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1 Subject of specification

This specification used in conjunction with other technical specifications of LOTOS Group S.A. (GLSA), establishes minimal requirements in scope of designing and technology of execution for telecommunication outdoor cabling systems.

2 Scope of validity

This specification shall be used when preparing both quotations and Purchase Orders concerning planned LOTOS Group S.A. new investments and modernizations.

It shall also be a base for preparation of other detailed specifications and quotations relevant for package units or other equipment deliveries.

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

This specification does not include:

- Requirements for low voltage supply distribution system
- Requirements regarding parameters of cables

The above-mentioned exclusions constitute subject matter 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

4.1 Basic concepts

- **Cable route** – zone of area or space, which symmetry axis is straight line, broken line or wavy line, connecting two or more electric apparatuses, in which one or more cable lines are laid.

- **Cable duct** – a duct in wall, ceiling, floor or in soil, covered with fully or partially removable plates, destined for laying of cables, and not intended for moving of service staff inside it.
- **Telephone conduit** – protective tubes laid in soil with built-in telephone manhole, destined for routing of telecommunication cables in them.
- **Telephone manhole** – underground premise built-in between protective tubes, in order to enable pulling in, assembly and maintenance of cables.
- **Through telephone manhole** – the telephone manhole, in which entrances of ducts are located only on opposite manhole walls
- **Corner telephone manhole** – the telephone manhole, in which entrances of ducts are located only on adjacent manhole walls
- **Single side branch telephone manhole** – the telephone manhole, in which entrances of ducts are located on three manhole walls
- **Double-sided branch telephone manhole** – the telephone manhole, in which entrances of ducts are located on all four manhole walls
- **Cable room** – underground or overground premise in control room, destined for entering of cables.

4.2 Designations

GLSA – Grupa Lotos S. A.

SK – telephone manhole

SKR – distribution telephone manhole

SKM – arterial telephone manhole

SKS – cabinet-type telephone manhole

4.3 Ambient conditions

External temperature:

▪ Design maximum	35ºC
▪ Design minimum	–25ºC
Average monthly minimum humidity	70%
Average monthly maximum humidity	90%
Elevation over sea level	1m
Wind speed	25m/s
Snowfall	290mm

5 Description

5.1 General requirements

5.1.1 Laying of cable routes

Telecommunication cable routes can be laid together with control and automatics cable routes.

Main cable routes shall be laid in cable ducts and on pipe racks, while it is preferred that between control room and a plant the cables shall be laid in cable ducts, and within the plant with use of pipe racks. In particular cases laying of cables directly in soil is allowed after obtaining of GLSA approval.

In exceptional cases, for example connection of remote back-up facilities of contractors, or in case of failure until rectified, it is possible to foreseen construction of overhead cable line made with use of cables with suspension wire, or with cable suspended on steel wire, with use of adequate accessories.

5.1.2 Selection of cable route

Cable route shall be set with consideration given to the following provisions:

- Number of crossings and approaches of cable on route with other equipment, as well as number of passages through walls, ceilings and other obstructions shall be minimised
- Distance between cable and hot pipeline shall take into account thermal effects
- The cable shall be as less as possible endangered with mechanical and chemical damages
- Laying of cables shall be performed in a way precluding their damage in effect of bending, twisting, stretching, etc

5.1.3 Laying of cables on vertical and inclined sections

Cables being laid vertically or on slopes shall be such fastened, so that tension force would not create stresses in cable and would not effect in axial displacement of cables.

5.1.4 Laying of fire resistant cables

Fire resistant cables according IEC 60331 shall be laid on structures and holders of fire resistance not less than required durability of the cable.

Fire resistant cables routed horizontally or with inclination at angle less than 15° to level, shall be routed in cable trays or in holders, while fire resistant cables routed with inclination at angle greater than 15° to level, as well as vertically routed cables, shall be fastened in holders attached to supporting structures or directly to walls.

5.1.5 Types of cables laid in ducts, on pipe racks and in rooms

Acceptable types of cables are specified in Enclosure N° 1, and their parameters are given in standard N° 3760.

5.2 Detailed requirements

Laying of telecommunication cables:

- In cable ducts
- On cable platforms (pipe racks)
- In protective conduits
- Directly in soil
- In cable trays
- At passages through walls

shall conform to requirements given in standard N° 3110

Marking of cable routes cross sections shall be made according to p.4.3 requirements of standard 3110. Execution of junction boxes shall meet requirements given in p. 4.6 of 3110 standard.

Minimum distances of telecommunication cables laid directly in soil and cable ducts from other underground equipment shall conform to values given in Enclosures N° 2 and 4. In case of technical difficulties, reduction of required distances is allowed on condition, that additional protections are used (e.g. steel conduits, concrete partitions), agreed with GLSA

5.3 Designing

Designing of cable networks shall be based on up-to-date maps. Cable or telephone conduit routes, as well as destination and types of cable shall result from the design. Each time design and cost estimate documentation shall be elaborated, according to regulations – p. 6.

5.4 Telephone conduit system

5.4.1 General requirements

New tracks of telephone conduits shall be made of PVC conduits of 100 mm internal diameter, and wall thickness not less than 2 mm. Number of tracks shall be adapted to needs, while maintaining reserve of at least 50% of free conduit tracks. In justified cases, and on GLSA approval, conduits of lesser internal diameter may be used. AROT type conduits shall not be applied for tracks of telephone conduit system. Application for that type of conduit is permitted in justified cases and shall be followed by written agreement accepted by GLSA.

Kind and type of applied manholes (arterial or distribution ones) shall be determined be designer depending on foreseen cable types and target number of protective conduits. Internal dimensions of a manhole shall conform to Enclosure N° 4.

5.4.2 Location of ducting

Telephone conduits shall be made under walkways on within green belt, parallelly to road axis, outside of explosion hazardous zones.

5.4.3 Location of telephone manholes

Telephone manholes shall be located in the following points of telephone conduit system:

- On the straight route of the system as through manholes, in order to keep allowable length of protective conduits between adjacent manholes
- On bends of cable route – as corner manholes
- On branches of the system – as branching manholes
- In front of cable cabinets – as cabinet-type manholes
- On terminations of conduit tracks, as terminal telephone manholes.

5.4.4 Through distances between telephone manholes

Length of protective conduits between adjacent telephone manholes shall net exceed 70 m. Length of conduit section from the manhole to building shall not exceed 20 m.

5.4.5 Depth of ducting placement

Telephone conduits shall be laid in such a way, so that the least coverage, counting from pavement (surface) level to upper surface of cable ducting would amount to 0.6 m.

At culverts under roads, depth of ducting shall be such, that coverage would not be less than 0.8 m. In case of technical difficulties with keeping to required depth, reduction of telephone conduit depth is allowed, providing that proper protection would be applied.

5.4.6 Path of telephone conduits

On sections between adjacent manholes, telephone conduits shall run along straight line, without bends. Conduits can be bent in order to pass by obstructions in such a way, so that bend radius would not be less than 6 m.

On even area, the ducting shall be laid with $1^{o}/_{oo}$ up to $3^{o}/_{oo}$ slope. In case of introducing the conduits into buildings, the slope shall be equal at least $5^{o}/_{oo}$ towards telephone manholes.

5.4.7 Laying of conduits

The conduits shall be laid on bottom of trench shaped with inclination according to requirements of p. 4.3.6. In case when conduits are laid in soils of weak compaction, such as dry sand without binding material, or in water saturated soils, then continuous footing made of B-10 class concrete and of thickness at least 10 cm shall be laid on the bottom of the trench.

Concrete footing shall also be applied when soil settlement is possible. It is allowed to produce the concrete footing in form of building stone layer, break stone and sand, grouted with cement mortar.

5.4.8 Laying and joining of PVC conduits

PVC conduits shall be hot or cold flange joined, depending on type of used conduit. All conduits being laid shall point in the same direction, with flange opening pointing in direction opposite to ditch inclination direction.

Distances between individual conduits in layer shall not be less than 2 cm, and between layers at least 3 cm. Gaps between conduits and layers shall be tightly filled with sand.

In order to ensure compactness of multi-hole conduit track, gaps between conduits shall be filled with concrete mass (concrete and sand in 1:3 ratio) on length of approx. 0.8 m and with spacing not less than 20 m.

The last layer of conduits shall be buried with sand up to coverage thickness not less than 5 cm, and then with soil layer with approx. thickness of 20 cm. The soil shall not contain stones and debris. The trench shall be backfilled in turn with native soil.

5.4.9 Introduction of conduits into telephone manholes and buildings

The conduits shall be concrete embedded in openings of manholes or cable room, and joined with concrete mortar on approx. length of 0.5 m starting from the manhole wall.

PVC conduits on sections subjected to laying or embedding with concrete shall be cleaned on approx. lenght of 0.5m, then coated with glue and sprinkled with sand and cement mixture. Such prepared conduit can be built-in to telephone manhole after 2 hours approximately.

All openings of telephone conduit system being introduced to cable room and buildings shall be sealed in a way protecting against penetration of gases and small rodents. Application of professional sealing systems is recommended.

5.4.10 Requirements for telephone manholes

It is recommended to produce the telephone manholes from ready prefabricated units. Construction of telephone manhole from concrete blocks is allowed in justified cases. The above design shall be agreed with GLSA.

Telephone manholes shall be covered with removable plates or equipped with locked access opening. Size of telephone manholes shall enable pulling through, change of laying direction and connecting of cables. The telephone manhole shall be equipped with climb steps and tubes for cable holders.

Ventilators shall be installed in covers of telephone manholes in the following cases:

- In every second through telephone manhole
- In every cabinet-type and distribution telephone manhole
- In every telephone manhole before introducing of conduits into building.

Types and dimensions of telephone manholes shall comply with data quoted in Enclosure N° 4.

5.5 Cable termination enclosures

5.5.1 Cable cabinets

Design of cable cabinets shall enable wall, or free-standing installation.

The cabinets shall feature the following design:

- Enclosure made of plastic (polyester) of laminar structure
- External surface made of reinforced glass fiber
- One or two pairs of door
- A rack made of stainless steel with central earthing point
- Bottom plate with entrance opening prepared.

Cable cabinets shall be adapted to assembly of cable heads or connecting block units. The rack prepared for cable heads shall enable installation of up to 16, 100-pair cable heads. In case of rack made for assembly of connecting block units, capacity of the cabinet shall amount to 1200 pairs with extension possibility to 2400 pairs.

The enclosures shall be equipped with installation kits of Abloy lock and three-point lock for door locking with door opening limiter. Degree of protection shall at least IP54.

5.5.2 Cable boxes

Design of cable boxes shall enable installation on wall or on post.

Cable boxes shall feature the following design:

- Enclosure made of plastic reinforced with glass fiber
- Box locking adapted for Abloy lock
- Optional assembly plate
- Cable entrance points made of synthetic rubber.

Cable boxes shall enable assembly of connecting blocks (in numbers depending on needs), as well as overvoltage or overvoltage–overcurrent protections. Degree of protection shall at least IP55.

5.5.3 Distribution posts

Distribution post shall be made of high density polyethylene (HDPE), which shall form a round cross section. The post shall consist of:

- housing equipped with brackets for connecting block units and cable heads
- cover equipped with a Abloy type lock

- concrete footing
- masking concrete plate

Housing of termination enclosures shall be immune to chemical compounds, moisture, sunlight, temperature fluctuation and electrolysis. Degree of protection shall at least IP54.

5.6 Scope of documentation

1. Technical description, including:
   - description of existing equipment
   - description of newly designed equipment
   - detailed description of system components
   - operation, installation and maintenance instructions
   - list of relevant norms and other documents
2. Equipment list
3. Cable list
4. Drawings
   - description of graphical symbols
   - block diagrams
   - layout drawings
   - wiring (cabling) diagrams
   - power supply diagrams
   - mounting examples

5.7 Acceptance of cable systems

5.7.1 Visual inspection

Commission with participation of works manager and supervision inspector shall verify correctness of execution:

- Laying of telecommunication cables in soil prior to backfilling them
- Laying of telecommunication cables in cable ducts and cable channels, prior to closing them
- Laying of telecommunication cables on cable platforms of pipe racks and in ducts
- Execution of telephone conduits prior to covering it.

5.7.2 Conformity to design

Compliance of cable routes and materials, with particular attention paid on profiles of cable routes and telephone conduits shall be verified.

5.7.3 Crossing and approaches

During visual inspection, distances of approaches and crossings with other underground facilities subject to verification.

5.7.4 Assessment of inspection results

Cable system presented for inspection shall be considered as executed according to requirements of this specification, if tests performed according to p. 4.6.1, 4.6.2 and 4.6.3 gave positive results. The components, which in result of inspection got negative assessment, shall be rectified and reported for acceptance once again.

5.7.5 As-built documentation

In course of acceptance, the following items shall be handed over to GLSA:

- Design documentation with plotted-in changes
- Factory documentation of accessories
- Manufacturers' or suppliers' declarations of conformity
- Detailed drawings with designations of cable system elements
- Acceptance report

6 Relevant documents

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

7 Norms and standards

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 7 July 1994 r. Building Law

1 Dz.U. 2002 nr 75 poz. 690 - Minister of Infrastructure order of 12 April 2002, on technical conditions that buildings and their location should adhere to.
2 Dz.U. 2012 nr 0 poz. 462 - Minister of transport, construction and maritime economy order of 25 April 2012, on detailed scope and form of building project.
3 Dz.U. 1995 nr 25 poz. 133 - Minister of Spatial Economy and Construction order of 21 February 1995, on type and scope of geodetic and cartography studies and geodetic activities binding in building engineering.

The Law of 16 April 2004, on building products

1 Dz.U. 2004 nr 195 poz. 2011 - Minister of Infrastructure order of 11 August 2004 on conformity assessment systems, requirements that notified bodies taking part in conformity assessment should adhere to, and method of building products marking with CE mark.
2 Dz.U. 2004 nr 237 poz. 2375 - Minister of Infrastructure order of 14 October 2004, on European technical approvals and Polish bodies authorized for issuing them.
3 M.P. 2004 nr 32 poz. 571 - 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.
4 Dz.U. 2004 nr 198 poz. 2041 - Minister of Infrastructure order of 11 August 2004 on methods of building products conformity declaring and method of marking them with building mark
5 Dz.U. 2004 nr 249 poz. 2497 - Minister of Infrastructure order of 8 November 2004, on technical approvals and organizational bodies authorised for issuing them.

6 Dz.U. 2011 nr 87 poz. 486 - Minister of Infrastructure order of 8 April 2011 on method of keeping National Register of Questioned Building Products.

9 Dz.U. 2009 nr 144 poz. 1182 - Minister of Infrastructure order of 2 September 2009 on inspection of building products introduced to turnover

10 Dz.U. 2011 nr 23 poz. 122 - Minister of Infrastructure order of 25 January 2011 on samples of building products introduced to turnover.

7.2 Norms

- BN-73 8984-01 Telecommunication cable systems. Telephone manholes. Classification and dimensions
- BN-73 8984-05 Cable ducting. General requirements and testing
- BN-74 3233-16 Cable cabinets
- BN-74 3233-18 SK1 telephone manhole

8 Enclosures

- Enclosure No. 1, Recommended types of cables (cable types according to standard 3760 Telecommunication cables)
- Enclosure No. 2, Minimum approach distances of telecommunication cables and telephone conduits to other underground facilities
- Enclosure No. 3, Minimum approach distances of cable ducting and gas pipelines
- Enclosure No. 4, External dimensions of telephone manholes

9 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
-	31-08-2015	Page layout corrections, no contents changes.	T. Wróbel

Cable types according to standard 3760 Telecommunication cables

Type	Telecommunication cables							Signalling cables	
Cable type	XzTKMX Ftl(y)	LAN-T11A cat 5	YnRPX	11F75(3) 1,6/7,3					YTDY, YTLY
profile	1x2 do 35x2	4x2	1x2 1x4	75Ω					Nx1
conductors	0,5/0,8	0,5	1,2	0,6/3,7					0,5
Telecomm. cat. < 3	X								
Telecomm cat. ≥ 5		X							
Dispatcher announcing [DSO, intercom]			X						
Public addressing			X						
Fire alarming	X								
Access control		X							X
Burglary alarming		X							X
CCTV		X		X					

Grupa LOTOS S.A.	**ENCLOSURE No. 2**	Spec. N° 3730
	Minimum approach distances of telecommunication cables and telephone conduits to other underground facilities	

Type of underground facility	Minimum allowable distance (m)	
	At crossing	At approach
Power cable line in shield	arbitrary	0,5
Power cable line without shield	0,5	0,5
Water pipeline	0,5	1,0
Gas pipeline	0,5	Acc. to Enclosure No 3
Hot pipeline without enclosure	0,5	2,0
Hot pipeline with enclosure	0,3	2,0
Rain-water and waste-water sewage	0,3	2,0
Foundations of buildings and other structures	Crossing is forbidden	1,0
Lightning protection devices of buildings	Crossing is forbidden	5,0

lp	Type of field objects	Nominal pressure [MPa] >	0,4 up to 1,2		1,2 up to 2.5		2,5 up to 10,0			
		Diameter of gas pipeline [mm]	up to 300	>300	up to 300	>300	up to 300	>300÷500	>500÷800	>800
1	Telephone conduits having direct connection to rooms intended for persons and animals	clearance gauge of pipe, cable, duct or telephone manhole	10	10	15	15	15	20	20	20
2	Telephone conduits, telecommunication cables without connection to rooms intended for persons and animals		1	3	1	5	5	7	8	8

Source: Minister of Industry and Commerce order of 14 November 1995. [JoL .95.139.686]

Grupa LOTOS S.A.	**ENCLOSURE No. 4**	Spec. N^{o}
	External dimensions of telephone manholes	3730

Telephone manhole type	Max number of ducting openings	Internal dimensions of telephone manhole (mm)			Dimensions of openings (mm)		Dimensions of access openings (mm)	
		L	W	H	W	H	W	L
SKR-1	1	1000	500	750	150	150	500	1000
SKR-2	2x2	1500	900	1400	300	150	500	1000
SKM-4	4x6	2400	1200	2000	500	900	600	1000
SKS-I	4x6	2400	1200	200	500	900	600	1000