TECHNICAL DESCRIPTION

ANODE TRANSPORT VEHICLE

Model No. 21.TA.747

designed for :

aluar
aluminio argentino

by :

TECHMO

Rev.	Date	Description	Redacted	Verified	Approved
0	19.04.2022	First emission	EZ	EZ	SSn

TABLE OF CONTENTS

ATV SUPPLIED TO ALUAR: MODEL 21.1174

INTRODUCTION

1.1 Foreword

This specification refers to the design and engineering, supply, manufacture, painting, packing and delivery of a new **Anode Transport Vehicle**. The vehicle will new and supplied to provide safe and efficient operation and be capable of continuous operation in the environmental conditions listed in Section 2.2 of this Specification.

NOTE: This description is based on dimensions given by the Client and the details taken from one of our previous ATV designs.

We are open to discuss and incorporate the modifications provided recently.

1.2 Confidentiality clause

This document with annexes and all information contained therein are and shall remain property of **Techmo Car SpA** shall be held confidential. Shall not be reproduced, copied, or otherwise disposed both directly and indirectly, and shall not be used, completely or partially, without the full knowledge and prior written consent of Techmo Car SpA.

1.3 Quality control

All phases of process of designing, purchasing, manufacturing, testing, packing is controlled by Techmo Quality System procedures. Techmo Quality System has been certified according to **ISO 9001 by LRQA**.

Furthermore Techmo carefully follows a **Certified Health and Safety Management System** in accordance to **OHSAS 18001** as well as an **Environment Management System** in accordance to **ISO 14001**.

1.4 Standards

Designing, manufacturing and instructions for this equipment will be in accordance with relevant ISO and IEC standard; furthermore, the design method of the machine will be in line with the European Directive 2006/42/CE for operation safety of machinery and equipment.

1.5 Design inputs

This technical description and the relevant economical offer are based on an expressly developed design, suitable for **heavy duty service**, which follows as much as possible Customer's request, considers types of the materials to be handled and takes into account that the requested equipment has to operate inside aluminium smelters, standing severe environmental conditions.

Techmo know-how, from this points of view, can guarantee **an experience of more than 50 years.**

2 GENERAL DESCRIPTION

2.1 Vehicle's aim

Purpose of this vehicle is the complete mechanisation of Customer's anode pallets transport as for Customer's requests.

2.2 Design environmental data

Vehicle construction is very strong and the design, as well as component choice, has been made in consideration of the demanding working environment of a reduction plant with conditions as specified below.

Design external (ambient) temperature ..... -15°C to 55°C
Relative Humidity ..... up to 100%
Strong magnetic fields ..... typical for AP18 technology
High dust concentrations ..... alumina, coke and fluorides
Operating cycles..... multiple shifts/day, 7 days/week

2.3 Main technical data

Main technical characteristics

Length ..... approx. 8250 mm
Height ..... approx. 3595 mm
Width..... 2500 (front) – 2600 (rear) mm
Ground clearance ..... approx. 250 mm
Weight (empty) ..... approx. 15000 kg
Front wheels..... 2 x 12.00 R 20 pneumatic tyres
Rear wheels ..... 2 x 12.00 R 20 pneumatic tyres
Engine..... diesel
Steering ..... hydraulic power steering
Traction..... hydrostatic automotive
Brakes..... parking-safety + positive service
Service brakes ..... hydrostatic + positive disk brakes
Parking-safety brakes..... hydrostatic + negative spring-operated wet oil disks
Lifting system ..... independent lifting arms operated by hydraulic cylinders
Cabin air conditioning and filtering system ..... included
External turning radius..... approx. 6300 mm
Max slope..... 5 %
Max driving speed ..... 15 / 20 km/h

3 TECHNICAL DESCRIPTION

3.1 Vehicle composition

The vehicle includes the following main units:

- vehicle frame, lifting system
- upper turning deck
- turning traction axle
- cabin and controls
- engine
- hydraulic plant
- electrical plant

3.2 Vehicle frame, lifting system

It consists of a welded box profiles structure, especially designed to support high stresses caused by hard operations.

The rear U shaped frame is designed to engage the pallet. The load on the trailer is borne by two idle **pneumatic tyres 12.00 R 20** with 8 mm thick rims. On the outside the rear wheel are protected by a removable beam. Rear axle is equipped with **positive drum brakes** to increase safety, operated by foot pedal.

The lifting system is able to lift the pallet by at least **250 mm** from the floor. It is composed by two profiles operated by hydraulic cylinders, with rear part shorter than Techmo previous vehicle and a reduced length to max 4500 mm.

The rear will be equipped with **hydraulic covers** to protect the loaded material against dust or rain, to reduce emissions and to support the anode rods during transport. The internal stoppers for the covers will be modified to protrude less when cover is open.

Oversized steel plates will be fixed on lower part of the rear frame, in order to increase their resistance against possible impact with tray.

Towing eyeplate is provided at the vehicle front end.

Inside the loading bay an additional bigger stopper will be welded to avoid the pallet to collide against internal corner. At the rear chassis the lower part will be revised with structural reinforcements.

Final structural design changes will be defined and shared with end-user after order.

3.3 Upper turning deck

The round deck, connected to the bottom turning axle, supports the cabin, the engine-pumps unit and the tanks.

In this way, all the major hydraulic and electrical connections take place without any relative rotation. Only the oil for rear lifting cylinders and the wires for rear lights are conveyed to the fixed frame through an improved **heavy duty** rotating joint.
The structural design of this section will be modified to increase accessibility to the drive pump.
Due to this lay-out the machine acquires an optimal manoeuvrability in terms of turning radius, length and visibility of the operator.

3.4 Turning traction axle

A fifth-wheel is connected to the bottom part of the main frame. A steel frame with a hinge for the axle support is bolted on fifth-wheel. The same frame supports another superior frame for the cabin and the engine. In this way both axle and cabin move at the same time. The axle is provided with negative brake for parking and safety / emergency.
Turning traction axle is complete with leaf spring suspension. Reinforced suspension elastic anchoring will be installed in order to increase their reliability. Contact surface of the pins of the leaf-springs will be increased.
Traction control. With the automotive control the accelerator pedal operates directly the injection pump controlling engine turning speed. Swash-plate inclination, pump delivery and speed are hence obtained as a function of the engine turning speed.
The axle is complete with two **pneumatic tyres 12.00 R 20** with 8 mm thick rims. Front wheels are protected by a suitable plates fixed on the frame by bolts. In this way no protruding hinges needs to be used to fixed protection plates, this can avoid to operator to collide front part against pallet during manoeuvre. Final design will be defined and shared with end-user after order.

3.5 Cabin and controls

It is mounted on anti-vibrators and is ergonomically designed to allow the operator the best visibility. The cabin supporting frame will be reinforced.
Insulation. Internal walls are coated with insulating panels against noise and heat.
Windows. Wide safety glass window panels, protected by a **protective foil on both sides,** allow the operator a proper direct view all around the vehicle. Windscreen will be laminated glass 4+4 mm. The rear glass panel will have a thermal-acoustic insulation.
In addition, the vehicle will be equipped with a **closed circuit camera** system with LCD monitor installed on the dashboard.
Seat. Driver seat is horizontally and vertically adjustable, hydraulically damped, with inertial folding safety belt.
Pedals. Accelerator – right / Brake – left
Control system. Ergonomic layout of driving position.

- Hydraulic power steering
- Accelerator and brakes pedal

- Drive direction selector
- Parking brake pushbutton
- Levers and joysticks for movements activation

Lights: head, meeting and driving lights are fitted on the front of the vehicle, while flashing lights, working aux. lights, reverse beeper and the horn are on the roof.

Instrumentation:

- The instrumentation is designed to work in magnetic field
- Engine oil pressure control lamp + buzzer
- Hydraulic oil temperature gauge + control lamp + buzzer
- Hydraulic oil level control lamp
- Fuel level and control lamp
- Six digit hours meter
- Battery charging lamp and gauge
- Manual switch horn, fitted on steering column

Warning lamps for:

- clogging of oil filters
- clogging indicator for engine air filter + buzzer
- oil pressure
- hydraulic services oil temperatures
- brakes failure
- parking brake
- fuel reserve
- head-lights, driving and meeting beams
- alternator (battery) charging

Air conditioning. The vehicle will be provided with an air conditioning system, compatible with **R134A Refrigerant** and filtering system designed for the following conditions :

external air temperature.....up to 60 °C

relative humidity ..... up to 100%

power ..... 22.000 Btu/h

Controls and other characteristics :

- adjustable speed blower

- adjustable thermostat
- cabin fresh air flow (without recirculation) 544 m^3/h
- cabin pressurisation 3 to 5 mm H_2O.

Air filtering is included.

3.6 Engine

The vehicle will be powered by a diesel engine, turbocharged, water cooled, according to the latest local emission normative. Currently foreseen: Deutz BF6L914, max power 110 kW/2000 rpm, max torque 550 Nm/1600 rpm, unless mentioned otherwise.
The engine is dimensioned in order to allow to be rated at a lower RPM then the standard (approx. 1800 / 2000 rpm) in order to reduce the noise and to extend the engine life.
It is covered by a soundproof hood complete with doors for better maintenance. The unit is mounted on a sub-frame with vibration dampers. Engine protection system with automatic cut-off in case of abnormal temperature of engine or engine oil pressure.
Air filtering system consisting of:

- Heavy duty dual element air-filter
- Pre-cleaner unit included

Exhaust system complete with rain proof protection.

3.7 Hydraulic plant

The hydraulic plant can be divided in two sections:
a) hydrostatic traction close circuit:

- variable displacement swash-plate pump
- fixed displacement hydraulic motor
- max working pressure ab. 350 bar

b) services open circuit :

- services gear pump with safety relief valve
- priority valve + compensated distributors for:
- power steering circuit
- braking system with safety accumulator
- lifting system
- hydraulic operated covers (with ½" hoses)

3.8 Electrical plant

A sealed box, placed on cab side, accommodates the main components for vehicle's controls: relays, fuses box rack fitted, wiring in plastic conduit assembled. For the part installed in the cabin see the relevant paragraph.

The position main electrical cabinet will be lowered compared to previous models and hinges will be placed on the vertical side.

Techmo standard concept for the electrical plant foresees the installation of multipolar connectors (plug system) so that, in case of maintenance, the only wiring interested in the current operation can be disconnected.

All cables are protected by oil / fire proof sheaths connected by terminal boxes placed on suitable positions of the machine.

The vehicle will be equipped with a **Siemens PLC system (see below).**

Main components:

- 90 A alternator, 24 V
- 200 Ah battery, 2x12 V
- starter motor 24V, 4 kW

3.9 PLC specification

PLC brand SIEMENS with dedicated control panel. SIEMENS S7 –CPU 315-2dp

Control panel OP 77 SIMATIC, onless mentioned otherwise.

The programmable computer is needed to the operator to obtain information on a dashboard OP, about all the possible situations occurring on the vehicle and enabling him to check the various possible situations in order to avoid the wrong use of the vehicle, reduce the corrective actions and preserve the condition of the vehicle.

3.9.1 Operation

The vehicle has two basic operation modes: the maintenance mode and the automatic mode that can be selected through a two-positions key on the main control panel.

The maintenance mode allows to the maintenance personnel to make a global control of the vehicle and to check all the electrical components to verify their conditions.

The automatic mode allows to the operator to use the vehicle and to see all the possible situations (i.e. damages and alarms, suggestions and messages) on the panel control, avoiding wrong manoeuvring.

3.9.1.1 Maintenance mode

The maintenance mode allows the independent utilization of different electric parts of the vehicle, such as the check of the panel lamps, the turn on and off of the front and rear lamps, of the direction indicators, the tail lamps and the stop lights and the power supply of two separate solenoids of the vehicle.

The elements shown on the panel are:

- Alternator
- Engine oil pressure switch
- Lamps
- Contact
- Load lifting
- Load lowering
- Caps opening
- Caps closing
- Forward movement
- Reverse movement
- Parking brake
- Clogged oil filter
- Clogged hydraulic oil filter
- Foot brake pedal
- Transmission oil temperature
- Load upper position
- Load lower position
- Headlight pushbutton
- Fuel minimum level
- Covers open
- Covers closed
- Maintenance or automatic mode

3.9.1.2 Automatic mode

With the automatic mode it is possible to see the conditions of some parts of the vehicle (load upper or lower position, cover open or closed, parking brake activated or not) and the status of the possible failures or alarms.

A) Failures description

On the screen, a red light shows three types of failure:

- Red light off: no failure
- Dashing red light: new failure

- Steady red light: the failure persists immediately after the identification.

Then the failure description follows:

- Engine oil low pressure.
- Engine oil high temperature

B) Alarms description

Unlike the failure, in case of alarm, the vehicle will not stop immediately. In any case the alarm will be shown on the control panel by the ALARM indicator.

Then the description of the alarms follows:

- Fuel low level
- Contradictory load pushbutton
- Contradictory doors pushbutton
- Contradictory movement pushbutton
- Contradictory seat pushbutton
- Contradictory movement lever
- Loading position time out
- Hydraulic oil refrigeration
- Transmission high temperature
- Oil transmission low pressure
- Low battery
- Clogged air filter
- Clogged oil filter
- Brake on
- Brake failure
- Load up

4 PAINTING

The vehicles shall be painted in accordance with the following painting cycle:

1. Sand blasting Sa 2-1/2
2. One layer of zinc primer, 50 microns
3. One layer of ordinary primer, 50 microns

4. One-Two layers of undercoat, 50-75 microns
5. One-Two layers of top-coating, 50-75 microns

Colour DIN Standard Yellow shade RAL 1007

5 PACKING

All equipment shall be suitably prepared and/or packed for shipment. All packages shall have adequate lifting points.

6 TESTING

Before shipment the vehicle must face an internal testing at Techmo workshop to verify main features.
Expected noise level will be:
Outside of vehicle- operating conditions at 7.5 m dist / 1.7 mt high..... 85 dB (A)
Inside the cabin (fan off) ..... 75 dB (A)
Noise measurement shall be carried out as part of shop tests according to ISO 5128 and ISO/DIS 362R.

7 TRAINING

During commissioning period customer's operators and maintenance people will be trained by Techmo personnel about the correct use and keeping of the vehicle.

8 TECHNICAL DOCUMENTATION

The following documentation in Spanish will be supplied with the vehicle:

a. Spare parts book
b. Maintenance and operating manuals
c. Hydraulic and electrical schematic diagrams
d. Spare list for all components for two years operation (on request)

9 LIST OF MAIN SUPPLIERS

HYDRAULIC COMPONENTS

9.1 Hydraulic components

Traction variable capacity pump ..... Bosch Rexroth / Sauer Danfoss or equivalent
Service variable capacity pump ..... Bosch Rexroth / Sauer Danfoss or equivalent

Drive motors..... Bosch Rexroth / Sauer Danfoss or equivalent
Front axle.....Omsi / Kessler or equivalent
Hydraulic motors ..... Bosch Rexroth / Sauer Danfoss or equivalent
Gear pumps ..... Sauer Danfoss / Sundstrand or equivalent
Solenoid valves .....Bosch Rexroth / Danfoss or equivalent
Oil filters.....Techmo or equivalent
Power-steering .....Danfoss or equivalent
Accumulators .....Bosch Rexroth / Epe or equivalent
Pressure switches ..... Bosch Rexroth / Sauer Danfoss or equivalent
Relief valves..... Bosch Rexroth / Sauer Danfoss or equivalent
Safety valves..... Bosch Rexroth / Sauer Danfoss or equivalent
Hydraulic cylinders .....Techmo or equivalent

9.2 Engine Unit

Engine..... Deutz or equivalent
Air prefilter.....Donaldson or equivalent
Coupler .....Technodrive or equivalent
Muffler..... Bersy or equivalent

9.3 Electric Components

Battery .....Fiamm or equivalent
Alternator ..... Lucas or equivalent
Relays..... National / Bosch or equivalent
Starter switch ..... Sipea or equivalent
Horn..... Remp or equivalent
Lights ..... Cobo or equivalent
Clogged filter indicators ..... Hydac or equivalent
Warning lights ..... Cema or equivalent
Multi-connectors..... Hss or equivalent
Joysticks ..... Sauer Danfoss / Tecnord or equivalent
PLC (in case applicable) .....Siemens / Allen Bradley or equivalent

9.4 Air Conditioning

Cabin unit make / model..... Red Dot
Compressor ..... Sanden or equivalent

9.5 Miscellaneous

Tyres.....Michelin / Continental or equivalent

Seat ..... Grammer / ISRI or equivalent

Techmo takes the right to modify the above listed components according to Customer's or market requirements.

10 ATTACHMENTS

Dwg. 21.TA.747 rev.0