	Israel Railways – Communication and Signaling Department - Infrastructure Division	
IRS-008	NYBY and NYY Control Cable: Armored and Non-Armored Nx0.9, Nx1.4 mm Conductors	Revision 2 24-4-2017

1. Scope

This Specification describes the construction and properties of armored and un-armored control cables for Israel Railways, having solid conductors of either 0.9 or 1.4 mm diameter. In general the cables shall be designed per IEC 60502-1 for a rated voltage of 0.6/1.0 kV.

The cables shall meet the requirement of the RoHS regulation.

In addition this specification defines Israel Railways requirements for supplier qualification and quality assurance program, as well as packaging requirements.

2. Application and Lifetime

For outdoor use near railway tracks, in ducts, concrete conduits or direct burial. The cable shall be designed for a lifetime of 25 years in such applications.

3. Standards

- [IEC 60228](#) – Conductors of insulated cables
- [IEC 60304](#) – Standard colors for insulation for low-frequency cables and wires
- [IEC 60502-1](#) – Power cables with extruded insulation and their accessories for rated voltages from 1 kV up to 30 kV– Part 1: Cables for rated voltages of 1 kV and 3 kV
- [EN 10346](#) - Continuously hot-dip coated steel flat products. Technical delivery conditions
- [EN 50290-2-23](#) – Communication Cables – Part 2-23: Common design rules and construction – PE insulation
- [EN 50290-2-24](#) – Communication Cables – Part 2-24: Common design rules and construction – PE sheathing
- [IEC 60794-1-21](#) – Optical Fiber Cables – Part 1-21: Generic Specification – Basic optical test procedures – Mechanical test methods

Quoting a standard in this document implies a requirement to use all standards referenced in the quoted standard. Potential suppliers may suggest using other, equivalent, standards.

4. Requirements for Manufacturers

A pre-requisite for purchasing cables is an approval by Israel Railways of the manufacturing factory. The company owning the factory (supplier) and the Israeli agent of the supplier will also have to be approved by Israel Railways. However, approval conditions of the supplier and its local agent are given elsewhere.

The following is a list of requirement for factory approval.



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1.	The factory Quality System shall have been approved to conform to ISO-9001 for at least 3 years prior to the proposal date. A valid ISO-9001 certification shall be submitted with the proposal documents. The certifying body shall be registered with an international organization such as IQNet or similar.
2.	The factory shall agree to undergo a certification process by Israel Railways personnel or representatives upon winning a contract with Israel Railways. Such a certification will be a pre-condition for cable supply.
3.	The factory has been producing and selling to railway operators in OECD countries at least 250 km/year control/signaling cables of the type specified here for at least the last 3 years. A proof of sales shall be attached to the Tender documents
4.	The factory's test laboratory is able to carry out all the routine tests specified in this specification
5.	Upon winning a contract with Israel Railways, the factory shall submit a detailed Quality Assurance Program for the offered cables. This program shall form the basis for a type test to be carried out in the factory and witnessed by Israel Railways personnel or representatives

5. Cable Construction

Conductor	Solid bare annealed copper (class 1), 0.9 or 1.4 mm	Per IEC 60228. Notes 1, 2
Insulation	PVC/A. Nominal thickness: 0.8 mm, minimum thickness: 0.62 mm	Per IEC 60502-1. Note 3
Color code	See color code table	
Core layout	In concentric layers with successive layer in opposite lay direction	See color and structure table below. Note 4
Core covering	Polyester tape, helically wrapped, minimum overlap 20%	
Inner Jacket (if required)	Black PVC type ST1, 1.6 mm thick	Per IEC 60502-1. Note 5
Armor (if required)	Two galvanized steel tapes 0.2 mm thickness, helically applied, with overlap	Per IEC 60502-1 Steel per EN 10346, Notes 6, 7, 8
Outer Jacket	Grey UV-protected PVC type ST1, 2 mm thick	Per IEC 60502-1. Notes 5, 9
Printing	ISRAEL RAILWAYS - Cable description from Section 8 below - Israel Railways Cable PN - Manufacturer Name - Month and Year of Production - Batch Number - Meter mark	Notes 9, 10

Notes

1. Conductor elongation. The elongation before fracture, of a test piece of the conductor extracted from the completed cable, shall be minimum 15%. The test method shall be per IEC 60189-1.
2. Conductor joints. Joints in the conductor shall be kept to a minimum. If the conductor contains a joint, the tensile strength of a conductor segment of 250 mm with a joint shall be no less than 90% of the tensile strength of an adjacent section of the conductor not containing a joint.

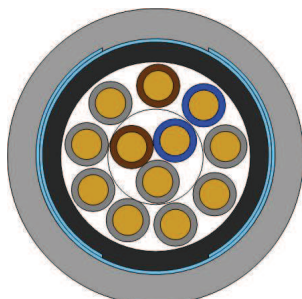


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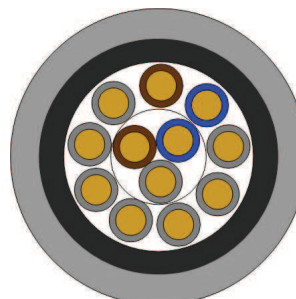
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NYBY



NYY

Drawings are not in the correct scale

3. Insulation properties. The insulation shall pass the PVC/A requirements in Table 15 (page 65) in IEC 60502-1.
4. Core layout: The relative positions of all conductors shall be maintained from end to end.
5. Jacket properties: The inner and outer jackets shall pass the PVC/ST1 requirements in Table 16 in IEC 60502-1.
6. Armor: The outer tape shall be laid approximately central over the gap of the inner tape. The gap between adjacent turns of each tape shall not exceed 50 % of the width of the tape.
7. Armor tape: The tape shall be made of galvanized steel. Each tape shall be electrically continuous along the entire cable.
8. Galvanized steel tape. The steel tape shall meet EN 10346 and have a tensile strength of more than 400 MPa, and be coated by at least 100 gr/m² of zinc.
9. Outer jacket. The jacket shall be **grey** and contain UV-protective additives to allow it to pass at least 100 kLY per IEC 60068-2-5 while maintaining at least 50% of the original jacket tensile strength and elongation. An equivalent test may be suggested.
10. Printing. The printing shall be made at 100 (-0/+0.5) cm intervals in black characters, 5 mm high.
11. Printing: The printing shall withstand the abrasion test per IEC 60794-1-21 method E2B.

6. Layer Structure and Color Code

Layer	No. of wires	Colors
40 member cables		
Center	1	Red
First	7	Red, (white, black, yellow, brown), white, blue
Second	13	Red, 2x(white, black, yellow, brown), white, black, yellow, blue
Third	19	Red, 4x(white, black, yellow, brown), white, blue



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10 member cable (*)		
Center	2	Brown, blue
First	8	Brown, Blue, 6 x grey
12 member cable (*)		
Center	3	Brown, blue, grey
First	9	Brown, blue, 7x grey


(*) All wires in the 10 and 12 member cables shall be numbered consecutively starting from the inner layer to the outer layer.

7. Electrical Properties (all measured at or corrected to 20°C)

Conductor Diameter	mm	0.9	1.38	
Conductor cross section area	mm ²	0.64	1.5	
Conductor resistance @ 20°C	Ω/km	≤ 28	≤ 11.9	
Insulation resistance @ 500 VDC, 20°C	GΩ*cm	10		IEC 60502-1 Clause 17.1
Voltage test @ 50 Hz, 5 minute - Core/Core 2500 VAC, - Core/armor 2500 VAC,		No breakdown		IEC 60502-1 Clause 15.3

8. Mechanical and Environmental Properties of the Completed Cable

Bending test	IEC -60502-1 Clause 18.17, Except mandrel diameter = 10 x cable diameter	In addition to 18.17, No cracks visible on outer jacket
Torsion test (for armored cables)	Per IEC 60794-1-21 method E7 Except only 3 cycles. Cable length under test 125 times the cable diameter	No cracks or tears visible on the jacket
Installation temperature	0 to +50 °C	
Operation temperature range	-10 to +70 °C	
Storage temperature range	-10 to +80 °C	
Fire retardance	Meet	IEC-60332-1-2
UV resistance	Per note 9 above. Material supplier certification may be submitted as proof of compliance	IEC 60068-2-5

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9. Cable Codes, Nominal Weight and Diameter

Size and number of wires	Israel Railways Description	Israel Railways P/N
40x0.9	NYBY 40 x 0.9	IR-NV-04009-045
4x1.4	NYBY 4 x 1.4	IR-NV-00414-048
10x1.4	NYBY 10 x 1.4	IR-NV-01014-051
12x1.4	NYBY 12 x 1.4	IR-NV-01214-054
40x1.4	NYBY 40 x 1.4	IR-NV-04014-057
40x0.9	NYY 40 x 0.9	IR-NV-04009-060
12x1.4	NYY 12 x 1.4	IR-NV-01209-063

10. Quality Assurance Program

The supplier shall devise and maintain a product quality assurance program comprising of the following elements:

- Type test
- Routine tests

The following tests shall be carried out:

Type test


- Insulation properties per for PVC/A per requirements in Table 15 (page 65) in IEC 60502-1
- Inner and outer jackets properties for PVC/ST1 per requirements in Table 16 (page 67) in IEC 60502-1
- Insulation resistance per IEC 60502-1 Clause 17.1
- Fire retardance per IEC 60332-1

Routine tests

- 100% testing
 - Visual inspection including verifying all dimensions and color code
 - Electrical resistance test of all conductors
 - Voltage test (per Section 4 above)
- Sampling tests - every production batch or any parameter change. Sampling rate per Table 12 in IEC 60502-1.
 - Verify printing text
 - Bending test

For long terms suppliers, the Type Test shall be repeated every year in coordination with Israel Railways.


The routine test results (as defined above) shall be sent to Israel Railways one week prior to shipping on a magnetic media or as files via the Internet. The file structure will be coordinated between the supplier and Israel Railways.

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The detailed records of all the tests (Type and Routine) shall be maintained by the supplier for a period of 7 years from the testing date. These records shall be made available to Israel Railways upon demand.

11. Packing and Marking

- 11.1 Standard cable length per drum shall be 1000 m \pm 5%. Israel Railways may request non-standard length.
- 11.2 The cables shall be wound on the drum such that the cable beginning is marked as 0 m and it is located on the inner cable end.
- 11.3 The cables shall be supplied in the ordered lengths wound on wooden drums.
- 11.4 Sealing Caps: After conclusion of the electrical tests, in order to prevent water penetration into the cable core through cable ends, each end shall be sealed with a shrinking cap of appropriate size.
- 11.5 The drums shall be made of new wood, properly treated against insect infection and bear an approval stamp per **ISPM 15**.
- 11.6 The drums shall be chosen to support the cable weight and sturdy enough to withstand sea transport and common cable installation practices.
- 11.7 Drums shipped by boat shall be fully battened with new wood battens. Plastic or cardboard protective cover shall be applied directly on the cable. Drums shipped by truck shall be protected with a suitable protective cover.
- 11.8 The flange diameter shall not exceed 250 cm.
- 11.9 The length of cable to be wound on the drum shall be such that a clear space of at least 50 mm shall be left between the outer layer and the battens.
- 11.10 The inner cable end shall be placed in a hollow, or other suitable device inside the drum, designed for this purpose. The hollow shall be covered with sheet-metal, to protect the end on the outer side.
- 11.11 The cable ends shall be secured to the drum flanges to prevent cable damage during transportation.
- 11.12 A label shall be fixed to each side of the drum. The lettering on the label shall be water and UV resistant. The plate shall contain information including:
 - Israel Railways Order number
 - Israel Railways part number
 - Israel Railways Cable code
 - Month and Year of manufacture
 - Cable length and weight in kilograms
 - Cable rolling direction
 - Drum number
 - Total weight.
 - The text "Property of Israel Railways"

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12. Appendix A - Technical Submission Check List

The following is a check-list for all major requirements in this Specification. Please provide all required supporting documents. Failure to comply with any parameter may lead to proposal rejection.

No.	Parameter	Notes
Factory Pre-requisites		
1.	ISO-9001	Provide a current certificate
2.	Agree to undergo certification	Fill in Form A
3.	Produced Similar cables	Provide catalogs
4.	Sales to OECD countries	Provide customer list and quantities
5.	Equipped test laboratory	Provide equipment list
6.	Carry out type test	Fill in Form B
Cable construction		
7.	Designed for 25 years lifetime	
8.	Cable Construction	Provide detailed data sheets for all options
9.	Conductor elongation and joint strength	
10.	PVC/A insulation per IEC 60502-1	
11.	Color code	
12.	PVC St1 Inner jacket Per IEC 60502-1	
13.	Galvanized steel armor	
14.	≥ 100 gr/m ² zinc on steel	
15.	PVC type ST1 outer jacket Per IEC 60502-1	
16.	Printing text and quality	
Electrical Properties		
17.	Conductor resistance	
18.	Insulation coaxial resistance	
19.	Voltage test	
20.	Spark test – 12 kV	
Mechanical and Environmental Properties of the Completed Cable		
21.	Bending test	
22.	Torsion test (for armored cables)	
23.	Installation/operation/storage temperature range	
24.	Fire retardance per IEC-60332-1	
25.	UV protection per note 9	

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No.	Parameter	Notes
Quality Program		
26.	Type test per Section 10	
27.	Routine tests per section 10	
28.	Supply all information to Israel Railways on magnetic media	
29.	Maintain records for 7 years	
Packing and Marking		
30.	Standard length	
31.	0 meter on inner end	
32.	New wood drums per requirements	
33.	Sealing caps	
34.	Treated drums per ISPM 15	
35.	Label data	