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1 Subject of specification

This specification used in conjunction with standard technical specifications of LOTOS Group S.A. (GLSA) establishes the minimum requirements for the design and supply of telecommunication cables.

2 Scope of validity

This specification applies to the preparation of tender documents, inquiries and contracts concerning new investments and modernization projects planned by LOTOS Group S.A.
It shall also be a basis for preparing both detailed specifications and inquiries for individual or package unit supplies.

2.1 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 SA. 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 SA or non-compliance with the referred documents / standards and obtain a written explanation from Grupa Lotos SA.

2.2 Exclusions

The specification does not include:

- Cable selection for specific systems
- Requirements for cable routing and laying.

Above mentioned exclusions are scope of separate specifications.

3 Hierarchy of documents

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 with GLSA
- Data Sheets approved by GLSA
- This specification
- Other Specifications
- Drawings and other documents
- Standards

4 Definitions

GLSA – Grupa Lotos S. A.

4.1 Basic terms

Fire retardant cable – cable manufactured acc. to standard IEC 60332-1

Fire resistant cable – cable manufactured acc. to standard IEC 60331

4.2 Ambient Conditions

Ambient temperature:

▪ design maximum	35ºC
▪ design minimum	–25ºC
Humidity min average monthly	70%
Humidity max average monthly	90%
Plant design elevation above sea level	1m
Design wind speed	25m/s
Design snow fall	290mm

4.3 Electrical data

Operating voltage for respective systems:

▪ Burglar Alarm & Access Control System	12 or 24 VDC
▪ Fire alarm and detection system	48 VDC
▪ Data, CCTV systems	5 VDC
▪ Public address & sound emergency systems	100 V DC

5 Description

5.1 General Requirements

Reliability of all cables to perform continuously in the service conditions specified is essential.

Typical cables of that being supplied shall have been in operational use elsewhere for a minimum of two years. Prototype or unproven cables not having a well established record shall not be considered.

The Supplier shall submit drawings and documents and shall be responsible for all the information therein:

- Cable type with description of cable construction
- Overall cable diameter (average minimum and average maximum)
- Insulation thickness (average minimum and average maximum)
- Thickness of insulation shield and metallic shielding, if applicable.
- Thickness of jacket (outer sheath).
- Maximum shipping lengths possible on standard drums.

- Splicing and terminating instructions.
- Weight of cable for each type per 1000 m length.
- Minimum allowable bending radius shall be furnished for each voltage class and size of cables quoted.
- Other applicable physical and electrical characteristics of cables quoted.
- Maximum pulling force
- Life of cables (not less than 40 years) in operation conditions

All performance data, nominal values and tolerance ranges stated by the Supplier shall be guaranteed values.

The cables and wires shall be quoted completely in accordance with this specification.

Supplier may quote alternative, but shall list and give detailed description of characteristics or construction details of his cable and wire, which do not observe principles included in this specification.

5.2 Joining of telecommunication cables

Telecommunication external cables, which are terminated in buildings equipped with MDF cabinet, are to be formed on separable terminal blocks, located in 19" standard racks. Such rack shall enable three-column arrangement of terminal blocks. For 100-pair cables, the terminal blocks shall be arranged in such a way, that whole cable is formed on 100-pair block located on left side of the rack.

The cables shall be protected against voltage surges by means of three-electrode gas lightning arrestors, with thermal protection at 230V 5A/10kA. Middle column of terminal blocks serves for external cable bridging in order to RJ45 crossing cables plug-in – separable terminal block standard. The third column of terminal blocks is used for other system cables (fire signalling, burglar alarms, clock system, etc.).

Different method of cable connection in buildings, which are not equipped with 19" MDF cabinet or in which an existing installation imposes different solution (e.g. connections in boxes or in wall recess), shall be agreed with personnel responsible for communication in GLSA.

Terminal blocks shall be numbered from 0 to 9.

5.3 Basic Design Data

5.3.1 General

All cables shall be suitable for indoor or outdoor applications according to detail specification. The cables are to be installed in trays, conduits, underground ducts and direct buried in soil.

Outdoor cables shall be suitable for continuous exposure to the environmental conditions in regard to the effects of soil, direct sunlight and ultra-violet radiation and oil industrial conditions including chemicals and oil products.

Steel tape armoured cables shall be foreseen for laying in soil or in steel trays placed on pipe racks.

As a conductor material shall be used un-coated copper. All cable parameters are valid for temperature of 20°C. Type examples refers to cable types listed in standards 3720, 3730, 3740 and 3750. Indoor cables shall be also applicable for telephone conduit system.

5.3.2 PE jacket cables

Polyethylene can be rated among inflammable and fire-spreading materials; therefore it shall not be used inside buildings. Addition of anti-oxidizing agents, carbon black or pigments, makes polyethylene inure to weather conditions (ultraviolet), so that cables with jacket of that type can be used for external applications.

5.3.3 PVC jacket cables

Relatively high resistance to fire and flame retardant ability are advantages of PVC. It can, however, release large volumes of smoke and hydrogen chloride. There are some PVC variations featuring low fumes and gases emission during combustion and these variations shall particularly be used for internal solutions.

5.3.4 FRHF jacket cables

Halogen-free, flame retardant materials (FRHF), which do not release aggressive fumes, are particularly recommended for internal applications.

5.3.5 Gel-filled cables

For outdoor routed cables, humidity penetration danger along the cable is of significance. In order to limit such penetration, cable internals shall be filled with special gel, hot forced into cable. Such cables can be buried in the ground.

5.4 Technical requirements for outdoor cables

5.4.1 Telecommunication cables

Description:

- Solid copper conductor with diameter of 0,5; 0,6 or 0,8 mm
- PE insulation
- Core twisted into fours
- Pairs wrapped with polyester tape
- Inner sheath extruded PE material
- Anti-moisture barrier tape
- Armour of galvanized flat steel tapes
- PVC outer jacket
- Jacket colour: red for cables of Fire Alarm System, black for other systems

Electrical parameters

- Maximal loop resistance of conductors (pairs) 192/133/74 Ω/km
- Minimal insulation resistance of each conductor 1500 MΩxkm
- Effective capacitance of each pair mean/max 50/55 nF/km
- Operation voltage (max) 48V DC
- Test voltage :core:core/core:screen 700V/2000V AC

Type example
XzTKMXwFtl(y) n x 4 x 0,5mm

5.4.2 Data cable

Description:

- Solid copper conductor with diameter of 0,5 or 0,6 mm
- PE insulation
- Core twisted into four pairs
- Anti-moisture gel filling
- Pairs wrapped with polyester tape
- Cable screen tape with tinned copper drain wire
- Anti-moisture barrier tape
- PE outer jacket, colour: grey

Electrical parameters

Maximal loop resistance of conductors (pairs)	192 Ω/km
Minimal insulation resistance of each conductor	150 MΩxkm
Wave impedance at frequency 100MHz	100 Ω
Asymmetric capacitance to earth (max)	1600 pF/km
Maximal attenuation at 1000 Hz	2,1dB/100m
Operation voltage (max)	24V DC
Test voltage :core:core/core:screen	700V/700V AC

Type example
LAN-T11A Kat.5 4 x 2 x 0,5mm

5.4.3 Radio cable

Description:

- Solid copper conductor with diameter of 0,9mm or1,2mm
- PE insulation
- Parallel cores
- PVC outer jacket, colour: black

Electrical parameters

Maximal loop resistance of conductors (pairs)	58/32,5 Ω/km
Minimal insulation resistance of each conductor	5000 MΩxkm
Wave impedance at frequency 100MHz	100 Ω
Effective capacitance (max)	45nF/km
Asymmetric capacitance (max)	500 pF/500m

- Maximal attenuation at 1000 Hz 0,9dB/100m
- Operation voltage max. 100V
- Test voltage :core:core 1000V AC

Type example

YRPX 2(4) x 1,2mm

5.4.4 Coaxial cable

Description:

- Solid copper conductor
- PE insulation
- Tape Al/PETP/Al
- Copper braid
- Anti-moisture gel filling
- Tape Cop/Al/Cop
- PE outer jacket, colour black

Electrical parameters

- Inner conductor min. dia 1,16 mm
- Insulation diameter 7,25 mm
- Maximal resistance of inner conductors 8 Ω/m
- Maximal resistance of outer conductors 14,5 Ω/m
- Impedance 50 or 75 Ω
- Maximal attenuation at 1 MHz 0,6 dB/100m
- Capacitance for 1 kHz 60pF/m
- Operation voltage (max) 5V DC

Type example
11F 75(3) -1,6/7,3

5.5 Technical requirements for indoor cables

5.5.1 Telecommunication standard cable

Description:

- Solid copper conductor with diameter of 0,5mm or 0,8 mm
- Solid copper conductor with diameter of 0,5mm
- PVC insulation
- Core twisted into pars or fours

- Wrapping polyester tape
- Cable screen tape with tinned copper drain wire
- PVC outer jacket halogen free and fire retardant
- Jacket colour: red for cables of Fire Alarm System, black for other systems

Electrical parameters

- Maximal loop resistance of conductors (pairs) 195/75 Ω/km
- Maximal loop resistance of conductors (pairs) 195 Ω/km
- Minimal insulation resistance of each conductor 200 MΩxkm
- Effective capacitance of each pair (max) 150 nF/km
- Operation voltage (max) 48V DC
- Test voltage :core:core/core:screen 1000V/1500V AC

Type example
YnTKSYekw n x 2(4) x 0,5 mm

5.5.2 Telecommunication special cable

Description:

- Solid copper conductor with diameter of 0,8mm
- PE insulation
- Core twisted into pairs
- Wrapping polyester tape
- Cable screen tape with tinned copper drain wire
- Anti-moisture barrier tape
- PVC outer jacket halogen free and fire retardant with limited emission of smoke and toxic, corrosive gases
- Jacket colour: black

Electrical parameters

- Maximal loop resistance of conductors (pairs) 75 Ω/km
- Minimal insulation resistance of each conductor 5000 MΩxkm
- Effective capacitance of each pair (max) 90 nF/km
- Operation voltage (max) 48V DC
- Test voltage :core:core/core:screen 700V/700V AC

Type example
NTKSXekw n x 2 x 0,8mm

5.5.3 Data cable

5.5.3.1 FTP 4 x 2 x 0,5mm Cat 5

Description:

- Solid copper conductor with diameter of 0,5mm
- PE insulation
- Core twisted into pairs
- Wrapping polyester tape
- Cable screen tape with tinned copper drain wire
- PVC outer jacket halogen free, colour grey

Electrical parameters

Maximal loop resistance of conductors (pairs)	190 Ω/km
Minimal insulation resistance of each conductor	500 MΩxkm
Wave impedance at frequency 100MHz	100 Ω
Asymmetric capacitance to earth (max)	1600 pF/km
Maximal attenuation at 1000 Hz	0,9dB/100m
Operation voltage (max)	24V DC
Test voltage :core:core/core:screen	700V/700V AC

5.5.3.2 UTP 4 x 2 x 0,5mm

Description:

- Solid copper conductor with diameter of 0,5mm
- PE insulation
- Core twisted into pairs
- PVC outer jacket halogen free, colour grey

Electrical parameters as same as for FTP/UTP

5.5.3.3 STP 4 x 2 x 0,5mm Cat 5

Description:

- Solid copper conductor with diameter of 0,5mm
- PE insulation
- Core twisted into pairs
- Each pair with screen tape
- Pairs wrapped with tinned copper drain wire
- PVC outer jacket halogen free, colour grey

Electrical parameters as same as for FTP/UTP

5.5.4 Radio cable

Description:

- Solid copper conductor with diameter of 0,9mm
- PE insulation
- Parallel cores
- PVC outer jacket halogen free and fire retardant, colour black

Electrical parameters

Maximal loop resistance of conductors (pairs)	58 Ω/km
Minimal insulation resistance of each conductor	5000 MΩxkm
Wave impedance at frequency 100MHz	100 Ω
Effective capacitance (max)	45nF/km
Asymmetric capacitance (max)	500 pF/500m
Maximal attenuation at 1000 Hz	0,9dB/100m
Operation voltage (max)	24V DC
Test voltage :core:core	1000V AC

Type example

YnRPX 2(4) x 0,9mm

5.5.5 Microphone cable

Description:

- Stranded copper conductor with diameter of 0,5mm
- PVC insulation
- Cores twisted
- Cores wrapped with copper wires
- PVC outer jacket fire retardant, colour black

Electrical parameters

Maximal resistance of conductors	105 Ω/km
Minimal insulation resistance of each conductor	10 MΩxkm
Effective capacitance (max)	300nF/km
Operation voltage (max)	24V DC
Test voltage	500V AC

Type example

YPMY ekw 2(4) x 0,5mm

5.5.6 Coaxial cable

Description:

- Stranded copper conductor
- PE insulation
- Copper braid
- PVC outer jacket, colour black

Electrical parameters

▪ Inner conductor min. dia	7x0,2 mm
▪ Insulation diameter	3,7 mm
▪ Maximal resistance of inner conductors	84 Ω/m
▪ Maximal resistance of outer conductors	16 Ω/m
▪ Impedance	75 Ω
▪ Maximal attenuation at 1 MHz	1,2 dB/100m
▪ Capacitance for 1 kHz	65pF/m
▪ Operation voltage (max)	5V DC

Type example
YWL 75 -0,6/3,7

5.6 Technical requirements for fire resistant cables

5.6.1 Control cable

Description:

- Solid copper conductor
- Silicon rubber insulation
- Parallel cores
- Wrapping polyester tape
- Cable screen Al tape
- Outer sheath halogen free, colour red

Parameters

▪ Minimal insulation resistance of each conductor	3000 MΩ x km
▪ Fire resistance	3h, 842^{0}C
▪ Operation voltage (max)	24V DC
▪ Test voltage :core:core /core:screen	2000V/1000V AC

Type example

HDGsekw n x 1,5(2,5)mm^2

5.6.2 Communication cable

Description:

- Solid copper conductor with diameter of 1,0mm
- Fire resisting tape
- Halogen free insulation
- Core twisted into pairs
- Cable screen tape with tinned copper drain wire
- Outer sheath halogen free colour red

Parameters

Maximal resistance of conductors	24 Ω/km
Insulation resistance of each conductor (max)	500 MΩxkm
Capacitance for 1 kHz (max)	120nF/km
L/R ratio	< 25 uH/ohm
Fire resistance	1,5h, 842^{0}C
Operation voltage (max)	24V DC
Test voltage :core:core/core:screen	1500V AC

Type example
HTKSHekw 1 x 2 x 1,0mm

5.7 Intrinsically safety cables

Description:
Cable construction shall be selected to specific application.
Cable outer sheath shall be coloured light blue.

Parameters

Maximum capacitance	200nF/km
Maximum inductance	1,0 mH/km
Maximum L/R ratio	30 μH/Ω
Test voltage :core:core/core:screen	500VAC/750VDC

6 Relevant documents

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

7 Standards and regulations

It is in each case understood that quoted standards, regulations, directives and orders are of their latest editions, along with amendments, annexes and supplements in force.

7.1 Regulations

The Law of 30 August 2002 on conformity assessment system (Journal of Laws 02.166.1360 as amended)

Minister of Economy order of August 21, 2007 on basic requirements for electric equipment (Journal of Laws 2007 No 155 pos. 1089).

Act of August 29, 2003 on the amendment to the act about the system of the conformity assessment and to some acts (Journal of Laws. 2003 no 170 posz. 1652 as amended).

Minister of Infrastructure order of April 15, 2004 , on conditions and mode of conducting compliance assessment of terminal telecommunication equipment intended for connecting to public networks terminals and radio equipment with basic requirements, and method of marking them. (Journal of Laws 2004 no 73 pos. 659 as amended).

Minister of Economy, Labour and Social Policy order of December 22, 2005 on basic requirements for protective equipment and systems intended for use in explosion endangered zones (Journal of Laws 2005 no 263 pos. 2203).

Act of April 16, 2004 on construction products (Journal of Laws 2004 no 92 pos. 881).

Minister of Infrastructure order of April 2, 2003 on evaluation of equipment conformity with basic requirements concerning electromagnetic compatibility, and method of its labelling (Journal of Laws No 90, pos. 848).

Council of Ministers order of September 10th 2002, on conditions and mode of conducting compliance assessment of terminal telecommunication equipment intended for connecting to public networks terminals and radio equipment with basic requirements, and method of marking them. (Journal of Laws No 176, pos. 1442).

Minister of Infrastructure order of 14 October 2004, on European technical approvals and Polish bodies authorized for issuing them (Journal of Laws 2004 no 237 pos. 2375).

Minister of Infrastructure announcement of 5 July 2004, on specification of mandates granted by European Commission for elaboration of European harmonized standards and guidelines for European technical approvals, along with subject scope of these mandates (M.P. 2004 no 32 pos. 571).

Minister of Infrastructure order of 8 November 2004, on technical approvals and organizational bodies authorised for issuing them (Journal of Laws 2004 no 249 pos. 2497 as amended).

8 Record of changes

No.	Date	Description	Introduced by
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
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