Grupa LOTOS S.A.	**TECHNICAL SPECIFICATION**	Spec. No. 2520
	Wagon pullers	

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1 Subject of specification

This specification used in conjunction with other technical specifications of the Grupa LOTOS S.A. establishes the minimum requirements for the design, fabrication, inspection and testing for stationary shunting equipment (wagon pullers) and their control systems which are subject to supervision by Transportation Technical Supervision and which are operated in Grupa LOTOS S.A. installations.

2 Scope of validity

This specification applies to the preparation of inquiries and contracts for new investments or modernisation projects of Grupa LOTOS S.A.

It is also serves as the base for preparation of detailed specifications and inquires for individual and package delivery.

2.1 Order of precedence

In case of conflicts existing between this specification and other documents, the following order of precedence shall govern:

- The current Polish legislation
- Terms of purchase order / contract and other requirements agreed in writing Grupa LOTOS S.A.
- Data Sheets approved by Grupa LOTOS S.A.
- This specification
- Other Specifications
- Drawings and other documents
- Standards

2.2 Local regulations

The stationary shunting equipment shall be designed, constructed and installed in compliance with all applicable national and local laws and regulations, Grupa LOTOS S.A. specifications and current technical standards referred to in purchase order documents.

2.3 Standards/norms

Stationary shunting equipment shall be designed and delivered in accordance with standards referenced in Related Documents (section 4). Other standards may be used if agreed with LOTOS Group S.A.

2.4 Deviations

Any deviation from this specification and the relevant specifications, standards and related documents including proposals, which the bidder claims to be economically and / or technically superior solutions, must be submitted in writing for review and approval by Grupa LOTOS S.A. Non-approved exceptions are not acceptable by Grupa LOTOS S.A.

The Supplier must report in writing any ambiguity in this or any other specifications of Grupa LOTOS S.A. or non-compliance with the referred documents / standards and obtain a written explanation from Grupa LOTOS S.A.

3 Design and structure

3.1 Intended use

A puller is a piece of equipment or a system comprised of:

- Movable control elements (holders) making moving of wagons possible,
- Drive elements: hydraulic or mechanic
- Protecting and control systems.

A puller is used for shunting railway wagons and for positioning them for loading, unloading, maintenance etc. It can be used to pull all types of normal-gauge cars/wagons.

Pullers can be used:

- to shunt a train set for loading where an exact positioning (with an accuracy of a few centimeters) is required for tank wagons to be filled with pulverized or liquid materials etc., or for unloading and, after loading/unloading, for moving the train set back to another place,
- by a crane operator, to put-on a train set for loading (or unloading) of bulk materials or general cargo and to move it back to be taken by a locomotive,
- to shunt wagons for switching train sets,
- to make up a train set. Here shunting is done in one direction. After pushing a wagon to the train set that is being made up, the truck stops when it senses the load. After the truck stops, it returns quickly to the starting position.

The number of wagons in the set that is to be shunted depends on the size of the machine, the mass of the wagons, and the inclination of the track. The machines can work individually or in a system of machines, forming automated lines meeting specific process requirements.

Shunting can take place in two directions. The track section along which the shunting truck moves must not have bends. The allowable inclination of the track is + 0.1%.

Cable pullers can have electric or hydraulic drives.

- Electric pullers are placed beside the track.
- Hydraulic pullers are installed in the track.

The drive has a variable stepless shunting speed adjustment within the range from 0 to 0.55 m/s and motor braking.

Pullers are used for the following purposes:

- automatic catching and releasing of the shunted wagon or the train set,
- stepless variable adjustment of the shunting speed in both directions with a possibility of dynamic braking,
- precise positioning of a wagon (train set) in the desired place,
- full control of the state of the system,

- pre-programmed value of the pulling force, acceleration and shunting speed.

3.2 Description of the puller unit

Generally the machine is comprised of the following:

3.2.1 The drive station, including:

- The hydraulic or electric drive, the transmissions, the return station, the direction station, the drive cable and a system protecting against wagon movement after the puller has stopped.
- The cable tensioning system.

3.2.2 The shunting truck

As required or depending on the track situation, i.e. whether shunting is to take place in one or two directions and also depending on whether the track is straight, bent or if it is a junction - different shunting trucks are used.

Every type of the truck has a frame on which the following is installed:

- a traveling set,
- coupling sets which are separate assembly units and which are comprised of:
  - levers with articulated bearings in the casing,
  - a coupling roll, and
  - control rolls.

The truck makes it possible to catch the wheels of any wagon from the set in any place on the track, while releasing is possible in the place of installation of cams on the track.

3.2.3 The cable system – the shunting truck is moved by the puller drive cable.

Cable tensioning possibilities:

- weight tensioning – the cable is permanently tensioned. The tensioning tower is located near the puller,
- weightless tensioning – forced from the drive of the frictional wheels. The cable is tensioned in proportion to the cable load. During the machine stoppage the cable is slackened.
- hydraulic tensioning – the hydraulic tensioning set is installed in the track on which the shunting truck travels.

3.2.4 The track railway and the track equipment (cams, connectors etc.)

Typically, the shunting trucks shall be designed for S49 rails.

Certain types of trucks may require the ends of rail sections to be welded and the welds to be ground.

Special fixing of rails to sleepers is also necessary.

The trucks can require an additional rail installed in the middle or beside the track, on which another pair of wheels moves.

The selection of the version shall be agreed with Grupa LOTOS S.A.

The recommended tolerance of the rail spacing shall be +5 mm and -3 mm, and for trucks ~ +2 mm.

The cams installed on the track control the position of the coupling rolls.

- uncoupling cams (putting the rolls away) are installed at the ends of the shunting truck track i.e. at the drive-and-tensioning station and at the return station,
- coupling cams (they can be one or two) are located in places determined by the shunting process.

3.2.5 Power supply and control

The puller control system secures an automatic stop at the shunting truck travel limit (obligatory), signalling that the train set has been put on.

Special track switches located on the shunting truck track shall:

- define the limit position of the shunting truck
- define its location in the characteristic points of the track
- define the proper position of tank wagons for filling
- reduce speed at approach to the cams
- stop the truck on the cams.

It shall be possible to control the work of the machine from a place agreed with Grupa LOTOS S.A.

The best solution shall be a full automation of the machine work.

The control shall be realized "by wire".

Pullers shall be provided with the signaling of limit states such as:

- load
- oil temperature in the hydraulic system
- filter fouling.

Puller control systems shall be interlocked with other equipment functioning together with them and with the railway traffic control system for the area where they operate.

Power switchgear shall be fitted with adequate overvoltage and lightning protection equipment to guarantee safe power supply of the delivered equipment.

3.2.5.1 Power cubicle

The voltage distribution system from which individual consumers are supplied shall be installed in a separate cubicle, which shall be protected in compliance with electric shock protection requirements - see specifications no. 4170, 4400, 4500 and 4600.

3.2.5.2 Drive cubicle

The drive cubicle shall house all equipment supervising the proper operation of the puller, for instance the frequency converter with the control gear, electric equipment of the drive such as the electromagnetic brake, oil heater, temperature regulator, interference filters, drive motor fan and force equipment connected with the shunting truck drive.

Control signals used for external control system and signals about the drive operating condition shall be lead out to the input/output terminal strip of the controller - see specifications no. 4850 and 4200.

3.2.5.3 Control panel

The control panel is the main point of the puller operation control and supervision system, it is used for the installation of the operator's panel, the pushbuttons controlling the shunting truck travel speed and direction, switches and signal lamps.

The control gear at the front panel is used for operating the pullers, for example:

- for switching control voltages on and off,
- for selecting the mode of operation and control,
- the signal lamps inform about the status of the equipment, the system readiness for work and about emergency conditions.

Optionally a common operator's panel can be used for the wagon shunting system and the tank wagon filling system.

3.2.5.4 Controller cubicle:

The whole gear connected with control and with functioning together with the controller shall be installed in a cubicle fitted with a heat exchanger to ensure the necessary comfort of the controller operation.

In addition, in the cubicle there shall be installed suitable feeders of the controller input and output circuits, relays and protective gear, and the controller input and output terminals.

It is necessary to follow requirements of specifications no. 3130 and 3640.

3.3 Occupational health and safety (BHP)

The equipment must meet the requirements of the relevant regulations concerning:

- fire protection
- personnel safety at work
- environmental protection.

On both sides of the track, on the section on which shunted wagons can travel, there shall be arranged optical (flashing light) or acoustic (whistles) warning signal columns which will be activated automatically several seconds prior to every start of the shunting truck /wagon set to protect outsiders that may be present on the siding during tank wagon filling.

On every signaling column post there shall be installed a pushbutton for emergency stopping the movement of the truck/set.

All movable elements of the drive station must be protected with covers.

Materials used for construction shall not permit the accumulation of electrostatic charges.

The machine shall also meet the requirements concerning the allowable noise emission. The acoustic warning signaling shall be active only a few seconds, during the rest of shunting time only light signaling shall be active.

3.4 Technical requirements

The design of pullers and their elements shall comply with the requirements provided in the relevant regulations and standards. In justified cases the Inspectorate of Transportation Technical Supervision (TDT) may settle the design requirements individually.

The requirements cover the following:

- design,
- manufacturing and repairs,
- operation,
- technical supervision.

Cables and other structural elements that carry loads from moving wagons shall be designed taking into account a safety factor of 5 in relation to the tensile strength of the material.

Passages and access ways in the puller area shall meet the conditions provided in the regulations and standards mentioned in section 4.

The limit position of elements, which make wagons move, shall be determined by limit switches function of which is to prevent the possibility of collision of movables elements of puller with bumping block or building structure if this collision is omitted in strength calculation.

A puller shall be provided with a load limiter reacting when the maximum force allowable in the drive and support system is exceeded.
The limiter shall not allow exceeding that force by more than 30%.

Movable puller elements, which might be a threat to life of health of persons nearby, shall be marked with colors as described in PN-81/M-45018.

Electric safety devices shall function on switch-off principle.

Manufacturers of equipment not covered by EU directives shall have TDT license for fabrication of such equipment, according to art. 9 of the Technical Supervision Law of 21 Dec 2000.

The same is required for materials and elements for fabrication.

3.5 Technical documentation

The technical documentation of a puller shall be approved by TDT. Documentation submitted to TDT for approval shall contain at least the following:

- a technical description,
- an assembly drawing with indicated main dimensions and distances to the surroundings, stating the required accuracy of fabrication,
- the diagrams of the electric, hydraulic and pneumatic systems,
- a logical diagram of the puller functioning,
- inspection and testing program,
- safety analysis, taking into account the local conditions, including weather conditions, and including, among other things, a justification of the adopted technical solutions and the safety factors applied when designing load-carrying elements whose damage may be a threat to life and health of persons and to the environment,
- a diagram of connector systems in drive mechanisms,
- operation manual,
- copies of type testing certificates for protecting equipment, if applicable,
- additional documentation, i.e. the track plan with indicated basic dimensions of the puller action zone and information concerning the interaction between the puller dependence and interlocking system and the railway traffic in the puller action zone,
- confirmation of the correctness of installation of the machine in explosive conditions, if applicable.

Technical documentation necessary for registration of a puller and for permission of operation after its manufacture or repair and acceptance testing by TDT shall contain at least the following:

- the documentation specified in the license conditions and the documentation submitted to TDT,

- the manufacturer's declaration of conformity (the original document and a translation),
- material certificates,
- reports of acceptance tests and examinations,
- the operation and maintenance manual,
- location sketch including in particular the actual distances between the machine and the surroundings, passages, access paths and any covering elements, not included in the assembly drawing,
- the track plan in the scale of 1:100 with indicated basic dimensions of the action zones of the pullers,
- information concerning interaction between the puller dependence and interlocking system and the railway traffic in the puller action zone,
- assembly diagrams of the electrical, hydraulic and pneumatic systems indicating in particular the fitting, size, type of the protections, the types of power supply cables,
- a cable system diagram specifying the diameters of the cables, wheels and cable pulleys,
- a description of the functioning of the safety devices,
- acceptance reports for building objects, insulation resistance and the shock protection of the electrical system,
- factory certificates of the manufacturers of equipment, mechanisms and other elements included in the puller unit, copies of type testing certificates for protective equipment, if applicable,

The scope of the registration documentation can be simplified at the manufacturer's or user's request.

A modification in the documentation agreed by TDT, affecting the technical characteristic of the puller or the safety of its operation shall require another agreement.

3.6 Technical supervision

The form of supervision for pullers shall be full supervision within the meaning of art. 12.1 of the Technical Supervision law of 21 December 2000 (Dz. U. No. 122, item 1321).

Technical acceptance shall be conducted following the receipt by TDT of the registration documentation and the certificate of manufacture and testing issued by the assembling factory. The report of acceptance testing and inspections shall be enclosed as an appendix to the a/m certificate.

Supervision actions concerning pullers consist in conducting acceptance tests after manufacture or revamping. Acceptance testing may be carried out at the manufacturer's premises. The purpose of the acceptance testing is to verify that:

- the machine is consistent with the submitted documentation,
- the assembly and intended use are consistent with the operation manual and the regulations concerning Technical Inspection,
- warning signs, information and instructions has been placed on the machine and they are legible and understandable,
- the machine can be put into safe operation.

Tests shall be carried out according to the testing and inspection program constituting a part of the technical documentation subject to agreement by TDT.

The load test of a puller shall be done by pulling a test set of wagons resulting in forces in the drive and support systems that exceed their rated values by 25 %. The test, consisting in a repeated (i.e. two-time) travel of the pulled wagons through the whole operating zone of the puller shall include the process of starting the travel of the test set and braking it.

4 Related documents

4.1 Grupa LOTOS S.A. specifications

Any "Technical Specification" issued by GRUPA LOTOS S.A. listed in Contract Files.

4.2 Regulations and standards

The designing and manufacture shall be made in compliance with the specified standards and regulations given in Grupa LOTOS S.A. technical standard No. 2010 and these listed below:

- Warunki Techniczne DT-DE-90/WO
- UIC regulations (card) 504 and 505-4, (UIC – Union Internationale des Chemins de Fer / International Railway Union)
- Polish building regulations referred to in the building design
- EN-10204 - Metallic products - Types of inspection documents
- EN-13463-2003 – Non-electrical equipment for use in potentially explosive atmospheres
- PN-81/M-45018 - Technika bezpieczeństwa. Dźwignice, oznaczenie barwami ostrzegawczymi części dźwignic
- Ustawa o Dozorze Technicznym z dnia 21 grudnia 2000r (Dz. U. 2013, poz.963)
- Rozporządzenie Min. Gospodarki, Pracy i Polityki Społecznej w sprawie warunków technicznych dozoru technicznego w zakresie eksploatacji niektórych urządzeń transportu bliskiego z dnia 29 października 2003 (Dz.U. 2003 nr 193, poz.1890)
- Rozporządzenie Ministra Transportu z dnia 20 września 2006 r. w sprawie warunków technicznych dozoru technicznego w zakresie projektowania, wytwarzania, eksploatacji, naprawy i modernizacji specjalistycznych urządzeń transportu ciągłego i bliskiego (Dz.U.2006 nr 178 poz.1320)
- Rozporządzenie Ministra Gospodarki z 21 października 2008 r. w sprawie zasadniczych wymagań dla maszyn (Dz.U. nr 199, poz.1228) (wprowadzające dyrektywę 2006/42/WE do prawa krajowego).
- Rozporzadzenie Ministra Gospodarki z dnia 30 października 2002 r. w sprawie minimalnych wymagań dotyczących bezpieczeństwa i higieny pracy w zakresie użytkowania maszyn przez pracowników podczas pracy (Dz.U.2002 nr 191, poz.1596)
- Rozporządzenie Ministra Gospodarki, Pracy i Polityki Społecznej z dnia 30 września 2003 r. zmieniające rozporządzenie w sprawie minimalnych wymagań dotyczących bezpieczeństwa i higieny pracy w zakresie użytkowania maszyn przez pracowników podczas pracy (Dz.U. 2003 nr 178 poz. 1745).

5 Record of changes

No.	Date	Description	Introduced by
0		This specification entirely replaces the former Grupa LOTOS S.A. S.A. standard No. PR 07 875 with the same title.	B. Kowalewski
1	30.11.2013 (rev.1)	Review, update, standardize and changes to the Standard within scope of order No. OK/990/2012	Editorial board coordinated by T.Wróbel
-	31-08-2015	Page layout corrections, no contents changes.	T. Wróbel