Base Load Power Hub (BLPH)

INSTRUMENT CABLES

EQUIPMENT MANUFACTURERS RECORD BOOK COMPLETE

Document Number: 1724002477-QC-DB-00007

Document Class: 2

01	02/04/2025	Accepted for Construction (AFC)	Fumagalli	Cucinotta	Beretta
00	31/01/2025	Issue for Review (IFR)	Fumagalli	Cucinotta	Beretta
Rev.	Date	Description	Prepared	Reviewed	Approved

FLEI s.r.l.

File: 1724002477-QC-DB-00007 Rev.00

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Revision / Change Log

Rev.	Description
00	Issue for Review (IFW)
01	Accepted for Construction (AFC)

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Base Load Power Hub (BLPH)

INSTRUMENT CABLES

EQUIPMENT MANUFACTURERS RECORD BOOK (FINAL DOSSIER) INDEX

Document Number: 1724002477-QC-LIS-00006

Document Class: 2

ROSETTI MARINO

1	NO COMMENTS - APPROVED - WORK MAY PROCEED
2	MINOR COMMENTS - REVISE AND RESUBMIT - WORK MAY PROCEED
3	MAJOR COMMENTS – REJECTED – DO NOT PROCEED
4	APPROVAL NOT REQUIRED

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Sign	Date
ROSETTI MARINO S.p.A.	21/02/2025

01	13/02/2025	Accepted for Construction (AFC)	Fumagalli	Cucinotta	Beretta
00	31/01/2025	Issue for Review (IFR)	Fumagalli	Cucinotta	Beretta
Rev.	Date	Description	Prepared	Reviewed	Approved

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Revision / Change Log

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PART 1 – DESIGN DOSSIER

-	Document register	1724002477-MD-LIS-00001
-	Cable drums schedule – electrical cables	1724002477-ELE-LIS-00004
-	ITP	1724002477-QC-ITP-00002
-	Packing, Transportation, Handling and Storage procedure	1724002477-QC-PRO-00008
-	Manufacturing and Testing procedures (FAT)	1724002477-QC-PRO-00005
-	Test Report and Declaration of Conformity	

PART 2 – CERTIFICATION DOSSIER

- Test record
- FAT reports (see Test record)
- IRN

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Base Load Power Hub (BLPH)

INSTRUMENT CABLES

SUPPLIER MASTER INFORMATION REGISTER

Document Number: 1724002477-MD-LIS-00001

Document Class: 3

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Sign	Date
V. Barratta	30-01-2025

00	28/01/2025	Issue for Information (IFI)	Fumagalli	Cucinotta	Beretta
Rev.	Date	Description	Prepared	Reviewed	Approved

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SMIR - REGISTRO DOCUMENTI / *SMIR - SUPPLIER MASTER INFORMATION REGISTER*

	Ordine n°/*order nr.*	1724002477		Fornitore/*Supplier* :	FLEI SRL
	data / *dated:*			Codice F./ *S. Code:*	
	Commessa / *Job:*			Indirizzo/ *address* :	VIA DE GASPERI, 82 20864 AGRATE BRIANZA (MB) MB
	Descrizione / *Description*	INSTRUMENTAL CABLES		Persona di riferim./ *contact person:*	stefania.fumagalli@flei.it
	Macrofase / *Phase*				

Pos.	Document nr. Client (1)	Doc Client Rev. (1)	Document nr. Internal	Document nr. Internal Rev. (2)	Document nr. Supplier (3)	Doc Supplier Rev. (3)	Titolo Documento / *Document title* (4)	Disciplina / *Discipline* (5)	Blocco Classe / *Class Block (6)*	Docum. Format (7)	first issue date (8)	Third Party Approval (I/A)	Design KEY Document	Document subject to liquidated damages	Document Approval (I/A)
							CONTROL DOCUMENTS								
1	1724002477-MD-LIS-00001	00	1724002477-MD-LIS-00001	00	TBD	00	SUPPLIER MASTER INDEX REGISTER (SMIR) - INSTRUMENTAL CABLES	INS		A4	31/01/2025				I
							QUALITY DOCUMENTS								
2	1724002477-QC-ITP-00002	00	1724002477-QC-ITP-00002	00	TBD	00	INSPECTION AND TEST PLAN - INSTRUMENTAL CABLES	QUA		A4	31/01/2025				A
							ENGINEERING DOCUMENTS								
3	1724002477-IN-DS-00003	00	1724002477-IN-DS-00003	00	TBD	00	CABLE DATA SHEETS-INSTRUMENTAL CABLES	INS		A4	31/01/2025		Y		I
4	1724002477-IN-LIS-00004	00	1724002477-IN-LIS-00004	00	TBD	00	CABLE DRUMS SCHEDULE-INSTRUMENTAL CABLES	INS		A4	31/01/2025				A
5	1724002477-QC-PRO-00005	00	1724002477-QC-PRO-00005	00	TBD	00	FAT PROCEDURE-INSTRUMENTAL CABLES	QUA			31/01/2025				
6	1724002477-QC-LIS-00006	00	1724002477-QC-LIS-00006	00	TBD	00	EQUIPMENT MANUFACTURERS RECORD BOOK (FINAL DOSSIER) - INDEX-INSTRUMENTAL CABLES	QUA		A4	31/01/2025				A
							CERTIFICATES (ref. to notes in the RDDS)								
7	1724002477-QC-DB-00007	00	1724002477-QC-DB-00007	00	TBD	00	EQUIPMENT MANUFACTURERS RECORD BOOK – COMPLETE -INSTRUMENTAL CABLES	CERT		A4	07/03/2025				A
							HANDLING, SHIPPING & SITE INSTALLATION								
8	1724002477-QC-PRO-00008	00	1724002477-QC-PRO-00008	00	TBD	00	PACKING SHIPPING HANDLING AND STORAGE PROCEDURES -INSTRUMENTAL CABLES	EXP		A4	31/01/2025				I

Notes:

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Document number assigned by final Client
(2) Numero documento interno
Document number internal
(3) Numero documento Fornitore (assegnato dal Fornitore)
Document number assigned by Supplier
(4) Assegnare il Titolo del documento (assegnato dal Fornitore)
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(5) Specific are la disciplina (compilato da Rosetti)
Process, Piping; Electrical, Expediting, Inspection, Commissioning, Quality, ecc (to be filled by Rosetti)
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Procedure, list, drawing, data sheet, etc. (to be filled by Rosetti)
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A4, A3, A1 (Supplier)
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Foreseen date for the first issue (Supplier)

Base Load Power Hub (BLPH)

INSTRUMENT CABLES

CABLE DRUMS SCHEDULE

Document Number: 1724002477-IN-LIS-00004

Document Class: 2

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Sign	Date
V. Barratta	19-02-2025

Rev.	Date	Description	Prepared	Reviewed	Approved
01	13/02/2025	Accepted for Constrution (AFC)	Fumagalli	Cucinotta	Beretta
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ID DRUM	CABLE TYPE	DESCRIPTION	DRUM LENGHT (m)
e220.2	ELECV21-4G4_E	CU CL.2/MGT/EPR/LSZH/GSWB/LSZH 4G4	300
20	SMICV01-1X2X0,75	CU CL.2/XLPE/OS/LSZH/SWB/LSZH 1X2X0,75	670
30	SMICV02-2X2X0,75	CU CL.2/XLPE/IS/OS/LSZH/SWB/LSZH 2X2X0,75	300
40	SMICV14-1X3X2,5	CU CL.2/MGT/XLPE/OS/LSZH/SWB/LSZH 1X3X2,5	300

THE LAYOUT SHOULD BE FIXED

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Base Load Power Hub (BLPH)

INSTRUMENT CABLES

CABLE DATA SHEETS

Document Number: 1724002477-IN-DS-00003

Document Class: 3

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Sign	Date
V. Barratta	07-02-2025

00	30/01/2025	Issue for Information (IFI)	Fumagalli	Cucinotta	Beretta
Rev.	Date	Description	Prepared	Reviewed	Approved

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File: 1724002477-IN-DS-00003 Rev.00

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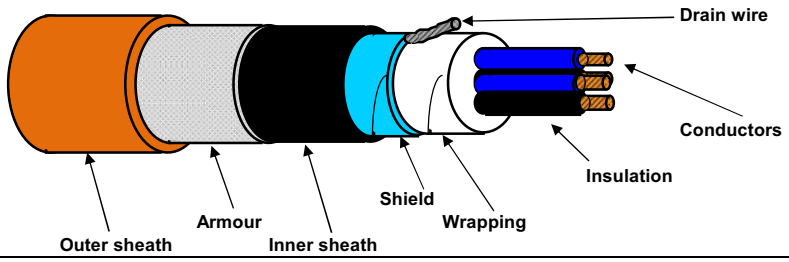
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Cu Cl.2/MGT/XLPE/OS/LSZH/SWB/LSZH 150/250 V (300 V)

1X3X2,5 - INSTRUMENT CABLE - Fire Resistant - Not I.S.



TECHNICAL FEATURES

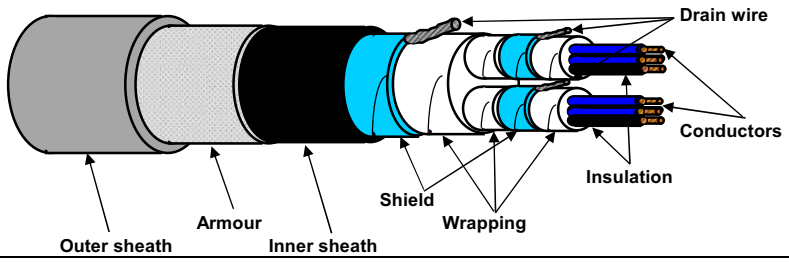
Conductors :	**7-STRANDED** plain/bare soft annealed copper wires	**IEC 60228 Class 2**
Insulation :	Mica/Glass Tape (MGT) plus XLPE, Nominal Thickness 0,6 mm	
Cores colour code :	**Red - White - Black**	
Triad Assembling :	Not required	
Triad Wrapping:	Not required	
Drain wire :	Not required	
Triad Shield :	Not required	
Shield Insulation :	Not required	
Total Assembling :	7/1mt	
Overall Wrapping:	by polyester-PET Minimum Thickness 0,010 mm tape helically wound (overlap ≥ 25%)	
Drain wire :	7-Stranded **TINNED** annealed copper drain wire, **size 1,0 sqmm**, in continuous contact with the shield	
Overall Shield :	by Aluminium-**Al** Minimum Thickness 0,008 mm / polyester-**PET** Minimum Thickness 0,010 mm tape helically wound (overlap ≥ 25%)	
Inner sheath :	Extruded LSZH Thermoplastic Compound (O.I. ≥ 30%), type **SHF1** to IEC 60093.360, Average Thickness 1,1 mm	
Inner sheath color code:	**Black**	
Armour :	Galvanized Steel Wire Braid Armour (coverage ≥ 90%)	
Outer sheath :	Extruded LSZH Thermoplastic Compound (O.I. ≥ 30%), type **SHF1** to IEC 60093.360, moisture/abrasion/UV Resistant, Average Thickness 1,3 mm	
Outer sheath color code:	**Orange**	
Outer printing (INKJET) :	**FLEI - 1X3X2,5 SQMM - MGT/XLPE/OS/LSZH/SWB/LSZH - 150/250 V - IEC 60331.21 -**	
(every 1000 mm)	**IEC 60332.1.2 - IEC 60332.3.22 - Year of Manufacture - CE + Meter Marking**	
Under armour diameter :	(10,9 ± 10%) mm	
Over armour diameter :	(12,1 ± 10%) mm	
Outer diameter :	(14,7 ± 10%) mm	
Bending radius :	cable outer diameter x 10 (in fixed installation)	
Voltage Test :	1,5 kV a.c. for 5' (Between Cores) / 1,5 kV a.c. for 5' (Between Cores - Shield)	
Conductors DC Resistance :	≤ 7,86 Ω/km (@ 20°C)	
Insulation Resistance :	≥ 1000 MΩ x Km (@ 20°C)	
Mutual Capacitance :	≤ 150 nF/km	
L/R ratio :	≤ 60 µH/Ω	
Inductance :	≤ 0,9 mH/km	
Applicable Standards		
Design Guidelines :	**IEC 60092.376**	
ON COMPLETE CABLE		
Fire Resistant test :	**IEC 60331.21**	
Flame Retardant test :	IEC 60332.1.2 - IEC 60332.3.22	
Acid Gas generation :	IEC 60754.1/2	
Smoke density/Light Transmittance :	IEC 61034.2 (LT ≥ 60%)	
Hazardous Areas :	IEC 60079.14 par.9.3.2a	
Temperature Range :		
ON INSULATION	(max +90°C) (max continuous operation temperature of conductors)	
	(max +250°C) (max conductors temperature during short-circuit for 5 seconds)	
ON COMPLETE CABLE		
During Operation :	(-20°C up to +90°C) (in fixed installation)	
During installation :	(- 5°C up to +50°C)	
Note :	**To meet the requirements of installation and use in Zone 1 & Zone 2 (IEC 60079-14) and "Gas & Vapour Tight" the cable must be provided with Penetrating Inner sheath together with correct ATEX approved equipment or accessories.**	

Office	Date	Sign	Rev.	Date	Sign
Drawn by :	04/04/2024	Messa			
Checked :	04/04/2024	Spaccasassi			
Approved :	04/04/2024	Cucinotta			

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Cu Cl.2/XLPE/IS/OS/LSZH/SWB/LSZH 150/250 V (300 V)

2X2X0,75 - INSTRUMENT CABLE - Flame Retardant - Not I.S.



TECHNICAL FEATURES

Conductors :	**7-STRANDED** plain/bare soft annealed copper wires **IEC 60228 Class 2**
Insulation :	XLPE, Nominal Thickness 0,5 mm
Cores colour code :	**White - Black (each core NUMBERED for PAIR identification)**
Pair Assembling :	13/1mt
Pair Wrapping:	by polyester-PET Minimum Thickness 0,010 mm tape helically wound (overlap ≥ 25%)
Drain wire :	7-Stranded **TINNED** annealed copper drain wire, **size 0,5 sqmm**, in continuous contact with the shield
Pair Shield :	by Aluminium-**Al** Minimum Thickness 0,008 mm / polyester-**PET** Minimum Thickness 0,010 mm tape helically wound (overlap ≥ 25%)
Shield Insulation :	by polyester-PET Minimum Thickness 0,010 mm tape helically wound (overlap ≥ 25%)
Total Assembling :	7/1mt
Overall Wrapping:	by polyester-PET Minimum Thickness 0,010 mm tape helically wound (overlap ≥ 25%)
Drain wire :	7-Stranded **TINNED** annealed copper drain wire, **size 0,5 sqmm**, in continuous contact with the shield
Overall Shield :	by Aluminium-**Al** Minimum Thickness 0,008 mm / polyester-**PET** Minimum Thickness 0,010 mm tape helically wound (overlap ≥ 25%)
Inner sheath :	Extruded LSZH Thermoplastic Compound (O.I. ≥ 30%), type **SHF1** to IEC 60093.360, Average Thickness 1,2 mm
Inner sheath color code:	**Black**
Armour :	Galvanized Steel Wire Braid Armour (coverage ≥ 90%)
Outer sheath :	Extruded LSZH Thermoplastic Compound (O.I. ≥ 30%), type **SHF1** to IEC 60093.360, moisture/abrasion/UV Resistant, Average Thickness 1,3 mm
Outer sheath color code:	**Grey**
Outer printing (INKJET) :	**FLEI - 2X2X0,75 SQMM - XLPE/IS/OS/LSZH/SWB/LSZH - 150/250 V - IEC 60332.1.2 - IEC 60332.3.22 -**
(every 1000 mm)	**Year of Manufacture - CE + Meter Marking**
Under armour diameter :	(11,4 ± 10%) mm
Over armour diameter :	(12,6 ± 10%) mm
Outer diameter :	(15,2 ± 10%) mm
Bending radius :	cable outer diameter x 10 (in fixed installation)
Voltage Test :	1,5 kV a.c. for 5' (Between Cores) / 1,5 kV a.c. for 5' (Between Cores - Shield)
Conductors DC Resistance :	≤ 26 Ω/km (@ 20°C)
Insulation Resistance :	≥ 1000 MΩ x Km (@ 20°C)
Mutual Capacitance :	≤ 150 nF/km
L/R ratio :	≤ 25 µH/Ω
Inductance :	≤ 0,9 mH/km
Applicable Standards	
Design Guidelines :	**IEC 60092.376**
ON COMPLETE CABLE	
Flame Retardant test :	IEC 60332.1.2 - IEC 60332.3.22
Acid Gas generation :	IEC 60754.1/2
Smoke density/Light Transmittance :	IEC 61034.2 (LT ≥ 60%)
Hazardous Areas :	IEC 60079.14 par.9.3.2a
Temperature Range :	
ON INSULATION	(max +90°C) (max continuous operation temperature of conductors)
	(max +250°C) (max conductors temperature during short-circuit for 5 seconds)
ON COMPLETE CABLE	
During Operation :	(-20°C up to +90°C) (in fixed installation)
During installation :	(- 5°C up to +50°C)
Note :	**To meet the requirements of installation and use in Zone 1 & Zone 2 (IEC 60079-14) and "Gas & Vapour Tight" the cable must be provided with Penetrating Inner sheath together with correct ATEX approved equipment or accessories.**

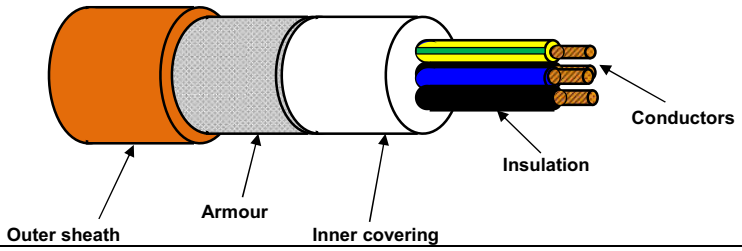
Office	Date	Sign	Rev.	Date	Sign
Drawn by :	04/04/2024	Messa			
Checked :	04/04/2024	Spaccasassi			
Approved:	04/04/2024	Cucinotta			

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Cu Cl.2/MGT/EPR/LSZH/GSWB/LSZH 0,6/1 KV

4G4_E - L.V. POWER CABLE - Fire Resistant & Flame Retardant - ARMOURED



TECHNICAL FEATURES

Conductors :	**STRANDED** plain/bare annealed copper wires IEC 60228 Class 2
Insulation :	Mica/Glass Tape (MGT) plus EPR compound, quality to IEC 60092.360, Nominal Thickness 1,0 mm
Cores colour code :	**Black - Brown - Blue - Yellow/Green**
Pair Assembling :	Not required
Pair Wrapping:	Not required
Drain wire :	Not required
Pair Shield :	Not required
Shield Insulation :	Not Required
Total Assembling :	Cores layed up with optimal lay length
Overall Wrapping:	Not required
Drain wire :	Not required
Overall Shield:	Not required
Inner covering :	Extruded LSZH compound, Average Thickness 1,0 mm
Inner covering color code:	**Black or Natural**
Armour :	**Galvanized Steel Wire Braid Armour (coverage ≥ 90%)**
Outer sheath :	Extruded LSZH Thermoplastic Compound (O.I. ≥ 30%), type **SHF1** to IEC 60093.360, Average Thickness 1,4 mm
Outer sheath color code:	**Orange**
Outer printing (INKJET) :	**FLEI - ELECTRIC CABLE - 1000V - 4G4 SQMM - MGT/EPR/LSZH/GSWB/LSZH - 0,6/1 KV - IEC 60331.21 - IEC 60332.1.2 - IEC 60332.3.22 - Year of Manufacture - CE + Meter Marking**
Under Armour diameter :	(14,3 ± 10%) mm
Over Armour diameter :	(15,5 ± 10%) mm
Outer diameter :	(18,3 ± 10%) mm
Bending radius :	cable outer diameter x 10 (in fixed installation)
Voltage test :	3,5 kV a.c. for 5' (Between Cores - Armour)
Conductors DC Resistance :	IEC 60228 Class 2
Insulation Resistance :	≥ 790 MΩ x Km (@ 20°C)
Applicable Standards	
Design Guidelines :	**IEC 60092.353**
ON COMPLETE CABLE	
Fire Resistant test :	**IEC 60331.21**
Flame Retardant test :	IEC 60332.1.2 - IEC 60332.3.22
Acid Gas generation :	IEC 60754.1/2
Smoke density/Light Transmittance	IEC 61034.2 (LT ≥ 60%)
Temperature Range :	
ON INSULATION	(max +90°C) (max continuous operation temperature of conductors)
	(max +250°C) (max conductors temperature during short-circuit for 5 seconds)
ON COMPLETE CABLE	
During Operation :	(-20°C up to +90°C) (in fixed installation)
During installation :	(- 5°C up to +50°C)
Note :	**To meet the requirements of installation and use in Zone 1 & Zone 2 (IEC 60079-14) and "Gas & Vapour Tight" the cable must be provided with Penetrating Inner covering together with correct ATEX approved equipment or accessories.**

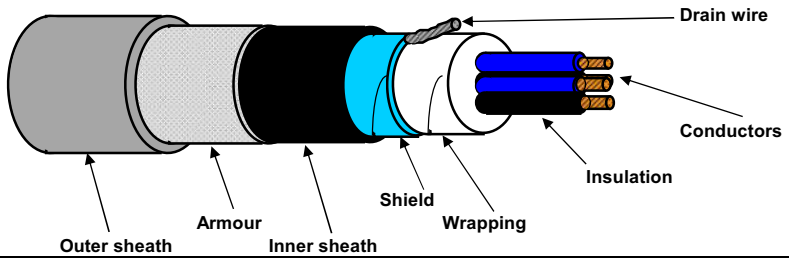
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Checked :	29/03/2024	Spaccasassi			
Approved :	29/03/2024	Cucinotta			

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Cu Cl.2/XLPE/OS/LSZH/SWB/LSZH 150/250 V (300 V)

1X2X0,75 - INSTRUMENT CABLE - Flame Retardant - Not I.S.



TECHNICAL FEATURES

Conductors :	**7-STRANDED** plain/bare soft annealed copper wires	**IEC 60228 Class 2**
Insulation :	XLPE, Nominal Thickness 0,5 mm	
Cores colour code :	**White - Black**	
Pair Assembling :	Not required	
Pair Wrapping:	Not required	
Drain wire :	Not required	
Pair Shield :	Not required	
Shield Insulation :	Not required	
Total Assembling :	13/1mt	
Overall Wrapping:	by polyester-PET Minimum Thickness 0,010 mm tape helically wound (overlap ≥ 25%)	
Drain wire :	7-Stranded **TINNED** annealed copper drain wire, **size 0,5 sqmm**, in continuous contact with the shield	
Overall Shield :	by Aluminium-**Al** Minimum Thickness 0,008 mm / polyester-**PET** Minimum Thickness 0,010 mm tape helically wound (overlap ≥ 25%)	
Inner sheath :	Extruded LSZH Thermoplastic Compound (O.I. ≥ 30%), type **SHF1** to IEC 60093.360, Average Thickness 1,0 mm	
Inner sheath color code:	**Black**	
Armour :	Galvanized Steel Wire Braid Armour (coverage ≥ 90%)	
Outer sheath :	Extruded LSZH Thermoplastic Compound (O.I. ≥ 30%), type **SHF1** to IEC 60093.360, moisture/abrasion/UV Resistant, Average Thickness 1,1 mm	
Outer sheath color code:	**Grey**	
Outer printing (INKJET) :	**FLEI - 1X2X0,75 SQMM - XLPE/OS/LSZH/SWB/LSZH - 150/250 V - IEC 60332.1.2 - IEC 60332.3.22 -**	
(every 1000 mm)	**Year of Manufacture - CE + Meter Marking**	
Under armour diameter :	(6,5 ± 10%) mm	
Over armour diameter :	(7,3 ± 10%) mm	
Outer diameter :	(9,5 ± 10%) mm	
Bending radius :	cable outer diameter x 10 (in fixed installation)	
Voltage Test :	1,5 kV a.c. for 5' (Between Cores) / 1,5 kV a.c. for 5' (Between Cores - Shield)	
Conductors DC Resistance :	≤ 26 Ω/km (@ 20°C)	
Insulation Resistance :	≥ 1000 MΩ x Km (@ 20°C)	
Mutual Capacitance :	≤ 150 nF/km	
L/R ratio :	≤ 25 µH/Ω	
Inductance :	≤ 0,9 mH/km	
Applicable Standards		
Design Guidelines :	**IEC 60092.376**	
ON COMPLETE CABLE		
Flame Retardant test :	IEC 60332.1.2 - IEC 60332.3.22	
Acid Gas generation :	IEC 60754.1/2	
Smoke density/Light Transmittance :	IEC 61034.2 (LT ≥ 60%)	
Hazardous Areas :	IEC 60079.14 par.9.3.2a	
Temperature Range :		
ON INSULATION	(max +90°C) (max continuous operation temperature of conductors)	
	(max +250°C) (max conductors temperature during short-circuit for 5 seconds)	
ON COMPLETE CABLE		
During Operation :	(-20°C up to +90°C) (in fixed installation)	
During installation :	(- 5°C up to +50°C)	
Note :	**To meet the requirements of installation and use in Zone 1 & Zone 2 (IEC 60079-14) and "Gas & Vapour Tight" the cable must be provided with Penetrating Inner sheath together with correct ATEX approved equipment or accessories.**	

Office	Date	Sign	Rev.	Date	Sign
Drawn by :	04/04/2024	Messa			
Checked :	04/04/2024	Spaccasassi			
Approved :	04/04/2024	Cucinotta			

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Base Load Power Hub (BLPH)

INSTRUMENT CABLES

INSPECTION AND TEST PLAN

Document Number: 1724002477-QC-ITP-00002

Document Class: 2

ROSETTI MARINO

1	NO COMMENTS - APPROVED - WORK MAY PROCEED
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Sign	Date
ROSETTI MARINO SpA Stefano Linari Quality Control Dept.	07/03/2025

Rev.	Date	Description	Prepared	Reviewed	Approved
01	13/02/2025	Accepted for Construction (AFC)	Fumagalli	Cucinotta	Beretta
00	30/01/2025	Issue for Review (IFR)	Fumagalli	Cucinotta	Beretta

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Via Alcide De Gasperi 82,
20864 Agrate Brianza (MB) - Italy
Phone 039 65 32 51 mail : shipping@flei.it

ISO 9001: 2015

Customer	ROSETTI MARINO	PO No.1724002477 123A90A	ITP No.: 1/2025	Date : 22 January 2025
Cables Type	Cu Cl.2/MGT/EPR/LSZH/GSWB/LSZH 0,6/1 KV 4G4_E - L.V. POWER CABLE - Fire Resistant & Flame Retardant - ARMOURED			
	Cu Cl.2/XLPE/OS/LSZH/SWB/LSZH 150/250 V (300 V) 1X2X0,75 - INSTRUMENT CABLE - Flame Retardant - Not I.S.			
	Cu Cl.2/XLPE/IS/OS/LSZH/SWB/LSZH 150/250 V (300 V) 2X2X0,75 - INSTRUMENT CABLE - Flame Retardant - Not I.S.			
	Cu Cl.2/MGT/XLPE/OS/LSZH/SWB/LSZH 150/250 V (300 V) 1X3X2,5 - INSTRUMENT CABLE - Fire Resistant - Not I.S.			
Project	123A90A - Base Load Power Hub Platform			

INSPECTION TEST PLAN - Design Guidelines : IEC 60092.353

SL. No	Test Characteristics	Sampling Plan	Type of Test	Ref. Doc.	Instrument name	SUP FLEI	CTR ROSETTI MARINO	CPY CROSSWIND	CA CERTIFYNG AUTHORITY
1	**Routine Test**								
1.1	High Voltage Test	10 % of the order during Inspection	Electrical	IEC 60092-350	15 kV HV Transformer	Test Report	T	W	W	M/R
1.2	Conductor Resistance	10 % of the order during Inspection	Electrical	IEC 60228	Multimeter	Test Report	T	W	W	M/R
1.3	Insulation Resistance	10 % of the order during Inspection	Electrical	IEC 60092-350	Megahometro	Test Report	T	W	W	M/R
1.4	Mutual Capacitance	10 % of the order during Inspection	Electrical	EN 50288.7	LCR meter	Test Report	T	W	W	M/R
1.5	Inductance	10 % of the order during Inspection	Electrical	EN 50288.7	LCR meter	Test Report	T	W	W	M/R
1.6	L/R ratio	10 % of the order during Inspection	Electrical	EN 50288.7	LCR meter	Test Report	T	W	W	M/R
2	**Sample Test**								
2.1	Conductor EXAMINATION	10 % of the order during Inspection	Non-Electrical	IEC 60092-353	Digital Caliper	Test Report	T	W	W	M/R
2.2	Thickness of Insulation	10 % of the order during Inspection	Non-Electrical	IEC 60092-353	Profile Projector	Test Report	T	W	W	M/R
2.3	Core Identification	10 % of the order during Inspection	Non-Electrical	IEC 60092-353	Visual	DATA SHEET	T	W	W	M/R
2.4	Hot Set Test on Insulation	10 % of the order during Inspection	Non-Electrical	IEC 60092-360	Hot set Oven Vernier Caliper	Test Report	T	R	W	M/R
2.5	Thickness of outer Sheath	10 % of the order during Inspection	Non-Electrical	IEC 60092-353	Profile Projector	Test Report	T	W	W	M/R
3	**Type Test**								
3.1	Tensile strenght and elongation of insulation and sheath before ageing	One sample	Non-Electrical	IEC 60092-360	Tensile Testing Machine Vernier Caliper Dessicator	Test Report	T	R	R	M/R
3.2	Tensile strenght and elongation of insulation and sheath after ageing	One sample	Non-Electrical	IEC 60092-360	Oven Tensile machine Dessicator Vernier Caliper	Test Report	T	R	R	M/R
3.3	Fire Resistance Test	One sample	One sample	IEC 60331.21	Fire Apparatus	Test Report	T	R	R	M/R
3.4	Flame Retardant test	One sample	Non-Electrical	IEC 60332.1.2	Flame apparatus	Test Report	T	R	R	M/R
3.5	Flame Retardant test	One sample	Non-Electrical	IEC 60332.3.24 C	\	Compliance Declaration	Compliance Declaration	R	R	M/R
3.6	Corrosive and acid Gas test	One sample	Non-Electrical	IEC 60754.1 (HCl≤0,5%)	\	Compliance Declaration+Material supplier data sheet	Compliance Declaration+Material supplier data sheet	R	R	M/R
3.7	Smoke Emission test	One sample	Non-Electrical	IEC 61034.2 (LT≥60%)	\	Compliance Declaration+Material supplier data sheet	Compliance Declaration+Material supplier data sheet	R	R	M/R

T: TEST R: REVIEW
W: WITNESS H:HOLD M/R:MONITORING/REVIEW

Approved By :

Base Load Power Hub (BLPH)

INSTRUMENT CABLES

PACKING, SHIPPING, HANDLING AND STORAGE PROCEDURE

Document Number: 1724002477-QC-PRO-00008

Document Class: 3

ROSETTI MARINO

1	APPROVED - WORK MAY PROCEED
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2Y	REVISE AND RE-SUBMIT - WORK MAY PROCEED
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Sign	Date
Vincent Zwaan	03/02/2025

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PACKING, TRANSPORTATION, HANDLING, LAYING AND STORAGE OF CABLES

The cables, whether they are armoured or unarmoured , are manufactured with some high quality materials allowing long storage handling transport and unreeling subject to the following recommendations.

1 – TRANSPORTATION HANDLING AND STORAGE OF THE DRUMS

1.1 – Storage

Cables can be stored, in usual, on site temperature limits: -15°C to +60°C. The cables drums must be appropriately wedged and stored in a vertical position (never laid on flange) on a flat, dry and solid ground and in a covered place (applicable only for export project). They must be protected to avoid any mechanical risk and exterior shocks.
The original wooden lags have to be kept until the cable unreeling to ensure a good protection of the cable. The both ends of the cable (inner and outer end) have to be watertight in order to avoid penetration of water or humidity inside the cables. Thermo retractable polyethylene caps must be installed on the both ends.

1.2 – Transportation and handling

The wooden drums must be always carried vertically. They must be fixed and properly chocked with care on the vehicle, on the wagon and on the ship, in order to avoid any exterior chocs.
The unloading and the different handling will be done carefully with lifting equipments.

- In case of handling with a crane, an axle is used in crossing the drum center, lifted from both ends by two slings. It must have a length equal, at least, to the width of the drum. It is prohibited to put the slings on the lags,
- In case of handling with a forklift truck, the drum is put vertically with care on the forks,

Never let a drum fall during all kind of unloading and do not place any weight on the drums.
When the cables drums are arriving on site, they must be properly checked. The good order of the lagging and of the ends caps of the cables (a breaking of a wooden lag could tear the outer sheath of the cable).

1.3 – Rolling direction

If a drum has to be rolled, for transportation, it must be rolled “only” in the direction indicated by an arrow pointed on the flange of the drum: “do not roll the drum in the opposite direction arrow of the drum”.

2 – LAYING OF THE CABLES

2.1 – Laying temperature

The cables can be pulled at a minimum outer temperature of: -5°C, but with a slow and regular speed (about 20 m/mm) without shock. It is always necessary, before unreeling, to store the cables for at least 24 hours in a warmed room (about +10°).

2.2 – Bending radius

During the unreeling, the bending radius shall be, at least, “twice the static bending radius (as specified in our technical data sheets)”

2.3 – **Pulling strength**

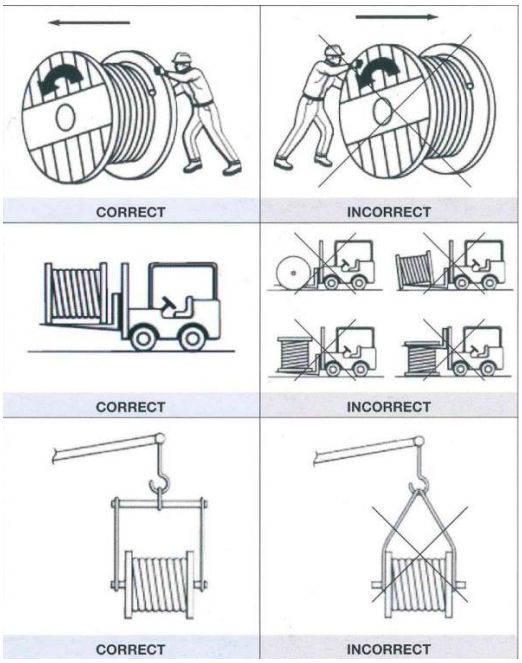
The pulling strengths exerted directly on the copper or aluminium cores of the cables should not exceed the values:

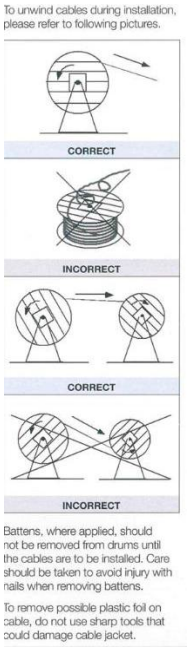
- 5 daN/mm² of cross section for copper conductors.
- 3 daN/mm² of cross section for aluminium conductors.

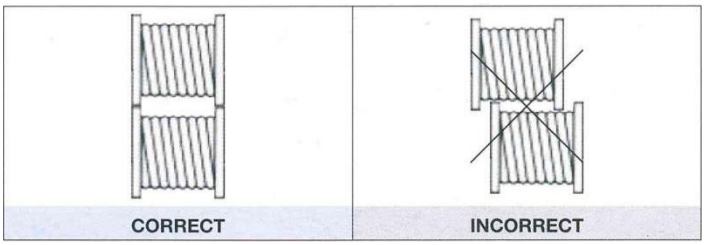
The pulling must be regular without shock and continuously checked by a dynamometer (especially in case of using a winch).

2.4 – **Cables unreeling**

The drum shall be settled on jacks by using a spindle through the central hole of the drum. The unreeling speed shall be monitored at a moment.
The cables must be unreeled "only in the opposite direction of the one indicated by an arrow" painted on the flange of the drum ("do not unreel the cable in the same direction of the arrow"). While unreeling, the cables shall not be twisted, waved or buckled.
The label, sticked on the flange, indicates the "correct unreeling method".
ANNEXE 1







Base Load Power Hub (BLPH)

INSTRUMENT CABLES

FAT PROCEDURE

Document Number: 1724002477-QC-PRO-00005

Document Class: 2

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Sign	Date
V. Barratta	19-02-2025

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FACTORY TEST PROCEDURES

Low Voltage Instrument Cables

CONTENTS	TITLE N.
Test procedure for High Voltage Test	1
Test procedure for Conductor Resistance	2
Test procedure for Insulation Resistance	3
Test procedure for Mutual Capacitance (pairs/triples)	4
Test procedure for Inductance (pairs/triples)	5
Determination Value of L/R ratio adiacent cores	6
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Test procedure for Measurement of Thickness of Insulation and Sheaths	8
Test procedure for Armour Wire / Tape Measurement	9
Test Procedure of diameter under armour and overall	10
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Fire Resistant & Flame Retardant	12

1 . Test Procedure for High Voltage test

1 SCOPE OF THE TEST

This test procedure details the test methods to verify the dielectric strength of the insulation of the finished instrumentation cables

2 NORMATIVE REFERENCES

IEC 60092-376

3 TEST EQUIPMENT

a. HV transformer 15Kv ac/100KVA Manuf. VNZ SIF MODEL 001/2011

b. Timer Chronometer Manuf. GEONAUTE SERIAL N° 13101

4 METHOD OF TESTING

4.1Method of Testing

The testing shall be carried out at ambient temperature.

Remove sufficient length of the outer jacket, armour and inner sheath from both end of the cable.

Connect the high voltage source to the conductor.

Connect amour, metallic screen to the ground.

Test voltage shall be applied between each conductor and the metallic sheath & the armour, if any.

4.2 Low Voltage cables

4.2.1 High voltage Test

Apply the 1.5 kV a.c. between each conductor and metallic screen & armour for 1 minutes.

4.2.1.1 Requirements

No breakdown of the insulation shall occur during the testing period.

(POINT 4 of the STANDARD IEC 60092-376)

4 Rated voltage

The standard rated voltage U_o/U (U_m) is as follows:

$$U_o/U\ (U_m) = 150\ V/250\ V\ (300\ V)\ a.c.$$

In the voltage designation of cables

U_o is the rated power-frequency voltage between the conductor and the earth or metallic covering for which the cable is designed;

U is the rated power-frequency voltage between conductors for which the cable is designed.

U_m is the maximum value of the highest system voltage for which the equipment may be used.

A d.c. voltage up to a maximum of 1,5 times the a.c. voltage may be used, provided that the voltage to earth does not exceed 250 V.

2. Test Procedure for Conductor Resistance

1 SCOPE OF THE TEST

This test procedure details the test methods to determine the DC resistance characteristics of the conductors and screens of the finished instrumentation cables

2 NORMATIVE REFERENCES

IEC 60092-376

3 TEST EQUIPMENT

Resistance measuring equipment - Manufacturer FLUKE Model 8840A Serial 5256028. Cert. Calibration N. 262675 ARO –

4 METHOD OF TESTING

Remove sufficient length of the outer jacket, armour and inner sheath from both end of the cable.

The insulation of the conductor has to be removed about 30mm from the end of the cable.

Connect the testing clamp of the resistomat to the both ends of the conductor.

Adjust suitable range for the same required value.

Adjust the cable temperature on the resistance-measuring unit for compensation at 20°C for manual measurement or connect the temperature sensor to the measuring unit for auto compensation.

Calculate the observed resistance value per kilometers by using the following formula:

$$R = \frac{R_1 \times 1000}{L} \text{ (ohm/Km)}$$

Where : R = Resistance per kilometers

R_1 = Measured Resistance

L = Length of the cable

5 REQUIREMENTS

As per relevant specifications.

Table 6 – Electrical resistance of conductors

	Class 2 Stranding		Class 5 Stranding	
Nominal cross-section	DC resistance of plain copper conductors	DC resistance of tinned copper conductors	DC resistance of plain copper conductors	DC resistance of tinned copper conductors
mm^2	Ω/km at 20°C	Ω/km at 20°C	Ω/km at 20°C	Ω/km at 20°C
0,50	40,4	41,6	41,4	42,5
0,75	26,0	26,3	27,6	28,3
1,00	19,2	19,3	20,7	21,2
1,50	12,8	12,9	14,1	14,5
2,50	7,86	8,02	8,47	8,71

3. Test Procedure for Insulation Resistance

1. TEST EQUIPMENT

1 . Megger

2. METHOD OF TESTING

→ Connect the ' + ' lead of the megger to core and ' - ' lead to all other cores, metallic screen & armour.

→ Apply 500 V DC for 1 minute and measure the reading.

→ Calculate the observed insulation resistance value per kilometers by using the Following formula:

$$Ri = R1 \times L \quad (MohmxKm)$$

Where Ri : Insulation resistance x kilometers
R1: Measured resistance Megaohm
L : Length of the cable kilometers

3. REQUIREMENT

→ Insulation resistance as per data sheet

Note: In the case of manual measurement, to calculate resistance at 20 deg.C, measured insulation resistance at ambient temperature shall be multiplied by the temperature correction factor of insulation material

Table 3 – Electrical requirements of insulation compounds

Designation of the insulating compound	EPR	HEPR	XLPE	HF90	S 95
Insulation resistance constant Ki (MΩ.km) (see 7.2 of IEC 60092-350:—)					
– at 20 °C, minimum,	3 670	3 670	3 670	550	1 850
– at maximum operating temperature, minimum.	3,67	3,67	3,67	0,55	1,85
Volume resistivity ρ(Ω.cm) (see 7.2 of IEC 60092-350:—)					
– at 20 °C, minimum,	$1,0 \times 10^{15}$	$1,0 \times 10^{15}$	$1,0 \times 10^{15}$	$1,5 \times 10^{14}$	$5,0 \times 10^{13}$
– at maximum operating temperature, minimum.	$1,0 \times 10^{12}$	$1,0 \times 10^{12}$	$1,0 \times 10^{12}$	$1,5 \times 10^{11}$	$5,0 \times 10^{10}$

4. Test procedure for mutual capacitance (Pairs/Triples)

1 SCOPE OF THE TEST

This test procedure details the test methods to determine the mutual capacitance characteristics of the finished instrumentation cables.

2 NORMATIVE REFERENCES

BS EN 50288.7
BS EN 50288.1
BS EN 50289.1.5 par. 4.3.2.1

3 TEST EQUIPMENT

Capacitance measuring equipment – LCR bridge 1KHZ Manufact. LEADER Model 7455 serial 0100392. Cert. Calibration N° CA26946 Aviatronic –

4 METHOD OF TESTING

Remove sufficient length of the outer sheath, armour and inner sheath from both the end of the cable

The insulation of the conductors of the pairs/triples have to be removed about 30mm from the end of the cable

Connecting testing clamp at one pair/triple to one end of the cable, all others conductors and screen, if any, connected to earth .

Adjust suitable range for the same required value

Calculate the observed mutual capacitance value per kilometers by using the following

Formula:

$$C = \frac{Cm \times 1000}{L} \quad (\mu F/Km)$$

Where

C= mutual capacitance

Cm= measured capacitance in µF

L= Length of the cable in meters

5 REQUIREMENTS As per relevant specifications (APPROVED SPECIFICATION TO BE AVAILABLE DURING FAT)

Data Sheets approved available during FAT.

Note The value of mutual capacitance measured at ambient temperature shall be multiplied by the temperature correction factor

5. Test Procedure for Inductance (Pairs/Triples)

1 SCOPE OF THE TEST

This test procedure details the test methods to determine the inductance characteristics of the finished instrumentation cables.

2 NORMATIVE REFERENCES

BS EN 50288.7
BS EN 50288.1
BS EN 50289.1.12

3 TEST EQUIPMENT

Inductance measuring equipment – LRC bridge 1KHZ Manufact. LEADER Model 7455 serial 0100392. Cert. Calibration N° CA26946 Aviatronic –

4 METHOD OF TESTING

Remove sufficient length of the outer sheath, armour and inner sheath from both the end of the cable.

The insulation of the conductors of the pairs/triples has to be removed about 30mm from both ends of the conductor.

Connecting testing clamp at one pair/triple to one end of the cable, on the other end the conductor are placed in short circuit .

Adjust suitable range for the same required value

Calculate the observed inductance value per kilometers by using the following Formula

$$L = \frac{Lm \times 1000}{Le} \quad (\text{Mh/Km})$$

Where L = Inductance

Lm= measured inductance in Mh

Le= Length of the cable in meters

5 REQUIREMENTS (APPROVED SPECIFICATION TO BE AVAILABLE DURING FAT)
Data Sheets approved available during FAT.

(POINT 7.6 of the standard IEC 60092-350)

7.6 Inductance to resistance ratio (control and instrumentation cables only)

The inductance-to-resistance ratio (L/R ratio) shall be calculated from measurements of inductance (L) made at 1 kHz on a total of at least two pairs, triples or quads that have been selected at random from the inner and outer layers and the d.c. resistance measured at 20 °C. The values obtained shall be recorded in the cable type-test report.

6. Determination Value of L/R Ratio Adjacent Cores

1 SCOPE OF THE TEST

This test procedure details the test methods to determine the value of the inductance to resistance ratio of adiacent cores (pais/triple) of the finished instrumentation cables.

2 NORMATIVE REFERENCES

IEC 60092-350

3 TEST EQUIPMENT

Inductance and resistance measuring equipment – LCR bridge 1 KHZ Manufact. LEADER Model 7455 serial 0100392. Cert. Calibration N° CA26946 Aviatronic –

4 METHOD OF TESTING

As per inductance and conductor resistance (Loop) of the pairs/triple

* Calculate the observed L/R ratio value

Formula $L/R = \frac{Lm \times 1000}{R1X2}$ (µH/ohm)

5 REQUIREMENTS (APPROVED SPECIFICATION TO BE AVAILABLE DURING FAT)

Data Sheets approved available during FAT. (POINT 7.6 of the standard IEC 60092-350)

7.6 Inductance to resistance ratio (control and instrumentation cables only)

The inductance-to-resistance ratio (L/R ratio) shall be calculated from measurements of inductance (L) made at 1 kHz on a total of at least two pairs, triples or quads that have been selected at random from the inner and outer layers and the d.c. resistance measured at 20 °C. The values obtained shall be recorded in the cable type-test report.

7. Test Procedure for Conductor examination

1. SCOPE OF THE TEST

This test procedure details the test methods to determine the diameter and number of copper wire in the conductors

2. NORMATIVE REFERENCE

IEC 60228

3 TEST EQUIPMENT

3. Vernier Caliper-> (digital 0÷150) Man. Mytutoyo Model 500-181U Serial 206522 ID 123
Cert. Calibration N° RT07640 –

4 METHOD OF TESTING

Take a sample have length of 30 cm approximately.
The average of two measurements taken at right angles shall be taken as the diameter.
Average of three measurements at different places shall be considered as the diameter.
Measurement must be taken up to two decimal places to avoid any over usage of material
Count the number of wires / strands in the conductor

5 REQUIREMENTS

As per IEC 60092-350 (SEE POINT 4.2.3)

4.2.3 Class and form

The conductors considered in this standard are intended only for fixed installations and shall comply with class 2 or class 5 of IEC 60228. The minimum nominal conductor size depends on the voltage rating of the cable and shall be in accordance with Table 1.

Stranded copper class 2 conductors are recommended for general fixed-installation systems.

To aid installation, a conductor of class 5 may be used. Cables using class 5 conductors should not be regarded as suitable for repeated flexing in service.

Stranded circular non-compacted or compacted conductors are permitted for all cross-sections. Sector-shaped conductors are permitted for cross-sections of 10 mm^2 and above.

Table 1 – Minimum size of conductors

U	Nominal cross-sectional area (Minimum) mm^2
250 V	0,5
1 000 V	1,0
3 kV	10
6 kV	10
10 kV	16
15 kV	25
20 kV	35
30 kV	50

8. Test Procedure for Measurement of Thickness of Insulation and Sheaths

1 SCOPE OF THE TEST

This test procedure details the test methods to determine the insulation and the sheath thickness.

2. NORMATIVE REFERENCE

IEC 60811-201

3. TEST EQUIPMENT

3. Profile Projector –> Optical Englander (20x) manuf. JVC Alpa TK-C700 E N° 1553454
Digital micrometers 0÷25 DIGITRIX N°399968-399978
Cert. Calibration N° RT02658 MTA
Vernier caliper -> (digital 0÷150) Man. Mytutoyo Model 500-181U Serial 206522 ID 123
Cert. Calibration N° RT07640 –

4 METHOD OF TESTING

Prepare each test piece of insulation and sheaths in the form of a thin slice along a place perpendicular to the axis of the conductor or cable.
Place the test piece under the measuring equipment with the plane of the cut, perpendicular to the optical axis.
Make six measurements at 60° to each other.
If the inner profile of the sample is irregular or uneven take six readings radically at a position where the thickness is thinnest.
Take the reading in millimeter to two decimal places if the thickness is greater than 0.50 mm and to three decimal places if the thickness is less than 0.50 mm.
For the sheath direct over the insulation cores the number of readings shall be the same number of cores but limited to six measurements points.

5 REQUIREMENTS

As per IEC 60092-350(SEE POINT 4.3.3)

4.3.3 Insulation thickness

The thickness of insulation is specified for each size and type of cable in the applicable product standard.

For single core or multi-core cables, the thickness at any point may be less than the specified value, provided the difference does not exceed 0,1mm + 10 % of the specified value.

For single-unit or multi-unit cables, the thickness at any point may be less than the specified value, provided the difference does not exceed 0,1mm + 20 % of the specified value.

The thickness of any separator, screen or inorganic tape(s) applied over the conductor or over the insulation shall not be included in the thickness of insulation.

9. Test Procedure for Armour Wire / Tape Measurement

1. SCOPE OF THE TEST

This test procedure details the test methods to determine the diameter of galvanized steel wire for armour and thickness of aluminum/polyester tape.

2. NORMATIVE REFERENCE

BS EN 608111-1-1
BS EN 50288.7
BS EN 50288.1

3 TEST EQUIPMENT

Y Micrometer digital 0÷25 Man. Mytutoyo Model 293.265 Serial 6099146 ID 120
Cert. Calibration N° RT07641 MTA –

4 METHOD OF TESTING

Take a sample have length of 30 cm approximately.
The average of two measurements taken at right angles shall be taken as the diameter of wire / width & thickness of tape.
Average of three measurements at different places shall be considered as the diameter of wire / width & thickness of tape.
Measurement must be taken up to two decimal places to avoid any over usage of material

5 REQUIREMENTS

As per relevant specifications (APPROVED SPECIFICATION TO BE AVAILABLE DURING FAT)
Data Sheets approved available during FAT.

10 – Title: Test Procedure of diameter under armour and overall

1. TEST EQUIPMENT

1. Vernier caliper

2. METHOD OF TESTING

→ Take a sample have length of 30 cm approximately.
→ The average of two measurements taken at right angles shall be taken as the diameter
→ Average of three measurements at different places shall be considered as the diameter
→ Measurement must be taken up to two decimal places to avoid any over usage of material

3. REQUIREMENT

→ As per relevant specification and data sheet.
Data Sheets approved available during FAT.(SEE BELOW POINTS of THE STANDARD IEC 60092-350

4.9 Outer sheath

4.9.1 Material

The sheath shall be selected from one of those listed in IEC 60092-360. The sheathing compound selected shall be compatible with the cable components with which it is in contact and compatible with the operating temperature of the cable.

4.9.2 Application

The outer sheath shall be extruded in one or more closely adherent layers. The outer sheath shall form a compact and homogeneous body and shall be so applied that it fits closely onto the underlying components.

It shall be possible to remove the outer sheath without damaging the underlying insulation and/or screen(s).

4.9.3 Thickness of outer sheath

The thickness of sheath for each size and type of cable shall be as specified in the applicable product standard.

Unless specified in the applicable product standard, the thickness at any point may be less than the specified value if any, providing the difference does not exceed 0,1 mm + 15 % of the specified value for sheaths applied on a smooth cylindrical surface, or 0,2 mm + 20 % of the specified value for sheaths applied on an irregular cylindrical surface.

11. Test Procedure for Hot Set Test

1. SCOPE OF THE TEST

This test procedure details the test methods to determine the max elongation under load and max permanent elongation after cooling of XLPE insulation.

2. NORMATIVE REFERENCE

IEC 60811-507

IEC 60092-360

IEC 60092-350

3 TEST EQUIPMENT

a. Heating Oven. 30°C ÷300°C Manuf. GALLI Model 2100 Serial N°2123
b. Calibrated weights Manuf. CIBE Serial N° B5608÷B5612 – Cert. Calibration N°041/10÷045/10
c. Sample holding fixture
d. Vernier Calliper (digital 0÷150) Man. Mytutoyo Model 500-181U Serial 206522 ID 123 Cert. Calibration N° RT07640 –e. Timer Chronometer Manuf. GEONAUTE SERIAL N° 13101
Cert. Calibration N° RT07564 MTA –
f. Temperature thermometer 0÷300°c – manuf. KAYE model Pt 50.4 Serial N°910908
Certificate Calibration EMITLAS LAT024 0414T12 –

4 METHOD OF TESTING

Prepare dumbbell test pieces from XLPE insulation with thickness 0.8 to 2.00 mm.
Mark 20 mm gauge length in the center of the dumbbell. (L_1)
Suspend the sample in the oven with a weight of 20 N/cm2 at 200^0C for 15 minutes.
After the test duration of 15 minutes measure the length between the marks. (L_2)

Calculate the elongation, in percentage, under load as follows

$$\frac{L_2 - L_1}{L_1} \times 100$$

Remove the load from the test piece and keep in oven at same temperature for 5 minutes.
After 5 minutes, remove the sample from oven and allow to cool to room temperature.
After the sample attained to room temperature measure the lengths between the marks. (L3)
Calculate the elongation, in percentage, without load as follows

$$\frac{L_3 - L_1}{L_1} \times 100$$

5 REQUIREMENTS

The elongation under load shall not be more than 175%
The elongation without load shall not be more than 15%

12. Test Procedure for Flame Retardant & Fire Resistant

1 SCOPE OF TEST

This test procedure details the test methods to check if cable will pass test for Flame retardant & or Fire Resistant

2. NORMATIVE REFERENCE

IEC 60332.1.2 **-** IEC 60332.3.22 Flame retardant
IEC 60331.21 Fire Resistant

3. TEST EQUIPMENT

According to IEC 60332.1.2 for Flame Retardant

TEST EQUIPMENT

- A suitable three-sided metallic screen, with open front and closed top and bottom. The base shall be non-metallic
- A clamp suitable to fix the test sample of cables
- One gas burner

TEST SAMPLE

The test sample shall be a piece of the finished cable of cable 600 + - 25 mm long

FLAME CONDITION

When propane is used, the burner being regulated to give a flame approximately 175 mm Long with an inner blue cone approximately 55 mm long

TEST PROCEDURE

The sample shall be clamped at each end to position it vertically in the middle of a three-sided metallic screen and shall be adjusted so that the bottom of sample is approximately 50 mm from the base of the metallic screen.
The axis of the burner shall be at an angle of 45° to the axis of the sample.
The flame is applied for a continuos period of T seconds derived from Table 1:

Table 1 – Time for flame application

Overall diameter of test piece [a] mm	Time for flame application [b] s
$D \leq 25$	60 ± 2
$25 < D \leq 50$	120 ± 2
$50 < D \leq 75$	240 ± 2
$D > 75$	480 ± 2

[a] Where non-circular cables (for example, flat-form constructions) are to be tested, the circumference shall be measured and used to calculate an equivalent diameter, as if the cable were circular.

[b] For flat cables having a ratio of major to minor axis greater than 17:1, the flame application time remains under consideration.

TEST EVALUATION CRITERIA

After the burning has ceased, the surface of sample shall be wiped clean and the charred of affected portion shall not have reached 50 mm of the lower edge of the top clamp.

According to IEC 60331.21 For Fire Resistant

TEST EQUIPMENT

- A suitable chamber, of minimum volume 10 m^3
- A source of heat comprising a horizontally mounted ribbon burner
- A sample supporting systems
- A test wall equipped with thermocouples for verification of the source of heat
- A continuity checking arrangement
- Fuses

TEST SAMPLE

A cable sample at least 4.5m long shall be available from the cable length for test. Each individual test specimen to be tested shall be a piece of cable, taken from the cable sample,
not less than 1200 mm long shall have approximately 100 mm of sheath or outer coverings removed at each end.
At each end of the cable, each conductor shall be suitably prepared for electrical connections, and the exposed conductors shall be spread apart to avoid contact with each other.

TEST CONDITIONS

- Flow rate (at reference conditions of 1 bar and 20°C)
- Propane: (5,0 ± 0,25) litres/minute
- Air: (80 ± 5) litres/minute
- Test temperature: 750 °C
- Voltage applied between the cores: 250 (300) V a.c.

TEST PROCEDURE

The test specimen shall be held horizontally by means of suitable supports at each end and securely clamped to prevent movement.
The middle portion of the test specimen shall be supported by two metal rings placed approximately 300 mm; these, as well as any other metal parts of the supporting systems, shall be earthed.
At the transformer end of the test sample, ground the neutral conductor and any protective conductors. Any metal screens, drain wire or metallic layer shall be interconnected and grounded. Where a metallic sheath, armour or screen acts as a neutral or protective conductor, it shall be connected as for a neutral or protective conductor.
Each phase conductor is connected to a separate phase of the transformer output by a 2A fuse.
For multicores ≥4, multipairs, and multitriads cables, the conductors have to be divided in groups and each group has to be connected to a separate phase of the transformer output with a 2 A fuse or circuit-breaker with equivalent characteristics in each phase.

Ignite the burner and adjust the propane and air flow rates to those obtained during the verification procedure (see IEC 60331-11).
Switch on the electricity supply and adjust the voltage to the rated voltage of the cable (subject to a minimum voltage of 100 V a.c.), i.e. the test voltage between conductors shall equal the rated voltage between conductors and the test voltage from conductors to earth shall equal the rated voltage from conductor to earth. In the case of single-core cables the voltage shall be applied between the conductor and the earthed supporting apparatus and earthed metallic covering, if present.
The test shall continue for the flame application for 3 hours, if not otherwise specified. After that the flame shall be extinguished but the cable sample shall remain energized for a further 15 min. The total test duration shall be the flame application time together with the 15 min cooling period.

TEST EVALUATION CRITERIA

The criteria for determining the point of failure shall be as follows:

. the voltage is not maintained during the test duration, as indicated by fuse failure
. a conductor rupture during the test duration, as indicated by the lamp extinguishing

FACTORY TEST PROCEDURES

Instrument Electrical Cables

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Test procedure for High Voltage Test	1
Test procedure for Conductor Resistance	2
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Test procedure for Mutual Capacitance (pairs/triples)	4
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1 . Test Procedure for High Voltage test

1 SCOPE OF THE TEST

This test procedure details the test methods to verify the dielectric strength of the insulation of the finished instrumentation cables

2 NORMATIVE REFERENCES

Generally to IEC 60092.353

3 TEST EQUIPMENT

a. HV transformer 15Kv ac/100KVA Manuf. VNZ SIF MODEL 001/2011

b. Timer Chronometer Manuf. GEONAUTE SERIAL N° 13101

4 METHOD OF TESTING

4.1Method of Testing

The testing shall be carried out at ambient temperature.

Remove sufficient length of the outer jacket, armour and inner sheath from both end of the cable.

Connect the high voltage source to the conductor.
Connect amour, metallic screen to the ground.
Test voltage shall be applied between each conductor and the metallic sheath & the armour, if any.

4.2 Low Voltage cables

4.2.1 High voltage Test

Apply the 3.5 kV a.c. between each conductor and metallic screen & armour for 5 minutes.

4.2.1.1 Requirements

No breakdown of the insulation shall occur during the testing period

2. Test Procedure for Conductor Resistance

1 SCOPE OF THE TEST

This test procedure details the test methods to determine the DC resistance characteristics of the conductors and screens of the finished instrumentation cables

2 NORMATIVE REFERENCES

EN 50288.7
IEC 60228

3 TEST EQUIPMENT

Resistance measuring equipment - Manufacturer FLUKE Model 8840A Serial 5256028.
Cert. Calibration N. RT06239

4 METHOD OF TESTING

Remove sufficient length of the outer jacket, armour and inner sheath from both end of the cable.
The insulation of the conductor has to be removed about 30mm from the end of the cable.
Connect the testing clamp of the resistomat to the both ends of the conductor.
Adjust suitable range for the same required value.
Adjust the cable temperature on the resistance-measuring unit for compensation at 20°C for manual measurement or connect the temperature sensor to the measuring unit for auto compensation.
Calculate the observed resistance value per kilometers by using the following formula:

$$R = \frac{R_1 \times 1000}{L} \text{ (ohm/Km)}$$

Where : R = Resistance per kilometers
R_1 = Measured Resistance
L = Length of the cable

5 REQUIREMENTS

As per relevant specifications.

Note : In the case of manual measurement, to calculate resistance at 20 deg.C, measured resistance at ambient temperature shall be multiplied by the temperature correction factor.

3. Test Procedure for Insulation Resistance

1 SCOPE OF THE TEST

This test procedure details the test methods to determine the insulation resistance of the finished instrumentation cables.

2 NORMATIVE REFERENCES

EN 50288.7

3 TEST EQUIPMENT

Megger Megahometro Manuf. CHAUVIN ARNOUX Model C.A 6543 Serial 175941KLH.
Cert. calibration N. RT00520

4 METHOD OF TESTING

Connect the ' + ' lead of the megger to core and ' - ' lead to all other cores, metallic screen and armour.
Apply 500 V DC for 1 minute and measure the reading.

Calculate the observed insulation resistance value per kilometers by using the Following formula:

$$Ri = R1 \times L \quad (MohmxKm)$$

Where Ri : Insulation resistance x kilometers
R1: Measured resistance Megaohm
L : Length of the cable kilometers

5 REQUIREMENTS

As per relevant specifications.

Note: In the case of manual measurement, to calculate resitance at 20 deg.C, measured insulation resistance at ambient temperature shall be multiplied by the temperature correction factor of insulation material

4. Test procedure for mutual capacitance (Pairs/Triples)

1 SCOPE OF THE TEST

This test procedure details the test methods to determine the mutual capacitance characteristics of the finished instrumentation cables.

2 NORMATIVE REFERENCES

EN 50288.7

3 TEST EQUIPMENT

Capacitance measuring equipment – LCR bridge 1KHZ Manufact. HIOKI Model IM3523 serial 230710207. Cert. Calibration N° RTR342597

4 METHOD OF TESTING

Remove sufficient length of the outer sheath, armour and inner sheath from both the end of the cable

The insulation of the conductors of the pairs/triples have to be removed about 30mm from the end of the cable

Connecting testing clamp at one pair/triple to one end of the cable, all others conductors and screen, if any, connected to earth .

Adjust suitable range for the same required value

Calculate the observed mutual capacitance value per kilometers by using the following

Formula:

$$C = \frac{Cm \times 1000}{L} \quad (\mu F/Km)$$

Where

C= mutual capacitance

Cm= measured capacitance in µF

L= Length of the cable in meters

5 REQUIREMENTS

As per relevant specifications

Note The value of mutual capacitance measured at ambient temperature shall be multiplied by the temperature correction factor

5. Test Procedure for Inductance (Pairs/Triples)

1 SCOPE OF THE TEST

This test procedure details the test methods to determine the inductance characteristics of the finished instrumentation cables.

2 NORMATIVE REFERENCES

EN 50288.7

3 TEST EQUIPMENT

Inductance measuring equipment – LCR bridge 1KHZ Manufact. HIOKI Model IM3523 serial 230710207. Cert. Calibration N° RTR342597

4 METHOD OF TESTING

Remove sufficient length of the outer sheath, armour and inner sheath from both the end of the cable.

The insulation of the conductors of the pairs/triples has to be removed about 30mm from both ends of the conductor.

Connecting testing clamp at one pair/triple to one end of the cable, on the other end the conductor are placed in short circuit .

Adjust suitable range for the same required value

Calculate the observed inductance value per kilometers by using the following Formula :

$$L = \frac{Lmx1000}{Le} \quad (\text{Mh/Km})$$

Where L = Inductance

Lm= measured inductance in Mh

Le= Length of the cable in meters

5 REQUIREMENTS

As per relevant specifications

Note If the length of the cable do NOT allow to reveal the value, the measurement must be

done in 10 mt. lengths.

6. Determination Value of L/R Ratio Adjacent Cores

1 SCOPE OF THE TEST

This test procedure details the test methods to determine the value of the inductance to resistance ratio of adiacent cores (pais/triple) of the finished instrumentation cables.

2 NORMATIVE REFERENCES

EN 50288.7

3 TEST EQUIPMENT

Inductance and resistance measuring equipment – LCR bridge 1KHZ Manufact. HIOKI Model IM3523 serial 230710207. Cert. Calibration N° RTR342597

4 METHOD OF TESTING

As per inductance and conductor resistance (loop) of the

pairs/triple * Calculate the observed L/R ratio value

Formula $L/R = \frac{Lm \times 1000}{R1X2}$ (µH/ohm)

5 REQUIREMENTS

As per relevant specifications

7. Test Procedure for Conductor examination

1. SCOPE OF THE TEST

This test procedure details the test methods to determine the diameter and number of copper wire in the conductors

2. NORMATIVE REFERENCE

IEC 60092.353

3 TEST EQUIPMENT

Vernier Caliper-> (digital 0÷150) Man. Marcall Model 16ER Serial 7101056465
Internal Cert. Calibration N° STS11
sample instruments used: parallel planes Cert. Calibration LAT187 35069

4 METHOD OF TESTING

Take a sample have length of 30 cm approximately.
The average of two measurements taken at right angles shall be taken as the diameter.
Average of three measurements at different places shall be considered as the diameter.
Measurement must be taken up to two decimal places to avoid any over usage of material
Count the number of wires / strands in the conductor

5 REQUIREMENTS

As per IEC 60228 / IEC 60092.353

8. Test Procedure for Measurement of Thickness of Insulation and Sheaths

1 SCOPE OF THE TEST

This test procedure details the test methods to determine the insulation and the sheath thickness.

2. NORMATIVE REFERENCE

IEC 60092.353

3. TEST EQUIPMENT

Profile Projector –> Manufacture. TECH TRIVIAL Type AS ASSOCIATES
Serialr No. 4050 SVI-CQ-64 Internal Cert. Calibration N° STS14

Vernier Caliper-> (digital 0÷150) Man. Marcall Model 16ER Serial 7101056465
Internal Cert. Calibration N° STS11
sample instruments used: disc jig Cert. Calibration RTD26895

4 METHOD OF TESTING

Prepare each test piece of insulation and sheaths in the form of a thin slice along a place perpendicular to the axis of the conductor or cable.
Place the test piece under the measuring equipment with the plane of the cut, perpendicular to the optical axis.
Make six measurements at 60° to each other.
If the inner profile of the sample is irregular or uneven take six readings radically at a position where the thickness is thinnest.
Take the reading in millimeter to two decimal places if the thickness is greater than
0.50 mm and to three decimal places if the thickness is less than 0.50 mm.
For the sheath direct over the insulation cores the number of readings shall be the same number of cores but limited to six measurements points.

5 REQUIREMENTS

As per relevant standards.

9. Test Procedure for Armour Wire / Tape Measurement

1. SCOPE OF THE TEST

This test procedure details the test methods to determine the diameter of galvanized steel wire for armour/Tape.

2. NORMATIVE REFERENCE

IEC 60092.353

3 TEST EQUIPMENT

Y Micrometer digital 0÷25 Man. Mytutoyo Model 293.265 Serial 6099146 ID 120
Internal Cert. Calibration N° STS8
sample instruments used: parallel planes Cert. Calibration LAT187 35069

4 METHOD OF TESTING

Take a sample have length of 30 cm approximately.
The average of two measurements taken at right angles shall be taken as the diameter of wire / width & thickness of tape.
Average of three measurements at different places shall be considered as the diameter of wire / width & thickness of tape.
Measurement must be taken up to two decimal places to avoid any over usage of material

5 REQUIREMENTS

As per relevant specifications.

10. Test Procedure for Hot Set Test

1. SCOPE OF THE TEST

This test procedure details the test methods to determine the max elongation under load and max permanent elongation after cooling of XLPE insulation.

2. NORMATIVE REFERENCE

IEC 60092.360

3 TEST EQUIPMENT

Heating Oven. 30°C ÷300°C Manuf. GALLI Model 2100 Serial N°2123
Calibrated weights Manuf. CIBE Serial N° B5608÷B5612 – Cert. Calibration N°041/10÷045/10
Sample holding fixture
Vernier Caliper-> (digital 0÷150) Man. Marcall Model 16ER Serial 7101056465
Internal Cert. Calibration N° STS11
sample instruments used: disc jig Cert. Calibration RTD26895
Timer Chronometer Manuf. GEONAUTE SERIAL N° 13101
Cert. Calibration N° RT07564 MTA –
Temperature thermometer 0÷300°c – manuf. KAYE model Pt 50.4 Serial N°910908 Certificate Calibration EMITLAS LAT024 0414T12 –

4 METHOD OF TESTING

Prepare dumbbell test pieces from XLPE insulation with thickness 0.8 to 2.00 mm.

Mark 20 mm gauge length in the center of the dumbbell. (L_1)

Suspend the sample in the oven with a weight of 20 N/cm2 at 200^{0}C for 15 minutes.

After the test duration of 15 minutes measure the length between the marks. (L_2)

Calculate the elongation, in percentage, under load as follows

$$\frac{L_2 - L_1}{L_1} \times 100$$

Remove the load from the test piece and keep in oven at same temperature for 5 minutes.

After 5 minutes, remove the sample from oven and allow to cool to room temperature.

After the sample attained to room temperature measure the lengths between the marks. (L3)

Calculate the elongation, in percentage, without load as follows

$$\frac{L_3 - L_1}{L_1} \times 100$$

5 REQUIREMENTS

The elongation under load shall not be more than 175%
The elongation without load shall not be more than

11. Test Procedure for Tensile strenght and elongation of insulation and sheath before and after ageing

The test requirements for mechanical characteristics of cross-linked insulating compounds are listed in the following Table 4.

Table 4 – Test requirements for cross-linked elastomeric insulating compounds

Test description	Unit	Test method described in		Type of insulating compound				
		Std	Clause	EPR	HEPR	XLPE	HF90	S 95
Mechanical properties in the state as delivered		IEC 60811-501						
Values to be obtained for the:								
– tensile strength, min	N/mm^2			4,2	8,5	12,5	9,0	7,0
– elongation at break, min	%			200	200	200	120	150
Mechanical properties after ageing in air oven without conductor		IEC 60811-401						
Ageing conditions:								
– temperature / tolerance	°C			135±3	135±3	135±3	135±3	200±3
– duration of treatment	h			168	168	168	168	240
Value to be obtained for the tensile strength								
– minimum value	N/mm^2			-	-	-	-	5,5
– variation max	%			±30	±30	±25	±30	-
Value to be obtained for the elongation at break								
– minimum value	%			-	-	-	100	120
– variation max	%			±30	±30	±25	±30	-

Table 6 – Test requirements for cross-linked sheathing compounds

Test description	Unit	Test method described in		Type of cross-linked sheathing compound		
		Std	Clause	SH	SE	SHF 2
Mechanical properties in the state as delivered		IEC 60811-501				
Values to be obtained for:						
– tensile strength, min	N/mm^2			10	10	9
– elongation at break, min	%			250	300	120
Mechanical properties after ageing in air oven		IEC 60811-401				
Ageing conditions:						
– temperature/tolerance	°C			100±2	100±2	120±3
– duration of treatment	h			168	168	168
Tensile strength						
– variation max	%			±30	±30	±30
Elongation at break						
– value min	%				250	–
– variation max	%			±30	±40	±30
Mechanical properties after immersion in mineral oil IRM 902		IEC 60811-404				
Ageing conditions:						
– temperature of oil	°C			100±2	100±2	100±2
– duration of treatment	h			24	24	24
Values to be obtained for:						
– tensile strength, variation max	%			±40	±40	±40
– elongation at break, variation max				±40	±40	±40

NORMATIVE REFERENCE

IEC 60092.360

3. TEST EQUIPMENT

Tensor check profile - Manufacture GIBITRE Serial TCC2018070 Cert. Calibration N.RT01054

12. Test Procedure for Flame Retardant & Fire Resistant

1. SCOPE OF TEST

This test procedure details the test methods to check if cable will pass test for FLAME RETARDANT

2. NORMATIVE REFERENCE

IEC 60332.1.2

3. TEST EQUIPMENT

According to IEC 60332.1.2 for Flame Retardant

TEST EQUIPMENT

- A suitable three-sided metallic screen, with open front and closed top and bottom. The base shall be non-metallic
- A clamp suitable to fix the test sample of cables
- One gas burner

TEST SAMPLE

The test sample shall be a piece of the finished cable of cable 600 + - 25 mm long

FLAME CONDITION

When propane is used, the burner being regulated to give a flame approximately 175 mm
Long with an inner blue cone approximately 55 mm long

TEST PROCEDURE

The sample shall be clamped at each end to position it vertically in the middle of a three-sided metallic screen and shall be adjusted so that the bottom of sample is approximately 50 mm from the base of the metallic screen.
The axis of the burner shall be at an angle of 45° to the axis of the sample.
The flame is applied for a continuos period of T seconds derived from Table 1:

Table 1 – Time for flame application

Overall diameter of test piece [a] mm	Time for flame application [b] s
$D \leq 25$	60 ± 2
$25 < D \leq 50$	120 ± 2
$50 < D \leq 75$	240 ± 2
$D > 75$	480 ± 2

[a] Where non-circular cables (for example, flat-form constructions) are to be tested, the circumference shall be measured and used to calculate an equivalent diameter, as if the cable were circular.

[b] For flat cables having a ratio of major to minor axis greater than 17:1, the flame application time remains under consideration.

TEST EVALUATION CRITERIA

After the burning has ceased, the surface of sample shall be wiped clean and the charred of affected portion shall not have reached 50 mm of the lower edge of the top clamp.

1. SCOPE OF TEST

This test procedure details the test methods to check if cable will pass test for FIRE RESISTANT

2. NORMATIVE REFERENCE

IEC 60331.21

3. TEST EQUIPMENT

- A suitable chamber, of minimum volume 10 m³
- A source of heat comprising a horizontally mounted ribbon burner
- A sample supporting systems
- A test wall equipped with thermocouples for verification of the source of heat
- A continuity checking arrangement
- Fuses

TEST SAMPLE

A cable sample at least 4.5m long shall be available from the cable length for test. Each individual test specimen to be tested shall be a piece of cable, taken from the cable sample,
not less than 1200 mm long shall have approximately 100 mm of sheath or outer coverings removed at each end.
At each end of the cable, each conductor shall be suitably prepared for electrical connections, and the exposed conductors shall be spread apart to avoid contact with each other.

TEST PROCEDURE

The test specimen shall be held horizontally by means of suitable supports at each end and securely clamped to prevent movement.
The middle portion of the test specimen shall be supported by two metal rings placed approximately 300 mm; these, as well as any other metal parts of the supporting systems, shall be earthed.
At the transformer end of the test sample, ground the neutral conductor and any protective conductors. Any metal screens, drain wire or metallic layer shall be interconnected and grounded. Where a metallic sheath, armour or screen acts as a neutral or protective conductor, it shall be connected as for a neutral or protective conductor.
Each phase conductor is connected to a separate phase of the transformer output by a 2A fuse.
For multicores ≥4, multipairs, and multitriads cables, the conductors have to be divided in groups and each group has to be connected to a separate phase of the transformer output with a 2 A fuse or circuit-breaker with equivalent characteristics in each phase.

Ignite the burner and adjust the propane and air flow rates to those obtained during the verification procedure (see IEC 60331-11).
Switch on the electricity supply and adjust the voltage to the rated voltage of the cable (subject to a minimum voltage of 100 V a.c.), i.e. the test voltage between conductors shall equal the rated voltage between conductors and the test voltage from conductors to earth shall equal the rated voltage from conductor to earth. In the case of single-core cables the voltage shall be applied between the conductor and the earthed supporting apparatus and earthed metallic covering, if present.
The test shall continue for the flame application for 3 hours, if not otherwise specified. After that the flame shall be extinguished but the cable sample shall remain energized for a further 15 min. The total test duration shall be the flame application time together with the 15 min cooling period.

TEST EVALUATION CRITERIA

The criteria for determining the point of failure shall be as follows:
- the voltage is not maintained during the test duration, as indicated by fuse failure
- a conductor rupture during the test duration, as indicated by the lamp extinguishing

TEST RESULT

POSITIVE
(During the test, no failure of any the 2 A fuses, insert on each phases occurs)
(During the test, no extinguishing of lamps)

FLEI s.r.l. — IMQ CERTIFIED QUALITY MANAGEMENT SYSTEM ISO 9001:2015 — IQNET RECOGNIZED CERTIFICATION

Via A. De Gasperi 82 Agrate Brianza – (MB) Italy

ATTESTATO DI COLLAUDO N° 130 / 2025

TEST REPORT: Testing document No.

Cliente Customer	ROSETTI MARINO	ORDINE N° Order No.	1724002477 123A90A
		Item/Rev	10
Tipo di cavo e sezione Cable type and section	Cu Cl.2/MGT/EPR/LSZH/GSWB/LSZH 0,6/1 KV 4G4_E - L.V. POWER CABLE - Fire Resistant & Flame Retardant - ARMOURED	Job card	1262/2024
Norma di riferimento Ref. Standard/customer spec.	IEC 60331.21 - IEC 60332.1.2 - IEC 60332.3.22		
Length mt.	302		
Drum No.	08-7820		

CARATTERISTICHE TECNICHE CONSTRUCTION CHARACTERISTICS							Richiesto Required	Riscontrato Tested
Conduttore Conductor	STRANDED plain/bare annealed copper wires	Classe Class	2	IEC 60228		Diametro Nominale Nominal Diameter	2,6 mm	2,6 mm
Isolamento Insulation	Mica/Glass Tape (MGT) plus EPR compound, quality to IEC 60092.360	Colore Colour	Black - Brown - Blue - Yellow/Green			Spessore Medio Average Thickness	1,0 mm	1,1 mm
Guaina interna Inner Sheath	Extruded LSZH compound - Black	Spessore Medio Average Thickness	1,0 mm	Diametro Diameter	tolerance ± 10%	mm	14,3	14,8
Armatura Armouring	Galvanized Steel Wire Braid Armour (coverage > 90%)				Nominal Wire Diameter	mm	0,3	0,3
Guaina esterna *Overall sheath*	Extruded LSZH Thermoplastic Compound (O.I. ≥ 30%), type SHF1 to IEC 60093.360			Colore Colour	Orange	Spessore Medio Average Thickness	1,4 mm	1,6 mm
Diametro esterno Overall Diameter				Diametro Diameter	tolerance ± 10%	mm	18,3	19,7
Marcatura Marking/Printing	FLEI - ELECTRIC CABLE - 1000V - 4G4 SQMM - MGT/EPR/LSZH/GSWB/LSZH - 0,6/1 KV - IEC 60331.21 - IEC 60332.1.2 - IEC 60332.3.22 - 2025 - CE PROGRESSIVE METER LENGTH PRINTING							

CARATTERISTICHE ELETTRICHE ELECTRICAL CHARACTERISTICS			Richiesto Required	Riscontrato Tested	PROVE DI TENSIONE VOLTAGE TEST Test eseguito in C.A. a 50 Hz Test performed in A.C. at 50 Hz	KV x min.	Risultato Result
Resistenza conduttore Conductor resistance	Ω/km a 20°C	≤	4,61	< 4,37	Tra conduttori Between conductors	3,5x5	OK
Resistenza isolamento a 500V Insulation resistance at 500V	MΩ x km@20°C	≥	790	> 1914	Tra conduttori / Armatura Between Cores / Armour	3,5x5	OK
					Spark Test Isolamento IEC 62230 Insulation Spark Test	7 KV	OK
					Spark test guaina IEC 62230 Sheath Spark Test	10 KV	OK
					TEST DI CONTINUITA' CONTINUITY TEST		OK

INSTRUMENT LIST				
	x	CODIFICATION I 23	TYPE : MULTIMETER	CODIFICATION I 05
	x	CODIFICATION I 03	TYPE : MEGAOHMETER	TYPE : HIGH VOLTAGE TEST BENCH
		CODIFICATION I 12	TYPE : LCR METER	
	x	CODIFICATION II 11	TYPE : DIGITAL CALIPER	
	x	CODIFICATION II 56	TYPE : PROFILE READER	

Data: 04/02/2025
Date:

Il collaudatore:Giovanni Cucinotta
Quality Control

FLEI s.r.l. Quality Control

Il Collaudatore del Cliente:
Customer Quality Control:

Foglio: Page: 1 / 5

Mod. 8.2.8

REV.2 Data 13/03/18 Aggiornamento ISO 9001:2015
REV.3 Data 20/12/2023 Aggiornamento lista strumenti

FLEI s.r.l.

Via A. De Gasperi 82 Agrate Brianza – (MB) Italy

ATTESTATO DI COLLAUDO N° 131 / 2025

TEST REPORT: Testing document No.

Cliente Customer	ROSETTI MARINO	ORDINE N° Order No.	1724002477 123A90A
		Item/Rev	20
Tipo di cavo e sezione Cable type and section	Cu Cl.2/XLPE/OS/LSZH/SWB/LSZH 150/250 V (300 V) 1X2X0,75 - INSTRUMENT CABLE - Flame Retardant - Not I.S.	Job card	1263/2024
Norma di riferimento Ref. Standard/customer spec.	IEC 60332.1.2 - IEC 60332.3.22		
Length mt.	676		
Drum No.	07-244		

CARATTERISTICHE TECNICHE CONSTRUCTION CHARACTERISTICS							Richiesto Required	Riscontrato Tested
Conduttore Conductor	STRANDED plain/bare soft annealed copper wires	Classe Class	2	IEC 60228		Diametro Nominale Nominal Diameter	1,1 mm	1,1 mm
Isolamento Insulation	XLPE	Colore Colour	White - Black			Spessore Nominale Nominal Thickness	0,5 mm	0,6 mm
Schermatura totale Collective screen	polyester-mylar tape helically wound 20X0,025(overlap > 25%) mm plus Aluminium/polyester tape helically wound 20X0,023(overlap > 25%) mm plus polyester-mylar tape helically wound 20X0,025(overlap > 25%)	Drenaggio Drain wire	Stranded TINNED annealed copper drain wire, size 0,5 sqmm(7x0,30 mm), in continuous contact with the shield			% coverage	100	> 100
Guaina interna Inner Sheath	Extruded LSZH Thermoplastic Compound (O.I. ≥ 30%), type SHF1 to IEC 60093.360 - Black	Spessore Medio Average Thickness	1,0 mm	Diametro Diameter	tolerance ± 10%	mm	6,5	6,4
Armatura Armouring	Galvanized Steel Wire Braid Armour (coverage > 90%)				Nominal Wire Diameter	mm	0,2	0,2
Guaina esterna *Overall sheath*	Extruded LSZH Thermoplastic Compound (O.I. ≥ 30%), type SHF1 to IEC 60093.360, moisture/abrasion/UV Resistant			Colore Colour	Grey	Spessore Medio Average Thickness	1,1 mm	1,2 mm
Diametro esterno Overall Diameter				Diametro Diameter	tolerance ± 10%	mm	9,5	9,6
Marcatura Marking/Printing	FLEI - 1X2X0,75 SQMM - XLPE/OS/LSZH/SWB/LSZH - 150/250 V - IEC 60332.1.2 - IEC 60332.3.22 - 2025 - CE PROGRESSIVE METER LENGTH PRINTING							

CARATTERISTICHE ELETTRICHE ELECTRICAL CHARACTERISTICS			Richiesto Required	Riscontrato Tested
Resistenza conduttore Conductor resistance	Ω/km a 20°C	≤	26	< 22,7
Capacità Capacitance	nF/km	≤	150	77,6
Induttanza Inductance	mH/Km	≤	0,9	0,7
L/R	µH/ohm	≤	25	14,64
Resistenza isolamento a 500V Insulation resistance at 500V	MΩ x km@20°C	≥	1000	> 100000

PROVE DI TENSIONE VOLTAGE TEST			
Test eseguito in C.A. a 50 Hz Test performed in A.C. at 50 Hz	KV x min.	Risultato Result
Tra conduttori Between conductors	1,5x5	OK
Tra conduttori / Schermo Between Cores / Shield	1,5x5	OK
Spark Test Isolamento IEC 62230 Insulation Spark Test	5 KV	OK
Spark test guaina IEC 62230 Sheath Spark Test	9 KV	OK
TEST DI CONTINUITA' CONTINUITY TEST		OK

INSTRUMENT LIST				
	x	CODIFICATION I 23	TYPE : MULTIMETER	CODIFICATION I 05
	x	CODIFICATION I 03	TYPE : MEGAOHMETER	TYPE : HIGH VOLTAGE TEST BENCH
	x	CODIFICATION I 12	TYPE : LCR METER	
	x	CODIFICATION II 11	TYPE : DIGITAL CALIPER	
	x	CODIFICATION II 56	TYPE : PROFILE READER	

Data: 04/02/2025
Date:

Il collaudatore:Giovanni Cucinotta
Quality Control

FLEI s.r.l. Quality Control

Il Collaudatore del Cliente:
Customer Quality Control:

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FLEI s.r.l. — IMQ CERTIFIED QUALITY MANAGEMENT SYSTEM ISO 9001:2015 — IQNET RECOGNIZED CERTIFICATION

Via A. De Gasperi 82 Agrate Brianza – (MB) Italy

ATTESTATO DI COLLAUDO N° 132 / 2025

TEST REPORT: Testing document No.

Cliente Customer	ROSETTI MARINO	ORDINE N° Order No.	1724002477 123A90A
		Item/Rev	30
Tipo di cavo e sezione Cable type and section	Cu Cl.2/XLPE/IS/OS/LSZH/SWB/LSZH 150/250 V (300 V) 2X2X0,75 - INSTRUMENT CABLE - Flame Retardant - Not I.S.	Job card	1264/2024
Norma di riferimento Ref. Standard/customer spec.	IEC 60332.1.2 - IEC 60332.3.22		
Length mt.	302		
Drum No.	07-243		

CARATTERISTICHE TECNICHE CONSTRUCTION CHARACTERISTICS							Richiesto Required	Riscontrato Tested
Conduttore Conductor	STRANDED plain/bare soft annealed copper wires	Classe Class	2	IEC 60228		Diametro Nominale Nominal Diameter	1,1 mm	1,1 mm
Isolamento Insulation	XLPE	Colore Colour	White - Black (each core NUMBERED for PAIR identification)			Spessore Nominale Nominal Thickness	0,5 mm	0,6 mm
Schermatura totale Collective screen	polyester-mylar tape helically wound 20X0,025(overlap > 25%) mm plus Aluminium/polyester tape helically wound 20X0,023(overlap > 25%) mm plus polyester-mylar tape helically wound 20X0,025(overlap > 25%)	Drenaggio Drain wire	Stranded TINNED annealed copper drain wire, size 0,5 sqmm(7x0,30 mm), in continuous contact with the shield			% coverage	100	> 100
Schermatura totale Collective screen	polyester-mylar tape helically wound 40X0,036(overlap > 25%) mm plus Aluminium/polyester tape helically wound 40X0,05(overlap > 25%) mm plus polyester-mylar tape helically wound 40X0,036(overlap > 25%)	Drenaggio Drain wire	Stranded TINNED annealed copper drain wire, size 0,5 sqmm(7x0,30 mm), in continuous contact with the shield			% coverage	100	> 100
Guaina interna Inner Sheath	Extruded LSZH Thermoplastic Compound (O.I. ≥ 30%), type SHF1 to IEC 60093.360 - Black	Spessore Medio Average Thickness	1,2 mm	Diametro Diameter	tolerance ± 10%	mm	11,4	11,0
Armatura Armouring	Galvanized Steel Wire Braid Armour (coverage > 90%)				Nominal Wire Diameter	mm	0,3	0,3
Guaina esterna *Overall sheath*	Extruded LSZH Thermoplastic Compound (O.I. ≥ 30%), type SHF1 to IEC 60093.360, moisture/abrasion/UV Resistant			Colore Colour	Grey	Spessore Medio Average Thickness	1,3 mm	1,4 mm
Diametro esterno Overall Diameter				Diametro Diameter	tolerance ± 10%	mm	15,2	15,3
Marcatura Marking/Printing	FLEI - 2X2X0,75 SQMM - XLPE/IS/OS/LSZH/SWB/LSZH - 150/250 V - IEC 60332.1.2 - IEC 60332.3.22 - 2025 - CE PROGRESSIVE METER LENGTH PRINTING							

CARATTERISTICHE ELETTRICHE ELECTRICAL CHARACTERISTICS			Richiesto Required	Riscontrato Tested
Resistenza conduttore Conductor resistance	Ω/km a 20°C	≤	26	< 22,5
Capacità Capacitance	nF/km	≤	150	78,3
Induttanza Inductance	mH/Km	≤	0,9	0,71
L/R	µH/ohm	≤	25	14,56
Resistenza isolamento a 500V Insulation resistance at 500V	MΩ x km@20°C	≥	1000	> 100000

PROVE DI TENSIONE VOLTAGE TEST			
Test eseguito in C.A. a 50 Hz Test performed in A.C. at 50 Hz	KV x min.	Risultato Result
Tra conduttori Between conductors	1,5x5	OK
Tra conduttori / Schermo Between Cores / Shield	1,5x5	OK
Spark Test Isolamento IEC 62230 Insulation Spark Test	5 KV	OK
Spark test guaina IEC 62230 Sheath Spark Test	10 KV	OK
TEST DI CONTINUITA' CONTINUITY TEST		OK

INSTRUMENT LIST				
	x	CODIFICATION I 23	TYPE : MULTIMETER	CODIFICATION I 05
	x	CODIFICATION I 03	TYPE : MEGAOHMETER	
	x	CODIFICATION I 12	TYPE : LCR METER	TYPE : HIGH VOLTAGE TEST BENCH
	x	CODIFICATION II 11	TYPE : DIGITAL CALIPER	
	x	CODIFICATION II 56	TYPE : PROFILE READER	

Data: 04/02/2025
Date:

Il collaudatore:Giovanni Cucinotta
Quality Control

FLEI s.r.l. Quality Control

Il Collaudatore del Cliente:
Customer Quality Control:

Foglio: Page: 3 / 5

FLEI s.r.l.

Via A. De Gasperi 82 Agrate Brianza – (MB) Italy

ATTESTATO DI COLLAUDO N° 133 / 2025

TEST REPORT: Testing document No.

Cliente Customer	ROSETTI MARINO	ORDINE N° Order No.	1724002477 123A90A
		Item/Rev	40

Tipo di cavo e sezione Cable type and section	Cu Cl.2/MGT/XLPE/OS/LSZH/SWB/LSZH 150/250 V (300 V) 1X3X2,5 - INSTRUMENT CABLE - Fire Resistant - Not I.S.	Job card	1265/2024
Norma di riferimento Ref. Standard/customer spec.	IEC 60331.21 - IEC 60332.1.2 - IEC 60332.3.22		

Length mt.	303									
Drum No.	07-250									

CARATTERISTICHE TECNICHE CONSTRUCTION CHARACTERISTICS							Richiesto Required	Riscontrato Tested
Conduttore Conductor	STRANDED plain/bare soft annealed copper wires	Classe Class	2	IEC 60228		Diametro Nominale Nominal Diameter	2,0 mm	2,0 mm
Isolamento Insulation	Mica/Glass Tape (MGT) plus XLPE	Colore Colour	Red - White - Black			Spessore Nominale Nominal Thickness	0,6 mm	0,8 mm
Schermatura totale Collective screen	polyester-mylar tape helically wound 40X0,025(overlap > 25%) mm plus Aluminium/polyester tape helically wound 40X0,023(overlap > 25%) mm plus polyester-mylar tape helically wound 40X0,025(overlap > 25%)	Drenaggio Drain wire	Stranded TINNED annealed copper drain wire, size 0,5 sqmm(7x0,30 mm), in continuous contact with the shield			% coverage	100	> 100
Guaina interna Inner Sheath	Extruded LSZH Thermoplastic Compound (O.I. ≥ 30%), type SHF1 to IEC 60093.360 - Black	Spessore Medio Average Thickness	1,1 mm	Diametro Diameter	tolerance ± 10%	mm	10,9	10,9
Armatura Armouring	Galvanized Steel Wire Braid Armour (coverage > 90%)				Nominal Wire Diameter	mm	0,3	0,3
Guaina esterna *Overall sheath*	Extruded LSZH Thermoplastic Compound (O.I. ≥ 30%), type SHF1 to IEC 60093.360, moisture/abrasion/UV Resistant			Colore Colour	Orange	Spessore Medio Average Thickness	1,3 mm	1,3 mm
Diametro esterno Overall Diameter				Diametro Diameter	tolerance ± 10%	mm	14,7	14,8
Marcatura Marking/Printing	FLEI - 1X3X2,5 SQMM - MGT/XLPE/OS/LSZH/SWB/LSZH - 150/250 V - IEC 60331.21 - IEC 60332.1.2 - IEC 60332.3.22 - 2025 - CE PROGRESSIVE METER LENGTH PRINTING							

CARATTERISTICHE ELETTRICHE ELECTRICAL CHARACTERISTICS			Richiesto Required	Riscontrato Tested
Resistenza conduttore Conductor resistance	Ω/km a 20°C	≤	7,86	< 7,31
Capacità Capacitance	nF/km	≤	150	73,9
Induttanza Inductance	mH/Km	≤	0,9	0,71
L/R	µH/ohm	≤	60	51,3
Resistenza isolamento a 500V Insulation resistance at 500V	MΩ x km@20°C	≥	1000	> 11500

PROVE DI TENSIONE VOLTAGE TEST			
Test eseguito in C.A. a 50 Hz Test performed in A.C. at 50 Hz	KV x min.	Risultato Result
Tra conduttori Between conductors	1,5x5	OK
Tra conduttori / Schermo Between Cores / Shield	1,5x5	OK
Spark Test Isolamento IEC 62230 Insulation Spark Test	5 KV	OK
Spark test guaina IEC 62230 Sheath Spark Test	10 KV	OK
TEST DI CONTINUITA' CONTINUITY TEST		OK

INSTRUMENT LIST				
	x	CODIFICATION I 23	TYPE : MULTIMETER	CODIFICATION I 05
	x	CODIFICATION I 03	TYPE : MEGAOHMETER	
	x	CODIFICATION I 12	TYPE : LCR METER	TYPE : HIGH VOLTAGE TEST BENCH
	x	CODIFICATION II 11	TYPE : DIGITAL CALIPER	
	x	CODIFICATION II 56	TYPE : PROFILE READER	

Data: 04/02/2025
Date:

Il collaudatore:Giovanni Cucinotta
Quality Control

FLEI s.r.l. Quality Control

Il Collaudatore del Cliente:
Customer Quality Control:

Foglio: Page: 4 / 5

FLEI s.r.l.

Via A. De Gasperi 82 Agrate Brianza – (MB) Italy

ATTESTATO DI COLLAUDO N° 134 / 2025

TEST REPORT: Testing document Nr.

Cliente Customer	ROSETTI MARINO	ORDINE N° Order No.	1724002477 123A90A
		Item/Rev Tested	From 10 to 40

Norma di riferimento *Ref. Standard/customer spec:*	IEC 60502.1 / IEC 60092.360

MATERIAL CERTIFICATE

MECHANICAL TEST

INSULATION XLPE	REQUIRED	**TESTED**
TENSILE STRENGHT	>12,5 N/mm²	17,3 N/mm²
ELONGATION AT BREAK	> 200 %	561%
AFTER AGEING (135° C x 168 hours)		
TENSILE STRENGHT	+/- 25 %	15,92 N/mm² (-8%)
ELONGATION AT BREAK	+/- 25 %	-7,7% (517,8%)
HOT SET TEST (200°C x 15 min.)	175%	75%
INSULATION EPR	**REQUIRED**	**TESTED**
TENSILE STRENGHT	> 8,5 N/mm²	11,9 N/mm²
ELONGATION AT BREAK	> 200%	>604 %
AFTER AGEING (150°C X 168 hours)		
TENSILE STRENGHT	+/- 30%	11,2 N/mmq (-5,8%)
ELONGATION AT BREAK	+/-30%	563,53% (-6,7%)
HOT SET TEST 250°CX15 min. MAX.ELONGATION UNDER LOAD	<175%	81%
HOT SET TEST(250°) MAX.PERMANENT ELONGATON	<15	Tested 5%
OVERALL SHEATH LSZH type SHF1	REQUIRED	**TESTED**
TENSILE STRENGHT	>9 N/MMQ	12,9 N/mm²
ELONGATION AT BREAK	> 120 %	170%
AFTER AGEING (110° C x 168 hours)		
TENSILE STRENGHT	+/- 30 %	13,67% (+6%)
ELONGATION AT BREAK	+/- 30 %	153% (-10%)

TYPE TESTS	**TESTED**
FIRE RESISTANT TEST (IEC 60331.21)	OK : PASS
FLAME RETARDANT TEST (IEC 60332.1.2)	OK : PASS
FLAME RETARDANT TEST (IEC 60332.22)	COMPLIANCE DECLARATION
ACID GAS GENERATION (IEC 60754.1/2)	COMPLIANCE DECLARATION
SMOKE DENSITY/LIGHT TRANSMITTANCE (IEC 61034.2 LT ≥ 60%)	COMPLIANCE DECLARATION
UV RESISTANCE TEST UL 2556 ex UL 1581 section 1200	COMPLIANCE DECLARATION

INSTRUMENT LIST	CODIFICATION I 04	TYPE : TENSOR CHECK PROFILE (DINAMOMETER)	
Data: 04/02/2025 Date:	Il collaudatore:Giovanni Cucinotta Quality Control	Il Collaudatore del Cliente: Customer Quality Control:	Foglio: Page: 5
	FLEI s.r.l. Quality Control		5

Mod. 8.2.8	REV.2	Data 13/03/18	Aggiornamento ISO 9001:2015
	REV.3	Data 20/12/2023	Aggiornamento lista strumenti

Via A. De Gasperi 82 Agrate Brianza – (MB) Italy

DECLARATION OF CONFORMITY
DICHIARAZIONE DI CONFORMITA'
DÉCLARATION DE CONFORMITÉ

CLIENTE:
CUSTOMER :
KUNDE:
ACHETEUR:

ROSETTI MARINO

ORDINE:
PURCHASE ORDER :
AUFTRAG:
COMMANDE:

1724002477 123A90A

DESCRIZIONE CAVO:
CABLE DESCRIPTION :
BESCHREIBURG KABLE.
DESCRIPTION CABLE:

SEE PACKING LIST

TIPO E QUANTITA':
TYPE AND QUANTITY :
MENGE:
TYPE ET QUANTITE':

SEE PACKING LIST

Con il presente si attesta che sono state eseguite le prove di collaudo del materiale fornito a fronte dell'ordine di acquisto da Voi conferitoci. Visto l'esito delle prove suddette, si certifica che il materiale in oggetto è conforme alle seguenti prescrizioni:
We declare we tested the material we are supplying to you with reference to the purchase order You granted us. On the basis of the results of the tests, we are certifying that the material in object comply with the following regulations:
Wir erklären hiermit, dass die Prüfungen in Übereinstimmung mit den bestellten Waren durchgeführt wurden. Wir bescheinigen daher, dass die oben genannten Waren mit den folgenden Normen übereinstimmen:
Nous déclarons par la présente que des tests ont été effectués sur l'équipement fourni dans le cadre de votre bon de commande. Sur la base des résultats de ces essais, nous certifions que le matériel en question répond aux exigences suivantes :

X	**VOSTRE SPECIFICHE** YOUR SPECIFICATIONS IHRE ANGABE VOTRE SPECIFICATIONS	SPECIFICATIONS INCLUDED IN THE ORDER
X	**NORME** STANDARDS NORME STANDARDS	IEC 60092.353 – IEC 60331.21 – IEC 60332.1.2 – IEC 60332.3.22 IEC 60754.1/2 – IEC 61034.2 - IEC 60079.14 par.9.3.2a
X	**ALLEGATI** ATTACHEMENTS ANLAGE ANNEXES	TEST REPORT No.: 130÷134/2025

DATE 04/02/2025

Quality Control : Giovanni Cucinotta

FLEI s.r.l. Quality Control

TEST UNDER FIRE CONDITIONS
FOR CABLES OF RATED VOLTAGES UP TO AND 0.6/1 kV

STANDARD: IEC 60331.21

CUSTOMER:

ROSETTI MARINO

Order N. 1724002477 123A90A - Item/Rev 10

TYPE OF CABLE:
Cu Cl.2/MGT/EPR/LSZH/GSWB/LSZH 0,6/1 KV
4G4_E - L.V. POWER CABLE - Fire Resistant & Flame Retardant - ARMOURED

INTERNAL JOB CARD: 1262/2024

PROJECT:
Crosswind - 123A90A - Base Load Power Hub Platform

28/01/2025
FLEI QUALITY CONTROL

FLEI s.r.l. Quality Control

TEST EQUIPMENT

- A suitable chamber, of minimum volume 10 m³
- A source of heat comprising a horizontally mounted ribbon burner
- A sample supporting systems
- A test wall equipped with thermocouples for verification of the source of heat
- A continuity checking arrangement
- Fuses

TEST SAMPLE

A cable sample at least 4.5m long shall be available from the cable length for test. Each individual test specimen to be tested shall be a piece of cable, taken from the cable sample, not less than 1200 mm long shall have approximately 100 mm of sheath or outer coverings removed at each end.
At each end of the cable, each conductor shall be suitably prepared for electrical connections, and the exposed conductors shall be spread apart to avoid contact with each other.

TEST CONDITIONS

- Flow rate (at reference conditions of 1 bar and 20°C)
- Propane: (5,0 ± 0,25) litres/minute
- Air: (80 ± 5) litres/minute
- Test temperature: 750 °C
- Voltage applied between the cores: 1000 V a.c.
- Time of Test: 90 minutes

TEST PROCEDURE

The test specimen shall be held horizontally by means of suitable supports at each end and securely clamped to prevent movement.
The middle portion of the test specimen shall be supported by two metal rings placed approximately 300 mm; these, as well as any other metal parts of the supporting systems, shall be earthed.
At the transformer end of the test sample, ground the neutral conductor and any protective conductors. Any metal screens, drain wire or metallic layer shall be interconnected and grounded. Where a metallic sheath, armour or screen acts as a neutral or protective conductor, it shall be connected as for a neutral or protective conductor.
Each phase conductor is connected to a separate phase of the transformer output by a 2A fuse.
For multicores ≥4, multipairs, and multitriads cables, the conductors have to be divided in groups and each group has to be connected to a separate phase of the transformer output with a 2 A fuse or circuit-breaker with equivalent characteristics in each phase.

Ignite the burner and adjust the propane and air flow rates to those obtained during the verification procedure (see IEC 60331-11).
Switch on the electricity supply and adjust the voltage to the rated voltage of the cable (subject to a minimum voltage of 100 V a.c.), i.e. the test voltage between conductors shall equal the rated voltage between conductors and the test voltage from conductors to earth shall equal the rated voltage from conductor to earth. In the case of single-core cables the voltage shall be applied between the conductor and the earthed supporting apparatus and earthed metallic covering, if present.
The test shall continue for the flame application for 3 hours, if not otherwise specified. After that the flame shall be extinguished but the cable sample shall remain energized for a further 15 min. The total test duration shall be the flame application time together with the 15 min cooling period.

TEST EVALUATION CRITERIA

The criteria for determining the point of failure shall be as follows:
- the voltage is not maintained during the test duration, as indicated by fuse failure
- a conductor rupture during the test duration, as indicated by the lamp extinguishing

CABLE DATA

Outer diameter: Required: 18.3 mm – Tested: 19.7 mm

Printed Marking:
FLEI - ELECTRIC CABLE - 1000V - 4G4 SQMM - MGT/EPR/LSZH/GSWB/LSZH - 0,6/1 KV - IEC 60331.21 - IEC 60332.1.2 - IEC 60332.3.22 - 2025 – CE+Meter Marking

TEST RESULT

POSITIVE
(During the test, no failure of any the 2 A fuses, insert on each phases occurs)
(During the test, no extinguishing of lamps)

END OF REPORT

TEST UNDER FIRE CONDITIONS
FOR CABLES OF RATED VOLTAGES UP TO AND 0.6/1 kV

STANDARD: IEC 60331.21

CUSTOMER:

ROSETTI MARINO

Order N. 1724002477 123A90A- Item/Rev 40

TYPE OF CABLE:
Cu Cl.2/MGT/XLPE/OS/LSZH/SWB/LSZH 150/250 V (300 V)
1X3X2,5 - INSTRUMENT CABLE - Fire Resistant - Not I.S. - Orange

INTERNAL JOB CARD: 1265/2024

PROJECT:
Crosswind - 123A90A - Base Load Power Hub Platform

23/01/2025
FLEI QUALITY CONTROL

FLEI s.r.l. Quality Control

TEST EQUIPMENT

- A suitable chamber, of minimum volume 10 m³
- A source of heat comprising a horizontally mounted ribbon burner
- A sample supporting systems
- A test wall equipped with thermocouples for verification of the source of heat
- A continuity checking arrangement
- Fuses

TEST SAMPLE

A cable sample at least 4.5m long shall be available from the cable length for test. Each individual test specimen to be tested shall be a piece of cable, taken from the cable sample, not less than 1200 mm long shall have approximately 100 mm of sheath or outer coverings removed at each end.
At each end of the cable, each conductor shall be suitably prepared for electrical connections, and the exposed conductors shall be spread apart to avoid contact with each other.

TEST CONDITIONS

- Flow rate (at reference conditions of 1 bar and 20°C)
- Propane: (5,0 ± 0,25) litres/minute
- Air: (80 ± 5) litres/minute
- Test temperature: 750 °C
- Voltage applied between the cores: 1000 V a.c.
- Time of Test: 90 minutes

TEST PROCEDURE

The test specimen shall be held horizontally by means of suitable supports at each end and securely clamped to prevent movement.
The middle portion of the test specimen shall be supported by two metal rings placed approximately 300 mm; these, as well as any other metal parts of the supporting systems, shall be earthed.
At the transformer end of the test sample, ground the neutral conductor and any protective conductors. Any metal screens, drain wire or metallic layer shall be interconnected and grounded. Where a metallic sheath, armour or screen acts as a neutral or protective conductor, it shall be connected as for a neutral or protective conductor.
Each phase conductor is connected to a separate phase of the transformer output by a 2A fuse.
For multicores ≥4, multipairs, and multitriads cables, the conductors have to be divided in groups and each group has to be connected to a separate phase of the transformer output with a 2 A fuse or circuit-breaker with equivalent characteristics in each phase.

Ignite the burner and adjust the propane and air flow rates to those obtained during the verification procedure (see IEC 60331-11).
Switch on the electricity supply and adjust the voltage to the rated voltage of the cable (subject to a minimum voltage of 100 V a.c.), i.e. the test voltage between conductors shall equal the rated voltage between conductors and the test voltage from conductors to earth shall equal the rated voltage from conductor to earth. In the case of single-core cables the voltage shall be applied between the conductor and the earthed supporting apparatus and earthed metallic covering, if present.
The test shall continue for the flame application for 3 hours, if not otherwise specified. After that the flame shall be extinguished but the cable sample shall remain energized for a further 15 min. The total test duration shall be the flame application time together with the 15 min cooling period.

TEST EVALUATION CRITERIA

The criteria for determining the point of failure shall be as follows:
- the voltage is not maintained during the test duration, as indicated by fuse failure
- a conductor rupture during the test duration, as indicated by the lamp extinguishing

CABLE DATA

Outer diameter: Required: 14.7 mm – Tested: 14.8 mm

Printed Marking:
FLEI - 1X3X2,5 SQMM - MGT/XLPE/OS/LSZH/SWB/LSZH - 150/250 V - IEC 60331.21 - IEC 60332.1.2 - IEC 60332.3.22 - 2025 – CE+Meter Marking

TEST RESULT

POSITIVE
(During the test, no failure of any the 2 A fuses, insert on each phases occurs)
(During the test, no extinguishing of lamps)

END OF REPORT

TEST UNDER FIRE CONDITIONS
Vertical Burning single Cable

STANDARD: IEC 60332.1.2

CUSTOMER:

ROSETTI MARINO

Order N. 1724002477 123A90A - Item/Rev 10

TYPE OF CABLE:
Cu Cl.2/MGT/EPR/LSZH/GSWB/LSZH 0,6/1 KV
4G4_E - L.V. POWER CABLE - Fire Resistant & Flame Retardant - ARMOURED

INTERNAL JOB CARD: 1262/2024

PROJECT:
Crosswind - 123A90A - Base Load Power Hub Platform

22/01/2025
FLEI QUALITY CONTROL

FLEI s.r.l. Quality Control

TEST EQUIPMENT

- A suitable three-sided metallic screen, with open front and closed top and bottom. The base shall be non-metallic
- A clamp suitable to fix the test sample of cables
- One gas burner

TEST SAMPLE

The test sample shall be a piece of the finished cable of cable 600 + - 25 mm long

FLAME CONDITION

When propane is used, the burner being regulated to give a flame approximately 175 mm Long with an inner blue cone approximately 55 mm long

TEST PROCEDURE

The sample shall be clamped at each end to position it vertically in the middle of a three-sided metallic screen and shall be adjusted so that the bottom of sample is approximately 50 mm from the base of the metallic screen.
The axis of the burner shall be at an angle of 45° to the axis of the sample.
The flame is applied for a continuos period of T seconds derived from Table 1:

Table 1 – Time for flame application

Overall diameter of test piece [a] mm	Time for flame application [b] s
$D \leq 25$	60 ± 2
$25 < D \leq 50$	120 ± 2
$50 < D \leq 75$	240 ± 2
$D > 75$	480 ± 2

[a] Where non-circular cables (for example, flat-form constructions) are to be tested, the circumference shall be measured and used to calculate an equivalent diameter, as if the cable were circular.

[b] For flat cables having a ratio of major to minor axis greater than 17:1, the flame application time remains under consideration.

TEST EVALUATION CRITERIA

After the burning has ceased, the surface of sample shall be wiped clean and the charred of affected portion shall not have reached 50 mm of the lower edge of the top clamp.

CABLE DATA

Outer diameter: Required: 18.3 mm – Tested: 19.7 mm

Printed Marking:
FLEI - ELECTRIC CABLE - 1000V - 4G4 SQMM - MGT/EPR/LSZH/GSWB/LSZH - 0,6/1 KV - IEC 60331.21 - IEC 60332.1.2 - IEC 60332.3.22 - 2025 – CE+Meter Marking

Weight of cable sample: 351,30 gr / 600 mm

Flame application time: 60 seconds

TEST DATA

Charred of affected portion: 274 mm

TEST RESULT

POSITIVE

END OF REPORT

TEST UNDER FIRE CONDITIONS
Vertical Burning single Cable

STANDARD: IEC 60332.1.2

CUSTOMER:

Order N. 1724002477 123A90A - Item/Rev 20

TYPE OF CABLE:
Cu Cl.2/XLPE/OS/LSZH/SWB/LSZH 150/250 V (300 V)
1X2X0,75 - INSTRUMENT CABLE - Flame Retardant - Not I.S.

INTERNAL JOB CARD: 1263/2024

PROJECT:
Crosswind - 123A90A - Base Load Power Hub Platform

22/01/2025
FLEI QUALITY CONTROL

TEST EQUIPMENT

- A suitable three-sided metallic screen, with open front and closed top and bottom. The base shall be non-metallic
- A clamp suitable to fix the test sample of cables
- One gas burner

TEST SAMPLE

The test sample shall be a piece of the finished cable of cable 600 + - 25 mm long

FLAME CONDITION

When propane is used, the burner being regulated to give a flame approximately 175 mm Long with an inner blue cone approximately 55 mm long

TEST PROCEDURE

The sample shall be clamped at each end to position it vertically in the middle of a three-sided metallic screen and shall be adjusted so that the bottom of sample is approximately 50 mm from the base of the metallic screen.
The axis of the burner shall be at an angle of 45° to the axis of the sample.
The flame is applied for a continuos period of T seconds derived from Table 1:

TEST EVALUATION CRITERIA

After the burning has ceased, the surface of sample shall be wiped clean and the charred of affected portion shall not have reached 50 mm of the lower edge of the top clamp.

CABLE DATA

Outer diameter: Required: 9.5 mm – Tested: 9.6 mm

Printed Marking:
FLEI - 1X2X0,75 SQMM - XLPE/OS/LSZH/SWB/LSZH - 150/250 V - IEC 60332.1.2 - IEC 60332.3.22 - 2025 – CE+Meter marking

Weight of cable sample: 92,29 gr / 600 mm

Flame application time: 60 seconds

TEST DATA

Charred of affected portion: 252 mm

TEST RESULT

POSITIVE

END OF REPORT

TEST UNDER FIRE CONDITIONS
Vertical Burning single Cable

STANDARD: IEC 60332.1.2

CUSTOMER:

ROSETTI MARINO

Order N. 1724002477 123A90A - Item/Rev 30

TYPE OF CABLE:
Cu Cl.2/XLPE/IS/OS/LSZH/SWB/LSZH 150/250 V (300 V)
2X2X0,75 - INSTRUMENT CABLE - Flame Retardant - Not I.S.

INTERNAL JOB CARD: 1264/2024

PROJECT:
Crosswind - 123A90A - Base Load Power Hub Platform

22/01/2025
FLEI QUALITY CONTROL

FLEI s.r.l. Quality Control

TEST EQUIPMENT

- A suitable three-sided metallic screen, with open front and closed top and bottom. The base shall be non-metallic
- A clamp suitable to fix the test sample of cables
- One gas burner

TEST SAMPLE

The test sample shall be a piece of the finished cable of cable 600 + - 25 mm long

FLAME CONDITION

When propane is used, the burner being regulated to give a flame approximately 175 mm Long with an inner blue cone approximately 55 mm long

TEST PROCEDURE

The sample shall be clamped at each end to position it vertically in the middle of a three-sided metallic screen and shall be adjusted so that the bottom of sample is approximately 50 mm from the base of the metallic screen.
The axis of the burner shall be at an angle of 45° to the axis of the sample.
The flame is applied for a continuos period of T seconds derived from Table 1:

Table 1 – Time for flame application

Overall diameter of test piece [a] mm	Time for flame application [b] s
$D \leq 25$	60 ± 2
$25 < D \leq 50$	120 ± 2
$50 < D \leq 75$	240 ± 2
$D > 75$	480 ± 2

[a] Where non-circular cables (for example, flat-form constructions) are to be tested, the circumference shall be measured and used to calculate an equivalent diameter, as if the cable were circular.

[b] For flat cables having a ratio of major to minor axis greater than 17:1, the flame application time remains under consideration.

TEST EVALUATION CRITERIA

After the burning has ceased, the surface of sample shall be wiped clean and the charred of affected portion shall not have reached 50 mm of the lower edge of the top clamp.

CABLE DATA

Outer diameter: Required: 15.2 mm – Tested: 15.3 mm

Printed Marking:
FLEI - 2X2X0,75 SQMM - XLPE/IS/OS/LSZH/SWB/LSZH - 150/250 V - IEC 60332.1.2 - IEC 60332.3.22 - 2025 – CE+Meter Marking

Weight of cable sample: 217,50 gr / 600 mm

Flame application time: 60 seconds

TEST DATA

Charred of affected portion: 286 mm

TEST RESULT

POSITIVE

END OF REPORT

TEST UNDER FIRE CONDITIONS
Vertical Burning single Cable

STANDARD: IEC 60332.1.2

CUSTOMER:

ROSETTI MARINO

Order N. 1724002477 123A90A- Item/Rev 40

TYPE OF CABLE:
Cu Cl.2/MGT/XLPE/OS/LSZH/SWB/LSZH 150/250 V (300 V)
1X3X2,5 - INSTRUMENT CABLE - Fire Resistant - Not I.S. - Orange

INTERNAL JOB CARD: 1265/2024

PROJECT:
Crosswind - 123A90A - Base Load Power Hub Platform

22/01/2025
FLEI QUALITY CONTROL

FLEI s.r.l. Quality Control

TEST EQUIPMENT

- A suitable three-sided metallic screen, with open front and closed top and bottom. The base shall be non-metallic
- A clamp suitable to fix the test sample of cables
- One gas burner

TEST SAMPLE

The test sample shall be a piece of the finished cable of cable 600 + - 25 mm long

FLAME CONDITION

When propane is used, the burner being regulated to give a flame approximately 175 mm Long with an inner blue cone approximately 55 mm long

TEST PROCEDURE

The sample shall be clamped at each end to position it vertically in the middle of a three-sided metallic screen and shall be adjusted so that the bottom of sample is approximately 50 mm from the base of the metallic screen.
The axis of the burner shall be at an angle of 45° to the axis of the sample.
The flame is applied for a continuos period of T seconds derived from Table 1:

Table 1 – Time for flame application

Overall diameter of test piece [a] mm	Time for flame application [b] s
$D \leq 25$	60 ± 2
$25 < D \leq 50$	120 ± 2
$50 < D \leq 75$	240 ± 2
$D > 75$	480 ± 2

[a] Where non-circular cables (for example, flat-form constructions) are to be tested, the circumference shall be measured and used to calculate an equivalent diameter, as if the cable were circular.

[b] For flat cables having a ratio of major to minor axis greater than 17:1, the flame application time remains under consideration.

TEST EVALUATION CRITERIA

After the burning has ceased, the surface of sample shall be wiped clean and the charred of affected portion shall not have reached 50 mm of the lower edge of the top clamp.

CABLE DATA

Outer diameter: Required: 14.7 mm – Tested: 14.8 mm

Printed Marking:
FLEI - 1X3X2,5 SQMM - MGT/XLPE/OS/LSZH/SWB/LSZH - 150/250 V - IEC 60331.21 - IEC 60332.1.2 - IEC 60332.3.22 - 2025 – CE+Meter Marking

Weight of cable sample: 220,89 gr / 600 mm

Flame application time: 60 seconds

TEST DATA

Charred of affected portion: 250 mm

TEST RESULT

POSITIVE

END OF REPORT

ROSETTI MARINO	RELEASE NOTE	Nr. RN-2477-FLE-01	Sheet 1 of 1
		Date 04/02/2025	Rev. 00

PROGETTO *Project*	CLIENTE *Client*	COMMESSA *Job*
HOLLANDSE KUST NOORD WIND PARK	CROSSWIND	*123A90*

FORNITORE *Vendor*	NUMERO D' ORDINE *Purchase Order No.*
FLEI	*1724002477*

Release Note	☐ FOR PAYMENT	☒ FOR SHIPMENT

RELEASE NOTE FOR PAYMENT

PO Art.	

RELEASE NOTE FOR SHIPMENT

POS. Item	Q.TA' Quantity	DESCRIZIONE Description	Nr. TAG TAG No.	TIPO DI ISPEZIONE / Kind of Inspection	ESITO / Result
10	300	Electrical Cable	ELECV21-4G4_E	NA	POSITIVE
20	670	Instrumental Cable	SMICV01-1X2X0,75	NA	POSITIVE
30	300	Instrumental Cable	SMICV02-2X2X0,75	NA	POSITIVE
40	300	Instrumental Cable	SMICV14-1X3X2,5	NA	POSITIVE

Warehouse open Monday to Friday From 08.00 to12.00 and from 13.00 to 17.00.
Contact Mr Rota +39 3451608099

DOCUMENTI APPLICABILI / *APPLICABLE DOCUMENTS*

POSIZIONE *Items*	TIPO DI DOCUMENTO *Type of Document*	NUMERO DI DOCUMENTO *Document Number*	Rev.	COD. DI APPROV. *Approv. Code*

PUNCH LIST: ☐ SI / *YES* VEDI PUNCH LIST ALLEGATA N° / *REFER TO ATTACHED PUNCH LIST N°*
☒ NO/ *NO*

CONTROLLO VALIDITA' FIDEJUSSIONE / *PERFORMANCE or WARRANTY BOND expiration date check*
Estensione Fidejussione Richiesta *(Performance or Warranty Bond Extension of Validity required)*
☐ SI / *YES* ☒ NO/ *NO*
Acceptance Method: *Performance or Warranty Bond valid if actually delivery date it's not greater than two weeks from contractual delivery date.*

RELEASE NOTE

RISULTATO / *RESULT*	FORNITURA / *SUPPLY*	DISTRIBUZIONE A: / *DISTRIBUTION TO:*	
☒ POSITIVO / *POSITIVE*	☒ COMPLETA / *COMPLETE*	☒ Project Manager	☒ Administration
☐ NEGATIVO / *NEGATIVE*	☐ PARZIALE / *PARTIAL*	☒ Project Quality Manager	☒ Project Eng-/Procurement Coord
☐ PUNTI PENDENTI / *PUNCH-LIST*	☐ ULTIMA / *FINAL*	☐ Warehouse	☐ Supplier

NOTE / *NOTES*

Note:
PL - ROSETTI MARINO ORD.N. 1724002477

L' INCARICATO /*Person in charge* ROSETTI MARINO *Supply Management dept.*		IL RAPPR. DEL CLIENTE / *Client Representative*	IL FORNITORE /*Vendor*	CONSTRUCTION MANAGER *Only requested for Punch List to be closed at Yard*
Nome Cognome *Name Surname*	**Firma** *Signature*			
Vincent Zwaan		N.A.	N.A.	N.A.

QUESTO DOCUMENTO NON SOLLEVA IL FORNITORE DALLA RESPONSABILITA' DI EVENTUALI DIFETTI E/O MALFUNZIONAMENTI RILEVATI DURANTE L'USO / *The present RELEASE NOTE does not relieve the Supplier of the responsibility of any possible defects and/or malfunctioning arising during the utilisation.*