 groups of fire extinguishment apparatus in driver cab for ease of use.
14. The personnel riding facilities are set in the vehicle.
15. Cabin rear end has one door to the loading area
16. The cockpit window is set before and after water spray type wiper.
17. Cab for artificial lighting, its illumination can meet the needs of the staff maintenance and driver operation.
18. A toolbox to contain 1 set of maintenance tools.





<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	Date: 18/08/2015
		Page 14 de 31

19. The car should have good sealing, sound insulation, heat preservation effect, the car's heat preservation material with flame retardant materials.
20. Cars at both ends under the head lamp, lamps and lights, console Settings instrument lights, driving the indoor set lighting (using cold light source).
21. One set of Diesel –generator (380V, 50HZ) with one set of power distribution device, which has sockets to supply power. The diesel –generator share the same oil tank with the diesel engine. Each side of the loading crane consist of 380V(2) and 220V(1) sockets.
22. Main frame adopts advanced welding technology and cleaning rust process.
23. The driver seat could be adjusted front and back, up and down, and the angle of inclination for chair back is also adjustable. So the driver could choose the suitable operating position.
24. The work station of the vice driver has horn button.
25. The cab has two front windows, four side windows, two rear windows, a back door, all equipped with safety glass, the front window and rear window equipped with electric wiper which could meet the needs of the locomotive observation.
26. Inside the cab will be installed: glass holders, electric heater for kettle.

#### 7.5.2. Driver cab communication and other requirements – Refer to Annex-1

1. The electric horn button is mounted in driver cab.
2. A set of onboard wireless communication devices communicating with surroundings for use in driver cab is mounted in driver cab, the installation issues will be determined during design liaison. Refer to Annex-1
3. The cameras are mounted at both ends of vehicle; the driver cab is mounted with color LCD video monitor; during reverse driving, it is possible to view and monitor the track line behind the vehicle from the driver cab. Refer to Annex-1
4. The glass window design in driver cab ensures good lookout and viewing conditions; it shall adopt the safe glass materials complying with Refer to Annex-1, the driver cab glass window is mounted with water spraying type double-speed electric wiper and demisting unit; the rear view glass is mounted at both ends out of the vehicle.
5. The facilities such as attached tool box, hat hook and luggage rack are set in driver cab.
6. The door for boarding and alighting is set in driver cab; the door is configured with lock.



<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	Date: 18/08/2015 <hr/> Page 15 de 31

7. The handrail, walkway and steps in driver cab and machine room shall meet the safety requirements; the steps shall be subjected to the anti-skidding treatment.

## 7.6. POWER SYSTEM

### 7.6.1. Engine configuration and parameters

The vehicle is equipped with 2 Deutz electric injection diesel engine; the exhaust emission complies with "EURO III" emission standard; this engine is widely used in road and railway equipment with excellent performance. The diesel engine is mounted with the protection and display apparatus including speed sensor, water temperature sensor, oil temperature sensor and oil pressure sensor. The engine profile is as shown in figure 8:

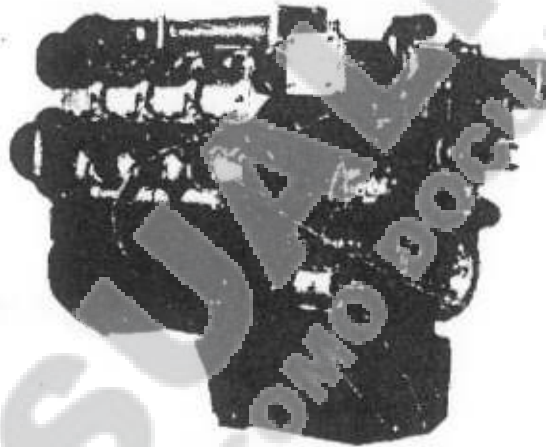


Figure 8 Engine profile drawing

The engine has following features:

- Water cooling type V6 engine; each cylinder so arranged will inter-coordinate with low noise and smooth operation. The V-type engine length and height dimensions are small and the arrangement is convenient.
- Turbo charging and pressurized air cooling.
- Four-valve technology; the torque in low to middle speed range of 4-valve internal combustion engine crankshaft is normally 10%-15% higher than that of 2-valve internal combustion engine, and 10%-20% in high speed range.
- Wet type cylinder liner; long oil replacement interval to cut down the operation and service cost and enhance the device availability.



<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	Date: 18/08/2015
		Page 16 de 31

- It has superior cold start performance under extreme conditions.
- Stable and reliable mechanical injection system.
- The engine design meets the operation requirements for various oil products under various conditions in global.

#### Engine parameters:

- Brand: Deutz
- Model: TCD2015V6
- Place of origin: German
- Structure type: V6
- Cylinder diameter x stroke: 132mm x 145mm
- Displacement: 11.9L
- Rated speed: 2100rpm
- Rated power: 330KW
- Maximum torque/speed: 2000Nm/1300rpm
- Idling speed: 600rpm
- Fuel consumption under rated power: 210g/kwh

#### 7.6.2. Transmission

The transmission is made with a hydrostatic system with pump and motor of the brand Rexroth or Eaton.

#### 7.6.3. Control, monitoring and auxiliary system of diesel engine

1. There is engine working status display in the driver cab and it can conveniently control the diesel engine; it has the alarm function in case of operation failure of diesel engine, and it can automatically and manually shut down.
2. Other design requirements of power supply
  - The diesel engine connects with the frame via elastic bearing; the vibration isolation unit is set to reduce the vibration and noise.
  - The fuel tank capacity is 1000L and it can meet the requirements for operation; the design of oil filler port is convenient for oil filling and configured with filtering device; the bottom of fuel tank is of inclined type and there is blow-down valve at the lowest position for ease of draining. The fuel tank gear is as shown in figure 9:

<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	Date: 18/08/2015 Page 17 de 31

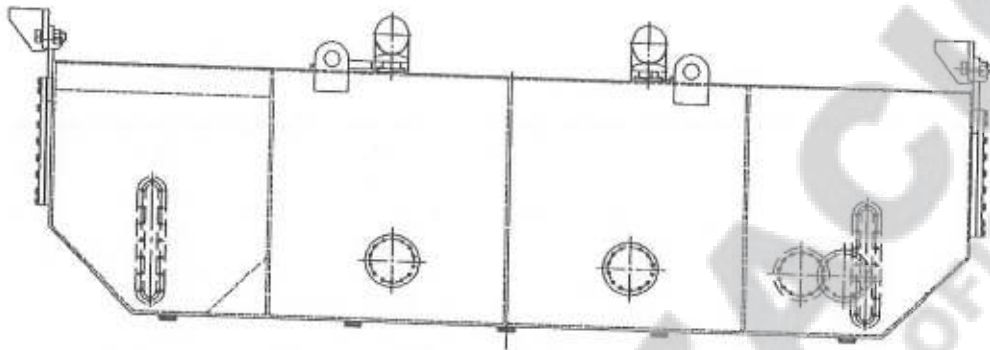


Figure 9 Profile drawing of fuel tank

- The filtering unit for diesel engine fuel system and lubrication system shall be easy for inspection and replacement of filter core; the fuel system filter elements adopt the products with internationally famous brand with proper installation positions for ease of maintenance and repair.
- The intake system of diesel engine is configured with effective and easy-for-maintenance air filter; the silencer is set at the diesel engine exhaust outlet and the exhaust will not affect the devices, personnel and environment along the line.

### 3. Intake/exhaust unit

The engine intake unit consists of air pre-filter, air filter, elastic element and pipeline.

The engine intake is arranged under the car; a air pre-filter is set at the air filter intake to filter the large particles in air. The filtered air flows into the engine after the secondary filtering by the air filter. The rubber elbow connection is connected in engine intake pipeline to cut down the mechanical vibration transmitted from engine; the hoop is used to connect the rubber elbow and pipeline.

The exhaust unit consists of exhaust pipe, hoop, exhaust joint, metal bellow, exhaust pipeline and silencer. The silencer is mounted under the vehicle and necessary thermal insulation measures are taken; the metal bellows are of vibration isolation elastic units.

### 4. Water cooling system

The engine water cooling system consists of water radiator, expansion water tank, fan, driving unit and water pipeline.

The expansion water tank is at the highest position of engine water cooling system; it functions providing the space for thermal expansion of the cooling water, and also for routine water replenishment, steam and water draining.

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<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	
	Date: 18/08/2015	
		Page 18 de 31

5. Adopt maintenance free battery; the main application of battery is to provide starter current while starting. It can automatically charge after engine starts up; the battery can meet the requirements for use of onboard radio, besides the capacity requirements for normal operation of vehicle and emergency treatment.

- Number: 2 groups
- Capacity: 200Ah

#### 7.6.4. Supplemental instruction of power system

1. Connect a transfer case on one of engines as the power output port for air compressor, radiation system and crane; the transfer case is selected as the product from internationally famous STIEBEL Company.
2. The engine emission indicators meet Euro III standard and it needs no tail gas clean-up and water washing device.
3. The exhaust emission indicators at low speed and idling speed of engine shall meet Euro III standard.

#### 7.6.5. Tractive effort driving system

The power and driving system consists of engine, hydraulic system, transfer case and drive shaft.

#### 7.6.6. Brake system – Refer to Annex-1

The following specification will be adapted to the Knorr Bremse equipment as require the mentioned Annex. The performance of the brake will be at least the same described in this paragraph. The brake system will provide hoses at both ends of the brake pipe (BP) in order to operate the brake of the trailed cars; this feature is similar to a Locomotive.

The rail car operating vehicle has the service braking, emergency braking and parking braking functions.

#### 7.6.7. Brake equipment structure – Refer to Annex-1

The air brake system consists of air supply unit, brake and foundation brake unit.

1. The air supply unit has the compressed air complying with the quality, pressure and flow requirements. It mainly consists of air compressor, double tower type dryer, main air reservoir, air filter and oil-water separator.
2. Foundation brake is of unit brake.

<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	
	Date: 18/08/2015 Page 19 de 31	

3. The air pipeline system adopts stainless steel; the brake hose assembly is set at front and rear ends of locomotive for the multi-operation with other engineering vehicles.

#### 7.6.8. System components and requirements – Refer to Annex-1

##### 1. Air compressor

Adopt a hydraulically driven air compressor.

2. The pneumatic brake is Knorr Bremse according to Annex I

3. Air cylinder

The volume of main air reservoir is about 500L and it can meet the operation requirements of long and large slope.

The main air reservoir has the automatic drain valve, and the cutout cock is added before the automatic drain valve to prevent the main air reservoir leak due to failure of automatic drain valve; the cutout valve is made from stainless steel metal materials.

The pipeline dust filter is assembled on main air reservoir inlet pipeline; the pipeline dust filter screen material is of stainless steel.

The separate cock is set on the pipeline of main air reservoir to the pipeline of each component to control the air pipeline for troubleshooting and pipeline maintenance.

Except the main air reservoir, other air cylinders have the manual drain valve; the manual drain valve is made from stainless steel metal materials.

Once completed the pre-acceptance, the inspection period of validity of main air reservoir safety valve shall be guaranteed as at least one year.

##### 4. Air pressure gauge

The double needle pressure gauge for main air reservoir and equalizing reservoir, the double needle pressure gauge for train pipeline and brake cylinder, double needle pressure gauge for operation air cylinder and control air cylinder on each control console are used to display related pressures.

5. Besides the pressure gauge, the brake system will be mounted with pressure sensor; the detected pressures include those for main air reservoir, train pipeline and braking cylinder; the pressure detected by the sensor and pressure error displayed on pressure gauge shall be no more than 5 kPa.

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<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	
	Date: 18/08/2015 Page 20 de 31	

## 6. Brake equipment

### Locomotive unit brake.

- It has the automatic and manual adjustment function of brake shoe clearance;
- The locomotive unit brake is easy for installation and replacement, and also has the measures to prevent the loose of mounting bolts.

### Parking brake

- Adopt spring braking, release by charging the air; it is also equipped with mechanical and manual release function, and also the manual release unit;
- Each wheelset will be equipped with a parking brake unit; the brake shoe is of composite brake shoe.
- There is a parking brake button on driver cab operation desk; it can be displayed on operation desk when applying the parking brake.
- Design requirements: at 25 ‰ slope test conditions, without use of other brake, the parking brake can stabilize the locomotive.

## 7.6.9. Safety protection

### 1. Operation pressure of main air reservoir

The working pressure range is 800 kPa; the set pressure of safety valve is 950 kPa.

The safety valve is mounted in main air reservoir and the action pressure value is  $950 \pm 20$  kPa. In case of failure of pressure regulator and out of control of operation of air compressor, the safety valve can timely activate the exhausting; at this time, even if the air compressor continuously runs, the main air reservoir pressure will not rise.

2. The pipeline before each braking cylinder is equipped with a full-sealing cutout cock; if necessary, it can be used to cut off the pressure air passage to this brake cylinder.
3. When applying the parking brake, the locomotive can not move; the parking brake applies the alarm indication in case of forced engagement of driver.

### 4. Emergency brake system

In case of emergency braking, it can not release before completely stop of locomotive (zero-speed interlock to prevent re-start during locomotive deceleration);

20  
18/08/2015

<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	
	Date: 18/08/2015	
		Page 21 de 31

For emergency braking for any cause, the locomotive must be braked with emergency braking rate.

The diesel engine of locomotive shall immediately and automatically unload;

5. When the dust plug chain naturally sags, the lowest end of dust plug will be above the lowest end of cowcatcher.

6. The manual emergency vent valve is set in driver cab. The emergency vent valve is set beside the co-driver in driver cab. It is used for emergency operation in case of emergency.

#### 7.6.10. Compressed air system

1. The technical parameters are as follows:

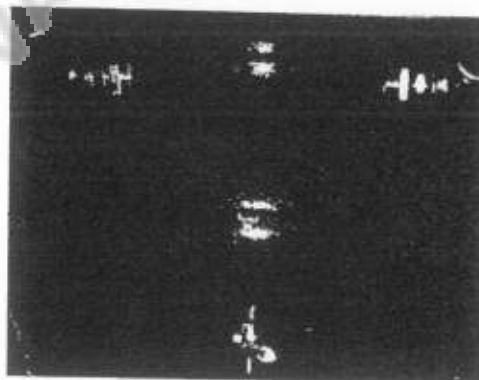
- Air compressor air supply volume: 1300 L/min
- Air pressure: 8 bar
- Air compressor hydraulic system flow: 38 L/min
- Air compressor hydraulic system pressure: 210 bar

2. Pressure control and safety valve of compressed air system

- Equip with air compressor pressure regulator to maintain the working pressure within specified range;
- When the main air reservoir pressure achieves 800 kPa, the air compressor can automatically stop operation;
- When the main air reservoir pressure is less than 700 kPa, the air compressor can automatically start;
- The air compressor has the manual air supply control switch to artificial control;
- The air compressor is equipped with no-load start valve to enable favorable startup performance of air compressor;
- The no-load start valve is equipped with bypass switch; in case of failure of no-load start valve, it can conveniently cut it off.

3. Oil-water separation and air drying unit

Oil-water filtering unit (the profile is shown in figure 17)



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Trenes Argentinos Operadora Ferroviaria	SUB GERENCIA DE VÍA Y OBRAS	
	ANNEX 4	Date: 18/08/2015
		Page 22 de 31

- The pipeline between air compressor and dryer sets the oil and water filtering unit used to eliminate the liquid state (oil, water) particles and dusts in compressed air from the air compressor, and therefore relieve the pollution of desiccant by the absorbed load and oil particles in air dryer.
- The oil-water separator is equipped with the drain outlet to bottom of car and the draining is controlled with cutout cock; the drain port will not pollute the undercar devices.

Air dryer (the profile is shown in figure 18)

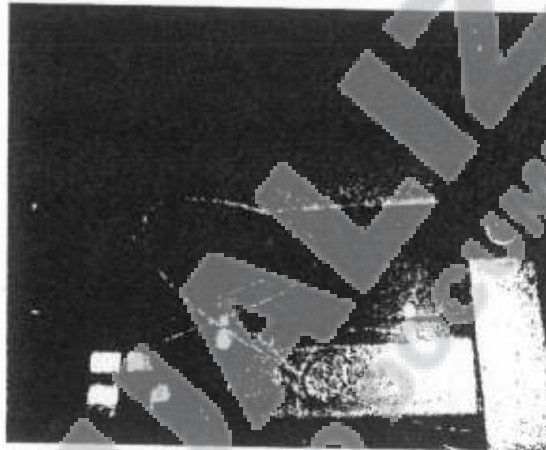


Figure 18 Air dryer

- 1) The air dryer and its parts & components comply with the regulations, absorbent Compressed Air Dryer on Locomotive and Power Car.
- 2) Adopt double-tower type air dryer;
- 3) Under rated flow of dryer, the compressed air quality from the outlet of dryer shall meet following requirements:
  - ✓ The solid particle grade of compressed air complies with the grade 3 specified in table 2 in ISO 8573-1:2001 (E) (grade 4 for that at air inlet); the particle dimension is less than or equal to  $5\mu\text{m}$ ; the concentration is less than or equal to  $5\text{mg}/\text{m}^3$ .
  - ✓ The humidity grade of compressed air complies with grade 2 specified in table 3 in ISO8573-1:2001(E).
  - ✓ The oil content grade in compressed air complies with grade 3 specified in table 5 in ISO8573-1: 2001(E) (the compressed air oil content grade at air inlet is grade 4).

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<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	Date: 18/08/2015
		Page 23 de 31

4. The regeneration air consumption rate of dryer is less than or equal to 18%; it is the ratio of difference of volumetric flow between dryer air inlet and outlet to the dryer air inlet volumetric flow.
5. When the compressed air pressure at air inlet of dryer is 800 kPa, the pressure loss at air inlet and outlet of dryer is less than 30 kPa.
6. The valve products used for dryer are of rubber sealing structure; the rubber temperature resistance range meets the requirements of -55°C - +80°C.
7. The dryer sets the air outlet check valve used to block the compressed air return after dried.
8. The bypass pipeline is set on the dryer; if the dryer cannot normally work in case of failure, it is possible to cut off the dryer and enable the compressor air direct flowing to the main air reservoir without through the dryer, and not affect the air supply of locomotive.
9. The dryer is equipped with the view port of desiccant status for ease of inspection of dryer status.
10. The protection grade of dryer is IP54. If mounted outdoors, the enclosure protection class is IP65. The definition of protection grade complies with the regulations in GB/T 4208.
11. All the drain valve external is equipped with riggers.

## 7.7. HYDRAULIC SYSTEM

### 7.7.1. Composition of hydraulic system

The hydraulic system in this vehicle provides the power for onboard crane, cooling unit and air compressor. The onboard crane oil circuit makes use of a set of operation hydraulic system. The cooling unit is of two sets of independent cooling hydraulic systems. The air compressor is a set of independent hydraulic system.

The hydraulic system consists of hydraulic oil tank, hydraulic pump, hydraulic motor, hydraulic valve, action cylinder and filter; the hydraulic system is of integrated design; the seal is reliable without any oil leak; the hydraulic system pipeline and unit feature tidy, reasonable and regular arrangement for ease of access.

The hydraulic circuit has an anti-knock pressure gauge to facilitate observation of pressure change during pressure adjustment and operation. All solenoid directional valves can be conveniently and manually operated.



<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	Date: 18/08/2015 Page 24 de 31

### 7.7.2. Other design instructions for hydraulic system

The pressure measurement points and measurement units are arranged on main parts of hydraulic system.

The pipeline in each part will be differentiated with different colors according to different systems and functions.

The hydraulic system has the filtering device, which can conveniently replace the filtering unit without draining the hydraulic oil; at same time, it can drain out the hydraulic oil with the rail operating vehicle at horizontal position and under gravity effect.

The hydraulic system has complete protection measures; each driving cylinder piston rod has the protection sleeve; the hydraulic hose and hydraulic system actuators have favorable protection measures for fireproof and anti-scratching.

The selected hydraulic oil meets the operation requirements of rail operating vehicle; it shall adopt the famous brand hydraulic oil for easy of procurement in Argentina. The brand will be REXROTH or PARKER.

The hydraulic system shall have complete fire prevention and control measures.

This crane will be capable of hoist 10 Tm in any direction with the arm extended. A pair of side legs will be added in order to ensure this feature without degrading safety.

Each side of rail car has one set of hydraulic system quick connect sockets of ½" nominal size.

- Pressure 138 Bar
- Flow 38 l/min

## 7.8. ELECTRIC SYSTEM

### 7.8.1. Electric system composition and design requirements

The electric system of this vehicle is mainly divided into DC24V DC control system and AC system.

DC24V DC control system mainly consists of power supply (including the battery set and charger generator of this vehicle), diesel engine starting speed-regulating control, hydraulic transmission case direction/gear change control, instrument monitoring, lighting and wiper, and other auxiliary unit control.

The AC system mainly consists of diesel generator set and air conditioning.

1. DC control system



0425/18

<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	Date: 18/08/2015
		Page 25 de 31

The power supply of DC electric system of rail operating vehicle adopts parallel supply of DC28V DC generator provided with the main engine and DC24V battery, which are of negative grounding mode.

- Starter: The starter is of DC self-excitation type and it mainly functions as the starting diesel engine.
- Generator: The generator is of integrated type of rectification and voltage regulation; it is the main power supply of DC system of this vehicle. During normal operation, it will supply all electric equipment (except starter) and charge the battery.
- Battery: The main application of battery is to supply strong current to the starter. The vehicle is equipped with two sets of 200 Ah and DC24V maintenance free lead-acid battery; the battery shall be charged and maintained during operation according to battery instructions.
- The vehicle is equipped with a boosting power supply module to increase DC24V power supply voltage refers to Annex-1 for use of onboard wireless unit.

## 2. AC electric system

The AC system mainly consists of diesel generator set, air conditioning and electric heater.

- Diesel generator set, air conditioning, electric heater

This vehicle is installed with Yamaha 3-phase diesel generator set EDL12000TE to provide AC power supply for air conditioning and electric heater.

The driver cab in this vehicle is installed with 4 sets of Haier air conditioning to ensure the driver cab temperature between 16°C and 26°C.

Each side of the loading crane will be provided with two 380 VAC three phase sockets and one 220VAC mono phasic socket. All be of the outdoors type.

- Generator set control cabinet

The AC control unit, protective unit and operation switch are collectively installed in generator set control cabinet.

## 3. Lighting and lamps

The complete vehicle is equipped with the lighting and indicator lamps complying with the equipment operation requirements, including: headlamp, auxiliary lamp, indicator lamp, flash alarm lamp, driver cab lamp, driver console instrument lamp; adequate lighting lamps are set outside of the car body and under the frame for inspection/maintenance of devices at night; the lamps shall be of international brand, which can be procured in Argentina market.

The illuminance of headlamp will be capable of illuminating a person, located at the axis of the rail at 200 m.

<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	
	Date: 18/08/2015	
		Page 26 de 31

#### 4. Protection grade of electric system and other safety instructions

The outer lighting lamp, hand lamp socket and other electric devices of rail operating vehicle have proper rainproof design.

The safety protection of electric system meets international standard requirements; the units and lines of different voltages have the voltage mark; the protection facility and obvious safety alarm identification are provided on the device with electric shock hazard; the manufacturer shall describe the safety protection measures of electric system in bidding document in detail.

The protection grade of electric devices in vehicle shall be no inferior to IP54.

The protection grade of other electric devices out of the vehicle shall be no inferior to IP65.

The protection grade of driver cab air conditioning (out of the vehicle) shall be no inferior to IP65.

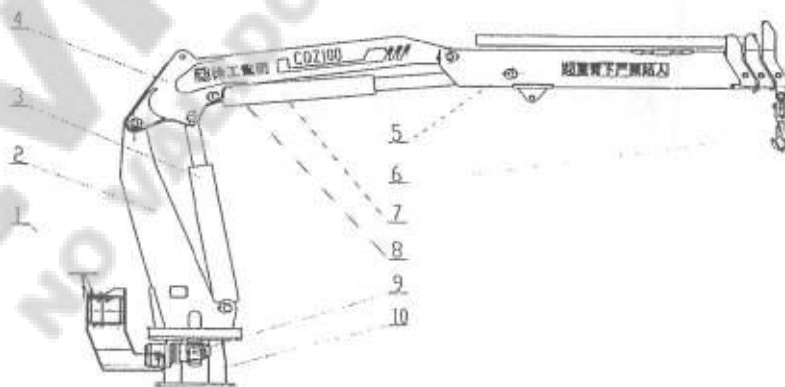
#### 7.9. CRANE

Loading crane can be remote controlled by radio system and beside the normal hydraulic levers.

##### 7.9.1. Names of main components of crane

Refer to the figure below and it will help the identification of name of each part defined in this manual.

- |  |  |                    |
|--|--|--------------------|
| 1. Operation system                    | 5. Outer arm assembly                    | 9. Slewing gear    |
| 2. Turntable                           | 6. Lifting hook                          | 10. Foundation bed |
| 3. Primary variable amplitude cylinder | 7. Secondary variable amplitude cylinder |                    |
| 4. Inner arm                           | 8. Identification assembly               |                    |



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Trenes Argentinos Operadora Ferroviaria	SUB GERENCIA DE VÍA Y OBRAS	
	ANNEX 4	
	Date: 18/08/2015	Page 27 de 31

### 7.9.2. Details of crane performance parameters

#### Operation parameters

The table below provides the operation performance parameters of CQZ100A crane.

Category	Item	Unit	CQZ100A
Lifting performance parameters	Maximum lifting moment	T.m	10
	Minimum operation amplitude	m	2.1
	Maximum operation amplitude	m	8.01
	Maximum lifting height	m	10.08
	Crane jib length	m	4.44~8.01
	Slewing range	°	Full circle swinging
	Variable amplitude range	°	0~75°
	Máximum rated lifting quality	Kg	5000
	Hydraulic system rated pressure	MPa	28
	Hydraulic system maximum flow	L/min	40
	Crane dead weight	Kg	1612

Loading crane can be remote controlled by radio system.

#### Hydraulic system

Parameter item	Unit	Value
System flow	l/min	40
Maximum operation pressure	MPa	28
Recommended power	KW	25
Ambient oil temperature range	°C	-25°C~+50°C
Hydraulic oil tank capacity	L	90

#### Speed of action

The table below provides the technical parameters for operation time of CQZ100A crane: (refer to attached drawing)

No.	Type	Item	Unit	Value	
1	Operation speed parameter	1st section arm extending time	Full-travel	S	16.2
			Full-travel	S	6
2nd section arm extending time		Full-travel	S	13.5	
		Full-travel	S	6.6	
3		Outer arm variable amplitude	Full-travel arm	S	34.9

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<b>Trenes Argentinos</b> <i>Operadora Ferroviaria</i>	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	
	Date: 18/08/2015 Page 28 de 31	

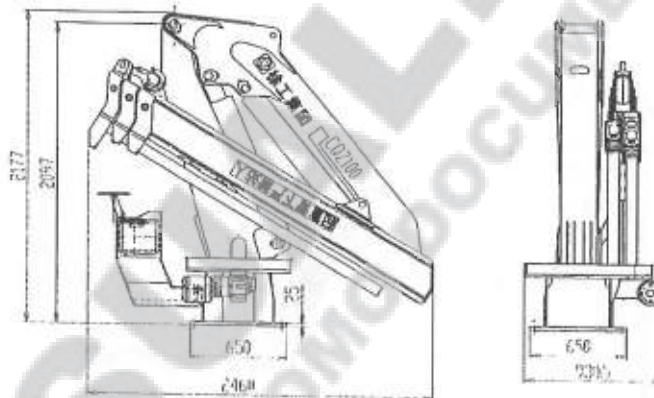
4	time	Full-travel arm	S	13.4	
		Inner arm variable amplitude time	Full-travel arm	S	38.3
			Full-travel arm	S	20.1
5	Slewing speed		rev/min	≤1.2	
6	Slewing range		°	360° Full	

Note:

1. The numerical values in the table refer to the theoretic time under no load condition of crane and rated flow of pump.
2. The slewing time refers to the time required for the crane rotating for 360°.

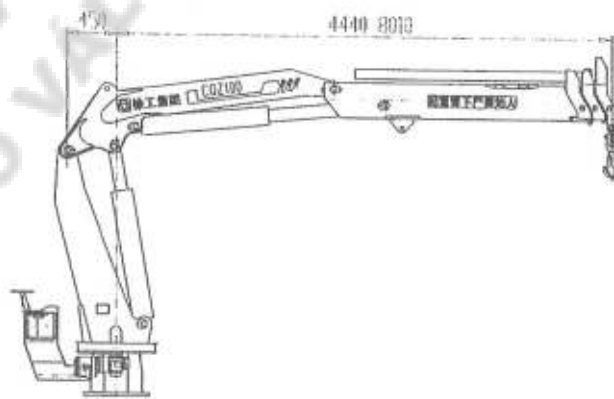
#### Overall dimensions

The figure below provides the minimum dimensions of CQZ100 crane at the full retraction position.



#### Working amplitude of crane jib

The figure below provides the minimum and maximum dimensions for full retraction and extension of CQZ100A crane at horizontal position.

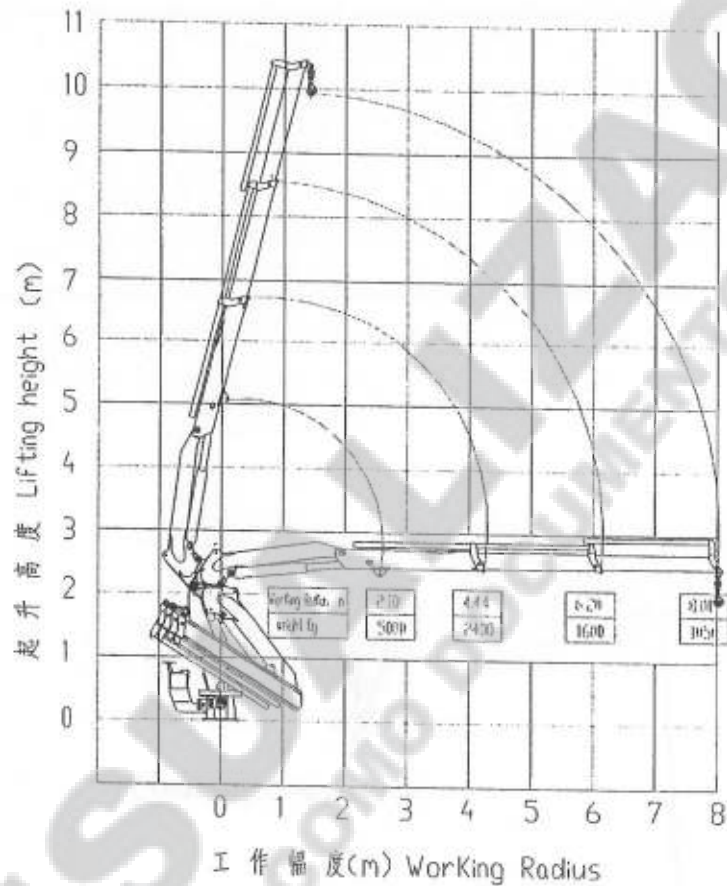


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<b>Trenes Argentinos</b> Operadora Ferroviaria	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 4	Date: 18/08/2015 Page 29 de 31

### Crane performance curve chart and lifting capacity table

The figure below annotates the performance curve chart of CQZ100A crane.



#### Note:

1. The maximum total rated load in above figure includes the weight of lifting hook and slings.
2. The load value with larger boom length shall be used when the crane jib extends between the lengths shown in above figure.





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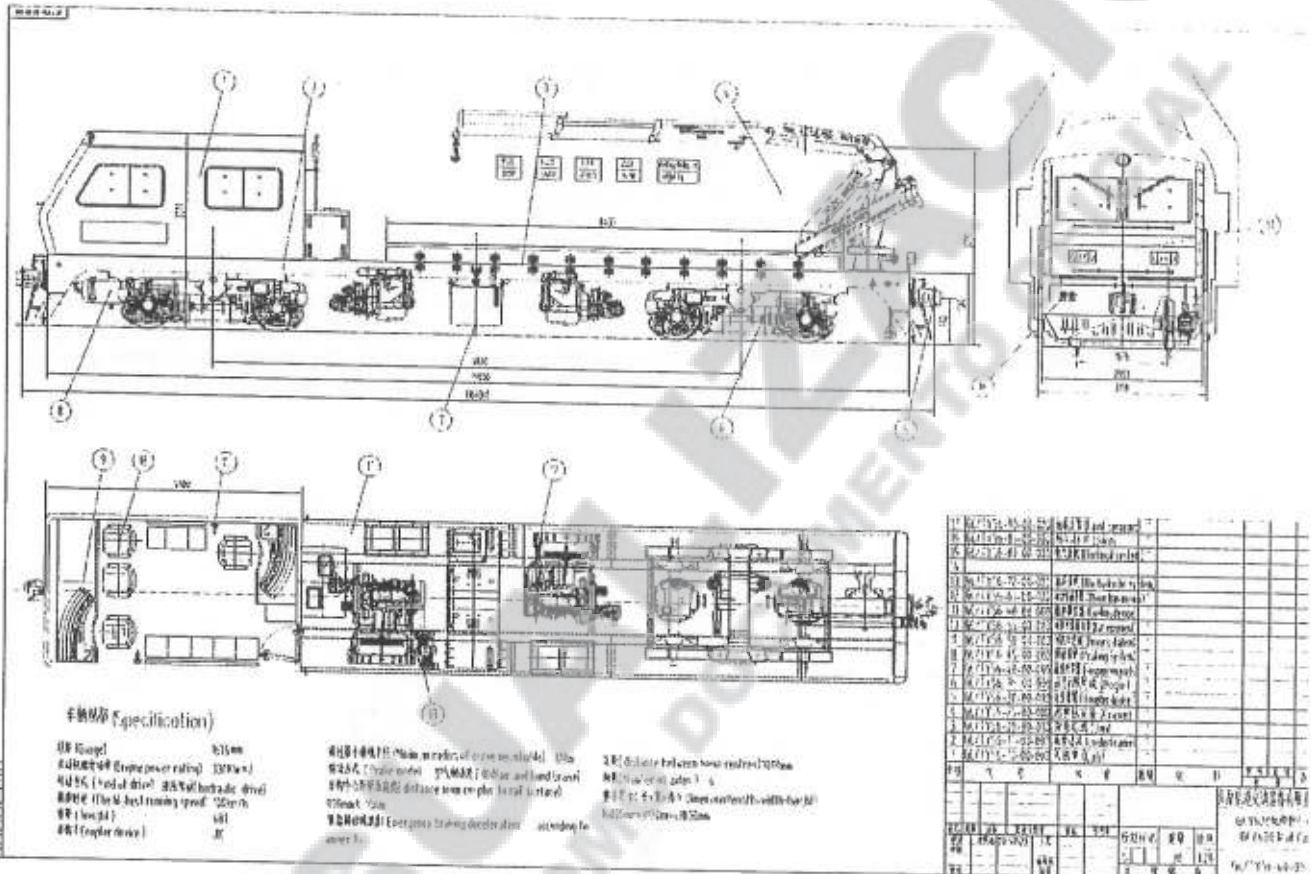
**SUB GERENCIA DE VÍA Y OBRAS**

**0425**

ANNEX 4

Date:  
18/08/2015

Page 30 de 31



**Note:**

- The Principal require the sides buffers for the wide gauge to be according to UIC 526-1 (blueprint N° NEFA 429).
- The Principal asked the coupling hook for the wide gauge to change to be according to UIC 520, CMEC coordinated and all factories finally agree to adopt UIC 520 coupling hook, while the height of hook center to rail surface is 1055,50 mm (-11 mm ; -35mm).

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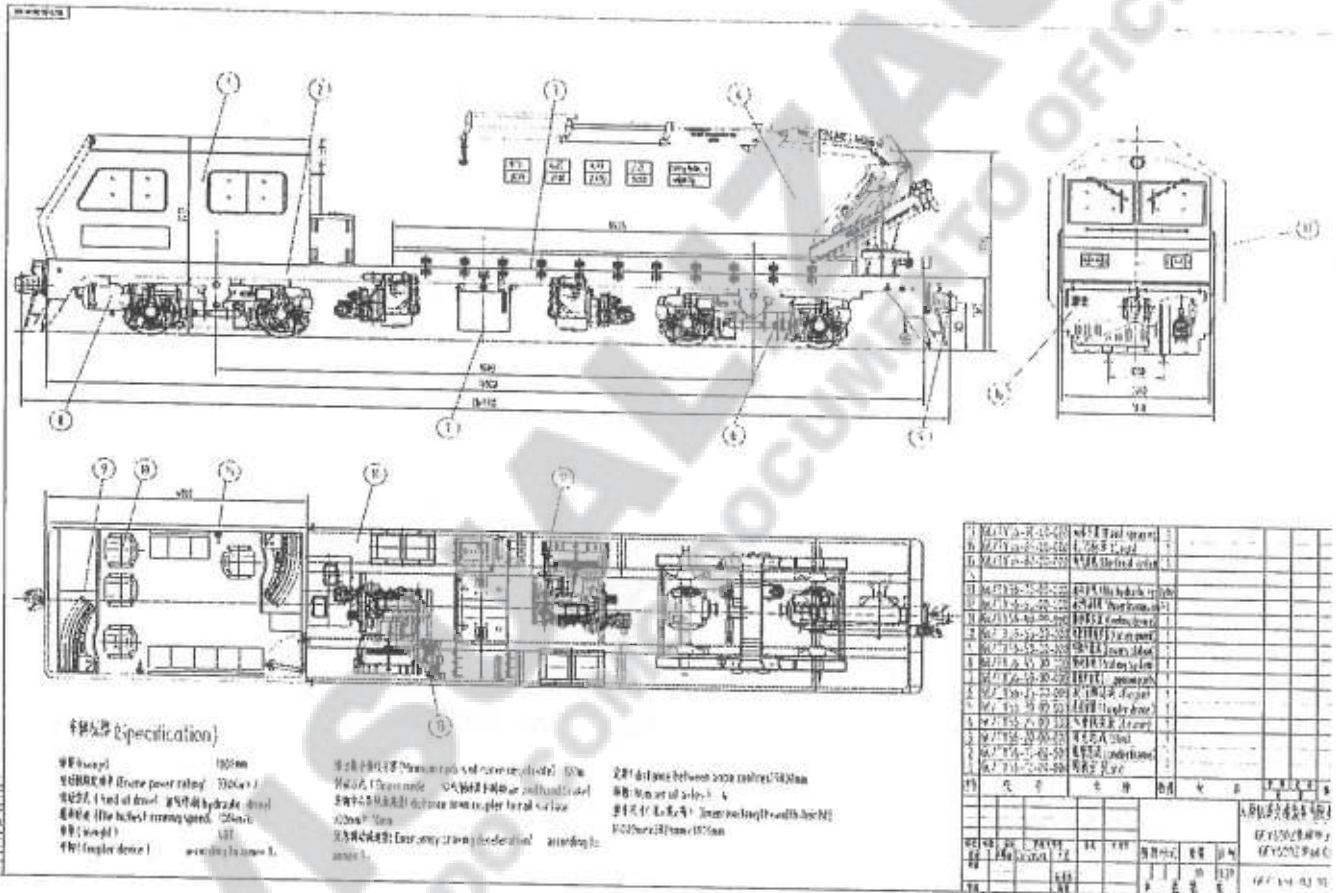
**Trenes Argentinos**  
 Operadora Ferroviaria

**SUB GERENCIA DE VÍA Y OBRAS**

ANNEX 4

Date:  
 18/08/2015

Page 31 de 31



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# ANNEX 5

## RAIL FLAW DETECTION AND MEASUREMENT MACHINE



Ing. MARTIN DE BON  
SUBGERENTE DE VIAS Y OBRAS  
OPERADORA FERROVIARIA  
SOCIEDAD DEL ESTADO



Index

1. EQUIPMENT TECHNICAL SPECIFICATIONS ..... 3

2. LIST OF FREE OF CHARGE ATTENDANT TOOLS FOR RAIL FLAW DETECTION AND MEASUREMENT MACHINE ..... 4

3. SPARE PARTS FOR TWO YEAR OPERATION OF RAIL FLAW DETECTION AND MEASUREMENT MACHINE ..... 5

4. TECHNICAL DOCUMENTS FOR RAIL FLAW DETECTION AND MEASUREMENT MACHINE ..... 5

5. TECHNICAL SERVICE PROGRAM FOR RAIL FLAW DETECTION AND MEASUREMENT MACHINE ..... 7

6. TECHNICAL TRAINING PROGRAM FOR RAIL FLAW DETECTION AND MEASUREMENT MACHINE ..... 7

7. DETAILED TECHNICAL DESCRIPTION ..... 8

PREVISUALIZACIÓN  
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SUBGERENTE DE VÍAS Y OBRAS  
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SOCIEDAD DEL ESTADO



## ANNEX 5

### 1. EQUIPMENT TECHNICAL SPECIFICATIONS

#### 1.1. TECHNICAL SPECIFICATIONS OF THE TRACK MEASUREMENT VEHICLE (RAIL FLAW DETECTION VEHICLE)

##### Main function

The track measurement vehicle can record and analyze the following data, according to EN 13848:

- Rail longitudinal level
- Rail Alignment
- Cross level measurement
- Twist
- Curvature and curve radius
- GPS positioning
- GPS data and odometer synchronization for each measurement point
- Rail profile measurement
- Video monitoring of rail parts
- Railway line environment visualization
- Acceleration measurement
- Clearance and ballast cross profile and distance to adjacent lines.
- Rail corrugation
- Ultrasonic rail flaw detection system

##### Technical data

- Engine: Cummins
- Power: 522 KW
- Fuel tank capacity about: 1400 L
- Generator: Refer to Annex-1
- Gauge 1676 mm
- Overall dimensions of the vehicle are to be confirmed after final design, to meet the clearance requirements of Argentina.
- Max. measurable height from rail surface 3900 mm – only for reference
- Min. distance between axles of bogie 2400 mm – only for reference
- Min. distance between bogie pivots 13000 mm – only for reference

- Wheel diameter 915 mm
- Driving mode Hydraulic drive
- Braking mode Air brake + hand brake – Refer to Annex-1
- Axleload not more than 20 ton
- Traveling speed: 80 km/h
- Towed speed: 80 km/h
- Measuring speed: 80 km/h
- Measuring speed of ultrasonic rail flaw detection system: 40km/h
- Minimum radius: 190 m
- Towing hook of coupler lock system: Refer to Annex-1
- Buffer: Refer to Annex-1
- Minimum working efficiency: 40 km/h
- Wheel profile EN13715-1/40
- Data measured are able to be analyzed in terms of mean, deviation or percentage, meanwhile to be classified into different grades (Alert Limit, Intervention Limit, Immediate Action Limit)
- Data localization is represented by GPS and wheel meters.
- Output representation will be visualized by software, and different groups of parameters can be represented separately by user setting.

## 2. LIST OF FREE OF CHARGE ATTENDANT TOOLS FOR RAIL FLAW DETECTION AND MEASUREMENT MACHINE

The following list is preliminary, for reference only, and the final list will be determined after final design is confirmed by the Principal.

### 2.1. RAIL FLAW DETECTION AND MEASUREMENT MACHINE

The following chart is a free of charge tool list for one rail flaw detection and measurement machine (for reference only)

No.	Name	Quantity
1	Short circuit copper wire	1
2	Multimeter	1
3	Thin flat file	1
4	Thin triangle file	1
5	Thin half-round file	1



6	Fitter's hammer	1
7	Inspecting hammer (with handle)	3
8	Electrician knife	1
9	Metallic tape	1
10	Feeler gauge	2
11	Clyburn spanner	1
12	Socket spanner (28 Pcs)	1
13	Screwdriver	1
14	Pipe wrench	1
15	Cutting pliers	1
16	Sharp-nose pliers	1
17	Double offset ring spanner (8 Pcs)	1
18	Double-ended wrench (10 Pcs)	1
19	Double offset ring spanner	1
20	Single-ended wrench	1

The Principal require all special tools for maintenance, routine and light maintenance of all equipment systems.

### 3. SPARE PARTS FOR TWO YEAR OPERATION OF RAIL FLAW DETECTION AND MEASUREMENT MACHINE

The Price of the Spare Parts for two year operation of the RAIL FLAW DETECTION AND MEASUREMENT MACHINE is as listed in the Price Breakdown. Detailed list will be submitted at the presentation of the final Design of the RAIL FLAW DETECTION AND MEASUREMENT MACHINE

The value of parts and supplies must not exceed 6% of the overall value of the equipment, which may be used interchangeably.

CMEC must ensure that spare parts and supplies of equipment are in the market for a period of 15 years.

### 4. TECHNICAL DOCUMENTS FOR RAIL FLAW DETECTION AND MEASUREMENT MACHINE

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Technical documents delivered along with each set of machinery to the Principal are listed below. The following list of technical documents is preliminary while the final one will be confirmed two month after signing the contract.

Technical Documentation: All documentation submitted by CMEC will be Castilian in digital and paper, prefabrication of equipment. At least 5 copies printed per vehicle.

**4.1. RAIL FLAW DETECTION AND MEASUREMENT MACHINE**

The technical documents delivered with the rail flaw detection and measurement machine includes:

No.	Name
1	Operation manual
2	Maintenance manual
3	Diesel engine operating and maintenance instruction
4	Spare parts manual
5	Inspection drawing

Add the following documents:

- Schematic diagrams and drawings for electrical, hydraulic system.
- Maintenance of the ultrasound equipment, cameras, geometric.
- Schematic brake and pneumatic system
- Box rear axle and front axle changes
- Communication principle diagram
- layout diagram of electrical appliances
- control principle diagram Diesel Engine
- Diagram early warning system
- Monitoring system principle diagram
- Operation diagram Lighting
- Operation control diagram
- Air conditioning control principle diagram
- Operation console design drawing
- Manual for safe operation
- Brake Specification
- Technical material attached diesel engine



	ANEXO II SUB GERENCIA DE VÍA Y OBRAS 0425	
	ANNEX 5	Date: 18/08/2015
		Page 7 de 32



- Operating instruction air conditioning
- Main parts will have a Reference Number and a Picture or drawing in order to recognize them.
- Parts, etc.

## 5. TECHNICAL SERVICE PROGRAM FOR RAIL FLAW DETECTION AND MEASUREMENT MACHINE

The following plan is a preliminary technical service program for this machine while the final one will be confirmed during the technical meeting.

The warranty period of the equipment is 2 year, which shall take effect at the end of commissioning in Argentina.

5.1 CMEC will send technicians to the Principal's premise to supervise and guide the unloading, installation, commissioning, and acceptance of large-scale maintenance machinery, as well as to provide on-site technical service. The costs of travel, lodging and staff mobility will send CMEC charge.

### 5.2 Services

- Static vehicle condition checking
- Guiding users to replace various oil
- On-site static and dynamic commission
- Running and working test
- Training in the basic principle, operation, safety and maintenance of the equipment
- Troubleshooting
- Car-following working

5.3 Within the guarantee period after delivering the maintenance machines, CMEC is in charge of sending technicians who meet the job requirements to provide after-sale services in Argentina. Service plan will be adjusted according to the actual working and using situation of different machines.

5.4 CMEC engineers will be responsible of technical training for end-user's local concerned people. For details, please refer to the technical training program.

## 6. TECHNICAL TRAINING PROGRAM FOR RAIL FLAW DETECTION AND MEASUREMENT MACHINE

### 6.1 TRAINING OBJECTIVES

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Helping the trainees to understand the principles, maintenance methods and some notes of each kind of large-scale maintenance machinery under the contract, letting the trainees get skilled at operating the equipment and preliminarily having emergency handling capability.

## 6.2 TRAINING MATERIAL AND DOCUMENTS

User's manual and maintenance.

## 6.3 TRAINEE REQUIREMENT

Good health physique quality is required. In particular, college degree or above, preliminary or above technical title, and over 1-year related working experience are also required for the trainees.

## 6.4 TRAINING PLAN

The following training plan is a preliminary plan while the final one will be confirmed during the technical liaison meeting.

No.	Equipment	Training time
1	Flaw detection machine	Factory theory and hands-on training: 5 weeks/ 8 people; On-site hands-on training: 8 weeks/10 people.

The costs for personnel designated by the SOFSE (passages, mobility, 5-star hotel accommodation, transfers, etc.) for training in China should be in charge of CMEC.

For training in China and Argentina CMEC will be in charge to include a translator for each course.

All training materials will be delivered in Castilian.

During training in China CMEC should schedule visits to the railways where equipments are being used.

CMEC will be responsible for all personal expenses (transportation, mobility, housing, etc.) during the training in Argentina.

## 7. DETAILED TECHNICAL DESCRIPTION

### 7.1. General description of main parts of measuring vehicle

The rail flaw-detection and line measuring vehicle (hereafter referred to as measuring vehicle) is used for the operation of rail flaw-detection and line measurement. The line

	ANEXO II <b>SUB GERENCIA DE VÍA Y OBRAS</b> 0425	
	ANNEX 5	Date: 18/08/2015 Page 9 de 32 504

measuring system of vehicle comprises a rail geometry detection system, a line component detection system, which also comprises five subsystems as follow: 1) rail geometry detection subsystem, 2) rail profile detection subsystem 3) corrugation subsystem, 4) clearance subsystem, 5) fastener inspection subsystem with the integrated position subsystem. All subsystems not only can work independently, but also can transmit data to data center through 3G, 4G, or Wi-Fi. All subsystems can realize data interaction and sharing through the Gigabit LAN.

The rail flaw-detection system can detect real-time rail damage, automatically judge the damage degree, conduct automatic analysis and comparison with former detection records, and output the information in real time. According to UIC 712.

The detecting systems are able to run in tunnels, on ground and elevated highway, with the locomotive body and all the equipment outside keeping working for whole days.

The measuring vehicle adopts the 2-car unit design of one motor car and one trailer. The power traction car is in the back, and the detection vehicle in the front. Tractor and testing vehicles separately, to ensure detection system is in a better work environment, the shock, the adverse effects of noise and electromagnetic interference detection system brings to a minimum, while providing a comfortable working environment for the staff.

The power car uses hydraulic transmission system, equipped with one set of Cummins diesel engine imported from the United States, and adopts PLC control system. The maximum operating speed is 80km/h. It also adopts ultrasonic flaw detection system and comprehensive track detection system, with high detection precision, fast detection speed, high detection efficiency and friendly HMI. Compared with other domestic and foreign manufacturers, this car is an engineering machinery product with high level, many advantages and high performance.

Rail geometric parameters detecting subsystem use an advanced technology based on GJ5 system, combining 2D laser measuring technology and international inertial reference principle, to timely, dynamically and high precisely detect the lengthways level, alignment, ultra-high and horizontal level, warp, curvature and other track geometrical parameters of rail, which provides basis for track inspection.

Rail whole section detection subsystem uses 2D laser measurement technology (non-contact detection technology), to timely, dynamically and high precisely detect the rail wear, full-face, providing the basis for track inspection.

Rail corrugating detection subsystem uses high precision laser displacement sensor, which combines with high-speed 2D sensor to detect line long wave, short wave and deep wave. The use of the equipment provides assistance and inspection basis to relative staff for line maintenance.

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	ANEXO II <b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 5	<span style="font-size: 2em; font-weight: bold;">0425</span> Date: 18/08/2018 Page 10 d



Fasteners and another parts of track inspection subsystem uses HD, high-speed cameras to timely monitoring the track environment, and synchronize with the detecting data of rail geometric parameters detection subsystem, it then checks a variety of fasteners through images, distinguishing fastener loss and providing the basis for inspection.

Clearance subsystem is able to realize the high-speed dynamic measurement of equipment clearance, distance tracks distance, ballast-section high-precisely and timely, providing protection for line maintenance and operating security.

General positioning subsystem consists of the composition of the speedometer and GPS information, which assigns location information to every detection subsystem, providing detection and location information for the detection subsystems, which eases of synchronizing the detection subsystems data.

The flaw detection car consists of car frame, carbody, engine, power transmission system, bogie, hydraulic system, electric system, brake system, flaw detection system and inspection system.

#### 7.2. CAR FRAME

The car frame is the solid structure welded with advanced welding technologies and plant production method; the welding passes the EN15085 certification. Refer to Annex-1

##### Driver cab

When the driver cab at one end operates, corresponding operation functions of the driver cab at the other end are automatically locked, to prevent misuse. The layout of driver cab conforms to ergonomic requirements, with good vibration reduction and sound insulation design. The operator seat can be lifted and lowered, and its backrest can be tilted, easy for operator to operate. The driver cab is installed additionally with temporary folding seats, toolbox, clothes hooks, cup holders and other facilities for other staff. Under normal working conditions, driver's cab noise is not higher than 75dB.

##### Washroom

On the vehicle, there're one washroom and water basins for using by staff on board. The washroom adopts vacuum toilet. Design and manufacture process is performed as per the current domestic EMU standard.

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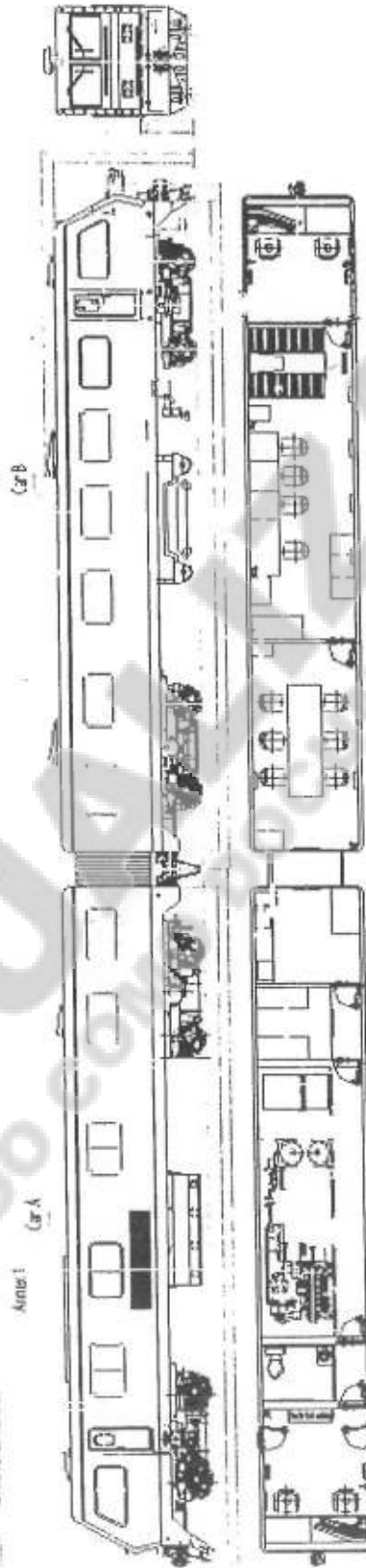


SUB GERENCIA DE VÍA Y OBRAS

Date:  
18/08/2015

ANNEX 5

Page 11 de 32



Schematic drawing of TS02 rail flaw detection and measurement vehicle

General layout of measuring vehicle

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**7.3. CAR BODY**

The car body of flaw detection car adopts all-car shed type welding structure; car A is arranged from front to rear as the driver cab, toilet, electrical room, machine room and kitchen; car B is arranged from front to rear as the meeting room, working room, rest room and driver cab. Each room is configured with the Heating and Cooling air conditioning system; the main driver cab is at the left side in forward direction. The working room is configured with working machine place, equipment cabinet and display. Inside the cab will be installed: glass holders, electric heater for kettle.

Exterior painting will comply with the requirements of the Annex I.

**7.4. POWER TRANSMISSION SYSTEM**

The engine used by flaw detection car is US Cummins QSK19-522 diesel engine with the main technical parameters as follows:

Model	QSK19-522
Place of origin	CUMMINS INC
Structure type	Supercharged, inter-
Cylinder diameter x	158.8×158.8 (mm)
Rated power/speed	522kW/2000rpm
Maximum	2983Nm/1500rpm
Displacement	19L
Fuel consumption	214g/kW·h

**7.5. GENERATOR UNIT**

The generator unit adopts original Yamaha diesel engine.

**7.6. BOGIE**

The complete machine arrangement is configured with two primary suspension 2-axle bogies; each bogie is configured with two driving axles, which are of closed type hydraulic driving system design. The frame is H-type integral welding structure with high diamond resistance rigidity for ease of enhancement of critical speed.

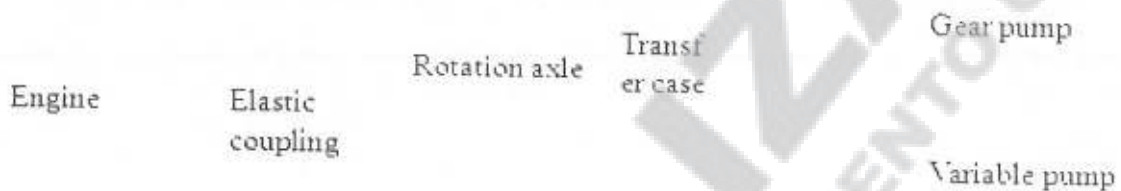
The bogie has the spring damping device; each bogie is mounted with 4 hydraulic shock absorber, which are mounted between axle and bogie frame. It ensures the running stability of car and also the comfortability of crew.



The wheel set diameter is 915mm; the rolling bearing (SKF, FAG, TIMKEN) See Annex I, is mounted in the axle box and the hydraulic shock absorber is mounted on the axle box cover.

#### 7.7. HYDRAULIC SYSTEM

The vehicle adopts hydrostatic drive system. The hydraulic system is a multi-function composite system integrated with the direction, pressure, speed and proportional control. The hydraulic oil cooler maintains the constant temperature of hydraulic system for operation and high-speed running conditions, and ensures the temperature of hydraulic oil in system will not exceed 80°.



The hydraulic system is mounted with independent hydraulic oil tank. The independent filtering return circuit ensures the cleanliness of oil product so as to save the oil product, extend the machine life, minimize the wearing and replacement of parts, and reduce the failure rate of hydraulic system. The hydraulic system is mounted with manual and an electrically driven emergency pump and the car working device can normally reset in case of emergency.

#### 7.8. ELECTRIC SYSTEM

The electric system mainly includes DC24V DC control system, AC380V/AC220V AC 50 Hz power supply system.

The power supply of DC24V DC control system includes the battery set and charger generator; the electric equipment mainly includes various indication lamp, lighting lamp, wiper, electric fan, various instruments, sensor, magnet valves, DC converter, electric quantity converter, data processor and various relays.

The AC system is mainly powered by diesel engine generator set and the main electric equipment includes air conditioning. The circuit breaker, AC contactor, leak protector are set in AC circuit to protect the safety of electric equipment.

#### 7.9. BRAKE SYSTEM. Refer to Annex-1

The air brake system consists of air supply unit, brake and foundation brake unit.



1) The air supply unit has the compressed air complying with the quality, pressure and flow requirements. It mainly consists of air compressor, double tower type dryer, main air reservoir, air filter and oil-water separator. It can enable the remote startup and stop control for working air source device; the comprehensive alarm signals (list important alarm contents: for example the air compressor failure, main reservoir air pressure low alarm, drier failure alarm) are displayed at the control console at both ends of driver cab.

2) The brake is Knorr or Wabtec air brake.

3) The foundation brake is of compact type unit brake.

4) Our party will provide the braking distance **See Annex I** calculation of service brake and emergency brake under different conditions and different initial speed at brake application for audit by the buyer.

5) The air pipeline system adopts stainless steel; the brake hose assembly is set at front and rear ends of locomotive to provide braking for other vehicles during multi-operation with other engineering vehicles. Height and distance to the center of track will be according to the drawing NEFA 907.

#### 7.10. ULTRASONIC RAIL FLAW DETECTION AND VISION SYSTEM-SPERRY

Machine installed Sperry's latest ultrasonic test system, the 30-channel 1900 test system, and an advance proven test carriage to accommodate two UX-6 RSUs and one X-Fire RSU, six RSUs in total.

##### 7.10.1. Track Conitions

Track Gauge: 1676 mm

Min Curve Radius: 190m

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Max Cant: 160mm

Max Gradient: 25%

Rail Profile: UIC 54 / UIC 60 / U-50 / U-36 / 100 Lbs. BSR / 85 Lbs. 522 A / 74 Lbs. FCS / Russian (50.50kg/m), 54 E1, 60E, 50E6.

Inclination of track: 1/20 and 1/40.

#### 7.10.2. Test Carriage

The existing carriage will allow testing operations at 40km/h.

#### 7.10.3. 1900 Test System

Sperry's 1900 System is its latest and the most advanced rail flaw detection system. The 1900 System offers superior rail coverage, ease of use, and advanced replay features. The 1900 System uses six Rollerearch Units (4 x UX6 + 2 x X-Fire) which house a total of 30 ultrasonic transducers (with future expandability to 48 channels) positioned in a patented array of angles, thereby achieving thorough test coverage.

1900 test data is sent to a custom-designed data acquisition rack, processed and stored by a Pentium class computer and presented to the operator in real time with a clear and intuitive data presentation. Sperry has combined the 1900 System with Application Specific Software, Automatic Defect Pattern Recognition Processing, and Unique Defect Mapping and Defect Management Systems. The system can be conveniently combined with the SPERRY B-Scan walking sticks which will be provided by CMEC (Sperry's Post Test Verification Technology).

These added features as:

- Automatic Defect Pattern Extraction and Recognition
- Defect Severity Classification
- Backup of the parameters for each measuring file. Real Time Filtered Graphical Results
- File System
- Local/Global Position Controlling
- Post Analysis Tools
- Simulation/Training Tools

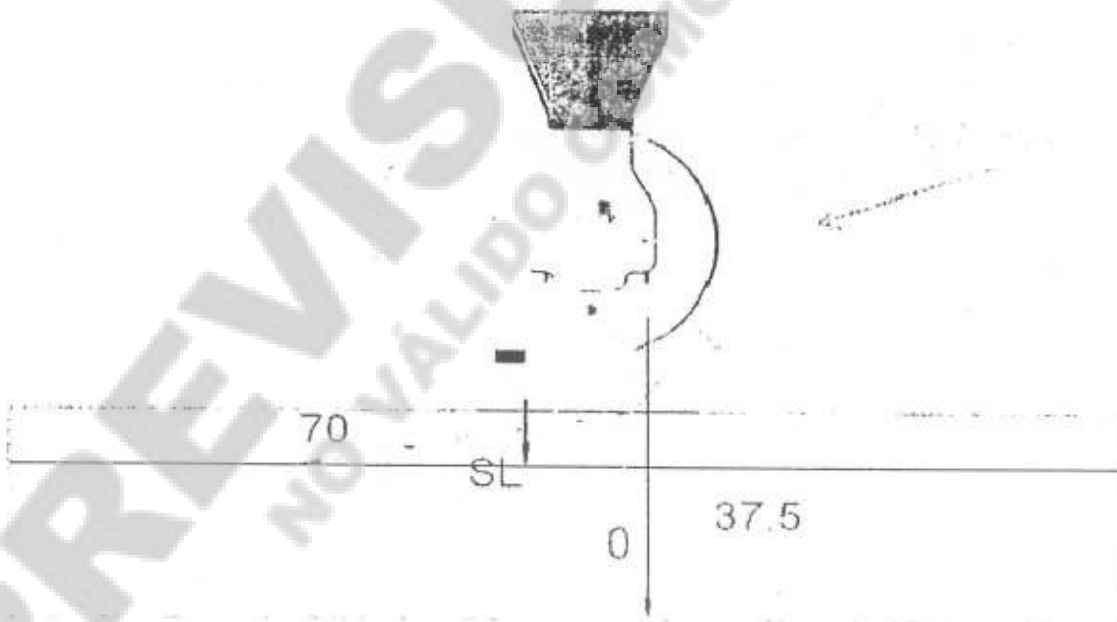
#### 7.10.4. Roller Search Units

Included in this proposal are Sperry' standard UX- RSUs with and Sperry'X-fire RSUs. Typical arrangement of RSU wheels on a high speed test boggywith two UX-6 wheels (front & rear) and X-Fire™ in the middle. The front and rear UX-6 wheels are positioned in a mirror image fashion.

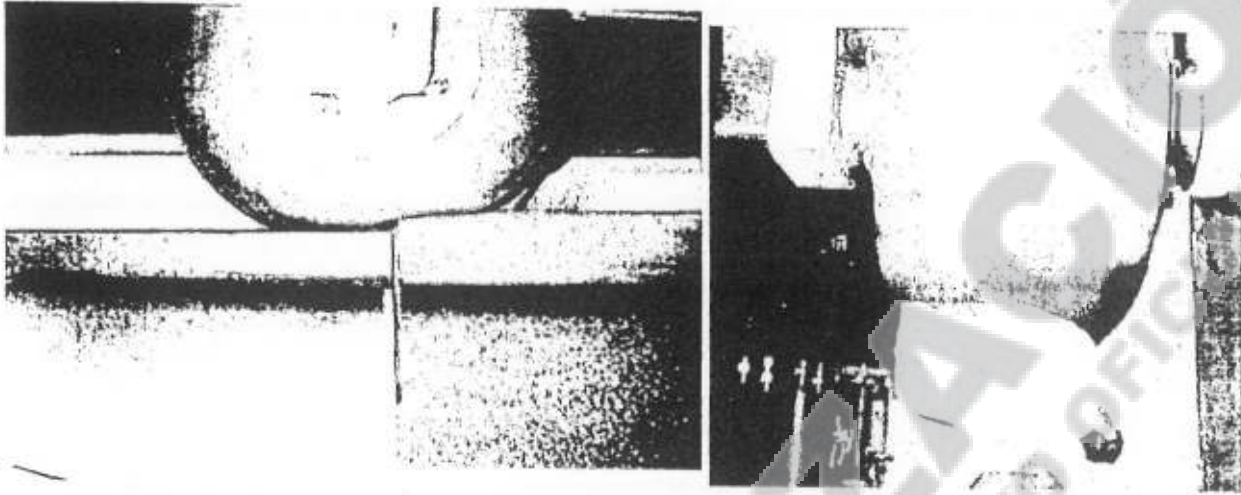


- XU-6 RSU

The ultrasonic probes in the UX-6 RSUs are designed to examine the rail for standard head, web and base (under the web) defects, including transverse defects, bolt hole cracks, vertical spliteheads. Current RSU configuration UX-6 is composed of one zero degree probe, one 37.5 degree probe, one sidelooper and three 70 degree probes for field, center and gauge side of the rail head.

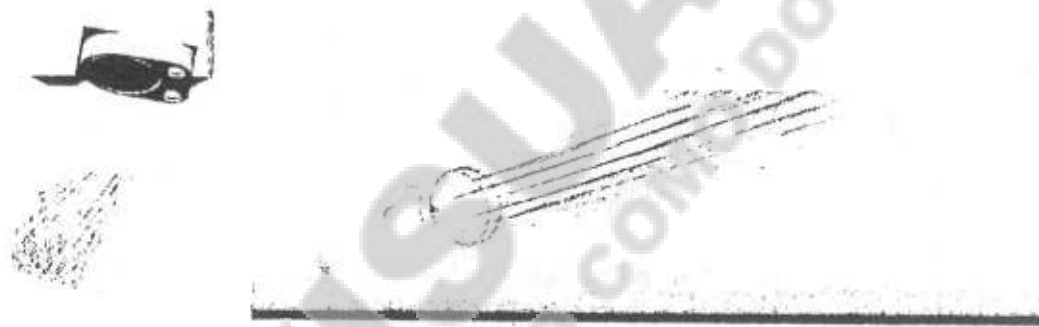


The membrane of the RSU is designed to conform to uneven surfaces in order to maintain constant contact necessary for transmission/reception of the ultrasonic beam.

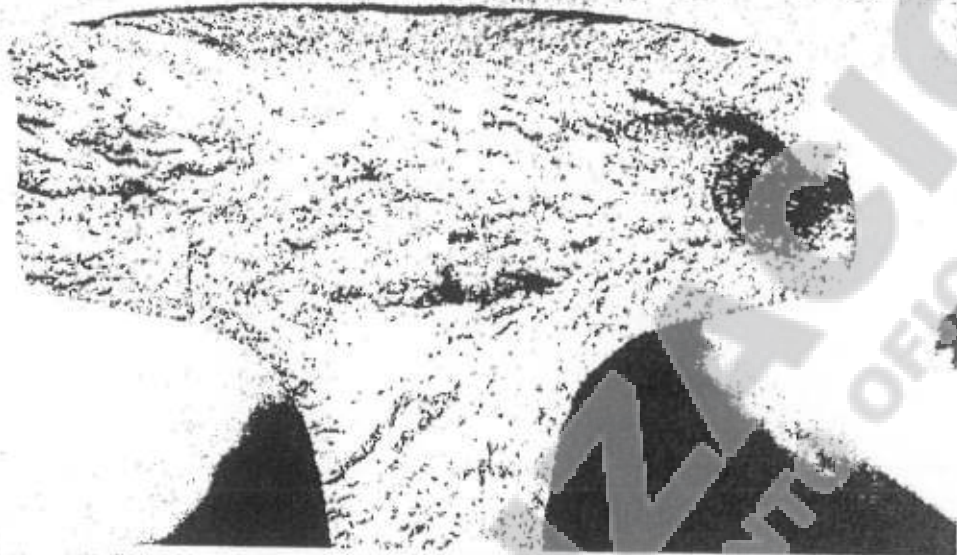


- X-Fire RSU

X-Fire™ (pronounced “cross-fire”) is focused on detecting Detail Fracture defects (DFs), specifically on the gauge corner of the rail, whose orientation make it difficult to detect solely with traditional transducer angles and ultrasonic beam focus. Performance of the new technology has proven to provide a marked improvement in the detection of detail fractures.



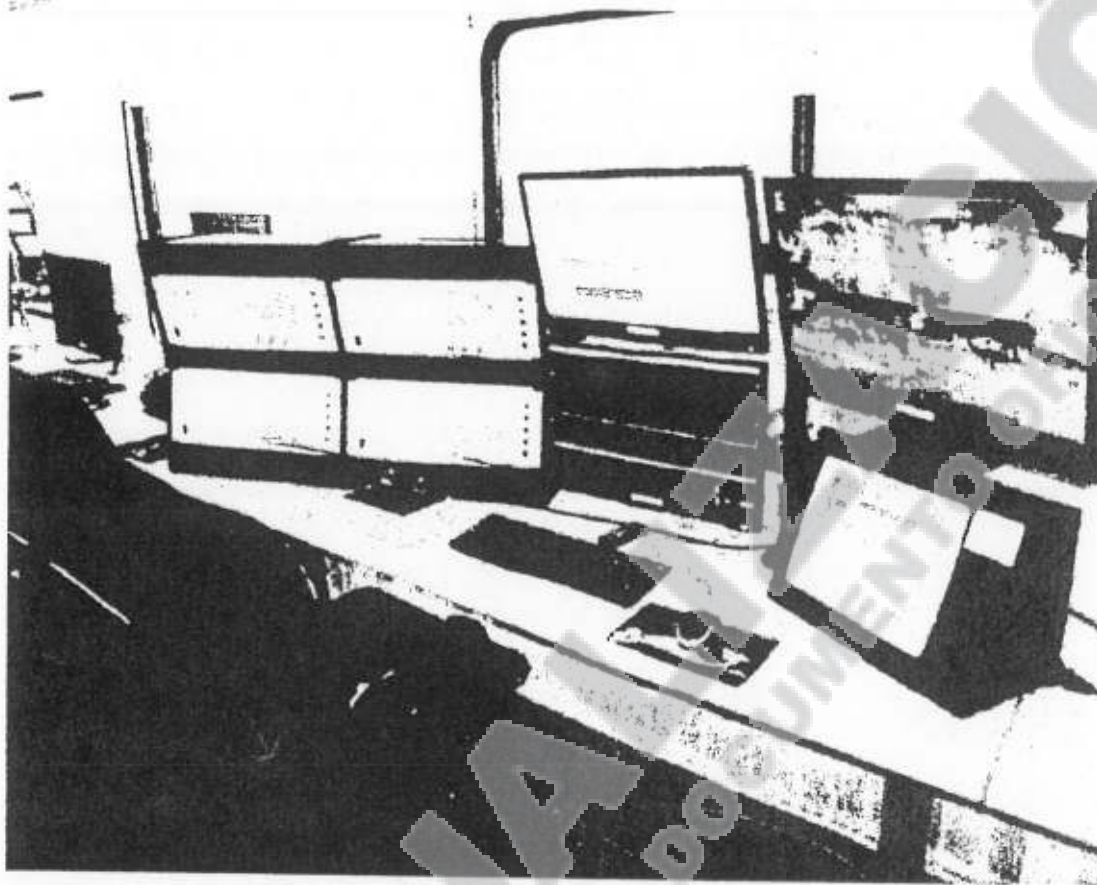
The typical “hidden” transverse flaws detected by the X-Fire™ wheel. Note the shell above the flaw preventing the ultrasonic beam to hit it directly.



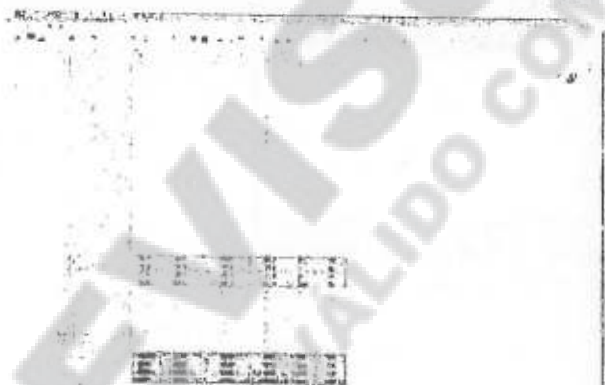
#### 7.10.5. Operator Station

Operator work station will include:

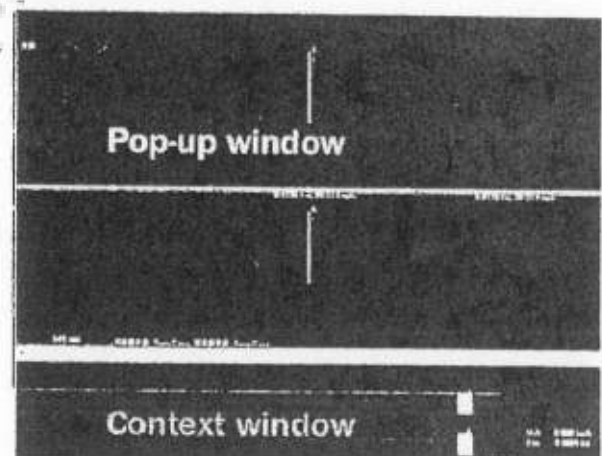
- Ultrasonic scopes to monitoring RSU performance
- Monitors to display 1900 test system output
- Video monitors to display carriage performance
- Touch-screen controls for system components including carriage and couplant system
- on board video system



The user interface of System 1900 has been designed to help the operator in performing daily tasks such as setting up the test parameters, controlling gains, gates, filters etc.

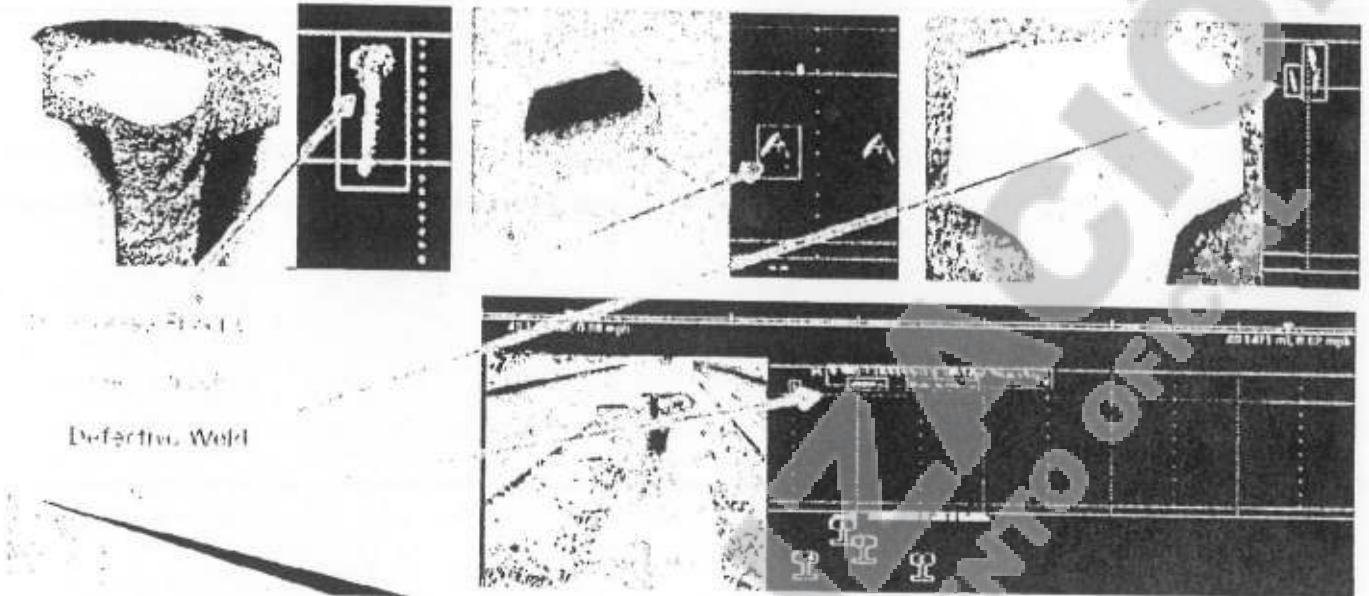


Test parameters window



Context window

The B-Scan presentations of System 1900 are neat, uncomplicated and user friendly. They have been designed to facilitate interpretation of indications, defect recognition and decision making. Being color coded, the B-Scans give necessary information such as location, depth, size and type of defect. Operators usually become quickly familiar with B-Scans, and the training takes short time.



#### 7.10.6. Calibration Machine

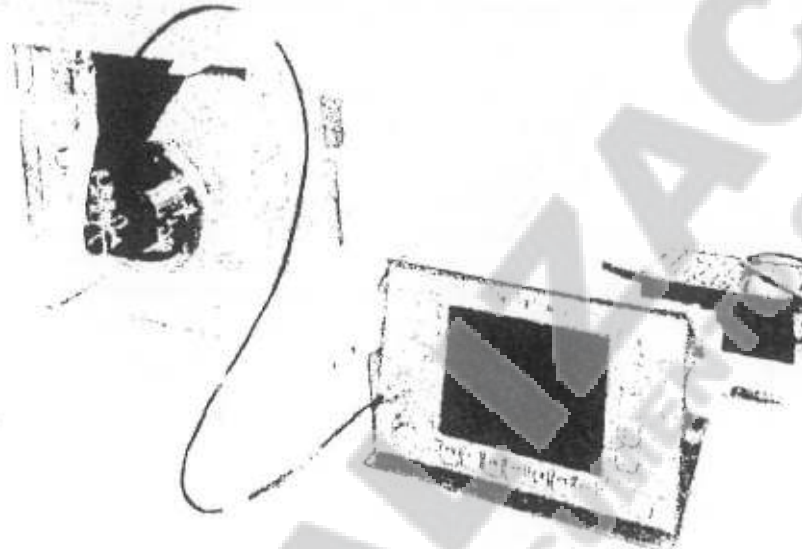
A calibrated approach to testing ensures repeatability through appropriately-configured RSUs. Prior to each test run, the chief operator follows established procedures to calibrate all Roller Search Units (RSUs) on the test vehicle with the Calibration Machine and recording the calibration results.

The Sperry Static Calibration Machine is designed to enable the test car operators to calibrate RSUs inside the vehicle rather than trackside. This gives the benefits of safety and comfort in case of inclement weather whereby the operator is out of the vehicle for only the time it takes to connect the calibration machine's cables into the sill box ultrasonics near the test carriage.



### 7.10.7. Calibration Rails

Sperry will provide a roller search unit regulator includes relevant test coupon. This regulator can calibrate transducers in 0 degree, 37.5 degree, and 70 degree of UX-6 search roller.



### 7.10.8. Documentation

The following documentation will be provided:

- Operations and Maintenance Manual for Test System Carriage in English and Spanish
- Operations Manual for 1900 Test System in English and Spanish
- Assembly Outline Drawings in Castellán
- Parts Manual in Castellán

### 7.10.9. Equipments and Parameters

#### 1) Ultrasonics

##### Wheel Probes

- Three RSUs per Rail, comprising:
  - Two UX-6 RSUs, each with one 0°, one 37.5°, three 70° and one Side Looker Probe
  - One X-Fire RSU with one 0° and 2 Gauge Probes
- Standard transducer frequency 3.5 & 2.25 MHz.
- Transducers are medium damped.
- Wheel probe type: polyurethane.
- Wheel probe fluid: temperature coefficient suited for -45°C to 55°C (-49°F to 131°F).
- Tire diameter before filling: 178 mm (7").

- • Low noise wheel probe with minimal ultrasonic internal reflection for sensitive flaw detection.
- • Variations available.

## Resolution

## ① Longitudinal

- • Pulse density along the track:

Sample Rate	Max. Speed
1.5mm (1/16")	12 kph (7.5 mph)
3.2mm (1/8")	24 kph (15 mph)
4.7mm (3/16")	53 kph (33 mph)
6.4mm (1/4")	71 kph (44 mph)

- • Below 1.6 km/hr (1 mph) time based.
- • Subject to system configuration and set-up.

## ② Vertical

- Depth of artifact in rail:  
±1.5 mm (.062") (2.25 MHz) irrespective of longitudinal sampling and speed.

## Instrumentation

- Up to 48 independent ultrasonic channels (30 as standard) - parallel fired (not multiplexed).
- • Lack of Base monitoring.
- • Computer controlled.
- • No manual controls on front panels.
- • Provision of Digital Amplitude Correction (DAC) & 80 dB gain range, calibrated.
- • 150 V bidirectional pulse frequency matched.
- • Transmitter matched to transducers for optimum signal strength and sharpness.

## 2) System Layout

## Operator's Console

- The operator's work-station typically contains those parts of the system that are used for control and data presentation during calibration/run time. They are:
  - o DCC (Display Control Computer) VDU (Video Display Unit), Dual Display VDU and keyboard.
  - o Color printer.
  - o One four trace oscilloscope.
  - o All other operator controllable facilities are contained on the console desktop.
  - o Lateral adjustment controls.
  - o Optional Video monitor showing test carriage.
  - o PLC / Auxiliary Control Systems Display

## Driver's Station



- • Keypad for entering track features and updating position.
- • Lock switch for testing through switches and crossings

## Auxiliary Control System

- • PLC Computer Management System
  - o RSU Couplant Control
  - o RSU Guidance Control
  - o RSU Lift Control (Air)
  - o Vehicle Aux Systems Monitor

## 3) Computer

- • Intel Duo Core 2.33GHz processor with Ethernet datalink for ultra fast real time processing.
- • System Control for operator control of system.
- • Display for presentation and storage of test results.
- • Modular design using plug and play technology. Specially designed interface modules for high-speed data passing.
- • System function verified using data injection.
- • Rugged Nema 12 / IP 60 mounting system.
- • Capture and processing of ultrasonic echoes with independent gating for each channel.
- • Selectable digital thresholds and gate detection areas.
- • Structured, modular programming.
- • Run time software written in "C" and "C++" for fast real-time and multi-threaded processing.
- • Function key driven.
- • Computers perform comprehensive self-test before operating.
- • Built-in fault diagnostic aids and system communication monitoring.

## 4) Peripherals

## Printer

- • Color Printing

## Control

- • 19" LCD Color Monitor

## Display VDU

- • 19" LCD Color Monitor
- • Video display of defects are stored on a large capacity hard disc for storage and playback.
- • Ruggedized, removable, large capacity hard disc system.
- • Resolution - 1280 x 1024 or better.
- • Automatic backup to a second storage device.
- • Manual backup to a CD/DVD.



- System operating parameters automatically logged to data display file.
- Keyboard and pointing device for operator interface.

## Oscilloscopes

- Bright display for visibility in ambient vehicle lighting.
- 100 MHz bandwidth also useful as a service aid.
- Four channel.

## 5) Signal Processing Sequence

- Ultrasonic channels operate independently pulsed according to an optical encoder driven odometer or via internal settings.
- Echoes processed by digital "front end" electronics.
- All time of flight data is in digital format.
- Multi-gating and thresholding determines echoes of interest, including "bottom of rail" echoes.
- Noise and pulse discrimination.
- Simultaneously, the following can occur:
  - o Echo amplitude-distance display (A-scan).
  - o Pattern recognition.
  - o Profile view (B-scan).
  - o Audible alarm.
  - o Paint spray marking.
- Echo details, with the relevant system set-up are recorded for future analysis.
- All the ultrasonic data is tagged with Sperry's track location data, DGPS data when available (not in tunnels or covered track) and the capability to tag the data with the customer's own track location data.

## 6) Displays

## DCC VDU 1

- Used for all system set-up and computer control.
- Easy to learn and use, menu and "function key" driven.
- Screen displays, run time and set-up screens.
- Display shows date, time, run number, etc.
- All fields for operator set-up are error-checked and limit-bound for sensible information.
- Test parameters stored as "jobs" for different rail weights and rail conditions.
- Four "hot" keys for on the fly changing of rail weight "jobs".

## DCC VDU 2

- Video display unit with display of transducer responses spatially transformed in two dimensions along the length of the rail.
- Both rails displayed simultaneously.



- • Real time display of defects types.
- • Recognitions displayed as universally recognizable icons.
- • Multiple parameter defect filters.
- • Recognition can be labeled with unique number identification, odometer reading, and type.
- • Two simultaneous display windows - one showing detailed B-scan information and induction responses and the other showing context information for adjustable large scale distance.
- • Playback and screen dump capabilities.
- • Track feature function keys for operator to enter icons as part of the permanent record.
- • Comment fields for operator input, correlated to a specific location.

## Print Out

- • Color B-scan images of potential defects.
- • System Set-Up Display Pages

## Test Set - Up

- • Details of current test run.
- • Company name and address.
- • Region and division.
- • Line code.
- • Track identification.
- • Milepost started.
- • Car number.
- • Facing forward or reverse.
- • Increasing/decreasing odometer.

## Recognitions

- • Displays details of recognitions as they occur.

## Job Parameter

- • Screen permits viewing and/or adjustment of gain, timing, DAC etc.

## 7) Control

## Computer Control

- • Loading and distributing software.
- • Control of system peripherals.
- • Set-up procedures; input and storage of parameters.
- • Control of ultrasonic instrumentation.
- • Setting of pulse repetition frequency to time based firing upon entering calibration mode.
- • Control of defect marking.
- • System status reports; ultrasonic channel failure, communications failure etc.

	<b>SUB GERENCIA DE VÍA Y OBRAS</b>	
	ANNEX 5	<b>0425</b> Date: 18/08/2015 Page 26 de 32

- Report: time, date, odometer, speed (update every 0.1 second or 1 foot).

#### Manual/PLC Control

- Turn water on/off.
- Manual paint gun testing.
- Test carriage raise/lower.
- Complete test carriage function control.
- Operator control of wheel probe alignment and lateral position.

#### 8) Vision System

##### Image Capture

- Detailed image of head and web captured at the suspect area.
- Up to 25" of rail captured in each image.
- Image capture triggered by real-time analysis of inspection data.
- Image displayed immediately to the operator.
- All images stored for later review.
- Long image buffer allows cameras to be installed at a convenient location including the front of the vehicle away from the test system.
- Continuous Video Option.

##### Image Creation

- 96 lines per inch resolution.
- Line rate is encoder triggered for constant resolution at varying speed.
- Single images stored in IMG and PNG formats.
- Continuous Video in AVI or JPEG compressed formats.

##### Cameras

- Leading technology 65kHz Line-scan Cameras.
- 512 resolution with 14um pixel size.
- 40MHz data rate.

##### Lighting

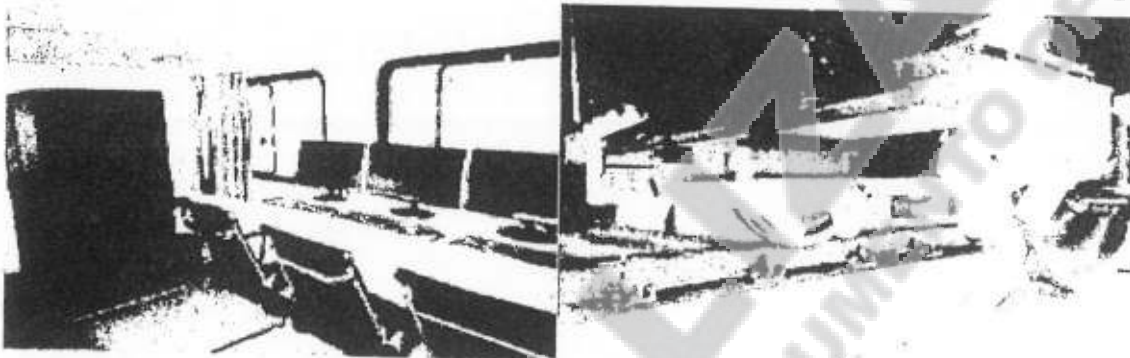
- Powerful focused LED lighting for maximum effectiveness and efficiency.

##### Features

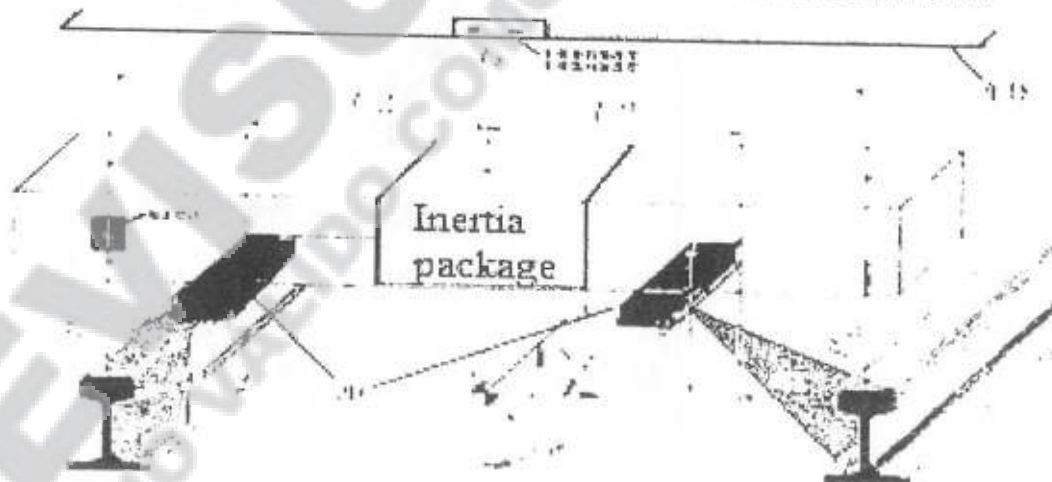
- Separate computer system for fast storage to dedicated hard drive
- Ethernet link to the Ultrasonic test system for
- commands to start and stop recording and provide location information
- Simulated mode for camera test and focus.

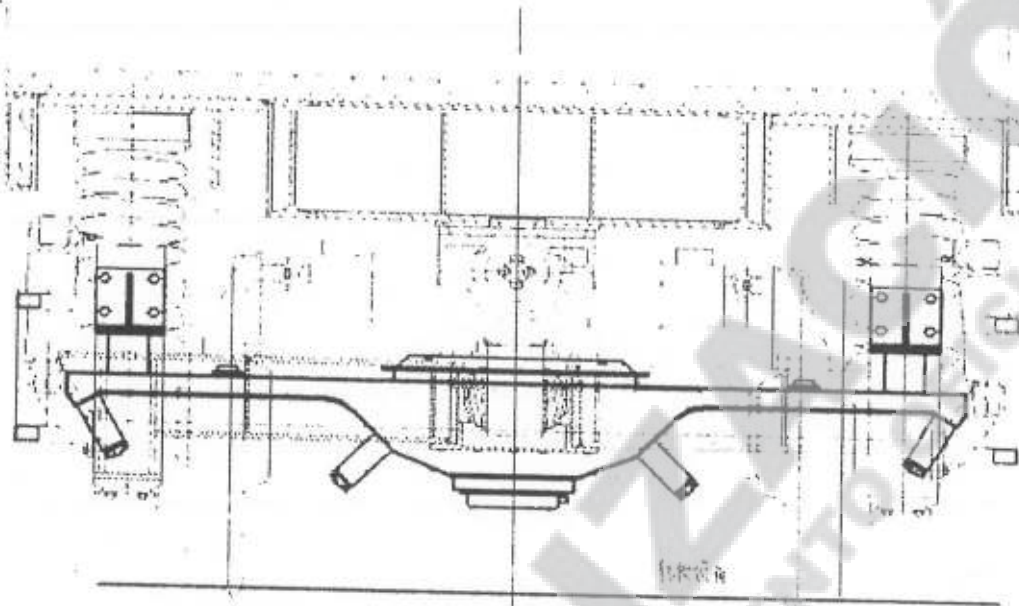
## 7.11. DETECTION SYSTEM

The rail detection system mounted on this car is commonly developed by Chengdu Tang Yuan Electric Co., Ltd. and Southwest Jiaotong University national level traction power laboratory. This technology is based on the world leading GJ5 system, adopts inertia reference measurement principle, and comprehensively utilizes various precise sensors and devices, adopts simulation and digital processing technology with the features of high anti-interference capacity of signal and high precision.



The detection system is mainly for the detection and analysis for gauge, clearance limit and track wearing; the track detection devices are mainly on the detection beam to detect the connection of beam with the bogie frame. The devices mounted on the detection beam include: 2D laser sensor, detection inertia package, track cruise detection device and onboard local area network.

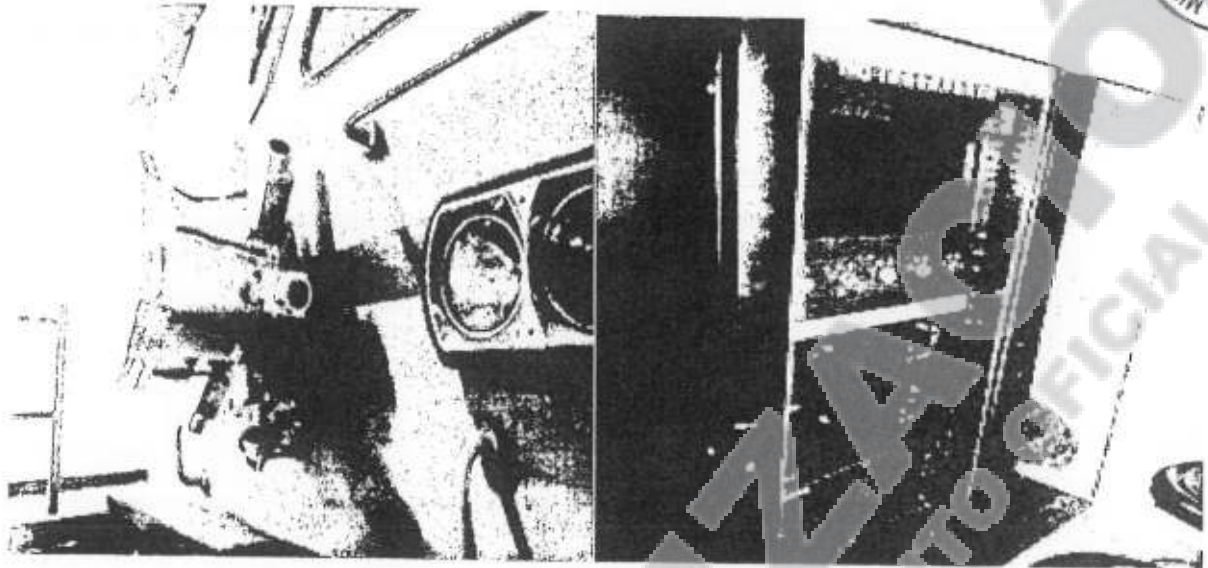




The track detection system make uses of multi-channel distributed network test technology, and remotely controls the synchronous operation of test devices at different places with the computer, and transmits the data and synchronous information via the network. It has the functions including acquisition and processing of origin signal, storage of intermediate data and final results, online display of oscillogram, data transmission via network, report of output out-of-limit, correction of mileage, post replay of stored data, output of oscillogram data and related place and speed. It enables the data acquisition, storage of origin data, data validity judgment and oscillogram display.

The track clearance limit detection system consists of clearance limit detection main device, compensation device and in-car data processing system. It mainly makes use of laser scanning measurement technology to enable measurement of building profile, and the seamless composition and automatic invasion judgment of building section profile with the image processing and recognition algorithm. It can receive the synchronous pulse signal and positioning information from the synchronous positioning system to enable mileage accumulation and precise positioning.

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Clearance limit detection device Data processing treatment

In the line measuring workroom, there are operating platform, equipment cabinet, equipment connecting seat, etc. for line measuring system. Each operator's table is installed with 220V AC power socket supplying power for monitor, laptop, etc. Under full load, there are extra enough position for spare sockets for the charging of cell phones, walkie-talkies and other charge.

Line measuring workroom is equipped with an UPS (uninterruptible power supply for minimum 10 hours), use for data storage of rail flaw-detection system and line measuring system under emergency. The UPS is industrial grade UPS, with shock-proof, explosion-proof and anti-interference capability. Its output power meets the specified power requirement of rail flaw-detection and line measuring emergency system.



Line measuring workroom

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### 7.12. Replication analysis room

Replication analysis room is mainly used for detected data analysis and staff rest. Inside this room, there's an oval conference table, large-screen displays, drinking fountains, etc., as well as a 220V AC,  $\geq 2$ kW power socket for laptops, cell phones, walkie-talkies and other electrical equipment.



Replication analysis room

### 7.13. Main technical parameters of line measuring system

The measuring system comply with EN 13848. The measuring items are not limited to the listed, the final will be determined during design liaison.

#### Rail geometry detection system

No.	Parameter	Resolution	Accuracy	Measuring range	Remarks
1	Gauge	$\leq 0.5$ mm	$\pm 1$ mm	-15mm/+50mm	Worn rail need to be defined
2	Longitudinal level	$\leq 0.5$ mm	$\pm 1$ mm	$\pm 50$ mm	Wavelength 3m-25m
		$\leq 0.5$ mm	$\pm 3$ mm	$\pm 100$ mm	Wavelength 25m-70m
		$\leq 0.5$ mm	$\pm 5$ mm	$\pm 300$ mm	Wavelength : 71m-150m
3	Crosslevel	$\leq 0.5$ mm	$\pm 5$ mm	$\pm 225$ mm	-



## SUB GERENCIA DE VÍA Y OBRAS

042!

ANNEX 5

Date:  
18/08/2015

Page 31



4	Alignment	$\leq 0.5\text{mm}$	$\pm 1.5\text{mm}$	$\pm 50\text{mm}$	Wavelength 3m-25m
		$\leq 0.5\text{mm}$	$\pm 4\text{mm}$	$\pm 100\text{mm}$	Wavelength : 25 m - 70 m
		$\leq 0.5\text{mm}$	$\pm 10\text{mm}$	$\pm 500\text{mm}$	Wavelength : 71 m - 200 m
5	Twist	$\leq 0.5\text{mm}$	$\pm 1.5/\ell$	$\pm 15\text{mm/m}$	$\ell = 3\text{ m}$
6	Curvature	-	$\leq 0.05^\circ/30\text{m}$ $\leq \pm 2\text{mm}$	$\pm 23^\circ/30\text{m}$ $6.25 \sim 1000\text{mm}$	
7	Body vertical, lateral acceleration	-	$\leq \pm 0.01\text{g}$	$\pm 2\text{g}$	-

## Rail profile detection system – According EN 13848

No.	Parameters	Accuracy	Remarks
1	Headwear	$\pm 0.3\text{mm}$	Compared with standard rail profile
2	Sidewear	$\pm 0.3\text{mm}$	
3	Rail cant	$\pm 0.3\text{mm}$	
4	Equivalent conicity	$\pm 0.3\text{mm}$	
5	Rail profile	$\pm 0.3\text{mm}$	

## Clearance detection system

No.	Parameters	Performance requirements	Remarks
1	Equipment Bound	$\pm 20\text{mm}$	Straight line measurement accuracy of $\pm 20\text{mm}$ , with a resolution of 5mm. Note: the scanning distance within 3000mm, with a resolution of 5mm; Accuracy of straight section and large curved segment was 85%, small curve segment is temporarily not required.
2	Angular resolution	$0.055^\circ$	
3	The maximum scanning distance	3000mm	The maximum scanning distance is within this range can meet the required precision, greater than this distance, it can scan, but the accuracy is slightly lower. On this distance resolution of 5mm.
4	Minimum scanning distance	500mm	On this distance, the resolution of 2mm
5	Valid data points per	More than 8000	Duplicate parts to prevent undetected

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6	revolution Best speed	points 40km/h	
7	Continuous working time	>12 hours	12 hours non-stop
8	Data Storage	1T	Driving 3000 km range can store all the test data
9	Measurement	No contact	
10	Test methods	Point inspection	
11	Positioning accuracy	Refer to Annex-1	

Accuracy table of comprehensive positioning system

No.	Description	range	accuracy
1	Velocity	0 ~ 90km/h	< ±1 km/h
2	Distance	0 ~ 9999km	< ±1 m/km

Corrugation detection system

No.	Parameter	Detection range
1	Detection depth of corrugation	5 mm
2	Detection length of corrugation	30 mm - 1000 mm

- Other measurements according to EN 13848 – Annex B and EN 13848-5
- Quality qualification of track geometry with recommended maximum speed according to EN 13848-6

#### 7.14. SOFTWARE, GPS and COMMUNICATIONS

Refer to Annex-1

#### 7.15. MISCELLANEOUS

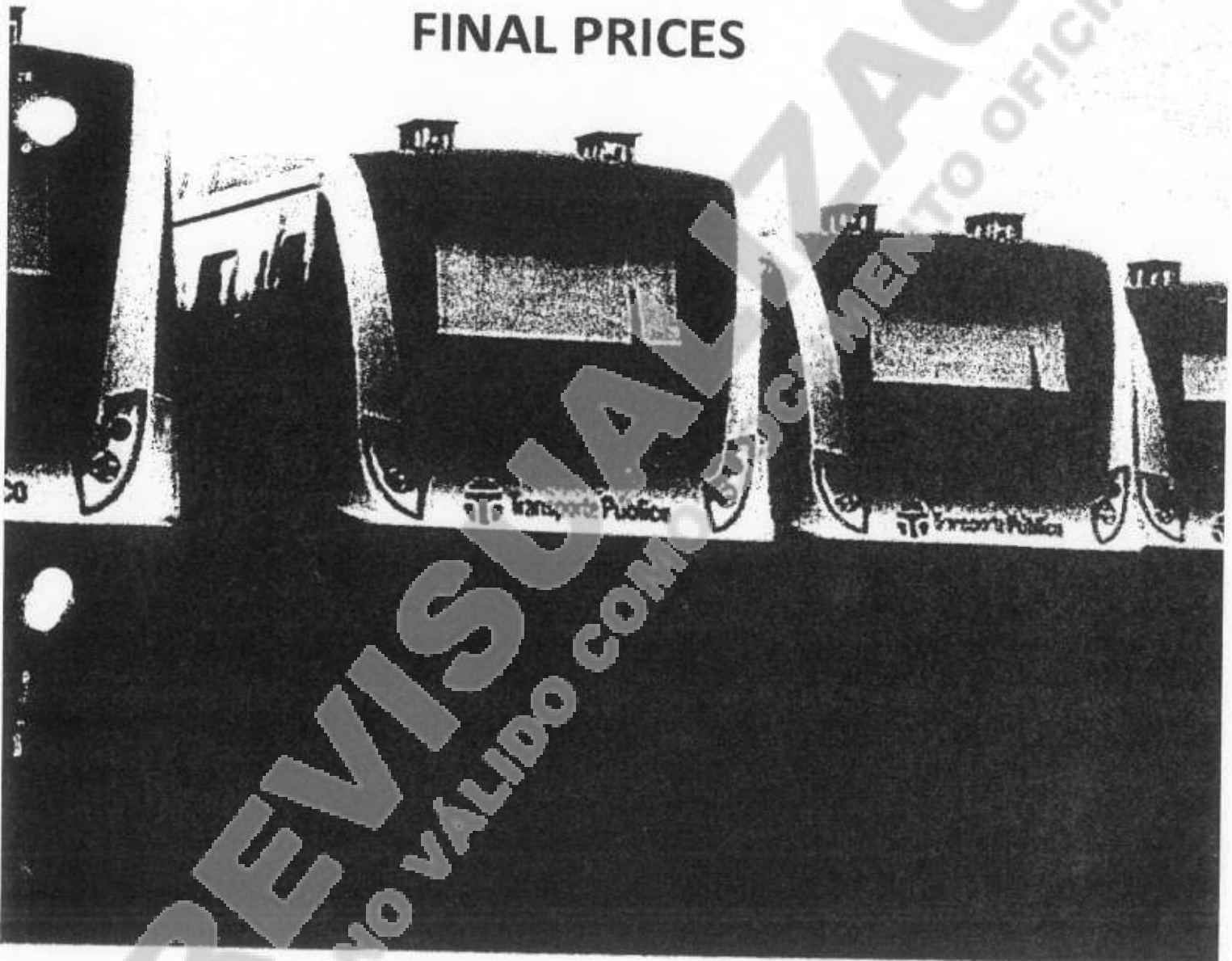
- Server and Computer Room
- In the meeting room and operation room must be locate displays for speed, line, position, etc. Content must be programmable.
- All laser probes must be surrounded by a protection box.
- Intercommunication between cabs and operation room.
- Two curtains will be installed in every window, with exception of the cab, with two degrees of transparency: one for shading light and the other as black-out.
- Front Headlights will be capable of illuminate and distinguish a person at 200 m of distance located in the axis of a straight track.

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**ANNEX 6**  
**FINAL PRICES**



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	ANNEX 6	Date: 19/08/2015 Page 1 de

**ANNEX 6****FINAL PRICES****Breakdown of the Large-Scale Maintenance Machinery**

S/N	Item	Qty.	Unit Price of the Machine (USD, CIF to Argentina)	Spare parts for two-year operation (6% of the machine price)	Total (USD)
1	Track Measurement & Rail Flaw Detecting Vehicle(1676)	1	8.141,000	1.835.820	32,432,820
2	Rail Grinder (1676mm)	1	9.188,000		
3	Dynamic Track Stabilizer (1676mm)	1	2.739,000		
4	Tamping Machine (1676mm)	1	3.061,000		
5	Ballast Regulator(1676mm)	1	1.048,000		
6	Rail Car(1676mm)	4	1.284,500		
7	Rail Car(1000mm)	1	1.282,000		
		subtotal	30.597,000		

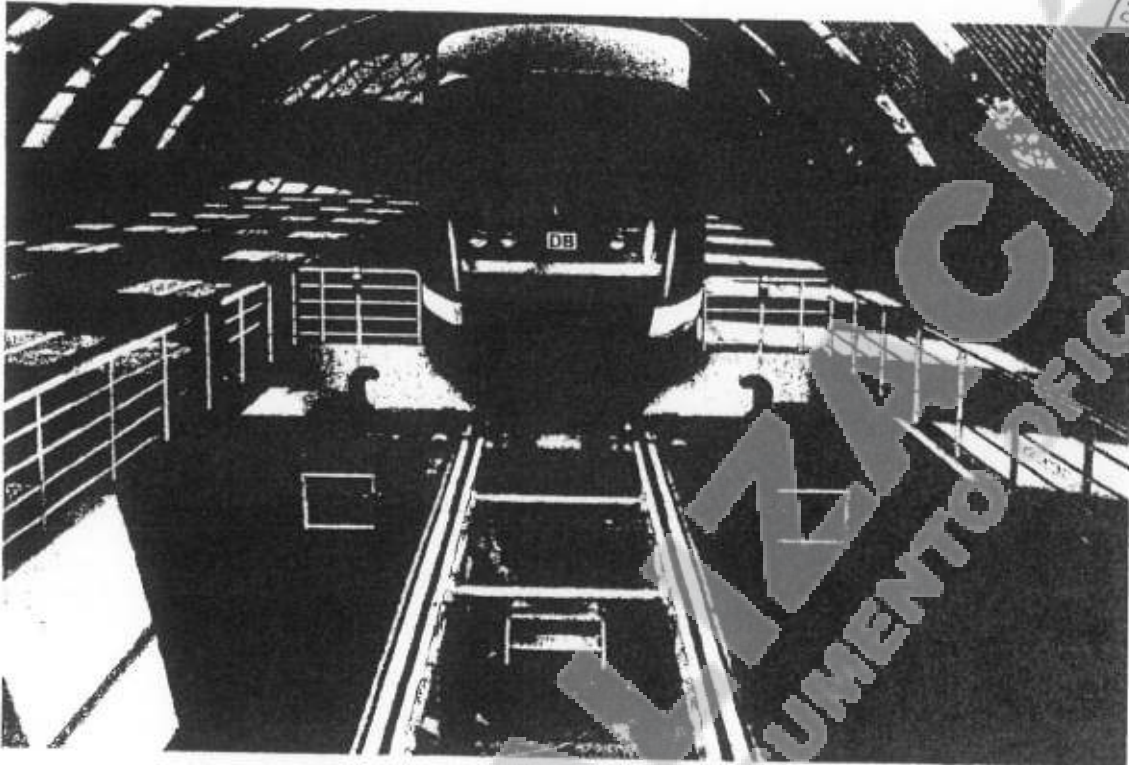
The final price includes the following items:

- Coupling hook for the wide gauge according to UIC 520 and change of the meter gauge rail car coupling hook
- The brand of generators changes to Stamford or Yamaha
- FEA: tests of vibration frequency and modes, and the fatigue strength (36km/h impact test included)
- Physical static load test items for structural safety and impact test to 5 km/h.
- Toxicity and flammability tests for main parts of the internal cabin according to DIN 5510
- Windshield and side glazing
- Braking system changed to the brand of KNORR CCB26 or Wabtech
- Industrial PC, USB2.0
- Event Recorder – HASLER TELOC 3000 (MR-1-2013-E2)
- Radios
- Software
- Design change of the rail car

Annex-2.1

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Technical Specifications of Under-floor Wheel Lathe U2000-400



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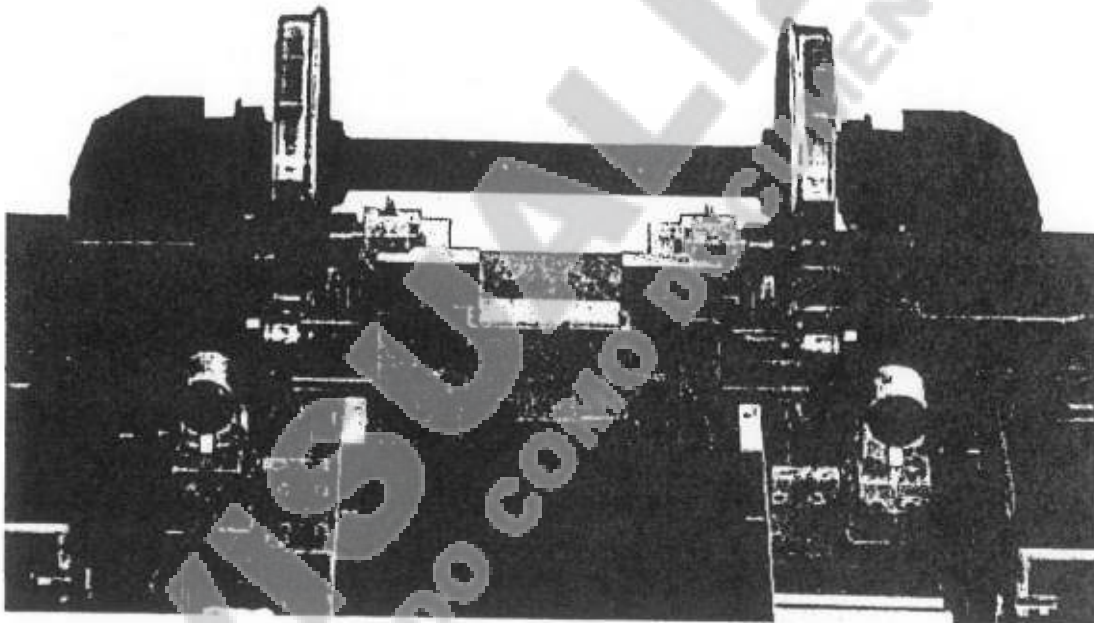
**Operative range and scope of application**

**General**

The modern underfloor wheel set lathe does not only fulfil all demands on working conditions and accuracy requirements layout is also intended to satisfy all future requirements. It is a universal, dynamically rigid and particularly user and service friendly wheel set lathe. This execution represents the currently highest standard within the scope of wheel set machining technology. Due to its high utilisation ratio, its precision, long service life and low maintenance costs, the machine guarantees optimal economic efficiency.

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**Function**

Wheel sets of high speed trains, of suburban trains as well as wheel sets of tramways are reprofiled with the highest accuracy by means of CNC controlled Hegenscheidt-MFD underfloor wheel set lathes, no matter if they are in an assembled or disassembled condition.

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Description

The underfloor wheel set lathe is embedded in a pit. The wheel sets to be reprofiled are positioned onto feed rail ( if they are still assembled ) or by a crane ( if they are disassembled ).

To carry out reprofiling, the wheel sets are driven at the treads by two friction rollers for each wheel. To achieve the highest possible machining accuracy, while taking into account a high dynamic rigidity, the wheel sets are centred at their axle bearing boxes. Then, they are additionally guided by the axial guide rollers in axial direction.

The underfloor wheel set lathe is suitable for:

- profile machining and machining of the inner faces of the wheels,
- turning of the treads up to the flange top and the flange rear face,
- machining of inner axle mounted brake disks and wheel mounted brake disks ( option ),

The machine is operated via a central control panel so that the operator has continuous access to all machine functions while simultaneously being in the optimum working position. During machining, the operator is protected against flying chips.

The automatic machining system relieves the operator to a large extent and thus enables easy handling of the machine.

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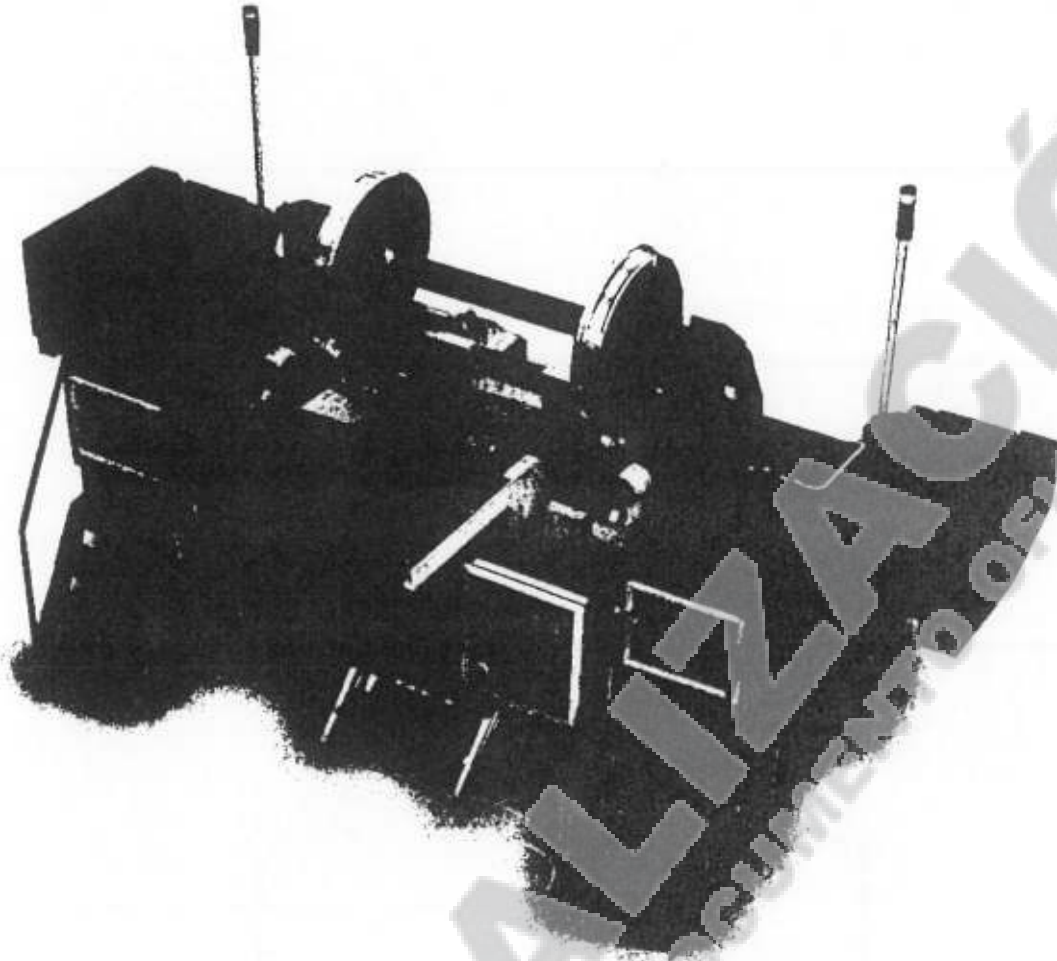
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**Basic machine**

**Machine construction**

Standard  
 components

The base machine is a standard unit which is CNC controlled and designed to lift, measure and machine a wheel set together with its customer-specific supplementary modules.

The following components belong to the standard unit:

- 2 machine columns,
- crossbeams,
- 2 tool posts with integrated positioning and wear probes,

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- 2 diameter measuring units
- 2 friction roller drives ( roller carrier with drive unit ),
- 2 lateral guide rollers
- electrical equipment,
- hydraulics,
- machine casing,
- CNC control Sinumerik 840 DE, make Siemens, control in the offered language ( if available ),
- 

Customer or vehicle-specific components

- 2 outer bearing centring units with adapters (in basic machine),
- chip disposal system,
- necessary extensions according to machining task,

Further options to extend the operative range and to increase the degree of automation

- anti - slip control unit
- dust and fume extraction,
- brake disk machining programs and set of tools(option)
- hydraulic operated lifting units for lifting of the second wheel set from coupled wheel sets with variable wheel base distance

Technical Machine Data

track gauge .....	1,000/1,435/1676	mm
min. tread diameter .....		350 mm
max. tread diameter .....		1,400 mm
min. tyre width.....		85 mm



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max. tyre width .....	145
min. centre distance, coupled.....	1,300
min. centre distance, uncoupled.....	1,000
max. axle length to be received .....	
..... 2,165/2,600/2,841	mm
min. axle length to be received .....	
..... 1,465/1,900/2,141	mm
max. axle load machine .....	400 kN
max. axle load rail system .....	
..... 400	kN

Machining accuracy

max. diameter difference of two wheels on one axle.....	0.1 mm <sup>1</sup>
max. diameter difference of four wheels on two axles.....	0.3 mm <sup>1</sup>
deviation from round true on the measuring circle level.....	0.1 mm <sup>2,4</sup>
deviation from flat running on the flange.....	0.3 mm <sup>3,4</sup>
deviation from the profile geometry .....	0.2 mm <sup>1</sup>
surface finish, profile machining, .....	Rz < 60 µm

- 1) Prerequisites: Equal cutting allowance on both wheels, sharp tool tips and accurate and firm clamping of axle bearing boxes. Cutting depth not exceeding 4 mm (2 cuts)
- 2) Prerequisites: Measuring cut, pre-cut or true running wheel and sharp tool tips, normal cutting conditions and correct centring of wheelsets.
- 3) Prerequisite: Flat running of inner tyre face better 0,5 mm.
- 4) In the case of rubber-cushioned wheel sets, the value may increase by up to 0.3 mm.

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Machine data

drive rating ..... 2 x 30 kW

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cutting force ( if axle load is sufficient ).....	26 kN
max. cutting cross-section..... approx.	10 mm <sup>2</sup>
cutting speed, profile machining. .....	30-120 m/min
max. cutting speed, measuring circle level	305 m/min
tool post fast gear, longitudinal and flat ..... 5.....	m/min
feed range infinitely variable from - to.....	0 - 2.5
.....	mm/rev
distance between the drive rollers.....	440 mm
diameter of the drive rollers.....	220 mm
max. noise level of the machine ..... (except for cutting noise)	< 80 dB (A)
measuring system of the machine .....	metric
language: CNC screen, menu displays, error messages, documentation.....	English
..... signs .....	English

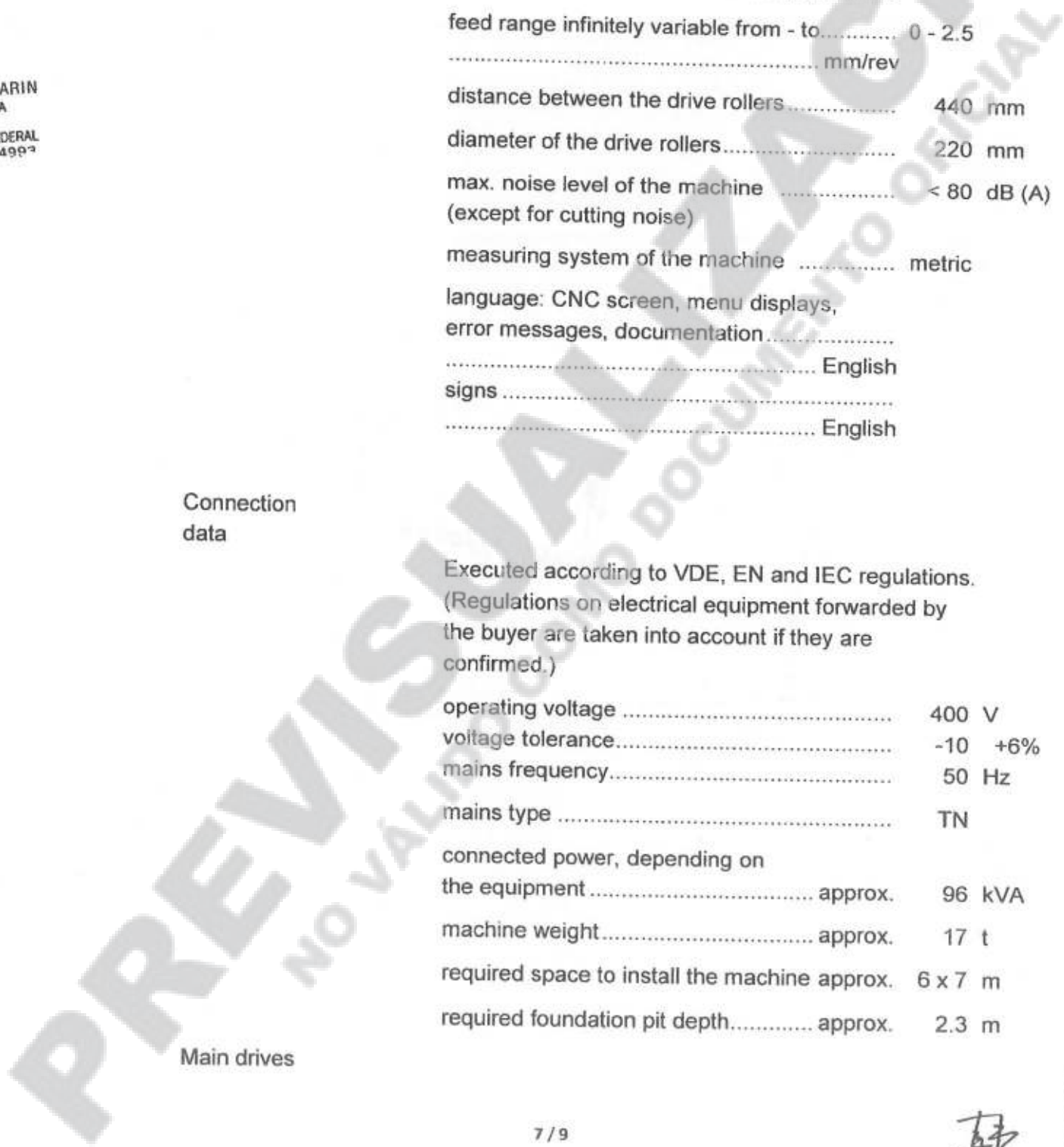
Connection data

Executed according to VDE, EN and IEC regulations.  
 (Regulations on electrical equipment forwarded by  
 the buyer are taken into account if they are  
 confirmed.)

operating voltage .....	400 V
voltage tolerance.....	-10 +6%
mains frequency.....	50 Hz
mains type .....	TN
connected power, depending on the equipment..... approx.	96 kVA
machine weight..... approx.	17 t
required space to install the machine approx.	6 x 7 m
required foundation pit depth..... approx.	2.3 m

Main drives

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two three-phase asynchronous motors with frequency control,

protection class ..... IP 54

total power ..... approx. 60 kW

power per motor (PS1-100%) ..... approx. 30 kW

overload resistant in short-time operation:

PS6-60% \* (per motor) ..... 37.5 kW

PS6-40% \* (per motor) ..... 45.0 kW

speed range:

total ..... 1-1.500-6.500 min<sup>-1</sup>

const. torque ..... 1-1.500 min<sup>-1</sup>

const. power ..... 1.500-6.500 min<sup>-1</sup>

- motor control via inverter,
- forced-air fan,
- electrical braking,
- speed repeater,
- remote adjustment and remote indicator.

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Note

PS6 - continuous operation with intermittent loading.  
(Reference time = 10 minutes acc. to DIN VDE 0530)

Feed drives

four highly dynamic electronic servo drives,  
continuously adjustable for feed and quick motions,  
power per motor ..... approx. 2.1 kW,  
at ..... 2000 1/min,  
protection class: ..... IP54

Pump drive,  
hydraulic unit

a three-phase motor  
power ..... approx. 5 kW  
at ..... 1800 1/min  
protection class: ..... IP 44

Auxiliary drives

a set of actuators, fans etc.,  
protection class: ..... IP 44 /  
54.

Each machine will come preset to each gauge according to next detail:

- One machine to 1000mm gauge
- One machine to 1435mm gauge
- One machine to 1676 mm gauge

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**Annex-2.2****Technical Specifications of Vertical Turning Lathe****Highlight**

1. The machine tool is suitable for machining of all industries, and can be used for rough and fine turning of external cylindrical surface, conical surface, end face, grooving and cutting. It is especially suitable for the CNC profiling processing of the spoke plates and rim treads of overall wheel sets of railway locomotives and vehicles.
2. The machine tool casting adopts high-quality lost-foam resin sand casting process, so the casting is high in quality, and is durable after aging treatment.
3. Automatic feed control is carried out using Germany's SIEMENS-828D CNC system.
4. The heavy-current control of the machine tool is carried out by a programmable controller (PLC).
5. A centralized lubrication system is configured in the machine tool to ensure that each transmission part of the machine tool can be finely lubricated.
6. The safety door of the machine tool has good protective effect for the machine tool and its operation.
7. The machine tool is preset with a profiling processing program of the spoke plates and rim treads of overall wheel sets of railway locomotives and vehicles.

**Regulations, Norms and Standards**

Regarding Quality, Safety and Environment, our proposed scope of supply shall comply with regulations, norms and standards in force:

GB /TB relevant regulations and standards

**Application Range**

It is suitable for the CNC profiling processing of the spoke plates and rim treads of overall wheel sets of railway locomotives and vehicles, and suitable for the CNC processing of inner holes and ends of locomotive and vehicle wheel sets.



### Technical Parameters

Name	Item	Parameter	
Major technical parameters	Table diameter	1400 mm	
	Turning diameter	1600mm	
	Max. tread diameter of solid wheel	1250 mm	
	Min. diameter of solid wheel hub hole	145mm	
	Max. weight of workpiece	8T	
	Max. workpiece height	1600mm	
	Variable speed	3.15-315rpm	
	Maximum torque	20kNm	
	Bearing diameter		1200mm
			1400mm
	Max. cutting force of vertical cutter	40kN	
	Accuracy	0.03mm	

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## Annex-2.3

## Technical Specifications of Wheel Assembly Press

**Highlight**

1. The train wheel assembly press is suitable for assembly and disassembly of wheels and axles on wheel sets of various models of newly-manufactured and overhauled locomotives, passenger trains and freight trains. The equipment is featured with reasonable structure, good rigidity, wide application range, high production efficiency, reliable performance, simple operation and easy maintenance.
2. It is a multi-purpose machine with wide application range, and can perform pressing and withdrawal.
3. The wheel assembly press is featured with advanced structure, reasonable stress state, high rigidity, treated components, and good stability.
4. The control system interface is designed to be easy for human operations, and the pressing curve therefore can be recorded, stored and printed.

**Regulations, Norms and Standards**

Regarding Quality, Safety and Environment, our proposed scope of supply shall comply with regulations, norms and standards in force:

GB /TB relevant regulations and standards

**Application Range**

The wheel assembly press is suitable for assembly and disassembly of wheels and axles on wheel sets of various models of newly-manufactured and overhauled locomotives, passenger trains and freight trains, which have track gauges of 1000mm-1435mm-1676mm.

**Technical Parameters**

Track	Track gauge	1000 mm -1435 mm -1676mm
Main specifications	Maximum force	350Tn
	Wheel Diameter	Max. 1250 mm
	Max. axle length	2600 mm
	Min. axle length	1500mm
	Axle length range	1500—2600 mm
Technical Parameters	pressing speed	Max. 300mm/min – Min. 30 mm/min



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	Total power of power supply	About 38KW, 380V three-phase AC
	Mass	About 30000 kg

Each machine will come preset to each gauge according to next detail:

- One machine to 1000mm gauge
- One machine to 1435mm gauge
- One machine to 1676 mm gauge

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## Annex-2.4

**Technical Specifications of Wheel Lathe****Highlight**

1. A special piece of equipment suitable for processing rims and treads on wheel sets of various models of passenger and freight vehicles, diesel locomotives, which have track gauges of 1000mm-1435mm-1676mm.
2. The machine tool adopts AC servo control CNC built-in advanced programmable logic controller (PLC) circuit matched with AC servo CNC system profiling processing, so that the comprehensive technical level of this machine tool reach the level of the most advanced CNC wheel lathe at home and abroad.
3. The machine tool can meet the profiling and repairing required by various kinds of wheel set technologies.
4. The automatically controlled profiling types of the machine tool include LM-32, LM-30, LM-28, LM-26 and LMA, and other wheel set shapes required by users.
5. The cutting tool is a throw-away, mechanical clamping powerful tool.
6. The machine tool has fault self-diagnosis and display functions.

**Regulations, Norms and Standards**

Regarding Quality, Safety and Environment, our proposed scope of supply shall comply with regulations, norms and standards in force:

GB /TB relevant regulations and standards

**Application Range**

It is suitable for turning rims and treads on wheel sets of various models of electric locomotives, diesel locomotives, passenger and freight vehicles, and urban rail vehicles, which have track gauges of 1000mm-1435mm-1676mm.

The turning processing is positioned by the lathe top and executed by a CNC cutter rest system. Scrap iron can be disposed through a clastic machine and chip removal device, and then be moved to the chip container above the pit.

**Technical Parameters**



Track	Track gauge	1000 mm -1435 mm -1676mm
Axle	Max. axle length	2610 mm
	Min. axle length	1700mm
	Max. work piece weight	5000kg
Wheels	Wheel diameter on tread	650 - 1300 mm
	Wheel width	120 - 140 mm
Processing technology parameters	Profiling manner	Automatic CNC full profiling and segmented local profiling
	Wheel full profiling time for once	6min ~ 20min/time 6min~20min/profiling
	Maximum feed cutting depth	≤8mm
	Implementation standards	China TB standards
Machining accuracy parameters	Wheel diameter difference of the same component	≤0.20mm
	Wheel profile shape difference	≤0.20mm
	Rolling round degree difference	≤0.20mm
	Radial run-out	≤0.20mm
	Inner end side run-out of wheel set	≤0.30mm
	Surface roughness	≤6.3μm
Applied work environment	Altitude	≤2500m
	Ambient working temperature	-5°C~45°C
	Relative humidity	≤90%

The wheel transport track in a workshop is connected with a wheel lathe loading and unloading track, the wheel set to be processed reaches the wheel loading and unloading track of lathe set through the wheel transport track of workshop, and the wheel set to be processed is automatically clamped by an automatic hydraulic wheel of the lathe set, and then the processed wheel set is automatically unloaded, and returns to a wheel transport track of the workshop through the lathe loading and



unloading track.

Each machine will come preset to each gauge according to next detail:

- One machine to 1000mm gauge
- One machine to 1435mm gauge
- One machine to 1676 mm gauge

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## Annex-3

No.	Item	Qty	Unit price(US\$)	Total price(US\$)
1	Bolster for 1676mm Gauge(piece)	30	2950	\$ 88,500.00
2	Side Frame for 1676mm Gauge(piece)	60	1463	\$ 87,780.00
3	Bolster for 1435mm Gauge(piece)	20	2399	\$ 47,980.00
4	Side Frame for 1435mm Gauge(piece)	40	1274	\$ 50,960.00
5	Bolster for 1000mm Gauge(piece)	30	1985	\$ 59,550.00
6	Side Frame for 1000mm Gauge(piece)	60	1148	\$ 68,880.00
7	Wheel(840mm,piece)	700	1109	\$ 776,300.00
8	Bearing(6x11,piece)	800	550	\$ 440,000.00
9	Axle (for 1676mm Gauge,piece)	60	1828	\$ 109,680.00
10	Axle (for 1435mm Gauge,piece)	40	1590	\$ 63,600.00
11	Axle (for 1000mm Gauge,piece)	60	1366	\$ 81,960.00
12	Reduction Gearbox for Hopper	40	1957	\$ 78,280.00
13	Reduction Gearbox for Hopper	40	1957	\$ 78,280.00
14	13B coupler(set)	100	5750	\$ 575,000.00
15	Discharge Gate Assembly for Ore Hopper Wagon (1676mm gauge,piece)	50	1750	\$ 87,500.00
16	Discharge Gate Assembly for Ballast Hopper Wagon (1435mm gauge,piece)	20	1338	\$ 26,760.00
17	Discharge Gate Assembly for Ballast Hopper Wagon (1000mm gauge,piece)	20	1295	\$ 25,900.00
18	Discharge Gate Assembly for grain hopper wagon (1676mm gauge,piece)	60	1422	\$ 85,320.00
19	Discharge Gate Assembly for grain hopper wagon (1435mm gauge,piece)	20	1271	\$ 25,420.00
20	Discharge Gate Assembly for grain hopper wagon (1000mm gauge,piece)	30	1206	\$ 36,180.00
21	Top Hatch Assembly for Grain Hopper	50	2695	\$ 134,750.00
22	Hand Brake (piece)	40	391	\$ 15,640.00
23	Outer Ring for 1676mm Gauge(piece)	400	42	\$ 16,800.00
24	Inner Ring for 1676mm Gauge(piece)	400	18	\$ 7,200.00
25	Outer Ring for 1435/1000mm Gauge(piece)	400	38	\$ 15,200.00
26	Inner Ring for 1435/1000mm Gauge(piece)	400	13	\$ 5,200.00
27	Wedge(include spring,piece)	660	73	\$ 48,180.00
28	Upper Center Plate(piece)	100	202	\$ 20,200.00
29	Brake Beam(1676mm gauge, left,piece)	50	533	\$ 26,650.00
30	Brake Beam(1676mm gauge, right,piece)	50	533	\$ 26,650.00
31	Brake Beam(1435mm gauge, left,piece)	50	468	\$ 23,400.00
32	Brake Beam(1435mm gauge, right,piece)	50	468	\$ 23,400.00
33	Brake Beam(1000mm gauge,piece)	50	390	\$ 19,500.00
34	Adaptor(piece)	400	121	\$ 48,400.00
35	Side Bearer(piece)	500	91	\$ 45,500.00
36	Brake Lever for 1676mm Gauge Bogie(piece)	100	98	\$ 9,800.00
37	Brake Lever for 1435mm Gauge Bogie(piece)	100	86	\$ 8,600.00
38	Brake Lever for 1000mm Gauge Bogie(piece)	100	77	\$ 7,700.00
39	Bottom Pulling Rod for 1676mm Gauge	50	150	\$ 7,500.00

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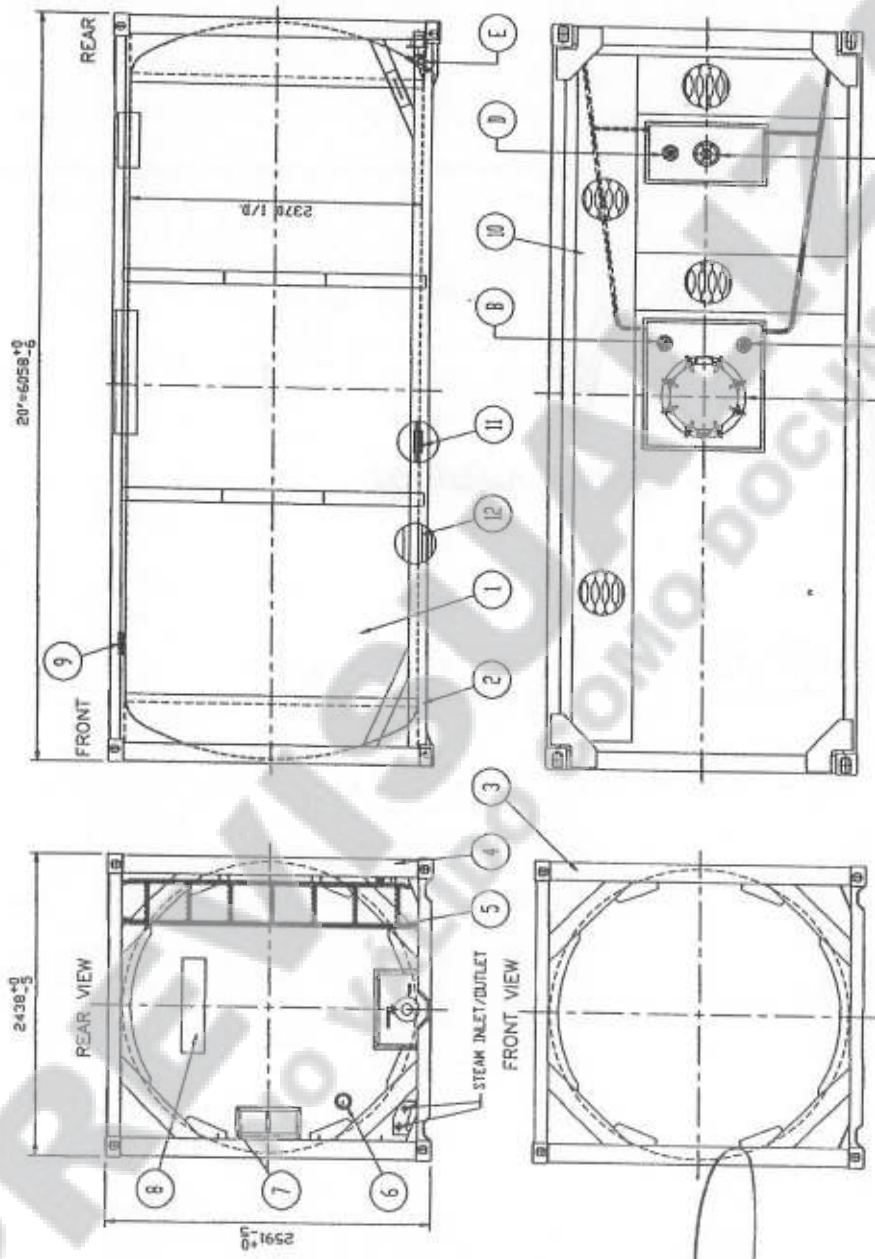
ANEXO II  
0425



40	Bottom Pulling Rod for 1435mm Gauge	50	282	\$	14,100.00
41	Bottom Pulling Rod for 1000mm Gauge	50	368	\$	18,400.00
42	Center Plate Wear Plate(piece)	90	31	\$	2,790.00
43	Adaptor Wear Plate(piece)	360	10	\$	3,600.00
44	Side Frame Column Wear Plate(piece)	360	18	\$	6,480.00
Total spare parts for wagons					\$ 3,449,470.00

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Annex 4.1 Drawing of 25K-T11 Tank



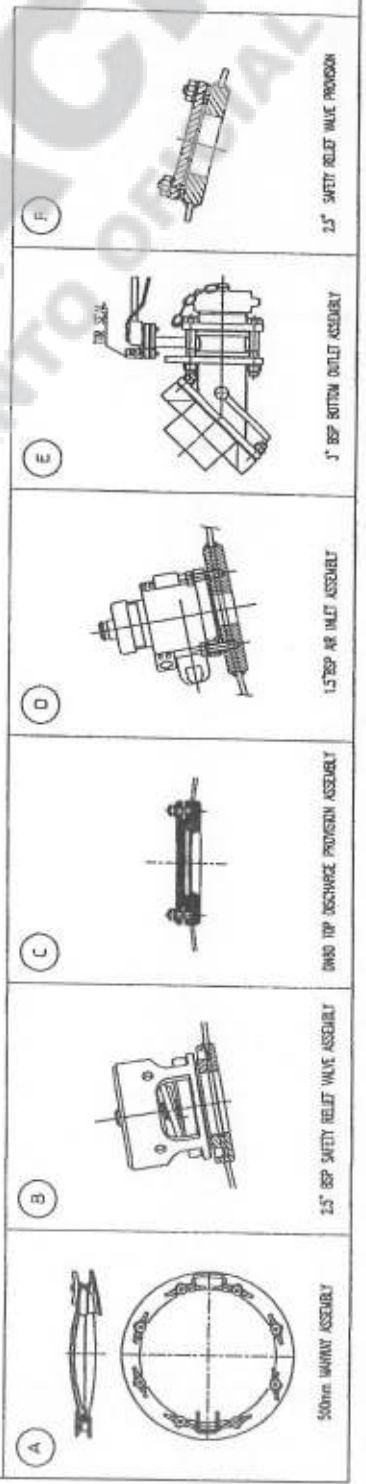
### DESIGN REQUIREMENTS

MAX GROSS WEIGHT	34000 KG
TANK WEIGHT	30000 KG
CAPACITY	30000 L
PRODUCT OPERATOR RESPONSIBILITY TO ODO COMPLIANT (Y/N)	AS LISTED IN PORTABLE TANK T11
MAX ALLOWABLE WORKING PRESSURE	1.0 MPa (14.5 BAR)
TEMPERATURE	100°C
STEAM HEATING	1 BAR
HYDROSTATIC PRESSURE	1.5 BAR
AIR LEAKAGE	1.0 BAR
STEAM HEATING	1.0 BAR
VESEL	STEEL SHEET PILING, TENSILE STRENGTH CLASS S355JR
MATERIALS	STEEL SHEET PILING, TENSILE STRENGTH CLASS S355JR
INSULATION	NO
DESIGN CODE	EN 12954-1
CONSTRUCTION	EN 12954-1
COMPRESSOR ALLOWANCE	SHELL
MANHOLES/VIEWING	SHELL
STANCHION LOAD	SHELL
COMPLETION DATA PLATE	YES
PORTABLE TANK RESTRICTION	NO
APPROVALS	TR-REV/AN/ESC-1000T-IND-UC-TC
FRONT	FRONT
REAR	REAR
STEAM HEATING	NO
HYDROSTATIC PRESSURE	1.5 BAR
AIR LEAKAGE	1.0 BAR
STEAM HEATING	1.0 BAR
VESEL	STEEL SHEET PILING, TENSILE STRENGTH CLASS S355JR
MATERIALS	STEEL SHEET PILING, TENSILE STRENGTH CLASS S355JR
INSULATION	NO
DESIGN CODE	EN 12954-1
CONSTRUCTION	EN 12954-1
COMPRESSOR ALLOWANCE	SHELL
MANHOLES/VIEWING	SHELL
STANCHION LOAD	SHELL
COMPLETION DATA PLATE	YES
PORTABLE TANK RESTRICTION	NO
APPROVALS	TR-REV/AN/ESC-1000T-IND-UC-TC

### PARTS LIST

DETAIL	DESCRIPTION
A	500mm DIA. MANWAY, 8 FEET FRAME
B	2.5" BOP PRESSURE RELIEF VALVE SET AT 1.4 BAR
C	POSITION PLATE OF A 3" TOP DISCHARGE ASSEMBLY
D	1.5" BOP AIR INLET VALVE WITH CAP AND CHAIN
E	EXTERNAL VALVES CLAMPED BUTTERFLY VALVE WITH 2" BOP CAP CONNECTOR FITTED WITH L&S BLANKING CAP AND RETURNING CABLE
F	2.5" BOP PRESSURE RELIEF VALVE PREVISION

12	STEAM HEATING		
11	HEATING CONTROL		
10	VALVEWAY ASSEMBLY		
9	WALDLINER & CHAINING		
8	WALDLINER		
7	DISCHARGE ASSEMBLY		
6	DISCHARGE ASSEMBLY		
5	AIR INLET ASSEMBLY		
4	SAFETY RELIEF VALVE ASSEMBLY		
3	SAFETY RELIEF VALVE ASSEMBLY		
2	SAFETY RELIEF VALVE ASSEMBLY		
1	SAFETY RELIEF VALVE ASSEMBLY		



ANEXO II



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<b>1. Technical Characteristics</b>				
<b>1.1 Design &amp; Testing</b>				
Tank – in accordance with		IMDG, CFR 49, RID/ADR and ASME VIII, Div1 US DOT, RID/ADR and TC		
Frame – in accordance with		IMDG Equivalent Thickness (mm): 6 mm ISO Standard 1496/3		
<b>1.2 ISO Type</b>		1CC/22K2		
<b>1.3 UN Portable Tank Instruction</b>		T11		
<b>1.4 Nominal Capacity (± 1% Tolerance)</b>	SI	US		
	25 000 ℓ	6604		US gal
<b>1.5 Frame Dimensions and Weight</b>				
Max Gross Weight	36000 kg	79366		lb
Tare Weight (± 3% Tolerance)	3650 kg	8047		lb
Length	6058 mm	20		ft
Width	2438 mm	8		ft
Height	2591 mm	8 ft 6		in
<b>1.6 Tank Dimensions</b>				
Internal Diameter	2370 mm	93.31		in
Shell Calculation Thickness	4.18 mm	0.1646		in
Shell Order Thickness	4.40 mm	0.1732		in
Corrosion Allowance	0.22 mm			
Head Calculation Thickness				
Dished End	4.40 mm	0.1732		in
Corrosion Allowance	0.20 mm			
Dished Ends				
Dished Ends After Forming Thickness	4.60 mm	0.1811		in
<b>1.7 Pressure &amp; Temperature Rating</b>				
Maximum Tank Design Temperature	-40-130 °C			
Maximum Allowable Working Pressure	4.0 bar	58.0		psi
Test Pressure	6.0 bar	87.0		psi
Vacuum Pressure	0.41 bar	5.95		psi
Steam Heating				
Maximum Allowable Working Pressure	4.0 bar	58.0		psi
Test Pressure	6.0 bar	87.0		psi
<b>1.8 Material of Construction</b>				
Framework	Q345D /SPA -H or eqv.			
Corner Castings	ISO Standard 1161 (Tested to -40°C)			
Shell	SANS 50028-7 (1.4402) Max carbon content 0.03% Cold Rolled 2B finish			
Heads	SANS 50028-7 (1.4402) Max carbon content 0.03% Hot Rolled No.1 finish			
Vessel Material Supplier	ALZ, TISCO, BAOSTEEL			
Vacuum Stiffening Rings	ASTM A240 Gr. 304, 2-off channel section			
Steam Channels	ASTM A240 Gr. 304			



0425



2. Tank Fitting and Accessories		
2.1	<p><b>Manhole</b> Supplier Dimensions Material Description Gasket</p>	<p><b>(Main Spillbox)</b> FortVale/Perolo/GUARD 500 mm ID 316 Low profile ,8 point fixing PTFE/EPDM</p>
2.2	<p><b>Safety Relief Valve</b> Supplier Quantity Description Specifications Weld in Flange Remarks</p>	<p><b>(Main Spillbox)</b> FortVale/Perolo/GUARD one 2.5" BSP Super Maxi High Flow Safety Relief Valve. +4,4 Bar pressure (+63,8 psi) Yes, off centre line And a provision is made for the future fitting of another SRV.</p>
2.3	<p><b>Air Inlet Valve</b> Supplier Quantity Description  Gasket Weld In Flange</p>	<p><b>(Rear Spillbox)</b> FortVale/Perolo/GUARD One 1½" BSP Airline Ball Valve with Low profile handle and stainless steel cap. PTFE envelope Yes, off centre line</p>
2.4	<p><b>Top Discharge Provision (Rear Spillbox)</b> Supplier Quantity Dimensions Specification Gasket Remarks  Weld in flange</p>	<p>FortVale/Perolo/GUARD One DN 80 (3") 3" weld-in tank pad(6xM12 on 168.3 PCD) PTFE envelope Provision is made for the future fitting of a clamped 3" butterfly valve and 3" syphon tube A siphon tube guide plate is fitted on bottom of tank Yes,on centre line</p>
2.5	<p><b>Bottom Discharge</b> Supplier Dimensions Specification  Gasket: Weld in flange Remarks  Lid</p>	<p>FortVale/Perolo/GUARD DN 80 ( 3" ) opening diameter Internal valve -45 deg footvalve External valve – DN80 clamped butterfly valve with a 3" BSP threaded connector closed by a stainless steel cap with a retaining chain. PTFE envelope Yes The CXIC remote control is connected to the internal valve handle and a provision for fitted with a fusible link No</p>
2.6	<p><b>Thermometer</b> Quantity Description  Type Position</p>	<p>One 100 mm diameter Dual scale -40°C to 160°C, -40°F to 320°F Contact type,dial thermometer Rear end (8 o'clock)</p>
2.7	<p><b>Spillbox (s)</b> Quantity Description  Material Drain Pipes  Lid</p>	<p>Two At centre around manhole,safety&amp;SVR provision, relief valve.At rear around top discharge provision,air inlet. ASTM A240 304, 2 mm thick Each box is equipped with 2 DN 25 surface mounted PVC spirally reinforced drain tubes fitted to opposite end of box. No</p>

- 0425
- MINISTERIO DEL INTERIOR Y TRANSPORTE  
FOLIO 548
- PREVISUALIZACIÓN DOCUMENTO OFICIAL
- 2.8 Steam Heating**  
 Heating area Above 9.6m<sup>2</sup> effective  
 No. of runs 8  
 Inlet diameter 3/4 inch BSP male threaded  
 Outlet diameter 3/4 inch BSP male threaded  
 Drain valve Yes, 1/4 inch BSP Ball Valve  
 End cap material stainless steel c/w cable
- 2.9 Tank Treatment**  
 Pickling  
 Internal Yes  
 Passivation  
 Internal Yes  
 External Spill boxes only
- 2.10 Insulation and Cladding**  
 Material Rock Wool  
 Shell 50mm Rockwool  
 Ends 50mm Rockwool varies  
 Remarks Aluminium foil to be placed between rockwool and tank shell.  
 Cladding 1.8mm thickness GRP( RAL 9010 )for shell with 0.4mm polished stainless steel banding. Seal provided by silicone.  
 2.0mm thickness GRP( RAL 9010 )for ends.
- 2.11 Walkway**  
 Layout "F" Type (1x longitudinal members and 2x transverse members)  
 Width / thick 475 mm  
 Material Aluminium Grade 5052H32 or equivalent  
 Remarks Using stainless steel fastenings with nylock nuts.
- 2.12 Ladder**  
 One ladder 300 mm (30 x 30 mm section) wide is bolted with welded nuts onto the right hand side of the rear frame. The ladder rungs have an anti-slip surface. The ladder is made from SUS304 material.
- 2.13 Corner Protection**  
 4 off per tank located at the top frame corner.  
 4 off stacking cut outs located on front and rear frame
- 2.14 Earthing Connection**  
 One stainless steel lug 50 x 30 x 3 mm, with 15 mm hole, located at rear of tank frame.
- 2.15 Document Holder**  
 1-off plastic document holder 75 mm diameter 320 mm long.  
 Colour Opaque  
 Drain hole diameter 6mm
- 2.16 Data Plates**  
 One stainless steel data plate per tank as per code requirements.
- 2.17 Dipstick**                      No                      Bracket                      No
- 2.18 Calibration**  
 Calibration plate Yes, marked in litres and US gallons/cm, tack-welded inside the spillbox.  
 Chart Material 304 Stainless Steel
- 2.19 Frame Treatment**  
 Surface Preparation Shot Blasting to SA 2,5 Finish

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**2.20 Painting of Frame**

Coat	Epoxy zinc rich primer
Intermediate	Epoxy primer
Final coat	Hempatex
Total DFT (Primer & Top)	Minimum DFT
Final coat colour	RAL 5013

0425  
30 micron  
40 micron  
50 micron  
120 micron

**2.21 Decals**

One set of mandatory decals & customer logo approved by client and applied by manufacturer

**2.22 Painting of Vessel**

Steam ducts, inlet and outlet pipes and fittings below the insulation coated as Follows:  
Hempel heat resistant silicone aluminium - minimum 25 micron DFT

**3. Vessel and fittings Surface Finish**

Vessel	Cold Rolled 2B finish.
Dished Ends	Polished to Ra 1.2 microns.
Shell circumferential welds	Weld penetration and bead flushed and polished at bottom 400mm. Finished to 1.2 microns.

**4. Tests and Approvals**

- 4.1 These tank containers are constructed according to an approved design.
- 4.2 Each production unit is subject to testing and non-destructive examination as required by ASME VIII Division 1, UIC and Suppliers own quality requirements. The independent Inspection Authority, BV/LR, inspects each unit.
- 4.3 The tank container has been approved for a stacking load of 86400kg per corner post.
- 4.4 The tank container fulfils the performance specification of the following International Organizations regulations and recommendations and is supplied with their Approvals / Registrations.
- 4.5 Each container will be supplied with following approvals:
- |           |                  |
|-----------|------------------|
| US-DOT    | IMDG             |
| TIR       | CSC              |
| RID / ADR | Transport Canada |
| UIC       |                  |
- 4.6 Radiography (UW51 and UW52)
- |             |      |
|-------------|------|
| Shell       | Spot |
| Dished Ends | 100% |

**5. Documentation**

The following documentation will be provided:

- 5.1 Details and GA drawings  
5.2 Technical specification  
5.3 Cleanliness Certificate  
5.4 Initial Inspection Certificate  
5.5 BV/LR technical note / approvals

Files must be prepared as specified hereafter:

- 1 x paper file  
1 x CD ROM

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## Annex-4.3

## Technical Specifications of the Heavy Machinery

## I. Technical Specifications

## 966H Wheel Loader Technical Specifications and Parameters

## 1. Technical specifications

## 1.1 Power train

- (1) Engine : Caterpillar C11 engine with ACERT Technology –EPA Tier III, EU Stage III a Compliant
- ① Model : C11 ACERT
- ② Type : 6-cylinder , in line , water cooling , waste gate turbo charger, air-to-air after cooling (ATAAC), electronically controlled unit injection (MEUI) system
- ③ Net Power : 194kW ( 260hp ) @1,800rpm
- ④ Displacement : 11.1L
- (2) Transmission :
- ① Type : electronically controlled, caterpillar planetary power shift transmission , electronic clutch pressure control
- ② Transmission : 4 forward, 4 reverse
- ③ Maximum travel speeds : Forward 37.4km/h , Reverse 37.4km/h
- (3) Torque converter : Free wheel stator torque converter
- (4) Final drives : Automatic planetary power-shift transmission
- (5) Axles : Suspension semi-axle, heavy load, differential axle

## 1.2 Durability

## (1) Z-Bar Linkage

The proven Z-bar linkage with Performance Series Buckets offer excellent penetration into the pile, high breakout forces, good roll back angles and faster dig times. The results are improved longer tire life, superior fuel efficiency and exceptional production capabilities;



## (2) Axles

The axles are designed to handle extreme applications resulting in reliable performance and extended life. The front axle is rigidly mounted to the frame in order to withstand internal torque loads and still maintain support for the wheel loader. The rear axle can oscillate to  $\pm 13$  degrees helping to ensure all four wheels stay on the ground providing stability even in the roughest terrain.

## 1.3 Hydraulic System

## (1) Load Sensing Hydraulics

The 966H features a load sensing hydraulic system that automatically adjusts to operating conditions to provide only the hydraulic flow required by the implement for improved fuel efficiency. A new hydraulic valve has been implemented providing improved service access and machine weight distribution. Operators will notice enhanced ease of operation, more rimpull into the pile and an increase in lift force

(2).Maximum flow : 320L/min

## 1.4 Steering System

(1) Load sensing steering system , articulated frame steering

(2) Independent steering system

## 1.5 Structure (frame and arms)

(1) frame and support tower : Box structure

(2) lift arms : Double-arm structure

## 1.6 Cab

(1) Pressurized and sound-suppressed closed cab. In Cab : Control system, monitoring system, instrumentation and switches.

(2) Seat : all-way adjustable , suspension seat

## 1.7 Working device

(1) Z-bar linkage

(2) General Purpose Buckets :  $4.2\text{m}^3$  , tips & segments.

## 2. Parameters

Rated payload : ..... 6.8t

Maximum bucket Capacity : ..... $4.2\text{m}^3$

Operating weight : .....23,319kg

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Engine Net Power : .....194kW

Engine Peak Torque : .....1,299Nm

Maximum travel speeds : .....Forward 37.4km/h ;  
Reverse: 37.4km/h

Hydraulic cycle time :

Raise : .....6.5s

Dump : .....2.7s

Lower : .....3.5s

Axles :

Front : .....Fixed

Rear : .....±13°

Wheelbase : .....3450mm

Maximum dumping height Forward dumping height (at full lift and 45° discharge) : .....2837mm

Dumping distance at full lift Forward dumping distance (at full lift and 45° discharge) : .....1,525mm

Overall Height at Full Raise and 45° Discharge : .....5902mm

Loader Clearance Circle with Bucket at Carry Position.....14951mm

Breakout Depth : .....124mm

Maximum breakout force : .....171kN

Maximum clearance : .....434mm

Full turn (single side) : .....37°

Static tipping load Full 37° turn : .....13664kg

Sound pressure level ( The declared dynamic operator sound pressure level for standard machine configuration, measured according to the procedures specified in "ISO 6396:2008," is 69 dB(A) with a cooling fan speed set at 70 percent of the maximum value. ) : .....69dB(A)

Tires size : .....26.5R25

Dimensions : (L × W × H).....9005×3,271×3,575mm

**966H Wheel Loader Main Configurations**

**ELECTRICAL**

- Alarm, back-up
- Alternator, 115-amp brushed
- Batteries, maintenance free (2) 1,400 CCA
- Ignition key; start/stop switch
- Lighting system, halogen
- Starter, electric, heavy-duty
- Starting and charging system (24-volt)

**OPERATOR ENVIRONMENT**

- Air conditioner
- Bucket/work tool function lockout
- Cab, pressurized and sound-suppressed ROPS/FOPS
- Radio-ready includes antenna, speakers and converter (12-volt, 10-amp)
- Coat hook
- Computerized monitoring system
- Instrumentation, gauges:
- Instrumentation, warning indicators
- Heater and defroster
- Horn, electric (console)
- Light, dome (cab)
- Mirror
- Seat, Cat Comfort with air suspension
- Seat belt, retractable
- Wet-arm wipers and washers, front and rear
- Window, sliding

**POWER TRAIN**

- Brakes, full hydraulic enclosed wet-disc with Integrated Braking System (IBS) and brake wear indicator
- Engine, with ACERT Technology
- Fan, radiator, electronically controlled, hydraulically driven, temperature sensing, on demand
- Filters, fuel, primary/secondary



- Filters, engine air, primary/secondary/tertiary
- Fuel priming pump
- Torque converter
- Transmission, automatic, planetary powershift (4F/4R)

**OTHER**

- Automatic bucket positioner
- Fenders, steel (front and rear)
- Hood, non-metallic, power tilting
- Hydraulic oil cooler
- Kickout, lift and tilt, automatic
- Linkage, Z-bar, cast cross tube/tilt lever
- Oil sampling valves
- Service center, electrical and hydraulic
- Steering, load sensing

Note: As part of the whole, all of the materials above are included and installed on the machine, and none of them can be provided separately. (Standard equipment may vary in different areas, the factory delivery shall prevail)

### Specifications of M317D2 Wheel Hydraulic Excavator

**1 OVERVIEW**

- 1.1 M317D2 Wheel Hydraulic Excavator is one of the standard products of Caterpillar. This product uses the latest and newest technology, which brings more efficiency, high reliability/durability and a better environment protection.

**2 SPECIFICATIONS****2.1 Engine:**

The emission level of CAT C4.4 is equivalent to the emission standards of US EPA Tier III and EU IIIA. It has a higher performance and reliability, also lowers the fuel consumption and noise level. The engine has lower noise level of operator and observer, longer filter replacement cycle and higher fuel efficiency, also a better environment protection.

1. Flywheel power-----101kW
2. Rated rotator speed-----2,000 rpm
3. Displacement-----4.4L
4. Bore × Stroke-----105mm × 127 mm
5. No power loss under the altitude of 3000m
6. EU Stage IIIA STD
7. Maximum torque @ 1,400 rpm: -----550N·m

**2.2 Hydraulic System****1. Main implement system**

(1) Implement Circuit (heavy lift)-----37500 kPa

**(2) Main Flow**

Implement/Travel Circuit-----220 L/min

Auxiliary Circuit - High Pressure-----220 L/min





Auxiliary Circuit - Medium Pressure-----40 L/min  
Swing Mechanism-----80 L/min

2.3 Transmission

Forward/Reverse

- 1st Gear 8 km/h
- 2nd Gear 34 km/h
- Creeper Speed
- 1st Gear 3 km/h
- 2nd Gear 13 km/h
- Drawbar Pull 97 kN
- Maximum Gradeability 69%

2.4 Swing Mechanism

- Swing Speed 10.5 rpm
- Swing Torque 40 kN·m

3 DATA

- 3.1 Operating Weight 16,512 kg
- 3.2 Bucket 0.8 m<sup>3</sup>
- 3.3 Flywheel power 101 kW
- 3.4 Maximum Travel Speed 34 km/h
- 3.5 Swing Speed 10.5 rpm
- 3.6 Swing Torque 40kN·m
- 3.7 Drawbar Pull 97kN
- 3.8 Tail Swing Radius 2210mm
- 3.9 Overall Transport Dimensions (L× W × H) 8330×2550× 3150mm
- 3.10 Working Range:
  - 1 Digging Height----- 9070 mm
  - 2 Dump Height----- 6110 mm
  - 3 Digging Depth----- 5690 mm
  - 4 Vertical Wall Digging Depth----- 3650 mm
  - 5 Depth 2.5m Straight Clean-up-----5490 mm
  - 6 Reach-----9160 mm
  - 7 Reach at Ground Level-----8970 mm
  - 8 Bucket Forces (ISO 6015) -----101 kN
  - 9 Stick Forces (ISO 6015) -----74 kN

DUAL-Tire, 10.00-20 16 PRR

5.05m One-Piece Boom

2.4m Standard Sticks

0.8m<sup>3</sup> General Purpose Bucket

M317D2 STANDARD EQUIPMENT:

Electrical



- Alternator, 75A
- Lights
  - Boom working light
  - Cab interior light
  - Rooding lights (front/rear)
  - Working lights, cab mounted (front and rear)
- Main shut-off switch
- Heavy duty maintenance free batteries
- Signal/warning horn

### Engine

- Automatic engine speed control
- Automatic starting aid
- Cat C4.4 engine with ACERT Technology Emits at levels equivalent to U.S.EPA Tire III and EU Stage IIIA emission standard.
- Fuel/water separator with level indicator

### Hydraulics

- Heavy lift mode
- Load-sensing Plus hydraulic system
- Manual work modes (economy, power)
- Separate swing pump
- Stick regeneration circuit

### Operator Station

- Adjustable armrests
- Air conditioner, heater and defroster with automatic climate control
- Ash tray with cigarette lighter (24 volt)
- Beverage cup/can and bottle holder
- Bolt-on FOGS capability
- Bottom mounted parallel wiping system
- Camera mounted on counterweight
- Coat hook
- Washable floor mat
- Fully adjustable suspension seat
- Instrument panel and gauges
  - Information and warning messages
  - Gauges for fuel level, engine coolant and hydraulic oil temperature
  - Filters/fluids change interval
  - Indicators for headlights, turning signal, low fuel, engine dial setting
  - Clock with 10-day backup battery
- Laminated front windshield
- Left side console, tiltable, with Locking mechanism for all controls
- Literature compartment behind seat

- Literature holder in right console
- Mobile phone holder
- Parking brake
- Positive filtered ventilation
- Power supply, 12V-7A
- Rear window, emergency exit
- Retractable seat belt
- Skylight
- Sliding door windows
- Steering column, tiltable
- Storage area suitable for a lunch box
- Sunshade for windshield and skylight
- Travel speed lock
- Visor for rain protection

#### UNDERCARRIAGE

- Heavy-duty axles, adjustable braking force
- Oscillating front axle with remote greasing
- Tires, 10.00-20 16 PR, dual
- Two tool boxes in undercarriage
- Two-piece drive shaft

#### OTHER EQUIPMENT

- Automatic swing brake
- Counterweight, 3500 kg
- Mirrors, frame and cab
- Product Link™ ready

All the system components above are designed and made by Caterpillar Inc..



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## 140K Motor Grader Specifications

0425



1. Specification
  - a. Model: 140K
  - b. Gross Vehicle Weight: 14,292 kg
  - c. Maximum travel speeds :  
Forward: 47.3 km/h; reverse: 37.4 km/h
  - d. Maximum lift above ground: 480 mm
  - e. Turning Radius outside front tires: 7.5 m
  
2. Engine
 

Engine Model: CAT<sup>®</sup>C7 ACERT™

Type: CAT C7 6 cylinder, water-cooled, turbo charged Diesel Engine.

Stroke × Bore: 127 × 105mm

Net Power: 1-2 Net: 128 kW (171 hp)  
3 Net: 135 kW (181 hp)  
4-8 Net: 143 kW (191 hp)

Displacement: 7.2L
  
3. Power Train
 

Type: Direct drive, Power shift

Forward/Reverse: 8forward/ 6reverse
  
4. Moldboard
 

Type: Hydraulics Control

Moldboard Measure: 3.7×0.61×0.022 m

Cutting Edge: width: 152mm / thickness: 16mm

Maximum lift above ground: 480mm

Blade Tip Range: forward 40°  
Back forward 5°

Maximum shoulder reach outside of tires

right: 1978 mm

left: 1896mm

Maximum Blade Position Angle: 90 Degrees

Maximum depth of cut: 735 mm

Throat Clearance: 120 mm
  
5. Brakes
  1. Service: Air actuated, multiple oil-disc, surface area 23948 cm<sup>2</sup>
  2. Parking: Air actuated, multiple oil-disc
  3. Secondary: Dual circuit
  
6. Tire: TIRES, 14.0-24 TR TL508 12PRSP
  
7. Service Refill:

Fuel Capacity	305L
Tandem housing:	64L/each
Transmission/Differential/Final Drive:	60L
Cooling System:	40L
Engine Oil:	18L

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### CAT320D2 Hydraulic Excavators

#### 1. Overview

The Cat 320D2 is designed and built for a variety of applications from quarry to industrial material-handling to construction and more. It is powerful, reliable, durable with great productivity and versatility making it an ideal machine whatever your job sites need.

#### 2. Technical specifications

##### 2.1 Engine:

The Cat C7.1 engine has been designed to meet U.S. EPA Tier 2, EU Stage II and China Tier 2 emission regulations. The engine is powerful, strong, and durable to meet all of your application needs. An ECO-mode feature helps reduce fuel consumption by up to 15 percent for fuel-conscious customers. The C7.1 engines incorporate proven, robust components and precision manufacturing you can count on for reliable and efficient operation. This is a proven engine that boasts improved reliability, as it's less sensitive to low quality fuel and also delivers better fuel consumption.

8. Engine Power ----- 104 kW

9. Displacement ----- 7.01 L

10. Bore x Stroke ----- 105 mm x 135 mm

11. The field-proven C7.1 engine can work efficiently at altitudes up to 4000 m (13,120').

##### 2.2 Hydraulic System

###### 1. Main System

(1) Maximum Pressure – Equipment ----- 35000 kPa

(2) Main hydraulic system:

① Number ----- 2

② Flow ----- 2 x 202 L/min

③ Type ----- Axial piston pump

###### 2. Pilot system

(1) Max. Flow ----- 32.4 L/min

(2) Max. Pressure ----- 3900 kPa

###### 3. Hydraulic cylinder

(1) Boom cylinder - Bore x Stroke ----- 120 x 1260 mm

(2) Stick cylinder - Bore x Stroke ----- 140 x 1504 mm

(3) Bucket cylinder - Bore x Stroke ----- 120 x 1104 mm

###### 4. Hydraulic System

Hydraulic system pressure from the two-hydraulic pump system delivers terrific digging performance and productivity

0425



**5. Hydraulic Cross-Sensing System:**

- The hydraulic cross-sensing system utilizes each of two hydraulic pumps to 100 percent of engine power under all operating conditions. This improves productivity with faster implement speeds and quicker, stronger pivot turns.

**6. Hydraulic Cylinder Snubbers:**

- Snubbers are located at the rod-end of the boom cylinders and both ends of the stick cylinders to cushion shocks while reducing sound levels and extending component life.

**7. Boom and Stick Regeneration Circuit:**

- Boom and stick regeneration circuits save energy during boom-down and stick-in operation which increases efficiency, reduces cycle times and pressure loss for higher productivity, lower operating costs, and increased fuel efficiency.

**2.3 Carbody Design and Track Roller Frames:**

1. The X-shaped, box-section carbody provides excellent resistance to torsional bending. Robot-welded track roller frames are press-formed, pentagonal units to deliver exceptional strength and service life.
2. Sealed and lubricated track rollers, carrier rollers, and idlers provide excellent service life to keep your machine in the field and working longer.
3. The standard undercarriage is well suited for applications that require frequent repositioning of the machine, restricted work space, or uneven rocky terrain

**2.4 Operator Station:**

1. The ergonomically designed operator station is spacious, quiet, and comfortable, assuring high productivity during a long work day. All switches are located in front of the operator for convenient access.
2. The monitor is a full-color Liquid Crystal Display (LCD) that has the capability of displaying information in 42 languages.
3. The suspension seat provides a variety of adjustments to accommodate a wide range of operators. All seats include a reclining back, upper and lower seat slide adjustments, and height and tilt adjustments, to meet operator needs for comfort and productivity.
4. Positive filtered ventilation with a pressurized cab is standard. Fresh air or re-circulated air can be selected with a switch on the left console.

**2.5 Tracks:**

The 320D2 track links are assembled and sealed with grease to decrease internal bushing wear, reduce travel noise and extend service life lowering operating costs.

**2.6 Automatic Engine Speed Control**

Automatic engine speed control is activated during no-load or light-load conditions which reduces engine speed to minimize fuel consumption.

Heavy Duty 5.7 m (18'8") reach boom with left side light

- R2.9B1 (9'6") HD stick
- 600 mm (24") triple grouser shoes

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-1.0m<sup>3</sup> Heavy duty buckets

### 3 Specifications and parameters

3.1	Operating Weight (kg)	21,110 kg
3.2	Capacity of Bucket (m <sup>3</sup> )	1.0 HD
3.3	Flywheel Power (kW)	98 kW
3.4	Maximum Travel Speed (km/h)	5.4 km/h
3.5	Swing Speed (rpm)	10.9 rpm
3.6	Swing Torque (kN·m)	61.8 kN·m
3.7	Maximum traction (kN)	205 kN
3.8	width of Shoes (mm)	600 mm
3.9	Length of Boom ( m )	5.7 m
3.10	Length of Stick ( m )	2.9 m
3.11	Maximum Reach at Ground Level ( m )	9.89 m
3.12	Maximum Digging Depth (m)	6.72 m
3.13	Maximum Loading Height (m)	6.49 m
3.14	Maximum Vertical Wall Digging Depth (m)	5.69 m
3.15	Maximum Cutting Height (m)	9.49 m
3.16	Gauge (m)	2.2 m
3.17	Overall Transport dimensions (length X width X height)	9.46 × 2.8 × 3.03 m

### D6R XL Track-Type Tractors

#### Specifications

Model: ..... D6R XL  
 Operating Weight: ..... 20,080 kg  
 Blade Capacity (Type SU) ..... 5.61 m<sup>3</sup>

#### Engine

Model ..... Cat® C9 ACERT™  
 Displacement ..... 8.8 L  
 Maximum Power at 1,800 rpm  
 Gross Power - ISO 14396 ..... 169 kW / 227 hp  
 Net Power - ISO 9249 ..... 158 kW / 212 hp

0425



Rated Power at 2,000 rpm	
Gross Power –ISO 14396 .....	148 kW / 198 hp
Net Power –ISO 9249 .....	131 kW / 175 hp

**Transmission**

1.0 Forward .....	3.8 km/h	2.3 mph
2.0 Forward .....	6.6 km/h	4.1 mph
3.0 Forward .....	11.5 km/h	7.1 mph
1.0 Reverse .....	4.8 km/h	3 mph
2.0 Reverse .....	8.4 km/h	5.2 mph
3.0 Reverse .....	14.6 km/h	9.1 mph

**Undercarriage**

Track gauge .....	1880 mm (74 in)
Ground clearance .....	383 mm (15.1 in)
Length of track on ground .....	2871 mm (104.9 in)
Standard Track shoe .....	560 mm (22 in)
Ground contact area .....	3.22 m <sup>2</sup> (4,972 in <sup>2</sup> )
Ground pressure .....	0.623 kg/cm <sup>2</sup> (8.90 psi)
Bulldozer Digging depth .....	459 mm
Bulldozer Ground clearance .....	1195 mm
Bulldozer Maximum tilt .....	743 mm

**Dimensions:**

(L×W×H) (Include SU Dozer Blade).....	5332mm×3260mm×3195 mm
(L×W×H)(Without Blade, over trunnions).....	3860mm×2640mm×3195 mm

**Hydraulic Controls**

Pump Capacity at.....	6900 kPa	1,001 psi
Pump Output.....	214 L/min	56.5 gal/min
Main Relief Valve Pressure Setting.....	42 000 kPa	6,092 psi
Maximum Operating Pressure Bulldozer.....	19 300 kPa	2,799 psi
Maximum Operating Pressure Steering.....	40 000 kPa	5,802 psi

**Features:**

**Engine - ACERT™ Technology**

Caterpillar is the world's leading engine manufacturer. Cat® engine is carefully designed to maximize durability and reliability. Precise controls optimize power and fuel efficiency while reducing emissions. Engine ACERT™ Technology provides advanced electronic control, precision fuel delivery and refined air management, resulting in outstanding



performance and lower emissions. Multiple injection fuel delivery very precisely controls the combustion cycle. This lowers combustion chamber temperatures to reduce emissions and translates into more work output per unit of fuel.

### **Differential Steering System**

Differential steering puts you on the leading edge of productivity by maintaining power to both tracks while turning. When one track speeds up, the other slows down an equal amount. Maneuverability –especially with large blade loads – is improved, as well as cycle times in some applications. Greater load capacity, power and speed control are possible in soft underfoot conditions on steep slopes because both tracks are powered during turns. A single tiller bar controls all directional and speed functions for ease of operation.

### **Torque Divider**

A unique Cat torque divider sends 70 percent of engine torque through a converter and 30 percent through a direct drive shaft for greater driveline efficiency and higher torque multiplication. The D6R torque divider provides high reliability and low dynamic torque. Components are designed to absorb full engine power, and deliver an optimum combination of operator efficiency and driveline reliability.

### **Planetary Power Shift Transmission**

The transmission includes three speeds forward and three speeds reverse, featuring thick, large diameter, high capacity, oil-cooled clutches. These clutches provide higher torque capacity and increase service life. The planetary power shift transmission has a proven, robust mechanical control system. Modular transmission and differential slide into rear case for servicing ease, even when a ripper is installed. An oil-to-water cooler provides maximum cooling capacity, and forced oil flow lubricates and cools clutch packs for maximum clutch life.

### **Undercarriage - Elevated sprocket "high drive"**

Since its ground-breaking introduction in 1978, more than 100,000 Cat Track-Type Tractors have been sold with the elevated sprocket "high drive" undercarriage. This is a field proven design that offers outstanding machine performance and longer component life. The elevated sprocket design gives the operator excellent sight lines to the blade, sides and back of the machine. However, machine center of gravity remains low, offering excellent stability, balance and traction.

Standard Heavy Duty undercarriage components are designed for extended wear life in abrasive conditions and high impact applications like forestry, side-slopes, or working in rocky or uneven terrain. Heavy duty track is designed for enhanced penetration. The leading and trailing edges of each track shoe overlap the adjacent shoe to increase durability and component life.

0425



### Track Shoes

Extreme Service track shoes for Heavy Duty Undercarriage help optimize the machine based on its most frequent applications.

### Structures

The foundation of every Cat dozer is a rugged frame built to absorb high impact shock loads and twisting forces. A reinforced saddle, welded front cross-member and steel castings on the main case add to the overall strength.

### L-Shaped Push Arms

L-shaped push arms bring the blade closer to the machine, providing excellent maneuverability, balance and blade penetration. The design provides solid lateral stability and better cylinder positions for constant pry-out independent of blade height.

### Load Sensing Hydraulics

Field-proven, load-sensing, pilot controlled hydraulics respond to operating requirements by automatically and continually adjusting hydraulic power to maximize work tool efficiency.

### Cab and Controls

Comfort features, excellent visibility and low-effort controls help improve operator efficiency so they can stay focused and more productive on the job.

## II. List of Free of Charge Attendant Tools

List of Attendant Tools for each set of 966H, M317D2 and 140K is as follows:

Item	Qty.	Part No.	Description
1	1	1P-0545	Tire Pressure Gauge
2	1	1S-0259	Socket, 1/2 in, 1/2 in drive, 12Pt.
3	1	4C-9592	Combination Wrench, 3/8 in
4	1	4C-9594	Combination Wrench, 1/2 in
5	1	4C-9595	Combination Wrench, 9/16 in
6	1	4C-9596	Combination Wrench, 5/8 in
7	1	4C-9597	Combination Wrench, 11/16 in

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Item	Qty.	Part No.	Description
8	1	4C-9598	Combination Wrench, 3/4 in
9	1	4C-9605	Combination Wrench, 5/16 in
10	1	5F-4764	Pry Bar, 406.4 mm(16.00 in)long
11	1	6V-7932	Screwdriver, Standard 3/8 in tip, 323.9 mm(12.75 in)long
12	1	6V-7934	Screwdriver, PHILLIPS™ No.2, 247.7 mm(9.75 in) long
13	1	8F-9866	Grease Gun
14	1	8H-8536	Socket, 1 5/16 in, 3/4 in drive, 12Pt.
15	1	8H-8537	Socket, 1 1/2 in, 3/4 in drive, 12Pt.
16	1	8H-8538	Socket, 1 11/16 in, 3/4 in drive, 12Pt.
17	1	8H-8541	Socket, 1 7/8 in, 3/4 in drive, 12Pt.
18	1	8H-8549	Socket, 9/16 in, 1/2 in drive, 12Pt.
19	1	8H-8551	Socket, 1 1/16 in, 1/2 in drive, 12Pt.
20	1	8H-8552	Socket, 3/4 in, 1/2 in drive, 12Pt.
21	1	8H-8553	Socket, 13/16 in, 1/2 in drive, 12Pt.
22	1	8H-8554	Socket, 7/8 in, 1/2 in drive, 12Pt.
23	1	8H-8555	Socket, 15/16 in, 1/2 in drive, 12Pt.
24	1	8H-8559	Socket Extension, 1/2 in drive, 254.0 mm(10.00 in) long
25	1	8H-8581	Feeler Gauge, 25 blade, .0015 in to .025 in
26	1	9S-1730	Socket, 1 1/8 in, 1/2 in drive, 12Pt.
27	1	9S-1731	Socket, 1 1/4 in, 1/2 in drive, 12Pt.
28	1	185-3630	Filter Strap Wrench

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Item	Qty.	Part No.	Description
29	1	212-8144	Petcock Socket, 1/2 in drive
30	1	212-8145	Drain Plug Socket, 1/2 in Female, 3/4 in Male
31	1	213-1985	Sliding T-Handle, 1/2 in drive, 304.8mm(12.00in)long

List of Attendant Tools for each set of 320D2 is as follows:

Items	Qty.	PART NBR	DESCRIPTION
1	1	65-255-22	S/DVR TANG THRU 8MMX10"
2	1	80308	Long Hex Chrome Plated 4.0mm
3	1	80310	Long Hex Chrome Plated 5.0mm
4	1	80312	Long Hex Chrome Plated 6.0mm
5	1	80314	Long Hex Chrome Plated 8.0mm
6	1	80316	Long Hex Chrome Plated 10.0mm
7	1	80320	Long Hex Black Plated 14.0mm
8	1	47204	WRENCH ADJUSTABLE 10"
9	1	70502	PLIER-SLIP JOINT 8"
10	1	13301	SOCKET STD 1/2"DR 6PT 10MM
11	1	13302	SOCKET STD 1/2"DR 6PT 11MM
12	1	13304	SOCKET STD 1/2"DR 6PT 13MM
13	1	13307	SOCKET STD 1/2"DR 6PT 16MM
14	1	13309	SOCKET STD 1/2"DR 6PT 18MM
15	1	13313	SOCKET STD 1/2"DR 6PT 22MM
16	1	13315	SOCKET STD 1/2"DR 6PT 24MM
17	1	13317	SOCKET STD 1/2"DR 6PT 30MM

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18	1	13902	RATCHET 1/2"DR QUICK REL
19	1	13909	HANDLE FLEX 1/2"DR 250MM
20	1	13904	EXTENSION BAR 1/2"DR 5"
21	1	25104	SOCKET TORX BIT 1/2"DR T-30
22	1	25107	SOCKET TORX BIT 1/2"DR T-50
23	1	40211	WRENCH COMB SL 16MM
24	1	40213	WRENCH COMB SL 18MM
25	1	40214	WRENCH COMB SL 19MM
26	1	40216	WRENCH COMB SL 21MM
27	1	40217	WRENCH COMB SL 22MM
28	1	heavy duty	GEESE GUN(HEAVY DUTY)
29	1	518-0790	METRIC FEELER GAUGE SET
30	1		DRIFT PUNCH
31	1	TB135	GENERAL PURPOSE BOX WITH TRAY
32	1		HAMMER 32 OZ ball pain
33	1		FILLTER WRENCH

List of Attendant Tools for each set of D6R XL is as follows:

Item	Qty.	Part No.	Description
1	1	1S-0259	Socket, 1/2 in, 1/2 in drive, 12Pt.
2	1	4C-9592	Combination Wrench, 3/8 in
3	1	4C-9594	Combination Wrench, 1/2 in
4	1	4C-9595	Combination Wrench, 9/16 in
5	1	4C-9596	Combination Wrench, 5/8 in
6	1	4C-9598	Combination Wrench, 3/4 in

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7	1	4C-9601	Combination Wrench, 7/8 in
8	1	4C-9603	Combination Wrench, 1 in
9	1	4C-9605	Combination Wrench, 5/16 in
10	1	5F-4764	Pry Bar, 406.4 mm(16.00 in) long
11	1	6V-7934	Screwdriver, PHILLIPS™ No.2, 247.7 mm(9.75 in) long
12	1	6V-7935	Screwdriver, Standard 1/4 in tip, 196.0 mm(7.75 in) long
13	1	8F-9866	Grease Gun
14	1	8H-8549	Socket, 9/16 in, 1/2 in drive, 12Pt.
15	1	8H-8554	Socket, 7/8 in, 1/2 in drive, 12Pt.
16	1	8H-8555	Socket, 15/16 in, 1/2 in drive, 12Pt.
17	1	8H-8556	Socket, 1 in, 1/2 in drive, 12Pt.
18	1	8H-8559	Socket Extension, 1/2 in drive, 254.0 mm(10.00 in) long
19	1	8H-8581	Feeler Gauge, 25 blade, .0015 in to .025 in
20	1	9S-1730	Socket, 1 1/8 in, 1/2 in drive, 12Pt.
21	1	9S-1732	Socket Extension, 1/2 in drive, 127.0 mm(5.00 in) long
22	1	9U-6639	Ratchet, 1/2 in drive
23	1	185-3630	Filter Strap Wrench
24	1	211-0136	Tool Bag
25	1	212-8144	Petcock Socket, 1/2 in drive
26	1	212-8145	Drain Plug Socket, 1/2 in Female, 3/4 in Male
27	1	213-1983	Combination Pliers, 167.0 mm(6.60 in) long

### III. List of 2000 Working Hours Spare Parts

2000 working hours spare parts for each set of 966H Wheel Loader is as follows:

Items	Qty.	Part No.	Part Name	Unit Price (USD)	Subtotal
1	4	1R-1808	Filter-Engine Oil	108	434
2	8	1R-0749	Filter-Fuel	76	606
3	4	326-1644	Filter As-Water Separator	112	448
4	4	245-3818	Element As-Air (Primary)	166	664
5	4	245-3819	Element As-Air (Secondary)	102	407

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6	4	126-1818	Filter As-HYDRAULIC OIL COOLER )-UHE	230	919
7	4	328-3655	Element As-Transmission-AE	223	891
8	4	220-9090	RETAINER-G.E.T.(K-80, K-90, K-100)	60	240
9	4	220-9092	TIP-GENERAL PURPOSE(K-90)	161	645
			<b>TOTAL</b>		<b>5,252</b>

2000 working hours spare parts for each set of M 317 D2 Wheel Excavator is as follows:

Items	Qty.	Part No.	Part Name	Unit Price (USD)	Subtotal
1	4	7W2326	Filter As-Engine Oil	59	237
2	4	2998229	Filter Fuel	93	373
3	4	4395037	Filter As-Water Sep & Fuel	148	594
4	4	252-5001	Filter Element As-Air (Primary)	168	672
5	4	252-5002	Filter Element As-Air	124	495
6	2	3617480	Filter Element As-Oil (Hydraulic) Pilot	202	405
7	4	8U-0723	Filter Element-Oil (Hydraulic Oil Return)	253	1,013
8	5	1U3302	Tip-Long	64	321
9	5	1073308	Pin	3	16
10	5	1073308	Retainer As	3	16
			<b>TOTAL</b>		<b>4,144</b>

2000 working hours spare parts for each set of 140K Motor Grader is as follows:

Items	Qty.	Part No.	Part Name	Unit Price (USD)	Subtotal
1	8	1R-1807	Filter-Engine Oil	67	540
2	4	326-1644	FILTER AS-WATER SEP & FUEL (PRIMARY)	112	447
3	4	1R-0749	Filter-Fuel	76	303
4	4	245-6376	Element-Air Filter	94	377



Items	Qty.	Part No.	Part Name	Unit Price (USD)	Subtotal
			( Secondary )		
5	4	245-6375	Element-Air Filter ( Primary )	133	532
6	4	1R-0774	Filter As-Hyd. Oil	115	459
7	4	328-3655	Filter As-Power Train	222	889
8	4	8S-9129	Filter -Magnetic/Transmission	70	278
			<b>TOTAL</b>		<b>3,825</b>

2000 working hours spare parts for each set of 320D2 Hydraulic Excavator is as follows:

Items	Qty.	Part No.	Part Name	Unit Price (USD)	Subtotal
1	4	3223155	Lube Filter	80	319
2	4	1R1804	Filter As-Fu	73	292
3	4	3820664	Filter As	131	525
4	2	1318821	Element As-P	79	158
5	2	1318822	Element As-S	91	182
6	2	518670	Filter A	105	210
7	2	937521	Filter	89	177
8	2	1799806	Element	172	343
			<b>TOTAL</b>		<b>2,206</b>

List of 2000 Working Hours Spare Parts for D6R XL Track-Type Tractors

Items	Qty.	Parts No.	Parts Name	Unit Price (USD)	Subtotal
1	4	1R-1808	Filter-Engine Oil	144.3	577
2	4	1R-0762	Filter-Fuel	136.3	545
3	4	326-1644	Element As-Water Separator	167.2	669
4	4	6I-2501	Element-Air Filter ( Primary )	157.3	629
5	4	6I-2502	Element-Air Filter ( Secondary )	117.6	471
6	2	328-3655	Filter As-POWER TRAIN-AE	416.5	833



ANEXO II  
0425

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7	8	1R-0777	Element-Hyd. Oil	179.7	1437
8	15	9W-1441	FUSE 15A	4.0	59
9	7	9W-1442	FUSE 10A	4.0	28
10	2	9W-1446	FUSE 20A	4.0	8
11	2	239-8107	FUSE 175A	34.3	69
12	2	351-9918	LAMP(24-VOLT, 70-WATT)(FLOODLIGHT)	50.1	100
13	15	3B-8489	Fitting-Grease	5.0	75
				Total	5500

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## ANNEX 5. TOTAL CONTRACT PRICE BREAKDOWN

SUPPLY PRICE BREAKDOWN			
Item	Unit price(US\$)	Qty	Total(US\$)
<b>RAILROAD COMPONENTS</b>			
Steel rails (t)	1.120	164.699	184.462.880
Wide gauge sleepers (piece)	104	744.079	77.384.216
Metric gauge sleepers (piece)	78	1.526.140	119.038.920
Clip fasteners (one set for each sleeper)	20	2.326.940	46.538.800
<b>Total Railroad Components</b>			<b>427.424.816</b>
<b>ROLLING STOCK</b>			
<b>Locomotives</b>			<b>230.886.392</b>
Locomotives 1676(set)	2.019.600	67	135.313.200
Locomotives 1435(set)	2.019.600	20	40.392.000
Locomotives 1000(set)	2.019.600	20	40.392.000
Spare parts for locomotives	14.789.192	1	14.789.192
<b>Wagons</b>			<b>422.843.720</b>
Flat wagon 1676 (set)(fish bone)	105.000	200	21.000.000
Flat wagon 1435 (set)(fish bone)	105.000	100	10.500.000
Flat wagon 1000 (set)(fish bone)	105.000	100	10.500.000
Flat wagon 1676 (set)(general purpose)	105.000	130	13.650.000
Flat wagon 1435 (set)(general purpose)	105.000	70	7.350.000
Flat wagon 1000 (set)(general purpose)	105.000	100	10.500.000
Coal Open top wagon (set) 1676	109.719	200	21.943.800
Open top wagon (set) 1435	109.719	100	10.971.900
Open top wagon (set) 1000	109.719	100	10.971.900
Grain hopper wagon 1676 (set)	132.193	650	85.925.450
Grain hopper wagon 1435 (set)	132.193	150	19.828.950
Grain hopper wagon 1000 (set)	132.193	500	66.096.500
Ore hopper wagon 1676 (set)	116.741	750	89.055.750
Ballast hopper wagon 1435 (set)	118.000	150	17.700.000
Ballast hopper wagon 1000 (set)	117.000	200	23.400.000
Spare parts for wagons	3449470	1	3.449.470
<b>Total rolling stock</b>			<b>653.730.112</b>
<b>WAGON PARTS</b>			
Wheels (piece)	890	16.000	14.240.000
Bearings 5 x 9 (piece)	445	4.000	1.780.000
Bearings 5 1/2 x 10 (piece)	485	12.000	5.820.000
1000mm gauge axle (piece)	1.000	2.000	2.000.000
1435mm gauge axle (piece)	1.075	1.200	1.290.000
1676mm gauge axle (piece)	1.150	4.800	5.520.000
Air braking systems (set)	9.900	2.000	19.800.000
Couplers (set)	5.750	2.000	11.500.000
<b>Total wagon parts</b>			<b>61.950.000</b>
<b>HEAVY MACHINERY</b>			
CAT 966H Wheel Loader(set)	432.740	18	7.789.320
Spare Parts for CAT 966H Wheel Loader (Set)	5.252	18	94.536
CAT M317D2 Wheel Excavator(set)	298.100	37	11.029.700
Spare Parts for CAT M317D2 Wheel Excavator(set)	4.144	37	153.328
CAT 140K Motor Grador(set)	433.000	6	2.598.000
Spare Parts for CAT 140K Motor Grador(set)	3.825	6	22.950
CAT 320D2 Hydraulic Excavator(set)	287.000	7	2.009.000
Spare Parts for CAT 320D2 Hydraulic Excavator(set)	2.206	7	15.442
CAT D6R Bulldozer(set)	420.000	18	7.560.000
Spare Parts for CAT D6R Bulldozer(set)	5.500	18	99.000
<b>Total Heavy Machinery</b>			<b>31.371.276</b>
<b>LARGE-SCALE MAINTENANCE MACHINERY</b>			



Track Measurement&Rail Flaw Detecting Vehicle(1676mm)(set)	8.141.000	1	8.141.000
Rail Grinder (1676mm)(set)	9.188.000	1	9.188.000
Dynamic Track Stabilizer (1676mm)(set)	2.739.000	1	2.739.000
Tamping Machine (1676mm)(set)	3.061.000	1	3.061.000
Ballast Regulator(1676mm)(set)	1.048.000	1	1.048.000
Rail Car(1676mm)(set)	1.284.500	4	5.138.000
Rail Car(1000mm)(set)	1.282.000	1	1.282.000
Spare Parts for Two Year Operation	1.835.820	1	1.835.820
<b>Total Large-scale Maintenance Machinery</b>			<b>32.432.820</b>
<b>CONTAINER</b>			
20' tank(set)	34.000	200	6.800.000
<b>Total Container</b>			<b>6.800.000</b>
<b>TOOLS FOR WORKSHOPS</b>			
Underfloor Wheel Lathe(set)	1.960.000	3	5.880.000
Two way shunter(set)	500.000	3	1.500.000
Vertical turning lathe(set)	510.000	3	1.530.000
Surface wheel lathe(set)	800.000	3	2.400.000
Wheel Assembly Press(set)	460.000	2	920.000
Ultrasound axle test equipment	57.000	4	228.000
Brake valves test facilities	133.000	3	399.000
Hot box detector	400.000	10	4.000.000
Automatic wheel profile measurer	600.000	3	1.800.000
Single car brake test device	75.000	9	675.000
Journal bearings installation and extract press*	130.749	4	522.996
Wagon jacks set 25 ton *4	171.000	10	1.710.000
<b>Total tools for workshops</b>			<b>21.564.996</b>
<b>Total supply price [A]</b>			<b>1.235.274.020</b>

PERFORMANCE PRICE BREAKDOWN			
Item	Unit price(US\$)	Qty	Total(US\$)
Rehabilitation civil work	730.000	1.511	1.103.030.000
Improvement civil work (no less than km)	300.000	321	96.265.165
Monitoring and payment services fee CMEC			35.978.855
<b>Total performance price [B]</b>			<b>1.235.274.020</b>

<b>TOTAL CONTRACT PRICE [A]+[B]</b>	<b>2.470.548.040</b>
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## Notes:

- The supply unit price is on basis of Technical Specification of the amended and restated contract and its amendments.
- The total performance price will be allocated to the Construction while the unit price serves as a reference and shall be determined ultimately by Builders.

**Annex-6****Commissioning and Acceptance Program for Lathes and Press**

The following plan is a preliminary Commissioning and Acceptance Program for lathes and the press, while the final one will be confirmed during the technical liaison meeting.

1. CMEC will send technicians to the Principal's premise to supervise and guide the unloading, installation, commissioning, and acceptance of lathes.
2. Pre-acceptance services for lathes
  - (1) four months after the Amendment II becomes effective, CMEC will provide the following documents necessary for the Principal to prepare the design and construction of facilities where machines will be installed:
    - Installation drawings
    - Installation manual
    - Electrical requirements
    - Additional machinery requirements like cranes, chip conveyor , winches and so on
    - Special features of the Lathes

NOTE: The Principal will do the design and construction of the civil works in accordance with the above technical documents by CMEC and the lathes and press manufacturers. Once the foundation drawings and building design are completed, the Principal will provide the above drawings to CMEC for their review. After CMEC's confirmation of the drawings, the Principal shall start the construction of the civil works. Once those are finished CMEC will deliver the Lathes and the Press.

(2) When the Lathes and the Press are delivered to the Principal's premises, the Principal will, as soon as possible but not later than two weeks thereafter, start the commissioning of the machines under the supervision and instruction of CMEC's technical personnel. Both parties shall fully cooperate together. Commissioning will take place after the dully installation of the Lathes and the Press.

(3) During commissioning, tests will be carried out by the Principal under supervision and instruction of CMEC technicians, the detailed test items to be determined later. When commissioning tests finished, PAC will be issued in accordance with Contract stipulations.



4. Within the guarantee period, CMEC is responsible for sending technicians to provide after-sale services in Argentina. Service plan will be adjusted according to the actual working and using situation of different machines.

5. CMEC engineers will be responsible of technical training in Argentina for end-user's local concerned people. Detailed training program will be determined during the technical liaison meeting.

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## Annex-7

**Commissioning and Acceptance Program****For the Large-Scale Maintenance Machinery**

The following plan is a preliminary Commissioning and Acceptance Program for the large-scale maintenance machinery, while the final one will be confirmed during the technical liaison meeting.

1. CMEC will send technicians to the Principal's premise to supervise and guide the unloading, installation, commissioning, and acceptance of large-scale maintenance machinery.
2. Pre-acceptance services for large-scale maintenance machinery
  - (1) Static vehicle condition checking
  - (2) Guiding users to replace various oil
  - (3) On-site dynamic commissioning
  - (4) Running and working test
  - (5) Training for the basic principle, operation, safety and maintenance of the equipment
  - (6) Troubleshooting
  - (7) Car-following working
3. Within the guarantee period, CMEC is responsible for sending technicians to provide after-sale services in Argentina. Service plan will be adjusted according to the actual working and using situation of different machines.
4. CMEC engineers will be responsible of technical training for end-user's local concerned people. For details, please refer to Annex-1 [Technical Communications on Large Scale Maintenance Machinery].

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## ANNEX 8 – CONSTRUCTION WORKS

Detail of the sections of railway to be renovated by civil work contracts

Line	From	To	Km
San Martín	Est. Soldini	Est. Rufino	290
	Est. Albardón	Est. Palmira	230
Belgrano	Est. Coronda	Est. Nare	132
	Ramal C - KM 211	Est. Las Breñas	376
	Ramal C12 - KM 1436	Ramal C12 - KM 1411	25
	Ramal C12 - KM 1332	Ramal C12 - KM 1202	130
	Ramal C12 - KM 1139	Est. Cnel Mollinedo	123
	Est. Avia Terai	Est. Barranqueras	205
<b>TOTAL</b>			<b>1511</b>

It is expected to renovate up to 1511 km and improve no less than 321 km in sections to be defined. 991 km of Line Belgrano and 520 km of Line San Martín will be renovated.

The renovation of railway will include the construction of overpasses at critical points in urban areas and by-passes in cities, and the adjustment of curves.

In order to homogenize the network and make full use of the investment, the features of the railway will be the followings:

Rails: UIC 54

Sleepers: Monoblock prestressed concrete (1540 per km)

Fasteners: Double elastic clip

Ballast: 30 cm, thickness

Bearing capacity: 22 t/axle in metric gauge and 25 t/axle in wide gauge

Maximum speed: 90km/h

Adjustment of curves wherever it is possible Minimum radius 300m

Compliance with Argentine norms (FA).

Wherever it is possible new tracks will be built parallel to the current ones in order to maintain the existing railway in service and to realize a two-way operation in the future.

The Construction period of the construction works is conditioned to the existence of Available Facility in the terms of the Credit Agreement.