# Jacobs

### **Capital Project 966**

**Cable Ratings Compendium** 

321084AE-REP-001A 03 April 2020

EirGrid

CP966



### Capital Project 966

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### Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved
Final	03/04/2020	Final		ES	NE	FL

## Jacobs

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## **Executive Summary**

This Document is to be read in conjunction with report "321084AE-REP-001 RevC - Cable Feasibility Report".

It has been prepared to collate and detail the numerous CYMCAP simulations that have been performed to support the EirGrid CP966 project.

Whilst there are a number of assumptions that need to be considered (as discussed in chapter 2), alongside the fact that such calculations have been performed to support a strategy for network development and not to provide a detailed design solution, there is some clear guidance:

For Option 3, where a 220kV UGC (underground cable) solution was requested, there is a, single conductor per phase, technically feasible cable solution which delivers the required winter and summer ratings, utilising readily available materials and components.

For Option 4, where a 400kV UGC solution was requested, there is no single conductor per phase cable solution which delivers the required winter and summer ratings.

The required ratings can only be achieved by utilising a 2 conductors per phase UGC solution.

### Important note about your report

- This report must be read in conjunction with 321084AE-REP-001 Rev C
- The sole purpose of the report is to support EirGrid CP966 project
- Any information relied upon and presumed accurate in preparing the report (i.e. client and/or third party supplied information)
- Ratings calculations have been performed using CYME Cymcap 7.3 rel 2
- Calculations have been performed to support a strategy for network development and not to provide a detailed design solution
- Observations and findings in the report subject to the extents permitted by law
- This report shall be read in full with no excerpts to be representative of the findings
- This report has been prepared exclusively for EirGrid Project CP966 <u>Step</u> 3, no liability is accepted for any use or reliance on the report by third parties

### 1. Introduction

The outputs of the ratings calculations, as shown in the pdf attachments, are divided in the following sections:

- Study summary
- Steady State summary
- Cables input
- Electrical parameters
- Steady state report

The 220kV and 400kV 2500sqmm cables are modelled on the supplied datasheets while the 3000sqmm cable is based on a generic model.

Where design parameters have not been made available, generic values have been adopted.

### 2. Calculation assumptions

### 2.1 Environmental conditions

All calculations have been performed under the following 3 temperature/soil conditions:

Season	Ground temperature	Indigenous Soil TR	CBGM TR
Winter	10C	1.0 K.m/W	0.85 K.m/W
Spring	15C	1.2 K.m/W	1.0 K.m/W
Summer	20C	1.2 K.m/W	1.0 K.m/W
Autumn	15C	1.2 K.m/W	1.0 K.m/W

### 2.2 Simulation tool

CYME CYMCAP 7.3 rev 2 is the cable ratings software tool utilised for all calculations.

It addresses steady-state and transient thermal cable rating as per the analytical techniques described by Neher-McGrath and the International Standards IEC 287© and IEC 853.

### 2.3 About Low Thermal Resistivity materials

Several technical backfill materials with extremely low Thermal Resistivity (TR) values have recently become commercially available under different brand names.

The TR values of such materials can be as low as 0.33K.m/W in dry-out conditions.

We have assumed the above value for all our calculations utilising "low TR" specialised backfills.

### 2.4 About supplied cable datasheets

The cable datasheets shown in the appendices have been provided by EirGrid.

### 2.5 About UGC with large conductor cross-sections

Due to the recent growth of the HVDC and interconnector market, high voltage cables with enhanced conductor cross-sections has become available.

3000sqmm Cu conductors can now be supplied by many different cable manufacturers.

Because such cables are not currently type registered by EirGrid and no datasheet was made available, we have assumed a "generic" 3000sqmm Cu cable design for all the simulations.

### 2.6 About trench dimensions

The trench dimensions, found in the simulations below, are based on one of the following criteria:

- Provided by EirGrid as one of their standard cable trench cross-sections
- Determined by Jacobs to be suitable for Ireland's narrow roads and capable of delivering the required rating
- Requested EirGrid and determined by Jacobs, to deliver the maximum/required cable rating given a specific conductor cross-section and material

Some simulations show large quantities of technical backfill (on top, beside and below the ducts) used around the cable ducts, especially when the cable phases are very far apart. This is due to the unrefined and high-level nature of these simulations.

During detailed design, when all the design constraints are known, the exact quantity of technical backfill required for each scenario will need to be determined. Most importantly, at this next stage, it will be possible to reduce extremely wide single trenches to 3 narrower ones.

### 3. Summary table

The table below summarises the results from the numerous simulations completed. It shows cable ratings variations in response to the change of the following parameters:

- Cable voltage
- Cable conductor cross-section
- Trench technical backfill
- Separation between phases

#### Complete results can be found in the attachments

		AUTUMN			
OPTIONS	WINTER	SPRING	SUMMER	Delivered by	
<u> Option 3 - 220kV UGC</u>					
<u>REQUIRED</u>	2377	n/a	2289		
Solution 1					
in 1.7m trench CGBM backfill	2220	2038	1968	2500mm <sup>2</sup>	1 cond/phase
in 2.5m trench with low TR backfill	2550	2394	2313	Cu Cable	1 trench
in 4.0m trench with CGBM backfill	2454	2280	2202		
in 7.0m trench with CGBM backfill	2377	2289	2289		
<u> Option 4 - 400kV UGC</u>					
<u>REQUIRED</u>	2963	n/a	2506		
Solution 1					
in 1.7m trench CGBM backfill	2119	1937	1867	2500mm <sup>2</sup>	1 cond/phase
in 2.5m trench with low TR backfill	2302	2157	2082	Cu Cable	1 trench
in 4.0m trench CGBM backfill	2389	2214	2135		
Solution 2					
in 1.7m trenches CGBM backfill	4238	3874	3734	2500mm <sup>2</sup>	2 cond/phase
in 2.5m trenches with low TR backfill	4604	4314	4164	Cu Cable	2 trenches
in 4.0m trench CGBM backfill	4778	4428	4270		
Solution 3					
in 10.5m wide trench with CGBM backfill	2524	2353	2271	3000mm <sup>2</sup>	1 cond/phase
				Cu Cable	1 trench



nkt document no. TDA 330 Rev. 2 / 13.03.2017 1 x 2500Cu XLPE AI PE 400 kV

## Appendix A. Cable Data Sheet

## nktables

1 TECHNICAL SCHEDULE TS – 56 Physical Characteristics

400 kV XLPE Land Cable – 2,500mm<sup>2</sup> Cu XLPE Note: All dimensions to be filled in where applicable.

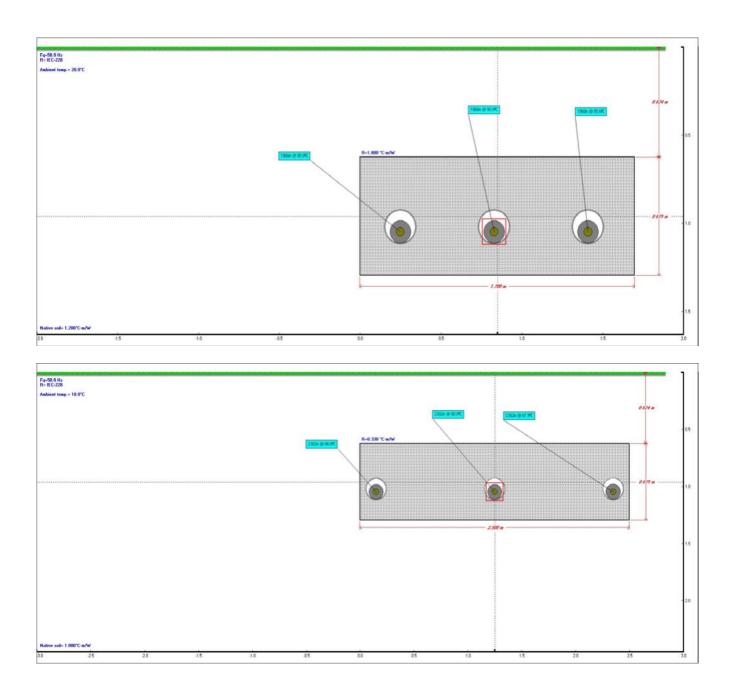
Note: Item	All dimensions to be filled in where applicable. Query	Unit	Reply
item	Query	Unit	Reply
1	Conductor:		
	Conductor:		
	(a) Material Grade		copper
	(b) Type e.g. round, etc.		round
	(c) Design e.g. stranded, segmental, enamelled etc.		stranded, segmental
	(d) Nominal diameter	mm	63
	(e) Cross-sectional area	mm <sup>2</sup>	2500
	(f) Method of water blocking		swelling yarns and/or swelling tapes
2	Inner Semi-conducting Layer:		and ing your a who of an energy super-
-			
	(a) Material Grade		XLPE
	(b) Nominal thickness	mm	1.8
	(c) Minimum thickness	mm	0,7
3	Insulation:		
	(a) Material Grade		XLPE
	(b) Nominal thickness	mm	26,2
	(c) Minimum thickness	mm	23,6
	(d) Ovality of insulation < 10%		≤ 10%
4	Outer Semi-conducting Layer:		
	(a) Material Grade		
	(b) Thickness	mm	1,5
	(c) Minimum thickness	mm	0,7
5	Nominal diameter over core screen	mm	123
	Roundness of core ; maximum ovality < 0.9mm	mm	max. 0,9
6	Radial thickness of insulation incl. semi-conducting layers		
	(a) Nominal	mm	29,5
7	(b) Minimum Redding Laure Webs Register	mm	25,0
· ·	Bedding Layer/Water Barrier		
	(a) Material		semiconducting and swellable tapes
	(b) Thickness	mm	2.5
	(c) OD of bedding layer	mm	128
	(d) Method of electrical connection between 4 and 8 to avoid		120
	discharges		semiconducting and swellable tapes
	(e) Method of water blocking		semiconducting and swellable tapes
8	Metallic Sheath:		
	(a) Material		aluminium
	(b) Type, corrugated or smooth		smooth
	(c) Nominal thickness	mm	1,5
	(d) Mean diameter	mm	129
	(e) Cross-sectional area	mm <sup>2</sup>	608
	(f) Diameter over crest of corrugations	mm	n. a.
	(g) OD of sheath if not corrugated	mm	131
	(h) Diameter and no. of extra copper wires required to ensure short		
	circuit performance of cable meets Specification 18080 (if needed)		n.a.
9	Outer HDPE/MDPE Sheath :		
	(a) Material		HD PE
	(b) Nominal thickness	mm	5,0
	(c) Minimum thickness	mm	4,15
	(d) Shore D hardness		appr. 58



			ESB specificatio
	A (continued) aracteristics of 220kV Crosslinked Polyethyler	ne Cable	
Item	Query		Reply
9	Corrosion Protection:		049-02-02-0
	(a) Material	000	PE
	(b) Nominal thickness	mm	4,9
	(c) Minimum thickness (d) Shore D hardness	mm approx.	4,07
	(d) Shore D hardness	approx.	56
	Height of marking with indented lettersby laser m	arking on the	
	cable sheath	mm	appr. 10
	and the second se		74:09
	marking text 1st line: ELECTRIC CABLE 220000 V 1x2500/	150	
	CU/XLPE/CU-PB/PE nkt cables <year< td=""><td></td><td></td></year<>		
	<metre (4="" digits)="" marking=""></metre>		
	2nd line: <code (4="" digits)="" number=""></code>		
10	Nominal diameter of completed cable	mm	135
11	Nominal weight of finished cable	kg/m	44
12	(a) Normal length per drum	m	740
0750	(b) Maximum length per drum	m	to be agreed upor
13	(a) Name I was unight of landed down	anness her	36
13	<ul> <li>(a) Normal gross weight of loaded drum</li> <li>(b) Maximum gross weight of loaded drum</li> </ul>	approx. kg	to be agreed upor
	(b) Maximum gross weight or loaded dram	approx. Ng	to be agreed upor
14	(a) Normal drum dimensions width/height	approx. m/m	3,2 /4,3
	(b) Maximum drum dimensions width/height	approx. m/m	3,7 /4,3
15	Minimum radius of bend around which cable can be pulled	m	3,4
	(a) Laid direct	m	3.4
	(b) In ducts	m	3.4
	(c) Cable placed in position with former	m	2.0
	(d) Cable placed in position without former	m	3,4
16	Permissible pulling force allowed on conductors	kN	125
10	during installation		125
	and the second team of the second second second second second	12000-0-0	2274
17	Maximum permissible sidewall forces	kN/m	10

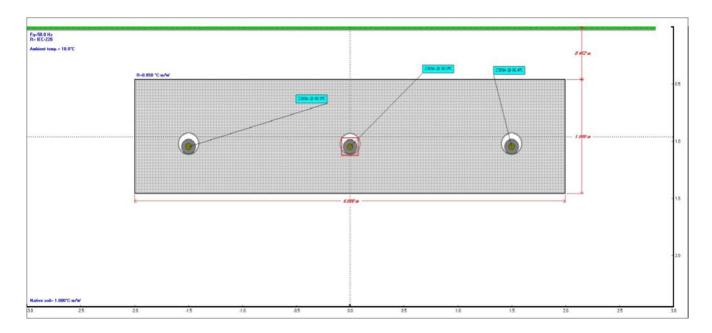
## Appendix B. Simulation trench cross-sections

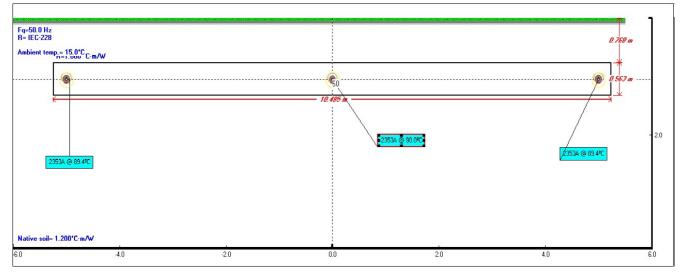
Following trench cross-sections and *dimensions* as per simulation output. These are outputs automatically generated by the software tool and not to be representative of the actual construction trench. Supplied here for reference only.



### Cable Ratings Compendium

## Jacobs





### **Appendix C. Cable Ratings Calculations**

- 400kV Cable 4.0m Width Trench (CGBM) Winter (10C)
- 400kV Cable 4.0m Width Trench (CGBM) Summer (20C)
- 400kV Cable 4.0m Width Trench (CGBM) Spring Autumn (15C)
- 400kV Cable 2.5m Trench (low TR) Winter (10C)
- 400kV Cable 2.5m trench (low TR) Summer (20C)
- 400kV Cable 2.5m Trench (low TR) Spring Autumn (15C)
- 400kV Cable 1.7m Trench (CGBM) Winter (10C)
- 400kV Cable 1.7m Trench (CGBM) Summer (20C)
- 400kV Cable 1.7m Trench (CGBM) Spring Autumn (15C)
- 220kV Cable 4.0m Width Trench (CGBM) Winter (10C)
- 220kV Cable 4.0m Width Trench (CGBM) Summer (20C)
- 220kV Cable 4.0m Width Trench (CGBM) Spring Autumn (15C)
- 220kV Cable 2.5m Trench (low TR) Winter (10C)
- 220kV Cable 2.5m Trench (low TR) Summer (20C)
- 220kV Cable 2.5m Trench (low TR) Spring Autumn (15C)
- 220kV Cable 1.7m Trench (CGBM) Winter (10C)
- 220kV Cable 1.7m Trench (CGBM) Summer (20C)
- 220kV Cable 1.7m Trench (CGBM) Spring Autumn (15C)
- 400kV 3000sqmm -10.5m trench CGBM Winter 10C
- 400kV 3000sqmm -10.5m trench CGBM Spring 15C
- 220kV Cable 7m trench CGBM Winter 10C
- 220kV Cable 7m trench CGBM Summer 20C
- 220kV Cable 7m trench CGBM Spring 15C

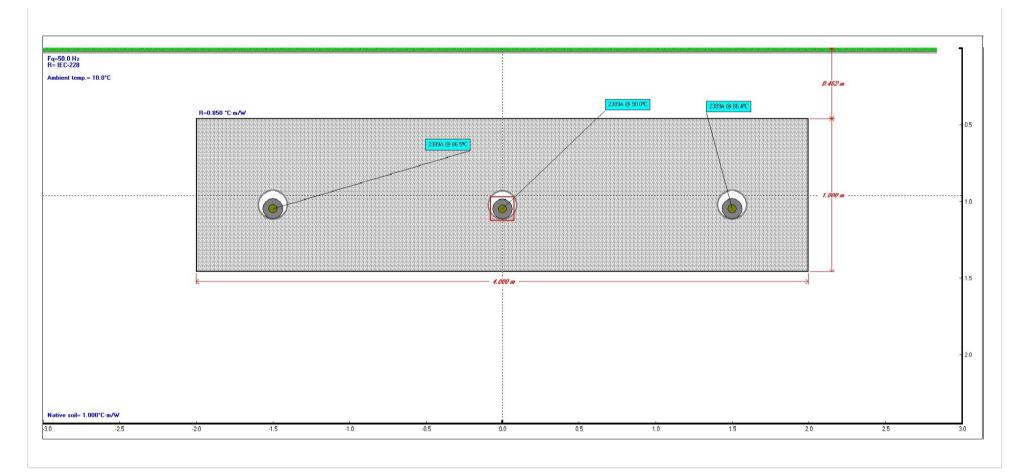
		6
	1.1	-
	10	-
INTERNAL	TITINA	7.00

### Study Summary

INTERNATIONAL TED	
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Road Width trench (1ct 400kV CABLE)
Date:	18/03/2020 11:24:45

General Simulation Data	
Steady State Option	Equally Loaded
Consider Electrical interaction between circuits	No
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0
Conductor Resistances Computation Option:	IEC-228

Installation Type:Ductbank		
Ambient Soil Temperature at Installation Depth	[°C]	10.0
Native Soil Thermal Resistivity	[K.m/W]	1.0
Thermal Resistivity of Duct Bank	[K.m/W]	0.9
Depth of Center of Duct Bank	[m]	0.96
Duct Bank Width	[m]	4.0
Duct Bank Height	[m]	1.0



Results Summary										
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [m]	Y coordinate [m]	temperature [°C]	Ampacity [A]
1	400KV.011	1		А	50.0	1.0	-1.5	1.05	86.5	2389.5
2	400KV.011	1		В	50.0	1.0	0.0	1.05	90.0	2389.5
3	400KV.011	1		С	50.0	1.0	1.5	1.05	86.4	2389.5



## Steady State Summary

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Road Width trench (1ct 400kV CABLE)
Date:	18/03/2020 11:24:45

Simulation Data		
Installation type:	Ductbank	
Steady State Option	Equally Loaded	
Ambient temperature [°C]	10	
Native Soil Thermal Resistivity [K.m/W]	1.0	
Consider Non-Isothermal Earth Surface	No	
Consider effect of soil dry out	No	
Consider Electrical interaction between circuits	No	
Induced current in metallic layers as a fraction of conductor current (applied to all single phase circuits)	0	

Variable	Description	Unit		Cables	
Cable No.	Cable Index Number		1	2	3
General Input	t Data				1
Cable ID	Cable Equipment ID		400KV.011	400KV.011	400KV.011
Circuit No.	Circuit No.		1	1	1
Phase	Cable Phase		А	В	С
Fq	Operating Frequency	[Hz]	50.0	50.0	50.0
x	X coordinate	[m]	-1.5	0.0	1.5
у	Y coordinate	[m]	1.05	1.05	1.05
DLF	Daily Load Factor	[p.u.]	1.0	1.0	1.0
	Bonding Type		1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat
Ampacity		· · ·			
	Steady State Ampacity	[A]	2389.5	2389.5	2389.5
<b>Femperature</b>	s				
θс	Conductor temperature	[°C]	86.5	90.0	86.4
θs	Sheath/Shield temperature	[°C]	64.5	67.7	64.4
θa	Armour temperature	[°C]	n/a	n/a	n/a
θsurf	Cable surface temperature	[°C]	61.5	64.7	61.4
θduct	Duct surface temperature	[°C]	44.6	47.8	44.5
Resistances					
$R_0$	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
R	AC Resistance of the Conductor at Operating Temperature	[Ω/km]	0.0101	0.01018	0.01009
ys	Skin Effect Factor		0.11125	0.1091	0.11132
ур	Proximity Effect Factor		0.00026	0.00026	0.00026
osses					
Wc	Conductor Losses	[W/m]	57.64346	58.15139	57.62698
Wd	Dielectric Losses	[W/m]	4.00936	4.00936	4.00936
Ws	Metallic Screen Losses	[W/m]	1.51482	1.99981	1.37184
Wa	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
Wt	Total Losses	[W/m]	63.16763	64.16055	63.00817
$\tilde{\lambda}_1$	Screen Loss Factor		0.02628	0.03439	0.02381
$\lambda_2$	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
Thermal resis	stances				
T1	Thermal resistance of insulation	[K.m/W]	0.36997	0.36997	0.36997
T2	Thermal resistance of bedding/medium inside pipe-type	[K.m/W]	n/a	n/a	n/a
Т3	Thermal resistance of outer covering	[K.m/W]	0.04684	0.04684	0.04684
T4	External thermal resistance	[K.m/W]	0.81558	0.85322	0.81612
Others					
Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
	Induced current on Metallic Screen	[A]	150.7	144.3	142.1

## 

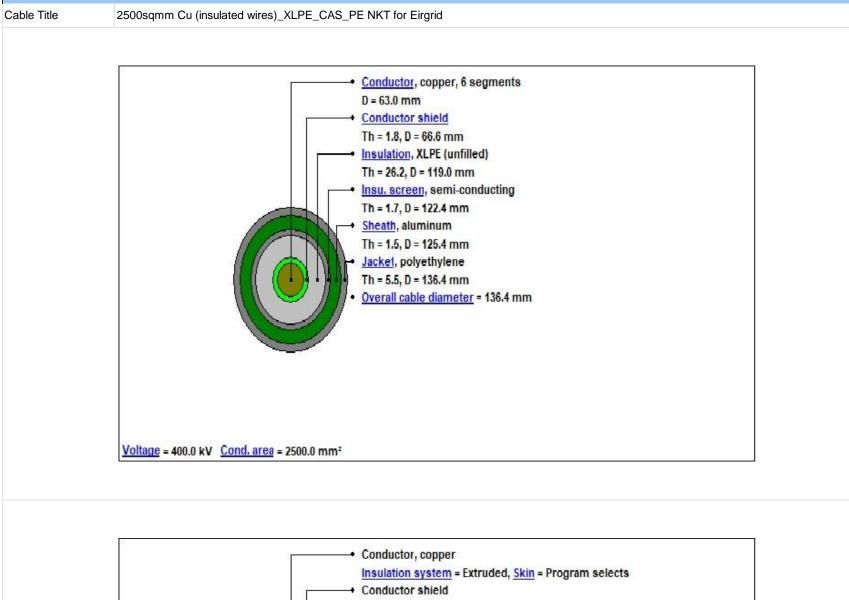
## **Cables Report**

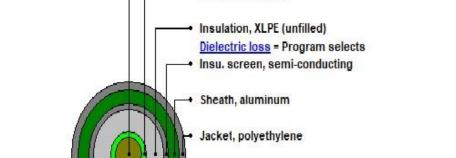
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Road Width trench (1ct 400kV CABLE)
Date:	18/03/2020 11:24:45

No.	Description	Unit	1
Gen	eral Cable Information		
1	Cable Equipment ID		400KV.011
2	Number of Cores		Single Core
3	Voltage	[kV]	400
4	Conductor Area	[mm²]	2500.0
5	Cable Overall Diameter	[mm]	136.4
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	110
Con	ductor		
8	Material		Copper
9	Electrical Resistivity at 20°C	[μΩ.cm]	1.7241
10	Temperature Coefficient at 20°C	[1/K]	0.00393
11	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
12	Volumetric Specific Heat (SH)	[J/(K*cm <sup>3</sup> )]	3.45
13	Construction	[0,(1,0,,)]	6 Segments
14	Conductor Insulation System		Extruded
15	Milliken Wires Construction		Insulated Wires
16	Ks (Skin Effect Coefficient)		0.35
17	Kp (Proximity Effect Coefficient)		0.2
17	Diameter	[mm]	-
	ductor Shield	[mm]	63.0
19	Diameter	[mm]	1.8
20		[mm]	66.6
21	Material		XLPE Unfilled
22	Thermal Resistivity	[K.m/W]	3.5
23	Dielectric Loss Factor - ( tan delta )		0.001
24	Relative Permittivity - ( epsilon )		2.5
25	Specific Insulation Resistance Constant at 60°F - ( K )	[MΩ.km]	65617.
26	Thickness	[mm]	26.2
27	Diameter	[mm]	119.0
Insu	lation Screen	- [ ]	
28	Material		Semi Conducting Screen
29	Thickness	[mm]	1.7
30	Diameter	[mm]	122.4
She	ath	1	
31	Is Sheath Around Each Core?		n/a
32	Material		Aluminum
33	Electrical Resistivity at 20°C	[μΩ.cm]	2.84
34	Temperature Coefficient at 20°C	[1/K]	0.00403
35	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	228
36	Volumetric Specific Heat (SH)	[J/(K*cm <sup>3</sup> )]	2.5
37	Corrugation Type		Non Corrugated
38	Thickness	[mm]	1.5
39	Diameter	[mm]	125.4
Jacl	ket		
40	Material		Polyethylene
41	Thermal Resistivity	[K.m/W]	3.5
42	Thickness	[mm]	5.5
43	Diameter	[mm]	136.4
-13	ļ	լոույ	100.4

No.	Description	Unit	1				
Spe	Specific Installation Data						
44	Cable Equipment ID		400KV.011				
45	Cable Frequency	[Hz]	50				
46	Sheath / Shield Bonding		1 Conductor Crossbonded Flat				
47	Loss Factor Constant (ALOS)		0.3				
48	Minor section length		Crossbonded Unknown Section Lengths UNKNOWN				
49	Duct construction		Polyethylene in Concrete				
50	Duct material thermal resistivity	[K.m/W]	3.5				
51	Inside Diameter of the Duct/Pipe	[mm]	188.0				
52	Outside Diameter of the Duct/Pipe	[mm]	200.0				

### Cable ID : 400KV.011







		0
and the second	10	-
INTERNAT	TIONAL	TED

## **Electrical Parameters**

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Road Width trench (1ct 400kV CABLE)
Date:	18/03/2020 11:24:45

No.	Description	Unit	Cable No.1	Cable No.2	Cable No.3
1	Cable Equipment ID		400KV.011	400KV.011	400KV.011
Resi	stances				
2	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00908	0.00918	0.00908
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.00841	0.00841	0.00841
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.0101	0.01018	0.01009
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.04864	0.04864	0.04864
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.05736	0.058	0.05734
Loss	ses				
8	Conductor Losses	[W/m]	57.64346	58.15139	57.62698
9	Dielectric Losses	[W/m]	4.00936	4.00936	4.00936
10	Metallic Screen Losses	[W/m]	1.51482	1.99981	1.37184
11	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
12	Total Losses	[W/m]	63.16763	64.16055	63.00817
Capa	acitance, Inductance, Impedance				
13	Capacitance	[µF/km]	0.239	0.239	0.239
14	Inductance of Conductor	[mH/km]	0.82265	0.82265	0.82265
15	Reactance of Conductor	[Ω/km]	0.25844	0.25844	0.25844
16	Inductance of Metallic Sheath	[mH/km]	0.63738	0.63738	0.63738
17	Reactance of Metallic Sheath	[Ω/km]	0.20024	0.20024	0.20024
18	Positive Sequence Impedance	[Ω/km]	0.010100 + j0.258440	0.010180 + j0.258440	0.010090 + j0.258440
19	Negative Sequence Impedance	[Ω/km]	0.010100 + j0.258440	0.010180 + j0.258440	0.010090 + j0.258440
20	Zero Sequence Impedance	[Ω/km]	0.056640 + j0.200240	0.056630 + j0.200240	0.056640 + j0.200240
21	Surge Impedance	[Ω]	58.63321	58.63321	58.63321
Othe	rs				
22	Dielectric Stress at Conductor Surface	[kV/mm]	11.94851	11.94851	11.94851
23	Dielectric Stress at Insulation Surface	[kV/mm]	6.68715	6.68715	6.68715
24	Insulation Resistance at 60°F (15.8°C)	[MΩ.km]	16540.20553	16540.20553	16540.20553
25	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a
26	Charging Current for One Phase	[A/km]	17.36102	17.36102	17.36102
27	Charging Capacity of three phase system at Uo	[kvar/km]	12028.06597	12028.06597	12028.06597
28	Voltage drop for Three Phase System	[V/A/km]	0.01749	0.01764	0.01748
29	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
30	Induced current on Metallic Screen	[A]	150.7	144.3	142.1

### CYME

Cable Parameters under Normal Operation

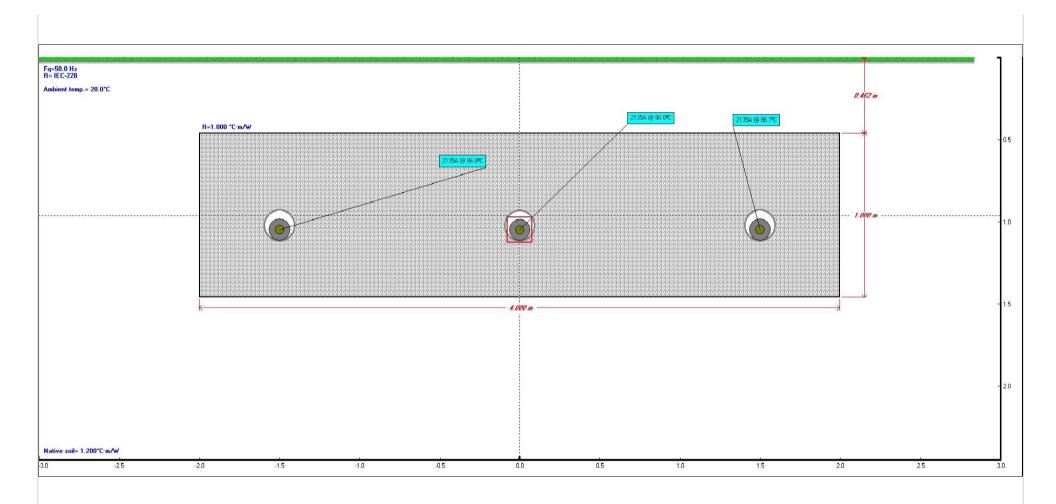
С	YMCAP Version	7.3 Revision 2
s	itudy:	Eirgrid Cp966 Feasibility study
E	xecution:	Eirgrid - Road Width trench (1ct 400kV CABLE)
D	ate:	18/03/2020 11:24:45

No.	Symbol	Description	Unit	Cable No.1	Cable No.2	Cable No.3
1		Cable Equipment ID		400KV.011	400KV.011	400KV.011
	Operation IE					
	tor AC Resis			[		[
2	R₀ R'	DC Resistance of the conductor at 20°C DC Resistance of Conductor at Operating Temperature	[Ω/km] [Ω/km]	0.0072	0.0072	0.0072
4	dc	Conductor Diameter	[mm]	63.0	63.0	63.0
5	s	Distance Between Conductor Axes	[mm]	1500.0	1500.0	1500.0
6	ks	Factor Used for xs Calculation (Skin Effect)		0.35	0.35	0.35
7	kp	Factor Used for xp Calculation (Proximity Effect)		0.2	0.2	0.2
8	XS	Component of Ys Calculation (Skin Effect)		2.20051	2.18875	2.2009
9	хр	Component of Yp Calculation (Proximity Effect)		1.66343	1.65454	1.66372
10	ys	Skin Effect Factor		0.11125	0.1091	0.11132
11 12	yp R	Proximity Effect Factor AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.0101	0.00028	0.01009
	ic Losses					
13	tanð	Dielectric Loss Factor		0.001	0.001	0.001
14	ε	Insulation Relative Permitivity		2.5	2.5	2.5
15	С	Cable Capacitance	[µF/km]	0.239	0.239	0.239
16 17	U <sub>0</sub> Wd	Voltage Cable Dielectric Losses Per Phase	[kV] [W/m]	230.94011 4.00936	230.94011 4.00936	230.94011 4.00936
	ing Loss Fac		[wwin]	4.00330	4.00330	4.00330
18	Rs	AC Resistance used for Circulating Loss Factor computation	[Ω/km]	0.05736	0.058	0.05734
19	d	Mean diameter used for Circulating Loss Factor computation	[mm]	123.9	123.9	123.9
20	х	Reactance used for Circulating Loss Factor computation	[Ω/km]	0.20024	0.20024	0.20024
21	Xm	Mutual Reactance	[Ω/km]	0.04355	0.04355	0.04355
22 23	P Q	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.24379	0.24379	0.24379
23	ч - ч	Component for Circulating Loss Factor Formula (Clause 2.3.3) Spacing Factor (applied when spacing between cable uneven or non-	[Ω/km]	0.10072	0.10072	0.10072
24	Fspacing	Spacing Factor (applied when spacing between cable uneven or non- equal minor section length)		0.004	0.004	0.004
25	λ'1	Screen Loss Factor Caused by Circulating Current		0.02259	0.02076	0.02008
-	ss Factor		10/11	0.05700	0.050	0.0570.1
26 27	Rs d	AC Resistance used for Eddy Loss Factor computation Mean diameter used for Eddy Loss Factor computation	[Ω/km] [mm]	0.05736	0.058	0.05734
27	ρs	Electrical Resistivity used for Eddy Loss Factor computation	[Ω.m]	0.0	0.0	0.0
29	Ds	External diameter used for Eddy Loss Factor computation	[mm]	125.4	125.4	125.4
30	ts	Thickness used for Eddy Loss Factor computation	[mm]	1.5	1.5	1.5
31	β1	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		108.57191	107.9702	108.59161
32	gs	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		1.00543	1.0054	1.00543
34	m	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.54769	0.54164	0.54789
35	λ <sub>o</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.00059	0.00232	0.00059
36 37	$\Delta_1$ $\Delta_2$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		-0.00488	0.00125	0.00398
38	F	Milliken conductor Effect		1.0	1.0	1.0
39	Fpipe	Magnetic effect factor due to pipe		1.0	1.0	1.0
40	Farmour	Magnetic effect factor due to armour		1.0	1.0	1.0
41	λ"1	Screen Loss Factor Caused by Eddy Current		0.00369	0.01363	0.00372
	Screen Loss					
42 Armour	λ <sub>1</sub> and Pipe Los	Screen Loss Factor		0.02628	0.03439	0.02381
43	λ <sub>2</sub> a	Armour Loss Factor		0.0	0.0	0.0
44	λ₂pipe	Pipe Loss Factor		0.0	0.0	0.0
46	$\lambda_2$	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
Normal	Operation IE	C 60287-2-1	I		I	
47	T <sub>1</sub>	Thermal Resistance Between Conductor and Screen	[K.m/W]	0.36997	0.36997	0.36997
48	t <sub>1</sub>	Insulation Thickness Between Conductor and Screen	[mm]	29.7	29.7	29.7
49 50	ρΤi Τ <sub>3</sub>	Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating	[K.m/W] [K.m/W]	3.5 0.04684	3.5 0.04684	3.5 0.04684
50	1 <sub>3</sub>	Thickness of Jacket/Pipe Coating	[K.m/vv] [mm]	5.5	5.5	5.5
52	ρTJ	Thermal Resistivity of Jacket/Pipe Coating	[K.m/W]	3.5	3.5	3.5
Cable in	Ducts					
53	U	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		1.87	1.87	1.87
54	V	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		0.312	0.312	0.312
55 56	Y Am	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	1001	0.0037	0.0037	0.0037 54.0
56 57	θm T₄'	Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe	[°C] [K.m/W]	54.1 0.23412	57.4 0.2294	54.0 0.23425
57	T₄ Do	Outside Diameter of the Duct/Pipe	[M.11/77]	200.0	200.0	200.0
59	Di	Inside Diameter of the Duct/Pipe	[mm]	188.0	188.0	188.0
60	ρΤ	Thermal Resistivity of the Duct/Pipe Material	[K.m/W]	3.5	3.5	3.5
61	T4"	Thermal Resistance of the Duct/Pipe	[K.m/W]	0.03447	0.03447	0.03447
62	T <sub>4</sub> "	Thermal Resistance of the Surrounding Medium	[K.m/W]	0.54699	0.58936	0.5474
		k/Backfill installation	feed.	10	10	10
63 64	x y	Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill	[m] [m]	1.0 4.0	1.0 4.0	1.0 4.0
65	y rb	Equivalent Radius of Duct Bank/Backfill	[m] [m]	4.0	4.0	4.0
66	LG	Depth of Laying to the Centre of Duct Bank/Backfill	[m]	0.962	0.962	0.962
67	u	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3		0.80178	0.80178	0.80178
68	N	Number of Loaded Cables in the Duct Bank/Backfill		3.0	3.0	3.0
69	ре	Thermal Resistivity of Earth Around the Duct Bank/Backfill	[K.m/W]	1.0	1.0	1.0
70	ρς	Thermal Resistivity of the Duct Bank/Backfill	[K.m/W]	0.85	0.85	0.85
71	T₄'" -	Thermal Resistance of the Surrounding Medium	[K.m/W]	0.54699	0.58936	0.5474
72	T₄	Total External Thermal Resistance	[K.m/W]	0.81558	0.85322	0.81612
73	Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
74	I.	Cable Core Current Ampacity	[A]	2389.5	2389.5	2389.5
74						

	Study Summary			
CYMCAP Version	Revision 2			
Study:	irgrid Cp966 Feasibility study			
Execution:	Eirgrid - Road Width trench (1ct 400kV CABLE) - Summer (20C)			
Date:	02/03/2020 16:02:32			

General Simulation Data				
Steady State Option	Equally Loaded			
Consider Electrical interaction between circuits	No			
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0			
Conductor Resistances Computation Option:	IEC-228			

Installation Type:Ductbank					
Ambient Soil Temperature at Installation Depth	[°C]	20.0			
Native Soil Thermal Resistivity	[K.m/W]	1.2			
Thermal Resistivity of Duct Bank	[K.m/W]	1.0			
Depth of Center of Duct Bank	[m]	0.96			
Duct Bank Width	[m]	4.0			
Duct Bank Height	[m]	1.0			



Results	Results Summary									
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [m]	Y coordinate [m]	Conductor temperature [°C]	Ampacity [A]
1	400KV.011	1		А	50.0	1.0	-1.5	1.05	86.8	2135.3
2	400KV.011	1		В	50.0	1.0	0.0	1.05	90.0	2135.3
3	400KV.011	1		С	50.0	1.0	1.5	1.05	86.7	2135.3

	Steady State Summary
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Road Width trench (1ct 400kV CABLE) - Summer (20C)
Date:	02/03/2020 16:02:32

Simulation Data			
Installation type:	Ductbank		
Steady State Option	Equally Loaded		
Ambient temperature [°C]	20		
Native Soil Thermal Resistivity [K.m/W]	1.2		
Consider Non-Isothermal Earth Surface	No		
Consider effect of soil dry out	No		
Consider Electrical interaction between circuits	No		
Induced current in metallic layers as a fraction of conductor current (applied to all single phase circuits)	0		

Variable	Description	Unit		Cables	
Cable No.	Cable Index Number		1	2	3
General Inpu	t Data				
Cable ID	Cable Equipment ID		400KV.011	400KV.011	400KV.011
Circuit No.	Circuit No.		1	1	1
Phase	Cable Phase		А	В	С
Fq	Operating Frequency	[Hz]	50.0	50.0	50.0
x	X coordinate	[m]	-1.5	0.0	1.5
у	Y coordinate	[m]	1.05	1.05	1.05
DLF	Daily Load Factor	[p.u.]	1.0	1.0	1.0
	Bonding Type		1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat
Ampacity					
	Steady State Ampacity	[A]	2135.3	2135.3	2135.3
Temperature	S				
θс	Conductor temperature	[°C]	86.8	90.0	86.7
θs	Sheath/Shield temperature	[°C]	69.0	72.1	68.9
θa	Armour temperature	[°C]	n/a	n/a	n/a
θsurf	Cable surface temperature	[°C]	66.6	69.6	66.5
θduct	Duct surface temperature	[°C]	53.3	56.4	53.2
Resistances					
$R_0$	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
R	AC Resistance of the Conductor at Operating Temperature	[Ω/km]	0.0101	0.01018	0.0101
ys	Skin Effect Factor		0.11112	0.1091	0.11119
ур	Proximity Effect Factor		0.00026	0.00026	0.00026
Losses					
Wc	Conductor Losses	[W/m]	46.05738	46.43925	46.04573
Wd	Dielectric Losses	[W/m]	4.00936	4.00936	4.00936
Ws	Metallic Screen Losses	[W/m]	1.22292	1.6034	1.10571
Wa	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
Wt	Total Losses	[W/m]	51.28965	52.05201	51.16079
$\lambda_1$	Screen Loss Factor		0.02655	0.03453	0.02401
$\lambda_2$	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
Thermal resis	stances				
T1	Thermal resistance of insulation	[K.m/W]	0.36997	0.36997	0.36997
T2	Thermal resistance of bedding/medium inside pipe-type	[K.m/W]	n/a	n/a	n/a
Т3	Thermal resistance of outer covering	[K.m/W]	0.04684	0.04684	0.04684
T4	External thermal resistance	[K.m/W]	0.90787	0.95374	0.90847
Others		-			
Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
-	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
	Induced current on Metallic Screen	[A]	134.6	128.7	126.8

## 

### **Cables Report**

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Road Width trench (1ct 400kV CABLE) - Summer (20C)
Date:	02/03/2020 16:02:32

No.	Description	Unit	1
Gen	eral Cable Information		
1	Cable Equipment ID		400KV.011
2	Number of Cores		Single Core
3	Voltage	[kV]	400
4	Conductor Area	[mm²]	2500.0
5	Cable Overall Diameter	[mm]	136.4
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	110
Con	ductor		
8	Material		Copper
9	Electrical Resistivity at 20°C	[µΩ.cm]	1.7241
10	Temperature Coefficient at 20°C	[1/K]	0.00393
	Reciprocal of Temperature Coefficient of Resistance		
11	(BETA)	[K]	234.5
12	Volumetric Specific Heat (SH)	[J/(K*cm <sup>3</sup> )]	3.45
13			6 Segments
14	Conductor Insulation System		Extruded
15	Milliken Wires Construction		Insulated Wires
16	Ks (Skin Effect Coefficient)		0.35
17	Kp (Proximity Effect Coefficient)		0.2
18	Diameter	[mm]	63.0
Con	ductor Shield		
19	Thickness	[mm]	1.8
20	Diameter	[mm]	66.6
Insu	lation		
21	Material		XLPE Unfilled
22	Thermal Resistivity	[K.m/W]	3.5
23	Dielectric Loss Factor - ( tan delta )		0.001
24	Relative Permittivity - ( epsilon )		2.5
25	Specific Insulation Resistance Constant at 60°F - ( K )	[MΩ.km]	65617.
26	Thickness	[mm]	26.2
27	Diameter	[mm]	119.0
Insu	lation Screen		
28	Material		Semi Conducting Screen
29	Thickness	[mm]	1.7
30	Diameter	[mm]	122.4
She	ath		
31	Is Sheath Around Each Core?		n/a
32	Material		Aluminum
33	Electrical Resistivity at 20°C	[μΩ.cm]	2.84
34	Temperature Coefficient at 20°C	[1/K]	0.00403
35	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	228
35 36	Volumetric Specific Heat (SH)	[K] [J/(K*cm <sup>3</sup> )]	2.5
36	Corrugation Type		
-	Thickness	[m-1	Non Corrugated
38	Diameter	[mm]	1.5
39 Jacl		[mm]	125.4
	Material		
40			Polyethylene
41	Thermal Resistivity	[K.m/W]	3.5
42		[mm]	5.5
43	Diameter	[mm]	136.4

No.	Description	Unit	1			
Spe	Specific Installation Data					
44	Cable Equipment ID		400KV.011			
45	Cable Frequency	[Hz]	50			
46	Sheath / Shield Bonding		1 Conductor Crossbonded Flat			
47	Loss Factor Constant (ALOS)		0.3			
48	Minor section length		Crossbonded Unknown Section Lengths UNKNOWN			
49	Duct construction		Polyethylene in Concrete			
50	Duct material thermal resistivity	[K.m/W]	3.5			
51	Inside Diameter of the Duct/Pipe	[mm]	188.0			
52	Outside Diameter of the Duct/Pipe	[mm]	200.0			

#### Cable ID : 400KV.011

Cable Title 2500sqmm Cu (insulated wires)\_XLPE\_CAS\_PE NKT for Eirgrid Conductor, copper, 6 segments D = 63.0 mm Conductor shield Th = 1.8, D = 66.6 mm Insulation, XLPE (unfilled) Th = 26.2, D = 119.0 mm Insu. screen, semi-conducting Th = 1.7, D = 122.4 mm • Sheath, aluminum Th = 1.5, D = 125.4 mm Jacket, polyethylene Th = 5.5, D = 136.4 mm Overall cable diameter = 136.4 mm Voltage = 400.0 kV Cond. area = 2500.0 mm<sup>2</sup> Conductor, copper Insulation system = Extruded, Skin = Program selects Conductor shield Insulation, XLPE (unfilled) Dielectric loss = Program selects Insu. screen, semi-conducting + Sheath, aluminum Jacket, polyethylene





## **Electrical Parameters**

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Road Width trench (1ct 400kV CABLE) - Summer (20C)
Date:	02/03/2020 16:02:32

No.	Description	Unit	Cable No.1	Cable No.2	Cable No.3		
1	Cable Equipment ID		400KV.011	400KV.011	400KV.011		
Resistances							
2	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072		
3	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00909	0.00918	0.00909		
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.00841	0.00841	0.00841		
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.0101	0.01018	0.0101		
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.04864	0.04864	0.04864		
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.05824	0.05885	0.05822		
Loss	es						
8	Conductor Losses	[W/m]	46.05738	46.43925	46.04573		
9	Dielectric Losses	[W/m]	4.00936	4.00936	4.00936		
10	Metallic Screen Losses	[W/m]	1.22292	1.6034	1.10571		
11	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0		
12	Total Losses	[W/m]	51.28965	52.05201	51.16079		
Сара	acitance, Inductance, Impedance		1				
13	Capacitance	[µF/km]	0.239	0.239	0.239		
14	Inductance of Conductor	[mH/km]	0.82265	0.82265	0.82265		
15	Reactance of Conductor	[Ω/km]	0.25844	0.25844	0.25844		
16	Inductance of Metallic Sheath	[mH/km]	0.63738	0.63738	0.63738		
17	Reactance of Metallic Sheath	[Ω/km]	0.20024	0.20024	0.20024		
18	Positive Sequence Impedance	[Ω/km]	0.010100 + j0.258440	0.010180 + j0.258440	0.010100 + j0.258440		
19	Negative Sequence Impedance	[Ω/km]	0.010100 + j0.258440	0.010180 + j0.258440	0.010100 + j0.258440		
20	Zero Sequence Impedance	[Ω/km]	0.056640 + j0.200240	0.056630 + j0.200240	0.056640 + j0.200240		
21	Surge Impedance	[Ω]	58.63321	58.63321	58.63321		
Othe	rs						
22	Dielectric Stress at Conductor Surface	[kV/mm]	11.94851	11.94851	11.94851		
23	Dielectric Stress at Insulation Surface	[kV/mm]	6.68715	6.68715	6.68715		
24	Insulation Resistance at 60°F (15.8°C)	[MΩ.km]	16540.20553	16540.20553	16540.20553		
25	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a		
26	Charging Current for One Phase	[A/km]	17.36102	17.36102	17.36102		
27	Charging Capacity of three phase system at Uo	[kvar/km]	12028.06597	12028.06597	12028.06597		
28	Voltage drop for Three Phase System	[V/A/km]	0.0175	0.01764	0.01749		
29	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0		
30	Induced current on Metallic Screen	[A]	134.6	128.7	126.8		

		0
_	1.1	
1000	10	

#### Cable Parameters under Normal Operation

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Road Width trench (1ct 400kV CABLE) - Summer (20C)
Date:	02/03/2020 16:02:32

No. 1	Symbol	Description Cable Equipment ID	Unit	Cable No.1 400KV.011	Cable No.2 400KV.011	Cable No.3 400KV.011
Normal	Operation I	EC 60287-1-1		I		I
Conduc	ctor AC Resi	stance				
2	R <sub>0</sub>	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	R'	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00909	0.00918	0.00909
4	dc	Conductor Diameter	[mm]	63.0	63.0	63.0
5	s	Distance Between Conductor Axes	[mm]	1500.0	1500.0	1500.0
6	ks	Factor Used for xs Calculation (Skin Effect)		0.35	0.35	0.35
7	kp	Factor Used for xp Calculation (Proximity Effect) Component of Ys Calculation (Skin Effect)		0.2	0.2 2.18875	0.2
9	xs xp	Component of Yp Calculation (Skin Effect)		1.6629	1.65454	1.66316
10	ys	Skin Effect Factor		0.11112	0.1091	0.11119
11	· · ·	Proximity Effect Factor		0.00026	0.00026	0.00026
12	yp R	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.0101	0.01018	0.00020
	ric Losses		[11/1011]	0.0101	0.01010	0.0101
13	tanδ	Dielectric Loss Factor		0.001	0.001	0.001
14	ε	Insulation Relative Permitivity		2.5	2.5	2.5
15	с	Cable Capacitance	[µF/km]	0.239	0.239	0.239
16	U <sub>0</sub>	Voltage	[kV]	230.94011	230.94011	230.94011
17	Wd	Cable Dielectric Losses Per Phase	[W/m]	4.00936	4.00936	4.00936
	ting Loss Fa		10.0			
18	Rs	AC Resistance used for Circulating Loss Factor computation	[Ω/km]	0.05824	0.05885	0.05822
19 20	d X	Mean diameter used for Circulating Loss Factor computation Reactance used for Circulating Loss Factor computation	[mm] [Ω/km]	123.9 0.20024	123.9 0.20024	123.9 0.20024
20	Xm	Mutual Reactance	[Ω/km]	0.04355	0.04355	0.04355
22	P	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.24379	0.24379	0.24379
23	Q	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.18572	0.18572	0.18572
		Spacing Factor (applied when spacing between cable uneven or non-				
24	Fspacing	equal minor section length)		0.004	0.004	0.004
25 Eddyla	λ' <sub>1</sub> oss Factor	Screen Loss Factor Caused by Circulating Current		0.0229	0.021	0.02033
26	Rs	AC Resistance used for Eddy Loss Factor computation	[Ω/km]	0.05824	0.05885	0.05822
20	d	Mean diameter used for Eddy Loss Factor computation	[12/KII]	123.9	123.9	123.9
28	ρs	Electrical Resistivity used for Eddy Loss Factor computation	[Ω.m]	0.0	0.0	0.0
29	Ds	External diameter used for Eddy Loss Factor computation	[mm]	125.4	125.4	125.4
30	ts	Thickness used for Eddy Loss Factor computation	[mm]	1.5	1.5	1.5
31	β1	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		107.74839	107.18805	107.76563
32	gs	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		1.00539	1.00536	1.00539
34	m	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.53942	0.53382	0.53959
35	λ <sub>o</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.00058	0.00227	0.00058
36	$\Delta_1$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		-0.00497	0.00124	0.00395
37	Δ <sub>2</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.00003	0.0	0.0
38	F	Milliken conductor Effect		1.0	1.0	1.0
39 40	Fpipe Farmour	Magnetic effect factor due to pipe Magnetic effect factor due to armour		1.0	1.0	1.0
41	λ"1	Screen Loss Factor Caused by Eddy Current		0.00365	0.01352	0.00369
Metallic	c Screen Los	ss factor		1		
42						
Armour	$\tilde{\lambda}_1$	Screen Loss Factor		0.02655	0.03453	0.02401
	λ <sub>1</sub> and Pipe Lo			0.02655	0.03453	0.02401
43				0.02655	0.03453	0.02401
44	and Pipe Lo	sss Factor Armour Loss Factor Pipe Loss Factor		0.0	0.0 0.0	0.0
44 46	λ₂a       λ₂pipe       λ₂	ses Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
44 46 Normal	λ2a       λ2pipe       λ2       Operation II	Armour Loss Factor Pipe Loss Factor Armour Loss Factor Armour Loss Factor + Pipe Loss Factor <b>EC 60287-2-1</b>		0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0
44 46 Normal 47	and Pipe Lo $\lambda_2 a$ $\lambda_2 pipe$ $\lambda_2$ Operation II $T_1$	Armour Loss Factor Pipe Loss Factor Armour Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen	[K.m/W]	0.0 0.0 0.0 0.36997	0.0 0.0 0.0 0.36997	0.0 0.0 0.0 0.36997
44 46 Normal	λ2a       λ2pipe       λ2       Operation II	Armour Loss Factor Pipe Loss Factor Armour Loss Factor Armour Loss Factor + Pipe Loss Factor <b>EC 60287-2-1</b>	[K.m/W] [mm]	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0
44 46 Normal 47 48	r and Pipe Lo $\lambda_2 a$ $\lambda_2 pipe$ $\lambda_2$ Operation II $T_1$ $t_1$	Armour Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen	[mm]	0.0 0.0 0.0 0.36997 29.7	0.0 0.0 0.0 0.36997 29.7	0.0 0.0 0.0 0.36997 29.7
44 46 Normal 47 48 49	r and Pipe Lo $\lambda_2 a$ $\lambda_2 pipe$ $\lambda_2$ Operation II $T_1$ $t_1$ pTi	Armour Loss Factor Pipe Loss Factor Armour Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation	[mm] [K.m/W]	0.0 0.0 0.36997 29.7 3.5	0.0 0.0 0.36997 29.7 3.5	0.0 0.0 0.36997 29.7 3.5
44 46 <b>Normal</b> 47 48 49 50	r and Pipe Lo $\lambda_2 a$ $\lambda_2 pipe$ $\lambda_2$ Operation II $T_1$ $t_1$ $\rho Ti$ $T_3$	Armour Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W]	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684
44 46 Normal 47 48 49 50 51 52	r and Pipe Lo $\lambda_2 a$ $\lambda_2 pipe$ $\lambda_2$ Operation II $T_1$ $t_1$ $\rho Ti$ $T_3$ $t_3$	Armour Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W] [mm]	0.0 0.0 0.36997 29.7 3.5 0.04684 5.5	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5
44 46 Normal 47 48 49 50 51 52	$\begin{tabular}{ c c c c } \hline {\bf and Pipe Lc} \\ \hline $\lambda_2 a$ \\ \hline $\lambda_2 pipe$ \\ \hline $\lambda_2$ \\ \hline $Deration II \\ \hline $T_1$ \\ \hline \hline $T_1$ \\ \hline $T_1$ \\ \hline \hline $T_1$ \\ \hline \hline $T_1$ \\ \hline \hline $T_1$ \\ \hline \hline $T_1$ \hline \hline $$	Armour Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W] [mm]	0.0 0.0 0.36997 29.7 3.5 0.04684 5.5	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5
44 46 Normal 47 48 49 50 51 52 <b>Cable in</b> 53 54	r and Pipe Lo $\lambda_2 a$ $\lambda_2 pipe$ $\lambda_2$ Operation II $T_1$ $t_1$ $\rho Ti$ $T_3$ $t_3$ $\rho TJ$ n Ducts U V	Armour Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm]	0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312	0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312	0.0 0.0 0.0 29.7 3.5 0.04684 5.5 3.5 1.87 0.312
44 46 Normal 47 48 49 50 51 52 Cable in 53 54 55	and Pipe Lo $\lambda_2 a$ $\lambda_2 pipe$ $\lambda_2$ Operation II       T1       t1 $\rho Ti$ T3       t3 $\rho TJ$ n Ducts       U       V       Y	Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Armour Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm] [K.m/W]	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037	0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 3.5 1.87 0.312 0.0037
44 46 Normal 47 48 49 50 51 52 <b>Cable in</b> 53 54 55 55 55	T         and Pipe Lo           λ₂a         λ₂pipe           λ₂pipe         λ₂           Operation II         T₁           t₁         ρTi           T₃         t₃           pTJ         t₃           value         V           V         Y           em         em	Armour Loss Factor  Armour Loss Factor  Pipe Loss Factor  Armour Loss Factor + Pipe Loss Factor  C 60287-2-1  Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen  Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space	[mm] [K.mW] [K.mW] [mm] [K.mW]	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 3.5 1.87 0.312 0.0037 60.8	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 63.9	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 3.5 1.87 0.312 0.0037 60.7
44 46 Normal 47 48 49 50 51 52 <b>Cable i</b> 53 54 55 55 56 57	And Pipe Lo           λ₂a           λ₂pipe           λ₂           Operation II           T₁           t₁           ρTi           T₃           pTJ           n           Ducts           U           Y           θm           T₄'	Armour Loss Factor  Armour Loss Factor  Pipe Loss Factor  Armour Loss Factor + Pipe Loss Factor  C 60287-2-1  Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen  Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating  Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1  Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1  Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1  Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe	[mm] [K.mW] [K.mW] [mm] [K.mW]	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 60.8 0.22464	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 63.9 0.22049	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 3.5 1.87 0.312 0.0037 60.7 0.22474
44 46 Normal 47 48 49 50 51 52 <b>Cable in</b> 53 54 55 55 55	T         and Pipe Lo           λ₂a         λ₂pipe           λ₂pipe         λ₂           Operation II         T₁           t₁         ρTi           T₃         t₃           pTJ         t₃           value         V           V         Y           em         em	Armour Loss Factor  Armour Loss Factor  Pipe Loss Factor  Armour Loss Factor + Pipe Loss Factor  C 60287-2-1  Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen  Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space	[mm] [K.mW] [K.mW] [mm] [K.mW]	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 3.5 1.87 0.312 0.0037 60.8	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 63.9	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 3.5 1.87 0.312 0.0037 60.7
44 46 Normal 47 48 49 50 51 52 <b>Cable in</b> 53 54 55 56 57 58	$\begin{tabular}{ c c c c } \hline r & and Pipe Lo \\ \hline $\lambda_2 a$ \\ \hline $\lambda_2 pipe$ \\ \hline $\lambda_2$ \\ \hline $Deration II \\ \hline $\lambda_2$ \\ \hline $Deration II \\ \hline $T_1$ \\ \hline $T_1$ \\ \hline $T_1$ \\ \hline $T_1$ \\ \hline $PTi \\ $T_3$ \\ \hline $PTi \\ $T_4$ \\ \hline $Pm \\ $T_4$ \\ \hline $Do \\ $Do \\ \hline \end{tabular}$	Armour Loss Factor  Armour Loss Factor  Pipe Loss Factor  Armour Loss Factor + Pipe Loss Factor  C 60287-2-1  Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filing the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe	[mm] [K.mW] [K.mW] [mm] [K.mW] [K.mW] [°C] [K.mW]	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 60.8 0.22464 200.0	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 63.9 0.22049 200.0	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 60.7 0.22474 200.0
44 46 Normal 47 48 49 50 51 52 <b>Cable in</b> 53 54 55 56 57 58 59	A         Pipe         Lo           λ2a         λ2pipe         λ2           λ2pipe         λ2         Operation II           T1         T1         T1           ΦΤΙ         T3         T3           ΦΤΙ         T3         T3           ΦΤΙ         T3         T4           ΦΤΙ         T4         ΦΤΙ           T         Φ         Φ           T         Φ         Φ           T         Φ         Φ           D0         Φ         Φ           Di         Φ         Φ	Armour Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe	[mm] [K.mW] [K.mW] [mm] [K.mW] [K.mW] [K.mW] [mm] [mm]	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 60.8 0.22464 200.0 188.0	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 63.9 0.22049 200.0 188.0	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 60.7 0.22474 200.0 188.0
44 46 Normal 47 48 49 50 51 52 <b>Cable in</b> 53 54 55 56 57 58 59 60	A         Pipe         Lo           λ2a         λ2pipe         λ2           Λ2pipe         λ2         Operation II           T1         T1         T1           ΦTI         T3         T3           ΦTJ         U         V           V         Y         0           T4         Do         Do           DI         P         P	Armour Loss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thirmal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Material	[mm] [K.mW] [K.mW] [mm] [K.mW] [K.mW] [mm] [mm] [mm] [K.mW]	0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 60.8 0.22464 200.0 188.0 3.5	0.0 0.0 0.0 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 63.9 0.22049 200.0 188.0 3.5	0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 60.7 0.22474 200.0 188.0 3.5
44 46 Normal 47 48 49 50 51 52 <b>Cable in</b> 53 54 55 56 57 55 56 57 58 59 60 61 62	Understand         Use of the second se	Armour Loss Factor  Armour Loss Factor  Pipe Loss Factor  Armour Loss Factor  Armour Loss Factor + Pipe Loss Factor  C 60287-2-1  Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thermal Resistivity of Insulation Insulation Insure Thermal Resistivity of the Duct/Pipe Inside Diameter of the Du	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [mm] [mm] [K.mW]	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.0312 0.0037 60.8 0.22464 200.0 188.0 3.5 0.03447	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 63.9 0.22049 200.0 188.0 3.5 0.03447	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 0.04684 5.5 0.04684 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
44 46 Normal 47 48 49 50 51 52 <b>Cable in</b> 53 54 55 56 57 55 56 57 58 59 60 61 62	Understand         Use of the second se	Armour Loss Factor  Armour Loss Factor  Pipe Loss Factor  Armour Loss Factor  Armour Loss Factor + Pipe Loss Factor  C 60287-2-1  Thermal Resistance Between Conductor and Screen Insulation Thickness of Jacket/Pipe Coating Thermal Resistivity of Insulation Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [mm] [mm] [K.mW]	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.0312 0.0037 60.8 0.22464 200.0 188.0 3.5 0.03447	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 63.9 0.22049 200.0 188.0 3.5 0.03447	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 0.04684 5.5 0.04684 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
44 46 Normal 47 48 49 50 51 52 <b>Cable in</b> 53 55 56 57 58 59 60 61 62 <b>Cable in</b> 62	αnd Pipe Lo           λ₂a           λ₂pipe           λ₂           Operation II           T₁           t₁           ρTi           T₃           pTi           T₃           v           V           V           Y           θm           T₄'           Do           Di           ρT           T₄''           Do           Di           ρT           T₄''	Armour Loss Factor  Armour Loss Factor  Pipe Loss Factor  Armour Loss Factor + Pipe Loss Factor  C 60287-2-1  Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating  Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1  Coefficient Used in LOC 60287-2-1 Clause 2.2.7.1  Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium  K/Backfill Installation  Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 60.8 0.22464 200.0 188.0 3.5 0.03447 0.64876	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 63.9 0.22049 200.0 188.0 3.5 0.03447 0.69878 0.1.0 4.0	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 60.7 0.22474 200.0 188.0 3.5 0.03447 0.64926
44 46 Normal 47 48 49 50 51 52 <b>Cable in</b> 53 54 55 56 57 58 59 60 61 62 <b>Cable in</b> 63 64 63 64 65	$\lambda_2 a$ $\lambda_2 a$ $\lambda_2 pipe$ $\lambda_2$ <b>Operation II</b> $T_1$ $t_3$ $\rho Ti$ $T_3$ $t_3$ $\rho Tj$ <b>DOUCLS</b> U           V $\Psi$ $Do$ Di $\rho T$ $T_4$ " $\rho T$ $\tau_4$ " $\gamma$ $\mu$ $\gamma$	Armour Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Thermal Resistance of the Medium Filing the Space Thermal Resistance of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium Nt/Backfill Installation Shorter Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 60.8 0.22464 200.0 188.0 3.5 0.03447 0.64876 1.0 4.0 1.19983	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 63.9 0.22049 200.0 188.0 3.5 0.03447 0.69878 20.0 1.0 1.0 4.0 1.19983	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 60.7 0.22474 200.0 188.0 3.5 0.03447 0.64926 4.0 1.0 4.0
44 46 Normal 47 48 49 50 51 52 52 <b>Cable in</b> 53 54 55 56 57 58 59 60 61 62 <b>Cable in</b> 63 64 65 66	$\lambda_2 a$ $\lambda_2 a$ $\lambda_2 pipe$ $\lambda_2$ <b>Operation II</b> $T_1$ $t_1$ $\rho Ti$ $T_3$ $t_3$ $\rho Tj$ <b>D</b> $V$ $V$ $V$ $T_4^{'i}$ $Do$ $Di$ $\rho T$ $\tau_4^{''}$ $x$ $y$ $rb$ LG	Armour Loss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in Lec 60287-2-1 Clause 2.2.7.1 Coefficient Resistance of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Duct/Pipe Shorter Side of the Duct Bank/Backfill Longe	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 60.8 0.22464 200.0 188.0 3.5 0.22464 200.0 188.0 3.5 0.03447 0.64876 <b>1</b> .0 4.0 1.19983 0.962	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 63.9 0.22049 200.0 188.0 3.5 0.03447 0.69878 0.03447 0.69878	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 60.7 0.22474 200.0 188.0 3.5 0.03447 0.64926 0.03447 0.64926
44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65           66           67	$\lambda_2 a$ $\lambda_2 a$ $\lambda_2 pipe$ $\lambda_2$ <b>Operation II</b> $T_1$ $t_1$ $\rho Ti$ $T_3$ $t_3$ $\rho TJ$ <b>Ducts</b> U $V$ $PT$ $T_4^{"}$ $Do$ Di $\rho T$ $\tau_4^{"}$ $x$ y           LG           u	Ses Factor           Armour Loss Factor           Pipe Loss Factor           Armour Loss Factor + Pipe Loss Factor           C 60287-2-1           Thermal Resistance Between Conductor and Screen           Insulation Thickness Between Conductor and Screen           Thermal Resistance of Jacket/Pipe Coating           Thermal Resistivity of Insulation           Thermal Resistance of Jacket/Pipe Coating           Thickness of Jacket/Pipe Coating           Thermal Resistivity of Jacket/Pipe Coating           Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1           Mean Temperature of the Medium Filling the Space           Thermal Resistance of the Duct/Pipe           Outside Diameter of the Duct/Pipe           Thermal Resistance o	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 60.8 0.22464 200.0 188.0 3.5 0.22464 200.0 188.0 3.5 0.03447 0.64876 1.0 4.0 1.19983 0.962 0.80178	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 63.9 0.22049 200.0 188.0 3.5 0.03447 0.69878 1.0 1.0 4.0 1.19983 0.962 0.80178	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 60.7 0.22474 200.0 188.0 3.5 0.03447 0.64926 1.0 4.0 1.19983 0.962 0.80178
44 46 Normal 47 48 49 50 51 52 <b>Cable in</b> 53 54 55 56 57 55 56 57 58 59 60 61 62 <b>Cable in</b> 63 64 66 66 67 66 68	U         V $\lambda_2 a$ $\lambda_2 pipe$ $\lambda_2$ $\lambda_2$ Operation II $T_1$ $T_1$ $t_1$ $\rho Ti$ $T_3$ $\eta TJ$ $T_3$ $\mu TJ$ $\eta TJ$	Armour Loss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium NK/Backfill Longer Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [C] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [M] [M] [M] [M] [M] [M]	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.0312 0.0037 60.8 0.22464 200.0 188.0 3.5 0.02464 200.0 188.0 3.5 0.03447 0.64876 0.0 3.5 0.03447 0.64876 0.0 1.0 4.0 1.19983 0.962 0.80178 3.0	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.0312 0.0037 63.9 0.22049 200.0 188.0 3.5 0.032447 0.09878 200.0 188.0 3.5 0.03447 0.69878 20.0 1.0 4.0 1.19983 0.962 0.80178 3.0	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.0312 0.0037 60.7 0.22474 200.0 188.0 3.5 0.03447 200.0 188.0 3.5 0.03447 200.0 188.0 3.5 0.03447 200.0 188.0 3.5 0.03447 200.0 188.0 3.5
44 46 Normal 47 48 49 50 51 52 <b>Cable in</b> 53 54 55 56 57 58 55 56 60 61 62 <b>Cable in</b> 63 64 65 66 66 67 68 68 69	U         V $\lambda_2 a$ $\lambda_2 pipe$ $\lambda_2$ $\lambda_2 pipe$ $\lambda_2$ Operation II           T1 $t_1$ $\rho Ti$ $T_3$ $\eta TJ$ $t_3$ $\rho TJ$ $\rho TJ$ Do $Di$ $PT$ $T_4$ '           Do $Di$ $\rho T$ $T_4$ '' $\chi$ $\gamma$ $\theta$ m $T_4$ '' $Do$ $Di$ $\rho T$ $T_4$ '' $\mu$	Armour Loss Factor  Armour Loss Factor  Pipe Loss Factor  Armour Loss Factor + Pipe Loss Factor  C 60287-2-1  Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating  Thermal Resistivity of Jacket/Pipe Coating  Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1  Mean Temperature of the Medium Filling the Space Thermal Resistance of the Duct/Pipe  Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium  K/Backfill Installation  Shorter Side of the Duct Bank/Backfill  Longer Side of the Duct Bank/Backfill  Equivalent Radius of Duct Bank/Backfill  Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3  Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [C] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.0312 0.0037 60.8 0.22464 200.0 188.0 3.5 0.22464 200.0 188.0 3.5 0.03447 0.64876 1.0 4.0 1.19983 0.962 0.80178 3.0 1.2	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 63.9 0.22049 200.0 188.0 3.5 0.22049 200.0 188.0 3.5 0.03447 0.69878 0.03447 0.69878 1.0 4.0 1.19983 0.962 0.80178 3.0 1.2	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.034684 0.0037 60.7 0.22474 200.0 188.0 3.5 0.03447 200.0 188.0 3.5 0.03447 200.0 188.0 3.5 0.03447 200.0 188.0 3.5 0.03447 200.0 188.0 3.5 0.03447 200.0 1.0 1.0 0.03447 200.0 1.0 0.0037 200.0 0.0037 0.0037 0.0037 0.0037 0.0037 0.0037 0.0037 0.0037 0.0037 0.0037 0.0037 0.00347 0.0036 0.00037 0.0037 0.0037 0.00000 0.0037 0.0000000000
44 46 Normal 47 48 49 50 51 52 <b>Cable in</b> 53 54 55 56 57 58 59 60 61 62 <b>Cable in</b> 63 64 63 64 65 66 67 68 68 69 70	αnd Pipe Lo           λ₂a           λ₂pipe           λ₂pipe           λ₂           Operation II           T₁           t₁           ρTi           T₃           pTJ           n           U           V           Y           θm           T₄'           Do           Di           ρT           T₄''           N           v           Y           Hom           T₄''           Do           Di           pT           rt₄''           N           k           y           rb           LG           u           pc	Armour Loss Factor  Armour Loss Factor  Pipe Loss Factor  Armour Loss Factor + Pipe Loss Factor  C 60287-2-1  Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Duct/Pipe Inside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium K/Backfill Installation Shorter Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [C] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 60.8 0.22464 200.0 188.0 3.5 0.03447 0.64876 1.0 4.0 1.19983 0.962 0.80178 3.0 1.2 1.0	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 63.9 0.22049 200.0 188.0 3.5 0.03447 0.69878 200.0 188.0 3.5 0.03447 0.69878 20.0 1.0 4.0 1.19983 0.962 0.80178 3.0 1.2 1.0	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 60.7 0.22474 200.0 188.0 3.5 0.03447 200.0 188.0 3.5 0.03447 200.0 188.0 3.5 0.03447 200.0 188.0 3.5 0.03447 200.0 188.0 3.5 0.03447 200.0 188.0 3.5 0.03447 200.0 1.0 1.0 1.0 1.2 1.0
44 46 Normal 47 48 49 50 51 52 <b>Cable in</b> 53 54 55 56 57 58 55 56 60 61 62 <b>Cable in</b> 63 64 65 66 66 67 68 68 69	U         V $\lambda_2 a$ $\lambda_2 pipe$ $\lambda_2$ $\lambda_2 pipe$ $\lambda_2$ Operation II           T1 $t_1$ $\rho Ti$ $T_3$ $\eta TJ$ $t_3$ $\rho TJ$ $\rho TJ$ DO $Di$ $PT$ $T_4$ '           Do $Di$ $\rho T$ $T_4$ '' $\chi$ $\gamma$ $\theta$ m $T_4$ '' $Do$ $Di$ $\rho T$ $T_4$ '' $\mu$	Armour Loss Factor  Armour Loss Factor  Pipe Loss Factor  Armour Loss Factor + Pipe Loss Factor  C 60287-2-1  Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating  Thermal Resistivity of Jacket/Pipe Coating  Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1  Mean Temperature of the Medium Filling the Space Thermal Resistance of the Duct/Pipe  Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium  K/Backfill Installation  Shorter Side of the Duct Bank/Backfill  Longer Side of the Duct Bank/Backfill  Equivalent Radius of Duct Bank/Backfill  Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3  Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [C] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.0312 0.0037 60.8 0.22464 200.0 188.0 3.5 0.22464 200.0 188.0 3.5 0.03447 0.64876 1.0 4.0 1.19983 0.962 0.80178 3.0 1.2	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 63.9 0.22049 200.0 188.0 3.5 0.22049 200.0 188.0 3.5 0.03447 0.69878 0.03447 0.69878 1.0 4.0 1.19983 0.962 0.80178 3.0 1.2	0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 60.7 0.22474 200.0 188.0 3.5 0.03447 0.64926 1.0 4.0 1.19983 0.962 0.80178 3.0 1.2
44 46 Normal 47 48 49 50 51 52 <b>Cable in</b> 53 54 55 56 57 58 59 60 61 61 62 <b>Cable in</b> 63 64 65 66 67 68 66 67 68 69 70 70 70	Image like like like like like like like lik	Armour Loss Factor  Armour Loss Factor  Pipe Loss Factor  Armour Loss Factor + Pipe Loss Factor  C 60287-2-1  Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating  Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1  Mean Temperature of the Medium Inling the Space Thermal Resistance of the Duct/Pipe Inside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium  K/Backfill Installation  Shorter Side of the Duct Bank/Backfill  Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3  Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of Harth Around the Duct Bank/Backfill Thermal Resistivity of Harth Around the Duct Bank/Backfill Thermal Resistivity of Harth Around the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of Harth Around the Duct Bank/Backfill Thermal Resistivity of Harth Around the Duct Bank/Backfill Thermal Resistivity of Harth Around the Duct Bank/Backfill Thermal Resistivity of Harth Around the Duct Bank/Backfill Thermal Resistivity of Harth Around the Duct Bank/Backfill Thermal Resistivity of Harth A	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [C] [K.mW] [K.mW] [K.mW] [K.mW] [M] [M] [M] [M] [M] [M] [M] [M] [M] [M	0.0 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 60.8 0.22464 200.0 188.0 3.5 0.03447 0.64876 1.0 4.0 1.19983 0.962 0.80178 3.0 1.2 1.0 0.962	0.0 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 63.9 0.22049 200.0 188.0 3.5 0.03447 0.69878 0.03447 0.69878 0.03447 0.69878	0.0 0.0 0.0 0.0 29.7 3.5 0.04684 5.5 3.5 3.5 1.87 0.312 0.0037 60.7 0.22474 200.0 188.0 3.5 0.03447 200.0 188.0 3.5 0.03447 0.64926 1.0 4.0 1.19983 0.962 0.80178 3.0 1.2 1.0 0.64926
44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65           66           67           68           69           70           71           72           73	A         Pipe Lo $\lambda_2 a$ $\lambda_2 pipe$ $\lambda_2$ $\lambda_2$ <b>Deration II</b> $T_1$ $T_1$ $t_1$ $\rho$ Ti $T_3$ $\rho$ Ti $T_3$ $\rho$ Ti $T_4$ $\rho$ $\rho$ $\sigma$ $\sigma$ $\sigma$ $\sigma$ $\sigma$ $\sigma$ $\sigma$ $\sigma$ $\rho$ $\sigma$ <	Price Loss Factor           Armour Loss Factor           Pipe Loss Factor           Armour Loss Factor + Pipe Loss Factor           C 60287-2-1           Thermal Resistance Between Conductor and Screen           Insulation Thickness Between Conductor and Screen           Thermal Resistivity of Insulation           Thermal Resistivity of Insulation           Thermal Resistivity of Jacket/Pipe Coating           Thermal Resistivity of Jacket/Pipe Coating           Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1           Coefficient Used in Use 60287-2-1 Clause 2.2.7.1           Coefficient Used in Use 60287-2-1 Clause 2.2.7.1           Coefficient Used in Use 0 buct/Pipe           Inside Diameter of the Duct/Pipe           Thermal Resistance of the Duct/Pipe           Thermal Resistance of the Duct/Pipe           Thermal Resistance of the Surrounding Medium           KBackfill Installation           KBackfill Installation           Shorter Side of the Duct Bank/Backfill           Coefficient Used in IEC 60287-2-	[mm] [K.mW] [K.mW] [K.mW] [K.mW] ["C] [K.mW] [K.mW] [K.mW] [K.mW] [M] [M] [M] [M] [M] [M] [M] [M] [M] [M	0.0 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 60.8 0.22464 200.0 188.0 3.5 0.03447 0.64876 1.0 4.0 1.19983 0.962 0.80178 3.0 1.2 1.0 0.64876 0.90787 0.0	0.0 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 63.9 0.22049 200.0 188.0 3.5 0.03447 0.69878 0.03447 0.69878 1.0 1.19983 0.962 0.80178 3.0 1.2 1.0 0.962 0.80178 3.0 1.2 1.0 0.69878	0.0 0.0 0.0 0.0 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 60.7 0.22474 200.0 188.0 3.5 0.03447 200.0 188.0 3.5 0.03447 0.64926 1.0 4.0 1.19983 0.962 0.80178 3.0 1.2 1.0 0.64926 0.90847 0.0
44 46 Normal 47 48 49 50 51 52 <b>Cable in</b> 53 54 55 56 57 58 59 60 61 62 <b>Cable in</b> 63 64 63 64 65 66 67 68 66 67 68 69 70 71 72	Image like $\lambda_2 a$ $\lambda_2 pipe$ $\lambda_2$ $\lambda_2 pipe$ $\lambda_2$ <b>Operation II</b> $T_1$ $t_1$ $\rho Ti$ $T_3$ $\rho Tj$ <b>Do</b> $V'$ $V$ $PTJ$ $Do$ $Di$ $\rho T$ $T_4''$ $Do$ $Di$ $\rho T$ $T_4'''$ $T_4''''''''''''''''''''''''''''''''''''$	Armour Loss Factor  Armour Loss Factor  Pipe Loss Factor  Armour Loss Factor + Pipe Loss Factor  C 60287-2-1  Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating  Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1  Mean Temperature of the Medium Filling the Space Thermal Resistance of the Duct/Pipe Inside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium  K/Backfill installation  Shorter Side of the Duct Bank/Backfill  Equivalent Radius of Duct Bank/Backfill  Depth of Laying to the Centre of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3  Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of Harmal Resistance Total External Thermal Resistance	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [C] [K.mW] [K.mW] [K.mW] [K.mW] [M] [M] [M] [M] [M] [M] [M] [M] [M] [M	0.0 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 60.8 0.22464 200.0 188.0 3.5 0.03447 0.64876 1.0 4.0 1.19983 0.962 0.80178 3.0 1.2 1.0 0.64876 0.90787	0.0 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 63.9 0.22049 200.0 188.0 3.5 0.03447 0.69878 1.0 4.0 1.19983 0.962 0.80178 3.0 1.2 1.0 0.69878 0.30 1.2 1.0 0.69878	0.0 0.0 0.0 0.0 29.7 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037 60.7 0.22474 200.0 188.0 3.5 0.03447 200.0 188.0 3.5 0.03447 0.64926 1.0 4.0 1.19983 0.962 0.80178 3.0 1.2 1.0 0.64926 0.90847

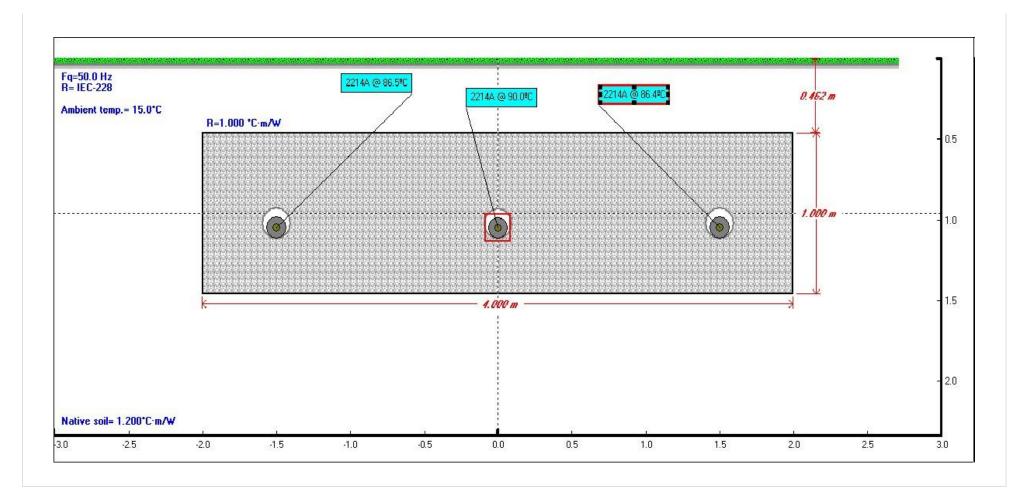
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### **Study Summary**

INTERNATIONAL T&D	
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Road Width trench (1ct 400kV CABLE)
Date:	16/01/2020 13:56:02

General Simulation Data	
Steady State Option	Equally Loaded
Consider Electrical interaction between circuits	No
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0
Conductor Resistances Computation Option:	IEC-228

Installation Type:Ductbank						
Ambient Soil Temperature at Installation Depth	[°C]	15.0				
Native Soil Thermal Resistivity	[K.m/W]	1.2				
Thermal Resistivity of Duct Bank	[K.m/W]	1.0				
Depth of Center of Duct Bank	[m]	0.96				
Duct Bank Width	[m]	4.0				
Duct Bank Height	[m]	1.0				



Results Summary										
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [m]	Y coordinate [m]	Conductor temperature [°C]	Ampacity [A]

1	400KV.011	1	A	50.0	1.0	-1.5	1.05	86.5	2213.5
2	400KV.011	1	В	50.0	1.0	0.0	1.05	90.0	2213.5
3	400KV.011	1	С	50.0	1.0	1.5	1.05	86.4	2213.5

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### Steady State Summary

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Road Width trench (1ct 400kV CABLE)
Date:	16/01/2020 13:56:02

#### **Simulation Data** Installation type: Ductbank **Steady State Option** Equally Loaded Ambient temperature [°C] 15 Native Soil Thermal Resistivity [K.m/W] 1.2 Consider Non-Isothermal Earth Surface No Consider effect of soil dry out No Consider Electrical interaction between circuits No Induced current in metallic layers as a fraction of conductor current 0 (applied to all single phase circuits)

Variable	Description	Unit		Cables	
Cable No.	Cable Index Number		1	2	3
General Input	t Data	- i i			
Cable ID	Cable Equipment ID		400KV.011	400KV.011	400KV.011
Circuit No.	Circuit No.		1	1	1
Phase	Cable Phase		A	В	С
Fq	Operating Frequency	[Hz]	50.0	50.0	50.0
x	X coordinate	[m]	-1.5	0.0	1.5
у	Y coordinate	[m]	1.05	1.05	1.05
DLF	Daily Load Factor	[p.u.]	1.0	1.0	1.0
	Bonding Type		1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat
Ampacity	•				
I	Steady State Ampacity	[A]	2213.5	2213.5	2213.5
Temperature	S				
θс	Conductor temperature	[°C]	86.5	90.0	86.4
θs	Sheath/Shield temperature	[°C]	67.5	70.8	67.4
θa	Armour temperature	[°C]	n/a	n/a	n/a
θsurf	Cable surface temperature	[°C]	64.9	68.2	64.8
θduct	Duct surface temperature	[°C]	50.5	53.9	50.5
Resistances	•				
R <sub>0</sub>	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
R	AC Resistance of the Conductor at Operating Temperature	[Ω/km]	0.01009	0.01018	0.01009
ys	Skin Effect Factor		0.11128	0.1091	0.11134
ур	Proximity Effect Factor		0.00026	0.00026	0.00026
Losses	1			I	I
Wc	Conductor Losses	[W/m]	49.4631	49.90372	49.44967
Wd	Dielectric Losses	[W/m]	4.00936	4.00936	4.00936
Ws	Metallic Screen Losses	[W/m]	1.30942	1.721	1.18454
Wa	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
Wt	Total Losses	[W/m]	54.78187	55.63408	54.64357
λı	Screen Loss Factor		0.02647	0.03449	0.02395
λ <sub>2</sub>	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
Thermal resis	stances	_ <b>_</b> I		L	l
T1	Thermal resistance of insulation	[K.m/W]	0.36997	0.36997	0.36997
T2	Thermal resistance of bedding/medium inside pipe-type	[K.m/W]	n/a	n/a	n/a
T3	Thermal resistance of outer covering	[K.m/W]	0.04684	0.04684	0.04684
T4	External thermal resistance	[K.m/W]	0.91089	0.95614	0.9115
Others	1	[]			
Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
Lonit	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
	Induced current on Metallic Screen	[V/RII] [A]	139.5	133.5	131.5

## 

### **Cables Report**

	CYMCAP Version	7.3 Revision 2
	Study:	Eirgrid Cp966 Feasibility study
	Execution:	Eirgrid - Road Width trench (1ct 400kV CABLE)
	Date:	16/01/2020 13:56:02

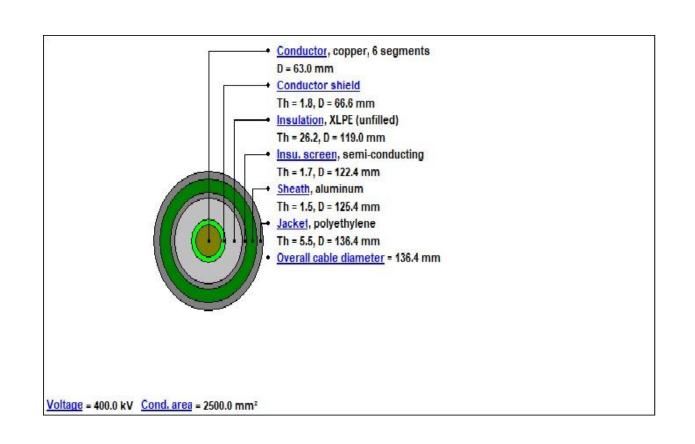
No.	Description	Unit	1
-	eral Cable Information		
1	Cable Equipment ID		400KV.011
2	Number of Cores		Single Core
3	Voltage	[kV]	400
4	Conductor Area	[mm²]	2500.0
5	Cable Overall Diameter	[mm]	136.4
6	Maximum Steady-State Conductor Temperature	1901	90
7	Maximum Emergency Conductor Temperature	[°C]	110
	ductor	[0]	110
8	Material		Copper
9	Electrical Resistivity at 20°C	[μΩ.cm]	1.7241
10	Temperature Coefficient at 20°C	[1/K]	0.00393
11	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
12	Volumetric Specific Heat (SH)	[J/(K*cm <sup>3</sup> )]	3.45
13	Construction		6 Segments
14	Conductor Insulation System		Extruded
15	Milliken Wires Construction		Insulated Wires
16	Ks (Skin Effect Coefficient)		0.35
17	Kp (Proximity Effect Coefficient)		0.2
18	Diameter	[mm]	63.0
Con	ductor Shield		
19	Thickness	[mm]	1.8
20	Diameter	[mm]	66.6
Insu	llation		
21	Material		XLPE Unfilled
22	Thermal Resistivity	[K.m/W]	3.5
23	Dielectric Loss Factor - ( tan delta )		0.001
24	Relative Permittivity - ( epsilon )		2.5
25	Specific Insulation Resistance Constant at $60^\circ$ F - ( K )	[MΩ.km]	65617.
26	Thickness	[mm]	26.2
27	Diameter	[mm]	119.0
Insu	Ilation Screen		
28	Material		Semi Conducting Screen
29	Thickness	[mm]	1.7
30	Diameter	[mm]	122.4
She			
31	Is Sheath Around Each Core?		n/a
32	Material		Aluminum
33	Electrical Resistivity at 20°C Temperature Coefficient at 20°C	[μΩ.cm]	2.84
34		[1/K]	0.00403
35	Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH)	[K]	228
36	Corrugation Type	[J/(K*cm³)]	2.5
37	Thickness	[mm]	Non Corrugated
38 39	Diameter	[mm]	1.5
Jacl		[mm]	120.4
40	Material		Polyethylene
40	Thermal Resistivity	[K.m/W]	3.5
41	Thickness	[mm]	5.5
43	Diameter	[mm]	136.4
+5		[]	150.4

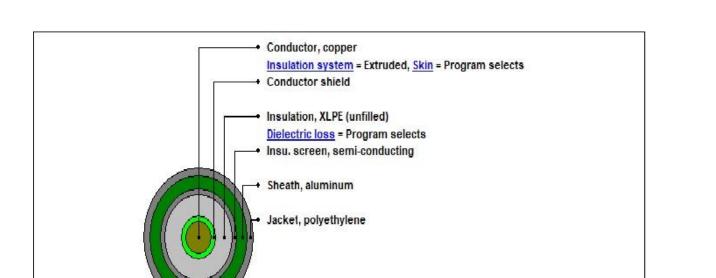
No.	Description	Unit	1				
Spe	Specific Installation Data						
44	Cable Equipment ID		400KV.011				
45	Cable Frequency	[Hz]	50				
46	Sheath / Shield Bonding		1 Conductor Crossbonded Flat				
47	Loss Factor Constant (ALOS)		0.3				
48	Minor section length		Crossbonded Unknown Section Lengths UNKNOWN				
49	Duct construction		Polyethylene in Concrete				
50	Duct material thermal resistivity	[K.m/W]	3.5				
51	Inside Diameter of the Duct/Pipe	[mm]	188.0				
52	Outside Diameter of the Duct/Pipe	[mm]	200.0				

#### Cable ID : 400KV.011

Cable Title

tle 2500sqmm Cu (insulated wires)\_XLPE\_CAS\_PE NKT for Eirgrid







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## **Electrical Parameters**

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Road Width trench (1ct 400kV CABLE)
Date:	16/01/2020 13:56:02

No.	Description	Unit	Cable No.1	Cable No.2	Cable No.3		
1	Cable Equipment ID		400KV.011	400KV.011	400KV.011		
Resi	Resistances						
2	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072		
3	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00908	0.00918	0.00908		
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.00841	0.00841	0.00841		
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01009	0.01018	0.01009		
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.04864	0.04864	0.04864		
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.05795	0.0586	0.05793		
Loss	es						
8	Conductor Losses	[W/m]	49.4631	49.90372	49.44967		
9	Dielectric Losses	[W/m]	4.00936	4.00936	4.00936		
10	Metallic Screen Losses	[W/m]	1.30942	1.721	1.18454		
11	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0		
12	Total Losses	[W/m]	54.78187	55.63408	54.64357		
Сара	acitance, Inductance, Impedance	_					
13	Capacitance	[µF/km]	0.239	0.239	0.239		
14	Inductance of Conductor	[mH/km]	0.82265	0.82265	0.82265		
15	Reactance of Conductor	[Ω/km]	0.25844	0.25844	0.25844		
16	Inductance of Metallic Sheath	[mH/km]	0.63738	0.63738	0.63738		
17	Reactance of Metallic Sheath	[Ω/km]	0.20024	0.20024	0.20024		
18	Positive Sequence Impedance	[Ω/km]	0.010090 + j0.258440	0.010180 + j0.258440	0.010090 + j0.258440		
19	Negative Sequence Impedance	[Ω/km]	0.010090 + j0.258440	0.010180 + j0.258440	0.010090 + j0.258440		
20	Zero Sequence Impedance	[Ω/km]	0.056640 + j0.200240	0.056630 + j0.200240	0.056640 + j0.200240		
21	Surge Impedance	[Ω]	58.63321	58.63321	58.63321		
Othe	rs						
22	Dielectric Stress at Conductor Surface	[kV/mm]	11.94851	11.94851	11.94851		
23	Dielectric Stress at Insulation Surface	[kV/mm]	6.68715	6.68715	6.68715		
24	Insulation Resistance at 60°F (15.8°C)	[MΩ.km]	16540.20553	16540.20553	16540.20553		
25	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a		
26	Charging Current for One Phase	[A/km]	17.36102	17.36102	17.36102		
27	Charging Capacity of three phase system at Uo	[kvar/km]	12028.06597	12028.06597	12028.06597		
28	Voltage drop for Three Phase System	[V/A/km]	0.01748	0.01764	0.01748		
29	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0		
30	Induced current on Metallic Screen	[A]	139.5	133.5	131.5		

	Cable Parameters under Normal Operation		
CYMCAP Version	7.3 Revision 2		
Study:	Eirgrid Cp966 Feasibility study		
Execution:	Eirgrid - Road Width trench (1ct 400kV CABLE)		
Date:	16/01/2020 13:56:02		

No.	Symbol	Description	Unit	Cable No.1	Cable No.2	Cable No.3
1 Normal	Operation IE(	Cable Equipment ID		400KV.011	400KV.011	400KV.011
	Operation IE					
	1	DC Resistance of the conductor at 20°C	[Q//m]	0.0072	0.0072	0.0072
2	R <sub>0</sub>	DC Resistance of Conductor at 20°C	[Ω/km] [Ω/km]	0.0072	0.0072	0.0072
4	dc	Conductor Diameter	[mm]	63.0	63.0	63.0
5	s	Distance Between Conductor Axes	[mm]	1500.0	1500.0	1500.0
6	ks	Factor Used for xs Calculation (Skin Effect)		0.35	0.35	0.35
7	kp xs	Factor Used for xp Calculation (Proximity Effect) Component of Ys Calculation (Skin Effect)		0.2	0.2	0.2
9	хр	Component of Yp Calculation (Proximity Effect)		1.66353	1.65454	1.6638
10	ys	Skin Effect Factor		0.11128	0.1091	0.11134
11	ур	Proximity Effect Factor		0.00026	0.00026	0.00026
12	R	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01009	0.01018	0.01009
Dielectr	ic Losses		1	1	1	
13	tanõ	Dielectric Loss Factor		0.001	0.001	0.001
14	3	Insulation Relative Permitivity		2.5	2.5	2.5
15	с	Cable Capacitance	[µF/km]	0.239	0.239	0.239
16	Uo	Voltage	[kV]	230.94011	230.94011	230.94011
17	Wd	Cable Dielectric Losses Per Phase	[W/m]	4.00936	4.00936	4.00936
Circulat	ing Loss Fac	tor				
18	Rs	AC Resistance used for Circulating Loss Factor computation	[Ω/km]	0.05795	0.0586	0.05793
10	110		[۱۱۱/۱۹۲	3.00790	0.0000	3.001 83
19	d	Mean diameter used for Circulating Loss Factor computation	[mm]	123.9	123.9	123.9
			101			
20 21	X Xm	Reactance used for Circulating Loss Factor computation Mutual Reactance	[Ω/km] [Ω/km]	0.20024	0.20024	0.20024
21	7111		[۱۱۱/۱۹۲	0.04000	0.04000	0.04000
22	Р	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.24379	0.24379	0.24379
23	Q	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.18572	0.18572	0.18572
24	Fspacing	Spacing Factor (applied when spacing between cable uneven or non- equal minor section length)		0.004	0.004	0.004
25	λ'1	Screen Loss Factor Caused by Circulating Current		0.02281	0.02093	0.02026
Eddy Lo	oss Factor		1	1	[	F
26	Rs	AC Resistance used for Eddy Loss Factor computation	[Ω/km]	0.05795	0.0586	0.05793
27	d	Mean diameter used for Eddy Loss Factor computation	[mm]	123.9	123.9	123.9
28	ρs	Electrical Resistivity used for Eddy Loss Factor computation	[Ω.m]	0.0	0.0	0.0
29	Ds	External diameter used for Eddy Loss Factor computation	[mm]	125.4	125.4	125.4
30	ts	Thickness used for Eddy Loss Factor computation	[mm]	1.5	1.5	1.5
31 32	β <sub>1</sub> gs	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		108.02153 1.0054	107.41766 1.00537	108.04011 1.0054
34	m	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.54215	0.53611	0.54234
35	λ <sub>o</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.00058	0.00228	0.00058
36	$\Delta_1$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		-0.00494	0.00124	0.00396
37	Δ <sub>2</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.00003	0.0	0.0
38	F	Milliken conductor Effect		1.0	1.0	1.0
39 40	Fpipe Farmour	Magnetic effect factor due to pipe Magnetic effect factor due to armour		1.0	1.0	1.0
41	λ" <sub>1</sub>	Screen Loss Factor Caused by Eddy Current		0.00367	0.01356	0.0037
Metallic	Screen Loss					
42	λ <sub>1</sub>	Screen Loss Factor		0.02647	0.03449	0.02395
	and Pipe Los		1	1	1	1
43	λ₂a 1.eine	Armour Loss Factor		0.0	0.0	0.0
44	λ <sub>2</sub> pipe λ <sub>2</sub>	Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
-	Operation IE					
47	T1	Thermal Resistance Between Conductor and Screen	[K.m/W]	0.36997	0.36997	0.36997
48	t1	Insulation Thickness Between Conductor and Screen	[mm]	29.7	29.7	29.7
49	ρΤι	Thermal Resistivity of Insulation	[K.m/W]	3.5	3.5	3.5
50 51	T <sub>3</sub>	Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating	[K.m/W] [mm]	0.04684	0.04684	0.04684
51	ι <sub>3</sub> ρΤJ	Thermal Resistivity of Jacket/Pipe Coating	[K.m/W]	3.5	3.5	3.5
	Ducts					
53	U	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		1.87	1.87	1.87
54	v	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		0.312	0.312	0.312
55	Y	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	10.03	0.0037	0.0037	0.0037
56	θm	Mean Temperature of the Medium Filling the Space	[°C]	58.7	62.0	58.6
57	T₄'	Thermal Resistance of the Medium Inside the Duct/Pipe	[K.m/W]	0.22759	0.22304	0.2277
58	Do	Outside Diameter of the Duct/Pipe	[mm]	200.0	200.0	200.0
59	Di	Inside Diameter of the Duct/Pipe	[mm]	188.0	188.0	188.0
60	ρΤ Τ."	Thermal Resistivity of the Duct/Pipe Material	[K.m/W]	3.5	3.5	3.5
61 62	T4" T4"	Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium	[K.m/W] [K.m/W]	0.03447	0.03447	0.03447
		/Backfill installation	[CARTAN]	0.04000	5.03004	0.04000
63	x	Shorter Side of the Duct Bank/Backfill	[m]	1.0	1.0	1.0
64	у	Longer Side of the Duct Bank/Backfill	[m]	4.0	4.0	4.0
65	rb	Equivalent Radius of Duct Bank/Backfill	[m]	1.19983	1.19983	1.19983
66	LG	Depth of Laying to the Centre of Duct Bank/Backfill	[m]	0.962	0.962	0.962
67 68	u N	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill		0.80178	0.80178	0.80178
30				0.0	0.0	0.0
69	ре	Thermal Resistivity of Earth Around the Duct Bank/Backfill	[K.m/W]	1.2	1.2	1.2
70	ρς	Thermal Resistivity of the Duct Bank/Backfill	[K.m/W]	1.0	1.0	1.0
71	T₄'''	Thermal Resistance of the Surrounding Medium	[K.m/W]	0.64883	0.69864	0.64933
72	T4	Total External Thermal Resistance	[K.m/W]	0.91089	0.95614	0.9115
73	Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
74	I	Cable Core Current Ampacity	[A]	2213.5	2213.5	2213.5
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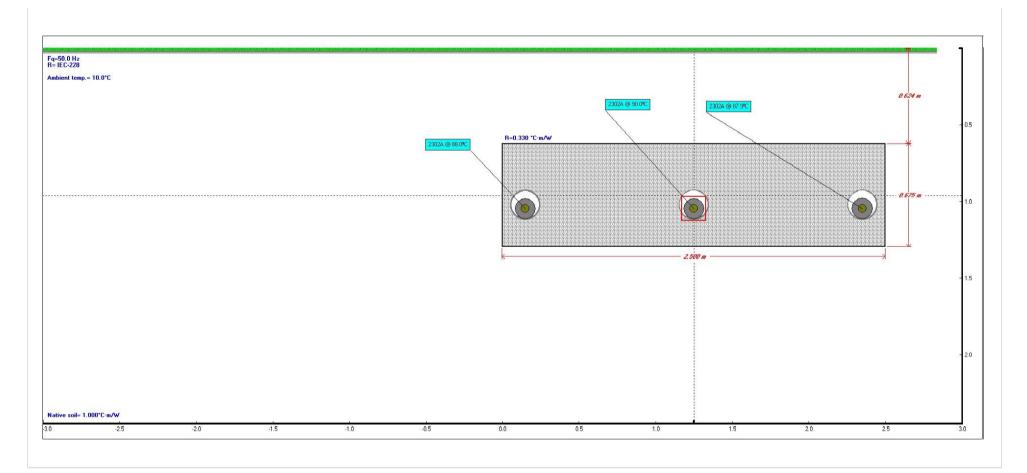
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### Study Summary

INTERNATIONAL T&D	
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 400kV CABLE) v2
Date:	18/03/2020 11:18:58

General Simulation Data			
Steady State Option	Equally Loaded		
Consider Electrical interaction between circuits	No		
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0		
Conductor Resistances Computation Option:	IEC-228		

Installation Type:Ductbank				
Ambient Soil Temperature at Installation Depth	[°C]	10.0		
Native Soil Thermal Resistivity	[K.m/W]	1.0		
Thermal Resistivity of Duct Bank	[K.m/W]	0.3		
Depth of Center of Duct Bank	[m]	0.96		
Duct Bank Width	[m]	2.5		
Duct Bank Height	[m]	0.68		



Results Summary										
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [m]	Y coordinate [m]	temperature [°C]	Ampacity [A]
1	400KV.010	1		А	50.0	1.0	0.15	1.05	88.0	2302.2
2	400KV.010	1		В	50.0	1.0	1.25	1.05	90.0	2302.2
3	400KV.010	1		С	50.0	1.0	2.35	1.05	87.9	2302.2

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## Steady State Summary

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 400kV CABLE) v2
Date:	18/03/2020 11:18:58

Simulation Data				
Installation type:	Ductbank			
Steady State Option	Equally Loaded			
Ambient temperature [°C]	10			
Native Soil Thermal Resistivity [K.m/W]	1.0			
Consider Non-Isothermal Earth Surface	No			
Consider effect of soil dry out	No			
Consider Electrical interaction between circuits	No			
Induced current in metallic layers as a fraction of conductor current (applied to all single phase circuits)	0			

Variable	Description	Unit		Cables	
Cable No.	Cable Index Number		1	2	3
General Input	t Data			1	
Cable ID	Cable Equipment ID		400KV.010	400KV.010	400KV.010
Circuit No.	Circuit No.		1	1	1
Phase	Cable Phase		A	В	С
Fq	Operating Frequency	[Hz]	50.0	50.0	50.0
х	X coordinate	[m]	0.15	1.25	2.35
У	Y coordinate	[m]	1.05	1.05	1.05
DLF	Daily Load Factor	[p.u.]	1.0	1.0	1.0
	Bonding Type		1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat
mpacity		· · ·			
I	Steady State Ampacity	[A]	2302.2	2302.2	2302.2
emperature	S				
θс	Conductor temperature	[°C]	88.0	90.0	87.9
θs	Sheath/Shield temperature	[°C]	64.1	66.0	64.0
θa	Armour temperature	[°C]	n/a	n/a	n/a
θsurf	Cable surface temperature	[°C]	60.9	62.8	60.9
θduct	Duct surface temperature	[°C]	42.5	44.2	42.5
Resistances					
$R_0$	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
R	AC Resistance of the Conductor at Operating Temperature	[Ω/km]	0.01181	0.01186	0.01181
ys	Skin Effect Factor		0.29301	0.29022	0.29312
ур	Proximity Effect Factor		0.00121	0.0012	0.00121
.osses					
Wc	Conductor Losses	[W/m]	62.58874	62.839	62.57941
Wd	Dielectric Losses	[W/m]	4.00936	4.00936	4.00936
Ws	Metallic Screen Losses	[W/m]	1.55628	2.44998	1.40382
Wa	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
Wt	Total Losses	[W/m]	68.15438	69.29833	67.99259
λ <sub>1</sub>	Screen Loss Factor		0.02487	0.03899	0.02243
λ2	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
hermal resis	stances				
T1	Thermal resistance of insulation	[K.m/W]	0.36997	0.36997	0.36997
T2	Thermal resistance of bedding/medium inside pipe-type	[K.m/W]	n/a	n/a	n/a
Т3	Thermal resistance of outer covering	[K.m/W]	0.04684	0.04684	0.04684
T4	External thermal resistance	[K.m/W]	0.74712	0.76143	0.74799
Others					
Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
	Induced current on Metallic Screen	[A]	145.0	137.6	135.2

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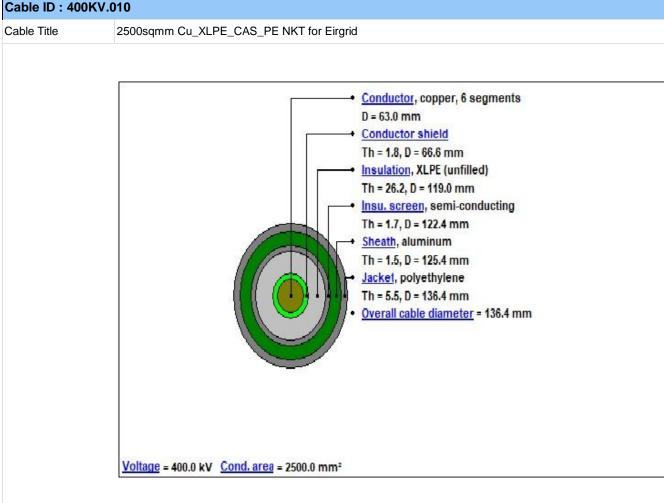
## **Cables Report**

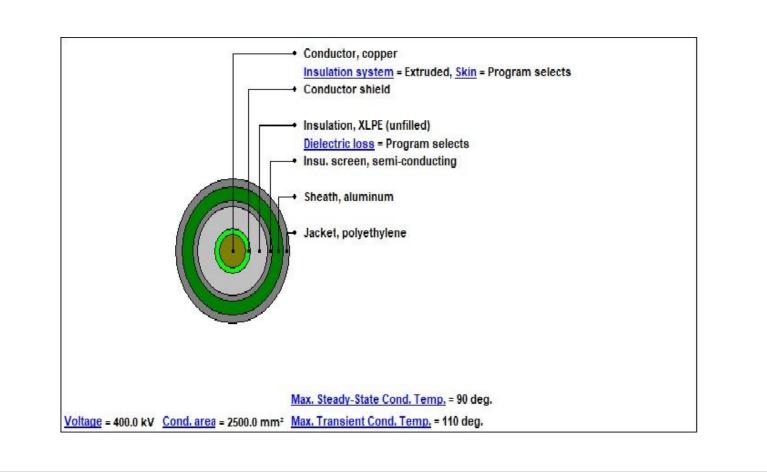
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 400kV CABLE) v2
Date:	18/03/2020 11:18:58

No.	Description	Unit	1					
Gen	eral Cable Information							
1	Cable Equipment ID		400KV.010					
2	Number of Cores		Single Core					
3	Voltage	[kV]	400					
4	Conductor Area	[mm²]	2500.0					
5	Cable Overall Diameter	[mm]	136.4					
6	Maximum Steady-State Conductor Temperature	[°C]	90					
7	Maximum Emergency Conductor Temperature	[°C]	110					
Con	ductor	<u> </u>						
8	Material		Copper					
9	Electrical Resistivity at 20°C	[μΩ.cm]	1.7241					
10	Temperature Coefficient at 20°C	[1/K]	0.00393					
11	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5					
12	Volumetric Specific Heat (SH)	[J/(K*cm <sup>3</sup> )]	3.45					
13	Construction		6 Segments					
14	Conductor Insulation System		Extruded					
15	Milliken Wires Construction		Bare Unidirectional Wires					
16	Ks (Skin Effect Coefficient)		0.62					
17	Kp (Proximity Effect Coefficient)		0.37					
18	Diameter	[mm]	63.0					
Con	ductor Shield							
19	Thickness	[mm]	1.8					
20	Diameter	[mm]	66.6					
	lation	[]						
21	Material		XLPE Unfilled					
22	Thermal Resistivity	[K.m/W]	3.5					
23	Dielectric Loss Factor - ( tan delta )	[	0.001					
24	Relative Permittivity - ( epsilon )		2.5					
25	Specific Insulation Resistance Constant at 60°F - ( K )	[MΩ.km]	65617.					
26	Thickness	[mm]	26.2					
20	Diameter	[mm]	119.0					
	lation Screen	[11111]	113.0					
28	Material		Semi Conducting Screen					
20	Thickness	[mm]	1.7					
30	Diameter	[mm]	1.7					
Shea		[mm]	122.4					
31	Is Sheath Around Each Core?		n/a					
-	Material							
32	Electrical Resistivity at 20°C	[uO am]	Aluminum					
33	Temperature Coefficient at 20°C	[μΩ.cm]	2.84					
34	Reciprocal of Temperature Coefficient of Resistance	[1/K]	0.00403					
35	(BETA) Volumetric Specific Heat (SH)	[K]	228					
36	Corrugation Type	[J/(K*cm <sup>3</sup> )]	2.5					
37	Thickness		Non Corrugated					
38	Diameter	[mm]	1.5					
39		[mm]	125.4					
	Jacket							
40	Material		Polyethylene					
41	Thermal Resistivity	[K.m/W]	3.5					
42	Thickness	[mm]	5.5					
43	Diameter	[mm]	136.4					

No.	Description	Unit	1					
Spe	Specific Installation Data							
44	Cable Equipment ID		400KV.010					
45	Cable Frequency	[Hz]	50					
46	Sheath / Shield Bonding		1 Conductor Crossbonded Flat					
47	Loss Factor Constant (ALOS)		0.3					
48	Minor section length		Crossbonded Unknown Section Lengths UNKNOWN					
49	Duct construction		Polyethylene in Concrete					
50	Duct material thermal resistivity	[K.m/W]	3.5					
51	Inside Diameter of the Duct/Pipe	[mm]	188.0					
52	Outside Diameter of the Duct/Pipe	[mm]	200.0					

### Cable ID : 400KV.010





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CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 400kV CABLE) v2
Date:	18/03/2020 11:18:58

No.	Description	Unit	Cable No.1	Cable No.2	Cable No.3			
1	Cable Equipment ID		400KV.010	400KV.010	400KV.010			
Resistances								
2	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072			
3	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00912	0.00918	0.00912			
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.0102	0.0102	0.0102			
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01181	0.01186	0.01181			
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.04864	0.04864	0.04864			
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.05729	0.05766	0.05727			
Loss	ses							
8	Conductor Losses	[W/m]	62.58874	62.839	62.57941			
9	Dielectric Losses	[W/m]	4.00936	4.00936	4.00936			
10	Metallic Screen Losses	[W/m]	1.55628	2.44998	1.40382			
11	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0			
12	Total Losses	[W/m]	68.15438	69.29833	67.99259			
Capa	acitance, Inductance, Impedance							
13	Capacitance	[µF/km]	0.239	0.239	0.239			
14	Inductance of Conductor	[mH/km]	0.76062	0.76062	0.76062			
15	Reactance of Conductor	[Ω/km]	0.23895	0.23895	0.23895			
16	Inductance of Metallic Sheath	[mH/km]	0.57535	0.57535	0.57535			
17	Reactance of Metallic Sheath	[Ω/km]	0.18075	0.18075	0.18075			
18	Positive Sequence Impedance	[Ω/km]	0.011810 + j0.238950	0.011860 + j0.238950	0.011810 + j0.238950			
19	Negative Sequence Impedance	[Ω/km]	0.011810 + j0.238950	0.011860 + j0.238950	0.011810 + j0.238950			
20	Zero Sequence Impedance	[Ω/km]	0.057950 + j0.180750	0.057930 + j0.180750	0.057950 + j0.180750			
21	Surge Impedance	[Ω]	56.37929	56.37929	56.37929			
Othe		I	I					
22	Dielectric Stress at Conductor Surface	[kV/mm]	11.94851	11.94851	11.94851			
23	Dielectric Stress at Insulation Surface	[kV/mm]	6.68715	6.68715	6.68715			
24	Insulation Resistance at 60°F (15.8°C)	[MΩ.km]	16540.20553	16540.20553	16540.20553			
25	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a			
26	Charging Current for One Phase	[A/km]	17.36102	17.36102	17.36102			
27	Charging Capacity of three phase system at Uo	[kvar/km]	12028.06597	12028.06597	12028.06597			
28	Voltage drop for Three Phase System	[V/A/km]	0.02045	0.02054	0.02045			
29	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0			
30	Induced current on Metallic Screen	[A]	145.0	137.6	135.2			

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Cable Parameters under Normal Operation

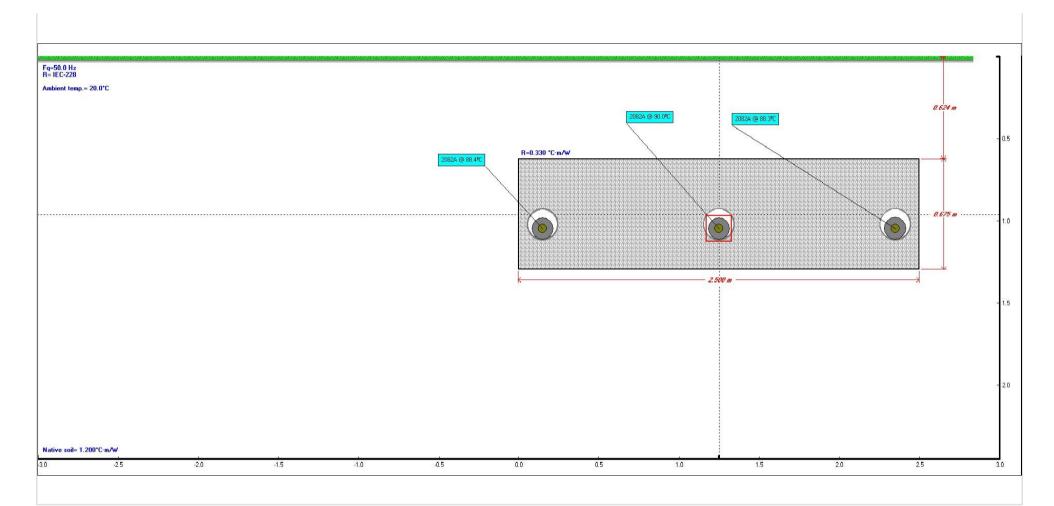
(	CYMCAP Version	7.3 Revision 2
\$	Study:	Eirgrid Cp966 Feasibility study
I	Execution:	Eirgrid - WIDE trench (1ct 400kV CABLE) v2
I	Date:	18/03/2020 11:18:58

No.	Symbol	Description	Unit	Cable No.1	Cable No.2	Cable No.3
1	Cynisor	Cable Equipment ID		400KV.010	400KV.010	400KV.010
Normal	Operation IE	C 60287-1-1				
Conduc	tor AC Resis	itance	[			
2	R <sub>0</sub>	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	R' dc	DC Resistance of Conductor at Operating Temperature Conductor Diameter	[Ω/km] [mm]	0.00912 63.0	0.00918 63.0	0.00912 63.0
5	s	Distance Between Conductor Axes	[mm]	1099.99995	1099.99995	1099.99995
6	ks	Factor Used for xs Calculation (Skin Effect)		0.62	0.62	0.62
7	kp	Factor Used for xp Calculation (Proximity Effect)		0.37	0.37	0.37
8	xs	Component of Ys Calculation (Skin Effect)		2.92212	2.91314	2.92246
9	хр	Component of Yp Calculation (Proximity Effect)		2.25737	2.25043	2.25763
10	ys	Skin Effect Factor		0.29301	0.29022	0.29312
11 12	yp R	Proximity Effect Factor AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00121	0.0012	0.00121
	ic Losses		[12/1011]	0.01101	0.01100	
13	tanδ	Dielectric Loss Factor		0.001	0.001	0.001
14	ε	Insulation Relative Permitivity		2.5	2.5	2.5
15	С	Cable Capacitance	[µF/km]	0.239	0.239	0.239
16 17	U₀ Wd	Voltage Cable Dielectric Losses Per Phase	[kV] [W/m]	230.94011 4.00936	230.94011 4.00936	230.94011 4.00936
-	ing Loss Fac		[vv/m]	4.00936	4.00936	4.00936
18	Rs	AC Resistance used for Circulating Loss Factor computation	[Ω/km]	0.05729	0.05766	0.05727
19	d	Mean diameter used for Circulating Loss Factor computation	[mm]	123.9	123.9	123.9
20	х	Reactance used for Circulating Loss Factor computation	[Ω/km]	0.18075	0.18075	0.18075
21	Xm		[Ω/km]	0.04355	0.04355	0.04355
22 23	P	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.2243	0.2243	0.2243
23	Q	Component for Circulating Loss Factor Formula (Clause 2.3.3) Spacing Factor (applied when spacing between cable uneven or non-	[Ω/km]	0.16623	0.16623	0.16623
24	Fspacing	equal minor section length)		0.004	0.004	0.004
25	λ' <sub>1</sub>	Screen Loss Factor Caused by Circulating Current		0.01926	0.01736	0.01674
	ss Factor	AC Desistance used for Edital and Easter computation	[Q//m]	0.05720	0.05766	0.05707
26 27	Rs d	AC Resistance used for Eddy Loss Factor computation Mean diameter used for Eddy Loss Factor computation	[Ω/km] [mm]	0.05729	0.05766	0.05727
28	ρs	Electrical Resistivity used for Eddy Loss Factor computation	[Ω.m]	0.0	0.0	0.0
29	Ds	External diameter used for Eddy Loss Factor computation	[mm]	125.4	125.4	125.4
30	ts	Thickness used for Eddy Loss Factor computation	[mm]	1.5	1.5	1.5
31	β1	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		108.63994	108.28869	108.6531
32	gs	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		1.00544	1.00542	1.00544
34 35	m	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.54838	0.54484	0.54851
36	$\lambda_0$ $\Delta_1$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		-0.00788	0.00430	0.00761
37	Δ <sub>2</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.00007	0.0	0.0
38	F	Milliken conductor Effect		1.0	1.0	1.0
38 39	F Fpipe	Milliken conductor Effect Magnetic effect factor due to pipe		1.0 1.0	1.0 1.0	1.0 1.0
39 40 41	Fpipe Farmour λ"1	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current		1.0	1.0	1.0
39 40 41 Metallic	Fpipe Farmour λ"1 Screen Loss	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current s factor		1.0 1.0 0.00561	1.0 1.0 0.02162	1.0 1.0 0.00569
39 40 41 <b>Metallic</b> 42	Fpipe Farmour λ"1	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current s factor Screen Loss Factor		1.0 1.0	1.0 1.0	1.0 1.0
39 40 41 <b>Metallic</b> 42	Fpipe Farmour $\lambda$ " <sub>1</sub> Screen Loss $\lambda_1$	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current s factor Screen Loss Factor		1.0 1.0 0.00561	1.0 1.0 0.02162	1.0 1.0 0.00569
39 40 41 <b>Metallic</b> 42 <b>Armour</b>	Fpipe           Farmour           λ"1           Screen Loss           λ1           and Pipe Loss	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>s factor</b> Screen Loss Factor <b>ss Factor</b>		1.0 1.0 0.00561 0.02487	1.0 1.0 0.02162 0.03899	1.0 1.0 0.00569 0.02243
39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43 44	Fpipe Farmour $\lambda$ " <sub>1</sub> Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ a $\lambda_2$ pipe $\lambda_2$	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>5 factor</b> Screen Loss Factor <b>5 Factor</b> <b>5 Factor</b> Armour Loss Factor Pipe Loss Factor + Pipe Loss Factor		1.0 1.0 0.00561 0.02487	1.0 1.0 0.02162 0.03899	1.0 1.0 0.00569 0.02243
39 40 41 Metallic 42 Armour 43 44 46 Normal 0	Fpipe Farmour $\lambda_{1}^{*}$ Screen Loss $\lambda_{1}$ and Pipe Los $\lambda_{2}a$ $\lambda_{2}pipe$ $\lambda_{2}$ Operation IE	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current s factor Screen Loss Factor Screen Loss Factor Sas Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-2-1		1.0 1.0 0.00561 0.02487 0.0 0.0 0.0	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0
39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43 44	Fpipe Farmour $\lambda''_1$ Screen Loss $\lambda_1$ and Pipe Los $\lambda_2a$ $\lambda_2pipe$ $\lambda_2$ Operation IEC $T_1$	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>5 factor</b> Screen Loss Factor <b>5 Factor</b> <b>5 Factor</b> Armour Loss Factor Pipe Loss Factor + Pipe Loss Factor	[K.m/W]	1.0 1.0 0.00561 0.02487 0.0 0.0	1.0 1.0 0.02162 0.03899 0.0 0.0	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0
39 40 41 Metallic 42 Armour 43 44 46 Normal 47	Fpipe Farmour $\lambda_{1}^{*}$ Screen Loss $\lambda_{1}$ and Pipe Los $\lambda_{2}a$ $\lambda_{2}pipe$ $\lambda_{2}$ Operation IE	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>s factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Pipe Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen		1.0 1.0 0.00561 0.02487 0.0 0.0 0.0 0.0 0.0 0.36997	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.0 0.0 0.0 0.0	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
39 40 41 Metallic 42 Armour 43 44 46 Normal 47 48	Fpipe Farmour $\lambda_{1}^{*}$ Screen Loss $\lambda_{1}$ and Pipe Los $\lambda_{2}a$ $\lambda_{2}pipe$ $\lambda_{2}$ Operation IE $T_{1}$ $t_{1}$	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current s factor Screen Loss Factor Screen Loss Factor Streen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen	[mm]	1.0 1.0 0.00561 0.02487 0.0 0.0 0.0 0.0 0.0 0.0 0.36997 29.7	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.0 0.0 0.36997 29.7	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.0 0.0 0.0 0.36997 29.7
39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43 44 46 <b>Normal</b> 0 47 48 49	Fpipe Farmour $\lambda$ " <sub>1</sub> Screen Loss $\lambda_1$ and Pipe Los $\lambda_2 a$ $\lambda_2 pipe$ $\lambda_2$ Operation IEC $T_1$ $t_1$ $\rho$ Ti	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>s factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation	[mm] [K.m/W]	1.0 1.0 0.00561 0.02487 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43 44 46 <b>Normal</b> 47 48 49 50 51 52	Fpipe Farmour $\lambda$ ", Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ a $\lambda_2$ pipe $\lambda_2$ Operation IE T <sub>1</sub> t <sub>1</sub> $\rho$ Ti T <sub>3</sub> t <sub>3</sub> $\rho$ TJ	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>5 factor</b> Screen Loss Factor Screen Loss Factor Stromer Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W]	1.0 1.0 0.00561 0.02487 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43 44 46 <b>Normal</b> 47 48 49 50 51 52 <b>Cable in</b>	Fpipe Farmour $\lambda^n_1$ Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ $\lambda_2$ $\rho_{pipe}$ $\lambda_2$ Operation IE $T_1$ $t_1$ $c_1$ $c_1$ $c_2$ $T_1$ $c_3$ $c_4$ $c_5$ $c_6$ $c_7$	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>s factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W] [mm]	1.0 1.0 0.00561 0.02487 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5
39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43 44 46 <b>Normal</b> 47 48 49 50 51 52	Fpipe Farmour $\lambda$ ", Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ a $\lambda_2$ pipe $\lambda_2$ Operation IE T <sub>1</sub> t <sub>1</sub> $\rho$ Ti T <sub>3</sub> t <sub>3</sub> $\rho$ TJ	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>5 factor</b> Screen Loss Factor <b>5 Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W] [mm]	1.0 1.0 0.00561 0.02487 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 0.0569 0.02243 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43 44 46 <b>Normal</b> 47 48 49 50 51 52 <b>Cable in</b> 53	Fpipe Farmour $\lambda_{1}^{*}$ Screen Loss $\lambda_{1}$ and Pipe Los $\lambda_{2}a$ $\lambda_{2}pipe$ $\lambda_{2}$ Operation IE $T_{1}$ $t_{1}$ $\rho$ Ti $T_{3}$ $t_{3}$ $\rho$ TJ Ducts U	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>s factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm]	1.0 1.0 0.00561 0.02487 0.0 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5
39           40           41           Metallic           42           Armour           43           44           46           Normal 0           47           48           49           50           51           52           Cable in           53           54	Fpipe Farmour $\lambda_{1}^{*}$ Screen Loss $\lambda_{1}$ and Pipe Los $\lambda_{2}$ $\lambda_{2}$ $\rho$ $\rho$ $\rho$ $\Gamma_{1}$ $t_{1}$ $\rho$ Ti $T_{3}$ $t_{3}$ $\rho$ TJ Ducts U V	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>s factor</b> Screen Loss Factor Screen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm]	1.0 1.0 0.00561 0.02487 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 1.87 0.312	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
39           40           41           Metallic           42           Armour           43           44           46           Normal 0           47           48           49           50           51           52           Cable in           53           54           55	Fpipe Farmour $\lambda$ "1 Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ and Pipe Los $\lambda_2$ Operation IE T1 t1 $\rho$ Ti T3 t3 $\rho$ TJ Ducts U V Y	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>s factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm] [K.m/W]	1.0 1.0 0.00561 0.02487 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 1.87 0.312 0.0037
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58	Fpipe Farmour $\lambda^n_1$ Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ $\lambda_2$ Depration IE $\lambda_2$ Operation IE $T_1$ $t_1$ $\rho_Ti$ $T_3$ $t_3$ $\rho_TJ$ Ducts U V Y $\theta$ m $T_4'$ Do	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>s factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 0287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thirmal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [°C] [K.m/W] [mm]	1.0 1.0 0.00561 0.02487 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43 44 46 47 48 49 50 51 52 <b>Cable in</b> 53 54 55 56 57 58 57 58 57	Fpipe Farmour $\lambda^n_1$ Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ $\lambda_2$ Deration IE $\lambda_2$ Operation IE $T_1$ $t_1$ $\rho_Ti$ $T_3$ $t_3$ $\rho_TJ$ U U V V $\gamma$ $\theta_m$ $T_4'$ Do	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>s factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [%C] [%C] [K.m/W] [mm] [mm]	1.0 1.0 0.00561 0.02487 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.037 52.9 0.23598 200.0 188.0	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.037 54.7 0.2333 200.0 188.0	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.037 52.8 0.23605 200.0 188.0
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58	Fpipe Farmour $\lambda^n_1$ Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ $\lambda_2$ Depration IE $\lambda_2$ Operation IE $T_1$ $t_1$ $\rho_Ti$ $T_3$ $t_3$ $\rho_TJ$ Ducts U V Y $\theta$ m $T_4'$ Do	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>s factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [°C] [K.m/W] [mm]	1.0 1.0 0.00561 0.02487 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
39           40           41           Metallic           42           Armour           43           44           46           Normal 0           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60	Fpipe           Farmour           λ"1           Screen Loss           λ1           and Pipe Los           λ2           Δ           λ2pipe           λ2           Operation IEI           T1           t1           ρTi           T3           t3           ρTJ           U           V           Y           θm           T4'           Do           Di           ρT	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>s factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe	[mm] [K.m/W] [Mm] [K.m/W] [K.m/W] [%C] [%C] [K.m/W] [mm] [mm] [K.m/W]	1.0 1.0 0.00561 0.02487 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 0.312 0.0037 52.9 0.23598 200.0 188.0 3.5	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.037 54.7 0.2333 200.0 188.0 3.5	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 0.312 0.0037 52.8 0.23605 200.0 188.0 3.5
39           40           41           Metallic           42           Armour           43           44           46           Normal 0           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62	Fpipe           Farmour           λ"1           Screen Loss           λ1           and Pipe Loss           λ2           Φ           λ2           Operation IE           Τ1           t1           φTi           T3           t3           φTJ           U           V           Y           θm           T4"           Do           Di           φT           4"	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>s factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Internal Resistivity of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [mm] [mm] [K.m/W] [K.m/W]	1.0 1.0 0.00561 0.02487 0.0 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.0312 0.0037 52.9 0.23598 200.0 188.0 3.5 0.03447	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.0312 0.0037 54.7 0.2333 200.0 188.0 3.5 0.03447	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
39           40           41           Metallic           42           Armour           43           44           46           Normal 0           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62	Fpipe           Farmour           λ"1           Screen Loss           λ1           and Pipe Loss           λ2           Φ           λ2           Operation IE           Τ1           t1           φTi           T3           t3           φTJ           U           V           Y           θm           T4"           Do           Di           φT           4"	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>s factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistance of the Medium Inside the Incut/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistance of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [mm] [mm] [K.m/W] [K.m/W]	1.0 1.0 0.00561 0.02487 0.0 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.0312 0.0037 52.9 0.23598 200.0 188.0 3.5 0.03447	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.0312 0.0037 54.7 0.2333 200.0 188.0 3.5 0.03447	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64	Fpipe Farmour $\lambda^n_1$ Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ and Pipe Los $\lambda_2$ Operation IE $\lambda_2$ Operation IE $T_1$ $t_1$ $\rho_Ti$ $T_3$ $t_3$ $\rho_TJ$ Ducts U V Y $\theta$ m $T_4'$ Do Di $\rho_T$ $T_4''$ T $T_4'''$ a Duct Banl $\chi$ y	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>s factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 0287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thirmal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>x/Backfill installation</b> Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W] [mm] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 0.00561 0.02487 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65	Fpipe Farmour $\lambda^n_1$ Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ Deration IE $\lambda_2$ Operation IE $\lambda_2$ Operation IE $\lambda_2$ Operation IE $\lambda_2$ Operation IE $\lambda_2$ Operation IE $\lambda_2$ Operation IE $\lambda_2$ $\Gamma_1$ $\tau_3$ $\tau_3$ $\rho$ TJ $\tau_3$ $\tau_3$ $\rho$ TJ $\tau_3$ $\tau_3$ $\rho$ TJ $\tau_4$ $\rho$ T $\tau_4''$ $\rho$ T $\tau_4'''$ $\tau_4''''''''''''''''''''''''''''''''''''$	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>s factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-21</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>XBackfill Installation</b> Shorter Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill	[mm] [K.m/W] [K.m/W] [Mm] [K.m/W] [K.m/W] [mm] [Mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 0.00561 0.02487 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65           64	Fpipe Farmour $\lambda^{"}_1$ Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ Depretion IE $\lambda_2$ Operation IE $\lambda_2$ Operation IE $\lambda_1$ $\mu_2$ $\mu_1$ $\mu_1$ $\mu_2$ $\mu_1$ $\mu_1$ $\mu_1$ $\mu_2$ $\mu_1$ $\mu_1$ $\mu_2$ $\mu_1$ $\mu_1$ $\mu_2$ $\mu_1$ $\mu_1$ $\mu_2$ $\mu_1$ $\mu_2$ $\mu_1$ $\mu_1$ $\mu_2$ $\mu_1$ $\mu_2$ $\mu_1$ $\mu_2$ $\mu_1$ $\mu_2$ $\mu_1$ $\mu_2$ $\mu_1$ $\mu_2$ $\mu_1$ $\mu_2$ $\mu_1$ $\mu_2$ $\mu_2$ $\mu_1$ $\mu_2$ $\mu_2$ $\mu_1$ $\mu_2$ $\mu_2$ $\mu_1$ $\mu_2$ $\mu_2$ $\mu_1$ $\mu_2$ $\mu_2$ $\mu_1$ $\mu_2$ $\mu_2$ $\mu_2$ $\mu_2$ $\mu_1$ $\mu_2$ $\mu_2$ $\mu_1$ $\mu_2$ $\mu_2$ $\mu_2$ $\mu_2$ $\mu_1$ $\mu_2$ $\mu_$	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>s factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Thermal Resistance of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W] [mm] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 0.00561 0.02487 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.0312 0.0037 52.8 0.23605 200.0 188.0 3.5 0.03447 0.47747 0.675 2.5 0.85977 0.962
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65	Fpipe Farmour $\lambda^n_1$ Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ Deration IE $\lambda_2$ Operation IE $\lambda_2$ Operation IE $\lambda_2$ Operation IE $\lambda_2$ Operation IE $\lambda_2$ Operation IE $\lambda_2$ Operation IE $\lambda_2$ $\Gamma_1$ $\tau_3$ $\tau_3$ $\rho$ TJ $\tau_3$ $\tau_3$ $\rho$ TJ $\tau_3$ $\tau_3$ $\rho$ TJ $\tau_4$ $\rho$ T $\tau_4''$ $\rho$ T $\tau_4'''$ $\tau_4''''''''''''''''''''''''''''''''''''$	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>s factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-21</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>XBackfill Installation</b> Shorter Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W] [mm] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 0.00561 0.02487 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
39           40           41           Metallic           42           Armour           43           44           46           Normal 0           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65           66           67	Fpipe           Farmour           λ"1           Screen Loss           λ1           and Pipe Los           λ2           Deration IE           Λ2           T1           t1           ρTi           T3           pTJ           Ducts           U           Y           θm           T4''           Do           Di           ρT           X''           Y           Bm           X''           Y           Bm           T4''           Do           Di           ρT           X''           Y           Bm           X           Y           LG           u	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>s factor</b> Sereen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistivity of the Duct/Pipe Outside Diameter of the Duct/Pipe Thermal Resistance of t	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W] [mm] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 0.00561 0.02487 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 0.312 0.0037 52.8 0.23605 200.0 188.0 3.5 0.03447 0.47747 0.675 2.5 0.675 2.5 0.85977 0.962 1.1189
39           40           41           Metallic           42           Armour           43           44           46           Normal 0           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65           66           67           68	Fpipe           Farmour           λ"1           Screen Loss           λ1           and Pipe Los           λ2           λ2           Diperation IE           Τ1           τ1           τ1           τ1           τ2           Deration IE           Τ3           τ3           ρTJ           ΦTJ           Φ           U           V           Θm           Τ4'           Do           Di           ρT           σ           T4''           Do           Di           ρT           σ         Duct Banl           χ           y           rb           LG           u           N	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>s factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistivity of the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Medium Inside the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>KBackfill Installation</b> Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [mm] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 0.00561 0.02487 0.0 0.0 0.0 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 0.037 52.9 0.23598 200.0 188.0 3.5 0.03447 0.47667 0.675 2.5 0.85977 0.962 1.1189 3.0	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.0 0.0 0.0 0.36997 29.7 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 3.5 0.04684 5.5 0.037 54.7 0.2333 200.0 188.0 3.5 0.03447 0.49366 0.03447 0.49366 0.03447 0.49366 0.03447 0.49366 0.03447 0.49366 0.03447 0.49366 0.03447 0.49366 0.03447 0.49366 0.03447 0.49366 0.03447 0.49366 0.03447 0.49366 0.03447 0.49366 0.03447 0.49366 0.03447 0.49366 0.03447 0.49366 0.03447 0.49366 0.03447 0.49366 0.03447 0.04936 0.03447 0.04936 0.03447 0.03957 0.04936 0.03447 0.03957 0.04957 0.04957 0.04957 0.0497 0.03447 0.04956 0.03447 0.04956 0.03447 0.04956 0.04977 0.0497 0.03447 0.04956 0.04977 0.04956 0.03447 0.04956 0.04957 0.04956 0.04977 0.03447 0.04956 0.04957 0.04956 0.04957 0.04956 0.03447 0.04956 0.04957 0.04957 0.04956 0.049575 0.0495757 0.049575 0.0495757 0.0495757 0.0495757	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
39           40           41           Metallic           42           Armour           43           44           46           Normal 0           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65           66           67           68           69	Fpipe           Farmour           λ''1           Screen Loss           λ1           and Pipe Los           λ2           Diperation IE           λ2           Operation IE           T1           t1           ρTi           T3           t3           ρTJ           Ducts           U           Y           θm           T4'           D0           D1           ρT           X           Y           Hom           T4''           D0           D1           ρT           K           Y           Hom           T4''           D0           D1           ρT           X           Y           LG           U           N           ρe	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>s factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filing the Space Thermal Resistivity of the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Shorter Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [mm] [mm] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 0.00561 0.02487 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
39           40           41           Metallic           42           Armour           43           44           46           Normal 0           47           48           49           50           51           52           Cable in           53           56           57           58           59           60           61           62           Cable in           63           64           65           66           67           68           69           70	Fpipe           Farmour           λ"1           Screen Loss           λ1           and Pipe Los           λ2           Deration IE           Λ2           Operation IE           Τ1           τ1           τ2           Operation IE           ΦΤ1           Τ3           τ3           φTJ           Ducts           U           V           Υ           Θm           T4'           Do           Di           φT           x'           Y           θm           T4''           Do           Di           φT           x'''           Y           Hom           X'''           φT           x           y           rb           LG           μc           ρc	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>s factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating <b>Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1</b> Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>KBackfill Installation</b> Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W] [mm] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 0.00561 0.02487 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65           66           67           68           69           70           71           72	Fpipe           Farmour           λ"1           Screen Loss           λ1           and Pipe Los           λ2           λ2           71           1           73           1           73           1           73           1           73           1           73           1           73           1           73           1           73           1           73           1           73           1           7           0           0           0           7           0           0           7           0           0           0           0           0           0           0           0           0           0           0           0           0           0 <td< td=""><td>Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor <b>SFactor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistaince of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Thermal Resistance of the Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the Duct Ban</td><td>[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W] [mm] [mm] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]</td><td>1.0 1.0 0.02487 0.02487 0.02 0.0 0.0 0.0 0.0 0.0 0.0 0.</td><td>1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0</td><td>1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.</td></td<>	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor <b>SFactor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistaince of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Thermal Resistance of the Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the Duct Ban	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W] [mm] [mm] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 0.02487 0.02487 0.02 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65           66           67           68           69           70           71	Fpipe           Farmour           λ"1           Screen Loss           λ1           and Pipe Los           λ2           Diperation IE           λ2           Operation IE           T1           t1           ρTi           T3           t3           ρTJ           Ducts           U           V           Y           θm           T4'           Do           Di           ρT           T4''           N           N           LG           u           N           ρc           T4'''	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>stator</b> Screen Loss Factor <b>Streen Loss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>KBackfill Installation</b> Shorter Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of the Thermal Resistivity of the Cable Duct Bank/Backfill Thermal Resistivity of the Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the Duct Bank	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W] [mm] [mm] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 0.02487 0.02487 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 0.02162 0.03899 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 0.00569 0.02243 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.

	Study Summary
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 400kV CABLE) v2 - Summer (20C)
Date:	02/03/2020 15:44:49

General Simulation Data	
Steady State Option	Equally Loaded
Consider Electrical interaction between circuits	No
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0
Conductor Resistances Computation Option:	IEC-228

Installation Type:Ductbank					
Ambient Soil Temperature at Installation Depth	[°C]	20.0			
Native Soil Thermal Resistivity	[K.m/W]	1.2			
Thermal Resistivity of Duct Bank	[K.m/W]	0.3			
Depth of Center of Duct Bank	[m]	0.96			
Duct Bank Width	[m]	2.5			
Duct Bank Height	[m]	0.68			



Results	Results Summary									
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [m]	Y coordinate [m]	Conductor temperature [°C]	Ampacity [A]
1	400KV.010	1		А	50.0	1.0	0.15	1.05	88.4	2081.8
2	400KV.010	1		В	50.0	1.0	1.25	1.05	90.0	2081.8
3	400KV.010	1		С	50.0	1.0	2.35	1.05	88.3	2081.8

	Steady State Summary
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 400kV CABLE) v2 - Summer (20C)
Date:	02/03/2020 15:44:49

Simulation Data			
Installation type:	Ductbank		
Steady State Option	Equally Loaded		
Ambient temperature [°C]	20		
Native Soil Thermal Resistivity [K.m/W]	1.2		
Consider Non-Isothermal Earth Surface	No		
Consider effect of soil dry out	No		
Consider Electrical interaction between circuits	No		
Induced current in metallic layers as a fraction of conductor current (applied to all single phase circuits)	0		

Variable	Description	Unit		Cables	
Cable No.	Cable Index Number		1	2	3
General Inpu	it Data				
Cable ID	Cable Equipment ID		400KV.010	400KV.010	400KV.010
Circuit No.	Circuit No.		1	1	1
Phase	Cable Phase		А	В	С
Fq	Operating Frequency	[Hz]	50.0	50.0	50.0
x	X coordinate	[m]	0.15	1.25	2.35
у	Y coordinate	[m]	1.05	1.05	1.05
DLF	Daily Load Factor	[p.u.]	1.0	1.0	1.0
	Bonding Type		1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat
Ampacity					
I	Steady State Ampacity	[A]	2081.8	2081.8	2081.8
<b>Femperature</b>	25				
θс	Conductor temperature	[°C]	88.4	90.0	88.3
θs	Sheath/Shield temperature	[°C]	68.7	70.3	68.6
θа	Armour temperature	[°C]	n/a	n/a	n/a
θsurf	Cable surface temperature	[°C]	66.0	67.6	66.0
θduct	Duct surface temperature	[°C]	51.3	52.7	51.3
Resistances					
$R_0$	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
R	AC Resistance of the Conductor at Operating Temperature	[Ω/km]	0.01182	0.01186	0.01182
ys	Skin Effect Factor		0.29252	0.29022	0.2926
ур	Proximity Effect Factor		0.0012	0.0012	0.0012
osses					
Wc	Conductor Losses	[W/m]	51.21418	51.38255	51.20791
Wd	Dielectric Losses	[W/m]	4.00936	4.00936	4.00936
Ws	Metallic Screen Losses	[W/m]	1.28394	2.00453	1.15592
Wa	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
Wt	Total Losses	[W/m]	56.50747	57.39643	56.37319
$\lambda_1$	Screen Loss Factor		0.02507	0.03901	0.02257
$\lambda_2$	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
Thermal resi	stances				
T1	Thermal resistance of insulation	[K.m/W]	0.36997	0.36997	0.36997
T2	Thermal resistance of bedding/medium inside pipe-type	[K.m/W]	n/a	n/a	n/a
Т3	Thermal resistance of outer covering	[K.m/W]	0.04684	0.04684	0.04684
T4	External thermal resistance	[K.m/W]	0.81452	0.82865	0.81555
Others					
Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
	Induced current on Metallic Screen	[A]	131.1	124.2	122.1

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 400kV CABLE) v2 - Summer (20C)
Date:	02/03/2020 15:44:49

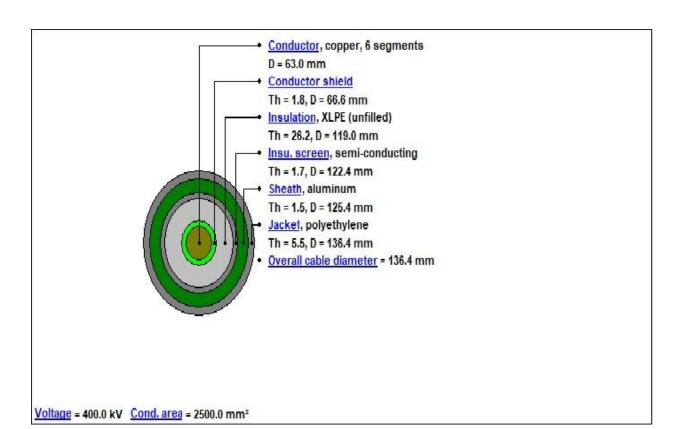
No.	Description	Unit	1
Gen	eral Cable Information		
1	Cable Equipment ID		400KV.010
2	Number of Cores		Single Core
3	Voltage	[kV]	400
4	Conductor Area	[mm²]	2500.0
5	Cable Overall Diameter	[mm]	136.4
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	110
Con	ductor		
8	Material		Copper
9	Electrical Resistivity at 20°C	[μΩ.cm]	1.7241
10	Temperature Coefficient at 20°C	[1/K]	0.00393
	Reciprocal of Temperature Coefficient of Resistance		
11	(BETA) Volumetric Specific Heat (SH)	[K]	234.5
12	Construction	[J/(K*cm <sup>3</sup> )]	3.45
13			6 Segments
14	Conductor Insulation System		Extruded
15	Milliken Wires Construction		Bare Unidirectional Wires
16	Ks (Skin Effect Coefficient)		0.62
17	Kp (Proximity Effect Coefficient)		0.37
18	Diameter	[mm]	63.0
Con	ductor Shield		
19	Thickness	[mm]	1.8
20	Diameter	[mm]	66.6
Insu	lation		
21	Material		XLPE Unfilled
22	Thermal Resistivity	[K.m/W]	3.5
23	Dielectric Loss Factor - ( tan delta )		0.001
24	Relative Permittivity - ( epsilon )		2.5
25	Specific Insulation Resistance Constant at 60°F - ( K )	[MΩ.km]	65617.
26			03017.
27	Thickness	[mm]	26.2
Insu	Thickness Diameter	[mm] [mm]	
28			26.2
20	Diameter		26.2
29	Diameter Iation Screen		26.2 119.0
-	Diameter Iation Screen Material	[mm]	26.2 119.0 Semi Conducting Screen
29	Diameter Iation Screen Material Thickness Diameter	[mm] [mm]	26.2 119.0 Semi Conducting Screen 1.7
29 30	Diameter Iation Screen Material Thickness Diameter	[mm] [mm]	26.2 119.0 Semi Conducting Screen 1.7
29 30 <b>Shea</b>	Diameter Iation Screen Material Thickness Diameter ath	[mm] [mm]	26.2 119.0 Semi Conducting Screen 1.7 122.4
29 30 <b>Shea</b> 31	Diameter Iation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C	[mm]	26.2 119.0 Semi Conducting Screen 1.7 122.4 n/a
29 30 <b>Shea</b> 31 32	Diameter Iation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material	[mm] [mm] [mm]	26.2 119.0 Semi Conducting Screen 1.7 122.4 n/a Aluminum
29 30 <b>Shea</b> 31 32 33	Diameter Iation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C	[mm] [mm] [mm] [mm] [μΩ.cm]	26.2 119.0 Semi Conducting Screen 1.7 122.4 n/a Aluminum 2.84
29 30 <b>Shea</b> 31 32 33 34	Diameter Diameter Iation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance	[mm] [mm] [mm] [μΩ.cm] [1/K]	26.2 119.0 Semi Conducting Screen 1.7 122.4 n/a Aluminum 2.84 0.00403
29 30 <b>Shea</b> 31 32 33 34 35	Diameter  Iation Screen  Material  Thickness Diameter  ath  Is Sheath Around Each Core?  Material  Electrical Resistivity at 20°C  Temperature Coefficient at 20°C  Reciprocal of Temperature Coefficient of Resistance (BETA)	[mm] [mm] [mm] [mm] [μΩ.cm] [1/K] [K]	26.2 119.0 Semi Conducting Screen 1.7 122.4 N/a Aluminum 2.84 0.00403 228
29 30 <b>Shea</b> 31 32 33 34 35 36	Diameter Diameter Iation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH)	[mm] [mm] [mm] [mm] [μΩ.cm] [1/K] [K]	26.2 119.0 Semi Conducting Screen 1.7 122.4 N/a Aluminum 2.84 0.00403 228 2.5
29 30 <b>Shea</b> 31 32 33 34 35 36 37	Diameter  Iation Screen  Material  Thickness Diameter  ath  Is Sheath Around Each Core?  Material  Electrical Resistivity at 20°C  Temperature Coefficient at 20°C  Reciprocal of Temperature Coefficient of Resistance (BETA)  Volumetric Specific Heat (SH)  Corrugation Type	[mm] [mm] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)]	26.2 119.0 Semi Conducting Screen 1.7 122.4 0.00403 228 2.5 Non Corrugated
29 30 <b>Shez</b> 31 32 33 34 35 36 37 38	Diameter  Iation Screen  Material  Thickness Diameter  ath  Is Sheath Around Each Core?  Material  Electrical Resistivity at 20°C  Temperature Coefficient at 20°C  Reciprocal of Temperature Coefficient of Resistance (BETA)  Volumetric Specific Heat (SH)  Corrugation Type  Thickness Diameter	[mm] [mm] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)] [J/(K*cm³)]	26.2 119.0 Semi Conducting Screen 1.7 122.4 122.4 Aluminum 2.84 0.00403 228 228 2.5 Non Corrugated 1.5
29 30 <b>Shez</b> 31 32 33 34 35 36 37 38 39	Diameter  Iation Screen  Material  Thickness Diameter  ath  Is Sheath Around Each Core?  Material  Electrical Resistivity at 20°C  Temperature Coefficient at 20°C  Reciprocal of Temperature Coefficient of Resistance (BETA)  Volumetric Specific Heat (SH)  Corrugation Type  Thickness Diameter	[mm] [mm] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)] [J/(K*cm³)]	26.2 119.0 Semi Conducting Screen 1.7 122.4 122.4 Aluminum 2.84 0.00403 228 228 2.5 Non Corrugated 1.5
29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Jack</b>	Diameter  Jation Screen  Material  Thickness Diameter  ath  Is Sheath Around Each Core?  Material  Electrical Resistivity at 20°C  Temperature Coefficient at 20°C  Reciprocal of Temperature Coefficient of Resistance (BETA)  Volumetric Specific Heat (SH)  Corrugation Type  Thickness Diameter  tet	[mm] [mm] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)] [J/(K*cm³)]	26.2 119.0 Semi Conducting Screen 1.7 122.4 0.00403 228 2.5 Non Corrugated 1.5 125.4
29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Jack</b> 40 41	Diameter Diameter Iation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Cet	[mm] [mm] [mm] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)] [J/(K*cm³)] [mm]	26.2 119.0 Semi Conducting Screen 1.7 122.4 0.00403 2.84 0.00403 228 2.5 Non Corrugated 1.5 125.4 Polyethylene

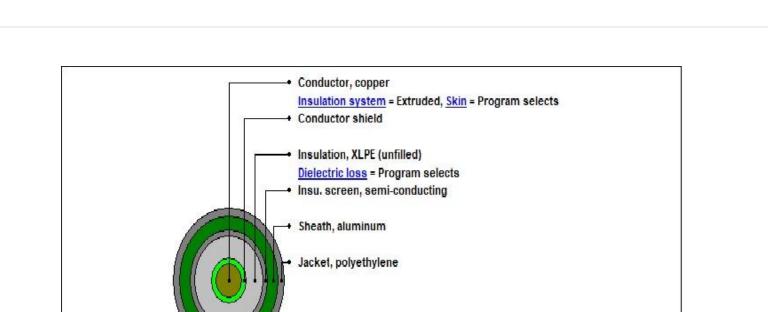
No.	Description	Unit	1
Spe	cific Installation Data		
44	Cable Equipment ID		400KV.010
45	Cable Frequency	[Hz]	50
46	Sheath / Shield Bonding		1 Conductor Crossbonded Flat
47	Loss Factor Constant (ALOS)		0.3
48	Minor section length		Crossbonded Unknown Section Lengths UNKNOWN
49	Duct construction		Polyethylene in Concrete
50	Duct material thermal resistivity	[K.m/W]	3.5
51	Inside Diameter of the Duct/Pipe	[mm]	188.0
52	Outside Diameter of the Duct/Pipe	[mm]	200.0

#### Cable ID : 400KV.010

Cable Title

le 2500sqmm Cu\_XLPE\_CAS\_PE NKT for Eirgrid









CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 400kV CABLE) v2 - Summer (20C)
Date:	02/03/2020 15:44:49

No.	Description	Unit	Cable No.1	Cable No.2	Cable No.3
1	Cable Equipment ID		400KV.010	400KV.010	400KV.010
Resi	stances				
2	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00913	0.00918	0.00913
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.0102	0.0102	0.0102
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01182	0.01186	0.01182
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.04864	0.04864	0.04864
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.05818	0.05849	0.05817
Loss	ses				
8	Conductor Losses	[W/m]	51.21418	51.38255	51.20791
9	Dielectric Losses	[W/m]	4.00936	4.00936	4.00936
10	Metallic Screen Losses	[W/m]	1.28394	2.00453	1.15592
11	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
12	Total Losses	[W/m]	56.50747	57.39643	56.37319
Сара	acitance, Inductance, Impedance				
13	Capacitance	[µF/km]	0.239	0.239	0.239
14	Inductance of Conductor	[mH/km]	0.76062	0.76062	0.76062
15	Reactance of Conductor	[Ω/km]	0.23895	0.23895	0.23895
16	Inductance of Metallic Sheath	[mH/km]	0.57535	0.57535	0.57535
17	Reactance of Metallic Sheath	[Ω/km]	0.18075	0.18075	0.18075
18	Positive Sequence Impedance	[Ω/km]	0.011820 + j0.238950	0.011860 + j0.238950	0.011820 + j0.238950
19	Negative Sequence Impedance	[Ω/km]	0.011820 + j0.238950	0.011860 + j0.238950	0.011820 + j0.238950
20	Zero Sequence Impedance	[Ω/km]	0.057950 + j0.180750	0.057930 + j0.180750	0.057950 + j0.180750
21	Surge Impedance	[Ω]	56.37929	56.37929	56.37929
Othe	ers				
22	Dielectric Stress at Conductor Surface	[kV/mm]	11.94851	11.94851	11.94851
23	Dielectric Stress at Insulation Surface	[kV/mm]	6.68715	6.68715	6.68715
24	Insulation Resistance at 60°F (15.8°C)	[MΩ.km]	16540.20553	16540.20553	16540.20553
25	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a
26	Charging Current for One Phase	[A/km]	17.36102	17.36102	17.36102
27	Charging Capacity of three phase system at Uo	[kvar/km]	12028.06597	12028.06597	12028.06597
28	Voltage drop for Three Phase System	[V/A/km]	0.02047	0.02054	0.02047
29	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
30	Induced current on Metallic Screen	[A]	131.1	124.2	122.1

	Cable Parameters under Normal Operation			
CYMCAP Version	7.3 Revision 2			
Study:	rgrid Cp966 Feasibility study			
Execution:	Eirgrid - WIDE trench (1ct 400kV CABLE) v2 - Summer (20C)			
Date:	02/03/2020 15:44:49			

No	Symbol	Description	Unit	Cable No.1	Cable No.2	Cable No.3
No. 1	Symbol	Description Cable Equipment ID	Unit	400KV.010	400KV.010	400KV.010
	Operation I	EC 60287-1-1	1			
Conduc	ctor AC Resi	istance				
2	R <sub>0</sub>	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	R'	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00913	0.00918	0.00913
4	dc	Conductor Diameter	[mm]	63.0	63.0	63.0
5	s	Distance Between Conductor Axes	[mm]	1099.99995	1099.99995	1099.99995
6	ks	Factor Used for xs Calculation (Skin Effect) Factor Used for xp Calculation (Proximity Effect)		0.62	0.62	0.62
7 8	kp xs	Component of Ys Calculation (Skin Effect)		0.37	0.37 2.91314	0.37
9	хр	Component of Yp Calculation (Skin Effect)		2.92052	2.25043	2.25635
10	ys	Skin Effect Factor		0.29252	0.29022	0.2926
11	ур	Proximity Effect Factor		0.0012	0.0012	0.0012
12	R	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.0012	0.01186	0.01182
	ric Losses		[]		1	1
13	tanδ	Dielectric Loss Factor		0.001	0.001	0.001
14	ε	Insulation Relative Permitivity		2.5	2.5	2.5
15	с	Cable Capacitance	[µF/km]	0.239	0.239	0.239
16	U <sub>0</sub>	Voltage	[kV]	230.94011	230.94011	230.94011
17	Wd	Cable Dielectric Losses Per Phase	[W/m]	4.00936	4.00936	4.00936
	ting Loss Fa					
18	Rs	AC Resistance used for Circulating Loss Factor computation	[Ω/km]	0.05818	0.05849	0.05817
19 20	d X	Mean diameter used for Circulating Loss Factor computation Reactance used for Circulating Loss Factor computation	[mm] [Ω/km]	123.9 0.18075	123.9 0.18075	123.9 0.18075
20	Xm	Mutual Reactance	[Ω/km]	0.04355	0.04355	0.04355
22	P	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.2243	0.2243	0.2243
23	Q	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.16623	0.16623	0.16623
		Spacing Factor (applied when spacing between cable uneven or non-				
24	Fspacing	equal minor section length)		0.004	0.004	0.004
25 Eddyl c	ئ\ Ss Factor	Screen Loss Factor Caused by Circulating Current	ļ	0.01952	0.01756	0.01693
26	Rs	AC Resistance used for Eddy Loss Factor computation	[Ω/km]	0.05818	0.05849	0.05817
20	d	Mean diameter used for Eddy Loss Factor computation	[mm]	123.9	123.9	123.9
28	ρs	Electrical Resistivity used for Eddy Loss Factor computation	[Ω.m]	0.0	0.0	0.0
29	Ds	External diameter used for Eddy Loss Factor computation	[mm]	125.4	125.4	125.4
30	ts	Thickness used for Eddy Loss Factor computation	[mm]	1.5	1.5	1.5
31	β1	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		107.80196	107.51684	107.81262
32	gs	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		1.00539	1.00537	1.00539
34	m	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.53995	0.5371	0.54006
35	λ <sub>o</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.00107	0.00426	0.00107
36	Δ <sub>1</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		-0.008	0.00195	0.00755
37	Δ <sub>2</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.00006	0.0	0.0
38 39	F Fpipe	Milliken conductor Effect Magnetic effect factor due to pipe		1.0	1.0	1.0
40	Farmour	Magnetic effect factor due to armour		1.0	1.0	1.0
41	λ"1	Screen Loss Factor Caused by Eddy Current		0.00555	0.02145	0.00564
Metallic	c Screen Los					1
42	$\tilde{\lambda}_1$	Screen Loss Factor		0.02507	0.03901	0.02257
Armour	r and Pipe Lo	oss Factor				
43	Å₂a	Armour Loss Factor		0.0	0.0	0.0
44	λ <sub>2</sub> pipe	Pipe Loss Factor		0.0	0.0	0.0
46	λ <sub>2</sub>	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
	1	EC 60287-2-1		0.00007	0.00007	0.00007
47	T <sub>1</sub>	Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen	[K.m/W] [mm]	0.36997 29.7	0.36997 29.7	0.36997
40	t <sub>1</sub> ρTi	Thermal Resistivity of Insulation	[K.m/W]	3.5	3.5	3.5
50	T <sub>3</sub>	Thermal Resistance of Jacket/Pipe Coating	[K.m/W]	0.04684	0.04684	0.04684
51	t <sub>3</sub>	Thickness of Jacket/Pipe Coating	[mm]	5.5	5.5	5.5
52	ρTJ	Thermal Resistivity of Jacket/Pipe Coating	[K.m/W]	3.5	3.5	3.5
Cable in	n Ducts					
53	U	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		1.87	1.87	1.87
54	V	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		0.312	0.312	0.312
55	Y	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		0.0037	0.0037	0.0037
56	θm	Mean Temperature of the Medium Filling the Space	[°C]	59.6	61.1	59.6
57	T₄'	Thermal Resistance of the Medium Inside the Duct/Pipe	[K.m/W]	0.22625	0.2242	0.2263
58	Do	Outside Diameter of the Duct/Pipe	[mm]	200.0	200.0	200.0 188.0
59 60	Di pT	Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Material	[mm] [K.m/W]	188.0 3.5	188.0 3.5	188.0 3.5
60	ρι Τ <sub>4</sub> "	Thermal Resistivity of the Duct/Pipe Material Thermal Resistance of the Duct/Pipe	[K.m/W]	3.5 0.03447	3.5 0.03447	3.5 0.03447
62	T4	Thermal Resistance of the Surrounding Medium	[K.m/W]	0.5538	0.56998	0.55478
		nk/Backfill installation	[			
63	х	Shorter Side of the Duct Bank/Backfill	[m]	0.675	0.675	0.675
64	у	Longer Side of the Duct Bank/Backfill	[m]	2.5	2.5	2.5
65	rb	Equivalent Radius of Duct Bank/Backfill	[m]	0.85977	0.85977	0.85977
66	LG	Depth of Laying to the Centre of Duct Bank/Backfill	[m]	0.962	0.962	0.962
67	u	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3		1.1189	1.1189	1.1189
68	N	Number of Loaded Cables in the Duct Bank/Backfill		3.0	3.0	3.0
69	ρe	Thermal Resistivity of Earth Around the Duct Bank/Backfill	[K.m/W]	1.2	1.2	1.2
70	ρc 	Thermal Resistivity of the Duct Bank/Backfill	[K.m/W]	0.33	0.33	0.33
71	Т <sub>4</sub> ''' т	Thermal Resistance of the Surrounding Medium	[K.m/W]	0.5538	0.56998	0.55478
72	T <sub>4</sub>	Total External Thermal Resistance	[K.m/W]	0.81452	0.82865	0.81555
73	Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
74	I	Cable Core Current Ampacity	[A]	2081.8	2081.8	2081.8

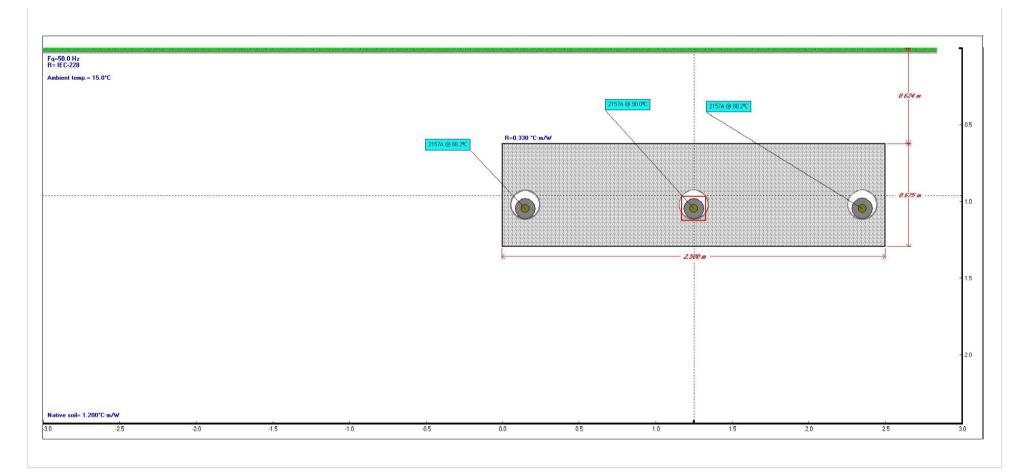
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### Study Summary

INTERNATIONAL T&D	
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 400kV CABLE) v2
Date:	17/01/2020 16:13:45

General Simulation Data	
Steady State Option	Equally Loaded
Consider Electrical interaction between circuits	No
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0
Conductor Resistances Computation Option:	IEC-228

Installation Type:Ductbank						
Ambient Soil Temperature at Installation Depth	[°C]	15.0				
Native Soil Thermal Resistivity	[K.m/W]	1.2				
Thermal Resistivity of Duct Bank	[K.m/W]	0.3				
Depth of Center of Duct Bank	[m]	0.96				
Duct Bank Width	[m]	2.5				
Duct Bank Height	[m]	0.68				



Results Summary										
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [m]	Y coordinate [m]	temperature [°C]	Ampacity [A]
1	400KV.010	1		А	50.0	1.0	0.15	1.05	88.2	2156.9
2	400KV.010	1		В	50.0	1.0	1.25	1.05	90.0	2156.9
3	400KV.010	1		С	50.0	1.0	2.35	1.05	88.2	2156.9

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# Steady State Summary

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 400kV CABLE) v2
Date:	17/01/2020 16:13:45

Simulation Data		
Installation type:	Ductbank	
Steady State Option	Equally Loaded	
Ambient temperature [°C]	15	
Native Soil Thermal Resistivity [K.m/W]	1.2	
Consider Non-Isothermal Earth Surface	No	
Consider effect of soil dry out	No	
Consider Electrical interaction between circuits	No	
Induced current in metallic layers as a fraction of conductor current (applied to all single phase circuits)	0	

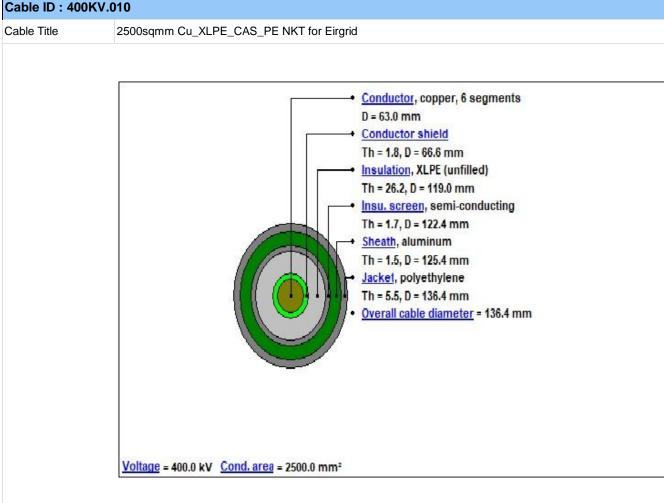
Variable	Description	Unit		Cables			
Cable No.	Cable Index Number		1	2	3		
General Input Data							
Cable ID	D Cable Equipment ID		400KV.010	400KV.010	400KV.010		
Circuit No.	Circuit No.		1	1	1		
Phase	Cable Phase		А	В	С		
Fq	Operating Frequency	[Hz]	50.0	50.0	50.0		
х	X coordinate	[m]	0.15	1.25	2.35		
у	Y coordinate	[m]	1.05	1.05	1.05		
DLF	Daily Load Factor	[p.u.]	1.0	1.0	1.0		
	Bonding Type		1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat		
Ampacity							
I	Steady State Ampacity	[A]	2156.9	2156.9	2156.9		
Temperature	S						
θс	Conductor temperature	[°C]	88.2	90.0	88.2		
θs	Sheath/Shield temperature	[°C]	67.2	68.9	67.1		
θа	Armour temperature	[°C]	n/a	n/a	n/a		
θsurf	Cable surface temperature	[°C]	64.3	66.0	64.3		
θduct	Duct surface temperature	[°C]	48.4	49.9	48.4		
Resistances							
R <sub>0</sub>	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072		
R	AC Resistance of the Conductor at Operating Temperature	[Ω/km]	0.01181	0.01186	0.01181		
ys	Skin Effect Factor		0.29268	0.29022	0.29277		
ур	Proximity Effect Factor		0.0012	0.0012	0.0012		
Losses							
Wc	Conductor Losses	[W/m]	54.96289	55.15645	54.95568		
Wd	Dielectric Losses	[W/m]	4.00936	4.00936	4.00936		
Ws	Metallic Screen Losses	[W/m]	1.37422	2.15133	1.23799		
Wa	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0		
Wt	Total Losses	[W/m]	60.34647	61.31714	60.20302		
λı	Screen Loss Factor		0.025	0.039	0.02253		
$\lambda_2$	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0		
Thermal resis	stances				1		
T1	Thermal resistance of insulation	[K.m/W]	0.36997	0.36997	0.36997		
T2	Thermal resistance of bedding/medium inside pipe-type	[K.m/W]	n/a	n/a	n/a		
T3	Thermal resistance of outer covering	[K.m/W]	0.04684	0.04684	0.04684		
T4	External thermal resistance	[K.m/W]	0.81766	0.83144	0.8187		
Others							
Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0		
	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0		
	Induced current on Metallic Screen	[A]	135.8	128.7	126.6		

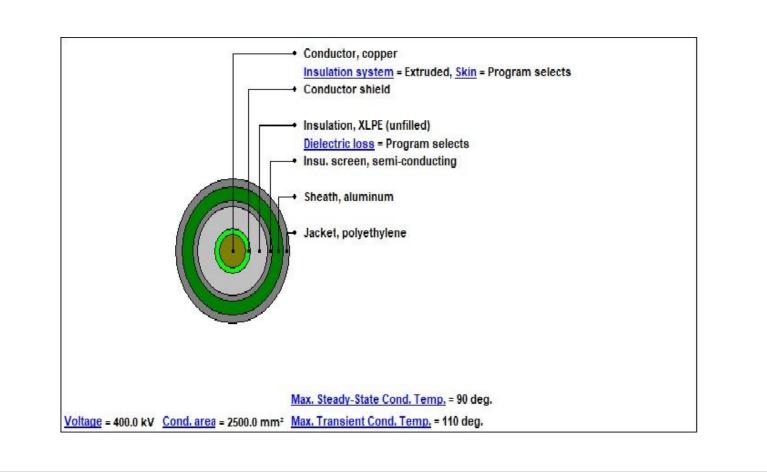
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 400kV CABLE) v2
Date:	17/01/2020 16:13:45

No.	Description	Unit	1
Gen	eral Cable Information		
1	Cable Equipment ID		400KV.010
2	Number of Cores		Single Core
3	Voltage	[kV]	400
4	Conductor Area	[mm²]	2500.0
5	Cable Overall Diameter	[mm]	136.4
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	110
Con	ductor		
8	Material		Copper
9	Electrical Resistivity at 20°C	[μΩ.cm]	1.7241
10	Temperature Coefficient at 20°C	[1/K]	0.00393
11	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
12	Volumetric Specific Heat (SH)	[J/(K*cm <sup>3</sup> )]	3.45
13	Construction	[0,(,)]	6 Segments
14	Conductor Insulation System		Extruded
15	Milliken Wires Construction		Bare Unidirectional Wires
16	Ks (Skin Effect Coefficient)		0.62
17	Kp (Proximity Effect Coefficient)		0.37
17	Diameter	[mm]	
	ductor Shield	[mm]	63.0
19	Diameter	[mm]	1.8
20		[mm]	66.6
21	Material		XLPE Unfilled
22	Thermal Resistivity	[K.m/W]	3.5
23	Dielectric Loss Factor - ( tan delta )		0.001
24	Relative Permittivity - ( epsilon )		2.5
25	Specific Insulation Resistance Constant at 60°F - ( K )	[MΩ.km]	65617.
26	Thickness	[mm]	26.2
27	Diameter	[mm]	119.0
Insu	lation Screen	1	
28	Material		Semi Conducting Screen
29	Thickness	[mm]	1.7
30	Diameter	[mm]	122.4
Shea	ath	1 1	
31	Is Sheath Around Each Core?		n/a
32	Material		Aluminum
33	Electrical Resistivity at 20°C	[µΩ.cm]	2.84
34	Temperature Coefficient at 20°C	[1/K]	0.00403
35	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	228
36	Volumetric Specific Heat (SH)	[J/(K*cm <sup>3</sup> )]	2.5
37	Corrugation Type		Non Corrugated
38	Thickness	[mm]	1.5
39	Diameter	[mm]	125.4
Jack	ket		
40	Material		Polyethylene
40	Thermal Resistivity	[K.m/W]	3.5
41	Thickness	[K.II/W]	5.5
	Diameter		
43		[mm]	136.4

No.	Description	Unit	1	
Specific Installation Data				
44	Cable Equipment ID		400KV.010	
45	Cable Frequency	[Hz]	50	
46	Sheath / Shield Bonding		1 Conductor Crossbonded Flat	
47	Loss Factor Constant (ALOS)		0.3	
48	Minor section length		Crossbonded Unknown Section Lengths UNKNOWN	
49	Duct construction		Polyethylene in Concrete	
50	Duct material thermal resistivity	[K.m/W]	3.5	
51	Inside Diameter of the Duct/Pipe	[mm]	188.0	
52	Outside Diameter of the Duct/Pipe	[mm]	200.0	

#### Cable ID : 400KV.010





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CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 400kV CABLE) v2
Date:	17/01/2020 16:13:45

No.	Description	Unit	Cable No.1	Cable No.2	Cable No.3		
1	Cable Equipment ID		400KV.010	400KV.010	400KV.010		
Resistances							
2	DC Resistance of the conductor at 20°C [Ω/km] 0.0072		0.0072	0.0072			
3	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00913	0.00918	0.00913		
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.0102	0.0102	0.0102		
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01181	0.01186	0.01181		
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.04864	0.04864	0.04864		
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.05789	0.05822	0.05788		
Loss	ses						
8	Conductor Losses	[W/m]	54.96289	55.15645	54.95568		
9	Dielectric Losses	[W/m]	4.00936	4.00936	4.00936		
10	Metallic Screen Losses	[W/m]	1.37422	2.15133	1.23799		
11	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0		
12	Total Losses	[W/m]	60.34647	61.31714	60.20302		
Capa	acitance, Inductance, Impedance						
13	Capacitance	[µF/km]	0.239	0.239	0.239		
14	Inductance of Conductor	[mH/km]	0.76062	0.76062	0.76062		
15	Reactance of Conductor	[Ω/km]	0.23895	0.23895	0.23895		
16	Inductance of Metallic Sheath	[mH/km]	0.57535	0.57535	0.57535		
17	Reactance of Metallic Sheath	[Ω/km]	0.18075	0.18075	0.18075		
18	Positive Sequence Impedance	[Ω/km]	0.011810 + j0.238950	0.011860 + j0.238950	0.011810 + j0.238950		
19	Negative Sequence Impedance	[Ω/km]	0.011810 + j0.238950	0.011860 + j0.238950	0.011810 + j0.238950		
20	Zero Sequence Impedance	[Ω/km]	0.057950 + j0.180750	0.057930 + j0.180750	0.057950 + j0.180750		
21	Surge Impedance	[Ω]	56.37929	56.37929	56.37929		
Othe	rs	1					
22	Dielectric Stress at Conductor Surface	[kV/mm]	11.94851	11.94851	11.94851		
23	Dielectric Stress at Insulation Surface	[kV/mm]	6.68715	6.68715	6.68715		
24	Insulation Resistance at 60°F (15.8°C)	[MΩ.km]	16540.20553	16540.20553	16540.20553		
25	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a		
26	Charging Current for One Phase	[A/km]	17.36102	17.36102	17.36102		
27	Charging Capacity of three phase system at Uo	[kvar/km]	12028.06597	12028.06597	12028.06597		
28	Voltage drop for Three Phase System	[V/A/km]	0.02046	0.02054	0.02046		
29	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0		
30	Induced current on Metallic Screen	[A]	135.8	128.7	126.6		

### CYME

Cable Parameters under Normal Operation

CY	MCAP Version	7.3 Revision 2
Stu	ıdy:	Eirgrid Cp966 Feasibility study
Exe	ecution:	Eirgrid - WIDE trench (1ct 400kV CABLE) v2
Dat	te:	17/01/2020 16:13:45

No	Cumbal	Description	Unit	Cobio No 1	Cable No.2	Cable No.3	
No. 1	Symbol	Description Cable Equipment ID	Unit	Cable No.1 400KV.010	400KV.010	400KV.010	
	Operation IE		l	4001010	400101.010	4001010	
	Normal Operation IEC 60287-1-1 Conductor AC Resistance						
2	R <sub>0</sub>	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072	
3	R'	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00913	0.00918	0.00913	
4	dc	Conductor Diameter	[mm]	63.0	63.0	63.0	
5	s	Distance Between Conductor Axes	[mm]	1099.99995	1099.99995	1099.99995	
6	ks	Factor Used for xs Calculation (Skin Effect)		0.62	0.62	0.62	
7	kp	Factor Used for xp Calculation (Proximity Effect)		0.37	0.37	0.37	
8	xs	Component of Ys Calculation (Skin Effect)		2.92105	2.91314	2.92135	
9	хр	Component of Yp Calculation (Proximity Effect)		2.25654	2.25043	2.25677	
10	ys	Skin Effect Factor		0.29268	0.29022	0.29277	
11	ур	Proximity Effect Factor		0.0012	0.0012	0.0012	
12	R	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01181	0.01186	0.01181	
Dielectri	ic Losses				I	I	
13	tanδ	Dielectric Loss Factor		0.001	0.001	0.001	
14	з	Insulation Relative Permitivity		2.5	2.5	2.5	
15	С	Cable Capacitance	[µF/km]	0.239	0.239	0.239	
16	Uo	Voltage	[kV]	230.94011	230.94011	230.94011	
17	Wd	Cable Dielectric Losses Per Phase	[W/m]	4.00936	4.00936	4.00936	
Circulat	ing Loss Fac	tor					
18	Rs	AC Resistance used for Circulating Loss Factor computation	[Ω/km]	0.05789	0.05822	0.05788	
19	d	Mean diameter used for Circulating Loss Factor computation	[mm]	123.9	123.9	123.9	
20	х	Reactance used for Circulating Loss Factor computation	[Ω/km]	0.18075	0.18075	0.18075	
21	Xm	Mutual Reactance	[Ω/km]	0.04355	0.04355	0.04355	
22	Р	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.2243	0.2243	0.2243	
23	Q	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.16623	0.16623	0.16623	
	<b>F</b> 1	Spacing Factor (applied when spacing between cable uneven or non-		0.05 -	0.05	0.05.	
24	Fspacing	equal minor section length)		0.004	0.004	0.004	
25 Eddy Log	λ' <sub>1</sub> ss Factor	Screen Loss Factor Caused by Circulating Current	l	0.01943	0.0175	0.01687	
26	Rs	AC Resistance used for Eddy Loss Factor computation	[O/l/m]	0.05789	0.05822	0.05788	
26	RS d	AC Resistance used for Eddy Loss Factor computation Mean diameter used for Eddy Loss Factor computation	[Ω/km]	123.9	123.9		
27			[mm]	0.0	0.0	123.9 0.0	
29	ρs Ds	Electrical Resistivity used for Eddy Loss Factor computation External diameter used for Eddy Loss Factor computation	[Ω.m]	125.4	125.4	125.4	
30	ts	Thickness used for Eddy Loss Factor computation	[mm] [mm]	125.4	125.4	1.5	
30	β1	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1	[[1111]	108.07598	107.76927	108.08747	
32	gs	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		1.00541	1.00539	1.00541	
34	gs m	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.5427	0.53963	0.54282	
35	۸ <sub>0</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.00108	0.00429	0.00108	
36	Δ <sub>1</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		-0.00796	0.00195	0.00757	
37	$\Delta_1$ $\Delta_2$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.00006	0.0	0.0	
38	F	Milliken conductor Effect		1.0	1.0	1.0	
39	Fpipe	Magnetic effect factor due to pipe		1.0	1.0	1.0	
40	Farmour	Magnetic effect factor due to armour		1.0	1.0	1.0	
41	λ"1	Screen Loss Factor Caused by Eddy Current		0.00557	0.02151	0.00566	
-	Screen Loss		1				
42	λ <sub>1</sub>	Screen Loss Factor		0.025	0.039	0.02253	
Armour	and Pipe Los	ss Factor	1		1		
43	λ₂a	Armour Loss Factor		0.0	0.0	0.0	
44	λ₂pipe	Pipe Loss Factor		0.0	0.0	0.0	
46	λ <sub>2</sub>	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0	
Normal (	Operation IE	C 60287-2-1	1		I	I	
47	T <sub>1</sub>	Thermal Resistance Between Conductor and Screen	[K.m/W]	0.36997	0.36997	0.36997	
48	t1	Insulation Thickness Between Conductor and Screen	[mm]	29.7	29.7	29.7	
49	ρΤί	Thermal Resistivity of Insulation	[K.m/W]	3.5	3.5	3.5	
50	T <sub>3</sub>	Thermal Resistance of Jacket/Pipe Coating	[K.m/W]	0.04684	0.04684	0.04684	
51	t <sub>3</sub>	Thickness of Jacket/Pipe Coating	[mm]	5.5	5.5	5.5	
52	ρTJ	Thermal Resistivity of Jacket/Pipe Coating	[K.m/W]	3.5	3.5	3.5	
Cable in	Ducts						
53	U	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		1.87	1.87	1.87	
54	V	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		0.312	0.312	0.312	
55	Y	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		0.0037	0.0037	0.0037	
56	θm	Mean Temperature of the Medium Filling the Space	[°C]	57.4	59.0	57.4	
57	T₄'	Thermal Resistance of the Medium Inside the Duct/Pipe	[K.m/W]	0.22934	0.2271	0.2294	
58	Do	Outside Diameter of the Duct/Pipe	[mm]	200.0	200.0	200.0	
59	Di	Inside Diameter of the Duct/Pipe	[mm]	188.0	188.0	188.0	
60	ρΤ	Thermal Resistivity of the Duct/Pipe Material	[K.m/W]	3.5	3.5	3.5	
61	Τ4"	Thermal Resistance of the Duct/Pipe	[K.m/W]	0.03447	0.03447	0.03447	
62	T4""	Thermal Resistance of the Surrounding Medium	[K.m/W]	0.55386	0.56987	0.55484	
	1	k/Backfill installation					
63	x	Shorter Side of the Duct Bank/Backfill	[m]	0.675	0.675	0.675	
64	у	Longer Side of the Duct Bank/Backfill	[m]	2.5	2.5	2.5	
65	rb	Equivalent Radius of Duct Bank/Backfill	[m]	0.85977	0.85977	0.85977	
66		Depth of Laying to the Centre of Duct Bank/Backfill	[m]	0.962	0.962	0.962	
67	u	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3		1.1189	1.1189	1.1189	
68	N	Number of Loaded Cables in the Duct Bank/Backfill		3.0	3.0	3.0	
69	ре	Thermal Resistivity of Earth Around the Duct Bank/Backfill	[K.m/W]	1.2	1.2	1.2	
70	ρς	Thermal Resistivity of the Duct Bank/Backfill	[K.m/W]	0.33	0.33	0.33	
71	T4"	Thermal Resistance of the Surrounding Medium	[K.m/W]	0.55386	0.56987	0.55484	
72	T <sub>4</sub>	Total External Thermal Resistance	[K.m/W]	0.81766	0.83144	0.8187	
73	∆θint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0	
73	L	Cable Core Current Ampacity	[4]	2156.9	2156.9	2156.9	
	· · ·		6.7	2.00.0	2.00.0	2.30.3	

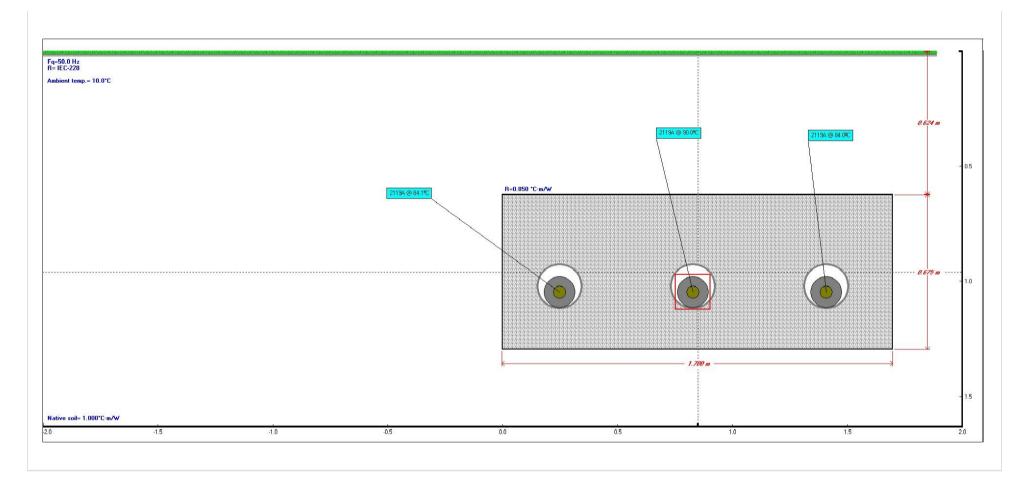
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### Study Summary

INTERNATIONAL ISD	
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 400kV CABLE) v2
Date:	18/03/2020 11:05:37

General Simulation Data	
Steady State Option	Equally Loaded
Consider Electrical interaction between circuits	No
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0
Conductor Resistances Computation Option:	IEC-228

Installation Type:Ductbank					
Ambient Soil Temperature at Installation Depth	[°C]	10.0			
Native Soil Thermal Resistivity	[K.m/W]	1.0			
Thermal Resistivity of Duct Bank	[K.m/W]	0.9			
Depth of Center of Duct Bank	[m]	0.96			
Duct Bank Width	[m]	1.7			
Duct Bank Height	[m]	0.68			



Results Summary										
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [m]	Y coordinate [m]	temperature [°C]	Ampacity [A]
1	400KV.011	1		А	50.0	1.0	0.25	1.05	84.1	2119.1
2	400KV.011	1		В	50.0	1.0	0.83	1.05	90.0	2119.1
3	400KV.011	1		С	50.0	1.0	1.41	1.05	84.0	2119.1

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# Steady State Summary

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 400kV CABLE) v2
Date:	18/03/2020 11:05:37

Simulation Data				
Installation type:	Ductbank			
Steady State Option	Equally Loaded			
Ambient temperature [°C]	10			
Native Soil Thermal Resistivity [K.m/W]	1.0			
Consider Non-Isothermal Earth Surface	No			
Consider effect of soil dry out	No			
Consider Electrical interaction between circuits	No			
Induced current in metallic layers as a fraction of conductor current (applied to all single phase circuits)	0			

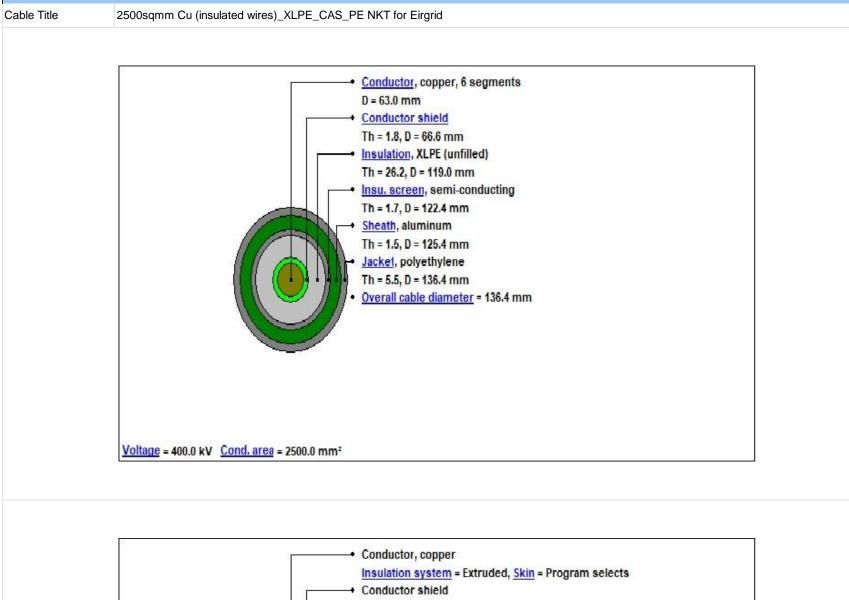
Variable	Description	Unit		Cables	
Cable No.	Cable Index Number		1	2	3
General Input	Data				
Cable ID	Cable Equipment ID		400KV.011	400KV.011	400KV.011
Circuit No.	Circuit No.		1	1	1
Phase	Cable Phase		А	В	С
Fq	Operating Frequency	[Hz]	50.0	50.0	50.0
x	X coordinate	[m]	0.25	0.83	1.41
у	Y coordinate	[m]	1.05	1.05	1.05
DLF	Daily Load Factor	[p.u.]	1.0	1.0	1.0
	Bonding Type		1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat
Ampacity	•				•
I	Steady State Ampacity	[A]	2119.1	2119.1	2119.1
Temperatures	3				
θс	Conductor temperature	[°C]	84.1	90.0	84.0
θs	Sheath/Shield temperature	[°C]	66.7	72.3	66.6
θa	Armour temperature	[°C]	n/a	n/a	n/a
θsurf	Cable surface temperature	[°C]	64.3	69.8	64.2
θduct	Duct surface temperature	[°C]	50.8	55.8	50.8
Resistances					
R <sub>0</sub>	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
R	AC Resistance of the Conductor at Operating Temperature	[Ω/km]	0.01005	0.0102	0.01004
ys	Skin Effect Factor		0.11282	0.1091	0.11288
ур	Proximity Effect Factor		0.00177	0.00171	0.00177
Losses					
Wc	Conductor Losses	[W/m]	45.11563	45.79786	45.10383
Wd	Dielectric Losses	[W/m]	4.00936	4.00936	4.00936
Ws	Metallic Screen Losses	[W/m]	2.03307	4.93426	1.88822
Wa	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
Wt	Total Losses	[W/m]	51.15806	54.74148	51.0014
$\lambda_1$	Screen Loss Factor		0.04506	0.10774	0.04186
$\lambda_2$	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
Thermal resis	stances				
T1	Thermal resistance of insulation	[K.m/W]	0.36997	0.36997	0.36997
T2	Thermal resistance of bedding/medium inside pipe-type	[K.m/W]	n/a	n/a	n/a
Т3	Thermal resistance of outer covering	[K.m/W]	0.04684	0.04684	0.04684
T4	External thermal resistance	[K.m/W]	1.06058	1.09159	1.06218
Others					
Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
	Induced current on Metallic Screen	[A]	132.9	121.4	119.5

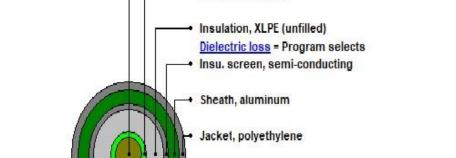
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 400kV CABLE) v2
Date:	18/03/2020 11:05:37

No.	Description	Unit	1
Gen	eral Cable Information		
1	Cable Equipment ID		400KV.011
2	Number of Cores		Single Core
3	Voltage	[kV]	400
4	Conductor Area	[mm²]	2500.0
5	Cable Overall Diameter	[mm]	136.4
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	110
Con	ductor		
8	Material		Copper
9	Electrical Resistivity at 20°C	[μΩ.cm]	1.7241
10	Temperature Coefficient at 20°C	[1/K]	0.00393
11	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
12	Volumetric Specific Heat (SH)	[J/(K*cm <sup>3</sup> )]	3.45
13	Construction		6 Segments
14	Conductor Insulation System		Extruded
15	Milliken Wires Construction		Insulated Wires
16	Ks (Skin Effect Coefficient)		0.35
17	Kp (Proximity Effect Coefficient)		0.2
18	Diameter	[mm]	63.0
Con	ductor Shield		
19	Thickness	[mm]	1.8
20	Diameter	[mm]	66.6
	lation	[]	00.0
21	Material		XLPE Unfilled
22	Thermal Resistivity	[K.m/W]	3.5
23	Dielectric Loss Factor - ( tan delta )	[((,),,,,,]	0.001
23	Relative Permittivity - ( epsilon )		2.5
25	Specific Insulation Resistance Constant at 60°F - ( K )	[MΩ.km]	65617.
26	Thickness	[ma:.kii]	26.2
20	Diameter	[mm]	119.0
	lation Screen	[]	113.0
28	Material		Semi Conducting Screen
29	Thickness	[mm]	1.7
30	Diameter		1.7
She		[mm]	122.4
31	Is Sheath Around Each Core?		n/a
31	Material		Aluminum
32	Electrical Resistivity at 20°C	[μΩ.cm]	2.84
33	Temperature Coefficient at 20°C		-
	Reciprocal of Temperature Coefficient of Resistance	[1/K]	0.00403
35	(BETA) Volumetric Specific Heat (SH)	[K]	228
36	Corrugation Type	[J/(K*cm <sup>3</sup> )]	2.5
37	Thickness	[ac ]	Non Corrugated
38	Diameter	[mm]	1.5
39 Jacl		[mm]	125.4
	Material		
40			Polyethylene
41	Thermal Resistivity	[K.m/W]	3.5
42		[mm]	5.5
43	Diameter	[mm]	136.4

No.	Description	Unit	1			
Spe	Specific Installation Data					
44	Cable Equipment ID		400KV.011			
45	Cable Frequency	[Hz]	50			
46	Sheath / Shield Bonding		1 Conductor Crossbonded Flat			
47	Loss Factor Constant (ALOS)		0.3			
48	Minor section length		Crossbonded Unknown Section Lengths UNKNOWN			
49	Duct construction		Polyethylene in Concrete			
50	Duct material thermal resistivity	[K.m/W]	3.5			
51	Inside Diameter of the Duct/Pipe	[mm]	188.0			
52	Outside Diameter of the Duct/Pipe	[mm]	200.0			

#### Cable ID : 400KV.011







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CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 400kV CABLE) v2
Date:	18/03/2020 11:05:37

No.	Description	Unit	Cable No.1	Cable No.2	Cable No.3				
1	Cable Equipment ID		400KV.011	400KV.011	400KV.011				
Resistances									
2	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072				
3	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00901	0.00918	0.00901				
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.00843	0.00843	0.00843				
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01005	0.0102	0.01004				
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.04864	0.04864	0.04864				
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.05779	0.0589	0.05777				
Loss	ies								
8	Conductor Losses	[W/m]	45.11563	45.79786	45.10383				
9	Dielectric Losses	[W/m]	4.00936	4.00936	4.00936				
10	Metallic Screen Losses	[W/m]	2.03307	4.93426	1.88822				
11	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0				
12	Total Losses	[W/m]	51.15806	54.74148	51.0014				
Сара	acitance, Inductance, Impedance	-							
13	Capacitance	[µF/km]	0.239	0.239	0.239				
14	Inductance of Conductor	[mH/km]	0.63261	0.63261	0.63261				
15	Reactance of Conductor	[Ω/km]	0.19874	0.19874	0.19874				
16	Inductance of Metallic Sheath	[mH/km]	0.44734	0.44734	0.44734				
17	Reactance of Metallic Sheath	[Ω/km]	0.14054	0.14054	0.14054				
18	Positive Sequence Impedance	[Ω/km]	0.010050 + j0.198740	0.010200 + j0.198740	0.010040 + j0.198740				
19	Negative Sequence Impedance	[Ω/km]	0.010050 + j0.198740	0.010200 + j0.198740	0.010040 + j0.198740				
20	Zero Sequence Impedance	[Ω/km]	0.056650 + j0.140540	0.056630 + j0.140540	0.056650 + j0.140540				
21	Surge Impedance	[Ω]	51.41672	51.41672	51.41672				
Othe	rs	I							
22	Dielectric Stress at Conductor Surface	[kV/mm]	11.94851	11.94851	11.94851				
23	Dielectric Stress at Insulation Surface	[kV/mm]	6.68715	6.68715	6.68715				
24	Insulation Resistance at 60°F (15.8°C)	[MΩ.km]	16540.20553	16540.20553	16540.20553				
25	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a				
26	Charging Current for One Phase	[A/km]	17.36102	17.36102	17.36102				
27	Charging Capacity of three phase system at Uo	[kvar/km]	12028.06597	12028.06597	12028.06597				
28	Voltage drop for Three Phase System	[V/A/km]	0.0174	0.01766	0.0174				
29	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0				
30	Induced current on Metallic Screen	[A]	132.9	121.4	119.5				

# CYME

Cable Parameters under Normal Operation

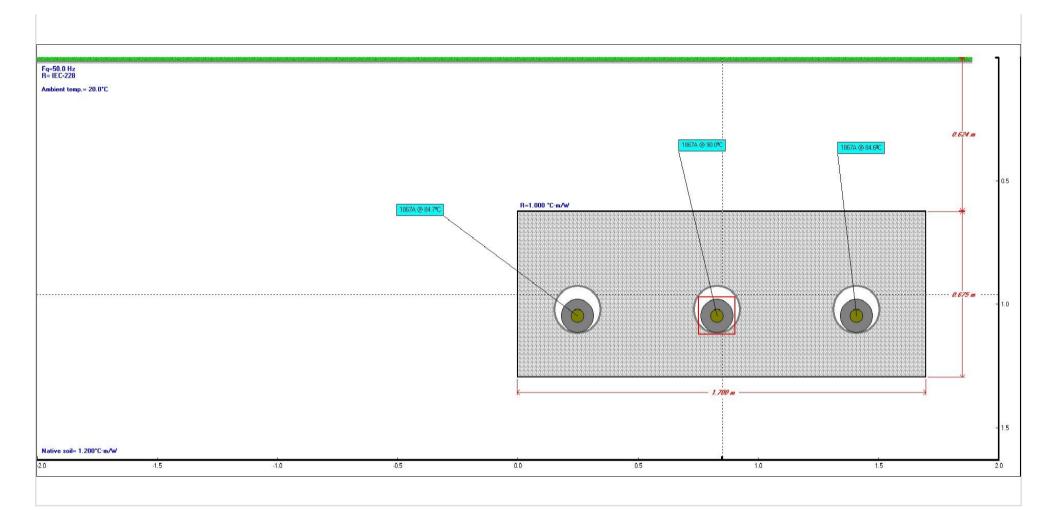
С	YMCAP Version	7.3 Revision 2
s	tudy:	Eirgrid Cp966 Feasibility study
E	xecution:	Eirgrid - std trench (1ct 400kV CABLE) v2
D	ate:	18/03/2020 11:05:37

No.	Symbol	Description	Unit	Cable No.1	Cable No.2	Cable No.3			
1	Gymbol	Cable Equipment ID	onn	400KV.011	400KV.011	400KV.011			
Normal O	Operation IE	C 60287-1-1							
Conductor AC Resistance									
2	R <sub>0</sub>	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072			
3	R'	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00901	0.00918	0.00901			
4	dc	Conductor Diameter	[mm]	63.0	63.0	63.0			
5	s ks	Distance Between Conductor Axes Factor Used for xs Calculation (Skin Effect)	[mm]	580.0 0.35	580.0 0.35	580.0 0.35			
7	kp	Factor Used for xp Calculation (Proximity Effect)		0.35	0.35	0.33			
8	xs	Component of Ys Calculation (Skin Effect)		2.20898	2.18874	2.20933			
9	хр	Component of Yp Calculation (Proximity Effect)		1.66983	1.65454	1.6701			
10	ys	Skin Effect Factor		0.11282	0.1091	0.11288			
11	ур	Proximity Effect Factor		0.00177	0.00171	0.00177			
12	R	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01005	0.0102	0.01004			
Dielectri	ic Losses		1	1					
13	tanδ	Dielectric Loss Factor		0.001	0.001	0.001			
14	3	Insulation Relative Permitivity		2.5	2.5	2.5			
15 16	C U <sub>0</sub>	Cable Capacitance Voltage	[µF/km] [kV]	0.239	0.239	0.239			
17	Wd	Cable Dielectric Losses Per Phase	[W/m]	4.00936	4.00936	4.00936			
	ing Loss Fac								
18	Rs	AC Resistance used for Circulating Loss Factor computation	[Ω/km]	0.05779	0.0589	0.05777			
19	d	Mean diameter used for Circulating Loss Factor computation	[mm]	123.9	123.9	123.9			
20	х	Reactance used for Circulating Loss Factor computation	[Ω/km]	0.14054	0.14054	0.14054			
21	Xm	Mutual Reactance	[Ω/km]	0.04355	0.04355	0.04355			
22	P	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.18409	0.18409	0.18409			
23	Q	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.12602	0.12602	0.12602			
24	Fspacing	Spacing Factor (applied when spacing between cable uneven or non- equal minor section length)		0.004	0.004	0.004			
25	λ'1	Screen Loss Factor Caused by Circulating Current		0.02263	0.01896	0.01829			
Eddy Los	ss Factor								
26	Rs	AC Resistance used for Eddy Loss Factor computation	[Ω/km]	0.05779	0.0589	0.05777			
27	d	Mean diameter used for Eddy Loss Factor computation	[mm]	123.9	123.9	123.9			
28	ρs	Electrical Resistivity used for Eddy Loss Factor computation	[Ω.m]	0.0	0.0	0.0			
29 30	Ds ts	External diameter used for Eddy Loss Factor computation Thickness used for Eddy Loss Factor computation	[mm] [mm]	125.4	125.4 1.5	125.4 1.5			
31	β1	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1	[IIIII]	108.16968	1.5	108.18768			
32	gs	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		1.00541	1.00535	1.00541			
34	m	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.54364	0.5334	0.54382			
		Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.0039	0.01516	0.00391			
35	λ <sub>o</sub>	Coefficient used in IEC 00287-1-1 Clause 2.3.0.1		0.0000					
35 36	λ <sub>0</sub> Δ <sub>1</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		-0.02134	0.00488	0.02882			
36 37	$\Delta_1$ $\Delta_2$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		-0.02134 0.00033		0.02882			
36 37 38	$\Delta_1$ $\Delta_2$ F	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect		-0.02134 0.00033 1.0	0.00488 0.0 1.0	0.00001			
36 37 38 39	Δ <sub>1</sub> Δ <sub>2</sub> F Fpipe	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe		-0.02134 0.00033 1.0 1.0	0.00488 0.0 1.0 1.0	0.00001 1.0 1.0			
36 37 38	$\Delta_1$ $\Delta_2$ F	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect		-0.02134 0.00033 1.0	0.00488 0.0 1.0	0.00001			
36 37 38 39 40 41	Δ <sub>1</sub> Δ <sub>2</sub> F Fpipe Farmour	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current		-0.02134 0.00033 1.0 1.0 1.0	0.00488 0.0 1.0 1.0 1.0	0.00001 1.0 1.0 1.0			
36 37 38 39 40 41	$\Delta_1$ $\Delta_2$ F Fpipe Farmour $\lambda_1^{"}$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current		-0.02134 0.00033 1.0 1.0 1.0	0.00488 0.0 1.0 1.0 1.0	0.00001 1.0 1.0 1.0			
36 37 38 39 40 41 <b>Metallic</b> 42	$\Delta_1$ $\Delta_2$ F Fpipe Farmour $\lambda''_1$ Screen Loss	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor		-0.02134 0.00033 1.0 1.0 1.0 0.02243	0.00488 0.0 1.0 1.0 1.0 0.08878	0.00001 1.0 1.0 1.0 0.02357			
36 37 38 39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43	$\begin{array}{c} \Delta_1 \\ \Delta_2 \\ F \\ Fpipe \\ Farmour \\ \lambda''_1 \\ \hline \textbf{Screen Loss} \\ \lambda_1 \end{array}$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor		-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506	0.00488 0.0 1.0 1.0 1.0 0.08878 0.10774 0.00	0.00001 1.0 1.0 1.0 0.02357			
36 37 38 39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43 44	$\begin{array}{c} \Delta_1 \\ \Delta_2 \\ F \\ Fpipe \\ Farmour \\ \lambda_{"1}^{"} \\ \textbf{Screen Loss} \\ \lambda_1 \\ \textbf{and Pipe Loss} \\ \lambda_2 a \\ \lambda_2 pipe \end{array}$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Screen Loss Factor Screen Loss Factor Screen Loss Factor Pipe Loss Factor		-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0	0.00488 0.0 1.0 1.0 0.08878 0.10774 0.0 0.0 0.0	0.00001 1.0 1.0 0.02357 0.04186 0.0 0.0			
36 37 38 39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43 44	$\begin{array}{c} \Delta_1 \\ \Delta_2 \\ F \\ Fpipe \\ Farmour \\ \lambda_{"1}^{"} \\ \textbf{Screen Loss} \\ \lambda_1 \\ \textbf{and Pipe Loss} \\ \lambda_2 \\ \lambda_2 \\ pipe \\ \lambda_2 \end{array}$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Screen Loss Factor Screen Loss Factor Pipe Loss Factor Armour Loss Factor Pipe Loss Factor + Pipe Loss Factor		-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506	0.00488 0.0 1.0 1.0 1.0 0.08878 0.10774 0.00	0.00001 1.0 1.0 0.02357 0.04186 0.0			
36 37 38 39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43 44 46 <b>Normal O</b>	$\Delta_1$ $\Delta_2$ F Fpipe Farmour $\lambda^{"_1}$ Screen Loss $\lambda_1$ and Pipe Los $\lambda_2a$ $\lambda_2pipe$ $\lambda_2$ Operation IEC	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor Screen Loss Factor Screen Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-2-1		-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0	0.00488 0.0 1.0 1.0 0.08878 0.10774 0.0 0.0 0.0 0.0	0.00001 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0			
36 37 38 39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43 44	$\begin{array}{c} \Delta_1 \\ \Delta_2 \\ F \\ Fpipe \\ Farmour \\ \lambda_{"1}^{"} \\ \textbf{Screen Loss} \\ \lambda_1 \\ \textbf{and Pipe Los} \\ \lambda_2 \\ \lambda_2 \\ pipe \\ \lambda_2 \end{array}$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Screen Loss Factor Screen Loss Factor Pipe Loss Factor Armour Loss Factor Pipe Loss Factor + Pipe Loss Factor	[K.m/W] [mm]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0	0.00488 0.0 1.0 1.0 0.08878 0.10774 0.0 0.0 0.0	0.00001 1.0 1.0 0.02357 0.04186 0.0 0.0			
36 37 38 39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43 44 46 <b>Normal O</b> 47	$\begin{array}{c} \Delta_1 \\ \Delta_2 \\ F \\ Fpipe \\ Farmour \\ \lambda''_1 \\ \hline \textbf{Screen Loss} \\ \lambda_1 \\ \textbf{and Pipe Los} \\ \hline \lambda_2 \\ \hline \lambda_2 pipe \\ \lambda_2 \\ \hline \textbf{Operation IEd} \\ \hline T_1 \\ \end{array}$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor Co287-2-1 Thermal Resistance Between Conductor and Screen		-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0.00488 0.0 1.0 1.0 0.08878 0.10774 0.0 0.0 0.0 0.0 0.0 0.0 0.36997	0.00001 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36 37 38 39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43 44 46 <b>Normal 0</b> 47 48	$\begin{array}{c} \Delta_1 \\ \Delta_2 \\ F \\ Fpipe \\ Farmour \\ \lambda''_1 \\ \hline \textbf{Screen Loss} \\ \lambda_1 \\ \textbf{and Pipe Loss} \\ \hline \lambda_2 \\ \hline \lambda_2 \\ \hline \lambda_2 \\ \hline \textbf{Dperation IEd} \\ \hline T_1 \\ t_1 \\ \hline t_1 \\ \end{array}$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen	[mm]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.08878 0.10774 0.0 0.0 0.0 0.0 0.0 0.0 0.36997 29.7	0.00001 1.0 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36 37 38 39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43 43 44 46 <b>Normal G</b> 47 48 49	$\begin{array}{c} \Delta_1 \\ \Delta_2 \\ F \\ Fpipe \\ Farmour \\ \lambda''_1 \\ \hline \textbf{Screen Loss} \\ \lambda_1 \\ \textbf{and Pipe Loss} \\ \lambda_2 \\ \hline \lambda_2 \\ \rhoipe \\ \lambda_2 \\ \hline \textbf{Operation IEC} \\ \hline T_1 \\ t_1 \\ \rho \\ \hline \textbf{Ti} \\ \end{array}$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor Co0287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation	[mm] [K.m/W]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.08878 0.10774 0.0 0.0 0.0 0.0 0.0 0.0 0.36997 29.7 3.5	0.00001 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36           37           38           39           40           41           Metallic           42           Armour           43           44           46           Normal O           47           48           49           50           51           52	$\begin{array}{c} \Delta_1 \\ \Delta_2 \\ F \\ Fpipe \\ Farmour \\ \lambda''_1 \\ \hline Screen Loss \\ \lambda_1 \\ \hline and Pipe Los \\ \lambda_2 \\ \hline \lambda_2 \\ \hline \lambda_2 \\ \hline \rho rie \\ \lambda_2 \\ \hline Deration IE \\ T_1 \\ t_1 \\ \rho Ti \\ T_3 \\ t_3 \\ \rho TJ \\ \end{array}$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor <b>Screen Loss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.08878 0.10774 0.10774 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.00001 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36 37 38 39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43 44 46 <b>Normal O</b> 47 48 49 50 51 51 52 <b>Cable in</b>	$\begin{array}{c} \Delta_1 \\ \Delta_2 \\ F \\ Fpipe \\ Farmour \\ \lambda''_1 \\ \hline Screen Loss \\ \lambda_1 \\ \hline and Pipe Los \\ \lambda_2 \\ \hline \lambda_2 \\ \hline and Pipe Los \\ \lambda_2 \\ \hline \lambda_2 \\ \hline r_1 \\ \hline \lambda_2 \\ \hline r_1 \\ \hline r_1 \\ \hline r_1 \\ \hline r_1 \\ \hline r_3 \\ \hline r_3 \\ \hline r_3 \\ \rho TJ \\ \hline Ducts \\ \hline \end{array}$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-21 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W] [mm]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.08878 0.10774 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.00001 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36 37 38 39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43 44 46 <b>Normal</b> 47 48 49 50 51 52 <b>Cable in</b> 53	$\begin{array}{c} \Delta_1 \\ \Delta_2 \\ F \\ Fpipe \\ Farmour \\ \lambda^{"}_1 \\ \hline Screen Loss \\ \lambda_1 \\ \hline and Pipe Los \\ \lambda_2 \\ \hline \lambda_2 \\ \hline \lambda_2 \\ \hline \rho \\ \rho \\ r_1 \\ \hline t_1 \\ \rho \\ T_1 \\ \hline t_1 \\ \rho \\ T_1 \\ \hline t_1 \\ \rho \\ T_1 \\ \hline T_3 \\ t_3 \\ \rho \\ TJ \\ \hline Ducts \\ \hline U \\ \hline \end{array}$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.08878 0.10774 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.00001 1.0 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36 37 38 39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43 44 46 <b>Normal O</b> 47 48 49 50 51 51 52 <b>Cable in</b>	$\begin{array}{c} \Delta_1 \\ \Delta_2 \\ F \\ Fpipe \\ Farmour \\ \lambda''_1 \\ \hline Screen Loss \\ \lambda_1 \\ \hline and Pipe Los \\ \lambda_2 \\ \hline \lambda_2 \\ \hline and Pipe Los \\ \lambda_2 \\ \hline \lambda_2 \\ \hline r_1 \\ \hline \lambda_2 \\ \hline r_1 \\ \hline r_1 \\ \hline r_1 \\ \hline r_1 \\ \hline r_3 \\ \hline r_3 \\ \hline r_3 \\ \rho TJ \\ \hline Ducts \\ \hline \end{array}$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-21 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W] [mm]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.08878 0.10774 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.00001 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36 37 38 39 40 41 <b>Metallic</b> 42 43 44 43 44 46 <b>Normal G</b> 47 48 49 50 51 51 52 <b>Cable in</b> 53 54	$\begin{array}{c} \Delta_1 \\ \Delta_2 \\ F \\ Fpipe \\ Farmour \\ \lambda''_1 \\ \hline Screen Loss \\ \lambda_1 \\ and Pipe Los \\ \lambda_2 \\ \hline \lambda_2 \\ \hline \lambda_2 \\ \hline Deration IE( \\ \lambda_2 \\ \hline \\ Deration IE( \\ T_1 \\ t_1 \\ \rho \\ T_1 \\ t_1 \\ \rho \\ T_3 \\ t_3 \\ \rho \\ TJ \\ \hline Ducts \\ \hline \\ U \\ V \\ \end{array}$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.08878 0.10774 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.00001 1.0 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36 37 38 39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43 43 44 46 <b>Normal G</b> 47 48 49 50 51 52 <b>Cable in</b> 53 54 55	$\begin{array}{c} \Delta_1 \\ \Delta_2 \\ F \\ Fpipe \\ Farmour \\ \lambda''_1 \\ \hline Screen Loss \\ \lambda_1 \\ \hline and Pipe Los \\ \lambda_2 \\ \hline \lambda_2 \\ \hline \lambda_2 \\ \hline \lambda_2 \\ \hline \rho \\ \hline \lambda_2 \\ \hline Deration IE( \\ T_1 \\ t_1 \\ \rho \\ T_1 \\ t_1 \\ \rho \\ T_3 \\ t_3 \\ \rho \\ TJ \\ \hline Ducts \\ \hline U \\ V \\ \gamma \\ \end{array}$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm] [K.m/W]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.08878 0.10774 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.00001 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36           37           38           39           40           41           Metallic           42           Armour           43           44           46           Normal O           47           48           49           50           51           52           Cable in           53           54           55           56	$\begin{array}{c} \Delta_1 \\ \Delta_2 \\ F \\ Fpipe \\ Farmour \\ \lambda^*_1 \\ \hline Screen Loss \\ \lambda_1 \\ \hline Screen Loss \\ \lambda_2 \\ \hline Deration IE0 \\ \hline \lambda_2 \\ \hline Deration IE0 \\ \hline \lambda_3 \\ \hline Deration IE0 \\ \hline \lambda_3 \\ \hline Ducts \\ \hline U \\ \hline V \\ \hline V \\ \hline W \\ \hline H \\ H \\$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor <b>Screen Loss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space	[mm] [K.m/W] [K.m/W] [mm] [K.m/W]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.08878 0.10774 0.10774 0.00 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00001 1.0 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36           37           38           39           40           41           Metallic           42           Armour           43           44           46           Normal O           47           48           49           50           51           52           Cable in           53           54           55           56           57	$\begin{array}{c} \Delta_1 \\ \Delta_2 \\ F \\ Fpipe \\ Farmour \\ \lambda^*_1 \\ \hline \textbf{Screen Loss} \\ \lambda_1 \\ \hline \textbf{Screen Loss} \\ \lambda_1 \\ \hline \textbf{Screen Loss} \\ \lambda_2 \\ \hline \textbf{Screen Loss} \\ \lambda_2 \\ \hline \textbf{Screen Loss} \\ \hline \textbf{A}_2 \\ \hline \textbf{A}_2 \\ \hline \textbf{Dperation IE} \\ \hline \textbf{A}_2 \\ \hline \textbf{Operation IE} \\ \hline \textbf{A}_3 \\ \hline \textbf{PTi} \\ \hline \textbf{T}_3 \\ \hline \textbf{C} \\ \hline \textbf{U} \\ \hline \textbf{V} \\ \hline \textbf{V} \\ \hline \textbf{W} \\ \hline \textbf{H} \\ \hline \textbf{T}_4 \\ \hline \textbf{H} \\ \hline \textbf{H} \\ \hline \textbf{H} \\ \hline \textbf{A}_2 \\ \hline \textbf{C} \\ \hline \textbf{A}_2 \\ \hline \textbf{B} \\ \hline \textbf{A}_2 \\ \hline \textbf{B} \\ \hline \textbf{A}_2 \\ \hline $	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor <b>s Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Lose 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [°C] [°C]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.08878 0.10774 0.00 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00001 1.0 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36           37           38           39           40           41           Metallic           42           Armour           43           44           46           Normal 0           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60	$\begin{array}{c} \Delta_1 \\ \Delta_2 \\ F \\ Fpipe \\ \hline Farmour \\ \lambda''_1 \\ \hline Screen Loss \\ \lambda_1 \\ \hline and Pipe Los \\ \lambda_2 \\ \hline \lambda_2 \\ \hline Deration IE \\ \lambda_2 \\ \hline Deration IE \\ \hline \\ \gamma \\ \hline \\ \hline$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Miliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor <b>s Factor</b> Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Filling the Space Thermal Resistance of the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Material	[mm] [K.m/W] [Mm] [K.m/W] [K.m/W] [%C] [%C] [K.m/W] [mm] [mm] [K.m/W]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0.00001 1.0 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36           37           38           39           40           41           Metallic           42           43           44           46           Normal G           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61	$\begin{array}{c} \Delta_1 \\ \Delta_2 \\ F \\ Fpipe \\ Farmour \\ \lambda''_1 \\ \hline Screen Loss \\ \lambda_1 \\ \hline Screen Loss \\ \lambda_2 \\ \hline Deration IE0 \\ \lambda_2 \\ \hline Deration IE0 \\ \hline T_1 \\ t_1 \\ \rho Ti \\ T_3 \\ t_3 \\ \rho TJ \\ \hline Ducts \\ \hline U \\ V \\ \hline V \\ \Theta \\ T_4 \\ \hline Do \\ Di \\ \rho T \\ T_4 \\ \ Hentice I \\ \hline Do \\ Di \\ \rho T \\ T_4 \\ \ Hentice I \\ \hline T_4 \\ \ T_4 \\ \ Hentice I \\ \hline T_4 \\ \ Hentice I \\ \hline T_4 \\ \ T_4 \\ \ Hentice I \\ \hline T_4 \\ \ T_4 \\$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor <b>Screen Loss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [mm] [mm] [K.m/W] [K.m/W]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.08878 0.10774 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.00001 1.0 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36           37           38           39           40           41           Metallic           42           Armour           43           44           46           Normal C           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62	$\begin{array}{c} \Delta_1 \\ \Delta_2 \\ F \\ Fpipe \\ Farmour \\ \lambda''_1 \\ \hline Screen Loss \\ \lambda_1 \\ \hline Screen Loss \\ \lambda_2 \\ \hline Deration IE0 \\ \lambda_2 \\ \hline Deration IE0 \\ \hline T_1 \\ t_1 \\ \rho Ti \\ T_3 \\ t_3 \\ \rho TJ \\ \hline Ducts \\ \hline U \\ V \\ \hline V \\ \Theta \\ T_4 \\ \hline Do \\ Di \\ \rho T \\ T_4'' \\ \hline T_4'' \\ T_4''' \\ \hline T_4''' \\ T_4''' \\ \hline \hline T_4''' \\ \hline \end{array}$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Miliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor <b>s Factor</b> Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Filling the Space Thermal Resistance of the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Material	[mm] [K.m/W] [Mm] [K.m/W] [K.m/W] [%C] [%C] [K.m/W] [mm] [mm] [K.m/W]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0.00001 1.0 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36           37           38           39           40           41           Metallic           42           Armour           43           44           46           Normal C           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62	$\begin{array}{c} \Delta_1 \\ \Delta_2 \\ F \\ Fpipe \\ Farmour \\ \lambda''_1 \\ \hline Screen Loss \\ \lambda_1 \\ \hline Screen Loss \\ \lambda_2 \\ \hline Deration IE0 \\ \lambda_2 \\ \hline Deration IE0 \\ \hline T_1 \\ t_1 \\ \rho Ti \\ T_3 \\ t_3 \\ \rho TJ \\ \hline Ducts \\ \hline U \\ V \\ \hline V \\ \Theta \\ T_4 \\ \hline Do \\ Di \\ \rho T \\ T_4'' \\ \hline T_4'' \\ T_4''' \\ \hline T_4''' \\ T_4''' \\ \hline \hline T_4''' \\ \hline \end{array}$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor <b>Screen Loss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [mm] [mm] [K.m/W] [K.m/W]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.08878 0.10774 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.00001 1.0 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36           37           38           39           40           41           Metallic           42           Armour           43           44           46           Normal O           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in	$\begin{array}{c} \Delta_1 \\ \Delta_2 \\ F \\ \hline Fpipe \\ \hline Farmour \\ \lambda^*_1 \\ \hline Screen Loss \\ \lambda_1 \\ \hline and Pipe Los \\ \lambda_2 \\ \hline \lambda_2 \\ \hline Deration IEG \\ \hline \lambda_2 \\ \hline Deration IEG \\ \hline \lambda_2 \\ \hline Deration IEG \\ \hline \lambda_2 \\ \hline Doeration IEG \\ \hline T_1 \\ \hline T_3 \\ \hline Do \\ \hline D \\ \hline D \\ \hline T_4 \\ \hline D \\ \hline D \\ \hline T_4 \\ \hline T_4 \\ \hline \end{bmatrix}$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor <b>Screen Loss Factor</b> <b>Screen Loss Factor</b> <b>Armour Loss Factor</b> Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>(Backfill Installation</b>	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [C] [K.m/W] [mm] [mm] [K.m/W] [K.m/W]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.0878 0.10774 0.10774 0.00 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00001 1.0 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36           37           38           39           40           41           Metallic           42           Armour           43           44           46           Normal O           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in	$\begin{array}{c} \Delta_1 \\ \Delta_2 \\ F \\ Fpipe \\ Farmour \\ \lambda^*_1 \\ \hline Screen Loss \\ \lambda_1 \\ \hline Screen Loss \\ \lambda_2 \\ \hline A_2 \\ \hline Deration IE \\ \lambda_2 \\ \hline Deration IE \\ \hline A_2 \\ \hline Deration IE \\ \hline D$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor <b>Screen Loss Factor</b> <b>Screen Loss Factor</b> <b>Armour Loss Factor</b> Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Insulation Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistance of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [%m/W] [mm] [mm] [K.m/W] [K.m/W] [K.m/W]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.0878 0.10774 0.00 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00001 1.0 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36           37           38           39           40           41           Metallic           42           Armour           43           44           46           Normal O           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64	$\begin{array}{c} \Delta_1 \\ \Delta_2 \\ F \\ Fpipe \\ Farmour \\ \lambda^*_1 \\ \hline Screen Loss \\ \lambda_1 \\ \hline Screen Loss \\ \lambda_2 \\ \hline A_2 \\ \hline Deration IE \\ \lambda_2 \\ \hline Deration IE \\ \lambda_2 \\ \hline Deration IE \\ \hline A_2 \\ \hline Deration IE \\ \hline Deration IE$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor <b>Screen Loss Factor</b> <b>Screen Loss Factor</b> <b>Armour Loss Factor</b> Pipe Loss Factor <b>Pipe Loss Factor</b> <b>Co0287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filing the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistance of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W] [mm] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.0878 0.10774 0.00 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00001 1.0 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36           37           38           39           40           41           Metallic           42           Armour           43           44           46           Normal O           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65	$\begin{array}{c} \Delta_1 \\ \Delta_2 \\ F \\ Fpipe \\ Farmour \\ \lambda''_1 \\ \hline Screen Loss \\ \lambda_1 \\ \hline and Pipe Loss \\ \lambda_2 \\ \hline Dyperation IE \\ \lambda_2 \\ \hline Dyperation IE \\ \lambda_2 \\ \hline Dyperation IE \\ \hline \lambda_2 \\ \hline Dyperation IE \\ \hline \lambda_2 \\ \hline Dyperation IE \\ \hline Dyperation IE$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor <b>Screen Loss Factor</b> <b>Screen Loss Factor</b> <b>Screen Loss Factor</b> <b>Armour Loss Factor</b> <b>Pipe Loss Factor</b> <b>Armour Loss Factor</b> <b>Pipe Loss Factor</b> <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Insulation Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resist	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.0878 0.00774 0.00 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00001 1.0 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36         37         38         39         40         41         Metallic         42         Armour         43         44         46         Normal G         47         48         49         50         51         52         Cable in         53         54         55         56         57         58         59         60         61         62         Cable in         63         64         65         66         67         68		Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Miliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor Screen Loss Factor <b>Screen Loss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-21</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Thermal Resistance of the Medium Inside the Duct/Pipe Thermal Resistance of the Medium Inside the Duct/Pipe Thermal Resistance of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Depth of Laying to the Centre of Duct	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [mm] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.0878 0.10774 0.00 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00001 1.0 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36           37           38           39           40           41           Metallic           42           Armour           43           44           46           Normal O           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65           66           67           68           67           68           67		Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Miliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor Screen Loss Factor Pipe Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-21</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Iniling the Space Thermal Resistance of the Medium Inile the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Thermal Res	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [C] [C] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.0878 0.10774 0.00 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00001 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36           37           38           39           40           41           Metallic           42           Armour           43           44           46           Normal O           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65           66           67           68           69           70		Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor <b>sr Factor</b> Armour Loss Factor Pipe Loss Factor <b>Coefficient</b> Uses Factor <b>Coefficient</b> Used in IEC 60287-21 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Thermal Resistance of the Duct Pipe Thermal Resistance of the Duct Pipe Thermal Resistance of the Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of te Zath Around the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W] [mm] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.0878 0.10774 0.00 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00001 1.0 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36         37         38         39         40         41         Metallic         42         Armour         43         44         46         Normal O         47         48         49         50         51         52         Cable in         53         54         55         56         57         58         59         60         61         62         Cable in         63         64         65         66         67         68         69         70         70         70         70         70	Δ₁           Δ₂           F           Fpipe           Farmour           λ"₁           Screen Loss           λ₁           and Pipe Loss           λ₂a           λ₂pipe           λ₂           Operation IEG           Τ₁           τ₁           τ₃           ρTi           T₃           τ₃           ρTJ           Ducts           U           Y           θm           T₄"           Do           Di           ρT           τ₄"           y           tbit           LG           u           N           ρe           ρc           τ₄"	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor <b>sr Factor</b> Armour Loss Factor Pipe Loss Factor Pipe Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct Pipe Thermal Resistance of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of the Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resist	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W] [mm] [mm] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.0878 0.10774 0.00 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00001 1.0 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36           37           38           39           40           41           Metallic           42           Armour           43           44           46           Normal O           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65           66           67           68           69           70		Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor <b>s Factor</b> Armour Loss Factor Pipe Loss Factor Pipe Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Insulation Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>(Backfill Installation</b> Shorter Side of the Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill Thermal Resistivity of the The Bank/Backfill Thermal Resistivity of the Cuct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the The Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of Harth Around the Duct Bank/Backfill Thermal Resistivity of Harth Around the Duct Bank/Backfill Thermal Resistivity of the Duct	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W] [mm] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.0878 0.10774 0.00 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00001 1.0 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			
36         37         38         39         40         41         Metallic         42         Armour         43         44         46         Normal O         47         48         49         50         51         52         Cable in         53         54         55         56         57         58         59         60         61         62         Cable in         63         64         65         66         67         68         69         70         70         70         70         70	Δ₁           Δ₂           F           Fpipe           Farmour           λ"₁           Screen Loss           λ₁           and Pipe Loss           λ₂a           λ₂pipe           λ₂           Operation IEG           Τ₁           τ₁           τ₃           ρTi           T₃           τ₃           ρTJ           Ducts           U           Y           θm           T₄"           Do           Di           ρT           τ₄"           y           tbit           LG           u           N           ρe           ρc           τ₄"	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor <b>sr Factor</b> Armour Loss Factor Pipe Loss Factor Pipe Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct Pipe Thermal Resistance of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of the Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resist	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W] [mm] [mm] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	-0.02134 0.00033 1.0 1.0 1.0 0.02243 0.04506 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00488 0.0 1.0 1.0 0.0878 0.10774 0.00 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.00001 1.0 1.0 1.0 0.02357 0.04186 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.			

	Study Summary			
CYMCAP Version	7.3 Revision 2			
Study:	Eirgrid Cp966 Feasibility study			
Execution:	irgrid - std trench (1ct 400kV CABLE) v2 - Summer (20C)			
Date:	02/03/2020 15:24:12			

General Simulation Data	
Steady State Option	Equally Loaded
Consider Electrical interaction between circuits	No
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0
Conductor Resistances Computation Option:	IEC-228

Installation Type:Ductbank		
Ambient Soil Temperature at Installation Depth	[°C]	20.0
Native Soil Thermal Resistivity	[K.m/W]	1.2
Thermal Resistivity of Duct Bank	[K.m/W]	1.0
Depth of Center of Duct Bank	[m]	0.96
Duct Bank Width	[m]	1.7
Duct Bank Height	[m]	0.68



<b>Results</b>	Results Summary										
									Conductor		

					Cable	Daily Load	X coordinate	Y coordinate	temperature	
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Frequency	Factor	[m]	[m]	[°C]	Ampacity [A]
1	400KV.011	1		А	50.0	1.0	0.25	1.05	84.7	1866.6
2	400KV.011	1		В	50.0	1.0	0.83	1.05	90.0	1866.6
3	400KV.011	1		С	50.0	1.0	1.41	1.05	84.6	1866.6

	Steady State Summary
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 400kV CABLE) v2 - Summer (20C)
Date:	02/03/2020 15:24:12

Simulation Data				
Installation type:	Ductbank			
Steady State Option	Equally Loaded			
Ambient temperature [°C]	20			
Native Soil Thermal Resistivity [K.m/W]	1.2			
Consider Non-Isothermal Earth Surface	No			
Consider effect of soil dry out	No			
Consider Electrical interaction between circuits	No			
Induced current in metallic layers as a fraction of conductor current (applied to all single phase circuits)	0			

Variable	Description	Unit		Cables	
Cable No.	Cable Index Number		1	2	3
General Inpu	t Data				
Cable ID	Cable Equipment ID		400KV.011	400KV.011	400KV.011
Circuit No.	Circuit No.		1	1	1
Phase	Cable Phase		А	В	С
Fq	Operating Frequency	[Hz]	50.0	50.0	50.0
x	X coordinate	[m]	0.25	0.83	1.41
У	Y coordinate	[m]	1.05	1.05	1.05
DLF	Daily Load Factor	[p.u.]	1.0	1.0	1.0
	Bonding Type		1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat
Ampacity					
Ι	Steady State Ampacity	[A]	1866.6	1866.6	1866.6
Temperature	S				
θс	Conductor temperature	[°C]	84.7	90.0	84.6
θs	Sheath/Shield temperature	[°C]	71.0	76.1	70.9
θа	Armour temperature	[°C]	n/a	n/a	n/a
θsurf	Cable surface temperature	[°C]	69.1	74.1	69.0
θduct	Duct surface temperature	[°C]	58.8	63.3	58.7
Resistances					
$R_0$	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
R	AC Resistance of the Conductor at Operating Temperature	[Ω/km]	0.01006	0.0102	0.01006
ys	Skin Effect Factor		0.11243	0.1091	0.11249
ур	Proximity Effect Factor		0.00176	0.00171	0.00176
Losses					
Wc	Conductor Losses	[W/m]	35.05604	35.53122	35.04811
Wd	Dielectric Losses	[W/m]	4.00936	4.00936	4.00936
Ws	Metallic Screen Losses	[W/m]	1.58059	3.81093	1.46462
Wa	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
Wt	Total Losses	[W/m]	40.64599	43.3515	40.52208
$\lambda_1$	Screen Loss Factor		0.04509	0.10726	0.04179
$\lambda_2$	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
Thermal resi	stances	· · · · · · · · · · · · · · · · · · ·			
T1	Thermal resistance of insulation	[K.m/W]	0.36997	0.36997	0.36997
T2	Thermal resistance of bedding/medium inside pipe-type	[K.m/W]	n/a	n/a	n/a
Т3	Thermal resistance of outer covering	[K.m/W]	0.04684	0.04684	0.04684
T4	External thermal resistance	[K.m/W]	1.20743	1.24765	1.20931
Others					
Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
	Induced current on Metallic Screen	[A]	116.9	106.7	105.0

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 400kV CABLE) v2 - Summer (20C)
Date:	02/03/2020 15:24:12

No.	Description	Unit	1
Gen	eral Cable Information		
1	Cable Equipment ID		400KV.011
2	Number of Cores		Single Core
3	Voltage	[kV]	400
4	Conductor Area	[mm²]	2500.0
5	Cable Overall Diameter	[mm]	136.4
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	110
Con	ductor	1	
8	Material		Copper
9	Electrical Resistivity at 20°C	[μΩ.cm]	1.7241
10	Temperature Coefficient at 20°C	[1/K]	0.00393
	Reciprocal of Temperature Coefficient of Resistance		
11		[K]	234.5
12	Volumetric Specific Heat (SH)	[J/(K*cm <sup>3</sup> )]	3.45
13	Construction		6 Segments
14	Conductor Insulation System		Extruded
15	Milliken Wires Construction		Insulated Wires
16	Ks (Skin Effect Coefficient)		0.35
17	Kp (Proximity Effect Coefficient)		0.2
18	Diameter	[mm]	63.0
Con	ductor Shield	Γ	
19	Thickness	[mm]	1.8
20	Diameter	[mm]	66.6
Insu	lation		
21	Material		XLPE Unfilled
22	Thermal Resistivity	[K.m/W]	3.5
23	Dielectric Loss Factor - ( tan delta )		0.001
24	Relative Permittivity - ( epsilon )		2.5
25	Specific Insulation Resistance Constant at 60°F - ( K )	[MΩ.km]	65617.
26	Thickness	[mm]	26.2
27	Diameter	[mm]	119.0
Insu	lation Screen		
28	Material		Semi Conducting Screen
29	Thickness	[mm]	1.7
30	Diameter	[mm]	122.4
She	ath		
31	Is Sheath Around Each Core?		n/a
32	Material		Aluminum
33	Electrical Resistivity at 20°C	[μΩ.cm]	2.84
34	Temperature Coefficient at 20°C	[1/K]	0.00403
35	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	228
36	Volumetric Specific Heat (SH)	[N] [J/(K*cm <sup>3</sup> )]	2.5
37	Corrugation Type	. /*	Non Corrugated
38	Thickness	[mm]	1.5
39	Diameter	[mm]	125.4
Jacl	ket	[]	
40	Material		Polvethylene
	Thermal Resistivity	[K ~ ^^/]	Polyethylene
	Thickness	[K.m/W]	3.5
42	Diameter	[mm]	5.5
43		[mm]	136.4

No.	Description	Unit	1
Spe	cific Installation Data		
44	Cable Equipment ID		400KV.011
45	Cable Frequency	[Hz]	50
46	Sheath / Shield Bonding		1 Conductor Crossbonded Flat
47	Loss Factor Constant (ALOS)		0.3
48	Minor section length		Crossbonded Unknown Section Lengths UNKNOWN
49	Duct construction		Polyethylene in Concrete
50	Duct material thermal resistivity	[K.m/W]	3.5
51	Inside Diameter of the Duct/Pipe	[mm]	188.0
52	Outside Diameter of the Duct/Pipe	[mm]	200.0

#### Cable ID : 400KV.011

Cable Title 2500sqmm Cu (insulated wires)\_XLPE\_CAS\_PE NKT for Eirgrid Conductor, copper, 6 segments D = 63.0 mm Conductor shield Th = 1.8, D = 66.6 mm Insulation, XLPE (unfilled) Th = 26.2, D = 119.0 mm Insu. screen, semi-conducting Th = 1.7, D = 122.4 mm + Sheath, aluminum Th = 1.5, D = 125.4 mm Jacket, polyethylene Th = 5.5, D = 136.4 mm Overall cable diameter = 136.4 mm Voltage = 400.0 kV Cond. area = 2500.0 mm<sup>2</sup> Conductor, copper Insulation system = Extruded, Skin = Program selects Conductor shield Insulation, XLPE (unfilled) Dielectric loss = Program selects Insu. screen, semi-conducting + Sheath, aluminum Jacket, polyethylene





CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 400kV CABLE) v2 - Summer (20C)
Date:	02/03/2020 15:24:12

No.	Description	Unit	Cable No.1	Cable No.2	Cable No.3
1	Cable Equipment ID		400KV.011	400KV.011	400KV.011
Resi	stances				
2	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00903	0.00918	0.00903
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.00843	0.00843	0.00843
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01006	0.0102	0.01006
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.04864	0.04864	0.04864
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.05864	0.05964	0.05862
Loss	ses				
8	Conductor Losses	[W/m]	35.05604	35.53122	35.04811
9	Dielectric Losses	[W/m]	4.00936	4.00936	4.00936
10	Metallic Screen Losses	[W/m]	1.58059	3.81093	1.46462
11	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
12	Total Losses	[W/m]	40.64599	43.3515	40.52208
Сара	acitance, Inductance, Impedance				
13	Capacitance	[µF/km]	0.239	0.239	0.239
14	Inductance of Conductor	[mH/km]	0.63261	0.63261	0.63261
15	Reactance of Conductor	[Ω/km]	0.19874	0.19874	0.19874
16	Inductance of Metallic Sheath	[mH/km]	0.44734	0.44734	0.44734
17	Reactance of Metallic Sheath	[Ω/km]	0.14054	0.14054	0.14054
18	Positive Sequence Impedance	[Ω/km]	0.010060 + j0.198740	0.010200 + j0.198740	0.010060 + j0.198740
19	Negative Sequence Impedance	[Ω/km]	0.010060 + j0.198740	0.010200 + j0.198740	0.010060 + j0.198740
20	Zero Sequence Impedance	[Ω/km]	0.056650 + j0.140540	0.056630 + j0.140540	0.056650 + j0.140540
21	Surge Impedance	[Ω]	51.41672	51.41672	51.41672
Othe	ers				
22	Dielectric Stress at Conductor Surface	[kV/mm]	11.94851	11.94851	11.94851
23	Dielectric Stress at Insulation Surface	[kV/mm]	6.68715	6.68715	6.68715
24	Insulation Resistance at 60°F (15.8°C)	[MΩ.km]	16540.20553	16540.20553	16540.20553
25	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a
26	Charging Current for One Phase	[A/km]	17.36102	17.36102	17.36102
27	Charging Capacity of three phase system at Uo	[kvar/km]	12028.06597	12028.06597	12028.06597
28	Voltage drop for Three Phase System	[V/A/km]	0.01743	0.01766	0.01742
29	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
30	Induced current on Metallic Screen	[A]	116.9	106.7	105.0

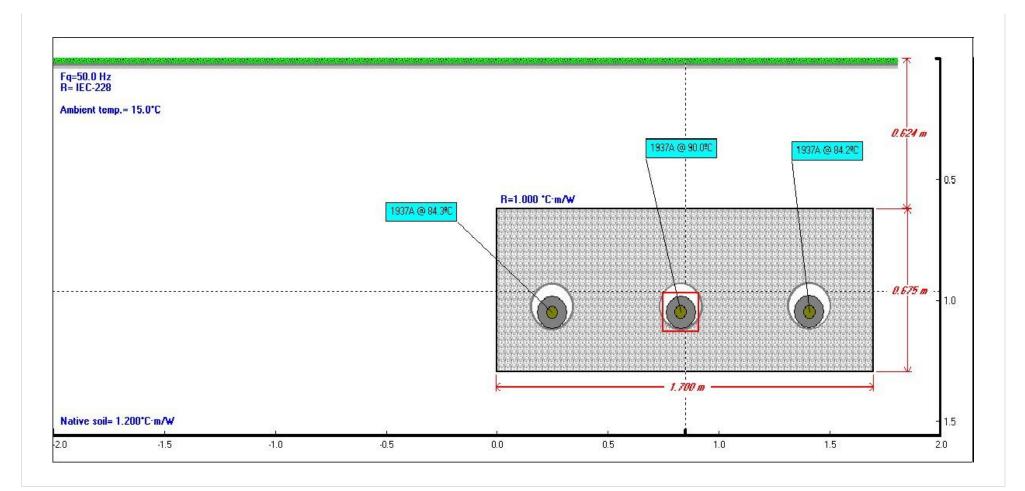
	Cable Parameters under Normal Operation				
CYMCAP Version	7.3 Revision 2				
Study:	grid Cp966 Feasibility study				
Execution:	Eirgrid - std trench (1ct 400kV CABLE) v2 - Summer (20C)				
Date:	02/03/2020 15:24:12				

No.	Symbol	Description	Unit	Cable No.1	Cable No.2	Cable No.3
1	Symbol	Cable Equipment ID	onit	400KV.011	400KV.011	400KV.011
Normal	Operation I	EC 60287-1-1		1		
Conduc	ctor AC Resi	istance				
2	R <sub>0</sub>	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	R'	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00903	0.00918	0.00903
4	dc	Conductor Diameter	[mm]	63.0	63.0	63.0
5	s	Distance Between Conductor Axes	[mm]	580.0	580.0	580.0
6	ks	Factor Used for xs Calculation (Skin Effect)		0.35	0.35	0.35
7	kp xc	Factor Used for xp Calculation (Proximity Effect)		0.2	0.2	0.2
8	xs xp	Component of Ys Calculation (Skin Effect) Component of Yp Calculation (Proximity Effect)		2.20688	2.18874 1.65453	2.20718 1.66847
10		Skin Effect Factor		0.11243	0.1091	0.11249
	ys			0.00176	0.00171	0.00176
11 12	yp R	Proximity Effect Factor AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01006	0.0102	0.01006
	ric Losses		[12/1011]	0.01000	0.0102	0.01000
13	tanδ	Dielectric Loss Factor		0.001	0.001	0.001
14	ε	Insulation Relative Permitivity		2.5	2.5	2.5
15	с	Cable Capacitance	[µF/km]	0.239	0.239	0.239
16	U <sub>0</sub>	Voltage	[kV]	230.94011	230.94011	230.94011
17	Wd	Cable Dielectric Losses Per Phase	[W/m]	4.00936	4.00936	4.00936
Circula	ting Loss Fa	actor				
18	Rs	AC Resistance used for Circulating Loss Factor computation	[Ω/km]	0.05864	0.05964	0.05862
19	d	Mean diameter used for Circulating Loss Factor computation	[mm]	123.9	123.9	123.9
20	X	Reactance used for Circulating Loss Factor computation Mutual Reactance	[Ω/km]	0.14054	0.14054	0.14054
21 22	Xm P	Mutual Reactance Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km] [Ω/km]	0.04355	0.04355	0.04355
22	Q	Component for Circulating Loss Factor Formula (Clause 2.3.3) Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.12602	0.12602	0.12602
	_	Spacing Factor (applied when spacing between cable uneven or non-				
24	Fspacing	equal minor section length)		0.004	0.004	0.004
25	λ'1 -	Screen Loss Factor Caused by Circulating Current		0.02287	0.01911	0.01845
	oss Factor		101			
26 27	Rs d	AC Resistance used for Eddy Loss Factor computation	[Ω/km]	0.05864	0.05964	0.05862
27	α ps	Mean diameter used for Eddy Loss Factor computation Electrical Resistivity used for Eddy Loss Factor computation	[mm] [Ω.m]	123.9 0.0	0.0	0.0
29	Ds	External diameter used for Eddy Loss Factor computation	[mm]	125.4	125.4	125.4
30	ts	Thickness used for Eddy Loss Factor computation	[mm]	1.5	1.5	1.5
31	β1	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		107.3843	106.47436	107.3997
32	gs	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		1.00537	1.00531	1.00537
34	m	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.53578	0.52674	0.53593
35	λ <sub>0</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.00382	0.01487	0.00382
36	$\Delta_1$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		-0.02153	0.00479	0.0286
37	$\Delta_2$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.00031	0.0	0.00001
38	F	Milliken conductor Effect		1.0	1.0	1.0
39	Fpipe	Magnetic effect factor due to pipe		1.0	1.0	1.0
40	Farmour	Magnetic effect factor due to armour		1.0	1.0	1.0
41	λ"1	Screen Loss Factor Caused by Eddy Current		0.02221	0.08814	0.02334
	Screen Los					
42	λ <sub>1</sub> and Pipe Lo	Screen Loss Factor		0.04509	0.10726	0.04179
43	λ <sub>2</sub> a	Armour Loss Factor		0.0	0.0	0.0
44	λ <sub>2</sub> pipe	Pipe Loss Factor		0.0	0.0	0.0
46	λ <sub>2</sub>	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
Normal		EC 60287-2-1		1		
47	T <sub>1</sub>	Thermal Resistance Between Conductor and Screen	[K.m/W]	0.36997	0.36997	0.36997
48	t1	Insulation Thickness Between Conductor and Screen	[mm]	29.7	29.7	29.7
49	ρΤί	Thermal Resistivity of Insulation	[K.m/W]	3.5	3.5	3.5
50	T <sub>3</sub>	Thermal Resistance of Jacket/Pipe Coating	[K.m/W]	0.04684	0.04684	0.04684
51	t3	Thickness of Jacket/Pipe Coating	[mm]	5.5	5.5	5.5
52	ρTJ	Thermal Resistivity of Jacket/Pipe Coating	[K.m/W]	3.5	3.5	3.5
	n Ducts			4.07	4.07	4.07
53 54	U V	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		1.87	1.87	0.312
54 55	V Y	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		0.312	0.312	0.312
55	θm	Mean Temperature of the Medium Filling the Space	[°C]	64.6	69.5	64.6
57	T4'	Thermal Resistance of the Medium Inside the Duct/Pipe	[K.m/W]	0.21956	0.21343	0.21965
58	Do	Outside Diameter of the Duct/Pipe	[mm]	200.0	200.0	200.0
59	Di	Inside Diameter of the Duct/Pipe	[mm]	188.0	188.0	188.0
60	ρΤ	Thermal Resistivity of the Duct/Pipe Material	[K.m/W]	3.5	3.5	3.5
61	T4"	Thermal Resistance of the Duct/Pipe	[K.m/W]	0.03447	0.03447	0.03447
62	T4'''	Thermal Resistance of the Surrounding Medium	[K.m/W]	0.9534	0.99975	0.95519
		nk/Backfill installation				
63	x	Shorter Side of the Duct Bank/Backfill	[m]	0.675	0.675	0.675
64	y rb	Longer Side of the Duct Bank/Backfill	[m]	1.7	1.7	1.7
65 66	rb LG	Equivalent Radius of Duct Bank/Backfill	[m]	0.47741	0.47741	0.47741
66 67	LG u	Depth of Laying to the Centre of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3	[m]	0.962 2.01505	0.962 2.01505	0.962 2.01505
68	u N	Number of Loaded Cables in the Duct Bank/Backfill	<u> </u>	3.0	3.0	3.0
69	ρε	Thermal Resistivity of Earth Around the Duct Bank/Backfill	[K.m/W]	1.2	1.2	1.2
70	ρο	Thermal Resistivity of the Duct Bank/Backfill	[K.m/W]	1.0	1.0	1.0
71	T4"	Thermal Resistance of the Surrounding Medium	[K.m/W]	0.9534	0.99975	0.95519
72	T <sub>4</sub>	Total External Thermal Resistance	[K.m/W]	1.20743	1.24765	1.20931
		Temperature Rise at the Surface of the Cable Due to Other				
73	Δθint	Surrounding Elements	[°C]	0.0	0.0	0.0
74	I	Cable Core Current Ampacity	[A]	1866.6	1866.6	1866.6

Study Summary	
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 400kV CABLE) v2
Date:	16/01/2020 14:24:42

General Simulation Data	
Steady State Option	Equally Loaded
Consider Electrical interaction between circuits	No
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0
Conductor Resistances Computation Option:	IEC-228

Installation Type:Ductbank		
Ambient Soil Temperature at Installation Depth	[°C]	15.0
Native Soil Thermal Resistivity	[K.m/W]	1.2
Thermal Resistivity of Duct Bank	[K.m/W]	1.0
Depth of Center of Duct Bank	[m]	0.96
Duct Bank Width	[m]	1.7
Duct Bank Height	[m]	0.68



Results Summary										
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [m]	Y coordinate [m]	Conductor temperature [°C]	Ampacity [A]

1	400KV.011	1	A	50.0	1.0	0.25	1.05	84.3	1937.1
2	400KV.011	1	В	50.0	1.0	0.83	1.05	90.0	1937.1
3	400KV.011	1	С	50.0	1.0	1.41	1.05	84.2	1937.1

	Steady State Summary
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 400kV CABLE) v2
Date:	16/01/2020 14:24:42

#### **Simulation Data** Installation type: Ductbank **Steady State Option** Equally Loaded 15 Ambient temperature [°C] Native Soil Thermal Resistivity [K.m/W] 1.2 Consider Non-Isothermal Earth Surface No Consider effect of soil dry out No Consider Electrical interaction between circuits No Induced current in metallic layers as a fraction of conductor current 0 (applied to all single phase circuits)

Variable	Description	Unit		Cables	
Cable No.	Cable Index Number		1	2	3
General Inpu	t Data				
Cable ID	Cable Equipment ID		400KV.011	400KV.011	400KV.011
Circuit No.	Circuit No.		1	1	1
Phase	Cable Phase		А	В	С
Fq	Operating Frequency	[Hz]	50.0	50.0	50.0
х	X coordinate	[m]	0.25	0.83	1.41
у	Y coordinate	[m]	1.05	1.05	1.05
DLF	Daily Load Factor	[p.u.]	1.0	1.0	1.0
	Bonding Type		1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat
Ampacity					
I	Steady State Ampacity	[A]	1937.1	1937.1	1937.1
Femperature	S				
θс	Conductor temperature	[°C]	84.3	90.0	84.2
θs	Sheath/Shield temperature	[°C]	69.6	75.1	69.5
θа	Armour temperature	[°C]	n/a	n/a	n/a
θsurf	Cable surface temperature	[°C]	67.6	72.9	67.5
θduct	Duct surface temperature	[°C]	56.4	61.3	56.4
Resistances					
$R_0$	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
R	AC Resistance of the Conductor at Operating Temperature	[Ω/km]	0.01005	0.0102	0.01005
ys	Skin Effect Factor		0.11269	0.1091	0.11275
ур	Proximity Effect Factor		0.00177	0.00171	0.00177
osses					
Wc	Conductor Losses	[W/m]	37.71928	38.26944	37.71014
Wd	Dielectric Losses	[W/m]	4.00936	4.00936	4.00936
Ws	Metallic Screen Losses	[W/m]	1.70128	4.10956	1.5776
Wa	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
Wt	Total Losses	[W/m]	43.42991	46.38836	43.2971
$\tilde{\lambda}_1$	Screen Loss Factor		0.0451	0.10738	0.04183
$\tilde{\lambda}_2$	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
Thermal resi	stances				
T1	Thermal resistance of insulation	[K.m/W]	0.36997	0.36997	0.36997
T2	Thermal resistance of bedding/medium inside pipe-type	[K.m/W]	n/a	n/a	n/a
Т3	Thermal resistance of outer covering	[K.m/W]	0.04684	0.04684	0.04684
T4	External thermal resistance	[K.m/W]	1.21029	1.24885	1.21218
Others	·				•
Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
	Induced current on Metallic Screen	[A]	121.4	110.8	109.1

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 400kV CABLE) v2
Date:	16/01/2020 14:24:42

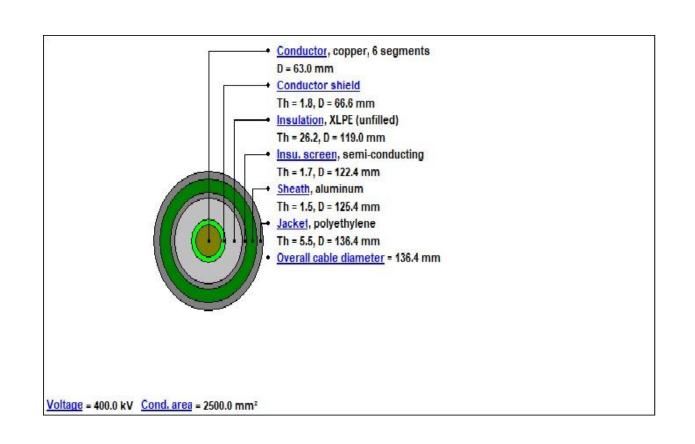
No.	Description	Unit	1
	eral Cable Information		
1	Cable Equipment ID		400KV.011
2	Number of Cores		Single Core
3	Voltage	[kV]	400
4	Conductor Area	[mm²]	2500.0
5	Cable Overall Diameter	[mm]	136.4
	Maximum Steady-State Conductor Temperature		
6	Maximum Emergency Conductor Temperature	[°C]	90
7 Con	ductor	[°C]	110
	Material		0
8	Electrical Resistivity at 20°C	[uQ am]	Copper 1.7241
9 10	Temperature Coefficient at 20°C	[μΩ.cm]	
10		[1/K]	0.00393
11	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
12	Volumetric Specific Heat (SH)	[J/(K*cm <sup>3</sup> )]	3.45
13	Construction		6 Segments
14	Conductor Insulation System		Extruded
15	Milliken Wires Construction		Insulated Wires
16	Ks (Skin Effect Coefficient)		0.35
17	Kp (Proximity Effect Coefficient)		0.2
18	Diameter	[mm]	63.0
Con	ductor Shield		
19	Thickness	[mm]	1.8
20		[mm]	66.6
Insu	lation		
21	Material		XLPE Unfilled
22	Thermal Resistivity	[K.m/W]	3.5
23	Dielectric Loss Factor - ( tan delta ) Relative Permittivity - ( epsilon )		0.001
24			2.5
25	Specific Insulation Resistance Constant at 60°F - (K)	[MΩ.km]	65617.
26	Thickness	[mm]	26.2
27	Diameter	[mm]	119.0
Insu	lation Screen		
28	Material		Semi Conducting Screen
29	Thickness	[mm]	1.7
30	Diameter	[mm]	122.4
Shea			
31	Is Sheath Around Each Core?		n/a
32	Material		Aluminum
33	Electrical Resistivity at 20°C	[μΩ.cm]	2.84
34	Temperature Coefficient at 20°C	[1/K]	0.00403
35	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	228
36	Volumetric Specific Heat (SH)	[J/(K*cm <sup>3</sup> )]	2.5
37	Corrugation Type		Non Corrugated
38	Thickness	[mm]	1.5
39	Diameter	[mm]	125.4
Jack	ket		
40	Material		Polyethylene
41	Thermal Resistivity	[K.m/W]	3.5
42	Thickness	[mm]	5.5
43	Diameter	[mm]	136.4

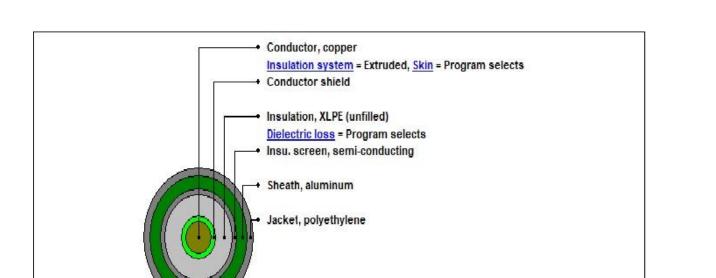
No.	Description	Unit	1						
Spe	Specific Installation Data								
44	Cable Equipment ID		400KV.011						
45	Cable Frequency	[Hz]	50						
46	Sheath / Shield Bonding		1 Conductor Crossbonded Flat						
47	Loss Factor Constant (ALOS)		0.3						
48	Minor section length		Crossbonded Unknown Section Lengths UNKNOWN						
49	Duct construction		Polyethylene in Concrete						
50	Duct material thermal resistivity	[K.m/W]	3.5						
51	Inside Diameter of the Duct/Pipe	[mm]	188.0						
52	Outside Diameter of the Duct/Pipe	[mm]	200.0						

#### Cable ID : 400KV.011

Cable Title

tle 2500sqmm Cu (insulated wires)\_XLPE\_CAS\_PE NKT for Eirgrid







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C=C'		
1000	10	-
INTERNA	TIONAL	TED

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 400kV CABLE) v2
Date:	16/01/2020 14:24:42

No.	Description	Unit	Cable No.1	Cable No.2	Cable No.3
1	Cable Equipment ID		400KV.011	400KV.011	400KV.011
Resi	stances				
2	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00902	0.00918	0.00902
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.00843	0.00843	0.00843
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01005	0.0102	0.01005
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.04864	0.04864	0.04864
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.05836	0.05944	0.05835
Loss	Ses				
8	Conductor Losses	[W/m]	37.71928	38.26944	37.71014
9	Dielectric Losses	[W/m]	4.00936	4.00936	4.00936
10	Metallic Screen Losses	[W/m]	1.70128	4.10956	1.5776
11	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
12	Total Losses	[W/m]	43.42991	46.38836	43.2971
Сара	acitance, Inductance, Impedance				
13	Capacitance	[µF/km]	0.239	0.239	0.239
14	Inductance of Conductor	[mH/km]	0.63261	0.63261	0.63261
15	Reactance of Conductor	[Ω/km]	0.19874	0.19874	0.19874
16	Inductance of Metallic Sheath	[mH/km]	0.44734	0.44734	0.44734
17	Reactance of Metallic Sheath	[Ω/km]	0.14054	0.14054	0.14054
18	Positive Sequence Impedance	[Ω/km]	0.010050 + j0.198740	0.010200 + j0.198740	0.010050 + j0.198740
19	Negative Sequence Impedance	[Ω/km]	0.010050 + j0.198740	0.010200 + j0.198740	0.010050 + j0.198740
20	Zero Sequence Impedance	[Ω/km]	0.056650 + j0.140540	0.056630 + j0.140540	0.056650 + j0.140540
21	Surge Impedance	[Ω]	51.41672	51.41672	51.41672
Othe	ers				
22	Dielectric Stress at Conductor Surface	[kV/mm]	11.94851	11.94851	11.94851
23	Dielectric Stress at Insulation Surface	[kV/mm]	6.68715	6.68715	6.68715
24	Insulation Resistance at 60°F (15.8°C)	[MΩ.km]	16540.20553	16540.20553	16540.20553
25	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a
26	Charging Current for One Phase	[A/km]	17.36102	17.36102	17.36102
27	Charging Capacity of three phase system at Uo	[kvar/km]	12028.06597	12028.06597	12028.06597
28	Voltage drop for Three Phase System	[V/A/km]	0.01741	0.01766	0.01741
29	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
30	Induced current on Metallic Screen	[A]	121.4	110.8	109.1

	Cable Parameters under Normal Operation			
CYMCAP Version	7.3 Revision 2			
Study:	Eirgrid Cp966 Feasibility study			
Execution:	Eirgrid - std trench (1ct 400kV CABLE) v2			
Date:	16/01/2020 14:24:42			

N	Ormshall	Description	11-14	0-14-14-4		0-1-1-0
No.	Symbol	Description Cable Equipment ID	Unit	Cable No.1 400KV.011	Cable No.2 400KV.011	Cable No.3 400KV.011
-	Operation IE		l	400KV.011	40000.011	4000011
	tor AC Resis					
2	R₀	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	R'	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00902	0.00918	0.00902
4	dc	Conductor Diameter	[mm]	63.0	63.0	63.0
5	s	Distance Between Conductor Axes	[mm]	580.0	580.0	580.0
6	ks	Factor Used for xs Calculation (Skin Effect)		0.35	0.35	0.35
7	kp	Factor Used for xp Calculation (Proximity Effect)		0.2	0.2	0.2
8	xs	Component of Ys Calculation (Skin Effect)		2.20826	2.18874	2.20858
9	хр	Component of Yp Calculation (Proximity Effect)		1.66928	1.65453	1.66953
10	ys	Skin Effect Factor		0.11269	0.1091	0.11275
11	ур	Proximity Effect Factor		0.00177	0.00171	0.00177
12	R	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01005	0.0102	0.01005
Dielectri	ic Losses	I.	[	1	1	
13	tanδ	Dielectric Loss Factor		0.001	0.001	0.001
14	3	Insulation Relative Permitivity		2.5	2.5	2.5
15	с	Cable Capacitance	[µF/km]	0.239	0.239	0.239
16	U <sub>0</sub>	Voltage	[kV]	230.94011	230.94011	230.94011
17	Wd	Cable Dielectric Losses Per Phase	[W/m]	4.00936	4.00936	4.00936
Circulat	ing Loss Fac	tor				
18	Rs	AC Resistance used for Circulating Loss Factor computation	[Ω/km]	0.05836	0.05944	0.05835
	l .				10	
19	d	Mean diameter used for Circulating Loss Factor computation	[mm]	123.9	123.9	123.9
20	x	Reactance used for Circulating Loss Factor computation	[Ω/km]	0.14054	0.14054	0.14054
21	Xm	Mutual Reactance	[Ω/km]	0.04355	0.04355	0.04355
22	Р	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.18409	0.18409	0.18409
23	Q	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.12602	0.12602	0.12602
24	Fspacing	Spacing Factor (applied when spacing between cable uneven or non- equal minor section length)		0.004	0.004	0.004
24	λ' <sub>1</sub>	Screen Loss Factor Caused by Circulating Current		0.02281	0.01907	0.01841
	oss Factor		1			
26	Rs	AC Resistance used for Eddy Loss Factor computation	[Ω/km]	0.05836	0.05944	0.05835
27	d	Mean diameter used for Eddy Loss Factor computation	[mm]	123.9	123.9	123.9
28	ρs	Electrical Resistivity used for Eddy Loss Factor computation	[Ω.m]	0.0	0.0	0.0
20	Do	External diameter used for Eddy Loss Factor computation	[mm]	125.4	125.4	105.4
29 30	Ds	· · · · · ·	[mm]	125.4	125.4	125.4
30	ts β <sub>1</sub>	Thickness used for Eddy Loss Factor computation Coefficient used in IEC 60287-1-1 Clause 2.3.6.1	[mm]	1.5 107.6336	1.5 106.65209	1.5 107.65015
32	gs	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		1.00538	1.00532	1.00538
34	m	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.53827	0.5285	0.53843
35	λ <sub>o</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.00384	0.01494	0.00385
36	Δ <sub>1</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		-0.02147	0.00482	0.02867
37	$\Delta_2$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.00032	0.0	0.00001
38	F	Milliken conductor Effect		1.0	1.0	1.0
39	Fpipe	Magnetic effect factor due to pipe		1.0	1.0	1.0
40	Farmour	Magnetic effect factor due to armour		1.0	1.0	1.0
41	λ"1	Screen Loss Factor Caused by Eddy Current		0.0223	0.08831	0.02342
Metallic	Screen Loss	s factor				
42	λ <sub>1</sub>	Screen Loss Factor		0.0451	0.10738	0.04183
	and Pipe Lo				·	
43	λ <sub>2</sub> a	Armour Loss Factor		0.0	0.0	0.0
44	λ <sub>2</sub> pipe	Pipe Loss Factor		0.0	0.0	0.0
	λ <sub>2</sub> Operation IE	Armour Loss Factor + Pipe Loss Factor C 60287-2-1	I	0.0	0.0	0.0
47	Т1	Thermal Resistance Between Conductor and Screen	[K.m/W]	0.36997	0.36997	0.36997
48	t <sub>1</sub>	Insulation Thickness Between Conductor and Screen	[mm]	29.7	29.7	29.7
49	ρTi	Thermal Resistivity of Insulation	[K.m/W]	3.5	3.5	3.5
50	T <sub>3</sub>	Thermal Resistance of Jacket/Pipe Coating	[K.m/W]	0.04684	0.04684	0.04684
51	t <sub>3</sub>	Thickness of Jacket/Pipe Coating	[mm]	5.5	5.5	5.5
52	ρΤͿ	Thermal Resistivity of Jacket/Pipe Coating	[K.m/W]	3.5	3.5	3.5
Cable in	1					
53	U	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		1.87	1.87	1.87
54	V	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		0.312	0.312	0.312
55	Y Am	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[00]	0.0037	0.0037	0.0037
56	θm	Mean Temperature of the Medium Filling the Space	[°C]	62.7	67.9	62.7
57	T4'	Thermal Resistance of the Medium Inside the Duct/Pipe	[K.m/W]	0.22203	0.21532	0.22212
58	Do	Outside Diameter of the Duct/Pipe	[mm]	200.0	200.0	200.0
59	Di	Inside Diameter of the Duct/Pipe	[mm]	188.0	188.0	188.0
60	ρΤ	Thermal Resistivity of the Duct/Pipe Material	[K.m/W]	3.5	3.5	3.5
61	T4"	Thermal Resistance of the Duct/Pipe	[K.m/W]	0.03447	0.03447	0.03447
62	T4'''	Thermal Resistance of the Surrounding Medium	[K.m/W]	0.9538	0.99906	0.95559
	n a Duct Banl	k/Backfill installation				
63	x	Shorter Side of the Duct Bank/Backfill	[m]	0.675	0.675	0.675
64	у	Longer Side of the Duct Bank/Backfill	[m]	1.7	1.7	1.7
65	rb	Equivalent Radius of Duct Bank/Backfill	[m]	0.47741	0.47741	0.47741
66	LG	Depth of Laying to the Centre of Duct Bank/Backfill	[m]	0.962	0.962	0.962
67 68	u N	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill		2.01505 3.0	2.01505 3.0	2.01505 3.0
80	N .			3.0	3.0	3.U
69	ρe	Thermal Resistivity of Earth Around the Duct Bank/Backfill	[K.m/W]	1.2	1.2	1.2
70	ρς	Thermal Resistivity of the Duct Bank/Backfill	[K.m/W]	1.0	1.0	1.0
71	T4'''	Thermal Resistance of the Surrounding Medium	[K.m/W]	0.9538	0.99906	0.95559
			[K.m/W]	1.21029	1.24885	1.21218
72	T4	Total External Thermal Resistance	[[X.11/ 44]	1.21025	1.24000	-
72		Temperature Rise at the Surface of the Cable Due to Other				
	T₄ ∆θint		[°C] [A]	0.0	0.0	0.0

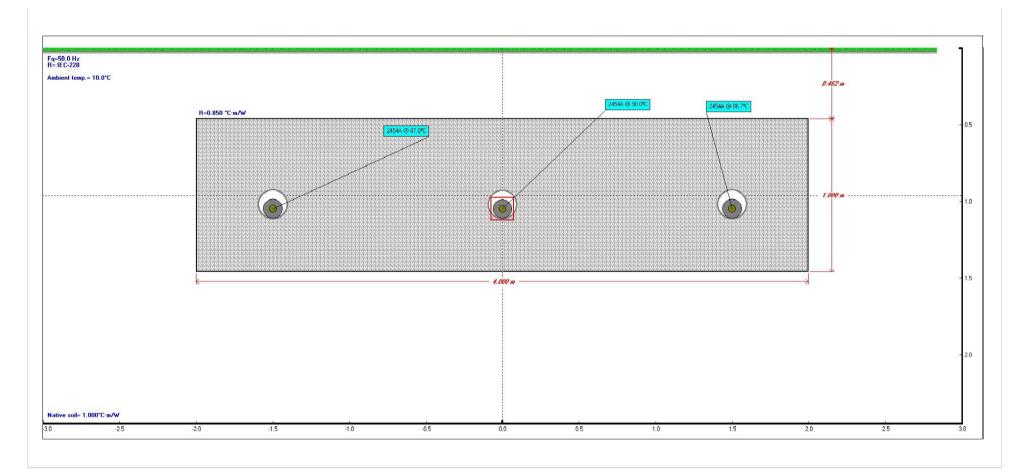
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### Study Summary

INTERNATIONAL TSD	
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Road Width Trench (1ct 220kV CABLE)
Date:	18/03/2020 11:21:16

General Simulation Data	
Steady State Option	Equally Loaded
Consider Electrical interaction between circuits	No
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0
Conductor Resistances Computation Option:	IEC-228

Installation Type:Ductbank						
Ambient Soil Temperature at Installation Depth	[°C]	10.0				
Native Soil Thermal Resistivity	[K.m/W]	1.0				
Thermal Resistivity of Duct Bank	[K.m/W]	0.9				
Depth of Center of Duct Bank	[m]	0.96				
Duct Bank Width	[m]	4.0				
Duct Bank Height	[m]	1.0				



Results Summary										
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [m]	Y coordinate [m]	temperature [°C]	Ampacity [A]
1	220KV.011	1		А	50.0	1.0	-1.5	1.05	87.0	2454.5
2	220KV.011	1		В	50.0	1.0	0.0	1.05	90.0	2454.5
3	220KV.011	1		С	50.0	1.0	1.5	1.05	86.7	2454.5

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### Steady State Summary

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Road Width Trench (1ct 220kV CABLE)
Date:	18/03/2020 11:21:16

### Simulation Data

Simulation Data				
Installation type:	Ductbank			
Steady State Option	Equally Loaded			
Ambient temperature [°C]	10			
Native Soil Thermal Resistivity [K.m/W]	1.0			
Consider Non-Isothermal Earth Surface	No			
Consider effect of soil dry out	No			
Consider Electrical interaction between circuits	No			
Induced current in metallic layers as a fraction of conductor current (applied to all single phase circuits)	0			

Variable	Description	Unit		Cables	
Cable No.	Cable Index Number		1	2	3
General Inpu	t Data	1			
Cable ID	Cable Equipment ID		220KV.011	220KV.011	220KV.011
Circuit No.	Circuit No.		1	1	1
Phase	Cable Phase		А	В	С
Fq	Operating Frequency	[Hz]	50.0	50.0	50.0
x	X coordinate	[m]	-1.5	0.0	1.5
у	Y coordinate	[m]	1.05	1.05	1.05
DLF	Daily Load Factor	[p.u.]	1.0	1.0	1.0
	Bonding Type		1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat
Ampacity					
I	Steady State Ampacity	[A]	2454.5	2454.5	2454.5
Temperature	S				
θс	Conductor temperature	[°C]	87.0	90.0	86.7
θs	Sheath/Shield temperature	[°C]	66.0	68.9	65.8
θа	Armour temperature	[°C]	n/a	n/a	n/a
θsurf	Cable surface temperature	[°C]	63.0	65.9	62.8
θduct	Duct surface temperature	[°C]	45.2	48.3	45.1
Resistances					
R <sub>0</sub>	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
R	AC Resistance of the Conductor at Operating Temperature	[Ω/km]	0.01011	0.01018	0.0101
ys	Skin Effect Factor		0.11099	0.1091	0.11116
ур	Proximity Effect Factor		0.00025	0.00024	0.00025
Losses					
Wc	Conductor Losses	[W/m]	60.88483	61.35644	60.84297
Wd	Dielectric Losses	[W/m]	1.37316	1.37316	1.37316
Ws	Metallic Screen Losses	[W/m]	2.23417	2.05405	1.8898
Wa	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
Wt	Total Losses	[W/m]	64.49216	64.78365	64.10592
$\lambda_1$	Screen Loss Factor		0.0367	0.03348	0.03106
$\lambda_2$	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
Thermal resis	stances				
T1	Thermal resistance of insulation	[K.m/W]	0.3402	0.3402	0.3402
T2	Thermal resistance of bedding/medium inside pipe-type	[K.m/W]	n/a	n/a	n/a
Т3	Thermal resistance of outer covering	[K.m/W]	0.04631	0.04631	0.04631
T4	External thermal resistance	[K.m/W]	0.82222	0.86282	0.8235
Others					·
Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
	Induced current on Metallic Screen	[A]	148.4	137.3	136.3

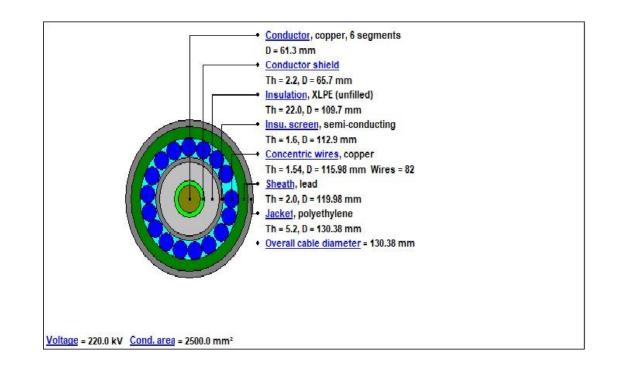
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Road Width Trench (1ct 220kV CABLE)
Date:	18/03/2020 11:21:16

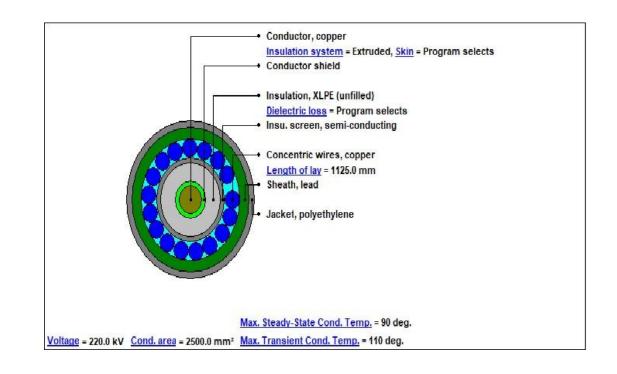
No.	Description	Unit	1				
	eral Cable Information						
1	Cable Equipment ID		220KV.011				
2	Number of Cores		Single Core				
3	Voltage	[k\/]	220				
	Conductor Area	[kV]					
4	Cable Overall Diameter	[mm²]	2500.0				
5	Maximum Steady-State Conductor Temperature	[mm]	130.38				
6	Maximum Emergency Conductor Temperature	[°C]	90				
7 <b>Con</b>		[°C]	110				
	ductor						
8	Material		Copper				
9	Electrical Resistivity at 20°C	[μΩ.cm]	1.7241				
10	Temperature Coefficient at 20°C	[1/K]	0.00393				
11	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5				
12	Volumetric Specific Heat (SH)	[J/(K*cm <sup>3</sup> )]	3.45				
13	Construction		6 Segments				
14	Conductor Insulation System		Extruded				
15	Milliken Wires Construction		Insulated Wires				
16	Ks (Skin Effect Coefficient)		0.35				
17	Kp (Proximity Effect Coefficient)		0.2				
18	Diameter	[mm]	61.3				
Con	ductor Shield						
19	Thickness	[mm]	2.2				
20	Diameter	[mm]	65.7				
Insu	lation						
21	Material		XLPE Unfilled				
22	Thermal Resistivity	[K.m/W]	3.5				
23	Dielectric Loss Factor - ( tan delta )		0.001				
24	Relative Permittivity - ( epsilon )		2.5				
25	Specific Insulation Resistance Constant at 60°F - ( K )	[MΩ.km]	65617.				
26	Thickness	[mm]	22.0				
	Diameter						
Insu	lation Screen						
	Iation Screen						
28		Imml	Semi Conducting Screen				
28 29	Material Thickness	[mm]	Semi Conducting Screen 1.6				
28 29 30	Material Thickness Diameter	[mm] [mm]	Semi Conducting Screen				
28 29 30 <b>Shea</b>	Material Thickness Diameter ath		Semi Conducting Screen 1.6 112.9				
28 29 30 <b>Shea</b> 31	Material Thickness Diameter ath Is Sheath Around Each Core?		Semi Conducting Screen 1.6 112.9 n/a				
28 29 30 <b>Shea</b> 31 32	Material Thickness Diameter ath Is Sheath Around Each Core? Material	[mm]	Semi Conducting Screen 1.6 112.9 n/a Lead				
28 29 30 <b>Shea</b> 31 32 33	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C	[mm]	Semi Conducting Screen 1.6 112.9 n/a Lead 21.4				
28 29 30 <b>Shea</b> 31 32	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C	[mm]	Semi Conducting Screen 1.6 112.9 n/a Lead				
28 29 30 <b>Shea</b> 31 32 33 34 35	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA)	[mm] [μΩ.cm] [1/K] [K]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230				
28 29 30 <b>Shea</b> 31 32 33 34 35 36	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH)	[mm] [μΩ.cm] [1/K]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45				
28 29 30 <b>Shea</b> 31 32 33 34 35	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type	[mm] [μΩ.cm] [1/K] [K]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230				
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness	[mm] [μΩ.cm] [1/K] [K]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0				
28 29 30 <b>Shez</b> 31 32 33 34 35 36 37 38 39	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated				
28 29 30 <b>Shez</b> 31 32 33 34 35 36 37 38 39	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter centric neutral/Skid wires	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0				
28 29 30 <b>Shez</b> 31 32 33 34 35 36 37 38 39	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core?	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0				
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Con</b>	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98				
28 29 30 <b>Shez</b> 31 32 33 34 35 36 37 38 39 <b>Cond</b>	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98				
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Cond</b> 40 41	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper				
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [mm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241				
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Cond</b> 40 41 42 43	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [mm] [μΩ.cm] [1/K]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393				
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42 43 44	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Temperature Coefficient at 20°C	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [mm] [μΩ.cm] [1/K] [K]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393           234.5				
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Cond</b> 40 41 42 43 44	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH)	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [mm] [mm] [1/K] [1/K] [L/(K*cm³)]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393           234.5           3.45				
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42 43 44 45 46	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [mm] [mm] [1/K] [1/K] [L/(K*cm³)]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393           234.5           3.45           1125.0				
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42 43 44 45 46 47	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Lectrical Resistivity at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [mm] [mm] [1/K] [1/K] [L/(K*cm³)]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393           234.5           3.45           1125.0           82				
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Cond</b> 40 41 42 43 44 45 46 47 48	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Wire Gauge	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [M]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393           234.5           3.45           1125.0           82           Undefined				
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42 43 44 45 46 47 48 49	Material Thickness Diameter Thickness Diameter Thickness Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge Thickness Diameter	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)] [N]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393           234.5           3.45           1125.0           82           Undefined           1.54				
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Cond</b> 40 41 40 41 42 43 44 45 46 47 48 49 50	Material Thickness Diameter Thickness Diameter Thickness Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge Thickness Diameter	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)] [N]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393           234.5           3.45           1125.0           82           Undefined           1.54				
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42 43 44 45 46 47 48 49 50 <b>Jack</b>	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Diameter Material	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)] [N]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393           234.5           3.45           1125.0           82           Undefined           1.54           115.98				
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42 43 44 45 46 47 48 49 50 <b>Jack</b> 51 52	Material Thickness Diameter Thickness Diameter Thickness Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge Thickness Diameter Cet	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [mm] [mm] [mm] [mm] [mm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393           234.5           3.45           1125.0           82           Undefined           1.54           115.98           Polyethylene           3.5				
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Cond</b> 40 41 40 41 42 43 44 45 46 47 48 49 50 <b>Jack</b>	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Diameter Cet Material Diameter Cet	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [μΩ.cm] [1/K] [J/(K*cm³)] [m] [m] [m]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           Opper           1.7241           0.00393           234.5           3.45           1125.0           82           Undefined           1.54           115.98				

No.	Description	Unit	1				
Spee	Specific Installation Data						
55	Cable Equipment ID		220KV.011				
56	Cable Frequency	[Hz]	50				
57	Sheath / Shield Bonding		1 Conductor Crossbonded Flat				
58	Loss Factor Constant (ALOS)		0.3				
59	Minor section length		Crossbonded Unknown Section Lengths UNKNOWN				
60	Duct construction		Polyethylene in Concrete				
61	Duct material thermal resistivity	[K.m/W]	3.5				
62	Inside Diameter of the Duct/Pipe	[mm]	188.0				
63	Outside Diameter of the Duct/Pipe	[mm]	200.0				

#### Cable ID : 220KV.011

Cable Title 2500sqmm Cu (insulated Wires)\_XLPE\_CWS+Pb\_PE NKT for Eirgrid





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INTERNA	TIONAL	TED

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Road Width Trench (1ct 220kV CABLE)
Date:	18/03/2020 11:21:16

No.	Description	Unit	Cable No.1	Cable No.2	Cable No.3
1	Cable Equipment ID		220KV.011	220KV.011	220KV.011
Resi	stances				
2	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00909	0.00918	0.00909
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.00841	0.00841	0.00841
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01011	0.01018	0.0101
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.28869	0.28869	0.28869
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.34182	0.34515	0.34153
8	DC Resistance of Concentric Wires at 20°C	[Ω/km]	0.1185	0.1185	0.1185
9	DC Resistance of Concentric Wires at Operating Temperature	[Ω/km]	0.13993	0.14128	0.13982
Loss	es				
10	Conductor Losses	[W/m]	60.88483	61.35644	60.84297
11	Dielectric Losses	[W/m]	1.37316	1.37316	1.37316
12	Metallic Screen Losses	[W/m]	2.23417	2.05405	1.8898
13	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
14	Total Losses	[W/m]	64.49216	64.78365	64.10592
Сара	citance, Inductance, Impedance				
15	Capacitance	[µF/km]	0.271	0.271	0.271
16	Inductance of Conductor	[mH/km]	0.82812	0.82812	0.82812
17	Reactance of Conductor	[Ω/km]	0.26016	0.26016	0.26016
18	Inductance of Metallic Sheath	[mH/km]	0.65017	0.65017	0.65017
19	Reactance of Metallic Sheath	[Ω/km]	0.20426	0.20426	0.20426
20	Positive Sequence Impedance	[Ω/km]	0.010110 + j0.260160	0.010180 + j0.260160	0.010100 + j0.260160
21	Negative Sequence Impedance	[Ω/km]	0.010110 + j0.260160	0.010180 + j0.260160	0.010100 + j0.260160
22	Zero Sequence Impedance	[Ω/km]	0.092020 + j0.204260	0.092000 + j0.204260	0.092020 + j0.204260
23	Surge Impedance	[Ω]	55.28699	55.28699	55.28699
Othe	rs				
24	Dielectric Stress at Conductor Surface	[kV/mm]	7.54233	7.54233	7.54233
25	Dielectric Stress at Insulation Surface	[kV/mm]	4.51715	4.51715	4.51715
26	Insulation Resistance at 60°F (15.8°C)	[MΩ.km]	14609.00643	14609.00643	14609.00643
27	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a
28	Charging Current for One Phase	[A/km]	10.81081	10.81081	10.81081
29	Charging Capacity of three phase system at Uo	[kvar/km]	4119.47055	4119.47055	4119.47055
30	Voltage drop for Three Phase System	[V/A/km]	0.0175	0.01764	0.01749
31	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
32	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
33	Induced current on Metallic Screen	[A]	148.4	137.3	136.3

### CYME

Cable Parameters under Normal Operation

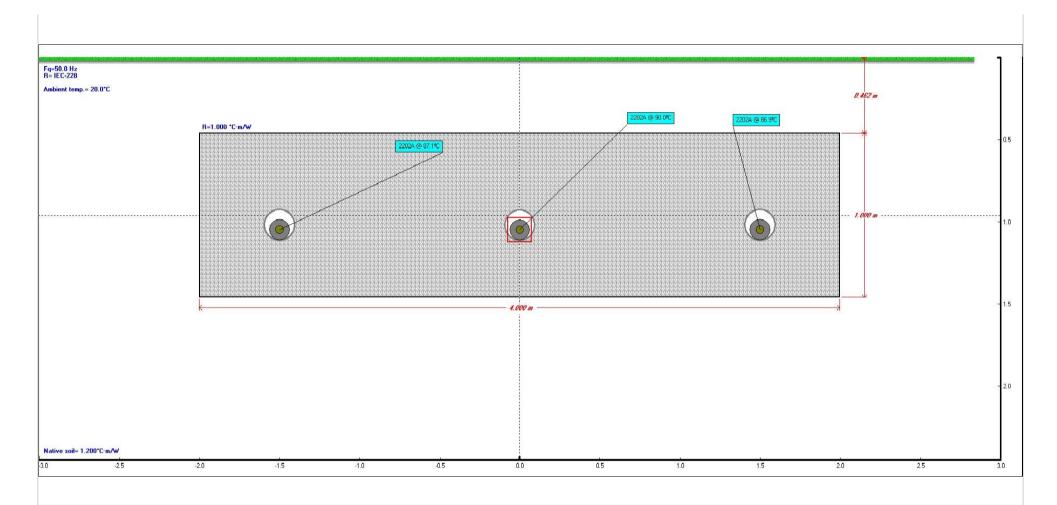
CY	MCAP Version	7.3 Revision 2
Stu	ıdy:	Eirgrid Cp966 Feasibility study
Exe	ecution:	Eirgrid - Road Width Trench (1ct 220kV CABLE)
Dat	te:	18/03/2020 11:21:16

NI-	O much a l	Description	11-34	0-1-1-1-4		
No. 1	Symbol	Description Cable Equipment ID	Unit	Cable No.1 220KV.011	Cable No.2 220KV.011	Cable No.3 220KV.011
	Operation IE		l	22010.011	22010.011	22010.011
	tor AC Resis					
2	R <sub>0</sub>	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	R'	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00909	0.00918	0.00909
4	dc	Conductor Diameter	[mm]	61.3	61.3	61.3
5	s	Distance Between Conductor Axes	[mm]	1500.0	1500.0	1500.0
6	ks	Factor Used for xs Calculation (Skin Effect)	[]	0.35	0.35	0.35
7	kp	Factor Used for xp Calculation (Proximity Effect)		0.2	0.2	0.2
8	xs	Component of Ys Calculation (Skin Effect)		2.19909	2.18875	2.20002
9	хр	Component of Yp Calculation (Proximity Effect)		1.66236	1.65454	1.66306
10	ys	Skin Effect Factor		0.11099	0.1091	0.11116
11	ур	Proximity Effect Factor	[Q//m]	0.00025	0.00024	0.00025
12 Dielectri	R ic Losses	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01011	0.01018	0.0101
		Distantia Lana Fantan		0.001	0.004	0.004
13 14	tanδ ε	Dielectric Loss Factor Insulation Relative Permitivity		0.001 2.5	0.001 2.5	0.001 2.5
	C E		[[//mo]			
15 16		Cable Capacitance Voltage	[µF/km]	0.271	0.271	0.271
17	U <sub>0</sub> Wd	Cable Dielectric Losses Per Phase	[kV]	127.01706 1.37316	127.01706 1.37316	1.37316
	ing Loss Fac		[vv/m]	1.37310	1.37310	1.37310
18	Rs	AC Resistance used for Circulating Loss Factor computation	[0/km]	0.09929	0.10024	0.0992
			[Ω/km]			
19 20	d X	Mean diameter used for Circulating Loss Factor computation	[mm]	116.22348	116.22348	116.22348
20	X	Reactance used for Circulating Loss Factor computation	[Ω/km]	0.20426	0.20426	0.20426
21	Xm P	Mutual Reactance	[Ω/km]	0.04355	0.04355	0.04355
22	P	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.24781	0.24781	0.24781
23	Q	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.18974	0.18974	0.18974
24	Fspacing	Spacing Factor (applied when spacing between cable uneven or non- equal minor section length)		0.004	0.004	0.004
25	λ' <sub>1</sub>	Screen Loss Factor Caused by Circulating Current	1	0.03593	0.03078	0.03029
	ss Factor		•			
26	Rs	AC Resistance used for Eddy Loss Factor computation	[Ω/km]	0.34182	0.34515	0.34153
27	d	Mean diameter used for Eddy Loss Factor computation	[mm]	117.98	117.98	117.98
28	ρs	Electrical Resistivity used for Eddy Loss Factor computation	[Ω.m]	0.0	0.0	0.0
29	Ds	External diameter used for Eddy Loss Factor computation	[mm]	119.98	119.98	119.98
30	ts	Thickness used for Eddy Loss Factor computation	[mm]	2.0	2.0	2.0
31	β1	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1	[]	39.47168	39.28088	39.48876
32	gs	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		1.00253	1.00251	1.00253
34	m ge	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.09191	0.09102	0.09199
35	۸ <sub>0</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.00002	0.00008	0.00002
36	Δ <sub>1</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		-0.00671	0.00004	0.0013
37	$\Delta_1$ $\Delta_2$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.0	0.00004	0.0013
38	Δ <sub>2</sub> F					
39		Milliken conductor Effect		1.0	1.0	1.0
40	Fpipe Farmour	Magnetic effect factor due to pipe			1.0	1.0
40		Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current		1.0 0.00076	1.0 0.0027	1.0 0.00077
	۸"1 Screen Loss		L	0.00070	0.0027	0.00077
42	λ <sub>1</sub>	Screen Loss Factor		0.0367	0.03348	0.03106
	and Pipe Los		<u> </u>	0.0007	0.00040	0.00100
43	λ₂a	Armour Loss Factor		0.0	0.0	0.0
44	λ <sub>2</sub> pipe	Pipe Loss Factor		0.0	0.0	0.0
46	λ <sub>2</sub> ριρε	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
-	A2 Operation IE		I	0.0	0.0	0.0
47	1		[K m///]	0.3402	0.3402	0.3402
47	T <sub>1</sub>	Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen	[K.m/W] [mm]	25.8	25.8	25.8
48 49	t <sub>1</sub> ρΤί		[mm] [K.m/W]	3.5	3.5	3.5
49 50		Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating	[K.m/W]	0.04631	3.5 0.04631	3.5 0.04631
50	T <sub>3</sub>	Thickness of Jacket/Pipe Coating	[K.m/vv] [mm]	5.2	5.2	5.2
51	t <sub>3</sub> ρTJ	Thermal Resistivity of Jacket/Pipe Coating	[mm] [K.m/W]	3.5	3.5	3.5
5∠ Cable in			[17:116.64]	0.0	0.0	0.0
53	U	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		1.87	1.87	1.87
54	v	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		0.312	0.312	0.312
55	Y	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		0.0037	0.0037	0.0037
56	θm	Mean Temperature of the Medium Filling the Space	[°C]	55.2	58.2	55.0
57	T <sub>4</sub> '	Thermal Resistance of the Medium Inside the Duct/Pipe	[K.m/W]	0.24185	0.23744	0.24215
58	Do	Outside Diameter of the Duct/Pipe	[mm]	200.0	200.0	200.0
59	Di	Inside Diameter of the Duct/Pipe	[mm]	188.0	188.0	188.0
60	ρΤ	Thermal Resistivity of the Duct/Pipe Material	[K.m/W]	3.5	3.5	3.5
61	τ₄"	Thermal Resistance of the Duct/Pipe	[K.m/W]	0.03447	0.03447	0.03447
62	T4	Thermal Resistance of the Surrounding Medium	[K.m/W]	0.54591	0.59092	0.54688
		k/Backfill installation	[			2.3.000
63	x	Shorter Side of the Duct Bank/Backfill	[m]	1.0	1.0	1.0
64	y y	Longer Side of the Duct Bank/Backfill	[m]	4.0	4.0	4.0
65	rb	Equivalent Radius of Duct Bank/Backfill	[m]	1.19983	1.19983	1.19983
66	LG	Depth of Laving to the Centre of Duct Bank/Backfill	[m]	0.962	0.962	0.962
67	u	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3	End.	0.962	0.962	0.962
68	u N	Number of Loaded Cables in the Duct Bank/Backfill		3.0	3.0	3.0
69	ρε	Thermal Resistivity of Earth Around the Duct Bank/Backfill	[K.m/W]	1.0	1.0	1.0
70	ρe ρc	Thermal Resistivity of the Duct Bank/Backfill	[K.m/W]	0.85	0.85	0.85
70	ρc Τ <sub>4</sub> '''	Thermal Resistance of the Surrounding Medium	[K.m/W]	0.85	0.59092	0.85
71	Τ <sub>4</sub>	Total External Thermal Resistance	[K.m/W]	0.54591	0.59092	0.8235
12	14		[17:110.04]	J.02222	0.00202	0.0200
73	Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
74	I	Cable Core Current Ampacity	[A]	2454.5	2454.5	2454.5

	Study Summary		
CYMCAP Version	7.3 Revision 2		
Study:	Eirgrid Cp966 Feasibility study		
Execution:	Eirgrid - Road Width Trench (1ct 220kV CABLE) - Summer (20C)		
Date:	02/03/2020 16:05:16		

General Simulation Data	
Steady State Option	Equally Loaded
Consider Electrical interaction between circuits	No
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0
Conductor Resistances Computation Option:	IEC-228

Installation Type:Ductbank					
Ambient Soil Temperature at Installation Depth	[°C]	20.0			
Native Soil Thermal Resistivity	[K.m/W]	1.2			
Thermal Resistivity of Duct Bank	[K.m/W]	1.0			
Depth of Center of Duct Bank	[m]	0.96			
Duct Bank Width	[m]	4.0			
Duct Bank Height	[m]	1.0			



<b>Results</b>	Results Summary									
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [m]	Y coordinate [m]	Conductor temperature [°C]	Ampacity [A]
1	220KV.011	1		А	50.0	1.0	-1.5	1.05	87.1	2202.5
2	220KV.011	1		В	50.0	1.0	0.0	1.05	90.0	2202.5
3	220KV.011	1		С	50.0	1.0	1.5	1.05	86.9	2202.5

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### Steady State Summary

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Road Width Trench (1ct 220kV CABLE) - Summer (20C)
Date:	02/03/2020 16:05:16

Simulation Data	
Installation type:	Ductbank
Steady State Option	Equally Loaded
Ambient temperature [°C]	20
Native Soil Thermal Resistivity [K.m/W]	1.2
Consider Non-Isothermal Earth Surface	No
Consider effect of soil dry out	No
Consider Electrical interaction between circuits	No
Induced current in metallic layers as a fraction of conductor current (applied to all single phase circuits)	0

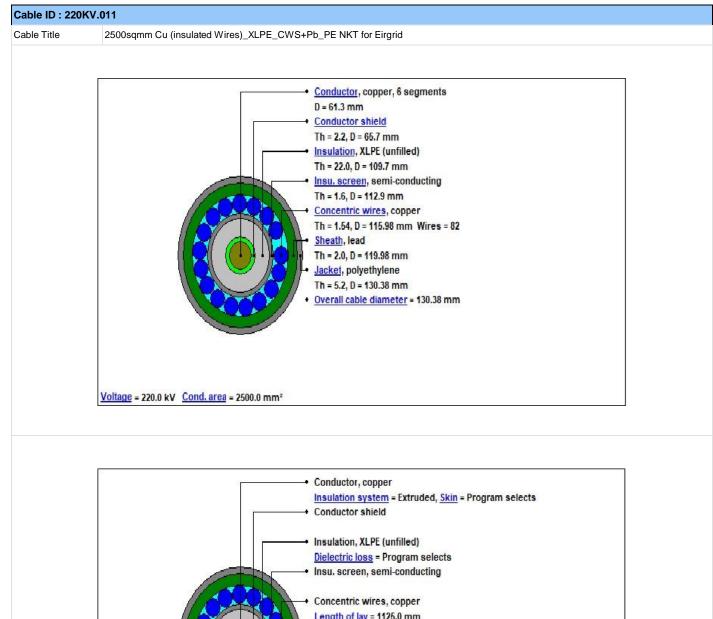
Variable	Description	Unit		Cables	
Cable No.	Cable Index Number		1	2	3
General Inpu	ıt Data				
Cable ID	Cable Equipment ID		220KV.011	220KV.011	220KV.011
Circuit No.	Circuit No.		1	1	1
Phase	Cable Phase		А	В	С
Fq	Operating Frequency	[Hz]	50.0	50.0	50.0
x	X coordinate	[m]	-1.5	0.0	1.5
у	Y coordinate	[m]	1.05	1.05	1.05
DLF	Daily Load Factor	[p.u.]	1.0	1.0	1.0
	Bonding Type		1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat
Ampacity					
I	Steady State Ampacity	[A]	2202.5	2202.5	2202.5
Temperature	25				·
θс	Conductor temperature	[°C]	87.1	90.0	86.9
θs	Sheath/Shield temperature	[°C]	70.2	73.0	70.0
θа	Armour temperature	[°C]	n/a	n/a	n/a
θsurf	Cable surface temperature	[°C]	67.8	70.5	67.6
<b>Oduct</b>	Duct surface temperature	[°C]	53.8	56.7	53.7
Resistances					L
R <sub>0</sub>	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
R	AC Resistance of the Conductor at Operating Temperature	[Ω/km]	0.01011	0.01018	0.0101
ys	Skin Effect Factor		0.1109	0.1091	0.11105
ур	Proximity Effect Factor		0.00025	0.00024	0.00025
osses		-1			ł
Wc	Conductor Losses	[W/m]	49.04357	49.40582	49.01384
Wd	Dielectric Losses	[W/m]	1.37316	1.37316	1.37316
Ws	Metallic Screen Losses	[W/m]	1.81642	1.66362	1.53425
Wa	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
Wt	Total Losses	[W/m]	52.23315	52.44259	51.92124
λı	Screen Loss Factor		0.03704	0.03367	0.0313
$\lambda_2$	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
hermal resi	istances				
T1	Thermal resistance of insulation	[K.m/W]	0.3402	0.3402	0.3402
T2	Thermal resistance of bedding/medium inside pipe-type	[K.m/W]	n/a	n/a	n/a
Т3	Thermal resistance of outer covering	[K.m/W]	0.04631	0.04631	0.04631
T4	External thermal resistance	[K.m/W]	0.91444	0.96362	0.91587
Others					L
Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
-	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
	Induced current on Metallic Screen	[A]	133.0	122.8	122.0

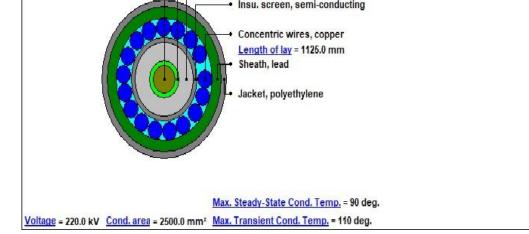
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CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Road Width Trench (1ct 220kV CABLE) - Summer (20C)
Date:	02/03/2020 16:05:16

No.	Description	Unit	1
Gen	eral Cable Information	•	•
1	Cable Equipment ID		220KV.011
2	Number of Cores		Single Core
3	Voltage	[kV]	220
4	Conductor Area	[mm²]	2500.0
5	Cable Overall Diameter	[mm]	130.38
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	110
Con	ductor		I
8	Material		Copper
9	Electrical Resistivity at 20°C	[μΩ.cm]	1.7241
10	Temperature Coefficient at 20°C	[1/K]	0.00393
10	Reciprocal of Temperature Coefficient of Resistance	[IN]	0.0000
11	(BETA)	[K]	234.5
12	Volumetric Specific Heat (SH)	[J/(K*cm3)]	3.45
13	Construction		6 Segments
14	Conductor Insulation System		Extruded
15	Milliken Wires Construction		Insulated Wires
16	Ks (Skin Effect Coefficient)		0.35
17	Kp (Proximity Effect Coefficient)		0.2
18	Diameter	[mm]	61.3
Con	ductor Shield		
19	Thickness	[mm]	2.2
20	Diameter	[mm]	65.7
Insu	lation	1	
21	Material		XLPE Unfilled
22	Thermal Resistivity	[K.m/W]	3.5
23	Dielectric Loss Factor - ( tan delta )		0.001
24	Relative Permittivity - ( epsilon )		2.5
25	Specific Insulation Resistance Constant at 60°F - ( K )	[MΩ.km]	65617.
26	Thickness	[mm]	22.0
20	Diameter	[mm]	109.7
	lation Screen	[iiiiii]	103.1
28	Material		
20			Somi Conducting Scroop
20	Thickness	[mm]	Semi Conducting Screen
29	Thickness Diameter	[mm]	1.6
30	Diameter	[mm] [mm]	
30 Shea	Diameter ath		1.6 112.9
30 <b>Shea</b> 31	Diameter ath Is Sheath Around Each Core?		1.6 112.9 n/a
30 Shea 31 32	Diameter ath Is Sheath Around Each Core? Material	[mm]	1.6 112.9 n/a Lead
30 <b>Shea</b> 31	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C		1.6 112.9 n/a
30 Shea 31 32	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C	[mm]	1.6 112.9 n/a Lead
30 Shea 31 32 33	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C	[mm]	1.6 112.9 n/a Lead 21.4
30 Shea 31 32 33 34	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance	[mm] [μΩ.cm] [1/K]	1.6 112.9 n/a Lead 21.4 0.004
30 Shea 31 32 33 34 35	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA)	[mm] [μΩ.cm] [1/K] [K]	1.6 112.9 n/a Lead 21.4 0.004 230
30 Shea 31 32 33 34 35 36	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH)	[mm] [μΩ.cm] [1/K] [K]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45
30 Shea 31 32 33 34 35 36 37	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type	[mm] [μΩ.cm] [1/K] [J/(K*cm³)]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated
30 Shea 31 32 33 34 35 36 37 38 39	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0
30 Shea 31 32 33 34 35 36 37 38 39	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0
30 Shea 31 32 33 34 35 36 37 38 39 Con	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter centric neutral/Skid wires	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm]	1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98
30 Shea 31 32 33 34 35 36 37 38 39 Con 40	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core?	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98
30 Shea 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material	[μΩ.cm] [μΩ.cm] [1/K] [J/(K*cm³)] [mm] [mm] [mm]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper
30 Shea 31 32 33 34 35 36 37 38 39 Cont 40 41	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm]	1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241
30 Shea 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C	[μΩ.cm] [μΩ.cm] [1/K] [J/(K*cm³)] [mm] [mm] [mm]	1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241
30 Shea 31 32 33 34 35 36 37 38 39 Con 40 41 42 43	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance	[mm] [μΩ.cm] [1/K] [J/(K*cm³)] [mm] [mm] [mm] [μΩ.cm] [1/K]	1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393
30 Shea 31 32 33 34 35 36 37 38 39 Conn 40 41 42 43 44	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA)	[μΩ.cm] [μΩ.cm] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [1/K] [K]	1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393           234.5
30 Shea 31 32 33 34 35 36 37 38 39 Conn 40 41 42 43 44 45	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH)	[μΩ.cm] [μΩ.cm] [1/K] [J/(K*cm³)] [mm] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)]	1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393           234.5           3.45
30 Shea 31 32 33 34 35 36 37 38 39 Con 40 41 42 43 44 45 46	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay	[μΩ.cm] [μΩ.cm] [1/K] [J/(K*cm³)] [mm] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.003933         234.5         3.45         1125.0
30 Shea 31 32 33 34 35 36 37 38 39 Con 40 41 42 43 44 45 46 47	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires	[μΩ.cm] [μΩ.cm] [1/K] [J/(K*cm³)] [mm] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)]	1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393           234.5           3.45           1125.0           82
30           31           32           33           34           35           36           37           38           39           Cond           40           41           42           43           44           45           46           47           48	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Lectrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge	[μΩ.cm] [μΩ.cm] [J/(K*cm <sup>3</sup> )] [mm] [mm] [mm] [μΩ.cm] [1/K] [L/(K*cm <sup>3</sup> )] [mm]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393         234.5         3.45         1125.0         82         Undefined
30 Shea 31 32 33 34 35 36 37 38 39 Con 40 41 42 43 44 45 46 47 48 49	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Diameter	[μΩ.cm] [μΩ.cm] [μΩ.cm] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [1/K]	1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393           234.5           3.45           1125.0           82           Undefined           1.54
30           31           32           33           34           35           36           37           38           39           Conn           40           41           42           43           44           45           46           47           48           49           50	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Diameter	[μΩ.cm] [μΩ.cm] [μΩ.cm] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [1/K]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393         234.5         3.45         1125.0         82         Undefined         1.54
30           31           32           33           34           35           36           37           38           39           Con-           40           41           42           43           44           45           46           47           48           49           50           Jack	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Diameter Center C	[μΩ.cm] [μΩ.cm] [μΩ.cm] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [1/K]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393         234.5         3.45         1125.0         82         Undefined         1.54         115.98
30 Shea 31 32 33 34 35 36 37 38 39 Con 40 41 42 43 44 45 46 47 48 49 50 Jack 51 52	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Diameter Cet Material	[μΩ.cm] [μΩ.cm] [μΩ.cm] [J/(K*cm³)] [mm] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [mm] [mm] [mm] [mm]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393         234.5         3.45         1125.0         82         Undefined         1.54         115.98         Polyethylene         3.5
30           31           32           33           34           35           36           37           38           39           Conn           40           41           42           43           44           45           46           47           48           49           50           Jack           51	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Lectrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge Thickness Diameter Cet Material Thermal Resistivity	[μΩ.cm] [μΩ.cm] [μΩ.cm] [J/(K*cm³)] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [μΩ.cm] [J/(K*cm³)] [J/(K*cm³)] [mm]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         0.00393         234.5         3.45         1125.0         82         Undefined         1.54         115.98

No.	Description	Unit	1						
Spe	Specific Installation Data								
55	Cable Equipment ID		220KV.011						
56	Cable Frequency	[Hz]	50						
57	Sheath / Shield Bonding		1 Conductor Crossbonded Flat						
58	Loss Factor Constant (ALOS)		0.3						
59	Minor section length		Crossbonded Unknown Section Lengths UNKNOWN						
60	Duct construction		Polyethylene in Concrete						
61	Duct material thermal resistivity	[K.m/W]	3.5						
62	Inside Diameter of the Duct/Pipe	[mm]	188.0						
63	Outside Diameter of the Duct/Pipe	[mm]	200.0						







CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Road Width Trench (1ct 220kV CABLE) - Summer (20C)
Date:	02/03/2020 16:05:16

No.	Description	Unit	Cable No.1	Cable No.2	Cable No.3
1	Cable Equipment ID		220KV.011	220KV.011	220KV.011
Resi	stances				
2	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.0091	0.00918	0.00909
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.00841	0.00841	0.00841
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01011	0.01018	0.0101
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.28869	0.28869	0.28869
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.34664	0.34985	0.34637
8	DC Resistance of Concentric Wires at 20°C	[Ω/km]	0.1185	0.1185	0.1185
9	DC Resistance of Concentric Wires at Operating Temperature	[Ω/km]	0.14188	0.14317	0.14177
Loss	es				
10	Conductor Losses	[W/m]	49.04357	49.40582	49.01384
11	Dielectric Losses	[W/m]	1.37316	1.37316	1.37316
12	Metallic Screen Losses	[W/m]	1.81642	1.66362	1.53425
13	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
14	Total Losses	[W/m]	52.23315	52.44259	51.92124
Сара	acitance, Inductance, Impedance				
15	Capacitance	[µF/km]	0.271	0.271	0.271
16	Inductance of Conductor	[mH/km]	0.82812	0.82812	0.82812
17	Reactance of Conductor	[Ω/km]	0.26016	0.26016	0.26016
18	Inductance of Metallic Sheath	[mH/km]	0.65017	0.65017	0.65017
19	Reactance of Metallic Sheath	[Ω/km]	0.20426	0.20426	0.20426
20	Positive Sequence Impedance	[Ω/km]	0.010110 + j0.260160	0.010180 + j0.260160	0.010100 + j0.260160
21	Negative Sequence Impedance	[Ω/km]	0.010110 + j0.260160	0.010180 + j0.260160	0.010100 + j0.260160
22	Zero Sequence Impedance	[Ω/km]	0.092010 + j0.204260	0.092000 + j0.204260	0.092020 + j0.204260
23	Surge Impedance	[Ω]	55.28699	55.28699	55.28699
Othe	irs	I	I	I	
24	Dielectric Stress at Conductor Surface	[kV/mm]	7.54233	7.54233	7.54233
25	Dielectric Stress at Insulation Surface	[kV/mm]	4.51715	4.51715	4.51715
26	Insulation Resistance at 60°F (15.8°C)	[MΩ.km]	14609.00643	14609.00643	14609.00643
27	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a
28	Charging Current for One Phase	[A/km]	10.81081	10.81081	10.81081
29	Charging Capacity of three phase system at Uo	[kvar/km]	4119.47055	4119.47055	4119.47055
30	Voltage drop for Three Phase System	[V/A/km]	0.01751	0.01764	0.0175
31	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
32	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
33	Induced current on Metallic Screen	[A]	133.0	122.8	122.0

		0
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1000	100	

TAD

#### Cable Parameters under Normal Operation

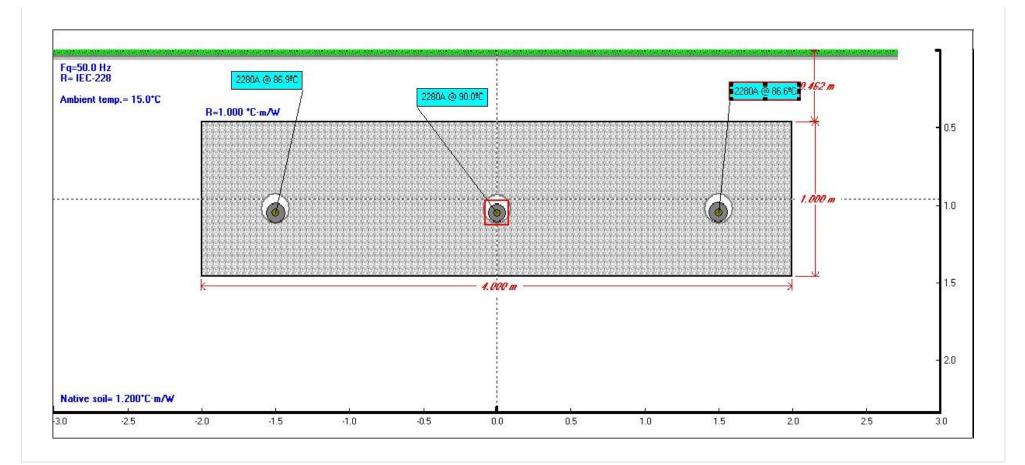
CYMCAP Version 7.3 Revision 2					
Study:	Eirgrid Cp966 Feasibility study				
Execution:	Eirgrid - Road Width Trench (1ct 220kV CABLE) - Summer (20C)				
Date:	02/03/2020 16:05:16				

No.	Symbol	Description	Unit	Cable No.1	Cable No.2	Cable No.3
1 Normal	Operation	Cable Equipment ID EC 60287-1-1	l	220KV.011	220KV.011	220KV.011
	ctor AC Resi					
		DC Resistance of the conductor at 20°C	[Q//m]	0.0072	0.0072	0.0072
2	R₀ R'	DC Resistance of Conductor at Operating Temperature	[Ω/km] [Ω/km]	0.0072	0.0072	0.0072
4	dc	Conductor Diameter	[mm]	61.3	61.3	61.3
5	s	Distance Between Conductor Axes	[mm]	1500.0	1500.0	1500.0
6	ks	Factor Used for xs Calculation (Skin Effect)	[]	0.35	0.35	0.35
7	kp	Factor Used for xp Calculation (Proximity Effect)		0.2	0.2	0.2
8	xs	Component of Ys Calculation (Skin Effect)		2.19861	2.18875	2.19942
9	хр	Component of Yp Calculation (Proximity Effect)		1.66199	1.65454	1.66261
10	ys	Skin Effect Factor		0.1109	0.1091	0.11105
11	ур	Proximity Effect Factor		0.00025	0.00024	0.00025
12	R	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01011	0.01018	0.0101
	ric Losses		[]			
13	tanð	Dielectric Loss Factor		0.001	0.001	0.001
14	ε	Insulation Relative Permitivity		2.5	2.5	2.5
15	с	Cable Capacitance	[µF/km]	0.271	0.271	0.271
16	Uo	Voltage	[kV]	127.01706	127.01706	127.01706
17	Wd	Cable Dielectric Losses Per Phase	[W/m]	1.37316	1.37316	1.37316
Circula	ting Loss Fa	actor				
18	Rs	AC Resistance used for Circulating Loss Factor computation	[Ω/km]	0.10067	0.10159	0.1006
19	d	Mean diameter used for Circulating Loss Factor computation	[mm]	116.22348	116.22348	116.22348
20	х	Reactance used for Circulating Loss Factor computation	[Ω/km]	0.20426	0.20426	0.20426
21	Xm	Mutual Reactance	[Ω/km]	0.04355	0.04355	0.04355
22	Р	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.24781	0.24781	0.24781
23	Q	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.18974	0.18974	0.18974
		Spacing Factor (applied when spacing between cable uneven or non-				
24	Fspacing	equal minor section length)		0.004	0.004	0.004
25 Eddyl c	λ' <sub>1</sub> oss Factor	Screen Loss Factor Caused by Circulating Current	l	0.03628	0.03101	0.03054
	1		[0//m]	0.04004	0.04005	0.04007
26 27	Rs d	AC Resistance used for Eddy Loss Factor computation	[Ω/km]	0.34664	0.34985	0.34637
27		Mean diameter used for Eddy Loss Factor computation	[mm]	0.0	0.0	0.0
29	ρs Ds	Electrical Resistivity used for Eddy Loss Factor computation External diameter used for Eddy Loss Factor computation	[Ω.m] [mm]	119.98	119.98	119.98
30	ts	Thickness used for Eddy Loss Factor computation	[mm]	2.0	2.0	2.0
31	β1	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1	[]	39.19658	39.01637	39.21149
32	gs	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		1.0025	1.00248	1.0025
34	m	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.09063	0.0898	0.0907
35	۸ <sub>0</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.00002	0.00007	0.00002
36	Δ <sub>1</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		-0.00668	0.00004	0.00129
37	Δ <sub>2</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.0	0.0	0.0
38	F	Milliken conductor Effect		1.0	1.0	1.0
39	Fpipe	Magnetic effect factor due to pipe		1.0	1.0	1.0
40	Farmour	Magnetic effect factor due to armour		1.0	1.0	1.0
41	λ"1	Screen Loss Factor Caused by Eddy Current		0.00075	0.00266	0.00076
Metallic	Screen Los	ss factor				
42	λ <sub>1</sub>	Screen Loss Factor		0.03704	0.03367	0.0313
Armour	and Pipe Lo	oss Factor				
43	λ₂a	Armour Loss Factor		0.0	0.0	0.0
44	λ₂pipe	Pipe Loss Factor		0.0	0.0	0.0
46	$\tilde{\lambda}_2$	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
Normal	Operation I	EC 60287-2-1				
47	T <sub>1</sub>	Thermal Resistance Between Conductor and Screen	[K.m/W]	0.3402	0.3402	0.3402
48	t <sub>1</sub>	Insulation Thickness Between Conductor and Screen	[mm]	25.8	25.8	25.8
49	ρΤί	Thermal Resistivity of Insulation	[K.m/W]	3.5	3.5	3.5
50	T <sub>3</sub>	Thermal Resistance of Jacket/Pipe Coating	[K.m/W]	0.04631	0.04631	0.04631
51	t <sub>3</sub>	Thickness of Jacket/Pipe Coating	[mm]	5.2	5.2	5.2
52 Cable in	ρTJ n Ducts	Thermal Resistivity of Jacket/Pipe Coating	[K.m/W]	3.5	3.5	3.5
	I	Coefficient Used in IEC 60207.2.4 Clourse 2.2.7.4		1 07	1 07	1 07
53	U V	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		1.87	1.87	1.87
54	V Y	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		0.312	0.312	0.312
55 56	Υ θm	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[°C1	0.0037 61.7	0.0037 64.5	0.0037
56	⊎m T₄'	Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe	[°C] [K.m/W]	61.7 0.23247	64.5 0.22857	61.5 0.23273
57	L4 Do	Outside Diameter of the Duct/Pipe	[K.m/VV] [mm]	200.0	200.0	200.0
58	Di	Inside Diameter of the Duct/Pipe	[mm]	188.0	188.0	188.0
60	ρΤ	Thermal Resistivity of the Duct/Pipe Material	[K.m/W]	3.5	3.5	3.5
61	рт Т <sub>4</sub> "	Thermal Resistance of the Duct/Pipe	[K.m/W]	0.03447	0.03447	0.03447
62	T4"	Thermal Resistance of the Surrounding Medium	[K.m/W]	0.6475	0.70058	0.64867
-		nk/Backfill installation				
63	×	Shorter Side of the Duct Bank/Backfill	[m]	1.0	1.0	1.0
64	у	Longer Side of the Duct Bank/Backfill	[m]	4.0	4.0	4.0
65	rb	Equivalent Radius of Duct Bank/Backfill	[m]	1.19983	1.19983	1.19983
66	LG	Depth of Laying to the Centre of Duct Bank/Backfill	[m]	0.962	0.962	0.962
67	u	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3		0.80178	0.80178	0.80178
68	N	Number of Loaded Cables in the Duct Bank/Backfill		3.0	3.0	3.0
69	ре	Thermal Resistivity of Earth Around the Duct Bank/Backfill	[K.m/W]	1.2	1.2	1.2
70	ρc	Thermal Resistivity of the Duct Bank/Backfill	[K.m/W]	1.0	1.0	1.0
71	T4'''	Thermal Resistance of the Surrounding Medium	[K.m/W]	0.6475	0.70058	0.64867
72	T₄	Total External Thermal Resistance	[K.m/W]	0.91444	0.96362	0.91587
		Temperature Rise at the Surface of the Cable Due to Other				
73	Δθint	Surrounding Elements	[°C]	0.0	0.0	0.0
74	I	Cable Core Current Ampacity	[A]	2202.5	2202.5	2202.5

	Study Summary			
CYMCAP Version	7.3 Revision 2			
Study:	Eirgrid Cp966 Feasibility study			
Execution:	Eirgrid - Road Width Trench (1ct 220kV CABLE)			
Date:	16/01/2020 13:53:26			

General Simulation Data	
Steady State Option	Equally Loaded
Consider Electrical interaction between circuits	No
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0
Conductor Resistances Computation Option:	IEC-228

Installation Type:Ductbank							
Ambient Soil Temperature at Installation Depth	[°C]	15.0					
Native Soil Thermal Resistivity	[K.m/W]	1.2					
Thermal Resistivity of Duct Bank	[K.m/W]	1.0					
Depth of Center of Duct Bank	[m]	0.96					
Duct Bank Width	[m]	4.0					
Duct Bank Height	[m]	1.0					



Results Summary										
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [m]	Y coordinate [m]	Conductor temperature [°C]	Ampacity [A]
1	220KV.011	1		А	50.0	1.0	-1.5	1.05	86.9	2279.5
2	220KV.011	1		В	50.0	1.0	0.0	1.05	90.0	2279.5

<b>3 2201.0 1.0 1.0 1.00 2273</b>		3	220KV.011	1		С	50.0	1.0	1.5	1.05	86.6	2279.5
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	Steady State Summary
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Road Width Trench (1ct 220kV CABLE)
Date:	16/01/2020 13:53:26

Simulation Data	
Installation type:	Ductbank
Steady State Option	Equally Loaded
Ambient temperature [°C]	15
Native Soil Thermal Resistivity [K.m/W]	1.2
Consider Non-Isothermal Earth Surface	No
Consider effect of soil dry out	No
Consider Electrical interaction between circuits	No
Induced current in metallic layers as a fraction of conductor current (applied to all single phase circuits)	0

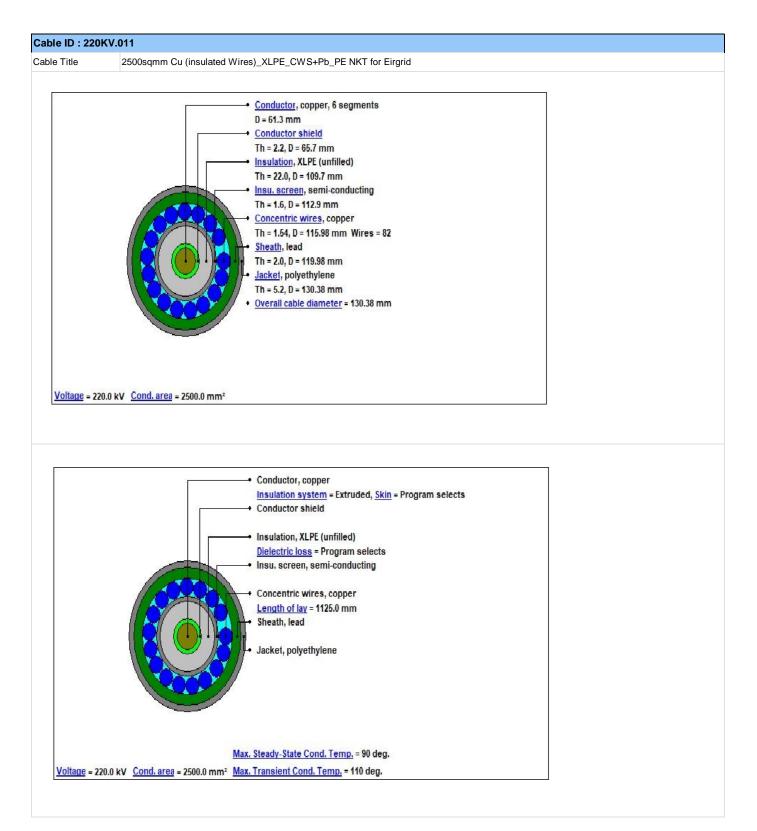
Variable	e Description	Unit		Cables	
Cable No.	Cable Index Number		1	2	3
General Inpu	it Data	1		1	·
Cable ID	Cable Equipment ID		220KV.011	220KV.011	220KV.011
Circuit No.	Circuit No.		1	1	1
Phase	Cable Phase		А	В	С
Fq	Operating Frequency	[Hz]	50.0	50.0	50.0
x	X coordinate	[m]	-1.5	0.0	1.5
y	Y coordinate	[m]	1.05	1.05	1.05
DLF	Daily Load Factor	[p.u.]	1.0	1.0	1.0
	Bonding Type	[[1.0.]	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat
Ampacity				•	•
I	Steady State Ampacity	[A]	2279.5	2279.5	2279.5
emperature	'S			1	1
θс	Conductor temperature	[°C]	86.9	90.0	86.6
θs	Sheath/Shield temperature	[°C]	68.8	71.8	68.6
θа	Armour temperature	[°C]	n/a	n/a	n/a
θsurf	Cable surface temperature	[°C]	66.2	69.2	66.0
θduct	Duct surface temperature	[°C]	51.1	54.3	51.0
Resistances				1	1
R <sub>0</sub>	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
R	AC Resistance of the Conductor at Operating Temperature	[Ω/km]	0.0101	0.01018	0.0101
ys	Skin Effect Factor		0.11104	0.1091	0.1112
ур	Proximity Effect Factor		0.00025	0.00024	0.00025
.osses				L	1
Wc	Conductor Losses	[W/m]	52.50642	52.9227	52.47224
Wd	Dielectric Losses	[W/m]	1.37316	1.37316	1.37316
Ws	Metallic Screen Losses	[W/m]	1.93954	1.77902	1.63899
Wa	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
Wt	Total Losses	[W/m]	55.81911	56.07488	55.48438
λ <sub>1</sub>	Screen Loss Factor		0.03694	0.03362	0.03124
λ <sub>2</sub>	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
hermal resi	stances			1	1
T1	Thermal resistance of insulation	[K.m/W]	0.3402	0.3402	0.3402
T2	Thermal resistance of bedding/medium inside pipe-type	[K.m/W]	n/a	n/a	n/a
Т3	Thermal resistance of outer covering	[K.m/W]	0.04631	0.04631	0.04631
T4	External thermal resistance	[K.m/W]	0.91739	0.96602	0.91885
Others					•
Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
	Induced current on Metallic Screen	[V/KII] [A]	137.7	127.2	126.4

CYMCAP Version	7.3 Revision 2

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Road Width Trench (1ct 220kV CABLE)
Date:	16/01/2020 13:53:26

No.	Description	Unit	1
	eral Cable Information	Onit	
1	Cable Equipment ID		220KV.011
2	Number of Cores		Single Core
3	Voltage	[kV]	220
4	Conductor Area	[mm²]	2500.0
5	Cable Overall Diameter	[mm]	130.38
	Maximum Steady-State Conductor Temperature	[]	100.00
6		[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	110
Con	ductor		
8	Material		Copper
9	Electrical Resistivity at 20°C	[μΩ.cm]	1.7241
10	Temperature Coefficient at 20°C	[1/K]	0.00393
11	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
12	Volumetric Specific Heat (SH)	[J/(K*cm <sup>3</sup> )]	3.45
13	Construction		6 Segments
14	Conductor Insulation System		Extruded
15	Milliken Wires Construction		Insulated Wires
16	Ks (Skin Effect Coefficient)		0.35
17	Kp (Proximity Effect Coefficient)		0.2
18	Diameter	[mm]	61.3
Con	ductor Shield		
19	Thickness	[mm]	2.2
20	Diameter	[mm]	65.7
Insu	lation		
21	Material		XLPE Unfilled
22	Thermal Resistivity	[K.m/W]	3.5
23	Dielectric Loss Factor - ( tan delta )		0.001
24	Relative Permittivity - ( epsilon )		2.5
25	Specific Insulation Resistance Constant at $60^{\circ}F$ - ( K )	[MQ.km]	65617.
26	Thickness	[mm]	22.0
27	Diameter		
	Bidinotor	immi	109.7
-	lation Screen	[mm]	109.7
-		[mm]	
Insu	lation Screen	[mm]	109.7 Semi Conducting Screen 1.6
<b>Insu</b> 28	lation Screen		Semi Conducting Screen
<b>Insu</b> 28 29	Iation Screen Material Thickness Diameter	[mm]	Semi Conducting Screen 1.6
<b>Insu</b> 28 29 30	Iation Screen Material Thickness Diameter	[mm]	Semi Conducting Screen 1.6
Insu 28 29 30 Shea	Iation Screen Material Thickness Diameter ath	[mm]	Semi Conducting Screen 1.6 112.9
Insu 28 29 30 Shea 31	Iation Screen Material Thickness Diameter ath Is Sheath Around Each Core?	[mm]	Semi Conducting Screen 1.6 112.9 n/a
Insu 28 29 30 Shea 31 32	Iation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material	[mm] [mm]	Semi Conducting Screen 1.6 112.9 n/a Lead
Insu 28 29 30 Shea 31 32 33 34	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance	[mm] [mm] [mm] [μΩ.cm] [μΩ.cm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004
Insu 28 29 30 Shea 31 32 33 34 34	Iation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA)	[mm] [mm] [μΩ.cm] [1/K] [K]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230
Insu 28 29 30 Shea 31 32 33 34 35 36	Iation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH)	[mm] [mm] [mm] [μΩ.cm] [μΩ.cm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45
Insu 28 29 30 <b>Shea</b> 31 32 33 34 35 36 37	Iation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA)	[mm] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated
Insu 28 29 30 Shea 31 32 33 34 35 36 37 38	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness	[mm] [mm] [mm] [μΩ.cm] [μΩ.cm] [1/K] [/(K*cm³)] [J/(K*cm³)]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0
Insu 28 29 30 <b>She</b> 31 32 33 34 35 36 37 38 39	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter	[mm] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated
Insu 28 29 30 <b>She</b> 31 32 33 34 35 36 37 38 39	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         centric neutral/Skid wires	[mm] [mm] [mm] [μΩ.cm] [μΩ.cm] [1/K] [/(K*cm³)] [J/(K*cm³)]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0
Insu 28 29 30 <b>She</b> 31 32 33 34 35 36 37 38 39	Iation Screen Iation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core?	[mm] [mm] [mm] [μΩ.cm] [μΩ.cm] [1/K] [/(K*cm³)] [J/(K*cm³)]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0
Insu 28 29 30 <b>She:</b> 31 32 33 34 35 36 37 38 39 <b>Con</b>	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material	[mm] [mm] [mm] [μΩ.cm] [μΩ.cm] [1/K] [/(K*cm³)] [J/(K*cm³)]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98
Insu 28 29 30 Shea 31 32 33 34 35 36 37 38 39 Con 40	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C	[mm] [mm] [mm] [μΩ.cm] [μΩ.cm] [1/K] [/(K*cm³)] [J/(K*cm³)]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98
Insu 28 29 30 She: 31 32 33 34 35 36 37 38 39 Con 40 41	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C	[mm]       [mm]       [mm]       [mm]       [μΩ.cm]       [1/K]       [J/(K*cm³)]       [J/(K*cm³)]       [mm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper
Insu 28 29 30 Shea 31 32 33 34 35 36 37 38 39 Con 40 41 42	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C	[mm]       [mm]       [mm]       [mm]       [μΩ.cm]       [μΩ.cm]       [J/(K*cm³)]       [mm]       [mm]       [mm]       [mm]       [mm]       [mm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98
Insu 28 29 30 Shea 31 32 33 34 35 36 37 38 39 Con 40 41 42 43	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reproced of Temperature Coefficient of Resistance	[mm]       [mm]       [mm]       [mm]       [μΩ.cm]       [μΩ.cm]       [J/(K' cm²)]       [mm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393
Insu 28 29 30 Shea 31 32 33 34 35 36 37 38 39 Con 40 41 42 43	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)	[mm] [mm] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)] [J/(K*cm³)] [J/(K*cm³)] [J/(K*cm³)] [J/(K*cm³)] [J/(K*cm³)] [J/(K*cm³)]	Semi Conducting Screen
Insu 28 29 30 She: 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42 43 44	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)	[mm]       [mm]       [mm]       [mm]       [μΩ.cm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98
Insu 28 29 30 Shea 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42 43 44 45 46	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Lectrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay	[mm]       [mm]       [mm]       [mm]       [μΩ.cm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393           234.5           3.45           1125.0
Insu 28 29 30 Shea 31 32 33 34 35 36 37 38 39 Con 40 41 42 43 44 45 46 47	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Lectrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay         Number of Wires	[mm]       [mm]       [mm]       [mm]       [μΩ.cm]	Semi Conducting Screen
Insu 28 29 30 Shea 31 32 33 34 35 36 37 38 39 Con 40 41 42 43 44 45 46 47 48	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay         Number of Wires         Wire Gauge	[mm]         [mm]         [mm]         [mm]         [mm]         [mm]         [μΩ.cm]         [μΩ.cm]         [J/(K*cm³)]         [μΩ.cm]         [mm]         [m]         [m]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           Copper           1.7241           0.00393           234.5           3.45           1125.0           82           Undefined
Insu 28 29 30 Shea 31 32 33 34 35 36 37 38 39 Con 40 41 42 43 44 43 44 45 46 47 48	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Lectrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay         Number of Wires         Wire Gauge         Thickness         Diameter	[mm]           [j](K*cm*)]           [j](K*cm*)]           [j](K*cm*)]           [j](K*cm*)]           [mm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           0.00393           234.5           3.45           1125.0           82           Undefined           1.54
Insu 28 29 30 Shea 31 32 33 34 35 36 37 38 39 Con 40 41 42 43 44 45 46 47 48 49 50	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Lectrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay         Number of Wires         Wire Gauge         Thickness         Diameter	[mm]           [j](K*cm*)]           [j](K*cm*)]           [j](K*cm*)]           [j](K*cm*)]           [mm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           0.00393           234.5           3.45           1125.0           82           Undefined           1.54
Insu 28 29 30 Shea 31 32 33 34 35 36 37 38 39 Con 40 41 42 43 44 45 46 47 48 49 50 Jack	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay         Number of Wires         Wire Gauge         Thickness         Diameter	[mm]           [j](K*cm*)]           [j](K*cm*)]           [j](K*cm*)]           [j](K*cm*)]           [mm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           Copper           1.7241           0.00393           234.5           3.45           1125.0           82           Undefined           1.54           115.98
Insu           28           29           30           Shea           31           32           33           34           35           36           37           38           39           Con           40           41           42           43           44           45           46           47           48           49           50           Jack           51	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay         Number of Wires         Wire Gauge         Thickness         Diameter         cet         Material	[mm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           0.00393           234.5           3.45           1125.0           82           Undefined           1.54           115.98           Polyethylene
Insu 28 29 30 Shea 31 32 33 34 35 36 37 38 39 Con 40 41 42 43 40 41 42 43 44 45 46 47 48 49 50 Jack 51 52	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay         Number of Wires         Wire Gauge         Thickness         Diameter         Cet         Material         Length of Lay         Number of Wires         Wire Gauge         Thickness         Diameter         Cet         Material         Thermal Resistivity	[mm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           Copper           1.7241           0.00393           234.5           3.45           1125.0           82           Undefined           1.54           115.98           Polyethylene           3.5

No.	Description	Unit	1
Spe	cific Installation Data		
55	Cable Equipment ID		220KV.011
56	Cable Frequency	[Hz]	50
57	Sheath / Shield Bonding		1 Conductor Crossbonded Flat
58	Loss Factor Constant (ALOS)		0.3
59	Minor section length		Crossbonded Unknown Section Lengths UNKNOWN
60	Duct construction		Polyethylene in Concrete
61	Duct material thermal resistivity	[K.m/W]	3.5
62	Inside Diameter of the Duct/Pipe	[mm]	188.0
63	Outside Diameter of the Duct/Pipe	[mm]	200.0



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	10	
INTERNAT	IONAL T	60

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Road Width Trench (1ct 220kV CABLE)
Date:	16/01/2020 13:53:26

No.	Description	Unit	Cable No.1	Cable No.2	Cable No.3
1	Cable Equipment ID		220KV.011	220KV.011	220KV.011
Resi	stances				
2	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00909	0.00918	0.00909
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.00841	0.00841	0.00841
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.0101	0.01018	0.0101
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.28869	0.28869	0.28869
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.34503	0.34846	0.34475
8	DC Resistance of Concentric Wires at 20°C	[Ω/km]	0.1185	0.1185	0.1185
9	DC Resistance of Concentric Wires at Operating Temperature	[Ω/km]	0.14123	0.14261	0.14112
Loss	es				
10	Conductor Losses	[W/m]	52.50642	52.9227	52.47224
11	Dielectric Losses	[W/m]	1.37316	1.37316	1.37316
12	Metallic Screen Losses	[W/m]	1.93954	1.77902	1.63899
13	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
14	Total Losses	[W/m]	55.81911	56.07488	55.48438
Сара	citance, Inductance, Impedance				
15	Capacitance	[µF/km]	0.271	0.271	0.271
16	Inductance of Conductor	[mH/km]	0.82812	0.82812	0.82812
17	Reactance of Conductor	[Ω/km]	0.26016	0.26016	0.26016
18	Inductance of Metallic Sheath	[mH/km]	0.65017	0.65017	0.65017
19	Reactance of Metallic Sheath	[Ω/km]	0.20426	0.20426	0.20426
20	Positive Sequence Impedance	[Ω/km]	0.010100 + j0.260160	0.010180 + j0.260160	0.010100 + j0.260160
21	Negative Sequence Impedance	[Ω/km]	0.010100 + j0.260160	0.010180 + j0.260160	0.010100 + j0.260160
22	Zero Sequence Impedance	[Ω/km]	0.092020 + j0.204260	0.092000 + j0.204260	0.092020 + j0.204260
23	Surge Impedance	[Ω]	55.28699	55.28699	55.28699
Othe	rs				
24	Dielectric Stress at Conductor Surface	[kV/mm]	7.54233	7.54233	7.54233
25	Dielectric Stress at Insulation Surface	[kV/mm]	4.51715	4.51715	4.51715
26	Insulation Resistance at 60°F (15.8°C)	[MΩ.km]	14609.00643	14609.00643	14609.00643
27	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a
28	Charging Current for One Phase	[A/km]	10.81081	10.81081	10.81081
29	Charging Capacity of three phase system at Uo	[kvar/km]	4119.47055	4119.47055	4119.47055
30	Voltage drop for Three Phase System	[V/A/km]	0.0175	0.01764	0.01749
31	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
32	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
33	Induced current on Metallic Screen	[A]	137.7	127.2	126.4

Cable Parameters under Normal Operation	
7.3 Revision 2	
grid Cp966 Feasibility study	
Eirgrid - Road Width Trench (1ct 220kV CABLE) 16/01/2020 13:53:26	

AC Resis R <sub>0</sub> R' dc ks kp xs xp ys yp R csses tanδ ε C U <sub>0</sub> Wd	DC Resistance of the conductor at 20°C DC Resistance of Conductor at Operating Temperature Conductor Diameter Distance Between Conductor Axes Factor Used for xs Calculation (Skin Effect) Factor Used for xp Calculation (Proximity Effect) Component of Ys Calculation (Skin Effect) Skin Effect Factor Proximity Effect Factor AC Resistance of Conductor at Operating Temperature Dielectric Loss Factor Insulation Relative Permitivity	[Ω/km] [Ω/km] [mm] [mm]	220KV.011 0.0072 0.00909 61.3 1500.0 0.35 0.2 2.19933 1.66254 0.11104 0.00025 0.0101 0.001	220KV.011 0.0072 0.00918 61.3 1500.0 0.35 0.2 2.18875 1.65454 0.1091 0.00024 0.01018	220KV.011 0.0072 0.00909 61.3 1500.0 0.35 0.2 2.20021 1.6632 0.1112 0.00025 0.0101
AC Resis R <sub>0</sub> R' dc s ks kp xs xp ys yp R osses tanδ ε C U <sub>0</sub>	tance DC Resistance of the conductor at 20°C DC Resistance of Conductor at Operating Temperature Conductor Diameter Distance Between Conductor Axes Factor Used for xs Calculation (Skin Effect) Factor Used for xp Calculation (Proximity Effect) Component of Ys Calculation (Skin Effect) Skin Effect Factor Proximity Effect Factor AC Resistance of Conductor at Operating Temperature Dielectric Loss Factor Insulation Relative Permitivity	[Ω/km] [mm] [mm]	0.00909 61.3 1500.0 0.35 0.2 2.19933 1.66254 0.11104 0.00025 0.0101	0.00918 61.3 1500.0 0.35 0.2 2.18875 1.65454 0.1091 0.00024	0.00909 61.3 1500.0 0.35 0.2 2.20021 1.6632 0.1112 0.00025
R₀           R'           dc           s           ks           kp           xs           xp           ys           yp           R           ossess           tanõ           ε           U₀	DC Resistance of the conductor at 20°C DC Resistance of Conductor at Operating Temperature Conductor Diameter Distance Between Conductor Axes Factor Used for xs Calculation (Skin Effect) Factor Used for xp Calculation (Proximity Effect) Component of Ys Calculation (Skin Effect) Skin Effect Factor Proximity Effect Factor AC Resistance of Conductor at Operating Temperature Dielectric Loss Factor Insulation Relative Permitivity	[Ω/km] [mm] [mm]	0.00909 61.3 1500.0 0.35 0.2 2.19933 1.66254 0.11104 0.00025 0.0101	0.00918 61.3 1500.0 0.35 0.2 2.18875 1.65454 0.1091 0.00024	0.00909 61.3 1500.0 0.35 0.2 2.20021 1.6632 0.1112 0.00025
R'           dc           s           ks           kp           xs           xp           ys           yp           R           osses           tanð           ε           C           U₀	DC Resistance of Conductor at Operating Temperature Conductor Diameter Distance Between Conductor Axes Factor Used for xs Calculation (Skin Effect) Factor Used for xs Calculation (Proximity Effect) Component of Ys Calculation (Skin Effect) Component of Yp Calculation (Proximity Effect) Skin Effect Factor Proximity Effect Factor AC Resistance of Conductor at Operating Temperature Dielectric Loss Factor Insulation Relative Permitivity	[Ω/km] [mm] [mm]	0.00909 61.3 1500.0 0.35 0.2 2.19933 1.66254 0.11104 0.00025 0.0101	0.00918 61.3 1500.0 0.35 0.2 2.18875 1.65454 0.1091 0.00024	0.00909 61.3 1500.0 0.35 0.2 2.20021 1.6632 0.1112 0.00025
dc s ks kp xs xp ys yp R osses tanδ ε C U <sub>0</sub>	Conductor Diameter Distance Between Conductor Axes Factor Used for xs Calculation (Skin Effect) Factor Used for xp Calculation (Proximity Effect) Component of Ys Calculation (Proximity Effect) Component of Yp Calculation (Proximity Effect) Skin Effect Factor Proximity Effect Factor AC Resistance of Conductor at Operating Temperature Dielectric Loss Factor Insulation Relative Permitivity	[mm] [mm]	61.3 1500.0 0.35 0.2 2.19933 1.66254 0.11104 0.00025 0.0101	61.3 1500.0 0.35 0.2 2.18875 1.65454 0.1091 0.00024	61.3 1500.0 0.35 0.2 2.20021 1.6632 0.1112 0.00025
s ks kp xs xp ys yp R osses tanδ ε C U <sub>0</sub>	Distance Between Conductor Axes Factor Used for xs Calculation (Skin Effect) Factor Used for xp Calculation (Proximity Effect) Component of Ys Calculation (Skin Effect) Component of Yp Calculation (Proximity Effect) Skin Effect Factor Proximity Effect Factor AC Resistance of Conductor at Operating Temperature Dielectric Loss Factor Insulation Relative Permitivity	[mm]	1500.0 0.35 0.2 2.19933 1.66254 0.11104 0.00025 0.0101	1500.0 0.35 0.2 2.18875 1.65454 0.1091 0.00024	1500.0 0.35 0.2 2.20021 1.6632 0.1112 0.00025
ks kp xs xp ys yp R osses tanδ ε C U <sub>0</sub>	Factor Used for xs Calculation (Skin Effect) Factor Used for xp Calculation (Proximity Effect) Component of Ys Calculation (Skin Effect) Component of Yp Calculation (Proximity Effect) Skin Effect Factor Proximity Effect Factor AC Resistance of Conductor at Operating Temperature Dielectric Loss Factor Insulation Relative Permitivity		0.35 0.2 2.19933 1.66254 0.11104 0.00025 0.0101	0.35 0.2 2.18875 1.65454 0.1091 0.00024	0.35 0.2 2.20021 1.6632 0.1112 0.00025
kp xs xp ys yp R osses tanδ ε C U <sub>0</sub>	Factor Used for xp Calculation (Proximity Effect) Component of Ys Calculation (Skin Effect) Component of Yp Calculation (Proximity Effect) Skin Effect Factor Proximity Effect Factor AC Resistance of Conductor at Operating Temperature Dielectric Loss Factor Insulation Relative Permitivity	[Ω/km]	0.2 2.19933 1.66254 0.11104 0.00025 0.0101	0.2 2.18875 1.65454 0.1091 0.00024	0.2 2.20021 1.6632 0.1112 0.00025
xs xp ys yp R osses tanδ ε C U <sub>0</sub>	Component of Ys Calculation (Skin Effect) Component of Yp Calculation (Proximity Effect) Skin Effect Factor Proximity Effect Factor AC Resistance of Conductor at Operating Temperature Dielectric Loss Factor Insulation Relative Permitivity	[Ω/km]	2.19933 1.66254 0.11104 0.00025 0.0101	2.18875 1.65454 0.1091 0.00024	2.20021 1.6632 0.1112 0.00025
xp ys R osses tanδ ε C U <sub>0</sub>	Component of Yp Calculation (Proximity Effect) Skin Effect Factor Proximity Effect Factor AC Resistance of Conductor at Operating Temperature Dielectric Loss Factor Insulation Relative Permitivity	[Ω/km]	1.66254 0.11104 0.00025 0.0101	1.65454 0.1091 0.00024	1.6632 0.1112 0.00025
ys yp R osses tanδ ε C U <sub>0</sub>	Skin Effect Factor Proximity Effect Factor AC Resistance of Conductor at Operating Temperature Dielectric Loss Factor Insulation Relative Permitivity	[Ω/km]	0.11104 0.00025 0.0101	0.1091 0.00024	0.1112
yp R osses tanδ ε C U <sub>0</sub>	Proximity Effect Factor AC Resistance of Conductor at Operating Temperature Dielectric Loss Factor Insulation Relative Permitivity	[Ω/km]	0.00025 0.0101	0.00024	0.00025
R osses tanδ ε C U <sub>0</sub>	AC Resistance of Conductor at Operating Temperature Dielectric Loss Factor Insulation Relative Permitivity	[Ω/km]	0.0101		
R osses tanδ ε C U <sub>0</sub>	AC Resistance of Conductor at Operating Temperature Dielectric Loss Factor Insulation Relative Permitivity	[Ω/km]	0.0101		
tanδ ε C U <sub>0</sub>	Dielectric Loss Factor Insulation Relative Permitivity				
ε C U <sub>0</sub>	Insulation Relative Permitivity		0.001		
C U <sub>0</sub>	· · · · · · · · · · · · · · · · · · ·			0.001	0.001
Uo			2.5	2.5	2.5
Uo					
_	Cable Capacitance	[µF/km]	0.271	0.271	0.271
Wd	Voltage	[kV]	127.01706	127.01706	127.01706
	Cable Dielectric Losses Per Phase	[W/m]	1.37316	1.37316	1.37316
Loss Fac	tor				
Rs	AC Resistance used for Circulating Loss Factor computation	[Ω/km]	0.10021	0.1012	0.10013
d	Mean diameter used for Circulating Loss Factor computation	[mm]	116.22348	116.22348	116.22348
3		[]	110.22040	. 10.22040	. 10.22348
х	Reactance used for Circulating Loss Factor computation	[Ω/km]	0.20426	0.20426	0.20426
Xm	Mutual Reactance	[Ω/km]	0.04355	0.04355	0.04355
Р	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.24781	0.24781	0.24781
Q	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.18974	0.18974	0.18974
engolac	Spacing Factor (applied when spacing between cable uneven or non-		0.004	0.004	0.001
					0.004
λ <sub>1</sub> Factor			0.00018	0.03094	0.03047
	AC Resistance used for Eddy Loss Eactor computation	[0/km]	0.34502	0.34846	0.34475
					117.98
u		[iiiii]	117.50	117.50	117.50
ρs	Electrical Resistivity used for Eddy Loss Factor computation	[Ω.m]	0.0	0.0	0.0
Ds	External diameter used for Eddy Loss Factor computation	[mm]	119.98	119.98	119.98
ts	Thickness used for Eddy Loss Factor computation	[mm]	2.0	2.0	2.0
β1	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		39.28764	39.09367	39.30371
gs	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		1.00251	1.00249	1.00251
m	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.09105	0.09016	0.09113
λ <sub>o</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.00002	0.00007	0.00002
$\Delta_1$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1				0100001
$\Delta_2$			-0.00669	0.00004	0.0013
	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		-0.00669 0.0	0.00004	
F	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect				0.0013
F Fpipe			0.0	0.0	0.0013 0.0
	Milliken conductor Effect		0.0	0.0	0.0013 0.0 1.0
Fpipe armour λ"1	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current		0.0 1.0 1.0	0.0 1.0 1.0	0.0013 0.0 1.0 1.0
Fpipe armour λ"1 reen Loss	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current • factor		0.0 1.0 1.0 1.0 0.00076	0.0 1.0 1.0 1.0 0.00267	0.0013 0.0 1.0 1.0 1.0 0.00076
Fpipe armour λ"1 reen Loss λ1	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current i factor Screen Loss Factor		0.0 1.0 1.0 1.0	0.0 1.0 1.0 1.0	0.0013 0.0 1.0 1.0 1.0
Fpipe armour λ"1 reen Loss λ1 I Pipe Lo	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current i factor Screen Loss Factor ss Factor		0.0 1.0 1.0 0.00076 0.03694	0.0 1.0 1.0 0.00267 0.03362	0.0013 0.0 1.0 1.0 1.0 0.00076 0.03124
Fpipe armour $\lambda$ " <sub>1</sub> <b>reen Loss</b> $\lambda_1$ <b>d Pipe Lo</b> $\lambda_2$ a	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Soreen Loss Factor Caused by Eddy Current ifactor Soreen Loss Factor Armour Loss Factor Armour Loss Factor		0.0 1.0 1.0 0.00076 0.03694 0.0	0.0 1.0 1.0 0.00267 0.03362 0.0	0.0013 0.0 1.0 1.0 1.0 0.00076 0.03124
Fpipe armour $\lambda_1^n$ reen Loss $\lambda_1$ d Pipe Lo $\lambda_2a$ $\lambda_2pipe$	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Soreen Loss Factor Caused by Eddy Current ifactor Soreen Loss Factor Armour Loss Factor Pipe Loss Factor		0.0 1.0 1.0 0.00076 0.03694 0.0 0.0	0.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0	0.0013 0.0 1.0 1.0 0.00076 0.03124 0.0 0.0 0.0
Fpipe armour $\lambda^{"_1}$ feen Loss $\lambda_1$ d Pipe Lo $\lambda_2$ a $\lambda_2$ a $\lambda_2$ pipe $\lambda_2$	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Soreen Loss Factor Caused by Eddy Current ifactor Soreen Loss Factor Soreen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor		0.0 1.0 1.0 0.00076 0.03694 0.0	0.0 1.0 1.0 0.00267 0.03362 0.0	0.0013 0.0 1.0 1.0 1.0 0.00076 0.03124
Fpipe armour $\lambda''_1$ een Loss $\lambda_1$ H Pipe Lo $\lambda_2$ a $\lambda_2$ pipe $\lambda_2$ eration IE	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ifactor Screen Loss Factor Ss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-2-1		0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0	0.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0	0.0013 0.0 1.0 1.0 0.00076 0.03124 0.0 0.0 0.0 0.0
Fpipe armour $\lambda_{1}^{*}$ reen Loss $\lambda_{1}$ H Pipe Lo $\lambda_{2}$ $\lambda_{2}$ $\lambda_{2}$ Pipe $\lambda_{2}$ Fration IE T <sub>1</sub>	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current i factor Screen Loss Factor Ss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen	[K.m/W]	0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0013 0.0 1.0 1.0 0.0076 0.03124 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
Fpipe armour $\lambda^{*}_1$ een Loss $\lambda_1$ H Pipe Lo $\lambda_2$ a $\lambda_2$ pipe $\lambda_2$ eration IE T <sub>1</sub> t <sub>1</sub>	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ifactor Screen Loss Factor Ss Factor Armour Loss Factor Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen	[mm]	0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.0 0.0 0.3402 25.8	0.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.3402 25.8	0.0013 0.0 1.0 1.0 0.0076 0.03124 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
Fpipe armour $\lambda_{1}^{*}$ een Loss $\lambda_{1}$ H Pipe Lo $\lambda_{2}$ a $\lambda_{2}$ pipe $\lambda_{2}$ eration IE T <sub>1</sub> t <sub>1</sub> $\rho$ Ti	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Ss Factor Armour Loss Factor Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation	[mm] [K.m/W]	0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5	0.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5	0.0013 0.0 1.0 1.0 0.0076 0.03124 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
Fpipe armour $\lambda_{1}^{*}$ feen Loss $\lambda_1$ f Pipe Lo $\lambda_2$ $\lambda_2$ fration IE $T_1$ $t_1$ $\rho$ Ti $T_3$	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Ss Factor Armour Loss Factor Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W]	0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631	0.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631	0.0013 0.0 1.0 1.0 0.00076 0.00076 0.03124 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
Fpipe armour $\lambda_{1}^{*}$ feen Loss $\lambda_1$ d Pipe Lo $\lambda_2$ d Appe $\lambda_2$ eration IE $T_1$ $t_1$ $\rho$ Ti $T_3$ $t_3$	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Ss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W] [mm]	0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0013 0.0 1.0 1.0 0.00076 0.03124 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
Fpipe armour $\lambda_{1}^{*}$ feen Loss $\lambda_1$ f Pipe Lo $\lambda_2$ $\lambda_2$ fration IE $T_1$ $t_1$ $\rho$ Ti $T_3$	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Ss Factor Armour Loss Factor Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W]	0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631	0.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631	0.0013 0.0 1.0 1.0 0.00076 0.03124 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
Fpipe armour $\lambda^{*}_1$ reen Loss $\lambda_1$ I Pipe Lo $\lambda_2$ a $\lambda_2$ a $\lambda_2$ pipe $\lambda_2$ eration IE $T_1$ $t_1$ $\rho$ Ti $T_3$ $t_3$ $\rho$ TJ	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Ss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W] [mm]	0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0013 0.0 1.0 1.0 0.00076 0.00076 0.03124 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
Fpipe armour $\lambda^{*}_1$ reen Loss $\lambda_1$ Fpipe Lo $\lambda_2$ $\lambda_2$ proton IE $\lambda_2$ proton IE $\Gamma_1$ $\tau_1$ $\tau_1$ $\tau_3$ $\rho$ TJ cts	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-21 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W] [mm]	0.0 1.0 1.0 0.0076 0.03694 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5	0.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5	0.0013 0.0 1.0 1.0 0.00076 0.00076 0.03124 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
Fpipe armour $\lambda^{*}_1$ reen Loss $\lambda_1$ Fipe Lo $\lambda_2$ A pipe Lo $\lambda_2$ $\lambda_2$ pipe $\lambda_2$ cration IE $T_1$ $t_1$ $\rho$ Ti $T_3$ $\rho$ TJ cts U	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor C 60287-21 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm]	0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87	0.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5	0.0013 0.0 1.0 1.0 0.00076 0.00076 0.00124 0.03124 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
Fpipe armour $\lambda^{a}_1$ reen Loss $\lambda_1$ Fpipe Lo $\lambda_2$ A Pipe Lo $\lambda_2$ $\lambda_2$ pipe $\lambda_2$ ration IE $T_1$ $t_1$ $\rho$ Ti $T_3$ $\rho$ TJ cts U V	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor SFactor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-21 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm]	0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 0.2 3.5 0.04631 0.2 0.3 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 0.2 3.5	0.0013 0.0 1.0 1.0 0.00076 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
$Fpipe armour \lambda^{*_1}reen Loss\lambda_1I Pipe Lo\lambda_2a\lambda_2pipe  \lambda_2ration IET_1t_1\rhoTiT_3\rhoTJ\rhoTJ\nu\nu\nu\nu\nu\nu\nu\nu$	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to parmour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Se Factor Armour Loss Factor Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm] [K.m/W]	0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 0.2 3.5 0.04631 0.2 0.312 0.0037	0.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0013 0.0 1.0 1.0 0.0076 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
$Fpipe armour \lambda^{*_1}reen Loss\lambda_1I Pipe Lo\lambda_2a\lambda_2pipe  \lambda_2ration IET_1t_1\rhoTiT_3\rhoTJ\rhoTJ\nu\nu\nu\nu\nu\nu\nu\nu$	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to parmour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Se Factor Armour Loss Factor Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm] [K.m/W]	0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 0.2 3.5 0.04631 0.2 0.312 0.0037	0.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0013 0.0 1.0 1.0 0.0076 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
Fpipe armour $\lambda^{*}_1$ reen Loss $\lambda_1$ I Pipe Lo $\lambda_2$ A pipe $\lambda_2$ pration IE $T_1$ $t_1$ $\rho Ti$ $T_3$ $\rho TJ$ cts U V Y $\theta m$	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor C 60287-21 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistivity of Insulation Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space	[mm] [K.m/W] [K.m/W] [mm] [K.m/W]	0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0013 0.0 1.0 1.0 0.00076 0.00076 0.00076 0.00124 0.0007 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
$Fpipe armour \lambda^{*}_1reen Loss\lambda_1I Pipe Lo\lambda_2\lambda_2pration IET_1t_1\rhoTiT_3\rhoTJCtsUV\gamma\ThetamT_4'$	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor C 60287-21 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Inside the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W]	0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0013 0.0 1.0 1.0 0.00076 0.00076 0.00076 0.00124 0.00124 0.0007 0.2 5.8 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5
Fpipe armour $\lambda^{*_1}$ reen Loss $\lambda_1$ I Pipe Lo $\lambda_2$ a $\lambda_2$ pipe $\lambda_2$ pration IE $T_1$ $t_1$ $\rho$ Ti $T_3$ $\rho$ TJ Cts U V V Y $\theta$ m $T_4'$ Do	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor Screen Loss Factor <b>Sa Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Insulation Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [°C] [°C] [K.m/W]	0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0013 0.0 1.0 1.0 0.00076 0.00076 0.00076 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
Fpipe armour $\lambda^{*_1}$ reen Loss $\lambda_1$ I Pipe Lo $\lambda_2$ R Pipe Lo $\lambda_2$ $\lambda_2$ Pration IE $T_1$ $t_1$ $\rho$ Ti $T_3$ $\rho$ Ti $T_3$ r r r r r r r r	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-21 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W] [%C] [%C] [K.m/W] [mm] [mm]	0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0013 0.0 1.0 1.0 0.00076 0.00076 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
Fpipe armour $\lambda''_1$ reen Loss $\lambda_1$ H Pipe Lo $\lambda_2a$ $\lambda_2$ pration IE $T_1$ $t_1$ $\rho Ti$ $T_3$ $\rho Ti$ $T_3$ $\rho TJ$ cts U V Y $\theta m$ $T_4''$ Do Di $\rho T$ $T_4'''$	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor Pipe Loss Factor C 60287-21 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistance of the Surrounding Medium	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [%C] [%C] [K.m/W] [mm] [K.m/W]	0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0013 0.0 1.0 1.0 0.00076 0.00076 0.00076 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
Fpipe armour $\lambda''_1$ reen Loss $\lambda_1$ H Pipe Lo $\lambda_2a$ $\lambda_2$ pration IE $T_1$ $t_1$ $\rho Ti$ $T_3$ $\rho Ti$ $T_3$ $\rho TJ$ cts U V Y $\theta m$ $T_4''$ Do Di $\rho T$ $T_4'''$	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Ses Factor Armour Loss Factor Pipe Loss Factor C 60287-21 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistivity of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [%] [%C] [K.m/W] [mm] [K.m/W] [K.m/W]	0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 1.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0013 0.0 1.0 1.0 0.00076 0.00076 0.00076 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
Fpipe armour $\lambda''_1$ reen Loss $\lambda_1$ H Pipe Lo $\lambda_2a$ $\lambda_2$ pration IE $T_1$ $t_1$ $\rho Ti$ $T_3$ $\rho Ti$ $T_3$ $\rho TJ$ cts U V Y $\theta m$ $T_4''$ Do Di $\rho T$ $T_4'''$	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor Pipe Loss Factor C 60287-21 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistance of the Surrounding Medium	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [%] [%C] [K.m/W] [mm] [K.m/W] [K.m/W]	0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 1.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0013 0.0 1.0 1.0 0.00076 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
Fpipe       armour $\lambda^*_1$ reen Loss $\lambda_1$ reen Loss $\lambda_1$ reen Loss $\lambda_2$ $\lambda_2$ $\lambda_2$ $\lambda_2$ $\lambda_2$ $\lambda_2$ $\lambda_2$ $r       \lambda_2 r       \lambda_2 r       \lambda_2 r       \lambda_2 r       \lambda_2 r       \gamma_1 $	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor Screen Loss Factor Pipe Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-21</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>Vacketill installation</b>	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W] [K.m/W]	0.0 1.0 1.0 1.0 0.03694 0.03694 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 1.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0013 0.0 1.0 1.0 0.03124 0.03124 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
Fpipe       armour $\lambda^*_1$ reen Loss $\lambda_1$ reen Loss $\lambda_1$ reen Loss $\lambda_2$ $\lambda_2$ $\lambda_2$ $\lambda_2$ ration IE $T_1$ $t_1$ $\rho$ T $r_1$ $\tau_3$ $\rho$ T $\rho$ T $\sigma$ T $\sigma$ T $\sigma$ T $\sigma$ T $\sigma$ T $\sigma$ T $\rho$ T $\rho$ T $\rho$ T $\sigma$ T	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-21</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Filling the Space Thermal Resistance of the Duct/Pipe Inside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>vBackfill installation</b> Shorter Side of the Duct Bank/Backfill	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [mm] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	0.0 1.0 1.0 1.0 0.03694 0.03694 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 1.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0013 0.0 1.0 1.0 0.03124 0.03124 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
Fpipe       armour $\lambda^*_1$ reen Loss $\lambda_1$ reen Loss $\lambda_1$ reen Loss $\lambda_2$ $\lambda_2$ $\lambda_2$ $\lambda_2$ $\lambda_2$ $\lambda_2$ $\lambda_2$ $r       \lambda_1 \lambda_2 \lambda_2 r       \lambda_2 \rho \sigma \sigma \sigma \sigma \sigma \sigma \sigma \sigma \sigma \rho \sigma \rho \sigma $	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>i factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor Pipe Loss Factor <b>C 60287-21</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Filling the Space Thermal Resistivity of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Medium Inside the Duct/Pipe Thermal Resistance of the Medium Inside the Duct/Pipe Thermal Resistance of the Duct Bank/Backfill	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [C] [%C] [%C] [%C] [%C] [%C] [%C] [%C]	0.0 1.0 1.0 1.0 0.03694 0.03694 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 1.0 1.0 0.00267 0.03362 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0013 0.00 1.0 1.0 0.00076 0.00076 0.00076 0.00 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0
Fpipe         armour $\lambda^*_1$ reen Loss $\lambda_1$ Pipe Lo $\lambda_2$ $\lambda_2$ $\lambda_2$ $\lambda_2$ $\lambda_2$ $\lambda_2$ $\lambda_2$ $r         \lambda_1 \lambda_2 \lambda_2 \lambda_2 \lambda_2 r         \gamma_1 \tau_3 \rhoTi         \tau_3 \rhoTJ         \rhoTJ         \phi \psi $	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>i factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor Pipe Loss Factor <b>C 60287-21</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Filling the Space Thermal Resistivity of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>vBackfill installation</b> Shorter Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [C] [%C] [%C] [%C] [%C] [%C] [%C] [%C]	0.0 1.0 1.0 1.0 0.03694 0.03694 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 1.0 1.0 0.00267 0.03362 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0013 0.00 1.0 1.0 0.00076 0.00076 0.00076 0.000 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
Fpipe       armour $\lambda^*_1$ reen Loss $\lambda_1$ reen Loss $\lambda_2$ $\lambda_2$ $\lambda_2$ $ration IE$ $\tau_1$ $\tau_1$ $\tau_1$ $\tau_1$ $\tau_1$ $\tau_1$ $\tau_3$ $\rho TJ$ $\rho TJ$ $\sigma T$	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>i factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor Pipe Loss Factor <b>C 60287-21</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Filling the Space Thermal Resistance of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>vBackfill Installation</b> Shorter Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [C] [%C] [%C] [%C] [%C] [%C] [%C] [%C]	0.0 1.0 1.0 0.03694 0.03694 0.03694 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 1.0 1.0 0.00267 0.03362 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0013 0.00 1.0 1.0 0.03124 0.03124 0.03124 0.00 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0
Fpipe         armour $\lambda^*_1$ reen Loss $\lambda_1$ <b>Pipe Lo</b> $\lambda_2$ a $\lambda_2$ pipe $\lambda_2$ pration IE $T_1$ $\tau_1$ $\tau_1$ $\tau_1$ $\tau_3$ $\rho$ TJ         ott $\gamma$ $\Theta$ m $T_4^*$ $Do$ $Di$ $\rho$ T $\tau_4^*$ $\rho$ ouct Bant $x$ $y$ $rb$ LG $u$	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Armour Loss Factor Armour Loss Factor Pipe Loss Factor C 60287-21 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistivity of the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistance of the Surrounding Medium (Backfill Installation Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [C] [K.m/W] [Mm] [Mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	0.0 1.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 1.0 1.0 0.00267 0.03362 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0013 0.00 1.0 1.0 0.00076 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
Fpipe         armour $\lambda^*_1$ reen Loss $\lambda_1$ <b>Pipe Lo</b> $\lambda_2$ a $\lambda_2$ pipe $\lambda_2$ pration IE $T_1$ $\tau_1$ $\tau_1$ $\tau_1$ $\tau_3$ $\rho$ TJ         ott $\gamma$ $\Theta$ m $T_4^*$ $Do$ $Di$ $\rho$ T $\tau_4^*$ $\rho$ ouct Bant $x$ $y$ $rb$ LG $u$	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor Pipe Loss Factor C 60287-21 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistivity of the Duct/Pipe Inside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistance of the Surrounding Medium (Backfill Installation Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [C] [C] [C] [mm] [mm] [K.m/W] [K.m/W] [m] [m] [m] [m] [m] [m] [m] [m] [m]	0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0013 0.0 1.0 1.0 0.00076 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
Fpipe       armour $\lambda_1^*$ reen Loss $\lambda_1$ Presentation $\lambda_2$ a $\lambda_2$ pipe $\lambda_2$ $\lambda_2$ a $\lambda_2$ $\lambda_2$ $\lambda_2$ $\alpha$ $\lambda_2$ $\alpha$ $\lambda_2$ $\alpha$ $\lambda_2$ $\lambda_2$ $\lambda_2$ $\lambda_2$ $\lambda_2$ $\lambda_2$ $\alpha$ $\lambda_2$ $\alpha$ $\lambda_2$ $\lambda_2$ </td <td>Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Armour Loss Factor Armour Loss Factor Pipe Loss Factor C 60287-21 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistivity of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistance of the Surrounding Medium (Backfill Installation Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of the Thermal Resistivity of the Thermal Resistivity of the Space</td> <td>[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [M] [m] [m] [m] [m] [m] [m] [m] [m] [m] [m</td> <td>0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.</td> <td>0.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.</td> <td>0.0013 0.00 1.0 1.0 0.00076 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.</td>	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Armour Loss Factor Armour Loss Factor Pipe Loss Factor C 60287-21 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistivity of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistance of the Surrounding Medium (Backfill Installation Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of the Thermal Resistivity of the Thermal Resistivity of the Space	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [M] [m] [m] [m] [m] [m] [m] [m] [m] [m] [m	0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0013 0.00 1.0 1.0 0.00076 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
Fpipe           armour $\lambda_{1}^{*}$ reen Loss $\lambda_{1}$ Presentation $\lambda_{2}a$ $\lambda_{2}a$ $\lambda_{2}pipe$ $\lambda_{2}$ ration IE $T_{1}$ $\rho$ Ti $T_{3}$ $\rho$ TJ           Cts           U           V $\gamma$ $\theta$ m $T_{4}^{*}$ $Do$ $Di$ $\rho$ T $T_{4}^{**}$ $Do$ $Di$ $\rho$ T $T_{4}^{**}$ $V$ $\gamma$ $Do$ $Di$ $\rho$ T $T_{4}^{**}$ $Y$ $rb$ LG $u$ $\rho e$ $\rho c$ $T_{4}^{**}$	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Armour Loss Factor Armour Loss Factor Pipe Loss Factor C 60287-21 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistivity of the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistance of the Surrounding Medium (Backfill Installation Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of the	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [C] [C] [K.m/W] [K.m/W] [M] [m] [m] [m] [m] [m] [m] [m] [m] [m] [m	0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 1.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0013 0.00 1.0 1.0 0.00076 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
Fpipe         armour $\lambda_{1}$ reen Loss $\lambda_{1}$ I Pipe Lo $\lambda_{2}a$ $\lambda_{2}pipe$ $\lambda_{2}$ ration IE         T <sub>1</sub> $\rho$ Ti         T <sub>3</sub> $\rho$ Ti         T <sub>3</sub> $\rho$ TJ         cts         U         V         Y $\theta$ m         Di         Di $\rho$ T         T <sub>4</sub> "         Y         Band         x         y         rb         LG $\mu$ $\rho$ e $\rho$ c	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Armour Loss Factor Armour Loss Factor Pipe Loss Factor C 60287-21 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistivity of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistance of the Surrounding Medium (Backfill Installation Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of the Thermal Resistivity of the Thermal Resistivity of the Space	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [M] [m] [m] [m] [m] [m] [m] [m] [m] [m] [m	0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0013 0.00 1.0 1.0 0.00076 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
Fpipe           armour $\lambda_{1}^{*}$ reen Loss $\lambda_{1}$ Presentation $\lambda_{2}a$ $\lambda_{2}a$ $\lambda_{2}pipe$ $\lambda_{2}$ ration IE $T_{1}$ $\rho$ Ti $T_{3}$ $\rho$ TJ           Cts           U           V $\gamma$ $\theta$ m $T_{4}^{*}$ $Do$ $Di$ $\rho$ T $T_{4}^{**}$ $Do$ $Di$ $\rho$ T $T_{4}^{**}$ $V$ $\gamma$ $Do$ $Di$ $\rho$ T $T_{4}^{**}$ $Y$ $rb$ LG $u$ $\rho e$ $\rho c$ $T_{4}^{**}$	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Armour Loss Factor Armour Loss Factor Pipe Loss Factor C 60287-21 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistivity of the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistance of the Surrounding Medium (Backfill Installation Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of the	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [C] [C] [K.m/W] [K.m/W] [M] [m] [m] [m] [m] [m] [m] [m] [m] [m] [m	0.0 1.0 1.0 0.00076 0.03694 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 1.0 1.0 1.0 0.00267 0.03362 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0013 0.00 1.0 1.0 0.00076 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
sr F	P Q Q P Q Q $A'_1$ $A'_1$ $A''_1$	Xm         Mutual Reactance           P         Component for Circulating Loss Factor Formula (Clause 2.3.3)           Q         Component for Circulating Loss Factor Formula (Clause 2.3.3)           Spacing Factor (applied when spacing between cable uneven or non- equal minor section length)         X <sub>1</sub> X <sub>1</sub> Screen Loss Factor Caused by Circulating Current actor           Rs         AC Resistance used for Eddy Loss Factor computation           d         Mean diameter used for Eddy Loss Factor computation           ps         Electrical Resistivity used for Eddy Loss Factor computation           ts         Thickness used for Eddy Loss Factor computation           β <sub>1</sub> Coefficient used in EC 60287-1-1 Clause 2.3.6.1           gs         Coefficient used in IEC 60287-1-1 Clause 2.3.6.1           m         Coefficient used in IEC 60287-1-1 Clause 2.3.6.1	Xm       Mutual Reactance       [ $\Omega$ /km]         P       Component for Circulating Loss Factor Formula (Clause 2.3.3)       [ $\Omega$ /km]         Q       Component for Circulating Loss Factor Formula (Clause 2.3.3)       [ $\Omega$ /km]         Spacing Factor (applied when spacing between cable uneven or non- equal minor section length)          X <sub>1</sub> Screen Loss Factor Caused by Circulating Current         actor         Rs       AC Resistance used for Eddy Loss Factor computation       [ $\Omega$ /km]         d       Mean diameter used for Eddy Loss Factor computation       [ $\Omega$ /m]         ps       Electrical Resistivity used for Eddy Loss Factor computation       [ $\Omega$ .m]         Ds       External diameter used for Eddy Loss Factor computation       [ $m$ m]         ts       Thickness used for Eddy Loss Factor computation       [ $m$ m] $\beta_1$ Coefficient used in IEC 60287-1-1 Clause 2.3.6.1       [ $m$ m       Coefficient used in IEC 60287-1-1 Clause 2.3.6.1       [ $m$	Xm         Mutual Reactance $[\Omega/km]$ 0.04355           P         Component for Circulating Loss Factor Formula (Clause 2.3.3) $[\Omega/km]$ 0.24781           Q         Component for Circulating Loss Factor Formula (Clause 2.3.3) $[\Omega/km]$ 0.24781           Q         Component for Circulating Loss Factor Formula (Clause 2.3.3) $[\Omega/km]$ 0.18974           Spacing Factor (applied when spacing between cable uneven or non- equal minor section length)         0.004           X <sub>1</sub> Screen Loss Factor Caused by Circulating Current         0.03618           actor          0.34503           d         Mean diameter used for Eddy Loss Factor computation         [ $\Omega/km$ ]         0.34503           d         Mean diameter used for Eddy Loss Factor computation         [ $\Omega.m$ ]         0.0           Ds         External diameter used for Eddy Loss Factor computation         [ $\Omega.m$ ]         0.0           Ds         External diameter used for Eddy Loss Factor computation         [ $mm$ ]         119.98           ts         Thickness used for Eddy Loss Factor computation         [ $mm$ ]         2.0 $\beta_1$ Coefficient used in IEC 60287-1-1 Clause 2.3.6.1         39.28764           gs         Coefficient used in IEC 60287-1-1 Clause 2.3.6.1         0.09105 <td>Xm       Mutual Reactance       <math>[\Omega/km]</math>       0.04355       0.04355         P       Component for Circulating Loss Factor Formula (Clause 2.3.3)       <math>[\Omega/km]</math>       0.24781       0.24781         Q       Component for Circulating Loss Factor Formula (Clause 2.3.3)       <math>[\Omega/km]</math>       0.18974       0.18974         Q       Component for Circulating Loss Factor Formula (Clause 2.3.3)       <math>[\Omega/km]</math>       0.18974       0.18974         Q       Component for Circulating Loss Factor Formula (Clause 2.3.3)       <math>[\Omega/km]</math>       0.18974       0.18974         Spacing Factor (applied when spacing between cable uneven or non-equal minor section length)       0.004       0.004       0.004         X1       Screen Loss Factor Caused by Circulating Current       0.03618       0.03094         actor       Rs       AC Resistance used for Eddy Loss Factor computation       <math>[mm]</math>       117.98       117.98         d       Mean diameter used for Eddy Loss Factor computation       <math>[mm]</math>       119.98       119.98         ps       Electrical Resistivity used for Eddy Loss Factor computation       <math>[mm]</math>       119.98       119.98         ts       Thickness used for Eddy Loss Factor computation       <math>[mm]</math>       2.0       2.0       <math>\beta_1</math>       Coefficient used in IEC 60287-11 Clause 2.3.6.1       39.28764       39.09367       <t< td=""></t<></td>	Xm       Mutual Reactance $[\Omega/km]$ 0.04355       0.04355         P       Component for Circulating Loss Factor Formula (Clause 2.3.3) $[\Omega/km]$ 0.24781       0.24781         Q       Component for Circulating Loss Factor Formula (Clause 2.3.3) $[\Omega/km]$ 0.18974       0.18974         Q       Component for Circulating Loss Factor Formula (Clause 2.3.3) $[\Omega/km]$ 0.18974       0.18974         Q       Component for Circulating Loss Factor Formula (Clause 2.3.3) $[\Omega/km]$ 0.18974       0.18974         Spacing Factor (applied when spacing between cable uneven or non-equal minor section length)       0.004       0.004       0.004         X1       Screen Loss Factor Caused by Circulating Current       0.03618       0.03094         actor       Rs       AC Resistance used for Eddy Loss Factor computation $[mm]$ 117.98       117.98         d       Mean diameter used for Eddy Loss Factor computation $[mm]$ 119.98       119.98         ps       Electrical Resistivity used for Eddy Loss Factor computation $[mm]$ 119.98       119.98         ts       Thickness used for Eddy Loss Factor computation $[mm]$ 2.0       2.0 $\beta_1$ Coefficient used in IEC 60287-11 Clause 2.3.6.1       39.28764       39.09367 <t< td=""></t<>

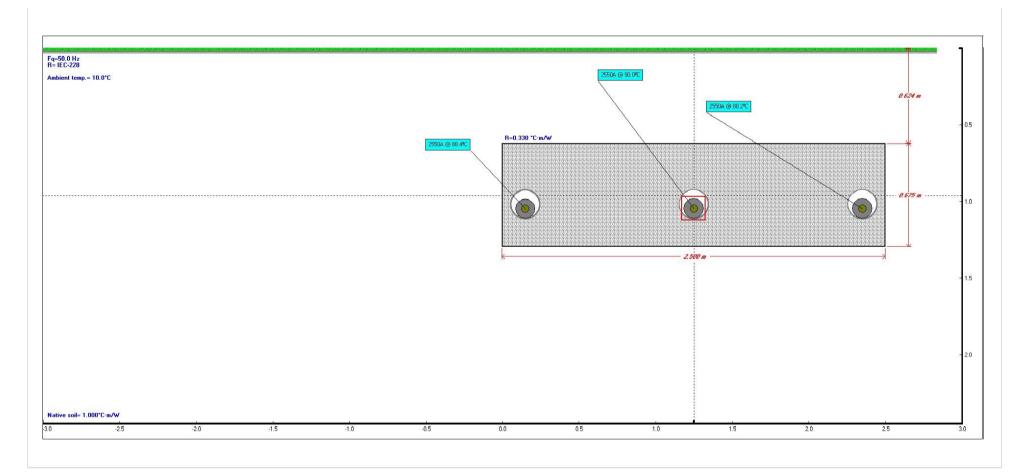
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### Study Summary

INTERNATIONAL T&D	
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 220kV CABLE) v2
Date:	18/03/2020 11:17:31

General Simulation Data	
Steady State Option	Equally Loaded
Consider Electrical interaction between circuits	No
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0
Conductor Resistances Computation Option:	IEC-228

Installation Type:Ductbank		
Ambient Soil Temperature at Installation Depth	[°C]	10.0
Native Soil Thermal Resistivity	[K.m/W]	1.0
Thermal Resistivity of Duct Bank	[K.m/W]	0.3
Depth of Center of Duct Bank	[m]	0.96
Duct Bank Width	[m]	2.5
Duct Bank Height	[m]	0.68



Results S	Summary									
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [m]	Y coordinate [m]	temperature [°C]	Ampacity [A]
1	220KV.011	1		А	50.0	1.0	0.15	1.05	88.4	2550.2
2	220KV.011	1		В	50.0	1.0	1.25	1.05	90.0	2550.2
3	220KV.011	1		С	50.0	1.0	2.35	1.05	88.2	2550.2

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### Steady State Summary

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 220kV CABLE) v2
Date:	18/03/2020 11:17:31

Simulation Data	
Installation type:	Ductbank
Steady State Option	Equally Loaded
Ambient temperature [°C]	10
Native Soil Thermal Resistivity [K.m/W]	1.0
Consider Non-Isothermal Earth Surface	No
Consider effect of soil dry out	No
Consider Electrical interaction between circuits	No
Induced current in metallic layers as a fraction of conductor current (applied to all single phase circuits)	0

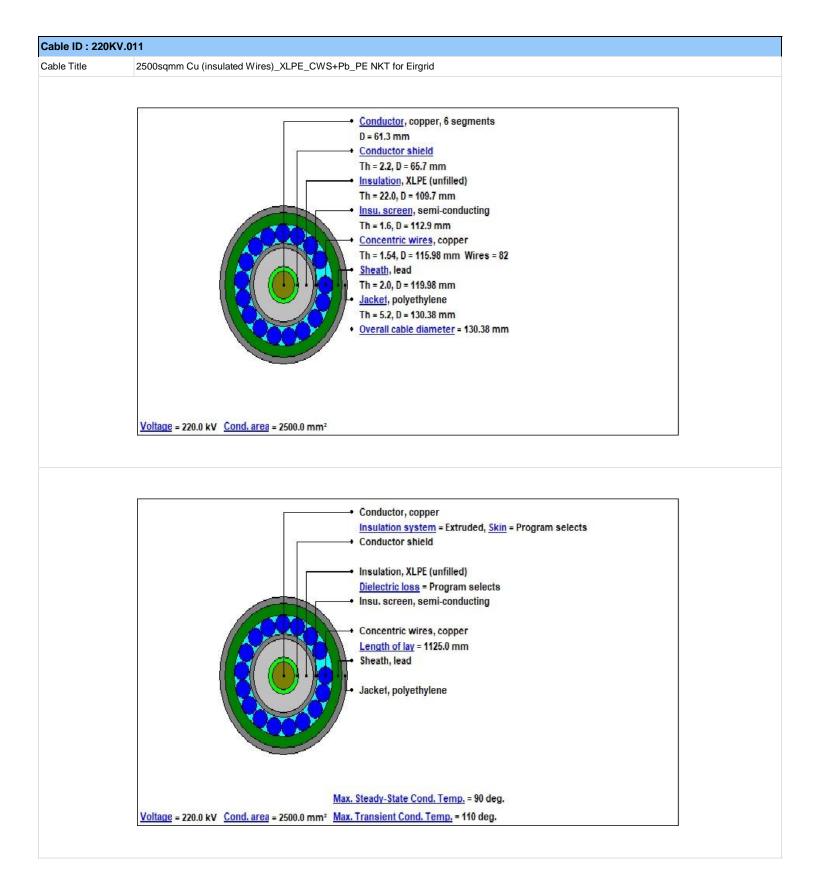
Variable	Description	Unit		Cables	
Cable No.	Cable Index Number		1	2	3
General Inpu	t Data	- I I			,
Cable ID	Cable Equipment ID		220KV.011	220KV.011	220KV.011
Circuit No.	Circuit No.		1	1	1
Phase	Cable Phase		А	В	С
Fq	Operating Frequency	[Hz]	50.0	50.0	50.0
x	X coordinate	[m]	0.15	1.25	2.35
у	Y coordinate	[m]	1.05	1.05	1.05
DLF	Daily Load Factor	[p.u.]	1.0	1.0	1.0
	Bonding Type		1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat
Ampacity					
I	Steady State Ampacity	[A]	2550.2	2550.2	2550.2
Temperature	S				
θс	Conductor temperature	[°C]	88.4	90.0	88.2
θs	Sheath/Shield temperature	[°C]	65.7	67.2	65.5
θа	Armour temperature	[°C]	n/a	n/a	n/a
θsurf	Cable surface temperature	[°C]	62.5	64.0	62.3
θduct	Duct surface temperature	[°C]	43.1	44.7	43.0
Resistances					
R <sub>0</sub>	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
R	AC Resistance of the Conductor at Operating Temperature	[Ω/km]	0.01015	0.01019	0.01014
ys	Skin Effect Factor		0.11008	0.1091	0.11022
ур	Proximity Effect Factor		0.00045	0.00045	0.00045
Losses					
Wc	Conductor Losses	[W/m]	65.98356	66.25004	65.94775
Wd	Dielectric Losses	[W/m]	1.37316	1.37316	1.37316
Ws	Metallic Screen Losses	[W/m]	2.40472	2.25926	1.98904
Wa	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
Wt	Total Losses	[W/m]	69.76143	69.88246	69.30994
$\lambda_1$	Screen Loss Factor		0.03644	0.0341	0.03016
$\lambda_2$	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
Thermal resis	stances				
T1	Thermal resistance of insulation	[K.m/W]	0.3402	0.3402	0.3402
T2	Thermal resistance of bedding/medium inside pipe-type	[K.m/W]	n/a	n/a	n/a
Т3	Thermal resistance of outer covering	[K.m/W]	0.04631	0.04631	0.04631
T4	External thermal resistance	[K.m/W]	0.75253	0.77267	0.7549
Others	·			·	·
Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
	Induced current on Metallic Screen	[A]	152.9	139.2	138.5

# 

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 220kV CABLE) v2
Date:	18/03/2020 11:17:31

No.	Description	Unit	1
	eral Cable Information	Ont	•
1	Cable Equipment ID		220KV.011
2	Number of Cores		Single Core
	Voltage	[1.) []	-
3	Conductor Area	[kV]	220
4		[mm²]	2500.0
5	Cable Overall Diameter	[mm]	130.38
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	110
Con	ductor		
8	Material		Copper
9	Electrical Resistivity at 20°C	[μΩ.cm]	1.7241
10	Temperature Coefficient at 20°C	[1/K]	0.00393
11	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
12	Volumetric Specific Heat (SH)	[J/(K*cm <sup>3</sup> )]	3.45
13	Construction		6 Segments
14	Conductor Insulation System		Extruded
15	Milliken Wires Construction		Insulated Wires
16	Ks (Skin Effect Coefficient)		0.35
17	Kp (Proximity Effect Coefficient)		0.2
18	Diameter	[mm]	61.3
Cone	ductor Shield		
19	Thickness	[mm]	2.2
20	Diameter	[mm]	65.7
Insu	lation		
21	Material		XLPE Unfilled
22	Thermal Resistivity	[K.m/W]	3.5
23	Dielectric Loss Factor - ( tan delta )	[[(,,,,,,,,]]	0.001
23	Relative Permittivity - ( epsilon )		
	Specific Insulation Resistance Constant at 60°F - ( K )	[W0  1	2.5
25	Thickness	[MΩ.km]	65617.
26	Diameter	[mm]	22.0
27	Diameter	[mm]	22.0
27 Insu	lation Screen		109.7
27 Insu 28	lation Screen	[mm]	109.7 Semi Conducting Screen
27 Insu 28 29	lation Screen Material Thickness		109.7 Semi Conducting Screen 1.6
27 Insu 28 29 30	lation Screen Material Thickness Diameter	[mm]	109.7 Semi Conducting Screen
27 Insu 28 29	lation Screen Material Thickness Diameter ath	[mm]	109.7 Semi Conducting Screen 1.6
27 Insu 28 29 30	Iation Screen Material Thickness Diameter Ath Is Sheath Around Each Core?	[mm]	109.7 Semi Conducting Screen 1.6
27 Insul 28 29 30 Shea	Iation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material	[mm]	109.7 Semi Conducting Screen 1.6 112.9
27 Insul 28 29 30 Shea 31	Iation Screen Material Thickness Diameter Ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C	[mm]	109.7 Semi Conducting Screen 1.6 112.9 n/a
27 Insul 28 29 30 Shea 31 32	Iation Screen Material Thickness Diameter Thickness Diameter The state of the state	[mm] [mm] [mm]	109.7 Semi Conducting Screen 1.6 112.9 n/a Lead
27 Insul 28 29 30 Shea 31 32 33	Itation Screen         Material         Thickness         Diameter         Ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)	[mm] [mm] [mm] [μΩ.cm]	109.7 Semi Conducting Screen 1.6 112.9 n/a Lead 21.4
27 Insul 28 29 30 Shea 31 32 33 34	Iation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH)	[mm] [mm] [mm] [μΩ.cm] [1/K]	109.7 Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004
27 Insul 28 29 30 Shea 31 32 33 34 35	Itation Screen         Material         Thickness         Diameter         Ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)	[mm] [mm] [mm] [mm] [μΩ.cm] [1/K] [K]	109.7 Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230
27 Insul 28 29 30 Shez 33 31 32 33 34 35 36	Iation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH)	[mm] [mm] [mm] [mm] [μΩ.cm] [1/K] [K]	109.7 Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45
27 Insul 28 29 30 Shez 31 32 33 34 35 36 37	lation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type	[mm] [mm] [mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)]	109.7 Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated
27 Insul 28 29 30 <b>Shez</b> 33 33 34 35 36 37 38 39	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness	[mm] [mm] [mm] [mm] [mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm]	109.7 Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0
27 Insul 28 29 30 <b>Shez</b> 33 33 34 35 36 37 38 39	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter	[mm] [mm] [mm] [mm] [mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm]	109.7 Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0
27 Insul 28 29 30 Sheze 31 32 33 34 35 36 37 38 39 Cont	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires	[mm] [mm] [mm] [mm] [mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm]	109.7 Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98
27 Insul 28 29 30 Shea 31 32 33 34 35 36 37 38 39 <b>Cont</b> 40	Itation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?	[mm] [mm] [mm] [mm] [mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm]	109.7 Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98
27 Insul 28 29 30 Shear 31 32 33 34 35 36 37 38 39 Conc 40 41	Itation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material	[mm] [mm] [mm] [mm] [mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [mm] [mm] [mm] [mm] [mm] [m	109.7 Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper
27 Insul 28 29 30 Sheze 33 31 32 33 34 35 36 37 38 39 Conc 40 41 42	Itation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C	[mm] [mm] [mm] [mm] [mm] [μΩ.cm] [J/(K*cm³)] [mm] [mm] [mm] [mm] [mm] [mm] [mm] [m	109.7 Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241
27 Insul 28 29 30 Shear 31 32 33 34 35 36 37 38 39 Conc 40 41 42 43	Itation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C	[mm] [mm] [mm] [mm] [mm] [μΩ.cm] [J/(K*cm³)] [J/(K*cm³)] [mm] [mm] [mm] [mm] [mm] [mm] [mm] [m	109.7 Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241 0.00393
27 Insul 28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42 43 44	Itation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)	[mm] [mm] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)] [mm] [mm] [mm] [mm] [mm]	109.7 Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241 0.00393 234.5
27 Insul 28 29 30 Shez 31 32 33 34 35 36 37 38 39 Conc 40 41 42 43 44 45	Itation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)	[mm] [mm] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)] [mm] [mm] [mm] [mm] [mm] [mm] [mm]	109.7 Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241 0.00393 234.5 3.45
27 Insul 28 29 30 Shez 31 32 33 34 35 36 37 38 39 Cond 40 41 42 43 44 45 46	Itation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Lectrical of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay	[mm] [mm] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)] [mm] [mm] [mm] [mm] [mm] [mm] [mm]	109.7 Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241 0.00393 234.5 3.45 1125.0 82
27 Insul 28 29 30 Sheze 31 32 33 34 35 36 37 38 39 Cont 40 41 42 43 44 45 46 47 48	Itation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Lectrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay         Number of Wires	[mm] [mm] [mm] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)] [mm] [mm] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [mm] [mm] [mm] [mm] [mm] [mm] [mm] [	109.7 Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241 0.00393 234.5 3.45 1125.0 82 Undefined
27 Insul 28 29 30 Shee 31 32 33 34 35 36 37 38 39 Conc 40 41 42 43 44 45 46 47 48 49	Itation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay         Number of Wires         Wire Gauge	[mm] [mm] [mm] [mm] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [mm] [mm] [mm] [mm] [mm] [mm] [mm] [	109.7 Semi Conducting Screen 1.6 1.2.9 
27 Insul 28 29 30 Shee 31 32 33 34 35 36 37 38 39 Conc 40 41 42 43 44 45 46 47 48 49 50	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay         Number of Wires         Wire Gauge         Thickness         Diameter	[mm] [mm] [mm] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)] [mm] [mm] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [mm] [mm] [mm] [mm] [mm] [mm] [mm] [	109.7 Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241 0.00393 234.5 3.45 1125.0 82 Undefined
27 Insul 28 29 30 Shea 31 32 33 34 35 36 37 38 39 Cond 40 41 42 43 44 45 46 47 48 49 50 Jack	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay         Number of Wires         Wire Gauge         Thickness         Diameter         Wire Gauge         Thickness         Diameter	[mm] [mm] [mm] [mm] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [mm] [mm] [mm] [mm] [mm] [mm] [mm] [	109.7 Semi Conducting Screen 1.6 1.2.9 
27 Insui 28 29 30 Shee 31 32 33 34 35 36 37 38 39 Cond 40 41 42 43 44 45 46 47 48 49 50 Jack	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay         Number of Wires         Wire Gauge         Thickness         Diameter         et         Material	[mm] [mm] [mm] [mm] [mm] [mm] [μΩ.cm] [J/(K*cm³)] [J/(K*cm³)] [mm] [mm] [mm] [[μΩ.cm] [[1/K] [J/(K*cm³)] [[] [[μΩ.cm]] [[] [[] [[] [[] [[] [[] [[] [[] [[]	109.7 Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 1.45 Non Corrugated 2.0 1.45 Non Corrugated 2.0 1.19.98 n/a Copper 1.7241 0.00393 234.5 3.45 1.7241 0.00393 234.5 3.45 1.125.0 82 Undefined 1.54 1.54 1.54 1.598
27 Insul 28 29 30 Sheat 31 32 33 34 35 36 37 38 39 Cond 40 41 42 43 44 45 46 47 48 49 50 Jack 52	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay         Number of Wires         Wire Gauge         Thickness         Diameter         Material         Thickness         Diameter         Material         Herapy         Number of Wires         Wire Gauge <td>[mm] [mm] [mm] [mm] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [mm] [mm] [mm] [mm] [mm] [mm] [mm] [</td> <td>109.7 Semi Conducting Screen 1.6 112.9</td>	[mm] [mm] [mm] [mm] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [mm] [mm] [mm] [mm] [mm] [mm] [mm] [	109.7 Semi Conducting Screen 1.6 112.9
27 Insui 28 29 30 Shee 31 32 33 34 35 36 37 38 39 Conc 40 41 42 43 44 45 46 47 48 49 50 Jack	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay         Number of Wires         Wire Gauge         Thickness         Diameter         et         Material	[mm] [mm] [mm] [mm] [mm] [mm] [μΩ.cm] [J/(K*cm³)] [J/(K*cm³)] [mm] [mm] [mm] [[μΩ.cm] [[1/K] [J/(K*cm³)] [[] [[μΩ.cm]] [[] [[] [[] [[] [[] [[] [[] [[] [[]	109.7 Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 1.45 Non Corrugated 2.0 1.45 Non Corrugated 2.0 1.19.98 n/a Copper 1.7241 0.00393 234.5 3.45 1.7241 0.00393 234.5 3.45 1.125.0 82 Undefined 1.54 1.54 1.54 1.598

No.	Description	Unit	1				
Spec	Specific Installation Data						
55	Cable Equipment ID		220KV.011				
56	Cable Frequency	[Hz]	50				
57	Sheath / Shield Bonding		1 Conductor Crossbonded Flat				
58	Loss Factor Constant (ALOS)		0.3				
59	Minor section length		Crossbonded Unknown Section Lengths UNKNOWN				
60	Duct construction		Polyethylene in Concrete				
61	Duct material thermal resistivity	[K.m/W]	3.5				
62	Inside Diameter of the Duct/Pipe	[mm]	188.0				
63	Outside Diameter of the Duct/Pipe	[mm]	200.0				



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INTERNAT	IONAL	TED

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 220kV CABLE) v2
Date:	18/03/2020 11:17:31

No.	Description	Unit	Cable No.1	Cable No.2	Cable No.3					
1	Cable Equipment ID		220KV.011	220KV.011	220KV.011					
Resi	Resistances									
2	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072					
3	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00914	0.00918	0.00913					
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.00842	0.00842	0.00842					
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01015	0.01019	0.01014					
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.28869	0.28869	0.28869					
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.3415	0.34323	0.34126					
8	DC Resistance of Concentric Wires at 20°C	[Ω/km]	0.1185	0.1185	0.1185					
9	DC Resistance of Concentric Wires at Operating Temperature	[Ω/km]	0.1398	0.1405	0.13971					
Loss	ses									
10	Conductor Losses	[W/m]	65.98356	66.25004	65.94775					
11	Dielectric Losses	[W/m]	1.37316	1.37316	1.37316					
12	Metallic Screen Losses	[W/m]	2.40472	2.25926	1.98904					
13	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0					
14	Total Losses	[W/m]	69.76143	69.88246	69.30994					
Сара	acitance, Inductance, Impedance									
15	Capacitance	[µF/km]	0.271	0.271	0.271					
16	Inductance of Conductor	[mH/km]	0.76609	0.76609	0.76609					
17	Reactance of Conductor	[Ω/km]	0.24067	0.24067	0.24067					
18	Inductance of Metallic Sheath	[mH/km]	0.58814	0.58814	0.58814					
19	Reactance of Metallic Sheath	[Ω/km]	0.18477	0.18477	0.18477					
20	Positive Sequence Impedance	[Ω/km]	0.010150 + j0.240670	0.010190 + j0.240670	0.010140 + j0.240670					
21	Negative Sequence Impedance	[Ω/km]	0.010150 + j0.240670	0.010190 + j0.240670	0.010140 + j0.240670					
22	Zero Sequence Impedance	[Ω/km]	0.092010 + j0.184770	0.092000 + j0.184770	0.092010 + j0.184770					
23	Surge Impedance	[Ω]	53.17602	53.17602	53.17602					
Othe	rs		Γ							
24	Dielectric Stress at Conductor Surface	[kV/mm]	7.54233	7.54233	7.54233					
25	Dielectric Stress at Insulation Surface	[kV/mm]	4.51715	4.51715	4.51715					
26	Insulation Resistance at 60°F (15.8°C)	[MΩ.km]	14609.00643	14609.00643	14609.00643					
27	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a					
28	Charging Current for One Phase	[A/km]	10.81081	10.81081	10.81081					
29	Charging Capacity of three phase system at Uo	[kvar/km]	4119.47055	4119.47055	4119.47055					
30	Voltage drop for Three Phase System	[V/A/km]	0.01757	0.01764	0.01756					
31	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0					
32	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0					
33	Induced current on Metallic Screen	[A]	152.9	139.2	138.5					

### CYME

Cable Parameters under Normal Operation

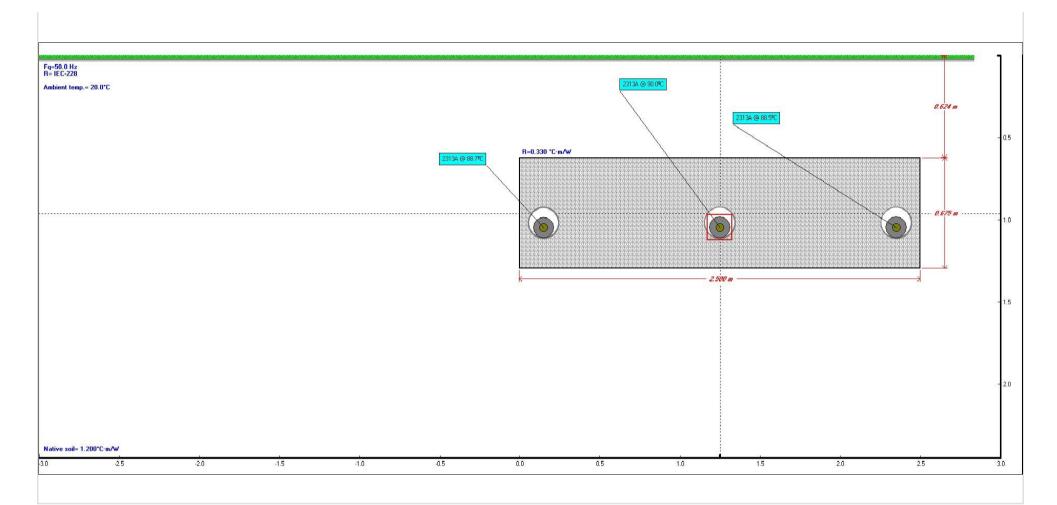
	CYMCAP Version	7.3 Revision 2
Study:         Eirgrid Cp966 Feasibility study           Execution:         Eirgrid - WIDE trench (1ct 220kV CABLE) v2		Eirgrid Cp966 Feasibility study
		Eirgrid - WIDE trench (1ct 220kV CABLE) v2
	Date:	18/03/2020 11:17:31

No.SymbolDescriptionUnitCable N1Cable Equipment ID220KV.Normal Operation IEC 60287-1-1Conductor AC Resistance2 $R_o$ DC Resistance of the conductor at 20°C[ $\Omega/km$ ]0.0073R'DC Resistance of Conductor at Operating Temperature[ $\Omega/km$ ]0.0094dcConductor Diameter[mm]61.35sDistance Between Conductor Axes[mm]1099.996ksFactor Used for xs Calculation (Skin Effect)0.28xsComponent of Ys Calculation (Proximity Effect)0.29xpComponent of Yp Calculation (Proximity Effect)1.658410ysSkin Effect Factor0.110011ypProximity Effect Factor0.000012RAC Resistance of Conductor at Operating Temperature[ $\Omega/km$ ]0.0100Dielectric Losses13tanðDielectric Loss Factor0.000	011 220KV.011 220KV.011 2 0.0072 0.0072 14 0.00918 0.00913 4 61.3 61.3 995 1099.99995 1099.99995 1099.99995 1099.99995 0.35 0.35 0.2 0.2 14 2.18875 2.19487 51 1.65454 1.65916 08 0.1091 0.11022
Normal Operation IEC 60287-1-1           Conductor AC Resistance           2         R₀         DC Resistance of the conductor at 20°C         [Ω/km]         0.007           3         R'         DC Resistance of Conductor at Operating Temperature         [Ω/km]         0.009           4         dc         Conductor Diameter         [mm]         61.3           5         s         Distance Between Conductor Axes         [mm]         1099.99           6         ks         Factor Used for xs Calculation (Skin Effect)         0.35           7         kp         Factor Used for xp Calculation (Proximity Effect)         0.2           8         xs         Component of Ys Calculation (Skin Effect)         2.194'           9         xp         Component of Yp Calculation (Proximity Effect)         1.658t           10         ys         Skin Effect Factor         0.1100           11         yp         Proximity Effect Factor         0.0000           12         R         AC Resistance of Conductor at Operating Temperature         [Ω/km]         0.010'	2         0.0072         0.0072           14         0.00918         0.00913           4         61.3         61.3           995         1099.99995         1099.99995           0.35         0.35           0.2         0.2           14         2.18875         2.19487           51         1.65454         1.65916           08         0.1091         0.11022
Conductor AC Resistance         2       R₀       DC Resistance of the conductor at 20°C       [Ω/km]       0.007         3       R'       DC Resistance of Conductor at Operating Temperature       [Ω/km]       0.009         4       dc       Conductor Diameter       [mm]       61.3         5       s       Distance Between Conductor Axes       [mm]       1099.99         6       ks       Factor Used for xs Calculation (Skin Effect)       0.35         7       kp       Factor Used for xp Calculation (Proximity Effect)       0.2         8       xs       Component of Ys Calculation (Skin Effect)       2.194'         9       xp       Component of Yp Calculation (Proximity Effect)       1.658#         10       ys       Skin Effect Factor       0.110#         11       yp       Proximity Effect Factor       0.000#         12       R       AC Resistance of Conductor at Operating Temperature       [Ω/km]       0.010*         Dielectric Losses	14         0.00918         0.00913           61.3         61.3         995           1099.99995         1099.99995           0.35         0.35           0.2         0.2           14         2.18875         2.19487           31         1.65454         1.65916           08         0.1091         0.11022
2         R₀         DC Resistance of the conductor at 20°C         [Ω/km]         0.007           3         R'         DC Resistance of Conductor at Operating Temperature         [Ω/km]         0.009           4         dc         Conductor Diameter         [mm]         61.3           5         s         Distance Between Conductor Axes         [mm]         1099.99           6         ks         Factor Used for xs Calculation (Skin Effect)         0.35           7         kp         Factor Used for xp Calculation (Proximity Effect)         0.2           8         xs         Component of Ys Calculation (Proximity Effect)         2.194'           9         xp         Component of Yp Calculation (Proximity Effect)         1.658t           10         ys         Skin Effect Factor         0.1100           11         yp         Proximity Effect Factor         0.0000           12         R         AC Resistance of Conductor at Operating Temperature         [Ω/km]         0.010'           Descent	14         0.00918         0.00913           61.3         61.3         995           1099.99995         1099.99995           0.35         0.35           0.2         0.2           14         2.18875         2.19487           31         1.65454         1.65916           08         0.1091         0.11022
3       R'       DC Resistance of Conductor at Operating Temperature       [Ω/km]       0.009'         4       dc       Conductor Diameter       [mm]       0.009'         5       s       Distance Between Conductor Axes       [mm]       1099.99         6       ks       Factor Used for xs Calculation (Skin Effect)       0.35         7       kp       Factor Used for xp Calculation (Proximity Effect)       0.2         8       xs       Component of Ys Calculation (Proximity Effect)       0.2         9       xp       Component of Yp Calculation (Proximity Effect)       1.6584         10       ys       Skin Effect Factor       0.1100         11       yp       Proximity Effect Factor       0.000-         12       R       AC Resistance of Conductor at Operating Temperature       [Ω/km]       0.010'         Dielectric Losses	14         0.00918         0.00913           61.3         61.3         995           1099.99995         1099.99995           0.35         0.35           0.2         0.2           14         2.18875         2.19487           31         1.65454         1.65916           08         0.1091         0.11022
4       dc       Conductor Diameter       [mm]       61.3         5       s       Distance Between Conductor Axes       [mm]       1099.99         6       ks       Factor Used for xs Calculation (Skin Effect)       0.35         7       kp       Factor Used for xp Calculation (Proximity Effect)       0.2         8       xs       Component of Ys Calculation (Proximity Effect)       0.2         9       xp       Component of Yp Calculation (Proximity Effect)       1.6584         10       ys       Skin Effect Factor       0.1104         11       yp       Proximity Effect Factor       0.000-         12       R       AC Resistance of Conductor at Operating Temperature       [Ω/km]       0.010	61.3         61.3           995         1099.99995         1099.99995           0.35         0.35           0.2         0.2           14         2.18875         2.19487           31         1.65454         1.65916           08         0.1091         0.11022
5       s       Distance Between Conductor Axes       [mm]       1099.99         6       ks       Factor Used for xs Calculation (Skin Effect)       0.35         7       kp       Factor Used for xp Calculation (Proximity Effect)       0.2         8       xs       Component of Ys Calculation (Skin Effect)       2.194'         9       xp       Component of Yp Calculation (Proximity Effect)       1.6580         10       ys       Skin Effect Factor       0.1100         11       yp       Proximity Effect Factor       0.0000         12       R       AC Resistance of Conductor at Operating Temperature       [Ω/km]       0.010'	995         1099.99995         1099.99995           0.35         0.35           0.2         0.2           14         2.18875         2.19487           31         1.65454         1.65916           08         0.1091         0.11022
6       ks       Factor Used for xs Calculation (Skin Effect)       0.35         7       kp       Factor Used for xp Calculation (Proximity Effect)       0.2         8       xs       Component of Ys Calculation (Skin Effect)       2.194'         9       xp       Component of Yp Calculation (Proximity Effect)       1.658/         10       ys       Skin Effect Factor       0.110/         11       yp       Proximity Effect Factor       0.000/         12       R       AC Resistance of Conductor at Operating Temperature       [Ω/km]       0.010'         Description	0.35         0.35           0.2         0.2           14         2.18875         2.19487           61         1.65454         1.65916           08         0.1091         0.11022
7       kp       Factor Used for xp Calculation (Proximity Effect)       0.2         8       xs       Component of Ys Calculation (Skin Effect)       2.194'         9       xp       Component of Yp Calculation (Proximity Effect)       1.658/         10       ys       Skin Effect Factor       0.110/         11       yp       Proximity Effect Factor       0.000/         12       R       AC Resistance of Conductor at Operating Temperature       [Ω/km]       0.010'         Description	0.2         0.2           14         2.18875         2.19487           61         1.65454         1.65916           08         0.1091         0.11022
8       xs       Component of Ys Calculation (Skin Effect)       2.194'         9       xp       Component of Yp Calculation (Proximity Effect)       1.658l         10       ys       Skin Effect Factor       0.1100         11       yp       Proximity Effect Factor       0.0000         12       R       AC Resistance of Conductor at Operating Temperature       [Ω/km]       0.010'         Dielectric Losses	14         2.18875         2.19487           31         1.65454         1.65916           08         0.1091         0.11022
9       xp       Component of Yp Calculation (Proximity Effect)       1.6584         10       ys       Skin Effect Factor       0.1104         11       yp       Proximity Effect Factor       0.0004         12       R       AC Resistance of Conductor at Operating Temperature       [Ω/km]       0.0105         Dielectric Losses	61         1.65454         1.65916           08         0.1091         0.11022
10     ys     Skin Effect Factor     0.1100       11     yp     Proximity Effect Factor     0.0000       12     R     AC Resistance of Conductor at Operating Temperature     [Ω/km]     0.0100       Dielectric Losses	08 0.1091 0.11022
11     yp     Proximity Effect Factor     0.000       12     R     AC Resistance of Conductor at Operating Temperature     [Ω/km]     0.010       Dielectric Losses	
12     R     AC Resistance of Conductor at Operating Temperature     [Ω/km]     0.010       Dielectric Losses	15 0.00045 0.00045
Dielectric Losses	
	15 0.01019 0.01014
12 tan 5 Dialastria Lass Fastar	
13 tanδ Dielectric Loss Factor 0.00 <sup>-</sup>	1 0.001 0.001
14 ε Insulation Relative Permitivity 2.5	2.5 2.5
15 C Cable Capacitance [µF/km] 0.27	
16         U <sub>0</sub> Voltage         [kV]         127.013	
17         Wd         Cable Dielectric Losses Per Phase         [W/m]         1.373*	
Circulating Loss Factor	1.37310 1.37310
18         Rs         AC Resistance used for Circulating Loss Factor computation         [Ω/km]         0.099	
19 d Mean diameter used for Circulating Loss Factor computation [mm] 116.22	
20         X         Reactance used for Circulating Loss Factor computation         [Ω/km]         0.184	
21         Xm         Mutual Reactance         [Ω/km]         0.0433	55 0.04355 0.04355
22         P         Component for Circulating Loss Factor Formula (Clause 2.3.3)         [Ω/km]         0.2283	32 0.22832 0.22832
23         Q         Component for Circulating Loss Factor Formula (Clause 2.3.3)         [Ω/km]         0.1702	25 0.17025 0.17025
Spacing Factor (applied when spacing between cable uneven or non-	
24         Fspacing         equal minor section length)         0.004	
25         λ'1         Screen Loss Factor Caused by Circulating Current         0.035	12 0.02915 0.02883
Eddy Loss Factor	
26         Rs         AC Resistance used for Eddy Loss Factor computation         [Ω/km]         0.341	5 0.34323 0.34126
27 d Mean diameter used for Eddy Loss Factor computation [mm] 117.9	8 117.98 117.98
28         ps         Electrical Resistivity used for Eddy Loss Factor computation         [Ω.m]         0.0	0.0 0.0
29 Ds External diameter used for Eddy Loss Factor computation [mm] 119.9	8 119.98 119.98
30 ts Thickness used for Eddy Loss Factor computation [mm] 2.0	2.0 2.0
31         β1         Coefficient used in IEC 60287-1-1 Clause 2.3.6.1         39.490	52 39.39063 39.50401
32 gs Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 1.0029	53 1.00252 1.00253
34 m Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 0.0919	
35         λ₀         Coefficient used in IEC 60287-1-1 clause 2.3.6.1         0.0000	
36 $\Delta_1$ Coefficient used in IEC 60287-1-1 Clause 2.3.6.1         -0.009           36 $\Delta_1$ Coefficient used in IEC 60287-1-1 Clause 2.3.6.1         -0.009	
	0.0 0.0
38         F         Milliken conductor Effect         1.0           20         Feine         Magnetic effect factor due to pine         1.0	1.0 1.0
39         Fpipe         Magnetic effect factor due to pipe         1.0	1.0 1.0
40 Farmour Magnetic effect factor due to armour 1.0	1.0 1.0
41 Å"1 Screen Loss Factor Caused by Eddy Current 0.0013	32 0.00495 0.00134
Metallic Screen Loss factor	
42 λ <sub>1</sub> Screen Loss Factor 0.0364	
Armour and Pipe Loss Factor	44 0.0341 0.03016
43         λ <sub>2</sub> a         Armour Loss Factor         0.0	44 0.0341 0.03016
	0.0 0.0
44         λ₂pipe         Pipe Loss Factor         0.0	
44         λ₂pipe         Pipe Loss Factor         0.0           46         λ₂         Armour Loss Factor + Pipe Loss Factor         0.0	0.0 0.0
	0.0 0.0
46         λ₂         Armour Loss Factor + Pipe Loss Factor         0.0	0.0 0.0 0.0 0.0 0.0 0.0
46         λ <sub>2</sub> Armour Loss Factor + Pipe Loss Factor         0.0           Normal Operation IEC 60287-2-1         0.0         0.0	2 0.3402 0.3402
46         λ₂         Armour Loss Factor + Pipe Loss Factor         0.0           Normal Operation IEC 60287-2-1         47         T₁         Thermal Resistance Between Conductor and Screen         [K.mW]         0.340	2 0.3402 0.3402
46         λ₂         Armour Loss Factor + Pipe Loss Factor         0.0           Normal Operation IEC 60287-2-1         47         T₁         Thermal Resistance Between Conductor and Screen         [K.m/W]         0.340           48         t₁         Insulation Thickness Between Conductor and Screen         [mm]         25.8	2 0.3402 0.3402 2 0.3402 0.3402 3 25.8 25.8 3.5 3.5
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	2 0.3402 0.3402 2 0.3402 0.3402 3 25.8 25.8 3.5 3.5
46 $\Lambda_2$ Armour Loss Factor + Pipe Loss Factor       0.0         Normal Operation IEC 60287-2-1         47       T <sub>1</sub> Thermal Resistance Between Conductor and Screen       [K.m/W]       0.340         48       t <sub>1</sub> Insulation Thickness Between Conductor and Screen       [mm]       25.8         49 $\rho$ Ti       Thermal Resistivity of Insulation       [K.m/W]       3.5         50       T <sub>3</sub> Thermal Resistance of Jacket/Pipe Coating       [K.m/W]       0.0463         51       t <sub>3</sub> Thickness of Jacket/Pipe Coating       [mm]       5.2	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           25.8         25.8           3.5         3.5           31         0.04631           5.2         5.2
46 $\Lambda_2$ Armour Loss Factor + Pipe Loss Factor       0.0         Normal Operation IEC 60287-2-1         47       T <sub>1</sub> Thermal Resistance Between Conductor and Screen       [K.m/W]       0.340         48       t <sub>1</sub> Insulation Thickness Between Conductor and Screen       [mm]       25.8         49 $\rho$ Ti       Thermal Resistivity of Insulation       [K.m/W]       3.5         50       T <sub>3</sub> Thermal Resistance of Jacket/Pipe Coating       [K.m/W]       0.0463         51       t <sub>3</sub> Thickness of Jacket/Pipe Coating       [mm]       5.2	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           25.8         25.8           3.5         3.5           31         0.04631           5.2         5.2
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2.5.8         25.8           3.5         3.5           3.1         0.04631           5.2         5.2           3.5         3.5
46 $\Lambda_2$ Armour Loss Factor + Pipe Loss Factor       0.0         Normal Operation IEC 60287-2-1         47 $T_1$ Thermal Resistance Between Conductor and Screen       [K.m/W]       0.340         48 $t_1$ Insulation Thickness Between Conductor and Screen       [mm]       25.8         49 $\rho$ Ti       Thermal Resistivity of Insulation       [K.m/W]       3.5         50 $T_3$ Thermal Resistance of Jacket/Pipe Coating       [K.m/W]       0.0463         51 $t_3$ Thickness of Jacket/Pipe Coating       [K.m/W]       3.5         52 $\rho$ TJ       Thermal Resistivity of Jacket/Pipe Coating       [K.m/W]       3.5         Cable in Ducts       53       U       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       1.87	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           25.8         25.8           3.5         3.5           3.1         0.04631           5.2         5.2           3.5         3.5           3.5         3.5
46 $\Lambda_2$ Armour Loss Factor + Pipe Loss Factor       0.0         Normal Operation IEC 60287-2-1         47       T <sub>1</sub> Thermal Resistance Between Conductor and Screen       [K.m/W]       0.340         48       t <sub>1</sub> Insulation Thickness Between Conductor and Screen       [mm]       25.8         49 $\rho$ Ti       Thermal Resistivity of Insulation       [K.m/W]       3.5         50       T <sub>3</sub> Thermal Resistance of Jacket/Pipe Coating       [K.m/W]       0.0463         51       t <sub>3</sub> Thickness of Jacket/Pipe Coating       [K.m/W]       3.5         52 $\rho$ TJ       Thermal Resistivity of Jacket/Pipe Coating       [K.m/W]       3.5         52 $\rho$ TJ       Thermal Resistivity of Jacket/Pipe Coating       [K.m/W]       3.5         53       U       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       1.87         54       V       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.312	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           25.8         25.8           3.5         3.5           3.1         0.04631           5.2         5.2           3.5         3.5           3.5         3.5           3.5         3.5           2         0.312
46 $\Lambda_2$ Armour Loss Factor + Pipe Loss Factor       0.0         Normal Operation IEC 60287-2-1         47       T <sub>1</sub> Thermal Resistance Between Conductor and Screen       [K.mW]       0.340         48       t <sub>1</sub> Insulation Thickness Between Conductor and Screen       [mm]       25.8         49 $\rho$ Ti       Thermal Resistivity of Insulation       [K.mW]       0.0463         50       T <sub>3</sub> Thermal Resistivity of Insulation       [K.mW]       0.0463         51       t <sub>3</sub> Thickness of Jacket/Pipe Coating       [mm]       5.2         67 J       Thermal Resistivity of Jacket/Pipe Coating       [K.mW]       3.5         Cable in Ducts       53       U       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       1.87         54       V       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.311         55       Y       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.031	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2         0.3402           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           7         0.0037
46 $\Lambda_2$ Armour Loss Factor + Pipe Loss Factor       0.0         Normal Operation IEC 60287-2-1         47       T <sub>1</sub> Thermal Resistance Between Conductor and Screen       [K.m/W]       0.340         48       t <sub>1</sub> Insulation Thickness Between Conductor and Screen       [mm]       25.8         49 $\rho$ Ti       Thermal Resistivity of Insulation       [K.m/W]       3.5         50       T <sub>3</sub> Thermal Resistance of Jacket/Pipe Coating       [K.m/W]       0.0463         51       t <sub>3</sub> Thickness of Jacket/Pipe Coating       [K.m/W]       3.5         52 $\rho$ TJ       Thermal Resistivity of Jacket/Pipe Coating       [K.m/W]       3.5         Cable in Ducts       53       U       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       1.87         54       V       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.312         55       Y       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.312         55       Y       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.312         56       6m       Mean Temperature of the Medium Filling the Space       [°C]       54.0	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2         0.3402           2         0.3402           3.5         3.5           3.5         3.5           3.1         0.04631           0.4631         0.04631           5.2         5.2           3.5         3.5
46 $\Lambda_2$ Armour Loss Factor + Pipe Loss Factor       0.0         Normal Operation IEC 60287-2-1         47 $T_1$ Thermal Resistance Between Conductor and Screen       [K.m/W]       0.340         48 $t_1$ Insulation Thickness Between Conductor and Screen       [mm]       25.8         49 $\rho$ Ti       Thermal Resistivity of Insulation       [K.m/W]       3.5         50 $T_3$ Thermal Resistance of Jacket/Pipe Coating       [K.m/W]       0.0466         51 $t_3$ Thickness of Jacket/Pipe Coating       [K.m/W]       3.5         52 $\rho$ TJ       Thermal Resistivity of Jacket/Pipe Coating       [K.m/W]       3.5         Cable in Ducts       53       U       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       1.87         54       V       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.003         55       Y       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.003         56 $\Theta$ m       Mean Temperature of the Medium Filling the Space       [°C]       54.0         57 $T_4$ Thermal Resistance of the Medium Inside the Duct/Pipe       [K.m/W]       0.243	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2         25.8           3.5         3.5           3.5         3.5           3.1         0.04631           0.24031         0.04631           5.2         5.2           3.5         3.5 <t< td=""></t<>
46 $\Lambda_2$ Armour Loss Factor + Pipe Loss Factor       0.0         Normal Operation IEC 60287-2-1         47 $T_1$ Thermal Resistance Between Conductor and Screen       [K.m/W]       0.340         48 $t_1$ Insulation Thickness Between Conductor and Screen       [mm]       25.8         49 $\rho$ Ti       Thermal Resistivity of Insulation       [K.m/W]       3.5         50 $T_3$ Thermal Resistance of Jacket/Pipe Coating       [K.m/W]       0.0466         51 $t_3$ Thickness of Jacket/Pipe Coating       [K.m/W]       3.5         52 $\rho$ TJ       Thermal Resistivity of Jacket/Pipe Coating       [K.m/W]       3.5         Cable in Ducts       53       U       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       1.87         53       U       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.0312         55       Y       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.0312         55       Y       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.312         55       Y       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.033         56       0m       Mean Temperature of the Medium Filling the Space       [°C]       54.00 <td>0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2         25.8           3.5         3.5           31         0.04631           5.2         5.2           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.6         3.5           3.7         0.0037           0.24134         0.24392           0         200.0  </td>	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2         25.8           3.5         3.5           31         0.04631           5.2         5.2           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.6         3.5           3.7         0.0037           0.24134         0.24392           0         200.0
46 $\Lambda_2$ Armour Loss Factor + Pipe Loss Factor       0.0         Normal Operation IEC 60287-2-1         47 $T_1$ Thermal Resistance Between Conductor and Screen       [K.mW]       0.340         48 $t_1$ Insulation Thickness Between Conductor and Screen       [mm]       25.8         49 $\rho$ Ti       Thermal Resistance of Jacket/Pipe Coating       [K.mW]       0.0466         50 $T_3$ Thermal Resistance of Jacket/Pipe Coating       [K.mW]       0.0466         51 $t_3$ Thickness of Jacket/Pipe Coating       [K.mW]       3.5         52 $\rho$ TJ       Thermal Resistivity of Jacket/Pipe Coating       [K.mW]       3.5         Cable in Ducts         53       U       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       1.87         54       V       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.031         55       Y       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.031         56 $em$ Mean Temperature of the Medium Filling the Space       [°C]       54.0         57 $T_4$ '       Thermal Resistance of the Medium Inside the Duct/Pipe       [Mm]       2.243         58       Do       Outside Diamete	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2         25.8           3.5         3.5           31         0.04631           5.2         5.2           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           7         0.0312           0.312         0.312           7         0.0037           55.6         53.9           71         0.24134         0.24392           0         200.0         200.0
46 $\Lambda_2$ Armour Loss Factor + Pipe Loss Factor       0.0         Normal Operation IEC 60287-2-1         47 $T_1$ Thermal Resistance Between Conductor and Screen       [K.m/W]       0.340         48 $t_1$ Insulation Thickness Between Conductor and Screen       [mm]       25.8         49 $\rho$ Ti       Thermal Resistivity of Insulation       [K.m/W]       3.5         50 $T_3$ Thermal Resistance of Jacket/Pipe Coating       [K.m/W]       0.0466         51 $t_3$ Thickness of Jacket/Pipe Coating       [K.m/W]       3.5         52 $\rho$ TJ       Thermal Resistivity of Jacket/Pipe Coating       [K.m/W]       3.5         Cable in Ducts       53       U       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       1.87         53       U       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.0312         55       Y       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.0312         55       Y       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.312         55       Y       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.033         56       0m       Mean Temperature of the Medium Filling the Space       [°C]       54.00 <td>0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2         25.8           3.5         3.5           31         0.04631           5.2         5.2           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           7         0.0312           0.312         0.312           7         0.0037           55.6         53.9           71         0.24134         0.24392           0         200.0         200.0</td>	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2         25.8           3.5         3.5           31         0.04631           5.2         5.2           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           7         0.0312           0.312         0.312           7         0.0037           55.6         53.9           71         0.24134         0.24392           0         200.0         200.0
46 $\Lambda_2$ Armour Loss Factor + Pipe Loss Factor       0.0         Normal Operation IEC 60287-2-1         47 $T_1$ Thermal Resistance Between Conductor and Screen       [K.mW]       0.340         48 $t_1$ Insulation Thickness Between Conductor and Screen       [mm]       25.8         49 $\rho$ Ti       Thermal Resistance of Jacket/Pipe Coating       [K.mW]       0.0466         50 $T_3$ Thermal Resistance of Jacket/Pipe Coating       [K.mW]       0.0466         51 $t_3$ Thickness of Jacket/Pipe Coating       [K.mW]       3.5         52 $\rho$ TJ       Thermal Resistivity of Jacket/Pipe Coating       [K.mW]       3.5         Cable in Ducts         53       U       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       1.87         54       V       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.031         55       Y       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.031         56 $em$ Mean Temperature of the Medium Filling the Space       [°C]       54.0         57 $T_4$ '       Thermal Resistance of the Medium Inside the Duct/Pipe       [Mm]       2.243         58       Do       Outside Diamete	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2         0.3402           2         0.3402           3.5         3.5           3.1         0.04631           5.2         5.2           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         5.2           3.5         3.5           3.5         3.5           3.5         5.9           71         0.24134         0.24392           0         20.0         200.0           0         188.0         188.0           3.5         3.5
46 $\Lambda_2$ Armour Loss Factor + Pipe Loss Factor       0.0         Normal Operation IEC 60287-2-1         47 $T_1$ Thermal Resistance Between Conductor and Screen       [K.mW]       0.340         48 $t_1$ Insulation Thickness Between Conductor and Screen       [mm]       25.8         49 $\rho$ Ti       Thermal Resistance of Jacket/Pipe Coating       [K.mW]       3.5         50 $T_3$ Thermal Resistance of Jacket/Pipe Coating       [K.mW]       0.0463         51 $t_3$ Thickness of Jacket/Pipe Coating       [K.mW]       3.5         51 $t_3$ Thickness of Jacket/Pipe Coating       [K.mW]       3.5         Cable in Ducts       53       U       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       1.87         54       V       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.003         56 $em$ Mean Temperature of the Medium Filling the Space       [°C]       54.0         57 $T_4$ Thermal Resistance of the Duct/Pipe       [mm]       200.0         58       Do       Outside Diameter of the Duct/Pipe       [mm]       200.0         59       Di       Inside Diameter of the Duct/Pipe Material       [K.mW]	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           3.5         3.5           3.5         3.5           3.1         0.04631           0.04631         0.04631           0.04631         0.04631           5.2         5.2           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           7         0.0037         0.0037           55.6         53.9           71         0.24134         0.24392           0         200.0         200.0           0         188.0         188.0           3.5         3.5           47         0.03447
46 $\Lambda_2$ Armour Loss Factor + Pipe Loss Factor       0.0         Normal Operation IEC 60287-2-1         47 $T_1$ Thermal Resistance Between Conductor and Screen       [K.mW]       0.340         48 $t_1$ Insulation Thickness Between Conductor and Screen       [mm]       25.8         49 $\rho$ Ti       Thermal Resistivity of Insulation       [K.mW]       3.5         50 $T_3$ Thermal Resistivity of Insulation       [K.mW]       0.0463         51 $t_3$ Thermal Resistivity of Jacket/Pipe Coating       [Mm]       5.2         52 $\rho$ TJ       Thermal Resistivity of Jacket/Pipe Coating       [K.mW]       3.5         53       U       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       1.87         54       V       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.003         56       0m       Mean Temperature of the Medium Filling the Space       [°C]       54.0         57 $T_4'$ Thermal Resistance of the Medium Inside the Duct/Pipe       [Mm]       2.0.4         58       Do       Outside Diameter of the Duct/Pipe       [mm]       188.6         60 $\rho$ T       Thermal Resistivity of the Duct/Pipe       [Mm]       3.5	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           3.5         3.5           3.5         3.5           3.1         0.04631           0.04631         0.04631           0.04631         0.04631           5.2         5.2           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           7         0.0037         0.0037           55.6         53.9           71         0.24134         0.24392           0         200.0         200.0           0         188.0         188.0           3.5         3.5           47         0.03447
46 $\Lambda_2$ Armour Loss Factor + Pipe Loss Factor       0.0         Normal Operation IEC 60287-2-1         47 $T_1$ Thermal Resistance Between Conductor and Screen       [K.mW]       0.340         48 $t_1$ Insulation Thickness Between Conductor and Screen       [mm]       25.8         49 $\rho$ Ti       Thermal Resistivity of Insulation       [K.mW]       3.5         50 $T_3$ Thermal Resistivity of Insulation       [K.mW]       0.0463         51 $t_3$ Thermal Resistivity of Jacket/Pipe Coating       [K.mW]       0.4663         51 $t_3$ Thickness of Jacket/Pipe Coating       [K.mW]       3.5         52 $\rho$ TJ       Thermal Resistivity of Jacket/Pipe Coating       [K.mW]       3.5         53       U       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       1.87         54       V       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.033         56       0m       Mean Temperature of the Medium Filling the Space       [°C]       54.0         57 $T_4$ Thermal Resistance of the Medium Inside the Duct/Pipe       [Mm]       20.04         57 $T_4$ Thermal Resistivity of the Duct/Pipe       [Mm]       3.	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2.5.8         25.8           3.5         3.5           3.5         3.5           3.1         0.04631           0.4631         0.04631           5.2         5.2           3.5         3.5           3.5         3.5           3.5         3.5           1.87         1.87           2         0.312         0.312           7         0.0037         0.0037           55.6         53.9           71         0.24134         0.24392           0         200.0         200.0           188.0         188.0           3.5         3.5           47         0.03447         0.03447           35         0.49687         0.47651
46 $\Lambda_2$ Armour Loss Factor + Pipe Loss Factor0.0Normal Operation IEC 60287-2-10.047 $T_1$ Thermal Resistance Between Conductor and Screen[K.m/W]0.34048 $t_1$ Insulation Thickness Between Conductor and Screen[mm]25.849 $\rho$ TiThermal Resistivity of Insulation[K.m/W]0.046050 $T_3$ Thermal Resistivity of Insulation[K.m/W]0.046651 $t_3$ Thickness of Jacket/Pipe Coating[mm]5.252 $\rho$ TJThermal Resistivity of Jacket/Pipe Coating[K.m/W]3.5Cable in Ducts53UCoefficient Used in IEC 60287-2-1 Clause 2.2.7.11.8754VCoefficient Used in IEC 60287-2-1 Clause 2.2.7.10.03155YCoefficient Used in IEC 60287-2-1 Clause 2.2.7.10.03156ØmMean Temperature of the Medium Filing the Space[°C]54.057T_4'Thermal Resistance of the Medium Inside the Duct/Pipe[mm]188.060 $\rho$ TThermal Resistance of the Duct/Pipe[mm]188.061T_4''Thermal Resistance of the Duct/Pipe[K.m/W]0.034462T_4''Thermal Resistance of the Surrounding Medium[K.m/W]0.034462T_4'''Thermal Resistance of the Surrounding Medium[K.m/W]0.034463LoQuiside Diameter of the Duct/Pipe[K.m/W]0.034464T_4'''Thermal Resistance of the Surrounding Medium[K.m/W] <td>0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2.5.8         25.8           3.5         3.5           3.5         3.5           3.1         0.04631           0.4631         0.04631           5.2         5.2           3.5         3.5           3.5         3.5           3.5         3.5           1.87         1.87           2         0.312         0.312           7         0.0037         0.0037           55.6         53.9           71         0.24134         0.24392           0         200.0         200.0           188.0         188.0           3.5         3.5           47         0.03447         0.03447           35         0.49687         0.47651</td>	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2.5.8         25.8           3.5         3.5           3.5         3.5           3.1         0.04631           0.4631         0.04631           5.2         5.2           3.5         3.5           3.5         3.5           3.5         3.5           1.87         1.87           2         0.312         0.312           7         0.0037         0.0037           55.6         53.9           71         0.24134         0.24392           0         200.0         200.0           188.0         188.0           3.5         3.5           47         0.03447         0.03447           35         0.49687         0.47651
46 $\Lambda_2$ Armour Loss Factor + Pipe Loss Factor       0.0         Normal Operation IEC 60287-2-1         47       T <sub>s</sub> Thermal Resistance Between Conductor and Screen       [K.mW]       0.340         48       t <sub>s</sub> Insulation Thickness Between Conductor and Screen       [mm]       25.8         49 $\rho$ Ti       Thermal Resistivity of Insulation       [K.mW]       0.35         50       T <sub>3</sub> Thermal Resistance of Jacket/Pipe Coating       [K.mW]       0.0463         51       t <sub>3</sub> Thickness of Jacket/Pipe Coating       [K.mW]       0.0463         51       t <sub>3</sub> Thickness of Jacket/Pipe Coating       [K.mW]       3.5         62 $\rho$ TJ       Thermal Resistivity of Jacket/Pipe Coating       [K.mW]       3.5         63       U       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       1.87         54       V       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.0312         55       Y       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.312         55       Y       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.0312         56       0m       Mean Temperature of the Medium Inside the Duct/Pipe       [Km/W]       0.2433	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2         0.3402           2         0.3402           3.5         3.5           3.1         0.04631           0.04631         0.04631           5.2         5.2           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           7         0.0037           0.2012         0.312           7         0.0037           0.2010         200.0           200.0         200.0           0         188.0         188.0           3.5         3.5           47         0.03447         0.03447           0.49687         0.47651           5         0.675         0.675
46 $\Lambda_2$ Armour Loss Factor + Pipe Loss Factor       0.0         Normal Operation IEC 60287-2-1         47 $T_1$ Thermal Resistance Between Conductor and Screen       [K.mW]       0.340         48 $t_1$ Insulation Thickness Between Conductor and Screen       [mm]       25.8         49 $\rho$ Ti       Thermal Resistivity of Insulation       [K.mW]       0.466         50       T_3       Thermal Resistance of Jacket/Pipe Coating       [K.mW]       0.0466         51 $t_3$ Thickness of Jacket/Pipe Coating       [K.mW]       0.0466         51 $t_3$ Thickness of Jacket/Pipe Coating       [K.mW]       3.5         Cable in Ducts       53       U       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       1.87         54       V       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.311         55       Y       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.003         56       0m       Mean Temperature of the Medium Filling the Space       [°C]       54.0         57       T_4'       Thermal Resistance of the Medium Inside the Duct/Pipe       [Km/W]       0.2437         58       Do       Outside Diameter of the Duct/Pipe       [mm]	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2.5.8         25.8           3.5         3.5           3.1         0.04631           0.2         0.3402           3.5         3.5           3.1         0.04631           0.4631         0.04631           5.2         5.2           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           7         0.0037           0.24134         0.24392           0         200.0           200.0         200.0           0         188.0           188.0         188.0           3.5         3.5           47         0.03447           0.03447         0.03447           35         0.49687           0.47651         2.5           5         0.675           0.675         0.675           77         0.85977
46 $\lambda_2$ Armour Loss Factor + Pipe Loss Factor       0.0         Normal Operation IEC 60287-2-1       0.00         47       T <sub>1</sub> Thermal Resistance Between Conductor and Screen       [K.mW]       0.340         48       t <sub>1</sub> Insulation Thickness Between Conductor and Screen       [mm]       25.8         49 $\rho$ Ti       Thermal Resistance of Jacket/Pipe Coating       [K.mW]       0.0466         51       t <sub>3</sub> Thermal Resistance of Jacket/Pipe Coating       [K.mW]       0.466         51       t <sub>3</sub> Thickness of Jacket/Pipe Coating       [K.mW]       3.5         52 $\rho$ TJ       Thermal Resistivity of Jacket/Pipe Coating       [K.mW]       3.5         Cable in Ducts       53       U       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       1.87         54       V       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.003       36         6       m       Mean Temperature of the Medium Filling the Space       [*C]       54.0         57       T <sub>4</sub> '       Thermal Resistance of the Quct/Pipe       [K.m/W]       0.243         58       Do       Outside Diameter of the Duct/Pipe       [K.m/W]       0.243         58       Do       Outside Diameter of the Duct/Pipe <td>0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2.5.8         25.8           3.5         3.5           3.1         0.04631           5.2         5.2           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           0.312         0.312           7         0.0037           0.2012         0.012           0         200.0           200.0         200.0           0         188.0           188.0         188.0           3.5         3.5           47         0.03447           0.49687         0.47651           5         0.675           5         0.675           2.5         2.5           77         0.85977</td>	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2.5.8         25.8           3.5         3.5           3.1         0.04631           5.2         5.2           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           0.312         0.312           7         0.0037           0.2012         0.012           0         200.0           200.0         200.0           0         188.0           188.0         188.0           3.5         3.5           47         0.03447           0.49687         0.47651           5         0.675           5         0.675           2.5         2.5           77         0.85977
46 $A_2$ Armour Loss Factor + Pipe Loss Factor0.0Normal Operation IEC 60287-2147 $T_1$ Thermal Resistance Between Conductor and Screen[K.mW]0.34048 $t_1$ insulation Thickness Between Conductor and Screen[mm]25.849 $\rho Ti$ Thermal Resistivity of Insulation[K.mW]0.3550 $T_3$ Thermal Resistance of Jacket/Pipe Coating[K.mW]0.046651 $t_3$ Thickness of Jacket/Pipe Coating[K.mW]0.46651 $t_3$ Thickness of Jacket/Pipe Coating[K.mW]3.5Cable in Ducts53UCoefficient Used in IEC 60287-2-1 Clause 2.2.7.11.8754VCoefficient Used in IEC 60287-2-1 Clause 2.2.7.10.00356 $\theta m$ Mean Temperature of the Medium Filing the Space[*C]54.0057T_4'Thermal Resistance of the Medium Inside the Duct/Pipe[K.mW]0.24358DoOutside Diameter of the Duct/Pipe[mm]188.860 $\rho T$ Thermal Resistance of the Duct/Pipe[K.mW]0.03461T_4''Thermal Resistance of the Duct/Pipe[K.mW]0.474363xShorter Side of the Duct/Pipe[m]108.864yLonger Side of the Duct Bank/Backfill[m]0.67365rbEquivalent Radius of Duct Bank/Backfill[m]0.66364yLonger Side of the Duct Bank/Backfill[m]0.665965rbEquivalent Ra	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2.5.8         25.8           3.5         3.5           3.1         0.04631           5.2         5.2           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           7         0.0037         0.0037           0.200.0         200.0         200.0           0         188.0         188.0           3.5         3.5         3.5           47         0.03447         0.03447           0.49687         0.47651           5         0.675         0.675           2.5         2.5         2.5           77         0.85977         0.85977
46 $\Lambda_2$ Armour Loss Factor + Pipe Loss Factor       0.0         Normal Operation IEC 60287-2-1         47 $T_1$ Thermal Resistance Between Conductor and Screen       [KmW]       0.340         48 $t_1$ Insulation Thickness Between Conductor and Screen       [KmW]       0.345         49 $\rho$ Ti       Thermal Resistivity of Insulation       [KmW]       0.346         50 $T_3$ Thermal Resistivity of Insulation       [KmW]       0.046         51 $t_3$ Thickness of Jacket/Pipe Coating       [KmW]       0.046         51 $t_3$ Thickness of Jacket/Pipe Coating       [KmW]       3.5         Cable in Ducts       53       U       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.312         54       V       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.312         55       Y       Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1       0.003         56 $\theta$ m       Mean Temperature of the Medium Filling the Space       [°C]       54.0         57 $T_4'$ Thermal Resistance of the Duct/Pipe       [Mm]       0.043         58       Do       Outside Diameter of the Duct/Pipe       [Mm]       0.044	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           1.87         1.87           2         0.312         0.312           7         0.0037         0.0037           55.6         53.9         71           0.24134         0.24392         0           0         188.0         188.0           3.5         3.5         3.5           47         0.03447         0.03447           3.5         0.49687         0.47651           5         0.675         0.675           2.5         2.5         2.5           77
46         Λ.2         Armour Loss Factor + Pipe Loss Factor         0.0           Normal Operation IEC 60287-2-1         0.0           47         T1         Thermal Resistance Between Conductor and Screen         [KmW]         0.340           48         t1         Insulation Thickness Between Conductor and Screen         [KmW]         0.340           49         ρTi         Thermal Resistivity of Insulation         [KmW]         0.345           50         T3         Thermal Resistivity of Insulation         [KmW]         0.0462           51         t5         T3         Thermal Resistivity of Jacket/Pipe Coating         [KmW]         0.0462           51         t5         T3         Thermal Resistivity of Jacket/Pipe Coating         [KmW]         3.5           Cable in Ducts         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         1.87         54         V         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         0.031           56         Y         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         0.033         56           61         Mean Temperature of the Medium Inside the Duct/Pipe         [KmW]         0.2433           58         Do         Outside Diameter of the Duct/Pipe         [Mm]         0.2433           59         Di	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2.5.8         25.8           3.5         3.5           3.5         3.5           3.1         0.04631           0.4631         0.04631           0.4631         0.04631           5.2         5.2           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           1.87         1.87           1.87         0.312           7         0.0037           0.0037         0.0037           0.201.0         200.0           200.0         200.0           200.0         200.0           188.0         188.0           3.5         3.5           3.5         3.5           47         0.03447           0.49687         0.47651           5         0.675           2.5         2.5           77         0.85977           0.962
46         Λ <sub>2</sub> Armour Loss Factor + Pipe Loss Factor         0.0           Normal Operation IEC 60287-2-1         0.0           47         T <sub>1</sub> Thermal Resistance Between Conductor and Screen         [K.m.W]         0.340           48         t <sub>1</sub> Insulation Thickness Between Conductor and Screen         [mm]         25.8           49         ρTi         Thermal Resistivity of Insulation         [K.m.W]         0.340           50         T <sub>3</sub> Thermal Resistivity of Jacket/Pipe Coating         [K.m.W]         0.0468           51         t <sub>3</sub> Thickness of Jacket/Pipe Coating         [K.m.W]         0.345           52         ρTJ         Thermal Resistivity of Jacket/Pipe Coating         [K.m.W]         0.0468           53         U         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         1.87           54         V         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         0.003           56         θm         Mean Temperature of the Medium Filing the Space         [°C]         54.00           57         T <sub>4</sub> Thermal Resistance of the Duct/Pipe         [Km.W]         0.2433           58         Do         Outside Diameter of the Duct/Pipe         [mm]         188.0           60	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2.5.8         25.8           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           1.87         1.87           2         0.312         0.312           7         0.0037         0.0037           55.6         53.9         71           0.24134         0.24392           0         200.0         200.0           0         188.0         188.0           3.5         3.5           47         0.03447         0.03447           35         0.675         0.675           2.5         2.5         2.5
46         λ₂         Armour Loss Factor + Pipe Loss Factor         0.0           Normal Operation IEC 60287-2-1         0.0           47         T₁         Thermal Resistance Between Conductor and Screen         [K.m/W]         0.340           48         t₁         Insulation Thickness Between Conductor and Screen         [K.m/W]         0.340           48         t₁         Insulation Thickness Between Conductor and Screen         [K.m/W]         0.340           49         pTi         Thermal Resistivity of Insulation         [K.m/W]         0.346           50         T₃         Thermal Resistivity of Jacket/Pipe Coating         [K.m/W]         0.0466           51         t₃         Thickness of Jacket/Pipe Coating         [K.m/W]         0.346           51         t₃         Thermal Resistivity of Jacket/Pipe Coating         [K.m/W]         0.356           61         Ducts         53         U         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         0.313           53         U         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         0.331           54         V         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         0.333           56         Øm         Mean Temperature of the Medium Inside the Duct/Pipe         [K.m/W]         0.2433 <td>0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2.5.8         25.8           3.5         3.5           3.1         0.04631           0.24031         0.04631           0.24031         0.04631           5.2         5.2           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.7         0.0037           0.0037         0.0037           0.200.0         200.0           20         200.0           20         200.0           20.0         200.0           188.0         188.0           3.5         3.5           3.5         3.5           2.5         2.5           3.6         0.49687           0.47651     <!--</td--></td>	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2.5.8         25.8           3.5         3.5           3.1         0.04631           0.24031         0.04631           0.24031         0.04631           5.2         5.2           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.7         0.0037           0.0037         0.0037           0.200.0         200.0           20         200.0           20         200.0           20.0         200.0           188.0         188.0           3.5         3.5           3.5         3.5           2.5         2.5           3.6         0.49687           0.47651 </td
46         Λ.         Armour Loss Factor + Pipe Loss Factor         0.0           Normal Operation EC 60287-2-1         0.0           47         T.         Thermal Resistance Between Conductor and Screen         [K.mW]         0.340           48         t.         Insulation Thickness Between Conductor and Screen         [mm]         25.8           49         ρTi         Thermal Resistivity of Insulation         [K.mW]         0.340           50         T.         Thermal Resistivity of Insulation         [K.mW]         0.046           51         t.s         Thickness of Jacket/Pipe Coating         [K.mW]         0.046           51         t.s         Thickness of Jacket/Pipe Coating         [K.mW]         3.5           52         ρTJ         Thermal Resistivity of Jacket/Pipe Coating         [K.mW]         3.5           53         U         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         1.87           54         V         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         0.003           56         θm         Mean Temperature of the Medium Filing the Space         [°C]         54.00           57         T_4'         Thermal Resistance of the Duct/Pipe         [KmW]         0.2433           58         Do         Outs	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2.5.8         25.8           3.5         3.5           3.1         0.04631           0.24031         0.04631           0.24031         0.04631           5.2         5.2           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.7         0.0037           0.0037         0.0037           0.200.0         200.0           20         200.0           20         200.0           20.0         200.0           188.0         188.0           3.5         3.5           3.5         3.5           2.5         2.5           3.6         0.49687           0.47651 </td
46         λ₂         Armour Loss Factor + Pipe Loss Factor         0.0           Normal Operation IEC 60287-2-1         0.0           47         T₁         Thermal Resistance Between Conductor and Screen         [K.mW]         0.340           48         t₁         Insulation Thickness Between Conductor and Screen         [K.mW]         0.340           48         t₁         Insulation Thickness Between Conductor and Screen         [K.mW]         0.340           49         ρTi         Thermal Resistance of Jacket/Pipe Coating         [K.mW]         0.0463           50         T₃         Thermal Resistance of Jacket/Pipe Coating         [K.mW]         0.0463           51         t₃         Thickness of Jacket/Pipe Coating         [K.mW]         0.0463           51         t₃         Thermal Resistivity of Jacket/Pipe Coating         [K.mW]         0.353           63         U         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         0.0031           53         U         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         0.0031           56         θm         Mean Temperature of the Medium Inside the Duct/Pipe         [K.mW]         0.243           56         Do         Outside Diameter of the Duct/Pipe         [m]         0.203           5	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2.5.8         25.8           3.5         3.5           3.1         0.04631           0.04631         0.04631           0.2         5.2           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.6         53.9           71         0.24134         0.24392           0         200.0         200.0           188.0         188.0         188.0           3.5         3.5         3.5           47         0.03447         0.03447           0.49687         0.47651           5         0.675         0.675           2.5         <
46         Λ₂         Armour Loss Factor + Pipe Loss Factor         0.0           Normal Operation IEC 60287-2-1         0.0           47         T₁         Thermal Resistance Between Conductor and Screen         [K.mW]         0.340           48         t₁         Insulation Thickness Between Conductor and Screen         [K.mW]         0.340           49         ρTi         Thermal Resistivity of Insulation         [K.mW]         0.0466           50         T₃         Thermal Resistivity of Jacket/Pipe Coating         [K.mW]         0.0466           51         t₃         Thickness of Jacket/Pipe Coating         [K.mW]         0.0466           51         t₃         Thickness of Jacket/Pipe Coating         [K.mW]         3.5           62         pTJ         Thermal Resistivity of Jacket/Pipe Coating         [K.mW]         3.5           63         U         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         1.87           54         V         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         0.033           56         θm         Mean Temperature of the Medium Filing the Space         ["C]         54.0           57         T₄'         Thermal Resistance of the Duct/Pipe         [mm]         200.1           57         T₄'	0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           0.0         0.0           2         0.3402           2.5.8         25.8           3.5         3.5           3.1         0.04631           0.2         0.312           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           3.5         3.5           1.87         1.87           2         0.312         0.312           7         0.0037         0.0037           0.2012         0.312         0.312           7         0.0037         0.0037           0         200.0         200.0           0         188.0         188.0           3.5         3.5         3.5           47         0.03447         0.03447           0.49687         0.47651           5         0.675

	Study Summary	
CYMCAP Version 2 7.3 Revision 2		
Study: Eirgrid Cp966 Feasibility study		
Execution:	ecution: Eirgrid - WIDE trench (1ct 220kV CABLE) v2 - Summer (20C)	
Date:	02/03/2020 16:00:47	

General Simulation Data	
Steady State Option	Equally Loaded
Consider Electrical interaction between circuits	No
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0
Conductor Resistances Computation Option:	IEC-228

Installation Type:Ductbank					
Ambient Soil Temperature at Installation Depth	[°C]	20.0			
Native Soil Thermal Resistivity	[K.m/W]	1.2			
Thermal Resistivity of Duct Bank	[K.m/W]	0.3			
Depth of Center of Duct Bank	[m]	0.96			
Duct Bank Width	[m]	2.5			
Duct Bank Height	[m]	0.68			



Results	Results Summary									
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [m]	Y coordinate [m]	Conductor temperature [°C]	Ampacity [A]
1	220KV.011	1		А	50.0	1.0	0.15	1.05	88.7	2313.4
2	220KV.011	1		В	50.0	1.0	1.25	1.05	90.0	2313.4
3	220KV.011	1		С	50.0	1.0	2.35	1.05	88.5	2313.4

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### Steady State Summary

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 220kV CABLE) v2 - Summer (20C)
Date:	02/03/2020 16:00:47

Simulation Data	
Installation type:	Ductbank
Steady State Option	Equally Loaded
Ambient temperature [°C]	20
Native Soil Thermal Resistivity [K.m/W]	1.2
Consider Non-Isothermal Earth Surface	No
Consider effect of soil dry out	No
Consider Electrical interaction between circuits	No
Induced current in metallic layers as a fraction of conductor current (applied to all single phase circuits)	0

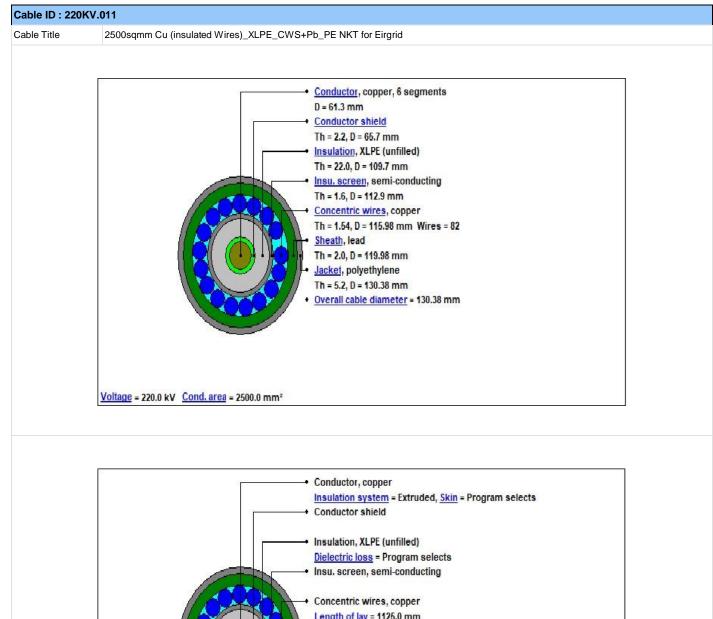
Variable	Description	Unit		Cables	
Cable No.	Cable Index Number		1	2	3
General Inpu	ut Data				, , , , , , , , , , , , , , , , , , ,
Cable ID	Cable Equipment ID		220KV.011	220KV.011	220KV.011
Circuit No.	Circuit No.		1	1	1
Phase	Cable Phase		А	В	С
Fq	Operating Frequency	[Hz]	50.0	50.0	50.0
x	X coordinate	[m]	0.15	1.25	2.35
у	Y coordinate	[m]	1.05	1.05	1.05
DLF	Daily Load Factor	[p.u.]	1.0	1.0	1.0
	Bonding Type		1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat
Ampacity		<u> </u>			
I	Steady State Ampacity	[A]	2313.4	2313.4	2313.4
Temperature	25	·			
θс	Conductor temperature	[°C]	88.7	90.0	88.5
θs	Sheath/Shield temperature	[°C]	70.0	71.2	69.8
θа	Armour temperature	[°C]	n/a	n/a	n/a
θsurf	Cable surface temperature	[°C]	67.3	68.5	67.2
θduct	Duct surface temperature	[°C]	51.8	53.1	51.7
Resistances		<u> </u>			
$R_0$	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
R	AC Resistance of the Conductor at Operating Temperature	[Ω/km]	0.01015	0.01019	0.01015
ys	Skin Effect Factor		0.10991	0.1091	0.11002
ур	Proximity Effect Factor		0.00045	0.00045	0.00045
osses					
Wc	Conductor Losses	[W/m]	54.33612	54.51722	54.31271
Wd	Dielectric Losses	[W/m]	1.37316	1.37316	1.37316
Ws	Metallic Screen Losses	[W/m]	1.99629	1.86583	1.64867
Wa	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
Wt	Total Losses	[W/m]	57.70557	57.75621	57.33453
$\tilde{\lambda}_1$	Screen Loss Factor		0.03674	0.03422	0.03036
$\lambda_2$	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
Thermal res	istances				
T1	Thermal resistance of insulation	[K.m/W]	0.3402	0.3402	0.3402
T2	Thermal resistance of bedding/medium inside pipe-type	[K.m/W]	n/a	n/a	n/a
Т3	Thermal resistance of outer covering	[K.m/W]	0.04631	0.04631	0.04631
T4	External thermal resistance	[K.m/W]	0.81958	0.84053	0.82237
Others					
Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
	Induced current on Metallic Screen	[A]	138.4	125.8	125.2

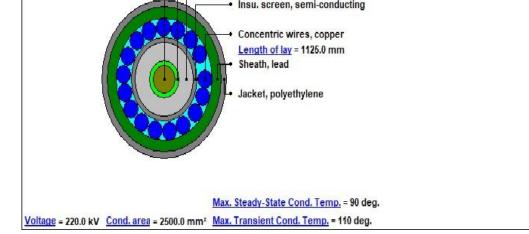
CYME

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 220kV CABLE) v2 - Summer (20C)
Date:	02/03/2020 16:00:47

No.	Description	Unit	1
Gen	eral Cable Information		
1	Cable Equipment ID		220KV.011
2	Number of Cores		Single Core
3	Voltage	[kV]	220
4	Conductor Area	[mm <sup>2</sup> ]	2500.0
5	Cable Overall Diameter	[mm]	130.38
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature		110
	ductor	[°C]	110
	Material		<u> </u>
8	Electrical Resistivity at 20°C		Copper
9	Temperature Coefficient at 20°C	[μΩ.cm]	1.7241
10	Reciprocal of Temperature Coefficient of Resistance	[1/K]	0.00393
11	(BETA)	[K]	234.5
12	Volumetric Specific Heat (SH)	[J/(K*cm <sup>3</sup> )]	3.45
13	Construction		6 Segments
14	Conductor Insulation System		Extruded
15	Milliken Wires Construction		Insulated Wires
16	Ks (Skin Effect Coefficient)		0.35
17	Kp (Proximity Effect Coefficient)		0.2
18	Diameter	[mm]	61.3
Con	ductor Shield		
19	Thickness	[mm]	2.2
20	Diameter	[mm]	65.7
	lation	[]	00.1
21	Material		XLPE Unfilled
21	Thermal Resistivity	[K m/M]	
	Dielectric Loss Factor - ( tan delta )	[K.m/W]	3.5
23	Relative Permittivity - ( epsilon )		0.001
24	Specific Insulation Resistance Constant at 60°F - (K)		2.5
25		[MΩ.km]	65617.
26	Thickness	[mm]	22.0
27	Diameter	[mm]	109.7
	lation Screen	[mm]	109.7
	lation Screen	[mm]	109.7 Semi Conducting Screen
Insu	Iation Screen Material Thickness	[mm]	
<b>Insu</b> 28 29 30	lation Screen Material Thickness Diameter		Semi Conducting Screen
<b>Insu</b> 28 29	Iation Screen Material Thickness Diameter ath	[mm]	Semi Conducting Screen
<b>Insu</b> 28 29 30	lation Screen Material Thickness Diameter	[mm]	Semi Conducting Screen
Insu 28 29 30 Shea	Iation Screen Material Thickness Diameter ath	[mm]	Semi Conducting Screen 1.6 112.9
Insu 28 29 30 Shea 31	Iation Screen Material Thickness Diameter ath Is Sheath Around Each Core?	[mm]	Semi Conducting Screen 1.6 112.9 n/a
Insu 28 29 30 Shea 31 32	Iation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material	[mm]	Semi Conducting Screen 1.6 112.9 n/a Lead
Insu 28 29 30 Shea 31 32 33 34	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance	[mm] [mm] [μΩ.cm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004
Insu 28 29 30 Shea 31 32 33 34 34	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)	[mm] [mm] [μΩ.cm] [1/K] [K]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230
Insu 28 29 30 Shea 31 32 33 34 35 36	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)	[mm] [mm] [μΩ.cm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45
Insu           28           29           30           Shea           31           32           33           34           35           36           37	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type	[mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated
Insu           28           29           30           Shee           31           32           33           34           35           36           37           38	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness	[mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0
Insu           28           29           30           Shea           31           32           33           34           35           36           37           38           39	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter	[mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated
Insu           28           29           30           Shea           31           32           33           34           35           36           37           38           39           Cont	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires	[mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98
Insu           28           29           30           Shea           31           32           33           34           35           36           37           38           39           Conn	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?	[mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98
Insu           28           29           30           Shea           31           32           33           34           35           36           37           38           39           Conn           40           41	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material	[mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)] [mm] [mm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper
Insu           28           29           30           Shea           31           32           33           34           35           36           37           38           39           Conn           40           41           42	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C	[mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98
Insu           28           29           30           Shea           31           32           33           34           35           36           37           38           39           Conn           40           41	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C	[mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)] [mm] [mm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper
Insu           28           29           30           Shea           31           32           33           34           35           36           37           38           39           Conn           40           41           42	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C	[mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)] [mm] [mm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241
Insu           28           29           30           Shea           31           32           33           34           35           36           37           38           39           Conn           40           41           42           43	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reproced of Temperature Coefficient of Resistance	[mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)] [mm] [mm] [mm] [μΩ.cm] [1/K]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98
Insu           28           29           30           Shea           31           32           33           34           35           36           37           38           39           Conn           40           41           42           43           44	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)	[mm] [mm] [μΩ.cm] [μΩ.cm] [1/K] [K] [(/(K*cm³)] [mm] [mm] [mm] [mm] [μΩ.cm] [μΩ.cm]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393           234.5
Insu           28           29           30           Shea           31           32           33           34           35           36           37           38           39           Con           40           41           42           43           44           45	Iation Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)	[mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)] [mm] [mm] [mm] [mm] [1/K] [μΩ.cm] [1/K] [J/(K*cm³)]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           0.00393           234.5           3.45
Insu           28           29           30           Shea           31           32           33           34           35           36           37           38           39           Con           40           41           42           43           44           45           46           47	Ition Screen         Material         Thickness         Diameter         Ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay	[mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)] [mm] [mm] [mm] [mm] [1/K] [μΩ.cm] [1/K] [J/(K*cm³)]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393           234.5           3.45           1125.0           82
Insu           28           29           30           Shea           31           32           33           34           35           36           37           38           39           Conn           40           41           42           43           44           45           46	Ition Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay         Number of Wires	[mm] [μΩ.cm] [[μΩ.cm] [J/(K*cm³)] [mm] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           Opper           1.7241           0.00393           234.5           3.45           1125.0           82           Undefined
Insu           28           29           30           Shea           31           32           33           34           35           36           37           38           39           Conn           40           41           42           43           44           45           46           47           48           49	Ition Screen         Material         Thickness         Diameter         Ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay         Volumetric Specific Heat (SH)         Length of Lay         Number of Wires         Wire Gauge	[mm] [μΩ.cm] [1/K] [[/(K*cm³)] [[/(K*cm³)] [mm] [[mm] [[1/K] [[/(K*cm³)] [[1/K] [[/(K*cm³)] [[1/K]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393           234.5           3.45           1125.0           82           Undefined           1.54
Insu           28           29           30           Shea           31           32           33           34           35           36           37           38           39           Con           40           41           42           43           44           45           46           47           48           49           50	Ition Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay         Number of Wires         Wire Gauge         Thickness         Diameter	[mm] [μΩ.cm] [[μΩ.cm] [J/(K*cm³)] [mm] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           Opper           1.7241           0.00393           234.5           3.45           1125.0           82           Undefined
Insu           28           29           30           Shea           31           32           33           34           35           36           37           38           39           Cond           40           41           42           43           44           45           46           47           48           49           50           Jack	Ition Screen         Material         Thickness         Diameter         Ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay         Number of Wires         Wire Gauge         Thickness         Diameter	[mm] [μΩ.cm] [1/K] [[/(K*cm³)] [[/(K*cm³)] [mm] [[mm] [[1/K] [[/(K*cm³)] [[1/K] [[/(K*cm³)] [[1/K]	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           0.00393           234.5           3.45           1125.0           82           Undefined           1.54           115.98
Insu           28           29           30           Sheat           31           32           33           34           35           36           37           38           39           Con           40           41           42           43           44           45           46           47           48           49           50           Jack           51	Ition Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay         Number of Wires         Wire Gauge         Thickness         Diameter	[mm]         [mm]         [mm]         [μΩ.cm]         [μΩ.cm]         [μΩ.cm]         [μΩ.cm]         [μ]         [μ]         [μ]         [μ]         [μ]         [μ]         [κ]         [μ]         [mm]         [μ]         [μ]         [μ]         [mm]         [κ]         [μ]         [μ]         [mm]         [mm] <tr< td=""><td>Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           Copper           1.7241           0.00393           234.5           3.45           1125.0           82           Undefined           1.54           115.98</td></tr<>	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           Copper           1.7241           0.00393           234.5           3.45           1125.0           82           Undefined           1.54           115.98
Insu           28           29           30           Shea           31           32           33           34           35           36           37           38           39           Conn           40           41           42           43           44           45           46           47           48           49           50           Jack           51           52	Ition Screen         Material         Thickness         Diameter         Ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay         Number of Wires         Wire Gauge         Thickness         Diameter         Material         Thickness         Diameter	[mm]           [mm]           [mm]           [mm]           [μΩ.cm]           [μΩ.cm]           [μΩ.cm]           [[μΩ.cm]           [[μΩ.cm]           [[μ.cm]           [[μ.cm]           [[μ.cm]           [[μ.cm]           [[mm]           [[mm]           [[μ.cm]           [[μ.cm]           [[[mm]           [[[mm]           [[[[[mm]           [[[[[[[[[[[[[[[[[[[[[[[[[[[[[[[[[[[[	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           Copper           1.7241           0.00393           234.5           3.45           1125.0           82           Undefined           1.54           115.98           Polyethylene           3.5
Insu           28           29           30           Sheat           31           32           33           34           35           36           37           38           39           Con           40           41           42           43           44           45           46           47           48           49           50           Jack           51	Ition Screen         Material         Thickness         Diameter         ath         Is Sheath Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient at 20°C         Reciprocal of Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Corrugation Type         Thickness         Diameter         Centric neutral/Skid wires         Are Concentric Neutral Wires Around Each Core?         Material         Electrical Resistivity at 20°C         Temperature Coefficient of Resistance (BETA)         Volumetric Specific Heat (SH)         Length of Lay         Number of Wires         Wire Gauge         Thickness         Diameter	[mm]         [mm]         [mm]         [μΩ.cm]         [μΩ.cm]         [μΩ.cm]         [μΩ.cm]         [μ]         [μ]         [μ]         [μ]         [μ]         [μ]         [κ]         [μ]         [mm]         [μ]         [μ]         [μ]         [mm]         [κ]         [μ]         [μ]         [mm]         [mm] <tr< td=""><td>Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           Copper           1.7241           0.00393           234.5           3.45           1125.0           82           Undefined           1.54           115.98</td></tr<>	Semi Conducting Screen           1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           Copper           1.7241           0.00393           234.5           3.45           1125.0           82           Undefined           1.54           115.98

No.	Description	Unit	1
Spe	cific Installation Data		
55	Cable Equipment ID		220KV.011
56	Cable Frequency	[Hz]	50
57	Sheath / Shield Bonding		1 Conductor Crossbonded Flat
58	Loss Factor Constant (ALOS)		0.3
59	Minor section length		Crossbonded Unknown Section Lengths UNKNOWN
60	Duct construction		Polyethylene in Concrete
61	Duct material thermal resistivity	[K.m/W]	3.5
62	Inside Diameter of the Duct/Pipe	[mm]	188.0
63	Outside Diameter of the Duct/Pipe	[mm]	200.0







CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 220kV CABLE) v2 - Summer (20C)
Date:	02/03/2020 16:00:47

No.	Description	Unit	Cable No.1	Cable No.2	Cable No.3			
1	Cable Equipment ID		220KV.011	220KV.011	220KV.011			
Resi	Resistances							
2	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072			
3	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00914	0.00918	0.00914			
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.00842	0.00842	0.00842			
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01015	0.01019	0.01015			
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.28869	0.28869	0.28869			
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.34639	0.34783	0.3462			
8	DC Resistance of Concentric Wires at 20°C	[Ω/km]	0.1185	0.1185	0.1185			
9	DC Resistance of Concentric Wires at Operating Temperature	[Ω/km]	0.14178	0.14236	0.1417			
Loss	es							
10	Conductor Losses	[W/m]	54.33612	54.51722	54.31271			
11	Dielectric Losses	[W/m]	1.37316	1.37316	1.37316			
12	Metallic Screen Losses	[W/m]	1.99629	1.86583	1.64867			
13	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0			
14	Total Losses	[W/m]	57.70557	57.75621	57.33453			
Сара	acitance, Inductance, Impedance							
15	Capacitance	[µF/km]	0.271	0.271	0.271			
16	Inductance of Conductor	[mH/km]	0.76609	0.76609	0.76609			
17	Reactance of Conductor	[Ω/km]	0.24067	0.24067	0.24067			
18	Inductance of Metallic Sheath	[mH/km]	0.58814	0.58814	0.58814			
19	Reactance of Metallic Sheath	[Ω/km]	0.18477	0.18477	0.18477			
20	Positive Sequence Impedance	[Ω/km]	0.010150 + j0.240670	0.010190 + j0.240670	0.010150 + j0.240670			
21	Negative Sequence Impedance	[Ω/km]	0.010150 + j0.240670	0.010190 + j0.240670	0.010150 + j0.240670			
22	Zero Sequence Impedance	[Ω/km]	0.092010 + j0.184770	0.092000 + j0.184770	0.092010 + j0.184770			
23	Surge Impedance	[Ω]	53.17602	53.17602	53.17602			
Othe	rs	I	I	I				
24	Dielectric Stress at Conductor Surface	[kV/mm]	7.54233	7.54233	7.54233			
25	Dielectric Stress at Insulation Surface	[kV/mm]	4.51715	4.51715	4.51715			
26	Insulation Resistance at 60°F (15.8°C)	[MΩ.km]	14609.00643	14609.00643	14609.00643			
27	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a			
28	Charging Current for One Phase	[A/km]	10.81081	10.81081	10.81081			
29	Charging Capacity of three phase system at Uo	[kvar/km]	4119.47055	4119.47055	4119.47055			
30	Voltage drop for Three Phase System	[V/A/km]	0.01758	0.01764	0.01758			
31	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0			
32	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0			
33	Induced current on Metallic Screen	[A]	138.4	125.8	125.2			

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#### Cable Parameters under Normal Operation

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 220kV CABLE) v2 - Summer (20C)
Date:	02/03/2020 16:00:47

No.	Symbol	Description	Unit	Cable No.1	Cable No.2	Cable No.3	
1	Symbol	Cable Equipment ID	onit	220KV.011	220KV.011	220KV.011	
Normal	Normal Operation IEC 60287-1-1						
Conduc	ctor AC Res	istance	1	1			
2	R <sub>0</sub>	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072	
3	R' dc	DC Resistance of Conductor at Operating Temperature Conductor Diameter	[Ω/km] [mm]	0.00914 61.3	0.00918 61.3	0.00914 61.3	
5	s	Distance Between Conductor Axes	[mm]	1099.99995	1099.99995	1099.99995	
6	ks	Factor Used for xs Calculation (Skin Effect)		0.35	0.35	0.35	
7	kp	Factor Used for xp Calculation (Proximity Effect)		0.2	0.2	0.2	
8	xs	Component of Ys Calculation (Skin Effect)		2.19322	2.18877	2.1938	
9	хр	Component of Yp Calculation (Proximity Effect)		1.65792	1.65455	1.65835	
10	ys	Skin Effect Factor		0.10991	0.1091	0.11002	
11 12	ур R	Proximity Effect Factor AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00045	0.00045	0.00045	
	ric Losses		[\$2/KIII]	0.01013	0.01019	0.01013	
13	tanδ	Dielectric Loss Factor		0.001	0.001	0.001	
14	3	Insulation Relative Permitivity		2.5	2.5	2.5	
15	С	Cable Capacitance	[µF/km]	0.271	0.271	0.271	
16	U <sub>0</sub>	Voltage	[kV]	127.01706	127.01706	127.01706	
17 Circulat	Wd ting Loss F	Cable Dielectric Losses Per Phase actor	[W/m]	1.37316	1.37316	1.37316	
18	Rs	AC Resistance used for Circulating Loss Factor computation	[Ω/km]	0.1006	0.10102	0.10055	
19	d	Mean diameter used for Circulating Loss Factor computation	[mm]	116.22348	116.22348	116.22348	
20	х	Reactance used for Circulating Loss Factor computation	[Ω/km]	0.18477	0.18477	0.18477	
21	Xm	Mutual Reactance	[Ω/km]	0.04355	0.04355	0.04355	
22	P	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.22832	0.22832	0.22832	
23	Q	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.17025	0.17025	0.17025	
24	Fspacing	Spacing Factor (applied when spacing between cable uneven or non-equal minor section length)		0.004	0.004	0.004	
25	λ'1	Screen Loss Factor Caused by Circulating Current		0.03544	0.02934	0.02904	
-	oss Factor						
26 27	Rs d	AC Resistance used for Eddy Loss Factor computation Mean diameter used for Eddy Loss Factor computation	[Ω/km] [mm]	0.34639	0.34783 117.98	0.3462	
27	α ps	Electrical Resistivity used for Eddy Loss Factor computation	[mm] [Ω.m]	0.0	0.0	0.0	
29	Ds	External diameter used for Eddy Loss Factor computation	[mm]	119.98	119.98	119.98	
30	ts	Thickness used for Eddy Loss Factor computation	[mm]	2.0	2.0	2.0	
31	β1	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		39.21082	39.12915	39.22142	
32	gs	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		1.0025	1.00249	1.0025	
34	m	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.0907	0.09032	0.09075	
35	λ <sub>0</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.00004	0.00014	0.00004	
36 37	$\Delta_1$ $\Delta_2$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		-0.00938	0.00005	0.00241	
- 57	$\Delta_2$						
38	F	Milliken conductor Effect					
38 39	F Fpipe	Milliken conductor Effect Magnetic effect factor due to pipe		1.0 1.0	1.0 1.0	1.0 1.0	
				1.0	1.0	1.0	
39 40 41	Fpipe Farmour λ"1	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current		1.0 1.0	1.0 1.0	1.0 1.0	
39 40 41 <b>Metallic</b>	Fpipe Farmour λ"1 c Screen Lo	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor		1.0 1.0 1.0 0.0013	1.0 1.0 1.0 0.00489	1.0 1.0 1.0 0.00132	
39 40 41 Metallio 42	Fpipe Farmour λ"1	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor		1.0 1.0 1.0	1.0 1.0 1.0	1.0 1.0 1.0	
39 40 41 Metallio 42	Fpipe Farmour λ"1 Screen Lo λ1	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor		1.0 1.0 1.0 0.0013	1.0 1.0 1.0 0.00489	1.0 1.0 1.0 0.00132	
39 40 41 <b>Metallic</b> 42 <b>Armour</b>	Fpipe Farmour λ"1 c Screen Lo λ1 r and Pipe L	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor oss Factor		1.0 1.0 1.0 0.0013 0.03674	1.0 1.0 1.0 0.00489 0.03422	1.0 1.0 1.0 0.00132 0.03036	
39 40 41 Metallic 42 Armour 43 44 46	Fpipe Farmour $\lambda''_1$ c Screen Lo $\lambda_1$ r and Pipe L $\lambda_2$ a $\lambda_2$ pipe $\lambda_2$	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor		1.0 1.0 0.0013 0.03674	1.0 1.0 0.00489 0.03422 0.0	1.0 1.0 0.00132 0.03036	
39 40 41 Metallic 42 Armour 43 44 46 Normal	Fpipe Farmour $\lambda''_1$ c Screen Lo $\lambda_1$ r and Pipe L $\lambda_2$ a $\lambda_2$ pipe $\lambda_2$ Operation I	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1		1.0 1.0 0.0013 0.03674 0.0 0.0 0.0	1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0	1.0 1.0 0.00132 0.03036 0.0 0.0 0.0	
39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43 44 46 <b>Normal</b> 47	Fpipe           Farmour           λ"1           c Screen Lo           λ1           rand Pipe L           λ2           λ2           Operation I           T1	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen	[K.m/W]	1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0	1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0	1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.0	
39 40 41 Metallic 42 Armour 43 44 46 Normal	Fpipe Farmour $\lambda''_1$ c Screen Lo $\lambda_1$ r and Pipe L $\lambda_2$ a $\lambda_2$ pipe $\lambda_2$ Operation I	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1	[K.m/W] [mm]	1.0 1.0 0.0013 0.03674 0.0 0.0 0.0	1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0	1.0 1.0 0.00132 0.03036 0.0 0.0 0.0	
39 40 41 Metallic 42 Armour 43 44 46 Normal 47 48	Fpipe Farmour $\lambda^{u_1}$ c Screen Lo $\lambda_1$ and Pipe L $\lambda_2 a$ $\lambda_2 pipe$ $\lambda_2$ Operation I T <sub>1</sub> t <sub>1</sub>	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen	[mm]	1.0 1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0 0.3402 25.8	1.0 1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.3402 25.8	
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49	$Fpipe \\ Farmour \\ \lambda''_1 \\ constraints \\ co$	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation	[mm] [K.m/W]	1.0 1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52	Fpipe           Farmour           λ"1           Screen Lo           λ1           and Pipe L           λ2pipe           λ2           Operation I           T1           T1           T1           T1           T3           T3           TJ	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W]	1.0 1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in	Fpipe           Farmour           λ",1           Screen Lo           λ,1           r and Pipe L           λ <sub>2</sub> pipe           λ <sub>2</sub> Operation           T <sub>1</sub> t <sub>1</sub> ρTi           T <sub>3</sub> t <sub>3</sub> ρTJ           n           DUCS	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W] [mm]	1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5	
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53	Fpipe           Farmour           λ",1           c Screen Lo           λ,1           r and Pipe L           λ <sub>2</sub> pipe           λ <sub>2</sub> Φ           Τ           T           τ           Φ           Γ           Φ           Γ           Φ           Γ           τ           τ           τ           φ           Γ           Φ           Γ           σ           σ           φ           σ           σ           φ           σ           σ           σ           σ           φ           σ           σ           σ           σ           σ           σ           σ           σ	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Pipe Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm]	1.0 1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5	1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5	
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in	Fpipe           Farmour           λ",1           Screen Lo           λ,1           r and Pipe L           λ <sub>2</sub> pipe           λ <sub>2</sub> Operation           T <sub>1</sub> t <sub>1</sub> ρTi           T <sub>3</sub> t <sub>3</sub> ρTJ           n           DUCS	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W] [mm]	1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5	
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54	Fpipe           Farmour           λ",1           c Screen Lo           λ,1           r and Pipe L           λ_2pipe           λ_2           Operation I           T,1           t,1           ρTi           T,3           t,3           ρTJ           n Ducts           U           V	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Pipe Loss Factor Pipe Loss Factor Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm]	1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5	1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54	Fpipe           Farmour           λ"1           Screen Lo           λ1           and Pipe L           λ2pipe           λ2           Operation I           T1           t1           ρTi           T3           t3           pTJ           n Ducts           U           V           Y	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm] [K.m/W]	1.0 1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56	Fpipe           Farmour           λ"1           Screen Lo           λ1           and Pipe L           λ2pipe           λ2           Operation I           T1           T1           T1           T3           T3           T3           T3           T3           T4           T3           T3           T4           T5           T4           T5           T4           T5           T4           T5           T4           T5	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space	[mm] [K.m/W] [K.m/W] [mm] [K.m/W]	1.0 1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59	Fpipe           Farmour           λ",1           Screen Lo           λ,1           rand Pipe L           λ <sub>2</sub> a           λ <sub>2</sub> pipe           λ <sub>2</sub> Operation I           T1           t1           ρTi           T3           t3           ρTJ           Ducts           U           V           Y           θm           T4'	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [C] [K.m/W] [mm] [mm]	1.0 1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60	Fpipe           Farmour           λ",1           Screen Lo           λ,1           r and Pipe L           λ <sub>2</sub> pipe           λ <sub>2</sub> Operation           T1           t1           ρTi           T3           t3           pTJ           t           D           V           Y           θm           T4'           Do           Di           ρT	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance Getween Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [%] [%] [%] [%] [mm] [mm] [%.m/W]	1.0 1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61	Fpipe           Farmour           λ",1           c Screen Lo           λ,1           r and Pipe L           λ <sub>2</sub> pipe           λ <sub>2</sub> Operation I           T,3           t,1           ρTI           T,3           t,3           ρTJ           Ducts           U           V           Y           θm           T,4"           Do           Di           ρT,4"	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Internal Resistivity of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [Mm] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W]	1.0 1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62	Fpipe           Farmour           λ",1           cscreen Lo           λ,1           r and Pipe L           λ <sub>2</sub> pipe           λ <sub>2</sub> Operation I           T,3           t,1           ρTI           T,3           t,3           ρTJ           U           V           Y           θm           T,4"           Do           Di           ρT,4"	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance Getween Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [%] [%] [%] [%] [mm] [mm] [%.m/W]	1.0 1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62	Fpipe           Farmour           λ",1           cscreen Lo           λ,1           r and Pipe L           λ <sub>2</sub> pipe           λ <sub>2</sub> Operation I           T,3           t,1           ρTI           T,3           t,3           ρTJ           U           V           Y           θm           T,4"           Do           Di           ρT,4"	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistance of the Surrounding Medium	[mm] [K.m/W] [K.m/W] [Mm] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W]	1.0 1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in	Fpipe           Farmour           λ",1           Screen Lo           λ,1           and Pipe L           λ <sub>2</sub> a           λ <sub>2</sub> pipe           λ <sub>2</sub> Operation I           T1           t1           pTiI           T3           t3           pTJ           DU           V           Y           θm           T4''           Do           Di           pT           T4''           Do           Di           pT           T4''	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistance of the Surrounding Medium Ink/Backfill Installation	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           62	Fpipe           Farmour           λ",1           Screen Lo           λ,1           and Pipe L           λ <sub>2</sub> a           λ <sub>2</sub> pipe           λ <sub>2</sub> Operation I           T <sub>1</sub> t <sub>1</sub> ρTJ           T <sub>3</sub> t <sub>3</sub> ρTJ           DU           V           Y           θm           T <sub>4</sub> ''           Do           Di           ρT           T <sub>4</sub> ''           Do           Di           ρT           T <sub>4</sub> ''           n a Duct Ba           x	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Armour Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium Ink/Backfill Installation Shorter Side of the Duct Bank/Backfill	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00489 0.03422 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65           66	Fpipe           Farmour           λ",1           Screen Lo           λ,1           and Pipe L           λ <sub>2</sub> a           λ <sub>2</sub> pipe           λ <sub>2</sub> Operation I           T1           t1           ρTJ           t3           pTJ           t3           pTJ           D           V           Y           θm           T4'           D0           Di           ρT           T4''           D0           Di           ρT           T4'''           n a Duct Ba           x           y	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Medium Inside the Duct/Pipe Thermal Resistance of the Surrounding Medium Ink/Backfill Installation Shorter Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [Mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65           66           67	Fpipe           Farmour           λ",1           Screen Lo           λ,1           A2pipe           λ2pipe           λ2           Operation I           T1           T3           T4           D0           T4           D0           Di           PT           T4"           D0           Di           PT           T4"           D0           Di           PT           T4"           D0           Di           CT4"           T4"	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance Getween Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistance of the Surrounding Medium Ink/Backfill installation Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65           66           67           68	Fpipe           Farmour           λ",1           cscreen Lo           λ,1           rand Pipe L           λ,2           Φ           λ,2           Φ           λ,2           Φ           λ,2           Φ           Λ           Φ           Λ           Φ <td>Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance Detween Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistance of the Surrounding Medium InV/Backfill Installation Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill</td> <td>[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [M] [M] [M] [M] [M] [M] [M]</td> <td>1.0 1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.</td> <td>1.0 1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0</td> <td>1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.</td>	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance Detween Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistance of the Surrounding Medium InV/Backfill Installation Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [M] [M] [M] [M] [M] [M] [M]	1.0 1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65           66           67	Fpipe           Farmour           λ",1           Screen Lo           λ,1           A2pipe           λ2pipe           λ2           Operation I           T1           T3           T4           D0           T4           D0           Di           PT           T4"           D0           Di           PT           T4"           D0           Di           PT           T4"           D0           Di           CT4"           T4"	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance Getween Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistance of the Surrounding Medium Ink/Backfill installation Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65           66           67           68           69	Fpipe           Farmour           λ",1           cscreen Lo           λ,2           λ,2           λ,2           Φ           λ,2           Φ           λ,2           Φ           λ,2           Φ           Λ           Φ           Λ           Φ           Φ           Λ           Φ           Λ           Δ           Δ           Φ           Δ           Δ           Δ           Φ           Φ     <	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>Nt/Backfill Installation</b> Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of Duct Bank/Backfill	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00489 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 0.312 0.037 60.4 0.312 0.037 60.4 0.23424 200.0 1.87 0.335 0.03447 0.55367 0.675 2.5 0.85977 0.962 1.1189 3.0 1.2	
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           63           64           65           66           67           68           69           70	Fpipe           Farmour           λ",1           cscreen Lo           λ,2           λ2pipe           λ2           7           1           7,1           1           7,2           Operation           7,3           1,3           ρTJ           N           U           V           Y           0m           T_4"           Do           Di           ρT           T_4"           N           Autor Ba           X           y           rb           LG           u           N           ρe           ρc	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistance of the Surrounding Medium nk/Backfill Installation Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [M] [m] [m] [m] [m] [m] [m] [m] [m] [K.m/W]	1.0 1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00489 0.03422 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           63           64           65           66           67           68           69           70           71           72	Fpipe           Farmour           λ"1           cscreen Lo           λ <sub>2</sub> λ <sub>2</sub> pipe           λ <sub>2</sub> Φ           λ <sub>2</sub> Operation I           Τ           τ           η           Φ           φ           φ           φ           φ           ψ           τ           ψ           ψ           ψ           κ           ψ           κ           ψ           κ           ψ           μ       <	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium mk/Backfill Installation Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of the Duct B	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [M] [M] [M] [M] [M] [M] [M] [M] [M] [M	1.0 1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00489 0.03422 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	
39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           655           66           67           68           69           70           71	Fpipe           Farmour           λ",1           Screen Lo           λ",1           and Pipe L           λ <sub>2</sub> a           λ <sub>2</sub> pipe           λ <sub>2</sub> Operation I           T1           t1           ρTJ           t3           ρTJ           t4           DO           DI           V           Y           θm           T4''           Do           Di           ρT           T4''           Do           Di           ρT           T4''           Do           Di           ρT           T4''           Do           Di           ρT           T4''           D           LG           u           N           ρe           ρc           T4'''	Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Uuct/Pipe Thermal Resistance of the Surrounding Medium mk/Backfill installation Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [M] [m] [m] [m] [m] [m] [m] [m] [m] [m] [m	1.0 1.0 1.0 0.0013 0.03674 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00489 0.03422 0.03422 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.00132 0.03036 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	

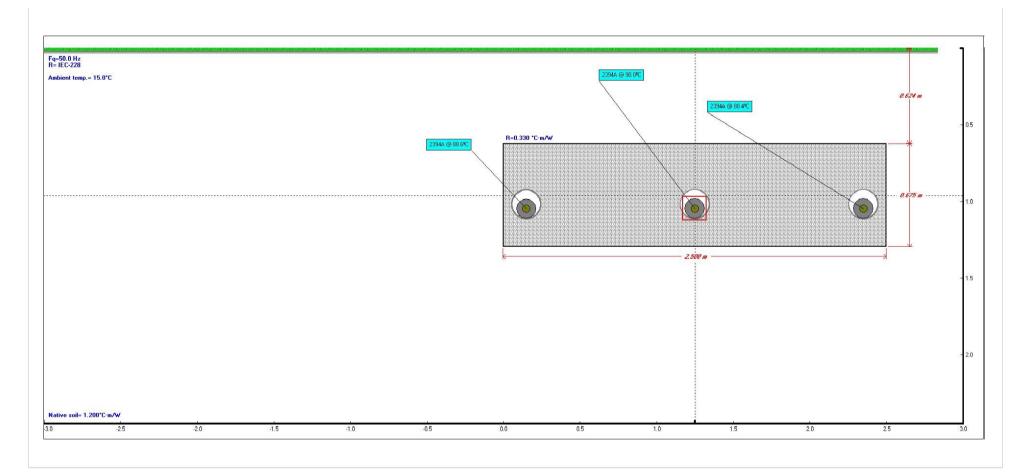
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### Study Summary

INTERNATIONAL TSD	
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 220kV CABLE) v2
Date:	17/01/2020 16:09:59

General Simulation Data	
Steady State Option	Equally Loaded
Consider Electrical interaction between circuits	No
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0
Conductor Resistances Computation Option:	IEC-228

Installation Type:Ductbank				
Ambient Soil Temperature at Installation Depth	[°C]	15.0		
Native Soil Thermal Resistivity	[K.m/W]	1.2		
Thermal Resistivity of Duct Bank	[K.m/W]	0.3		
Depth of Center of Duct Bank	[m]	0.96		
Duct Bank Width	[m]	2.5		
Duct Bank Height	[m]	0.68		



Results Summary										
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [m]	Y coordinate [m]	temperature [°C]	Ampacity [A]
1	220KV.011	1		А	50.0	1.0	0.15	1.05	88.6	2393.6
2	220KV.011	1		В	50.0	1.0	1.25	1.05	90.0	2393.6
3	220KV.011	1		С	50.0	1.0	2.35	1.05	88.4	2393.6

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### Steady State Summary

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 220kV CABLE) v2
Date:	17/01/2020 16:09:59

Simulation Data	
Installation type:	Ductbank
Steady State Option	Equally Loaded
Ambient temperature [°C]	15
Native Soil Thermal Resistivity [K.m/W]	1.2
Consider Non-Isothermal Earth Surface	No
Consider effect of soil dry out	No
Consider Electrical interaction between circuits	No
Induced current in metallic layers as a fraction of conductor current (applied to all single phase circuits)	0

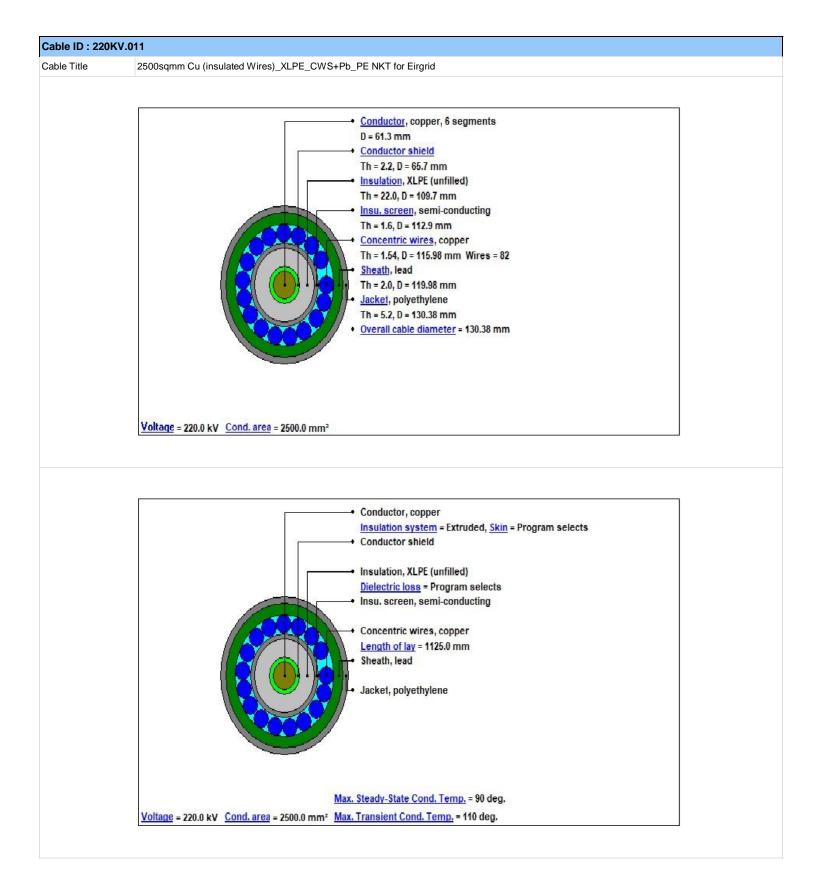
Variable	e Description	Unit		Cables	
Cable No.	Cable Index Number		1	2	3
General Inpu	it Data				-
Cable ID	Cable Equipment ID		220KV.011	220KV.011	220KV.011
Circuit No.	Circuit No.		1	1	1
Phase	Cable Phase		А	В	С
Fq	Operating Frequency	[Hz]	50.0	50.0	50.0
x	X coordinate	[m]	0.15	1.25	2.35
у	Y coordinate	[m]	1.05	1.05	1.05
DLF	Daily Load Factor	[p.u.]	1.0	1.0	1.0
	Bonding Type		1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat
Ampacity		<u>.</u>			
I	Steady State Ampacity	[A]	2393.6	2393.6	2393.6
Femperature	25	<u>.</u>			
θс	Conductor temperature	[°C]	88.6	90.0	88.4
θs	Sheath/Shield temperature	[°C]	68.6	69.9	68.4
θа	Armour temperature	[°C]	n/a	n/a	n/a
θsurf	Cable surface temperature	[°C]	65.7	67.1	65.6
θduct	Duct surface temperature	[°C]	49.0	50.4	48.9
Resistances					
R <sub>0</sub>	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
R	AC Resistance of the Conductor at Operating Temperature	[Ω/km]	0.01015	0.01019	0.01015
ys	Skin Effect Factor		0.10997	0.1091	0.11008
ур	Proximity Effect Factor		0.00045	0.00045	0.00045
osses		<u>.</u>			
Wc	Conductor Losses	[W/m]	58.1547	58.36176	58.12696
Wd	Dielectric Losses	[W/m]	1.37316	1.37316	1.37316
Ws	Metallic Screen Losses	[W/m]	2.13098	1.99507	1.76077
Wa	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
Wt	Total Losses	[W/m]	61.65884	61.72998	61.26089
$\hat{\lambda}_1$	Screen Loss Factor		0.03664	0.03418	0.03029
$\lambda_2$	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
Thermal resi	istances				
T1	Thermal resistance of insulation	[K.m/W]	0.3402	0.3402	0.3402
T2	Thermal resistance of bedding/medium inside pipe-type	[K.m/W]	n/a	n/a	n/a
Т3	Thermal resistance of outer covering	[K.m/W]	0.04631	0.04631	0.04631
T4	External thermal resistance	[K.m/W]	0.82266	0.84331	0.82548
Others				·	·
Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
	Induced current on Metallic Screen	[A]	143.3	130.3	129.7

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CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 220kV CABLE) v2
Date:	17/01/2020 16:09:59

	Description	Unit	1	
Gene	eral Cable Information			
1	Cable Equipment ID		220KV.011	
2	Number of Cores		Single Core	
	Voltage	[kV]	220	
4	Conductor Area	[mm <sup>2</sup> ]	2500.0	
	Cable Overall Diameter		130.38	
<u> </u>	Maximum Steady-State Conductor Temperature	[mm]	90	
Ŭ	Maximum Emergency Conductor Temperature	[°C]		
	ductor	[°C]	110	
	Material		_	
0	Electrical Resistivity at 20°C		Copper	
Ŭ		[μΩ.cm]	1.7241	
10	Temperature Coefficient at 20°C	[1/K]	0.00393	
	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5	
12	Volumetric Specific Heat (SH)	[J/(K*cm <sup>3</sup> )]	3.45	
15	Construction		6 Segments	
	Conductor Insulation System		Extruded	
15	Milliken Wires Construction		Insulated Wires	
10	Ks (Skin Effect Coefficient)		0.35	
17	Kp (Proximity Effect Coefficient)		0.2	
18	Diameter	[mm]	61.3	
Cond	ductor Shield			
19	Thickness	[mm]	2.2	
20	Diameter	[mm]	65.7	
Insul	lation		ſ	
21	Material		XLPE Unfilled	
22	Thermal Resistivity	[K.m/W]	3.5	
23	Dielectric Loss Factor - ( tan delta )		0.001	
24	Relative Permittivity - ( epsilon )		2.5	
25	Specific Insulation Resistance Constant at $60^\circ F$ - ( K )	[MΩ.km]	65617.	
26	Thickness	[mm]	22.0	
27	Diameter	[mm]	109.7	
Insulation Screen				
Insul	lation Screen			
	lation Screen Material		Semi Conducting Screen	
28		[mm]	Semi Conducting Screen 1.6	
28 29	Material	[mm]		
28 29	Material Thickness Diameter		1.6	
28 29 30 <b>Shea</b>	Material Thickness Diameter		1.6	
28 29 30 <b>Shea</b> 31	Material Thickness Diameter Ath		1.6 112.9	
28 29 30 <b>Shea</b> 31 32	Material Thickness Diameter ath Is Sheath Around Each Core?		1.6 112.9 n/a	
28 29 30 <b>Shea</b> 31 32 33	Material Thickness Diameter Ath Is Sheath Around Each Core? Material	[mm]	1.6 112.9 n/a Lead	
28 29 30 <b>Shea</b> 31 32 33 34	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C	[mm]	1.6 112.9 n/a Lead 21.4	
28 29 30 <b>Shea</b> 31 32 33 34	Material Thickness Diameter Ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C	[mm] [μΩ.cm] [1/K]	1.6 112.9 n/a Lead 21.4 0.004	
28 29 30 <b>Shea</b> 31 32 33 34 35 36	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA)	[mm] [μΩ.cm] [1/K] [K]	1.6 112.9 n/a Lead 21.4 0.004 230	
28 29 30 <b>Shea</b> 31 32 33 34 35 36	Material Thickness Diameter <b>ath</b> Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH)	[mm] [μΩ.cm] [1/K] [K]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45	
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated	
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0	
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98	
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Conc</b>	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a	
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Conc</b> 40 41	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core?	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm]	1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper	
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Conc</b> 40 41 42	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [mm]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241	
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Conc</b> 40 41 42 43	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [mm] [μΩ.cm] [1/K]	1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393	
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Conc</b> 40 40 41 42 43 44	Material Thickness Diameter Thickness Diameter Thickness Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Temperature Coefficient at 20°C	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [mm] [μΩ.cm] [1/K] [K]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393         234.5	
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Conc</b> 40 41 42 43 44	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH)	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [mm] [mm] [mm] [mm] [mm] [mm]	1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393           234.5           3.45	
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Conc</b> 40 41 42 43 44 45 46	Material Thickness Diameter Thickness Diameter Thickness Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corel Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corel Concentric Neutral Vires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [mm] [μΩ.cm] [1/K] [K]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393         234.5         3.45         1125.0	
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Conc</b> 40 41 42 43 44 45 46 47	Material Thickness Diameter Ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [mm] [mm] [mm] [mm] [mm] [mm]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393         234.5         3.45         1125.0         82	
28           29           30           Shea           31           32           33           34           35           36           37           38           39           Conc           40           41           42           43           44           45           46           47           48	Material Thickness Diameter Thickness Diameter Thickness Diameter Thickness Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [M]	1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393           234.5           3.45           1125.0           82           Undefined	
28           29           30           Shea           31           32           33           34           35           36           37           38           39           Concord           40           41           42           43           44           45           46           47           48           49	Material Thickness Diameter Thickness Diameter Thickness Diameter Thickness Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumeter Lectrical Resistivity at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumeter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge Thickness	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)] [N]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393         234.5         3.45         1125.0         82         Undefined         1.54	
28           29           30           Shea           31           32           33           34           35           36           37           38           39           Conce           40           41           42           43           44           45           46           47           48           49           50	Material Thickness Diameter Thickness Diameter Thickness Diameter Thickness Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Timperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge Thickness Diameter	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [M]	1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393           234.5           3.45           1125.0           82           Undefined	
28           29           30           Shea           31           32           33           34           35           36           37           38           39           Concord           40           41           42           43           44           45           46           47           48           49           50           Jack	Material Thickness Diameter Thickness Diameter Thickness Diameter Thickness Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Lectrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge Thickness Diameter	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)] [N]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393         234.5         3.45         1125.0         82         Undefined         1.54         115.98	
28           29           30           Shea           31           32           33           34           35           36           37           38           39           Conce           40           41           42           43           44           45           46           47           48           49           50           Jack           51	Material Thickness Diameter Thickness Diameter Thickness Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Electrical Resistivity at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge Thickness Diameter et Material	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [μΩ.cm] [1/K] [J/(K*cm³)] [m] [mm]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393         234.5         3.45         1125.0         82         Undefined         1.54	
28           29           30           Shea           31           32           33           34           35           36           37           38           39           Conc           40           41           42           43           44           45           46           47           48           49           50           Jack           51           52	Material Thickness Diameter Thickness Diameter Thickness Diameter Thickness Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge Thickness Diameter Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge Thickness Diameter	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [1/K] [J/(K*cm³)] [N]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393         234.5         3.45         1125.0         82         Undefined         1.54         115.98	
28           29           30           Shea           31           32           33           34           35           36           37           38           39           Conc           40           41           42           43           44           45           46           47           48           49           50           Jack           51           52           53	Material Thickness Diameter Thickness Diameter Thickness Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Electrical Resistivity at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge Thickness Diameter et Material	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [μΩ.cm] [1/K] [J/(K*cm³)] [m] [mm]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393         234.5         3.45         1125.0         82         Undefined         1.54         115.98	

No.	Description	Unit	1		
Spec	Specific Installation Data				
55	Cable Equipment ID		220KV.011		
56	Cable Frequency	[Hz]	50		
57	Sheath / Shield Bonding		1 Conductor Crossbonded Flat		
58	Loss Factor Constant (ALOS)		0.3		
59	Minor section length		Crossbonded Unknown Section Lengths UNKNOWN		
60	Duct construction		Polyethylene in Concrete		
61	Duct material thermal resistivity	[K.m/W]	3.5		
62	Inside Diameter of the Duct/Pipe	[mm]	188.0		
63	Outside Diameter of the Duct/Pipe	[mm]	200.0		



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CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 220kV CABLE) v2
Date:	17/01/2020 16:09:59

No.	Description	Unit	Cable No.1	Cable No.2	Cable No.3		
1	Cable Equipment ID		220KV.011	220KV.011	220KV.011		
Resi	Resistances						
2	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072		
3	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00914	0.00918	0.00914		
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.00842	0.00842	0.00842		
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01015	0.01019	0.01015		
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.28869	0.28869	0.28869		
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.34479	0.34633	0.34458		
8	DC Resistance of Concentric Wires at 20°C	[Ω/km]	0.1185	0.1185	0.1185		
9	DC Resistance of Concentric Wires at Operating Temperature	[Ω/km]	0.14113	0.14175	0.14105		
Loss	ses						
10	Conductor Losses	[W/m]	58.1547	58.36176	58.12696		
11	Dielectric Losses	[W/m]	1.37316	1.37316	1.37316		
12	Metallic Screen Losses	[W/m]	2.13098	1.99507	1.76077		
13	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0		
14	Total Losses	[W/m]	61.65884	61.72998	61.26089		
Сара	acitance, Inductance, Impedance						
15	Capacitance	[µF/km]	0.271	0.271	0.271		
16	Inductance of Conductor	[mH/km]	0.76609	0.76609	0.76609		
17	Reactance of Conductor	[Ω/km]	0.24067	0.24067	0.24067		
18	Inductance of Metallic Sheath	[mH/km]	0.58814	0.58814	0.58814		
19	Reactance of Metallic Sheath	[Ω/km]	0.18477	0.18477	0.18477		
20	Positive Sequence Impedance	[Ω/km]	0.010150 + j0.240670	0.010190 + j0.240670	0.010150 + j0.240670		
21	Negative Sequence Impedance	[Ω/km]	0.010150 + j0.240670	0.010190 + j0.240670	0.010150 + j0.240670		
22	Zero Sequence Impedance	[Ω/km]	0.092010 + j0.184770	0.092000 + j0.184770	0.092010 + j0.184770		
23	Surge Impedance	[Ω]	53.17602	53.17602	53.17602		
Othe	rs		Γ				
24	Dielectric Stress at Conductor Surface	[kV/mm]	7.54233	7.54233	7.54233		
25	Dielectric Stress at Insulation Surface	[kV/mm]	4.51715	4.51715	4.51715		
26	Insulation Resistance at 60°F (15.8°C)	[MΩ.km]	14609.00643	14609.00643	14609.00643		
27	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a		
28	Charging Current for One Phase	[A/km]	10.81081	10.81081	10.81081		
29	Charging Capacity of three phase system at Uo	[kvar/km]	4119.47055	4119.47055	4119.47055		
30	Voltage drop for Three Phase System	[V/A/km]	0.01758	0.01764	0.01757		
31	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0		
32	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0		
33	Induced current on Metallic Screen	[A]	143.3	130.3	129.7		

#### CYME

Cable Parameters under Normal Operation

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - WIDE trench (1ct 220kV CABLE) v2
Date:	17/01/2020 16:09:59

No.	Symbol	Description	Unit	Cable No.1	Cable No.2	Cable No.3
1	Symbol	Cable Equipment ID	Onit	220KV.011	220KV.011	220KV.011
	Operation IE	EC 60287-1-1				
Conduc	tor AC Resis	stance				
2	R <sub>0</sub>	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	R'	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00914	0.00918	0.00914
4	dc	Conductor Diameter	[mm]	61.3	61.3	61.3
5	s	Distance Between Conductor Axes	[mm]	1099.99995	1099.99995	1099.99995
6	ks	Factor Used for xs Calculation (Skin Effect)		0.35	0.35	0.35
7	kp	Factor Used for xp Calculation (Proximity Effect) Component of Ys Calculation (Skin Effect)		0.2	0.2	0.2
9	xs xp	Component of Yp Calculation (Skin Effect)		1.65813	1.65454	1.65861
10		Skin Effect Factor		0.10997	0.1091	0.11008
	ys			0.00045	0.00045	0.00045
11 12	ур R	Proximity Effect Factor AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01015	0.01019	0.00045
	ic Losses		[12/111]	0.01013	0.01013	0.01013
13	tanδ	Dielectric Loss Factor		0.001	0.001	0.001
14	ε	Insulation Relative Permitivity		2.5	2.5	2.5
15	С	Cable Capacitance	[µF/km]	0.271	0.271	0.271
16	U <sub>0</sub>	Voltage	[kV]	127.01706	127.01706	127.01706
17	Wd	Cable Dielectric Losses Per Phase	[W/m]	1.37316	1.37316	1.37316
Circulat	ing Loss Fa	ctor	T			
18	Rs	AC Resistance used for Circulating Loss Factor computation	[Ω/km]	0.10014	0.10058	0.10008
19	d	Mean diameter used for Circulating Loss Factor computation	[mm]	116.22348	116.22348	116.22348
20	X	Reactance used for Circulating Loss Factor computation	[Ω/km]	0.18477	0.18477	0.18477
21 22	Xm P	Mutual Reactance	[Ω/km]	0.04355	0.04355	0.04355
22	P Q	Component for Circulating Loss Factor Formula (Clause 2.3.3) Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km] [Ω/km]	0.22832	0.22832	0.22832
23	~	Spacing Factor (applied when spacing between cable uneven or	[۱۱۱۸،۲۲	0.17020	0.17020	0.17020
24	Fspacing	Spacing Factor (applied when spacing between cable uneven or non-equal minor section length)		0.004	0.004	0.004
25	$\lambda'_1$	Screen Loss Factor Caused by Circulating Current		0.03534	0.02928	0.02897
Eddy Lo	oss Factor					
26	Rs	AC Resistance used for Eddy Loss Factor computation	[Ω/km]	0.34479	0.34633	0.34458
27	d	Mean diameter used for Eddy Loss Factor computation	[mm]	117.98	117.98	117.98
28	ρs	Electrical Resistivity used for Eddy Loss Factor computation	[Ω.m]	0.0	0.0	0.0
29	Ds	External diameter used for Eddy Loss Factor computation	[mm]	119.98	119.98	119.98
30	ts	Thickness used for Eddy Loss Factor computation	[mm]	2.0	2.0	2.0
31	β1	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		39.30146	39.21396	39.31324
32 34	gs	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		1.00251	1.0025 0.09071	1.00251 0.09117
	m	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.09112	0.09071	0.00004
35 36	$\lambda_0$ $\Delta_1$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		-0.00939	0.00014	0.00004
37	$\Delta_1$ $\Delta_2$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.0	0.0	0.00242
38	F	Milliken conductor Effect		1.0	1.0	1.0
39	Fpipe	Magnetic effect factor due to pipe		1.0	1.0	1.0
40	Farmour	Magnetic effect factor due to armour		1.0	1.0	1.0
41	λ"1	Screen Loss Factor Caused by Eddy Current		0.00131	0.00491	0.00132
Metallic	Screen Los	s factor	I			
42	$\tilde{\lambda}_1$	Screen Loss Factor		0.03664	0.03418	0.03029
Armour	and Pipe Lo	oss Factor	1			
43	λ₂a	Armour Loss Factor		0.0	0.0	0.0
44	λ <sub>2</sub> pipe	Pipe Loss Factor		0.0	0.0	0.0
46	λ <sub>2</sub>	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
47		Thermal Resistance Between Conductor and Screen	[K.m/W]	0.3402	0.3402	0.3402
48	t <sub>1</sub>	Insulation Thickness Between Conductor and Screen	[mm]	25.8	25.8	25.8
49	ρΤi	Thermal Resistivity of Insulation	[K.m/W]	3.5	3.5	3.5
50	р.:. Т <sub>3</sub>	Thermal Resistance of Jacket/Pipe Coating	[K.m/W]	0.04631	0.04631	0.04631
51	t <sub>3</sub>	Thickness of Jacket/Pipe Coating	[mm]	5.2	5.2	5.2
52	ρTJ	Thermal Resistivity of Jacket/Pipe Coating	[K.m/W]	3.5	3.5	3.5
Cable in	Ducts					
53	U	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		1.87	1.87	1.87
54	V	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		0.312	0.312	0.312
55	Y	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		0.0037	0.0037	0.0037
56	θm	Mean Temperature of the Medium Filling the Space	[°C]	58.4	59.8	58.3
57	T4'	Thermal Resistance of the Medium Inside the Duct/Pipe	[K.m/W]	0.23713	0.23514	0.2373
58	Do	Outside Diameter of the Duct/Pipe	[mm]	200.0	200.0	200.0
59	Di	Inside Diameter of the Duct/Pipe	[mm]	188.0	188.0	188.0
60 61	ρТ Т₄''	Thermal Resistivity of the Duct/Pipe Material Thermal Resistance of the Duct/Pipe	[K.m/W]	3.5 0.03447	3.5 0.03447	3.5 0.03447
62	Τ <sub>4</sub> Τ <sub>4</sub> '''	Thermal Resistance of the Surrounding Medium	[K.m/W] [K.m/W]	0.03447	0.03447	0.03447
		k/Backfill installation	[15:10/04]	0.00100	0.01011	0.00012
63	x	Shorter Side of the Duct Bank/Backfill	[m]	0.675	0.675	0.675
64	y	Longer Side of the Duct Bank/Backfill	[m]	2.5	2.5	2.5
65	rb	Equivalent Radius of Duct Bank/Backfill	[m]	0.85977	0.85977	0.85977
66	LG	Depth of Laying to the Centre of Duct Bank/Backfill	[m]	0.962	0.962	0.962
67	u	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3		1.1189	1.1189	1.1189
68	N	Number of Loaded Cables in the Duct Bank/Backfill		3.0	3.0	3.0
69	ре	Thermal Resistivity of Earth Around the Duct Bank/Backfill	[K.m/W]	1.2	1.2	1.2
70	ρς	Thermal Resistivity of the Duct Bank/Backfill	[K.m/W]	0.33	0.33	0.33
71	T4'''	Thermal Resistance of the Surrounding Medium	[K.m/W]	0.55106	0.57371	0.55372
72	T4	Total External Thermal Resistance	[K.m/W]	0.82266	0.84331	0.82548
70	Alint	Temperature Rise at the Surface of the Cable Due to Other	1001	0.0	0.0	0.0
73 74	Δθint I	Surrounding Elements	[°C]	0.0	0.0	0.0
14		Cable Core Current Ampacity	[A]	2393.6	2393.6	2393.6

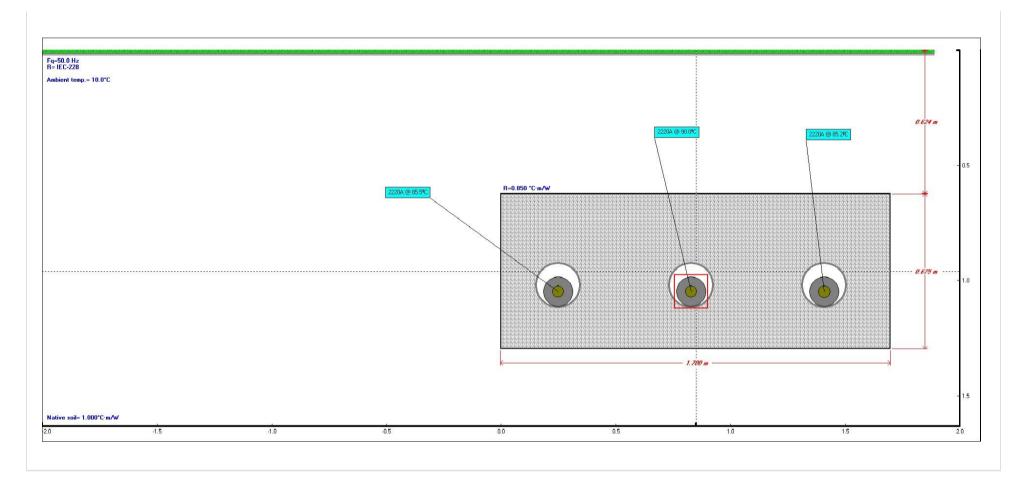
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### Study Summary

INTERNATIONAL TED	
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 220kV CABLE) v2
Date:	18/03/2020 10:45:00

General Simulation Data	
Steady State Option	Equally Loaded
Consider Electrical interaction between circuits	No
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0
Conductor Resistances Computation Option:	IEC-228

Installation Type:Ductbank		
Ambient Soil Temperature at Installation Depth	[°C]	10.0
Native Soil Thermal Resistivity	[K.m/W]	1.0
Thermal Resistivity of Duct Bank	[K.m/W]	0.9
Depth of Center of Duct Bank	[m]	0.96
Duct Bank Width	[m]	1.7
Duct Bank Height	[m]	0.68



Results Summary										
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [m]	Y coordinate [m]	temperature [°C]	Ampacity [A]
1	220KV.011	1		А	50.0	1.0	0.25	1.05	85.5	2219.7
2	220KV.011	1		В	50.0	1.0	0.83	1.05	90.0	2219.7
3	220KV.011	1		С	50.0	1.0	1.41	1.05	85.2	2219.7

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### Steady State Summary

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 220kV CABLE) v2
Date:	18/03/2020 10:45:00

Simulation Data	
Installation type:	Ductbank
Steady State Option	Equally Loaded
Ambient temperature [°C]	10
Native Soil Thermal Resistivity [K.m/W]	1.0
Consider Non-Isothermal Earth Surface	No
Consider effect of soil dry out	No
Consider Electrical interaction between circuits	No
Induced current in metallic layers as a fraction of conductor current (applied to all single phase circuits)	0

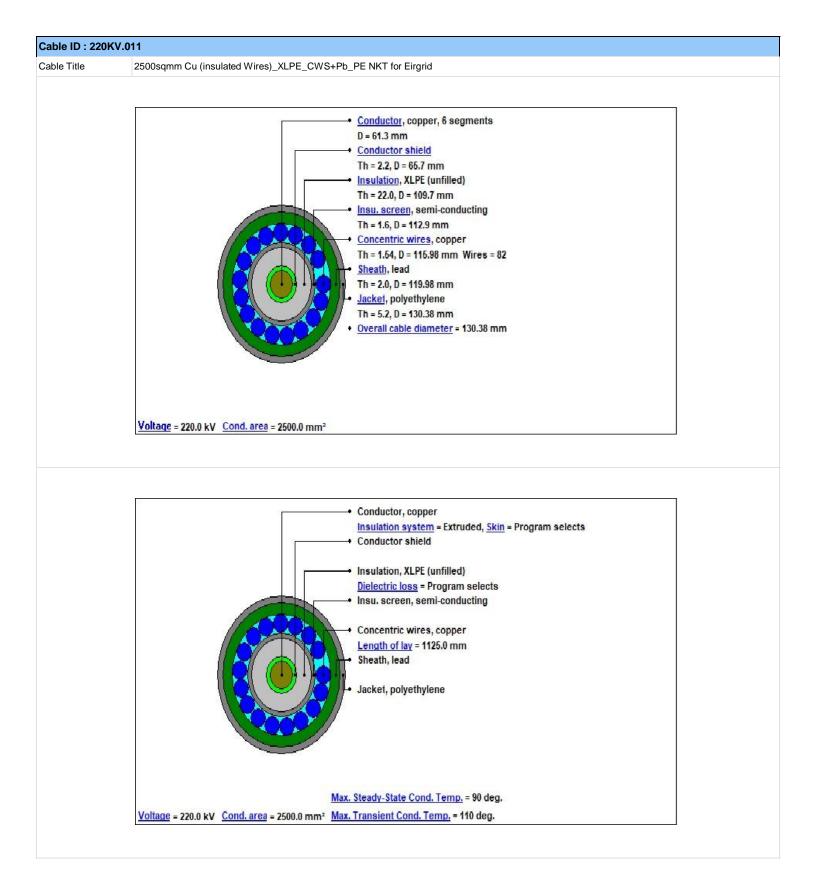
Variable	e Description	Unit		Cables	
Cable No.	Cable Index Number		1	2	3
General Inpu	it Data				-
Cable ID	Cable Equipment ID		220KV.011	220KV.011	220KV.011
Circuit No.	Circuit No.		1	1	1
Phase	Cable Phase		А	В	С
Fq	Operating Frequency	[Hz]	50.0	50.0	50.0
x	X coordinate	[m]	0.25	0.83	1.41
у	Y coordinate	[m]	1.05	1.05	1.05
DLF	Daily Load Factor	[p.u.]	1.0	1.0	1.0
	Bonding Type		1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat
Ampacity					
Ι	Steady State Ampacity	[A]	2219.7	2219.7	2219.7
Femperature	95				
θс	Conductor temperature	[°C]	85.5	90.0	85.2
θs	Sheath/Shield temperature	[°C]	68.3	72.7	68.1
θа	Armour temperature	[°C]	n/a	n/a	n/a
θsurf	Cable surface temperature	[°C]	65.9	70.2	65.6
θduct	Duct surface temperature	[°C]	51.6	56.0	51.5
Resistances					
R <sub>0</sub>	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
R	AC Resistance of the Conductor at Operating Temperature	[Ω/km]	0.01008	0.0102	0.01007
ys	Skin Effect Factor		0.11194	0.1091	0.11211
ур	Proximity Effect Factor		0.00166	0.00162	0.00166
osses					
Wc	Conductor Losses	[W/m]	49.66919	50.24438	49.63503
Wd	Dielectric Losses	[W/m]	1.37316	1.37316	1.37316
Ws	Metallic Screen Losses	[W/m]	1.88015	2.10722	1.48868
Wa	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
Wt	Total Losses	[W/m]	52.9225	53.72476	52.49686
$\lambda_1$	Screen Loss Factor		0.03785	0.04194	0.02999
$\lambda_2$	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
Thermal resi	istances				
T1	Thermal resistance of insulation	[K.m/W]	0.3402	0.3402	0.3402
T2	Thermal resistance of bedding/medium inside pipe-type	[K.m/W]	n/a	n/a	n/a
Т3	Thermal resistance of outer covering	[K.m/W]	0.04631	0.04631	0.04631
Τ4	External thermal resistance	[K.m/W]	1.05581	1.12033	1.05992
Others					
Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
	Induced current on Metallic Screen	[A]	128.8	110.7	112.4

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CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 220kV CABLE) v2
Date:	18/03/2020 10:45:00

No.	Description	Unit	1	
General Cable Information				
1	Cable Equipment ID		220KV.011	
	Number of Cores		Single Core	
	Voltage	[k\/]	220	
0	Conductor Area	[kV]		
-	Cable Overall Diameter	[mm²]	2500.0	
0	Maximum Steady-State Conductor Temperature	[mm]	130.38	
•		[°C]	90	
	Maximum Emergency Conductor Temperature	[°C]	110	
	ductor			
0	Material		Copper	
5	Electrical Resistivity at 20°C	[μΩ.cm]	1.7241	
10	Temperature Coefficient at 20°C	[1/K]	0.00393	
11	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5	
12	Volumetric Specific Heat (SH)	[J/(K*cm <sup>3</sup> )]	3.45	
13	Construction		6 Segments	
14	Conductor Insulation System		Extruded	
15	Milliken Wires Construction		Insulated Wires	
16	Ks (Skin Effect Coefficient)		0.35	
17	Kp (Proximity Effect Coefficient)		0.2	
18	Diameter	[mm]	61.3	
Cond	ductor Shield			
19	Thickness	[mm]	2.2	
	Diameter	[mm]	65.7	
	lation	[·····]		
21	Material		XLPE Unfilled	
	Thermal Resistivity	[[( ~ /\/]	3.5	
	Dielectric Loss Factor - ( tan delta )	[K.m/W]		
20	Relative Permittivity - ( epsilon )		0.001	
24	Specific Insulation Resistance Constant at 60°F - (K)		2.5	
-		[MΩ.km]	65617.	
20	Thickness	[mm]	22.0	
21		[mm]	109.7	
	lation Screen			
	Material			
20	Material		Semi Conducting Screen	
29	Thickness	[mm]	Semi Conducting Screen 1.6	
29 30	Thickness Diameter	[mm]		
29	Thickness Diameter		1.6	
29 30 Shea	Thickness Diameter		1.6	
29 30 <b>Shea</b> 31	Thickness Diameter <b>ath</b>		1.6 112.9	
29 30 <b>Shea</b> 31 32	Thickness Diameter ath Is Sheath Around Each Core?		1.6 112.9 n/a	
29 30 <b>Shea</b> 31 32	Thickness Diameter ath Is Sheath Around Each Core? Material	[mm]	1.6 112.9 n/a Lead	
29 30 <b>Shea</b> 31 32 33	Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C	[mm]	1.6 112.9 n/a Lead 21.4	
29 30 <b>Shea</b> 31 32 33 34	Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C	[mm] [μΩ.cm] [1/K]	1.6 112.9 n/a Lead 21.4 0.004	
29 30 <b>Shea</b> 31 32 33 34 35	Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA)	[mm] [μΩ.cm] [1/K] [K]	1.6 112.9 n/a Lead 21.4 0.004 230	
29 30 <b>Shea</b> 31 32 33 34 35 36	Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH)	[mm] [μΩ.cm] [1/K] [K]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45	
29 30 <b>Shea</b> 31 32 33 34 35 36 37 38	Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH)	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated	
29 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39	Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0	
29 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Conce</b>	Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0	
29 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Conc</b>	Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98	
29           30           Shear           31           32           33           34           35           36           37           38           39           Conc           40           41	Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core?	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a	
29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Conc</b> 40 41 42	Thickness Diameter Thickness Diameter Thickness Diameter Thickness Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [mm]	1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper	
29       29       30       Sheat       31       32       33       34       35       36       37       38       39       Const       40       41       42       43	Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [mm] [μΩ.cm] [1/K]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393	
29           30           Sheea           31           32           33           34           35           36           37           38           39           Conce           40           41           42           43           44	Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241 0.00393 234.5	
29       29       30       Sheat       31       32       33       34       35       36       37       38       39       Conc       40       41       42       43       44       45	Thickness Diameter Ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [mm] [mm] [1/K] [μΩ.cm] [1/K] [J/(K*cm³)]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393         234.5         3.45	
29       29       30       Sheat       31       32       33       34       35       36       37       38       39       Control       40       41       42       43       44       45       46	Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH)	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241 0.00393 234.5 3.45 1125.0	
29       29       30       Sheat       31       32       33       34       35       36       37       38       39       Control       40       41       42       43       44       45       46       47	Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [mm] [mm] [1/K] [μΩ.cm] [1/K] [J/(K*cm³)]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241 0.00393 234.5 3.45 1125.0 82	
29       29       30       Shee       31       32       33       34       35       36       37       38       39       Concord       40       41       42       43       44       45       46       47       48	Thickness Diameter Thickness Diameter Thickness Diameter Thickness Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Wire Gauge	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241 0.00393 234.5 3.45 1125.0 82 Undefined	
29       29       30       Sheea       31       32       33       34       35       36       37       38       39       Conc       40       41       42       43       44       45       46       47       48       49	Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393         234.5         3.45         1125.0         82         Undefined         1.54	
29       29       30       Sheat       31       32       33       34       35       36       37       38       39       Cont       40       41       42       43       44       45       46       47       48       49       50	Thickness Diameter Thickness Diameter Th Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Lectrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge Thickness	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241 0.00393 234.5 3.45 1125.0 82 Undefined	
29       29       30       Sheat       31       32       33       34       35       36       37       38       39       Cont       40       41       42       43       44       45       46       47       48       49       50       Jack	Thickness Diameter Thickness Diameter Thickness Diameter Thickness Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Lectrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Uire Gauge Thickness Diameter	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393         234.5         3.45         1125.0         82         Undefined         1.54	
29       29       30       Sheat       31       32       33       34       35       36       37       38       39       Cont       40       41       42       43       44       45       46       47       48       49       50       Jack	Thickness Diameter Thickness Diameter Thickness Diameter Thickness Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Lectrical Resistivity at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Lectrical Resistivity at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge Thickness Diameter Cet	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393         234.5         3.45         1125.0         82         Undefined         1.54	
29       29       30       Sheat       31       32       33       34       35       36       37       38       39       Conc       40       41       42       43       44       45       46       47       48       49       50       Jack	Thickness Diameter Thickness Diameter Thickness Diameter Thickness Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Lectrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Uire Gauge Thickness Diameter	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241 0.00393 234.5 3.45 1125.0 82 Undefined 1.54 115.98	
29       29       30       Sheat       31       32       33       34       35       36       37       38       39       Const       40       41       42       43       44       45       46       47       48       49       50       51	Thickness Diameter Thickness Diameter Thickness Diameter Thickness Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Lectrical Resistivity at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Lectrical Resistivity at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge Thickness Diameter Cet	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm³)] [mm] [mm] [μΩ.cm] [μΩ.cm] [1/K] [J/(K*cm³)] [mm] [mm] [mm]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393         234.5         3.45         1125.0         82         Undefined         1.54         115.98	

No.	Description	Unit	1	
Specific Installation Data				
55	Cable Equipment ID		220KV.011	
56	Cable Frequency	[Hz]	50	
57	Sheath / Shield Bonding		1 Conductor Crossbonded Flat	
58	Loss Factor Constant (ALOS)		0.3	
59	Minor section length		Crossbonded Unknown Section Lengths UNKNOWN	
60	Duct construction		Polyethylene in Concrete	
61	Duct material thermal resistivity	[K.m/W]	3.5	
62	Inside Diameter of the Duct/Pipe	[mm]	188.0	
63	Outside Diameter of the Duct/Pipe	[mm]	200.0	



CU	11	-
	10	-
INTERNA	TIONAL	TED

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 220kV CABLE) v2
Date:	18/03/2020 10:45:00

No.	Description	Unit	Cable No.1	Cable No.2	Cable No.3					
1	Cable Equipment ID		220KV.011	220KV.011	220KV.011					
Resi	Resistances									
2	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072					
3	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00905	0.00918	0.00904					
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.00843	0.00843	0.00843					
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01008	0.0102	0.01007					
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.28869	0.28869	0.28869					
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.3445	0.34952	0.3442					
8	DC Resistance of Concentric Wires at 20°C	[Ω/km]	0.1185	0.1185	0.1185					
9	DC Resistance of Concentric Wires at Operating Temperature	[Ω/km]	0.14101	0.14304	0.14089					
Loss	ses									
10	Conductor Losses	[W/m]	49.66919	50.24438	49.63503					
11	Dielectric Losses	[W/m]	1.37316	1.37316	1.37316					
12	Metallic Screen Losses	[W/m]	1.88015	2.10722	1.48868					
13	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0					
14	Total Losses	[W/m]	52.9225	53.72476	52.49686					
Сара	acitance, Inductance, Impedance									
15	Capacitance	[µF/km]	0.271	0.271	0.271					
16	Inductance of Conductor	[mH/km]	0.63808	0.63808	0.63808					
17	Reactance of Conductor	[Ω/km]	0.20046	0.20046	0.20046					
18	Inductance of Metallic Sheath	[mH/km]	0.46013	0.46013	0.46013					
19	Reactance of Metallic Sheath	[Ω/km]	0.14455	0.14455	0.14455					
20	Positive Sequence Impedance	[Ω/km]	0.010080 + j0.200460	0.010200 + j0.200460	0.010070 + j0.200460					
21	Negative Sequence Impedance	[Ω/km]	0.010080 + j0.200460	0.010200 + j0.200460	0.010070 + j0.200460					
22	Zero Sequence Impedance	[Ω/km]	0.092020 + j0.144550	0.092000 + j0.144550	0.092020 + j0.144550					
23	Surge Impedance	[Ω]	48.53043	48.53043	48.53043					
Othe	rs		Γ							
24	Dielectric Stress at Conductor Surface	[kV/mm]	7.54233	7.54233	7.54233					
25	Dielectric Stress at Insulation Surface	[kV/mm]	4.51715	4.51715	4.51715					
26	Insulation Resistance at 60°F (15.8°C)	[MΩ.km]	14609.00643	14609.00643	14609.00643					
27	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a					
28	Charging Current for One Phase	[A/km]	10.81081	10.81081	10.81081					
29	Charging Capacity of three phase system at Uo	[kvar/km]	4119.47055	4119.47055	4119.47055					
30	Voltage drop for Three Phase System	[V/A/km]	0.01746	0.01766	0.01745					
31	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0					
32	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0					
33	Induced current on Metallic Screen	[A]	128.8	110.7	112.4					

## CYME

Cable Parameters under Normal Operation

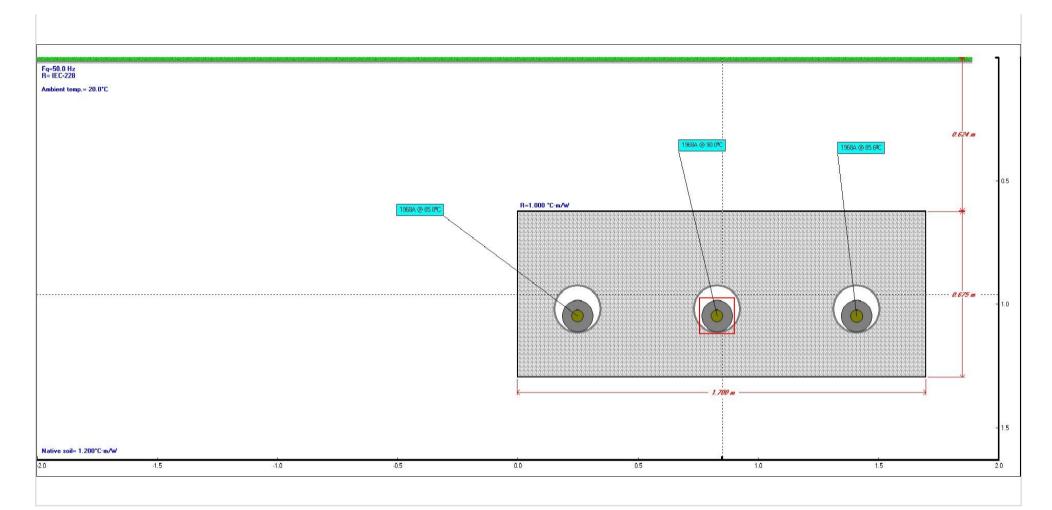
INTERNATIONAL ISD	
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 220kV CABLE) v2
Date:	18/03/2020 10:45:00

No.	Symbol	Description	Unit	Cable No.1	Cable No.2	Cable No.3			
1	Symbol	Cable Equipment ID	onn	220KV.011	220KV.011	220KV.011			
Normal	Operation IE	C 60287-1-1							
Conductor AC Resistance									
2	R <sub>0</sub>	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072			
3	R'	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00905	0.00918	0.00904			
4	dc s	Conductor Diameter Distance Between Conductor Axes	[mm] [mm]	61.3 580.0	61.3 580.0	61.3 580.0			
6	ks	Factor Used for xs Calculation (Skin Effect)	[[1]]	0.35	0.35	0.35			
7	kp	Factor Used for xp Calculation (Proximity Effect)		0.2	0.2	0.2			
8	xs	Component of Ys Calculation (Skin Effect)		2.20424	2.18875	2.20517			
9	хр	Component of Yp Calculation (Proximity Effect)		1.66625	1.65454	1.66695			
10	ys	Skin Effect Factor		0.11194	0.1091	0.11211			
11	ур	Proximity Effect Factor		0.00166	0.00162	0.00166			
12	R	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01008	0.0102	0.01007			
	ic Losses		1	0.004	0.004	0.004			
13 14	tanδ ε	Dielectric Loss Factor Insulation Relative Permitivity		0.001 2.5	0.001 2.5	0.001 2.5			
15	С	Cable Capacitance	[µF/km]	0.271	0.271	0.271			
16	Uo	Voltage	[kV]	127.01706	127.01706	127.01706			
17	Wd	Cable Dielectric Losses Per Phase	[W/m]	1.37316	1.37316	1.37316			
Circulat	ing Loss Fac	tor	[						
18	Rs	AC Resistance used for Circulating Loss Factor computation	[Ω/km]	0.10006	0.1015	0.09997			
19	d	Mean diameter used for Circulating Loss Factor computation	[mm]	116.22348	116.22348	116.22348			
20 21	X Xm	Reactance used for Circulating Loss Factor computation Mutual Reactance	[Ω/km] [Ω/km]	0.14455	0.14455	0.14455			
21	P	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.04355	0.18811	0.18811			
23	Q	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.13004	0.13004	0.13004			
	_	Spacing Factor (applied when spacing between cable uneven or non-							
24	Fspacing	equal minor section length)		0.004	0.004	0.004			
25 Eddy Lo	λ' <sub>1</sub> ss Factor	Screen Loss Factor Caused by Circulating Current		0.03344	0.02474	0.02545			
26	Rs	AC Resistance used for Eddy Loss Factor computation	[Ω/km]	0.3445	0.34952	0.3442			
27	d	Mean diameter used for Eddy Loss Factor computation	[mm]	117.98	117.98	117.98			
28	ρs	Electrical Resistivity used for Eddy Loss Factor computation	[Ω.m]	0.0	0.0	0.0			
29	Ds	External diameter used for Eddy Loss Factor computation	[mm]	119.98	119.98	119.98			
30	ts	Thickness used for Eddy Loss Factor computation	[mm]	2.0	2.0	2.0			
31	β1	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		39.31816	39.03469	39.3352			
32 34	gs m	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		1.00251 0.09119	1.00248 0.08988	1.00251 0.09127			
34	۲۰ ۸ <sub>0</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.00013	0.0005	0.00013			
36	Δ <sub>1</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		-0.01888	0.00008	0.0088			
37	Δ <sub>2</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.0	0.0	0.0			
	-			0.0		0.0			
38	F	Milliken conductor Effect		1.0	1.0	1.0			
	F Fpipe								
38 39 40	F Fpipe Farmour	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour		1.0 1.0 1.0	1.0 1.0 1.0	1.0 1.0 1.0			
38 39 40 41	F Fpipe	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current		1.0 1.0	1.0 1.0	1.0 1.0			
38 39 40 41	F Fpipe Farmour λ"1	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current		1.0 1.0 1.0	1.0 1.0 1.0	1.0 1.0 1.0			
38 39 40 41 <b>Metallic</b> 42	F Fpipe Farmour λ"1 Screen Loss	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current Stactor Screen Loss Factor		1.0 1.0 1.0 0.00441	1.0 1.0 1.0 0.0172	1.0 1.0 1.0 0.00454			
38 39 40 41 <b>Metallic</b> 42	F Fpipe Farmour $\lambda_1^n$ Screen Loss $\lambda_1$	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current Stactor Screen Loss Factor		1.0 1.0 1.0 0.00441	1.0 1.0 1.0 0.0172	1.0 1.0 1.0 0.00454			
38 39 40 41 <b>Metallic</b> 42 <b>Armour</b>	F           Fpipe           Farmour           λ"1           Screen Loss           λ1           and Pipe Loss	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Screen Loss Factor		1.0 1.0 1.0 0.00441	1.0 1.0 1.0 0.0172 0.04194	1.0 1.0 1.0 0.00454 0.02999			
38 39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43 44	F Fpipe Farmour $\lambda_{1}^{*}$ Screen Loss $\lambda_{1}$ and Pipe Los $\lambda_{2}a$ $\lambda_{2}pipe$ $\lambda_{2}$	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>s factor</b> Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor		1.0 1.0 0.00441 0.03785	1.0 1.0 0.0172 0.04194	1.0 1.0 0.00454 0.02999 0.0			
38 39 40 41 Metallic 42 Armour 43 44 46 Normal 0	F Fpipe Farmour $\lambda$ "1 Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ a $\lambda_2$ pipe $\lambda_2$ Operation IEC	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-2-1		1.0 1.0 0.00441 0.03785 0.0 0.0 0.0	1.0 1.0 0.0172 0.04194 0.0 0.0 0.0	1.0 1.0 0.00454 0.02999 0.0 0.0 0.0			
38 39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43 44 46 <b>Normal</b> 0 47	F Fpipe Farmour $\lambda_{1}^{*}$ Screen Loss $\lambda_{1}$ and Pipe Los $\lambda_{2}$ $\lambda_{2}$ $\lambda_{2}$ pipe $\lambda_{2}$ Operation IEC $T_{1}$	Miliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current <b>s factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor         Pipe Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen	[K.m/W]	1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.0	1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.3402	1.0 1.0 0.00454 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38 39 40 41 Metallic 42 Armour 43 44 46 Normal 0	F Fpipe Farmour $\lambda$ "1 Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ a $\lambda_2$ pipe $\lambda_2$ Operation IEC	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-2-1	[K.m/W] [mm] [K.m/W]	1.0 1.0 0.00441 0.03785 0.0 0.0 0.0	1.0 1.0 0.0172 0.04194 0.0 0.0 0.0	1.0 1.0 0.00454 0.02999 0.0 0.0 0.0			
38 39 40 41 <b>Metallic</b> 42 <b>Armour</b> 43 44 46 <b>Normal</b> 47 48	F Fpipe Farmour $\lambda$ " <sub>1</sub> Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ a $\lambda_2$ pipe $\lambda_2$ Operation IE( T <sub>1</sub> t <sub>1</sub>	Milliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current         stactor         Screen Loss Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor + Pipe Loss Factor         C 60287-2-1         Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen	[mm]	1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.3402 25.8	1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.3402 25.8	1.0 1.0 0.00454 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38           39           40           41           Metallic           42           Armour           43           44           46           Normal 0           47           48           49	F           Fpipe           Farmour $\lambda_{"1}$ Screen Loss $\lambda_1$ and Pipe Los $\lambda_2 a$ $\lambda_2 pipe$ $\lambda_2$ Operation IE0 $T_1$ $t_1$ $\rho$ Ti	Milliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current         a factor         Screen Loss Factor         space         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor         Pipe Loss Factor         C 60287-2-1         Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Thermal Resistivity of Insulation	[mm] [K.m/W]	1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00454 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38           39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52	$F$ Fpipe Farmour $\lambda^{"_1}$ Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ and Pipe Los $\lambda_2$ operation IE $T_1$ $T_1$ $T_1$ $T_3$ $t_3$ $\rho$ TJ	Milliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current         afactor         Screen Loss Factor         Screen Loss Factor         Screen Loss Factor         Pipe Loss Factor         Pipe Loss Factor         C 60287-2-1         Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Thermal Resistivity of Insulation         Thermal Resistance of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W]	1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00454 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38         39           40         41           Metallic         42           Armour         43           44         46           Normal         47           48         49           50         51           52         Cable in	$F$ Fpipe Farmour $\lambda$ "1 Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ and Pipe Los $\lambda_2$ Operation IEC $T_1$ $t_1$ $\rho$ Ti $T_3$ $t_3$ $\rho$ TJ Ducts	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Armour Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W] [mm]	1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5	1.0 1.0 0.00454 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38           39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53	F       Fpipe       Farmour $\lambda$ "1       Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ $\lambda_2$ Operation IEC       T1       t1 $\rho$ Ti       T3       t3 $\rho$ TJ       Ducts       U	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Armour Loss Factor Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm]	1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5	1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5	1.0 1.0 0.00454 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38         39           40         41           Metallic         42           Armour         43           44         46           Normal         47           48         49           50         51           52         Cable in	$F$ Fpipe Farmour $\lambda$ "1 Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ and Pipe Los $\lambda_2$ Operation IEC $T_1$ $t_1$ $\rho$ Ti $T_3$ $t_3$ $\rho$ TJ Ducts	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Armour Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W] [mm]	1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5	1.0 1.0 0.00454 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38           39           40           41           Metallic           42           Armour           43           44           46           Normal 0           47           48           49           50           51           52           Cable in           53           54	F       Fpipe       Farmour $\lambda_{"1}$ Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ $\lambda_2$ pipe $\lambda_2$ Operation IEC       T <sub>1</sub> t <sub>1</sub> $\rho$ Ti       T <sub>3</sub> t <sub>3</sub> $\rho$ TJ       Ducts       U       V	Milliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current <b>a factor</b> Screen Loss Factor <b>s Factor</b> Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor + Pipe Loss Factor         C 60287-2-1         Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Thermal Resistance of Jacket/Pipe Coating         Thickness of Jacket/Pipe Coating         Thermal Resistivity of Jacket/Pipe Coating         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm]	1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00454 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38         39           40         41           Metallic         42           Armour         43           44         46           Normal 0         47           48         49           50         51           52         Cable in           53         54           55         54	F         Fpipe         Farmour $\lambda_{"1}$ Screen Loss $\lambda_1$ and Pipe Los $\lambda_2 a$ $\lambda_2 pipe$ $\lambda_2$ Operation IE0         T <sub>1</sub> t <sub>1</sub> ρTi         T <sub>3</sub> t <sub>3</sub> ρTJ         Ducts         U         V         Y	Milliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current         afactor         Screen Loss Factor         s Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor + Pipe Loss Factor         C 60287-2-1         Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Thermal Resistance of Jacket/Pipe Coating         Thermal Resistivity of Insulation         Thermal Resistivity of Jacket/Pipe Coating         Thermal Resistivity of Jacket/Pipe Coating         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm] [K.m/W]	1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00454 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38           39           40           41           Metallic           42           Armour           43           44           46           Normal 0           47           48           49           50           51           52           Cable in           53           54           55           56	F         Fpipe         Farmour $\lambda_{"1}$ Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ a $\lambda_2$ pipe $\lambda_2$ Operation IE0         T <sub>1</sub> t <sub>1</sub> $\rho$ Ti         T <sub>3</sub> t <sub>3</sub> $\rho$ TJ         Ducts         U         V         Y $\theta$ m	Milliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current <b>a factor</b> Screen Loss Factor <b>s Factor</b> Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Thermal Resistance of Jacket/Pipe Coating         Thickness of Jacket/Pipe Coating         Thermal Resistivity of Losdet/Pipe Coating         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Mean Temperature of the Medium Filling the Space	[mm] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00454 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38           39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59	F         Fpipe         Farmour $\lambda_{1}^{*1}$ Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ $\lambda_2$ $\lambda_2$ $\rho$ pipe $\lambda_2$ Operation IE0         T <sub>1</sub> t <sub>1</sub> $\rho$ Ti         T <sub>3</sub> t <sub>3</sub> $\rho$ TJ         U         V         Y $\theta$ m         T <sub>4</sub> '         Do         Di	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>5 factor</b> Screen Loss Factor Screen Loss Factor <b>5 factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [%C] [%C] [K.m/W] [mm] [mm]	1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38         39           39         40           41         Metallic           42         Armour           43         44           46         Normal 0           47         48           49         50           51         52           Cable in         53           54         55           56         57           58         59           60         60	F         Fpipe         Farmour $\lambda_{1}$ Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ $\lambda_2$ pipe $\lambda_2$ Operation IE0         T1         t1 $\rho$ Ti         T3         t3 $\rho$ TJ         Ducts         U         V         Y $\theta$ m         T4'         Do         Di $\rho$ T	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>5 factor</b> Screen Loss Factor Screen Loss Factor <b>5 Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Material	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [°C] [°C] [K.m/W] [mm] [mm] [K.m/W]	1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.0454 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38           39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59	F           Fpipe           Farmour           λ"1           Screen Loss           λ1           and Pipe Los           λ2           Operation IE0           Τ1           t1           ρTi           T3           t3           ρTJ           Ducts           U           Y           θm           T4'           Do           Di           ρT	Milliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor <b>sreactor</b> Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Thermal Resistivity of Insulation         Thermal Resistance of Jacket/Pipe Coating         Thickness of Jacket/Pipe Coating         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Mean Temperature of the Medium Filling the Space         Thermal Resistance of the Medium Inside the Duct/Pipe         Outside Diameter of the Duct/Pipe         Inside Diameter of the Duct/Pipe         Thermal Resistivity of the Duct/Pipe         Thermal Resistivity of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [mm] [mm] [K.m/W] [K.m/W]	1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38         39           39         40           41         Metallic           42         Armour           43         44           46         Normal           47         48           49         50           51         52           Cable in         53           54         55           56         57           58         59           60         61           62         62	F           Fpipe           Farmour           λ"1           Screen Loss           λ1           and Pipe Los           λ2           Operation IE0           λ2           Operation IE0           T1           t1           ρTi           T3           t3           ρTJ           U           V           Y           θm           T4"           Do           Di           ρT	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>5 factor</b> Screen Loss Factor Screen Loss Factor <b>5 Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Material	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [°C] [°C] [K.m/W] [mm] [mm] [K.m/W]	1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00454 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38         39           39         40           41         Metallic           42         Armour           43         44           46         Normal           47         48           49         50           51         52           Cable in         53           54         55           56         57           58         59           60         61           62         62	F           Fpipe           Farmour           λ"1           Screen Loss           λ1           and Pipe Los           λ2           Operation IE0           λ2           Operation IE0           T1           t1           ρTi           T3           t3           ρTJ           U           V           Y           θm           T4"           Do           Di           ρT	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor Screen Loss Factor <b>armour Loss Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [mm] [mm] [K.m/W] [K.m/W]	1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00454 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38           39           40           41           Metallic           42           Armour           43           44           46           Normal 0           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in	F         Fpipe         Farmour $\lambda_{1}^{*}$ Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ $\lambda_2$ Operation IE0 $T_1$ $t_1$ $\rho$ Ti $T_3$ $t_3$ $\rho$ TJ         Ducts         U         V         Y $\theta$ m $T_4'$ Do         Di $\rho$ T $\tau_4''$ Do         Di $\rho$ T $\tau_4'''$ $\rho$ T $\tau_4'''$	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>5 factor</b> Screen Loss Factor Screen Loss Factor SFactor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Insulation Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>KBackfill Installation</b>	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [mm] [mm] [mm] [K.m/W] [K.m/W]	1.0 1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00454 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38         39           40         41           Metallic         42           Armour         43           44         46           Normal 0         47           48         49           50         51           52         Cable in           53         54           55         56           57         58           59         60           61         62           Cable in         63           64         65	F         Fpipe         Farmour $\lambda_{1}^{*1}$ Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ $\lambda_2$ Operation IE0 $T_1$ $t_1$ $\rho$ Ti $T_3$ $t_3$ $\rho$ TJ         U         V         Y $\theta$ m $T_4''$ Do         Di $\rho$ T $\tau_4'''$ a Duct Banl         x         y         rb	Milliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current <b>a factor</b> Screen Loss Factor <b>s Factor</b> Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Thermal Resistance of Jacket/Pipe Coating         Thermal Resistance of Jacket/Pipe Coating         Thermal Resistivity of Insulation         Thermal Resistivity of Jacket/Pipe Coating         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Mean Temperature of the Medium Inside the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W] [mm] [mm] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00454 0.02999 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38           39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65           64	F         Fpipe         Farmour $\lambda_1^*$ Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ $\lambda_2$ $\lambda_2$ Operation IE0 $T_1$ $t_1$ $\rho$ Ti $T_3$ $t_3$ $\rho$ TJ         Ducts         U $V$ $\gamma$ $\theta$ m $T_4^{''}$ $Do$ Di $\rho$ T $\tau_4^{'''}$ $a$ Duct Banl $x$ $y$ rb         LG	Milliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current <b>a factor</b> Screen Loss Factor <b>as Factor</b> Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Inhermal Resistance of Jacket/Pipe Coating         Thermal Resistivity of Insulation         Thermal Resistivity of Jacket/Pipe Coating         Thickness of Jacket/Pipe Coating         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Coefficient Used in Lec 60287-2-1 Clause 2.2.7.1         Coefficient Used in Lec bout/Pipe         Inhermal Resistance of the Medium Filling the Space         Thermal Resistance of the Duct/Pipe         Outside Diameter of the Duct/Pipe         Inhermal Resistance of the Duct/Pipe         Thermal Resistance of the Duct/Pipe         Thermal Resistance of the Duct/Pipe         Thermal Resistanc	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00454 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38           39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65           66           67	F         Fpipe         Farmour $\lambda_1^*$ Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ Deration IE0 $\lambda_2$ Operation IE0         T1         t1 $\rho$ Ti         T3         t3 $\rho$ Ti         T3         t3 $\rho$ Ti         T4''         Do         Di $\rho$ T         T4''         T4''         T5         LG         u	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>5 factor</b> Screen Loss Factor Screen Loss Factor <b>5 Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Thermal Resistance of	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [m] [m] [m] [m]	1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38         39           40         41           Metallic         42           Armour         43           44         46           Normal         47           48         49           50         51           52         Cable in           53         54           55         56           57         58           59         60           61         62           Cable in         63           64         65           66         66           67         68	F           Fpipe           Farmour           λ".1           Screen Loss           λ1           and Pipe Los           λ2           Deration IEI           τ1           τ1           τ1           τ1           τ1           τ1           τ3           ρTJ           Ducts           U           γ           θm           T4'           Do           Di           ρT           χ           ψ           κ           γ           θm           T4''           Do           Di           ρT           χ           γ           κ           y           rb           LG           u	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Surrounding Medium KBackfill Installation Shorter Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38           39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65           66           67	F         Fpipe         Farmour $\lambda_1^*$ Screen Loss $\lambda_1$ and Pipe Los $\lambda_2$ Deration IE0 $\lambda_2$ Operation IE0         T1         t1 $\rho$ Ti         T3         t3 $\rho$ Ti         T3         t3 $\rho$ Ti         T4''         Do         Di $\rho$ T         T4''         T4''         T5         LG         u	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>5 factor</b> Screen Loss Factor Screen Loss Factor <b>5 Factor</b> Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Thermal Resistance of	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00454 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38         39           40         41           Metallic         42           Armour         43           44         46           47         48           49         50           51         52           Cable in         53           54         55           56         57           58         59           60         61           62         Cable in           63         64           655         66           67         68           67         68           69         69	F           Fpipe           Farmour           λ".1           Screen Loss           λ1           and Pipe Los           λ2           Deration IEG           T1           t1           τ3           ρTJ           Dructs           U           Y           θm           T4'           Do           Di           ρT           X           Y           fm           X           y           t4           Do           Di           ρT           K           y           t5           LG           u           N           ρe	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current factor Screen Loss Factor Screen Loss Factor Fipe Loss Factor Armour Loss Factor Armour Loss Factor Armour Loss Factor C 00287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Duct/Pipe Cutside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Dutside Diameter of the Duct/Pipe Thermal Resistance of the	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [mm] [mm] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.0375 0.0037 0.0375 0.0037 0.0375 0.0037 0.0375 0.0037 0.0375 0.0037 0.0037 0.0375 0.0037 0.0375 0.0037 0.0355 0.003447 0.03447 0.03647 0.03447 0.03447 0.03655 0.03447 0.03447 0.0375 0.03447 0.03447 0.03447 0.0375 0.03447 0.0375 0.03447 0.03447 0.0375 0.03447 0.0355 0.03447 0.0355 0.04675 1.7 0.47741 0.962 2.01505 3.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1	1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38         39           40         41           Metallic         42           Armour         43           44         46           Normal         44           46         50           51         52           Cable in         53           55         56           57         58           59         60           61         62           Cable in         63           64         65           66         67           68         69           70         70	F           Fpipe           Farmour           λ".1           Screen Loss           λ1           and Pipe Los           λ2           Deration IEG           Τ1           1           τ3           ρTI           Τ3           τ3           ρTJ           U           V           Υ           Θm           T4'           Do           Di           ρT           τ4''           N           γ           H           Λ           O           U           Y           H           Λ           Δ           Υ           H           Λ           Δ           Δ           Δ           Δ           Λ           Λ           Δ           Δ           Δ           Δ           Δ           Δ           Δ           Δ	Milliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor <b>ss Factor</b> Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Thermal Resistance of Jacket/Pipe Coating         Thickness of Jacket/Pipe Coating         Thermal Resistivity of Jacket/Pipe Coating         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Coefficient Used in Lec 00287-2-1 Clause 2.2.7.1         Dutside Diameter of the Duct/Pipe         Thermal Resistance of the Medium Inside the Duct/Pipe         Thermal Resistance of the Duct/Pipe         Thermal Resis	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W] [mm] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00454 0.02999 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38         39           40         41           Metallic         42           Armour         43           44         46           Normal 0         47           48         49           50         51           52         Cable in           53         54           55         56           57         58           59         60           61         62           Cable in         63           64         65           66         67           68         69           70         71           72	F           Fpipe           Farmour           λ"1           Screen Loss           λ1           and Pipe Los           λ2           Deration IE           Λ2           T1           t1           ρTi           T3           t3           ρTJ           U           V           Y           θm           T4'           Do           Di           ρT           τ4''           Do           T4''           Rest           γ           Hont           τ4''           Do           Di           ρT           τ4''           Do           LG           u           N           ρe           ρc           T4''	Miliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current         factor         Screen Loss Factor         Sreen Loss Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor + Pipe Loss Factor         C0287-2-1         Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Thermal Resistivity of Insulation         Thermal Resistivity of Insulation         Thermal Resistivity of Jacket/Pipe Coating         Thickness of Jacket/Pipe Coating         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Detribuide Diameter of the Duct/Pipe         Therm	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00454 0.02999 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			
38         39           40         41           Metallic         42           Armour         43           44         46           Normal 0         47           48         49           50         51           52         Cable in           53         54           55         56           57         58           59         60           61         62           Cable in         63           64         65           66         67           68         69           70         71           70         71	F           Fpipe           Farmour           λ"1           Screen Loss           λ1           and Pipe Los           λ2           Deration IE0           λ2           T1           t1           ρTi           T3           t3           ρTJ           U           V           Y           θm           T4'           Do           Di           ρT           τ4''           Do           X           Y           θm           T4''           Do           Di           ρT           τ4'''           Do           LG           u           N           ρe           ρc           τ4'''	Miliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current <b>factor</b> Screen Loss Factor         SF Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor + Pipe Loss Factor         C 60287-21         Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Thermal Resistivity of Insulation         Thermal Resistivity of Insulation         Thermal Resistivity of Jacket/Pipe Coating         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Coefficient Used in the Duct/Pipe         Thermal Resistance of the Medium Filling the Space         Thermal Resistivity of the Duct/Pipe         Thermal Resistance of the Duct/Pipe         Thermal Resistance o	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	1.0 1.0 1.0 1.0 0.00441 0.03785 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 1.0 0.0172 0.04194 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00454 0.02999 0.02999 0.0 0.0 0.0 0.0 0.0 0.0 0.0			

	Study Summary			
CYMCAP Version	7.3 Revision 2			
Study:	Eirgrid Cp966 Feasibility study			
Execution:	Eirgrid - std trench (1ct 220kV CABLE) v2 - Summer (20C)			
Date:	02/03/2020 15:28:13			

General Simulation Data	
Steady State Option	Equally Loaded
Consider Electrical interaction between circuits	No
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0
Conductor Resistances Computation Option:	IEC-228

Installation Type:Ductbank						
Ambient Soil Temperature at Installation Depth	[°C]	20.0				
Native Soil Thermal Resistivity	[K.m/W]	1.2				
Thermal Resistivity of Duct Bank	[K.m/W]	1.0				
Depth of Center of Duct Bank	[m]	0.96				
Duct Bank Width	[m]	1.7				
Duct Bank Height	[m]	0.68				



Results Summary										
									Conductor	

					Cable	Daily Load	X coordinate	Y coordinate	temperature	
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Frequency	Factor	[m]	[m]	[°C]	Ampacity [A]
1	220KV.011	1		А	50.0	1.0	0.25	1.05	85.8	1967.5
2	220KV.011	1		В	50.0	1.0	0.83	1.05	90.0	1967.5
3	220KV.011	1		С	50.0	1.0	1.41	1.05	85.6	1967.5

### Steady State Summary

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 220kV CABLE) v2 - Summer (20C)
Date:	02/03/2020 15:28:13

### Simulation Data

Simulation Data	
Installation type:	Ductbank
Steady State Option	Equally Loaded
Ambient temperature [°C]	20
Native Soil Thermal Resistivity [K.m/W]	1.2
Consider Non-Isothermal Earth Surface	No
Consider effect of soil dry out	No
Consider Electrical interaction between circuits	No
Induced current in metallic layers as a fraction of conductor current (applied to all single phase circuits)	0

Variable	Description	Unit		Cables	
Cable No.	Cable Index Number		1	2	3
General Inpu	ıt Data				
Cable ID	Cable Equipment ID		220KV.011	220KV.011	220KV.011
Circuit No.	Circuit No.		1	1	1
Phase	Cable Phase		А	В	С
Fq	Operating Frequency	[Hz]	50.0	50.0	50.0
x	X coordinate	[m]	0.25	0.83	1.41
у	Y coordinate	[m]	1.05	1.05	1.05
DLF	Daily Load Factor	[p.u.]	1.0	1.0	1.0
	Bonding Type		1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat
Ampacity		-			
I	Steady State Ampacity	[A]	1967.5	1967.5	1967.5
Temperature	25				
θс	Conductor temperature	[°C]	85.8	90.0	85.6
θs	Sheath/Shield temperature	[°C]	72.3	76.3	72.1
θa	Armour temperature	[°C]	n/a	n/a	n/a
θsurf	Cable surface temperature	[°C]	70.3	74.4	70.1
θduct	Duct surface temperature	[°C]	59.4	63.5	59.2
Resistances		·			
R <sub>0</sub>	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
R	AC Resistance of the Conductor at Operating Temperature	[Ω/km]	0.01009	0.0102	0.01008
ys	Skin Effect Factor		0.11172	0.1091	0.11187
ур	Proximity Effect Factor		0.00166	0.00162	0.00166
osses					
Wc	Conductor Losses	[W/m]	39.05692	39.47495	39.03405
Wd	Dielectric Losses	[W/m]	1.37316	1.37316	1.37316
Ws	Metallic Screen Losses	[W/m]	1.48395	1.6503	1.17305
Wa	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
Wt	Total Losses	[W/m]	41.91402	42.49841	41.58025
$\tilde{\lambda}_1$	Screen Loss Factor		0.03799	0.04181	0.03005
$\lambda_2$	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
Thermal resi	istances				
T1	Thermal resistance of insulation	[K.m/W]	0.3402	0.3402	0.3402
T2	Thermal resistance of bedding/medium inside pipe-type	[K.m/W]	n/a	n/a	n/a
Т3	Thermal resistance of outer covering	[K.m/W]	0.04631	0.04631	0.04631
T4	External thermal resistance	[K.m/W]	1.20096	1.27943	1.20578
Others					
Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
	Induced current on Metallic Screen	[A]	113.9	97.6	99.3

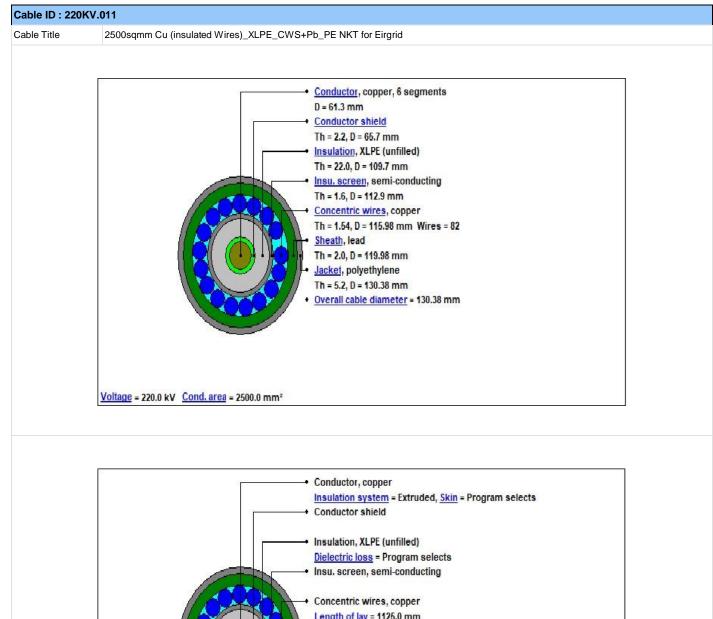
CYME

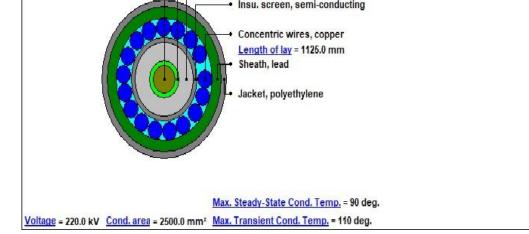
**Cables Report** 

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 220kV CABLE) v2 - Summer (20C)
Date:	02/03/2020 15:28:13

No.	Description	Unit	1
Gen	eral Cable Information		
1	Cable Equipment ID		220KV.011
2	Number of Cores		Single Core
3	Voltage	[kV]	220
4	Conductor Area	[mm²]	2500.0
5	Cable Overall Diameter	[mm]	130.38
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	110
Con	ductor		
8	Material		Copper
9	Electrical Resistivity at 20°C	[μΩ.cm]	1.7241
10	Temperature Coefficient at 20°C	[1/K]	0.00393
	Reciprocal of Temperature Coefficient of Resistance		
11	(BETA)	[K]	234.5
12	Volumetric Specific Heat (SH)	[J/(K*cm <sup>3</sup> )]	3.45
13			6 Segments
14	Conductor Insulation System		Extruded
15	Milliken Wires Construction		Insulated Wires
16	Ks (Skin Effect Coefficient)		0.35
17	Kp (Proximity Effect Coefficient)		0.2
18	Diameter	[mm]	61.3
Con	ductor Shield		
19	Thickness	[mm]	2.2
20	Diameter	[mm]	65.7
Insu	lation		
21	Material		XLPE Unfilled
22	Thermal Resistivity	[K.m/W]	3.5
23	Dielectric Loss Factor - ( tan delta )		0.001
24	Relative Permittivity - ( epsilon )		2.5
25	Specific Insulation Resistance Constant at 60°F - ( K )	[MΩ.km]	65617.
26	Thickness	[mm]	22.0
27	Diameter	[mm]	109.7
Insu	lation Screen		
28	Material		Semi Conducting Screen
29	Thickness	[mm]	1.6
30	Diameter	[mm]	112.9
Shea	ath		
31	Is Sheath Around Each Core?		n/a
32	Material		Lead
33	Electrical Resistivity at 20°C	[μΩ.cm]	21.4
34	Temperature Coefficient at 20°C	[1/K]	0.004
35	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	230
36	Volumetric Specific Heat (SH)	[J/(K*cm <sup>3</sup> )]	1.45
37	Corrugation Type	L-1.1. 011 /]	Non Corrugated
38	Thickness	[mm]	2.0
39	Diameter	[mm]	119.98
	centric neutral/Skid wires	L []	113.30
40	Are Concentric Neutral Wires Around Each Core?		n/a
40	Material		
41	Electrical Resistivity at 20°C	[μΩ.cm]	Copper 1.7241
42	Temperature Coefficient at 20°C		
43	Reciprocal of Temperature Coefficient of Resistance	[1/K]	0.00393
44	(BETA)	[K]	234.5
45	Volumetric Specific Heat (SH)	[J/(K*cm <sup>3</sup> )]	3.45
46	Length of Lay	[mm]	1125.0
47	Number of Wires		82
48	Wire Gauge		Undefined
49	Thickness	[mm]	1.54
50	Diameter	[mm]	115.98
Jack	set		
51	Material		Polyethylene
52	Thermal Resistivity	[K.m/W]	3.5
53	Thickness	[mm]	5.2
54	Diameter	[mm]	130.38

No.	Description	Unit	1				
Specific Installation Data							
55	Cable Equipment ID		220KV.011				
56	Cable Frequency	[Hz]	50				
57	Sheath / Shield Bonding		1 Conductor Crossbonded Flat				
58	Loss Factor Constant (ALOS)		0.3				
59	Minor section length		Crossbonded Unknown Section Lengths UNKNOWN				
60	Duct construction		Polyethylene in Concrete				
61	Duct material thermal resistivity	[K.m/W]	3.5				
62	Inside Diameter of the Duct/Pipe	[mm]	188.0				
63	Outside Diameter of the Duct/Pipe	[mm]	200.0				







CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 220kV CABLE) v2 - Summer (20C)
Date:	02/03/2020 15:28:13

No.	Description	Unit	Cable No.1	Cable No.2	Cable No.3
1	Cable Equipment ID		220KV.011	220KV.011	220KV.011
Resi	stances				
2	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00906	0.00918	0.00906
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.00843	0.00843	0.00843
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01009	0.0102	0.01008
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.28869	0.28869	0.28869
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.34906	0.35375	0.3488
8	DC Resistance of Concentric Wires at 20°C	[Ω/km]	0.1185	0.1185	0.1185
9	DC Resistance of Concentric Wires at Operating Temperature	[Ω/km]	0.14285	0.14475	0.14275
Loss	ies				
10	Conductor Losses	[W/m]	39.05692	39.47495	39.03405
11	Dielectric Losses	[W/m]	1.37316	1.37316	1.37316
12	Metallic Screen Losses	[W/m]	1.48395	1.6503	1.17305
13	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
14	Total Losses	[W/m]	41.91402	42.49841	41.58025
Сара	acitance, Inductance, Impedance				
15	Capacitance	[µF/km]	0.271	0.271	0.271
16	Inductance of Conductor	[mH/km]	0.63808	0.63808	0.63808
17	Reactance of Conductor	[Ω/km]	0.20046	0.20046	0.20046
18	Inductance of Metallic Sheath	[mH/km]	0.46013	0.46013	0.46013
19	Reactance of Metallic Sheath	[Ω/km]	0.14455	0.14455	0.14455
20	Positive Sequence Impedance	[Ω/km]	0.010090 + j0.200460	0.010200 + j0.200460	0.010080 + j0.200460
21	Negative Sequence Impedance	[Ω/km]	0.010090 + j0.200460	0.010200 + j0.200460	0.010080 + j0.200460
22	Zero Sequence Impedance	[Ω/km]	0.092020 + j0.144550	0.092000 + j0.144550	0.092020 + j0.144550
23	Surge Impedance	[Ω]	48.53043	48.53043	48.53043
Othe	ers	Γ	Γ		
24	Dielectric Stress at Conductor Surface	[kV/mm]	7.54233	7.54233	7.54233
25	Dielectric Stress at Insulation Surface	[kV/mm]	4.51715	4.51715	4.51715
26	Insulation Resistance at 60°F (15.8°C)	[MΩ.km]	14609.00643	14609.00643	14609.00643
27	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a
28	Charging Current for One Phase	[A/km]	10.81081	10.81081	10.81081
29	Charging Capacity of three phase system at Uo	[kvar/km]	4119.47055	4119.47055	4119.47055
30	Voltage drop for Three Phase System	[V/A/km]	0.01748	0.01766	0.01747
31	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
32	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
33	Induced current on Metallic Screen	[A]	113.9	97.6	99.3

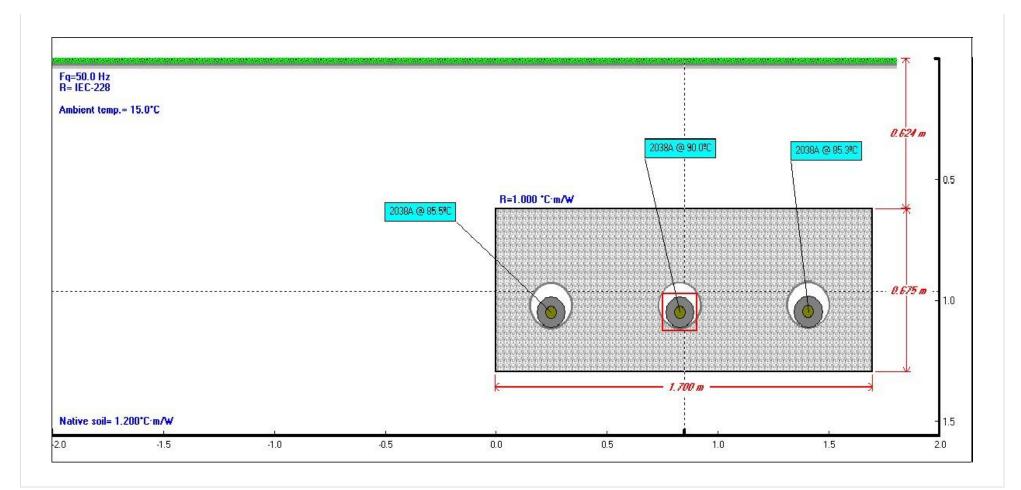
	Cable Parameters under Normal Operation
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 220kV CABLE) v2 - Summer (20C)
Date:	02/03/2020 15:28:13

Ne	Cumbel	Description	Unit	Cobio No 1	Coble No 2	Coble No 2
No. 1	Symbol	Description Cable Equipment ID	Unit	Cable No.1 220KV.011	Cable No.2 220KV.011	Cable No.3 220KV.011
Normal	Operation I	EC 60287-1-1		1		1
Conduc	ctor AC Resi	istance		I		I
2	R <sub>0</sub>	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	R' dc	DC Resistance of Conductor at Operating Temperature Conductor Diameter	[Ω/km]	0.00906	0.00918 61.3	0.00906
4 5	s	Distance Between Conductor Axes	[mm] [mm]	580.0	580.0	580.0
6	ks	Factor Used for xs Calculation (Skin Effect)	[]	0.35	0.35	0.35
7	kp	Factor Used for xp Calculation (Proximity Effect)		0.2	0.2	0.2
8	xs	Component of Ys Calculation (Skin Effect)		2.20306	2.18874	2.20385
9	хр	Component of Yp Calculation (Proximity Effect)		1.66536	1.65454	1.66596
10	ys	Skin Effect Factor		0.11172	0.1091	0.11187
11	ур	Proximity Effect Factor	10.1	0.00166	0.00162	0.00166
12 Dielecti	R ric Losses	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01009	0.0102	0.01008
13	tanδ	Dielectric Loss Factor		0.001	0.001	0.001
14	ε	Insulation Relative Permitivity		2.5	2.5	2.5
15	с	Cable Capacitance	[µF/km]	0.271	0.271	0.271
16	U <sub>0</sub>	Voltage	[kV]	127.01706	127.01706	127.01706
17 Circula	Wd ting Loss Fa	Cable Dielectric Losses Per Phase	[W/m]	1.37316	1.37316	1.37316
18	Rs	AC Resistance used for Circulating Loss Factor computation	[Ω/km]	0.10137	0.10272	0.10129
19	d	Mean diameter used for Circulating Loss Factor computation	[mm]	116.22348	116.22348	116.22348
20	х	Reactance used for Circulating Loss Factor computation	[Ω/km]	0.14455	0.14455	0.14455
21	Xm	Mutual Reactance	[Ω/km]	0.04355	0.04355	0.04355
22	Р	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.18811	0.18811	0.18811
23	Q	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.13004	0.13004	0.13004
24	Fspacing	Spacing Factor (applied when spacing between cable uneven or non- equal minor section length)		0.004	0.004	0.004
25	λ'1	Screen Loss Factor Caused by Circulating Current		0.03364	0.02481	0.02558
Eddy Lo	oss Factor					
26	Rs	AC Resistance used for Eddy Loss Factor computation	[Ω/km]	0.34906	0.35375	0.3488
27 28	d	Mean diameter used for Eddy Loss Factor computation	[mm]	0.0	117.98 0.0	117.98 0.0
20	ρs Ds	Electrical Resistivity used for Eddy Loss Factor computation External diameter used for Eddy Loss Factor computation	[Ω.m] [mm]	119.98	119.98	119.98
30	ts	Thickness used for Eddy Loss Factor computation	[mm]	2.0	2.0	2.0
31	β1	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		39.06026	38.8005	39.07464
32	gs	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		1.00249	1.00246	1.00249
34	m	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.09	0.08881	0.09007
35	λ <sub>o</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.00012	0.00049	0.00012
36 37	$\Delta_1$ $\Delta_2$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		-0.01879	0.00008	0.00872
		Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect		0.0	0.0	
38 39	F Fpipe	Miliken conductor Effect Magnetic effect factor due to pipe		0.0 1.0 1.0	1.0 1.0	1.0 1.0
38	F	Milliken conductor Effect		1.0	1.0	1.0
38 39 40 41	F Fpipe Farmour Å"1	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current		1.0 1.0	1.0 1.0	1.0 1.0
38 39 40 41 Metallic	F Fpipe Farmour λ"1 Screen Los	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor		1.0 1.0 1.0 0.00435	1.0 1.0 1.0 0.017	1.0 1.0 1.0 0.00448
38 39 40 41 <b>Metallic</b> 42	F Fpipe Farmour $\lambda_1^n$ Screen Los $\lambda_1$	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor		1.0 1.0 1.0	1.0 1.0 1.0	1.0 1.0 1.0
38 39 40 41 <b>Metallic</b> 42	F Fpipe Farmour λ"1 Screen Los	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor		1.0 1.0 1.0 0.00435	1.0 1.0 1.0 0.017	1.0 1.0 1.0 0.00448
38 39 40 41 Metallic 42 Armour	F       Fpipe       Farmour       λ"1       Screen Los       λ1       and Pipe Los	Miliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current states Screen Loss Factor Screen Loss Factor Screen Loss Factor		1.0 1.0 1.0 0.00435 0.03799	1.0 1.0 1.0 0.017	1.0 1.0 1.0 0.00448 0.03005
38 39 40 41 Metallic 42 Armour 43	F Fpipe Farmour $\lambda_1^n$ Screen Los $\lambda_1$ and Pipe Lo $\lambda_2 a$	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current station Screen Loss Factor Screen Loss Factor Armour Loss Factor		1.0 1.0 0.00435 0.03799 0.0	1.0 1.0 0.017 0.04181	1.0 1.0 0.00448 0.03005
38           39           40           41           Metallic           42           Armour           43           44           46	F Fpipe Farmour $\lambda_{1}^{n}$ Screen Los $\lambda_{1}$ and Pipe Lo $\lambda_{2}a$ $\lambda_{2}pipe$ $\lambda_{2}$	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current ss factor Screen Loss Factor Ss Factor Armour Loss Factor Pipe Loss Factor		1.0 1.0 0.00435 0.03799 0.0 0.0	1.0 1.0 0.017 0.04181 0.0 0.0	1.0 1.0 0.00448 0.03005 0.0 0.0
38 39 40 41 Metallic 42 Armour 43 44 46 Normal 47	F Fpipe Farmour $\lambda_{1}^{*}$ Screen Los $\lambda_{1}$ and Pipe Lo $\lambda_{2}a$ $\lambda_{2}pipe$ $\lambda_{2}$ Operation II T <sub>1</sub>	Miliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current         ss factor         Screen Loss Factor         pose Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor + Pipe Loss Factor         EC 60287-2-1         Thermal Resistance Between Conductor and Screen	[K.mW]	1.0 1.0 0.00435 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0	1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38           39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48	F Fpipe Farmour $\lambda_{1}^{*}$ Screen Los $\lambda_{1}$ and Pipe Lo $\lambda_{2}a$ $\lambda_{2}pipe$ $\lambda_{2}$ Operation II T <sub>1</sub> t <sub>1</sub>	Miliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current         ss factor         Screen Loss Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor + Pipe Loss Factor         EC 60287-2-1         Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen	[mm]	1.0 1.0 1.0 0.00435 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.3402 25.8	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38 39 40 41 Metallic 42 Armour 43 44 46 Normal 47	F Fpipe Farmour $\lambda_{1}^{*}$ Screen Los $\lambda_{1}$ and Pipe Lo $\lambda_{2}a$ $\lambda_{2}pipe$ $\lambda_{2}$ Operation II T <sub>1</sub>	Miliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current         ss factor         Screen Loss Factor         pose Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor + Pipe Loss Factor         EC 60287-2-1         Thermal Resistance Between Conductor and Screen		1.0 1.0 0.00435 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0	1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38           39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49	$F$ Fpipe Farmour $\lambda_{1}^{*}$ Screen Los $\lambda_{1}$ and Pipe Lo $\lambda_{2}a$ $\lambda_{2}pipe$ $\lambda_{2}$ Operation II $T_{1}$ $t_{1}$ $\rho Ti$	Miliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation	[mm] [K.m/W]	1.0 1.0 1.0 0.00435 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38           39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50	$F$ Fpipe Farmour $\lambda_{1}^{*}$ Screen Los $\lambda_{1}$ and Pipe Lo $\lambda_{2}a$ $\lambda_{2}pipe$ $\lambda_{2}$ Operation II $T_{1}$ $t_{1}$ $\rho Ti$ $T_{3}$	Miliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current         ss factor         Screen Loss Factor         pss Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor + Pipe Loss Factor         EC 60287-2-1         Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Thermal Resistivity of Insulation         Thermal Resistance of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W]	1.0 1.0 1.0 0.00435 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38         39           40         41           Metallic         42           Armour         43           44         46           Normal         47           48         49           50         51           52         Cable in	F           Fpipe           Farmour           λ"1           Screen Los           λ1           and Pipe Lo           λ2a           λ2pipe           λ2           Operation II           T1           t1           ρTi           T3           t3           ρTJ           DUCS	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current sfactor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W] [mm]	1.0 1.0 1.0 0.00435 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38           39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53	F           Fpipe           Farmour           λ"1           Screen Los           λ1           and Pipe Los           λ2pipe           λ2           Operation II           T1           t1           ρTi           T3           t3           ρTJ           Ducts           U	Miliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current s factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm]	1.0 1.0 1.0 0.0435 0.03799 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5	1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38           39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54	F           Fpipe           Farmour           λ"1           Screen Los           λ1           and Pipe Lo           λ20ipe           λ2           Operation II           T1           t1           pTi           T3           t3           pTJ           U           V	Miliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current         ss factor         Screen Loss Factor         pass Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor + Pipe Loss Factor         EC 60287-2-1         Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Thermal Resistance of Jacket/Pipe Coating         Thickness of Jacket/Pipe Coating         Thermal Resistivity of Jacket/Pipe Coating         Thermal Resistivity of Jacket/Pipe Coating         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm]	1.0 1.0 1.0 0.00435 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38           39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53	F           Fpipe           Farmour           λ"1           Screen Los           λ1           and Pipe Los           λ2pipe           λ2           Operation II           T1           t1           ρTi           T3           t3           ρTJ           Ducts           U	Miliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current         ss factor         Screen Loss Factor         pss Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor         Pipe Loss Factor         Pipe Loss Factor         Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Thermal Resistance of Jacket/Pipe Coating         Thickness of Jacket/Pipe Coating         Thermal Resistivity of Jacket/Pipe Coating         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.mW] [K.mW] [mm] [K.mW]	1.0 1.0 1.0 0.0435 0.03799 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5	1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38           39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55	F           Fpipe           Farmour           λ"1           Screen Los           λ1           and Pipe Lo           λ20ipe           λ30ipe           ρTJ           Ducts           U           V           Y	Miliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current         ss factor         Screen Loss Factor         pass Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor + Pipe Loss Factor         EC 60287-2-1         Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Thermal Resistance of Jacket/Pipe Coating         Thickness of Jacket/Pipe Coating         Thermal Resistivity of Jacket/Pipe Coating         Thermal Resistivity of Jacket/Pipe Coating         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm]	1.0 1.0 1.0 0.00435 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38           39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56	F           Fpipe           Farmour           λ",           Screen Los           λ,           and Pipe Lo           λ_2a           λ_2pipe           λ_2           Operation II           T,           t,           q,           pTi           T,           t,           pTi           T,           t,           pTJ           Ducts           U           V           Y           θm	Miliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current         ss factor         Screen Loss Factor         pss Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor         Pipe Loss Factor         Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Thermal Resistance of Jacket/Pipe Coating         Thickness of Jacket/Pipe Coating         Thermal Resistivity of Locket/Pipe Coating         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Mean Temperature of the Medium Filling the Space	[mm] [K.mW] [K.mW] [mm] [K.mW]	1.0 1.0 1.0 0.00435 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38         39           40         41           Metallic         42           Armour         43           44         46           Normal         47           48         49           50         51           52         Cable in           53         54           55         56           57         56	F           Fpipe           Farmour           λ"1           Screen Los           λ1           and Pipe Lo           λ2           Operation II           T1           T1           T1           T3           t3           pTI           Ducts           U           V           Y           0m           T4'	Milliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current         ss factor         Screen Loss Factor         pss Factor         Armour Loss Factor         Pipe Loss Factor         C60287-2-1         Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Thermal Resistance of Jacket/Pipe Coating         Thermal Resistance of Jacket/Pipe Coating         Thermal Resistivity of Insulation         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Mean Temperature of the Medium Filling the Space         Thermal Resistance of the Medium Inside the Duct/Pipe	[mm] [K.mW] [K.mW] [mm] [K.mW]	1.0 1.0 1.0 0.00435 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38         39           39         40           41         Metallic           42         Armour           43         44           46         Normal           47         48           49         50           51         52           Cable in         53           54         55           56         57           58         59           60         60	F           Fpipe           Farmour           λ"1           Screen Los           λ_1           and Pipe Lo           λ_2a           λ_2pipe           λ_2           Operation II           T1           t1           ρTi           T3           t3           pTJ           Ducts           U           V           Y           θm           T4'           Do           Di           q           0           T4'	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current safactor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Material	[mm] [K.mW] [K.mW] [mm] [K.mW] [K.mW] [K.mW] [mm] [mm] [K.mW]	1.0 1.0 1.0 0.00435 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38         39           40         41           Metallic         42           Armour         43           44         46           Normal         47           48         49           50         51           52         Cable in           53         54           55         56           57         58           59         60           61         61	F           Fpipe           Farmour           λ"1           Screen Los           λ1           and Pipe Los           λ2pipe           λ2           Operation II           T1           t1           ρTi           T3           t3           ρTJ           Ducts           U           V           Y           θm           T4'           Do           Di           ρT	Milliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current         ss factor         Screen Loss Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor + Pipe Loss Factor         C 60287-2-1         Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Thermal Resistivity of Insulation         Thermal Resistivity of Jacket/Pipe Coating         Thickness of Jacket/Pipe Coating         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Mean Temperature of the Medium Filling the Space         Thermal Resistance of the Medium Inside the Duct/Pipe         Outside Diameter of the Duct/Pipe         Inside Diameter of the Duct/Pipe         Inside Diameter of the Duct/Pipe         Thermal Resistivity of the Duct/Pipe         Thermal Resistivity of the Duct/Pipe	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [mm] [K.mW] [K.mW]	1.0 1.0 1.0 0.0435 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38           39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62	F           Fpipe           Farmour           λ"1           Screen Los           λ1           and Pipe Los           λ2           Operation II           T1           t1           φTi           T3           t3           φTJ           Ducts           U           V           Y           θm           T4''           Do           Di           φT           T4''	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current safactor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor C 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Material	[mm] [K.mW] [K.mW] [mm] [K.mW] [K.mW] [K.mW] [mm] [mm] [K.mW]	1.0 1.0 1.0 0.00435 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38           39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62	F           Fpipe           Farmour           λ"1           Screen Los           λ1           and Pipe Los           λ2           Operation II           T1           t1           φTi           T3           t3           φTJ           Ducts           U           V           Y           θm           T4''           Do           Di           φT           T4''	Milliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>ss factor</b> Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>EC 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [mm] [K.mW] [K.mW]	1.0 1.0 1.0 0.0435 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38           39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in	F           Fpipe           Farmour           λ"1           Screen Los           λ1           and Pipe Lo           λ2a           λ2pipe           λ2           Operation II           T1           T3           τ3           ρTJ           DUCtS           U           V           Y           θm           T4''           Do           Di           ρT           T4''           Do           Di           ρT           τ4''	Miliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current sa factor Screen Loss Factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor E 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Insulation Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium M/Backfill installation	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	1.0 1.0 1.0 0.00435 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38         39           40         41           Metallic         42           Armour         43           44         46           Normal         47           48         49           50         51           52         Cable in           53         54           55         56           57         58           59         60           61         62           Cable in         62	F           Fpipe           Farmour           λ"1           Screen Los           λ_1           and Pipe Lo           λ_2a           λ_2bipe           λ_2           Operation II           T1           t1           pTi           T3           t3           pTJ           Ducts           U           V           Y           0m           T4'           Do           Di           pT           T4''	Miliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current         ss factor         Screen Loss Factor         ss Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor + Pipe Loss Factor         C 60287-2-1         Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Inhermal Resistance of Jacket/Pipe Coating         Thermal Resistance of Jacket/Pipe Coating         Thermal Resistivity of Insulation         Thermal Resistivity of Jacket/Pipe Coating         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Coefficient Used in He Duct/Pipe	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	1.0 1.0 1.0 0.00435 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38           39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64	F           Fpipe           Farmour           λ"1           Screen Los           λ_1           and Pipe Lo           λ_2a           λ_2bipe           λ_2           Operation II           T1           t1           τ3           φTi           T3           t3           φTJ           DU           V           Ψ           θm           T4'           Do           Di           φT           τ4''           Do           Di           φT           τ4''           Do           Di           φT           τ4'''	Milliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current         ss factor         Screen Loss Factor         Dess Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor         Pipe Loss Factor         C 60287-2-1         Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Thermal Resistance of Jacket/Pipe Coating         Thickness of Jacket/Pipe Coating         Thermal Resistivity of Insulation         Thermal Resistivity of Jacket/Pipe Coating         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Coefficient Used in Lec 60287-2-1 Clause 2.2.7.1         Coefficient Used in Lec 00287-2-1 Clause 2.2.7.1         Mean Temperature of the Medium Filling the Space         Thermal Resistance of the Duct/Pipe <tr< td=""><td>[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]</td><td>1.0 1.0 1.0 0.00435 0.03799 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0</td><td>1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.</td><td>1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0</td></tr<>	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	1.0 1.0 1.0 0.00435 0.03799 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38           39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65           66           67	F           Fpipe           Farmour           λ"1           Screen Los           λ_1           and Pipe Lo           λ_2a           λ_2pipe           λ_2           Operation II           T1           t1           ρTI           T3           t3           pTJ           Ducts           U           V           Y           θm           T4'           Do           Di           pT           4''           Do           N           Y           H           Do           Di           T4''           Do           N           Y           H           Do           Di           T4''           Dy           Y           N           Y           N           Y           Di           Di           Di           Q	Milliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current         ss factor         Screen Loss Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor + Pipe Loss Factor         C 60287-2-1         Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Thermal Resistance of Jacket/Pipe Coating         Thermal Resistivity of Insulation         Thermal Resistivity of Jacket/Pipe Coating         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Coefficient Used in the Duct/Pipe         Outside Diameter of the Duct/Pipe         Inermal Resistance of the Medium Inside the Duct/Pipe         Outside Diameter of the Duct/Pipe         Thermal Resistance of the Duct/Pipe         Thermal Resistance of the Duct/Pipe         Thermal Resistance of the Duct/Pipe         Thermal Res	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	1.0 1.0 1.0 0.03799 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38           39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65           66           67           68	F           Fpipe           Farmour           λ"1           Screen Los           λ1           and Pipe Lo           λ2           Operation II           T1           t1           φTi           T3           t3           φTJ           DU           V           Y           θm           T4''           Do           Di           φT           T4''           Do           T4''           Do           Di           φT           T4''           Do           Di           φT           T4''           Do           Di           φT           T4'''	Miliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>ss factor</b> Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistivity of the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Medium Inside the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>K/Backfill Installation</b> Shorter Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	1.0 1.0 1.0 0.03799 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38           39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65           66           67           68           69	F           Fpipe           Farmour           λ"1           Screen Los           λ1           and Pipe Lo           λ2pipe           λ2pipe           λ2pipe           λ2pipe           λ3           ρT1           T3           t3           ρTJ           U           V           Y           θm           T4''           Do           Di           ρT           T4''           Do           Di           ρT           x'''           work           γ           B           A Duct Bar           x           y           rb           LG           u           N	Miliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>ss factor</b> Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>EC 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Muterial Thermal Resistance of the Muterial Thermal Resistance of the Duct/Pipe Thermal Resistance of the Duct/Pipe Shorter Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [C] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	1.0 1.0 1.0 0.03799 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38           39           40           41           Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable in           53           54           55           56           57           58           59           60           61           62           Cable in           63           64           65           66           67           68	F           Fpipe           Farmour           λ"1           Screen Los           λ1           and Pipe Lo           λ2           Operation II           T1           t1           φTi           T3           t3           φTJ           DU           V           Y           θm           T4''           Do           Di           φT           T4''           Do           T4''           Do           Di           φT           T4''           Do           Di           φT           T4''           Do           Di           φT           T4'''	Miliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>ss factor</b> Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistivity of the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Medium Inside the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>K/Backfill Installation</b> Shorter Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	1.0 1.0 1.0 0.03799 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38         39           40         41           Metallic         42           Armour         43           44         46           Normal         47           48         49           50         51           52         Cable in           53         54           55         56           57         58           59         60           61         62           Cable in         63           64         65           66         67           68         69           70         70	F           Fpipe           Farmour           λ"1           Screen Los           λ1           and Pipe Lo           λ2pipe           λ2pipe           λ2pipe           λ2pipe           λ3           ρT1           T3           t3           ρTJ           U           V           Y           θm           T4''           Do           Di           ρT           T4''           Do           Di           ρT           x'''           W           N           LG           u           N           ρc	Miliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current <b>ss factor</b> Screen Loss Factor <b>Screen Loss Factor</b> <b>Screen Loss Factor</b> <b>Armour Loss Factor</b> Pipe Loss Factor <b>C 60287-2-1</b> Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filing the Space Thermal Resistance of the Medium Inside the Duct/Pipe Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>N/Backfill Installation</b> Shorter Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [C] [C] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	1.0 1.0 1.0 0.00435 0.03799 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38         39           40         41           Metallic         42           Armour         43           44         46           Normal         44           46         Normal           47         48           49         50           51         52           Cable in         53           54         55           56         57           58         59           60         61           62         Cable in           63         64           655         66           67         68           69         70           71         72	F           Fpipe           Farmour           λ"1           Screen Los           λ_2           Φ           λ_2bipe           λ_2           Operation II           T1           t1           φTi           T3           φTi           T3           φTi           T4           ΦO           D0           D0           D1           φT           T4''           D0           D1           φT           X           Y           Honct Bar           X           Y           R           A DUCt Bar           X           Y           Honce Bar           X           Y           R           P           LG           U           N           P           Q           R           Y           R           Y           R	Miliken conductor Effect Magnetic effect factor due to pipe Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current Safactor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor C60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in the Duct/Pipe Thermal Resistance of the Medium Filling the Space Thermal Resistance of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium N/Backfill Longer Side of the Duct Bank/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistance of the Surrounding Medium Total External Thermal Resistance Termal Resistance of the Surrounding Medium Total External Thermal Resistance Termal Resistance of the Duct Bank/Backfill Thermal Resistance of the Surrounding Medium	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [C.mW] [K.mW] [K.mW] [K.mW] [M] [m] [m] [m] [m] [m] [m] [m] [K.mW] [K.mW] [K.mW]	1.0 1.0 1.0 1.0 0.0435 0.03799 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0
38         39           40         41           Metallic         42           Armour         43           44         46           Normal         44           46         Normal           47         48           49         50           51         52           Cable in         53           54         55           56         57           58         59           60         61           62         Cable in           63         64           655         66           67         68           69         70           70         71	F           Fpipe           Farmour           λ"1           Screen Los           λ_2           Δ           Λ20           Λ3           Λ3           Λ3           Λ3           Λ3           Λ3           Λ4           Λ	Miliken conductor Effect         Magnetic effect factor due to pipe         Magnetic effect factor due to armour         Screen Loss Factor Caused by Eddy Current         sa factor         Screen Loss Factor         pipe Loss Factor         Armour Loss Factor         Pipe Loss Factor         Armour Loss Factor + Pipe Loss Factor         C 60287-2-1         Thermal Resistance Between Conductor and Screen         Insulation Thickness Between Conductor and Screen         Thermal Resistance of Jacket/Pipe Coating         Thickness of Jacket/Pipe Coating         Thermal Resistivity of Loc 60287-2-1 Clause 2.2.7.1         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1         Coefficient Used in LEC 60287-2-1 Clause 2.2.7.3         Nutside D	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [C] [C] [K.mW] [K.mW] [K.mW] [M] [M] [M] [M] [M] [M] [M] [M] [M] [M	1.0 1.0 1.0 0.00435 0.03799 0.03799 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	1.0 1.0 1.0 0.017 0.04181 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	1.0 1.0 1.0 0.00448 0.03005 0.0 0.0 0.0 0.0 0.0 0.0 0.0

	Study Summary
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 220kV CABLE) v2
Date:	16/01/2020 14:02:08

General Simulation Data						
Steady State Option	Equally Loaded					
Consider Electrical interaction between circuits	No					
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0					
Conductor Resistances Computation Option:	IEC-228					

Installation Type:Ductbank							
Ambient Soil Temperature at Installation Depth	[°C]	15.0					
Native Soil Thermal Resistivity	[K.m/W]	1.2					
Thermal Resistivity of Duct Bank	[K.m/W]	1.0					
Depth of Center of Duct Bank	[m]	0.96					
Duct Bank Width	[m]	1.7					
Duct Bank Height	[m]	0.68					



Results Summary										
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [m]	Y coordinate [m]	Conductor temperature [°C]	Ampacity [A]

	1	220KV.011	1	A	50.0	1.0	0.25	1.05	85.5	2037.6
	2	220KV.011	1	В	50.0	1.0	0.83	1.05	90.0	2037.6
ſ	3	220KV.011	1	С	50.0	1.0	1.41	1.05	85.3	2037.6

	SANATIONAL TED	Steady State Summary
C١	(MCAP Version	7.3 Revision 2
St	udy:	Eirgrid Cp966 Feasibility study
Execution:		Eirgrid - std trench (1ct 220kV CABLE) v2
Da	ite:	16/01/2020 14:02:08

### Simulation Data

Installation type:	Ductbank
Steady State Option	Equally Loaded
Ambient temperature [°C]	15
Native Soil Thermal Resistivity [K.m/W]	1.2
Consider Non-Isothermal Earth Surface	No
Consider effect of soil dry out	No
Consider Electrical interaction between circuits	No
Induced current in metallic layers as a fraction of conductor current (applied to all single phase circuits)	0

Variable	e Description	Unit		Cables	
Cable No.	Cable Index Number		1	2	3
General Inpu	ıt Data				1
Cable ID	Cable Equipment ID		220KV.011	220KV.011	220KV.011
Circuit No.	Circuit No.		1	1	1
Phase	Cable Phase		А	В	С
Fq	Operating Frequency	[Hz]	50.0	50.0	50.0
x	X coordinate	[m]	0.25	0.83	1.41
у	Y coordinate	[m]	1.05	1.05	1.05
DLF	Daily Load Factor	[p.u.]	1.0	1.0	1.0
	Bonding Type		1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat
Ampacity				L	
	Steady State Ampacity	[A]	2037.6	2037.6	2037.6
emperature	25			L	1
θс	Conductor temperature	[°C]	85.5	90.0	85.3
θs	Sheath/Shield temperature	[°C]	71.0	75.4	70.8
θа	Armour temperature	[°C]	n/a	n/a	n/a
θsurf	Cable surface temperature	[°C]	69.0	73.3	68.7
θduct	Duct surface temperature	[°C]	57.1	61.5	57.0
Resistances				L	l
R <sub>0</sub>	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
R	AC Resistance of the Conductor at Operating Temperature	[Ω/km]	0.01008	0.0102	0.01008
ys	Skin Effect Factor		0.11192	0.1091	0.11207
ур	Proximity Effect Factor		0.00166	0.00162	0.00166
osses					
Wc	Conductor Losses	[W/m]	41.85832	42.33914	41.83198
Wd	Dielectric Losses	[W/m]	1.37316	1.37316	1.37316
Ws	Metallic Screen Losses	[W/m]	1.58932	1.77154	1.25699
Wa	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
Wt	Total Losses	[W/m]	44.8208	45.48384	44.46212
λı	Screen Loss Factor		0.03797	0.04184	0.03005
λ <sub>2</sub>	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
hermal resi	istances				
T1	Thermal resistance of insulation	[K.m/W]	0.3402	0.3402	0.3402
T2	Thermal resistance of bedding/medium inside pipe-type	[K.m/W]	n/a	n/a	n/a
Т3	Thermal resistance of outer covering	[K.m/W]	0.04631	0.04631	0.04631
T4	External thermal resistance	[K.m/W]	1.20356	1.28091	1.20842
Others					
Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
	Induced current on Metallic Screen	[V/Kili] [A]	118.0	101.3	102.9

CYMCAP Version	7.3 Revision 2

Cables Report

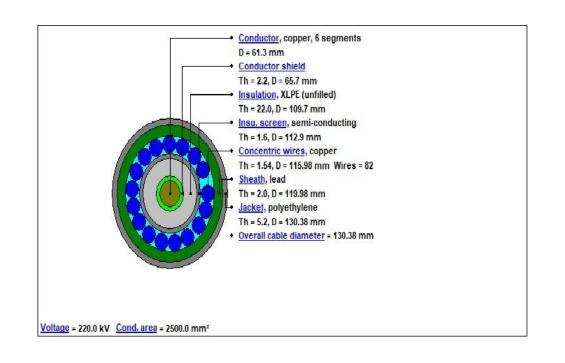
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 220kV CABLE) v2
Date:	16/01/2020 14:02:08

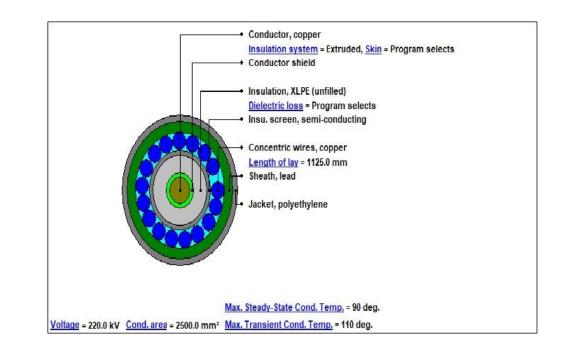
No.	Description	Unit	1
	eral Cable Information	Ont	
1	Cable Equipment ID		220KV.011
2	Number of Cores		Single Core
3	Voltage	[kV]	220
4	Conductor Area	[mm <sup>2</sup> ]	2500.0
5	Cable Overall Diameter	[mm]	130.38
	Maximum Steady-State Conductor Temperature		
6		[°C]	90
7 <b>Con</b>	Maximum Emergency Conductor Temperature	[°C]	110
	ductor Material		_
8	Electrical Resistivity at 20°C	[+0 em]	Copper
9 10	Temperature Coefficient at 20°C	[μΩ.cm]	0.00393
10	Reciprocal of Temperature Coefficient of Resistance	[1/K]	0.00393
11	(BETA)	[K]	234.5
12	Volumetric Specific Heat (SH)	[J/(K*cm <sup>3</sup> )]	3.45
13	Construction		6 Segments
14	Conductor Insulation System		Extruded
15	Milliken Wires Construction		Insulated Wires
16	Ks (Skin Effect Coefficient)		0.35
17	Kp (Proximity Effect Coefficient)		0.2
18	Diameter ductor Shield	[mm]	61.3
	Thickness		0.5
19	Diameter	[mm]	2.2
20 Insu	lation	[mm]	65.7
21	Material		XLPE Unfilled
21	Thermal Resistivity	[K.m/W]	3.5
23	Dielectric Loss Factor - ( tan delta )	[]	0.001
24	Relative Permittivity - ( epsilon )		2.5
	Specific Insulation Resistance Constant at 60°F - ( K )		
25		[MΩ.km]	65617.
26	Thickness Diameter	[mm]	22.0
27	lation Screen	[mm]	109.7
IIISU	lation Screen		
	Material		Semi Conducting Screen
28		[mm]	Semi Conducting Screen
	Material	[mm]	Semi Conducting Screen 1.6 112.9
28 29	Material Thickness Diameter		1.6
28 29 30	Material Thickness Diameter		1.6
28 29 30 <b>She</b> a	Material Thickness Diameter ath		1.6 112.9
28 29 30 <b>Shea</b> 31	Material Thickness Diameter ath Is Sheath Around Each Core?		1.6 112.9 n/a
28 29 30 <b>Shea</b> 31 32	Material Thickness Diameter ath Is Sheath Around Each Core? Material	[mm]	1.6 112.9 n/a Lead
28 29 30 <b>Shea</b> 31 32 33 34	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance	[mm]	1.6 112.9 n/a Lead 21.4 0.004
28 29 30 <b>Shea</b> 31 32 33 34 35	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C	[mm] [μΩ.cm] [1/K] [K]	1.6 112.9 n/a Lead 21.4 0.004 230
28 29 30 <b>Shea</b> 31 32 33 34	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA)	[mm]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45
28 29 30 <b>Shea</b> 31 32 33 34 35 36	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH)	[mm] [μΩ.cm] [1/K] [J/(K*cm³)]	1.6 112.9 n/a Lead 21.4 0.004 230
28 29 30 <b>Shea</b> 31 32 33 33 34 35 36 37	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type	[mm] [μΩ.cm] [1/K] [1/K] [(J/(K*cm³)]] [mm]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39	Material Thickness Diameter Thickness Diameter Thickness Diameter Thickness Diameter Temperature Coefficient at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Thickness	[mm] [μΩ.cm] [1/K] [J/(K*cm³)]	1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Con</b>	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter	[mm] [μΩ.cm] [1/K] [1/K] [(J/(K*cm³)]] [mm]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98
28 29 30 <b>She:</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core?	[mm] [μΩ.cm] [1/K] [1/K] [(J/(K*cm³)]] [mm]	1.6 112.9 N/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 N/a
28 29 30 <b>She:</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material	[mm]  [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm*)] [μ(K*cm*)] [μ(	1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Ccentric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C	[mm]  [μΩ.cm] [μΩ.cm] [J/(K*cm³)] [mm] [mm] [mm] [mm] [mm] [mm] [mm] [m	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241
28 29 30 <b>She:</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C	[mm]  [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm*)] [μ(K*cm*)] [μ(	1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Ccentric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C	[mm]  [μΩ.cm] [μΩ.cm] [J/(K*cm³)] [mm] [mm] [mm] [mm] [mm] [mm] [mm] [m	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42 43	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Ccentric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C	[mm]  [μΩ.cm] [μΩ.cm] [μΩ.cm] [J/(K*cm*)] [mm] [mm] [mm] [mm] [mm] [mm] [mm] [m	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42 43	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Ccentric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay	[mm]  [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μ[/(K*cm <sup>3</sup> )] [μ] [μ] [μ] [μ] [μ] [μ] [μ] [μ] [μ] [μ	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393         234.5
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42 43 44	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA)	[mm]  [μΩ.cm] [(μΩ.cm]) [(μΩ.cm]) [(μ(K*cm3))] [(mm]) [(m	1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393           234.5           3.45
28 29 30 <b>She:</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42 43 44 45 46	Material Thickness Diameter Thickness Diameter Thickness Diameter Thickness Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Ccentric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Ccentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge	[mm]  [μΩ.cm] [(μΩ.cm]) [(μΩ.cm]) [(μ(K*cm3))] [(mm]) [(m	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393         234.5         3.45         1125.0
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42 43 44 45 46 47	Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge Thickness	[mm]  [μΩ.cm] [(μΩ.cm]) [(μΩ.cm]) [(μ(K*cm3))] [(mm]) [(m	1.6           112.9           n/a           Lead           21.4           0.004           230           1.45           Non Corrugated           2.0           119.98           n/a           Copper           1.7241           0.00393           234.5           3.45           1125.0           82
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42 43 44 45 46 47 48 49 50	Material Thickness Diameter Thickness Diameter Thickness Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge Thickness Diameter	[mm]  [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μ[μ] [μ] [μ] [μ] [μ] [μ] [μ] [μ] [μ]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393         234.5         3.45         1125.0         82         Undefined
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42 43 44 45 46 47 48 49 50 <b>Jack</b>	Material Thickness Diameter Thickness Diameter Thickness Diameter Thickness State Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Ccentric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Ccentric Neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge Thickness Diameter Ccenter Ccente	[mm]         [μΩ.cm]         [μΩ.cm]         [μΩ.cm]         [1/K]         [J/(K*cm³)]         [mm]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393         234.5         3.45         1125.0         82         Undefined         1.54         115.98
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42 43 44 45 46 47 48 49 50 <b>Jack</b>	Material Thickness Diameter Thickness Diameter Thickness Diameter Temperature Coefficient at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Vire Gauge Thickness Diameter Cet Material	[mm]         [μΩ.cm]         [μΩ.cm]         [μΩ.cm]         [μΩ.cm]         [μΩ.cm]         [μΩ.cm]         [J/(K*cm*)]         [mm]         [J/(K*cm*)]         [mm]         [mm]         [mm]         [mm]         [μΩ.cm]         [μΩ.cm]         [μΩ.cm]         [mm]         [mm]         [mm]         [mm]         [mm]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393         234.5         3.45         1125.0         82         Undefined         1.54         115.98         Polyethylene
28 29 30 <b>She</b> : 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42 43 41 42 43 44 45 46 47 48 49 50 <b>Jac</b> 49 50	Material Thickness Diameter Ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Diameter Cet Material Thickness Diameter	[mm]           [μΩ.cm]           [μ]           [μ] <t< td=""><td>1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         0.00393         234.5         3.45         1125.0         82         Undefined         1.54         115.98         Polyethylene         3.5</td></t<>	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         0.00393         234.5         3.45         1125.0         82         Undefined         1.54         115.98         Polyethylene         3.5
28 29 30 <b>Shea</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42 43 44 45 46 47 48 49 50 <b>Jack</b>	Material Thickness Diameter Thickness Diameter Thickness Diameter Temperature Coefficient at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Vire Gauge Thickness Diameter Cet Material	[mm]         [μΩ.cm]         [μΩ.cm]         [μΩ.cm]         [μΩ.cm]         [μΩ.cm]         [μΩ.cm]         [J/(K*cm*)]         [mm]         [J/(K*cm*)]         [mm]         [mm]         [mm]         [mm]         [μΩ.cm]         [μΩ.cm]         [μΩ.cm]         [mm]         [mm]         [mm]         [mm]         [mm]	1.6         112.9         n/a         Lead         21.4         0.004         230         1.45         Non Corrugated         2.0         119.98         n/a         Copper         1.7241         0.00393         234.5         3.45         1125.0         82         Undefined         1.54         115.98         Polyethylene

No.	Description	Unit	1
Specific Installation Data			
55	Cable Equipment ID		220KV.011
56	Cable Frequency	[Hz]	50
57	Sheath / Shield Bonding		1 Conductor Crossbonded Flat
58	Loss Factor Constant (ALOS)		0.3
59	Minor section length		Crossbonded Unknown Section Lengths UNKNOWN
60	Duct construction		Polyethylene in Concrete
61	Duct material thermal resistivity	[K.m/W]	3.5
62	Inside Diameter of the Duct/Pipe	[mm]	188.0
63	Outside Diameter of the Duct/Pipe	[mm]	200.0

#### Cable ID : 220KV.011

Cable Title 2500sqmm Cu (insulated Wires)\_XLPE\_CWS+Pb\_PE NKT for Eirgrid





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CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 220kV CABLE) v2
Date:	16/01/2020 14:02:08

No.	Description	Unit	Cable No.1	Cable No.2	Cable No.3
1	Cable Equipment ID		220KV.011	220KV.011	220KV.011
Resi	stances				
2	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00905	0.00918	0.00905
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.00843	0.00843	0.00843
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01008	0.0102	0.01008
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.28869	0.28869	0.28869
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.34761	0.35262	0.34733
8	DC Resistance of Concentric Wires at 20°C	[Ω/km]	0.1185	0.1185	0.1185
9	DC Resistance of Concentric Wires at Operating Temperature	[Ω/km]	0.14227	0.14429	0.14216
Loss	es				
10	Conductor Losses	[W/m]	41.85832	42.33914	41.83198
11	Dielectric Losses	[W/m]	1.37316	1.37316	1.37316
12	Metallic Screen Losses	[W/m]	1.58932	1.77154	1.25699
13	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
14	Total Losses	[W/m]	44.8208	45.48384	44.46212
Сара	citance, Inductance, Impedance				
15	Capacitance	[µF/km]	0.271	0.271	0.271
16	Inductance of Conductor	[mH/km]	0.63808	0.63808	0.63808
17	Reactance of Conductor	[Ω/km]	0.20046	0.20046	0.20046
18	Inductance of Metallic Sheath	[mH/km]	0.46013	0.46013	0.46013
19	Reactance of Metallic Sheath	[Ω/km]	0.14455	0.14455	0.14455
20	Positive Sequence Impedance	[Ω/km]	0.010080 + j0.200460	0.010200 + j0.200460	0.010080 + j0.200460
21	Negative Sequence Impedance	[Ω/km]	0.010080 + j0.200460	0.010200 + j0.200460	0.010080 + j0.200460
22	Zero Sequence Impedance	[Ω/km]	0.092020 + j0.144550	0.092000 + j0.144550	0.092020 + j0.144550
23	Surge Impedance	[Ω]	48.53043	48.53043	48.53043
Othe	rs				
24	Dielectric Stress at Conductor Surface	[kV/mm]	7.54233	7.54233	7.54233
25	Dielectric Stress at Insulation Surface	[kV/mm]	4.51715	4.51715	4.51715
26	Insulation Resistance at 60°F (15.8°C)	[MΩ.km]	14609.00643	14609.00643	14609.00643
27	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a
28	Charging Current for One Phase	[A/km]	10.81081	10.81081	10.81081
29	Charging Capacity of three phase system at Uo	[kvar/km]	4119.47055	4119.47055	4119.47055
30	Voltage drop for Three Phase System	[V/A/km]	0.01746	0.01766	0.01745
31	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
32	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
33	Induced current on Metallic Screen	[A]	118.0	101.3	102.9

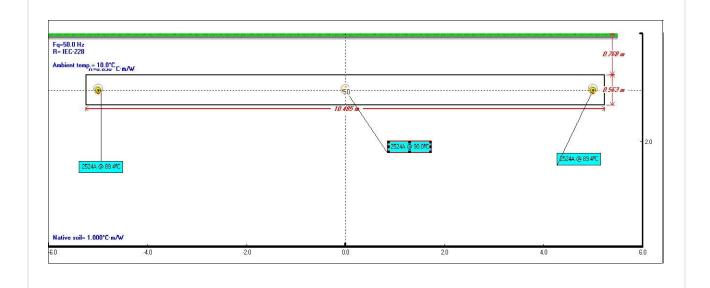
	Cable Parameters under Normal Operation
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - std trench (1ct 220kV CABLE) v2
Date: 16/01/2020 14:02:08	

No	O multi al	Description	11-2	0-1-1-1-4	0-11-11-0	0-1-1-0
No. 1	Symbol	Description Cable Equipment ID	Unit	Cable No.1 220KV.011	Cable No.2 220KV.011	Cable No.3 220KV.011
	Operation IE					
Conduc	tor AC Resis	tance				
2	R <sub>0</sub>	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	R'	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00905	0.00918	0.00905
4	dc	Conductor Diameter	[mm]	61.3	61.3	61.3
5	s	Distance Between Conductor Axes	[mm]	580.0	580.0	580.0
6	ks	Factor Used for xs Calculation (Skin Effect)		0.35	0.35	0.35
7	kp	Factor Used for xp Calculation (Proximity Effect)		0.2	0.2	0.2
8	XS	Component of Ys Calculation (Skin Effect)		2.20411	2.18875	2.20496
9	хр	Component of Yp Calculation (Proximity Effect)		1.66615	1.65454	1.6668
10	ys	Skin Effect Factor		0.11192	0.1091	0.11207
11	ур	Proximity Effect Factor		0.00166	0.00162	0.00166
12 Dielectri	R ic Losses	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01008	0.0102	0.01008
13	tanō	Dielectric Loss Factor		0.001	0.001	0.001
14	ε	Insulation Relative Permitivity		2.5	2.5	2.5
	_					
15	с	Cable Capacitance	[µF/km]	0.271	0.271	0.271
16	U <sub>0</sub>	Voltage	[kV]	127.01706	127.01706	127.01706
17	Wd	Cable Dielectric Losses Per Phase	[W/m]	1.37316	1.37316	1.37316
Circulat	ing Loss Fac	tor				
18	Rs	AC Resistance used for Circulating Loss Factor computation	[Ω/km]	0.10095	0.10239	0.10087
19	d	Mean diameter used for Circulating Loss Factor computation	[mm]	116.22348	116.22348	116.22348
						_
20	X	Reactance used for Circulating Loss Factor computation	[Ω/km]	0.14455	0.14455	0.14455
21	Xm	Mutual Reactance	[Ω/km]	0.04355	0.04355	0.04355
22	Р	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.18811	0.18811	0.18811
			[]			
23	Q	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.13004	0.13004	0.13004
		Spacing Factor (applied when spacing between cable uneven or non-				
24	Fspacing	equal minor section length)		0.004	0.004	0.004
25 Eddy Lo	λ' <sub>1</sub> oss Factor	Screen Loss Factor Caused by Circulating Current		0.0336	0.02479	0.02555
26	Rs	AC Resistance used for Eddy Loss Factor computation	[Ω/km]	0.34761	0.35262	0.34733
27	d	Mean diameter used for Eddy Loss Factor computation	[mm]	117.98	117.98	117.98
28	ρs	Electrical Resistivity used for Eddy Loss Factor computation	[Ω.m]	0.0	0.0	0.0
29	Ds	External diameter used for Eddy Loss Factor computation	[mm]	119.98	119.98	119.98
30 31	ts β <sub>1</sub>	Thickness used for Eddy Loss Factor computation Coefficient used in IEC 60287-1-1 Clause 2.3.6.1	[mm]	2.0 39.14181	2.0 38.86239	2.0 39.15731
32	gs	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		1.00249	1.00247	1.0025
34	m	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.09038	0.08909	0.09045
35	λ <sub>o</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.00013	0.00049	0.00013
36	Δ <sub>1</sub>	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		-0.01882	0.00008	0.00875
37	$\Delta_2$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.0	0.0	0.0
38	F	Milliken conductor Effect		1.0	1.0	1.0
39	Fpipe	Magnetic effect factor due to pipe		1.0	1.0	1.0
40	Farmour	Magnetic effect factor due to armour		1.0	1.0	1.0
41	λ"1	Screen Loss Factor Caused by Eddy Current		0.00437	0.01705	0.0045
	Screen Loss			0.00707		0.00005
42 Armour	λ <sub>1</sub> and Pipe Lo:	Screen Loss Factor		0.03797	0.04184	0.03005
43	λ <sub>z</sub> a	Armour Loss Factor		0.0	0.0	0.0
43	λ <sub>2</sub> pipe	Pipe Loss Factor		0.0	0.0	0.0
46	λ <sub>2</sub>	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
Normal	Operation IE		1			
47	T <sub>1</sub>	Thermal Resistance Between Conductor and Screen	[K.m/W]	0.3402	0.3402	0.3402
48	t <sub>1</sub>	Insulation Thickness Between Conductor and Screen	[mm]	25.8	25.8	25.8
49	ρΤί	Thermal Resistivity of Insulation	[K.m/W]	3.5	3.5	3.5
50	T <sub>3</sub>	Thermal Resistance of Jacket/Pipe Coating	[K.m/W]	0.04631	0.04631	0.04631
51	t <sub>3</sub>	Thickness of Jacket/Pipe Coating	[mm]	5.2	5.2	5.2
52 Cable in	ρTJ Ducts	Thermal Resistivity of Jacket/Pipe Coating	[K.m/W]	3.5	3.5	3.5
Cable in	U	Coefficient Lised in IEC 60287-2-1 Claure 2-2-7-4		1 07	1 07	1 07
53	U V	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		1.87 0.312	1.87 0.312	1.87 0.312
55	Y	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		0.0037	0.0037	0.0037
56	θm	Mean Temperature of the Medium Filling the Space	[°C]	63.8	68.2	63.6
57	Τ4'	Thermal Resistance of the Medium Inside the Duct/Pipe	[K.m/W]	0.22956	0.22377	0.22982
58	Do	Outside Diameter of the Duct/Pipe	[mm]	200.0	200.0	200.0
59	Di	Inside Diameter of the Duct/Pipe	[mm]	188.0	188.0	188.0
60	ρT T "	Thermal Resistivity of the Duct/Pipe Material	[K.m/W]	3.5	3.5	3.5
61 62	T4" T4"	Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium	[K.m/W] [K.m/W]	0.03447	0.03447	0.03447
		<pre>//Backfill installation</pre>	[canva]	0.00000		3.37714
63	x	Shorter Side of the Duct Bank/Backfill	[m]	0.675	0.675	0.675
64	у	Longer Side of the Duct Bank/Backfill	[m]	1.7	1.7	1.7
65	rb	Equivalent Radius of Duct Bank/Backfill	[m]	0.47741	0.47741	0.47741
66	LG	Depth of Laying to the Centre of Duct Bank/Backfill	[m]	0.962	0.962	0.962
67	u	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3		2.01505	2.01505	2.01505
68	N	Number of Loaded Cables in the Duct Bank/Backfill		3.0	3.0	3.0
		Thormal Registrative of Farth Argund the Durat Day 100, 100	[K - 442	4.0	4.0	4.0
69 70	pe oc	Thermal Resistivity of Earth Around the Duct Bank/Backfill	[K.m/W] [K.m/W]	1.2	1.2	1.2
70 71	ρc Τ₄'''	Thermal Resistivity of the Duct Bank/Backfill Thermal Resistance of the Surrounding Medium	[K.m/W] [K.m/W]	1.0 0.93953	1.0 1.02267	1.0 0.94414
72	T <sub>4</sub>	Total External Thermal Resistance	[K.m/W]	1.20356	1.28091	1.20842
		Temperature Rise at the Surface of the Cable Due to Other				
73	∆θint	Surrounding Elements	[°C]	0.0	0.0	0.0
74	I	Cable Core Current Ampacity	[A]	2037.6	2037.6	2037.6

	Study Summary
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Extra wide (1ct 400kV CABLE) 3000sqmm Cond
Date:	20/03/2020 15:55:53

General Simulation Data				
Steady State Option	Equally Loaded			
Consider Electrical interaction between circuits	No			
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0			
Conductor Resistances Computation Option:	IEC-228			

Installation Type:Ductbank				
Ambient Soil Temperature at Installation Depth	[°C]	10.0		
Native Soil Thermal Resistivity	[K.m/W]	1.0		
Thermal Resistivity of Duct Bank	[K.m/W]	0.9		
Depth of Center of Duct Bank	[m]	1.05		
Duct Bank Width	[m]	10.49		
Duct Bank Height	[m]	0.56		



Results Summary										
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Dally Load Factor	X coordinate [m]	Y coordinate [m]	Conductor temperature [°C]	Ampacity [A]
1	400KV.032	1		А	50.0	1.0	-5.0	1.05	89.4	2523.7
2	400KV.032	1		В	50.0	1.0	0.0	1.05	90.0	2523.7
3	400KV.032	1		С	50.0	1.0	5.0	1.05	89.4	2523.7

	Steady State Summary
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Extra wide (1ct 400kV CABLE) 3000sqmm Cond
Date:	20/03/2020 15:55:53

Simulation Data	
Installation type:	Ductbank
Steady State Option	Equally Loaded
Amblent temperature [°C]	10
Native Soli Thermal Resistivity [K.m/W]	1.0
Consider Non-Isothermal Earth Surface	No
Consider effect of soll dry out	No
Consider Electrical Interaction between circuits	No
Induced current in metallic layers as a fraction of conductor current (applied to all single phase circuits)	0

Variable	e Description	Unit		Cables	
Cable No.	Cable Index Number		1	2	3
General Inp	ut Data		· ·		
Cable ID	Cable Equipment ID		400KV.032	400KV.032	400KV.032
Circuit No.	Circuit No.		1	1	1
Phase	Cable Phase		А	В	С
Fq	Operating Frequency	[Hz]	50.0	50.0	50.0
x	X coordinate	[m]	-5.0	0.0	5.0
у	Y coordinate	[m]	1.05	1.05	1.05
DLF	Daily Load Factor	[p.u.]	1.0	1.0	1.0
	Bonding Type		1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat
Ampacity					
I	Steady State Ampacity	[A]	2523.7	2523.7	2523.7
Temperatur	es				
θc	Conductor temperature	[°C]	89.4	90.0	89.4
θs	Sheath/Shield temperature	[°C]	64.4	64.9	64.3
θа	Armour temperature	[°C]	n/a	n/a	n/a
θsurf	Cable surface temperature	[°C]	61.3	61.9	61.3
Øduct	Duct surface temperature	[°C]	42.4	43.0	42.4
Resistances	3				
R₀	DC Resistance of the conductor at 20°C	[Ω/km]	0.00586	0.00586	0.00586
R	AC Resistance of the Conductor at Operating Temperature	[Ω/km]	0.01041	0.01042	0.01041
ys	Skin Effect Factor		0.39468	0.3937	0.39476
ур	Proximity Effect Factor		0.00008	0.00008	0.00008
Losses					
Wc	Conductor Losses	[W/m]	66.28068	66.3506	66.27516
Wd	Dielectric Losses	[W/m]	4.00787	4.00787	4.00787
Ws	Metallic Screen Losses	[W/m]	1.14406	1.1141	1.08469
Wa	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
Wt	Total Losses	[W/m]	71.4326	71.47256	71.36771
λ1	Screen Loss Factor		0.01726	0.01679	0.01637
λ <sub>2</sub>	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
Thermal res	Istances				
T1	Thermal resistance of insulation	[K.m/W]	0.36693	0.36693	0.36693
T2	Thermal resistance of bedding/medium inside pipe-type	[K.m/W]	n/a	n/a	n/a
Т3	Thermal resistance of outer covering	[K.m/W]	0.0429	0.0429	0.0429
Τ4	External thermal resistance	[K.m/W]	0.7183	0.7255	0.7184
Others					
Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
	Induced current on Metallic Screen	[A]	159.9	157.3	155.7

	Cables Report
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Extra wide (1ct 400kV CABLE) 3000sqmm Cond
Date:	20/03/2020 15:55:53

No.	Description	Unit	1
Gen	eral Cable Information		
1	Cable Equipment ID		400KV.032
2	Number of Cores		Single Core
3	Voltage	[kV]	400
4	Conductor Area	[mm²]	3000.0
5	Cable Overall Diameter	[mm]	140.3
	Maximum Steady-State Conductor Temperature		
6		[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	90
Con	ductor		
8	Material		Copper
9	Electrical Resistivity at 20°C	[μΩ.cm]	1.7241
10	Temperature Coefficient at 20°C	[1/K]	0.00393
11	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
12	Volumetric Specific Heat (SH)	[J/(K*cm3)]	3.45
13	Construction		6 Segments
14	Conductor Insulation System		Extruded
15	Milliken Wires Construction		Bare Unidirectional Wires
16	Ks (Skin Effect Coefficient)		0.62
17	Kp (Proximity Effect Coefficient)		0.37
18	Diameter	[mm]	65.0
	ductor Shield	[trun]	63.0
19	Thickness	[mm]	1.8
20	Diameter	[mm]	68.6
	lation	[initin]	00.0
21	Material		XLPE Unfilled
21	Thermal Resistivity	DK AAO	
22	Dielectric Loss Factor - ( tan delta )	[K.m/W]	3.5
	Relative Permittivity - ( epsilon )		0.001
24			2.5
25	Specific Insulation Resistance Constant at 60°F - (K)	[MQ.km]	65617.
26	Thickness	[mm]	27.0
27	Diameter	[mm]	122.6
Insu	lation Screen		
28	Material		Semi Conducting Screen
29	Thickness	[mm]	1.5
29 30	Thickness Diameter	[mm] [mm]	1.5 125.6
	Diameter		
30	Diameter		
30 She	Diameter ath		125.6
30 She 31	Diameter ath Is Sheath Around Each Core?		125.6 n/a
30 She 31 32	Diameter ath Is Sheath Around Each Core? Material	[mm]	125.6 n/a Aluminum
30 She 31 32 33 34	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance	[mm]	125.6 n/a Aluminum 2.84 0.00403
30 She 31 32 33 34 35	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA)	[mm] [μΩ.cm] [1/K] [K]	125.6 n/a Aluminum 2.84 0.00403 228
30 She 31 32 33 34 35 36	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Z0°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH)	[mm]	125.6 n/a Aluminum 2.84 0.00403
30 She 31 32 33 34 35 36 37	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type	[mm] [μΩ.cm] [1/K] [K]	125.6 n/a Alumhum 2.84 0.00403 228
30 She 31 32 33 34 35 36 37 38	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness	[mm] [μΩ.cm] [1/K] [K]	125.6 n/a Aluminum 2.84 0.00403 228 2.5 Non Corrugated 0.1
30 She 31 32 33 34 35 36 37 38 39	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter	[mm] [μΩ.cm] [1/K] [K] [J/(K*cm <sup>3</sup> )]	125.6 n/a Aluminum 2.84 0.00403 228 2.5 Non Corrugaled
30 She 31 32 33 34 35 36 37 38 39	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness	[mm] [µΩ.cm] [1/K] [K] [//(K*cm?)] [mm]	125.6 n/a Alumhum 2.84 0.00403 228 2.5 Non Corrugated 0.1
30 She 31 32 33 34 35 36 37 38 39	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter	[mm] [µΩ.cm] [1/K] [K] [//(K*cm?)] [mm]	125.6 n/a Aluminum 2.84 0.00403 228 2.5 Non Corrugated 0.1
30 She 31 32 33 34 35 36 37 38 39 Con	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Z0°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter centric neutral/Skid wires	[mm] [µΩ.cm] [1/K] [K] [//(K*cm?)]	125.6 n/a Aluminum 2.84 0.00403 228 2.5 Non Corrugated 0.1 129.9 n/a
30 She 31 32 33 34 35 36 37 38 39 Con 40 41	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetic Specific Heat (SH) Corrugation Type Thickness Diameter centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core?	[mm] [j_i,Cl.cm] [1/K] [1/K] [1/K] [1/K] [mm] [mm]	125.6 n/a Aluminum 2.84 0.00403 228 2.5 Non Corrugated 0.1 129.9 n/a Copper
30 She 31 32 33 34 35 36 37 38 39 Con 40 41 42	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material	[mm] [μΩcm] [μΩcm] [1/K] [λ(K'cm?]) [mm] [mm] [mm] [μΩcm]	125.6 n/a Aluminum 2.84 0.00403 228 2.5 Non Corrugated 0.1 129.9 n/a Copper 1.7241
30 She 31 32 33 34 35 36 37 38 39 Con 40 41	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral//Skid wires Are Concentric Neutral/Wres Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance Reciprocal of Temperature Coefficient of Resistance	[mm] [j_i,Cl.cm] [1/K] [1/K] [1/K] [1/K] [mm] [mm]	125.6 n/a Aluminum 2.84 0.00403 228 2.5 Non Corrugated 0.1 129.9 n/a Copper
30 She 31 32 33 34 35 36 37 38 39 Con 40 41 42	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Controls of Temperature Coefficient of Resistance Diameter Centric neutral/Skid wires Are Concentric Neutral/Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA)	[mm] [μΩcm] [μΩcm] [1/K] [λ(K'cm?]) [mm] [mm] [mm] [μΩcm]	125.6 n/a Aluminum 2.84 0.00403 228 2.5 Non Corrugated 0.1 129.9 n/a Copper 1.7241
30 She 31 32 33 34 35 36 37 38 39 Con 40 41 42 43	Diameter ath  Is Sheath Around Each Core?  Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral/Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH)	(mm) [µ42.cm] [µ42.cm] [µ42.cm] [µ42.cm] [mm] [mm] [mm] [µ42.cm] [µ42.cm] [µ42.cm]	125.6 n/a Aluminum 2.84 0.00403 228 2.5 Non Corrugated 0.1 129.9 n/a Copper 1.7241 0.00393
30 She 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42 43 44	Diameter ath  Is Sheath Around Each Core?  Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocat of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/SkId wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocat of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay	[mm] [µ,Q,cm] [µ,Q,cm] [1/K] [K] [K] [mm] [mm] [mm] [mm] [mm] [mm]	125.6 n/a Aluminum 2.84 0.00403 228 2.5 Non Corrugated 0.1 129.9 n/a Copper 1.7241 0.00393 234.5
30 She 31 32 33 34 35 36 37 38 39 Con 40 41 42 43 44	Diameter ath  Is Sheath Around Each Core?  Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocat of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/VSkid wires Are Concentric Neutral/Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocat of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires	[mm] [µ,Q,cm] [µ,Q,cm] [µ,Q,cm] [µ,Q,cm] [µ,Q,cm] [µ,Q,cm] [mm] [mm] [mm] [mm] [mm] [mm] [mm] [	125.6 n/a Aluminum 2.84 0.00403 228 2.5 Non Corrugated 0.1 129.9 
30 She 31 32 33 34 35 36 37 38 39 Con 40 41 42 43 44 45 46	Diameter ath  Is Sheath Around Each Core?  Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocat of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/SkId wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocat of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay	[mm] [µ,Q,cm] [µ,Q,cm] [µ,Q,cm] [µ,Q,cm] [µ,Q,cm] [µ,Q,cm] [mm] [mm] [mm] [mm] [mm] [mm] [mm] [	125.6 n/a Aluminum 2.84 0.00403 228 2.5 Non Corrugated 0.1 129.9 n/a Copper 1.7241 0.00393 234.5 3.45 1000.0
30 She 31 32 33 34 35 36 37 38 39 Con 40 41 42 43 44 45 46 47	Diameter ath  Is Sheath Around Each Core?  Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocat of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/VSkid wires Are Concentric Neutral/Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocat of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires	[mm] [µ,Q,cm] [µ,Q,cm] [µ,Q,cm] [µ,Q,cm] [µ,Q,cm] [µ,Q,cm] [mm] [mm] [mm] [mm] [mm] [mm] [mm] [	125.6 n/a Aluminum 2.84 0.00403 228 2.5 Non Corrugated 0.1 129.9 129.
30 She 31 32 33 34 35 36 37 38 39 Con 40 41 42 43 44 45 46 47 48 49 50	Diameter ath  Is Sheath Around Each Core?  Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Vire Gauge Thickness Diameter	(mm) [mm] [µ1(k] [µ1(k] [µ1(k'cm?)] [µ1(k'cm?)] [mm] [µ1(k'cm?)] [µ1(k'cm?)] [µ1(k'cm?)] [mm]	125.6 n/a Aluminum 2.84 0.00403 228 2.5 Non Corrugated 0.1 129.9 129.9 129.9 129.9 129.9 129.9 1.7241 0.00393 234.5 3.45 1000.0 140 12
30 She 31 32 33 34 35 36 37 38 39 Con 40 41 42 43 44 45 46 47 48 49	Diameter ath  Is Sheath Around Each Core?  Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Vire Gauge Thickness Diameter	(mm) (mm) (µ,Q,Cm) (µ,Q,Cm) (µ,Q,Cm) (mm) (mm) (µ,Q,Cm) (mm) (µ,Q,Cm) (µ,Q,Cm) (mm) (µ,Q,Cm)	125.6 n/a Aluminum 2.84 0.00403 228 2.5 Non Corrugated 0.1 129.9 129.9 129.9 1.7241 0.00393 234.5 3.45 1000.0 140 12 2.05
30 She 31 32 33 34 35 36 37 38 39 Con 40 41 42 43 44 45 46 47 48 49 50	Diameter ath  Is Sheath Around Each Core?  Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Vire Gauge Thickness Diameter	(mm) (mm) (µ,Q,Cm) (µ,Q,Cm) (µ,Q,Cm) (mm) (mm) (µ,Q,Cm) (mm) (µ,Q,Cm) (µ,Q,Cm) (mm) (µ,Q,Cm)	125.6 n/a Aluminum 2.84 0.00403 228 2.5 Non Corrugated 0.1 129.9 129.9 129.9 1.7241 0.00393 234.5 3.45 1000.0 140 12 2.05
30 She 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42 43 40 41 42 43 44 45 46 47 48 49 50 <b>Jac</b>	Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Contric Neutral/VSkId wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge Thickness Diameter Coefficient Coefficient Coefficient of Resistance (BETA)	(mm) (mm) (µ,Q,Cm) (µ,Q,Cm) (µ,Q,Cm) (mm) (mm) (µ,Q,Cm) (mm) (µ,Q,Cm) (µ,Q,Cm) (mm) (µ,Q,Cm)	125.6 n/a Aluminum 2.84 0.00403 228 2.5 Non Corrugated 0.1 129.9 n/a Copper 1.7241 0.00393 234.5 3.45 1000.0 140 12 2.05 129.7
30 She 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42 43 40 41 42 43 44 45 46 47 48 49 50 <b>Jaci</b>	Diameter ath  Is Sheath Around Each Core?  Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Coentric Neutral/VSkId wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Vire Gauge Thickness Diameter Cet Material	(mm) [mm] [µ1(K] [µ1(K] [µ1(K'cm?]) [mm] [µ1(K'cm?]] [µ1(K'cm]] [µ1(K'cm]] [µ1(K'cm]] [µ1(K'cm]] [µ1(K'cm]] [µ	125.6 n/a Aluminum 2.84 0.00403 228 2.5 Non Corrugated 0.1 129.9 0.1 129.9 0.1 129.9 0.1 129.9 0.1 129.9 0.1 129.9 0.1 129.9 0.1 129.9 0.1 129.9 0.1 129.9 0.1 129.9 0.1 129.9 0.1 129.9 0.1 129.9 0.1 129.9 0.1 129.9 0.1 129.9 0.1 129.9 0.1 1.2241 0.00393 234.5 1.3.45 1.000.0 1.40 1.40 1.22 0.000 0.1 1.7241 0.00393 234.5 1.000.0 1.40 1.22 1.7241 0.00393 234.5 1.000.0 1.40 1.40 1.22 0.0 1.22 0.0 0.1 0.0 0.1 0.1 0.0 0.1 0.0 0.1 0.0 0.1 0.0 0.1 0.0 0.1 0.0 0.1 0.0 0.1 0.0 0.1 0.0 0.1 0.0 0.1 0.0 0.1 0.0 0.1 0.0 0.1 0.0 0.0
30 She 31 32 33 34 35 36 37 38 39 Con 40 41 42 43 40 41 42 43 44 45 46 47 48 49 50 cl 51 52	Diameter ath  Is Sheath Around Each Core?  Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric Neutral/VSkid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge Thickness Diameter Cet Material Thermal Resistivity	(mm) (mm) (mm) (µ,1)(K) (µ,1)(K) (µ,1)(K) (µ,1) (µ,1)(K) (mm) (µ,1) (	125.6 n/a Aluminum 2.84 0.00403 228 2.5 Non Corrugated 0.1 129.9 0.1 129.9 0.1 129.9 0.1 1.7241 0.00393 234.5 3.45 1000.0 140 12 2.05 129.7 Polyethylene 3.5

No.	Description	Unit	1		
Spe	Specific Installation Data				
55	Cable Equipment ID		400KV.032		
56	Cable Frequency	[Hz]	50		
57	Sheath / Shield Bonding		1 Conductor Crossbonded Flat		
58	Loss Factor Constant (ALOS)		0.3		
59	Minor section length		Crossbonded Unknown Section Lengths UNKNOWN		
60	Duct construction		Polyethylene in Concrete		
61	Duct material thermal resistivity	[K.m/W]	3.5		
62	Inside Diameter of the Duct/Pipe	[mm]	188.0		
63	Outside Diameter of the Duct/Pipe	[mm]	200.0		

#### Cable ID : 400KV.032

Cable Title	3000sqmm milliken Cu_xlpe_cws_pe (Generic design)
Voltage = 400.0 KV Cond. at	Conductor, copper, 6 segments D = 60. mm D = 60. mm The 15, 0 = 85.8 mm Insulation, XPE (unfiled) The 15, 0 = 125.0 mm The 15, 0 = 125.0 mm The 215.0 = 125.0 mm The 215.0 = 125.0 mm The 210.0 = 123.0 mm The 210.0 mm <sup>2</sup>
Yethan - dan w	Conductor, copper Insulation system - Enroded, Sain - Program selects Conductor sheld Reading July European Dealers, July Infield Reads, July Infi

# SAME

INTERNATIONAL TOD	
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Extra wide (1ct 400kV CABLE) 3000sqmm Cond
Date:	20/03/2020 15:55:53

	Description				
No.	Cable Equipment ID	Unit	Cable No.1	Cable No.2	Cable No.3
1 Resi	stances		400KV.032	400KV.032	400KV.032
2	DC Resistance of the conductor at 20°C	[Ω/km]	0.00586	0.00586	0.00586
	DC Resistance of Conductor at Operating Temperature	[\$2/KI1]	0.00300	0.00300	0.00300
3		[Ω/km]	0.00746	0.00747	0.00746
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.00907	0.00907	0.00907
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01041	0.01042	0.01041
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.69646	0.69646	0.69646
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.821	0.82253	0.82088
8	DC Resistance of Concentric Wires at 20°C	[Ω/km]	0.0402	0.0402	0.0402
	DC Resistance of Concentric Wires at Operating Temperature	[O#_]	0.01701	0.0470	0.0470
9 Loss		[Ω/km]	0.04721	0.0473	0.0472
10	Conductor Losses	[W/m]	66.28068	66.3506	66.27516
10	Dielectric Losses	[W/m]	4.00787	4.00787	4.00787
12	Metallic Screen Losses	[W/m]	1.14406	1.1141	1.08469
13	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
14	Total Losses	[W/m]	71.4326	71.47256	71.36771
Сара	acitance, Inductance, Impedance		•	-	
15	Capacitance	[µF/km]	0.239	0.239	0.239
16	Inductance of Conductor	[mH/km]	1.05719	1.05719	1.05719
17	Reactance of Conductor	[Ω/km]	0.33213	0.33213	0.33213
18	Inductance of Metallic Sheath	[mH/km]	0.87053	0.87053	0.87053
19	Reactance of Metallic Sheath	[Ω/km]	0.27348	0.27348	0.27348
20	Positive Sequence Impedance	[Ω/km]	0.010410 + j0.332130	0.010420 + j0.332130	0.010410 + j0.332130
21	Negative Sequence Impedance	[Ω/km]	0.010410 + j0.332130	0.010420 + j0.332130	0.010410 + j0.332130
22	Zero Sequence Impedance	[Ω/km]	0.046180 + j0.273480	0.046180 + j0.273480	0.046180 + j0.273480
23	Surge Impedance	[Ω]	66.48051	66.48051	66.48051
Othe	ers				
24	Dielectric Stress at Conductor Surface	[kV/mm]	11.59585	11.59585	11.59585
25	Dielectric Stress at Insulation Surface	[kV/mm]	6.48838	6.48838	6.48838
26	Insulation Resistance at 60°F (15.8°C)	[MΩ.km]	16546.34872	16546.34872	16546.34872
27	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a
28	Charging Current for One Phase	[A/km]	17.35457	17.35457	17.35457
29	Charging Capacity of three phase system at Uo	[kvar/km]	12023.60029	12023.60029	12023.60029
30	Voltage drop for Three Phase System	[V/A/km]	0.01803	0.01804	0.01802
31	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
32	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
33	Induced current on Metallic Screen	[A]	159.9	157.3	155.7

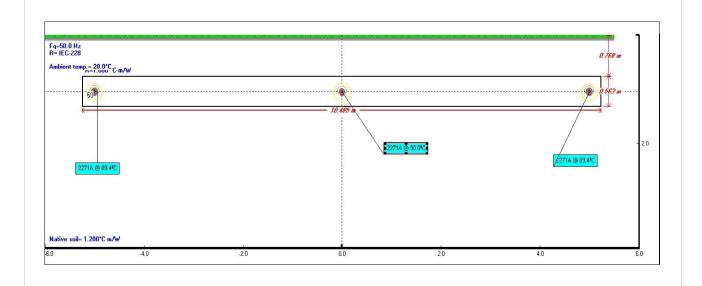
<u>Gy</u>		Cable Parameters under Normal Operation						
CYMC	AP Version	7.3 Revision 2						
Study:		Eirgrid Cp966 Feasibility study						
Execut	ion:	Eirgrid - Extra wide (1ct 400kV CABLE) 3000sqmm Cond						
Date:		20/03/2020 15:55:53						
No.	Symbol	Description	Unit	Cable No.1	Cable No.2	Cable No.3		

	Symbol	Description	Unit	Cable No.1		
1		Cable Equipment ID	I	400KV.032	400KV.032	400KV.032
		IEC 60287-1-1				
	tor AC Res	1				
2	Re	DC Resistance of the conductor at 20°C	[Ω/km]	0.00586	0.00586	0.00586
3	R'	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00746	0.00747	0.00746
4	dc	Conductor Diameter	[mm]	65.0	65.0	65.0
5	s	Distance Between Conductor Axes	[mm]	5000.0	5000.0	5000.0
6	ks	Factor Used for xs Calculation (Skin Effect)	[iiiiii]	0.62	0.62	0.62
7	kp	Factor Used for xp Calculation (Proximity Effect)		0.37	0.37	0.37
8	xs	Component of Ys Calculation (Skin Effect)		3.23139	3.22855	3.23161
9	xp	Component of Yp Calculation (Proximity Effect)		2.49629	2.49409	2.49646
10	γs	Skin Effect Factor		0.39468	0.3937	0.39476
11	ур	Proximity Effect Factor		0.00008	0.00008	0.00008
12 Dielect	R ric Losses	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01041	0.01042	0.01041
		Dielectric Loss Factor	1	0.004	0.004	0.004
13	tanδ ε			0.001	0.001	2.5
19	Ł	Insulation Relative Permitivity		2.5	2.5	2.5
15	с	Cable Capacitance	[µF/km]	0.239	0.239	0.239
16	U.	Voltage	[kV]	230.94011	230.94011	230.94011
17	Wd	Cable Dielectric Losses Per Phase	[W/m]	4.00787	4.00787	4.00787
Circula	ting Loss F					
18	Rs	AC Resistance used for Circulating Loss Factor computation	[Ω/km]	0.04464	0.04472	0.04464
19	d	Mean diameter used for Circulating Loss Factor computation	[mm]	128.72949	128.72949	128.72949
20	x	Reactance used for Circulating Loss Factor computation	[Ω/km]	0.27348	0.27348	0.27348
20	X Xm	Reactance used for Circulating Loss Factor computation Mutual Reactance	[Ω/km] [Ω/km]	0.2/348	0.2/348	0.2/348
21	AUI	maaan Abbulli ka	124/6101	0.04305	0.04305	0.04300
22	Р	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.31704	0.31704	0.31704
23	Q	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.25897	0.25897	0.25897
		Spacing Factor (applied when spacing between cable uneven or non-				7
24	Fspacing	equal minor section length)		0.004	0.004	0.004
25	λ'1	Screen Loss Factor Caused by Circulating Current		0.01723	0.01667	0.01634
Eddy L	oss Factor					
26	Rs	AC Resistance used for Eddy Loss Factor computation	[Ω/km]	0.821	0.82253	0.82088
27	d	Mean diameter used for Eddy Loss Factor computation	[mm]	129.8	129.8	129.8
28	ps	Electrical Resistivity used for Eddy Loss Factor computation	[Ω.m]	0.0	0.0	0.0
29	Ds	External diameter used for Eddy Loss Factor computation	[mm]	129.9	129.9	129.9
30	ts	Thickness used for Eddy Loss Factor computation	[mm]	0.1	0.1	0.1
31	β,	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1	100001	108.59124	108.49026	108.59922
32	gs	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		1.00005	1.00005	1.00005
34	m a-	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.03827	0.03819	0.03827
35	λo	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.0	0.0	0.0
36	Δ,	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		-0.00157	0.0	0.00008
37	Δ2	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.0	0.0	0.0
38	F	Milliken conductor Effect		1.0	1.0	1.0
39	Fpipe	Magnetic effect factor due to pipe		1.0	1.0	1.0
40	Farmour	Magnetic effect factor due to armour		1.0	1.0	1.0
41	λ٠,	Screen Loss Factor Caused by Eddy Current		0.00003	0.00012	0.00003
Metalli	c Screen Lo	ass factor		-	-	
42	λ,	Screen Loss Factor		0.01726	0.01679	0.01637
Armou	r and Pipe L	Loss Factor				
43	ĥ₂ð					
44		Armour Loss Factor		0.0	0.0	0.0
46	λ₂pipe	Pipe Loss Factor		0.0	0.0	0.0
	λz	Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor				
	λ <sub>2</sub> Operation	Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor IEC 60287-2-1		0.0	0.0	0.0
47	λ <sub>2</sub> Operation T <sub>1</sub>	Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor IEC 60287-2-1 Thermal Resistance Between Conductor and Screen	[K.m/W]	0.0 0.0 0.36693	0.0 0.0 0.36693	0.0 0.0 0.36693
47 48	λ <sub>2</sub> I Operation T <sub>1</sub>	Pipe Loss Factor Armour Loss Factor - Pipe Loss Factor ECE 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen	[mm]	0.0 0.0 0.36693 30.3	0.0 0.0 0.36693 30.3	0.0 0.0 0.36693 30.3
47 48 49	λ <sub>2</sub> I Operation T <sub>1</sub> t <sub>1</sub> ρTi	Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor IEC 60287-2-1 Thermal Resistance Between Conductor and Screen Husulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation	[mm] [K.m/W]	0.0 0.0 0.36693 30.3 3.5	0.0 0.0 0.36693 30.3 3.5	0.0 0.0 0.36693 30.3 3.5
47 48 49 50	λ <sub>2</sub> I Operation T <sub>1</sub> t <sub>1</sub> ρTi T <sub>3</sub>	Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Investition Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W]	0.0 0.0 0.36693 30.3 3.5 0.0429	0.0 0.0 0.36693 30.3 3.5 0.0429	0.0 0.0 0.36693 30.3 3.5 0.0429
47 48 49 50 51	λ <sub>2</sub> I Operation T, t, ρTi T <sub>s</sub> t <sub>s</sub>	Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 00287-2-1 Termial Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coaling Thickness of Jacket/Pipe Coaling	[mm] [K.m/W] [K.m/W] [mm]	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2
47 48 49 50 51 52	λ <sub>2</sub> I Operation T <sub>1</sub> t <sub>1</sub> ρTi T <sub>3</sub>	Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Investition Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W]	0.0 0.0 0.36693 30.3 3.5 0.0429	0.0 0.0 0.36693 30.3 3.5 0.0429	0.0 0.0 0.36693 30.3 3.5 0.0429
47 48 49 50 51 52	λ <sub>2</sub> <b>Operation</b> T, t, ρTi T <sub>3</sub> t <sub>3</sub> ρTJ	Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 00287-2-1 Termial Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coaling Thickness of Jacket/Pipe Coaling	[mm] [K.m/W] [K.m/W] [mm]	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5
47 48 49 50 51 52 Cable I	λ <sub>2</sub> <b>Operation</b> T, t, ρTi T <sub>3</sub> t <sub>3</sub> ρTJ	Pipe Loss Factor Armour Loss Factor - Pipe Loss Factor IEC 60287-2-1 Thermal Resistance Between Conductor and Screen Phermal Resistivity of Insulation Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coaling Thermar Resistivity of Jacket/Pipe Coaling Thermal Resistivity of Jacket/Pipe Coaling	[mm] [K.m/W] [K.m/W] [mm]	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2
47 48 49 50 51 52 <b>Cable I</b> 53	λ <sub>3</sub> I Operation T <sub>1</sub> t <sub>1</sub> ρTi T <sub>3</sub> t <sub>3</sub> ρTJ n Ducts U	Pipe Loss Factor Armor Loss Factor EC 0.0287-2-1 Thermal Resistance Betwean Conductor and Screen Insulation Thickness Betwean Conductor and Screen Thermal Resistance of Jacket/Pipe Coaling Thickness of Jacket/Pipe Coaling Thermal Resistivity of Jacket/Pipe Coaling Coefficient Used in EC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm]	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87
47 48 49 50 51 52 <b>Cable I</b> 53 54	λ₂           Operation           Τ,           ts           ρTi           Ts           ts           ρTJ           n Ducts           U           V	Pipe Loss Factor Armour Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Fisulation Thickness Between Conductor and Screen Thermal Resistance of JacketPipe Coating Thickness of JacketPipe Coating Thickness of JacketPipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm]	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312
47 48 49 50 51 52 <b>Cable I</b> 53 54 55	λ₂           λ₂           Operation           Τ,           t,           ρTi           Ts           ts           pTJ           n Ducts           U           V           Y	Pipe Loss Factor Armour Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coaling Thermal Resistance of Jacket/Pipe Coaling Thermal Resistance Decould a compare the second sec	[mm] [K.m/W] [K.m/W] [mm] [K.m/W]	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.0037	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.0037	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.0037
47 48 49 50 51 52 <b>Cable I</b> 53 54 55 55 56 57	λ₂           λ₂           Operation           Τ,           t,           ρTi           Ts           ts           pTJ           n Ducts           U           V           Y	Pipe Loss Factor Armour Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistance of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Inside the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W]	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.0037	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.0037 5.3.7 0.22907	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.0037
47 48 49 50 51 52 <b>Cable I</b> 53 54 55 56 57 58	λ₂           λ₂           Operation           Τ,           Ι,           ρΤi           Τs           Ιs           ρTJ           n Ducts           U           V           Y           θm           Tai           Do	Pipe Loss Factor Armor Loss Factor + Pipe Loss Factor EC 0027-2-1 Thermal Resistance Between Conductor and Screen Fusulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation Thermal Resistance of Jacket/Pipe Coaling Thickness of Jacket/Pipe Coaling Thermal Resistivity of Jacket/Pipe Coaling Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Mean Temporture of the Medum Filling the Space Thermal Resistance of the Medum Inside the Duct/Pipe Outside Diameter of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [K.m/W] [°C] [K.m/W] [mm]	0.0 0.36693 30.3 5.2 5.2 3.5 0.0429 5.2 3.5 0.0429 5.2 3.5 0.0429 5.2 3.5 0.0429 5.2 3.5 0.0429 1.87 0.312 0.0037 5.3.1 0.22991 200.0	0.0 0.36693 30.3 5.2 5.2 3.5 0.0429 5.2 3.5 0.0429 5.2 3.5 0.0429 5.2 3.5 0.0429 5.2 3.5 0.0429 0.312 0.0037 5.3.7 0.22907 200.0	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.0037 5.3.1 0.22996 200.0
47 48 49 50 51 52 <b>Cable I</b> 53 54 55 55 56 57	λ₂           λ₂           Operation           Τ,           t,           ρΤi           Ts           ta           ρTi           Ts           ta           V           Y           θm           Ta'	Pipe Loss Factor Armour Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Fisulation Thickness Between Conductor and Screen Thermal Resistance of LaketPipe Coaling Thickness of JacketPipe Coaling Thickness of JacketPipe Coaling Thickness of JacketPipe Coaling Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used on Coefficient of the Medium Filling the Space Thermal Resistance of the Medium Filling the Ducl/Pipe Inside Diameter of the Ducl/Pipe	[mm] [K.m/W] [K.m/W] [K.m/W] [°C] [K.m/W]	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.0037 5.3.1 0.22991	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.0037 5.3.7 0.22907	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.0037 53.1 0.22996
47 48 49 50 51 52 <b>Cable I</b> 53 54 55 56 57 58	λ₂           λ₂           Operation           Τ,           Ι,           ρΤi           Τs           Ιs           ρTJ           n Ducts           U           V           Y           θm           Tai           Do	Pipe Loss Factor Armour Loss Factor EC 60287-2-1 EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used In IEC 60287-2-1 Coefficient Used In IEC 60287-2-1 Coefficient Claus	[mm] [K.m/W] [K.m/W] [K.m/W] [°C] [K.m/W] [mm]	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 3.5 1.87 0.312 0.0037 5.3.1 0.22991 200.0 188.0 3.5	0.0 0.36693 30.3 5.2 5.2 3.5 0.0429 5.2 3.5 0.0429 5.2 3.5 0.0429 5.2 3.5 0.0429 5.2 3.5 0.0429 0.312 0.0037 5.3.7 0.22907 200.0	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.0037 5.3.1 0.22996 200.0 188.0 3.5
47 48 49 50 51 52 <b>Cable 1</b> 53 54 55 56 56 57 58 59 60 61	λ <sub>2</sub> Operation           Γ,           β           ρT           Γ           β	Pipe Loss Factor Armor Loss Factor + Pipe Loss Factor EC 6027-21 Thermal Resistance Between Conductor and Screen Instructure Thickness Between Conductor and Screen Thermal Resistance of JacketPipe Coaling Thickness of JacketPipe Coaling Thermal Resistance of JacketPipe Coaling Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Mean Temporature of the Medium Fisite the Duct/Pipe Chaide Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [*C] [*C] [mm] [mm] [K.m/W] [K.m/W]	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.0037 53.1 0.22991 200.0 188.0 3.5 0.03447	0.0 0.36693 30.3 3.5 5.2 3.5 1.87 0.312 0.0037 5.3.7 0.22907 200.0 188.0 3.5 0.03447	0.0 0.0 0.36693 30.3 3.5 5.2 3.5 0.0429 5.2 3.5 0.312 0.0037 5.3.1 0.22996 200.0 188.0 3.5 0.03447
47 48 49 50 51 52 <b>Cable 1</b> 53 54 55 55 56 57 58 59 60 61 62	λ <sub>2</sub> λ <sub>2</sub> Operation           T <sub>1</sub> μ           ρT           ts           ρTJ           n Ducts           U           V           Y           θm           T <sub>4</sub> <sup>*</sup> Do           Di           ρT           τ <sub>4</sub> <sup>**</sup> T <sub>4</sub> <sup>**</sup>	Pipe Loss Factor Armour Loss Factor EC 60297-2-1 Thermal Resistance Between Conductor and Screen Fisulation Thickness Between Conductor and Screen Thermal Resistance of Lacket/Pipe Coaling Thickness of Jacket/Pipe Coaling Thickness of Jacket/Pipe Coaling Thickness of Jacket/Pipe Coaling Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Coefficient Used on EC 60287-2-1 Clause 2.2.7.1 Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Coefficient Used on EC 60287-2-1 Clause 2.2.7.1 Coefficient Used in E 60207-2.1 Coefficient Used in EC 60287-2.1 Coefficient U	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [*C] [*C] [K.m/W] [mm] [K.m/W]	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 3.5 1.87 0.312 0.0037 5.3.1 0.22991 200.0 188.0 3.5	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 3.5 1.87 0.312 0.0037 5.3 7 5.3 7 5.3 7 0.22907 200.0 188.0 3.5	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.0037 5.3.1 0.22996 200.0 188.0 3.5
47 48 49 50 51 52 <b>Cable I</b> 53 54 55 56 57 58 57 58 59 60 61 62 <b>Cable I</b>	λs           Operation           Tr,           μ           pTi           Ts,           bs           pTJ           n Ducts           U           V           Y           θm           Tr,           Do           Di           Tr,           n Ducts	Pipe Loss Factor Armour Loss Factor EC 00287-2-1 Thermal Resistance Between Conductor and Screen Faulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used III Thermal Resistance of the Duct/Pipe Coefficient Clause 2.7.1 Coefficient IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	[mm] [K.m/M] [M.m/M] [mm] [K.m/M] [*C] [*C] [*C] [K.m/M] [mm] [K.m/M] [K.m/M]	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.0037 5.3.1 0.20991 2000 188.0 3.5 0.03447 0.45393	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.0037 53.7 0.22907 200.0 188.0 3.5 0.03447 0.03447 0.03447 0.03447	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.0037 5.3.1 0.22996 200.0 188.0 3.5 0.03447 0.45497
47 48 49 50 51 52 <b>Cable I</b> 53 54 55 56 57 58 59 60 61 62 <b>Cable I</b> 62 <b>Cable I</b>	λ.           Operation           T.           pTi           Ts.           pTJ           n Ducts           U           V           em           T.'.           Do           Di           pT           T.'."           n Docts	Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-21 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coaling Thermal Resistance of Jacket/Pipe Coaling Thermal Resistance of Jacket/Pipe Coaling Coefficient Used in EC 60287-21 Clause 2.2.7.1 Mean Temperature of the Medium Filing the Space Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium nn/Reskill Interlation Shorter Side of the Duct Bank/Backfill	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] ["C] ["C] [K.m/W] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.0037 53.1 0.0037 53.1 0.0037 200.0 188.0 3.5 0.03447 0.45393	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.0037 53.7 0.0037 200.0 188.0 0.0037 200.0 188.0 3.5 0.03447 0.46196	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.0037 53.1 0.0037 53.1 0.22996 200.0 188.0 3.5 0.03447 0.45397
47 48 49 50 51 52 <b>Cable I</b> 53 54 55 56 57 58 59 60 61 62 <b>Cable I</b> 63 64	λs           Coperation           T,           Is           pTI           Ts           pTJ           n Ducts           U           V           Y           Bem           Di           pT           T-**           T-**           T-**           y	Pipe Loss Factor Armor Loss Factor Pipe Loss Factor Piec Co207-2-1 Thermal Resistance Betwean Conductor and Screen Insulation Thickness Betwean Conductor and Screen Insulation Thickness Betwean Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistance of Jacket/Pipe Coating Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Coefficient Clause 2.2.7.1 Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Coefficient Clause	[mm] [K.m/W] [mm] [K.m/W] [K.m/W] [K.m/W] [mm] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	0.0 0.0 0.36693 30.3 3.5 5.2 3.5 1.87 0.312 0.0037 200.0 188.0 3.5 5.1 0.22991 200.0 188.0 3.5 5.1 0.02447 0.03447 0.03447 0.03447 0.03447 0.03447	0.0 0.0 0.36693 30.3 3.5 5.2 3.5 7 1.87 0.312 0.0037 200.0 188.0 3.5 7 0.22907 200.0 188.0 3.5 0.03447 0.00447 0.00447 0.00447 0.00447 0.00447 0.00447 0.00447 0.00447 0.0040 0.0047 0.00400000000	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.0037 5.3 1.87 0.312 0.0037 1.88,0 3.5 0.22996 200.0 188,0 3.5 0.03447 0.45397
47 48 49 50 51 52 <b>Cable</b> 53 54 55 55 55 55 55 60 61 62 <b>Cable</b> 63 64 65	λ.           Operation           T.           Is           ρTi           Ts           pTJ           n Ducts           U           V           Y           Øm           T*           Do           Di           pT           T**           T**           Y           n a Duct Be           x           y           rb	Pipe Loss Factor Armour Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Fusulation Thickness Between Conductor and Screen Thermal Resistance of Lacket/Pipe Coaling Thickness of Jacket/Pipe Coaling Thickness of Jacket/Pipe Coaling Thickness of Jacket/Pipe Coaling Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used on IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Coefficient Could III Could IIII Could	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] ["C] ["C] [K.m/W] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 7 7 1.87 0.312 0.0037 5.3 1.87 0.312 0.0037 5.3 5.3 5 0.345 1.80 0.00 188.0 3.5 0.03447 0.045 1.0485 1.40996	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 7 7 1.87 0.312 0.037 5.3,7 0.22907 200.0 188.0 3.5 0.03447 188.0 3.5 0.03447 0.461%	0.0 0.0 0.36693 30.3 5.2 3.5 5.2 3.5 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7
47 48 49 50 51 52 <b>Cable I</b> 53 55 55 55 55 55 56 60 61 62 63 64 63 64 65 66	λs           Coperation           T,           Is           pTI           Ts           pTJ           n Ducts           U           V           Y           Bem           Di           pT           T-**           T-**           T-**           y	Pipe Loss Factor Armour Loss Factor EC 0027-2-1 EC 0027-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Dataket/Pipe Coating Thermal Resistance of Jacket/Pipe Coating Thermal Resistance of Lock 2017-2-1 Clause 2.2.7.1 Coefficient Used in IEC 40287-2-1 Clause 2.2.7.1 Coefficient Claus	[mm] [K.m/W] [mm] [K.m/W] [K.m/W] [K.m/W] [mm] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	0.0 0.0 0.36693 30.3 3.5 5.2 3.5 1.87 0.312 0.0037 200.0 188.0 3.5 5.1 0.22991 200.0 188.0 3.5 5.1 0.02447 0.03447 0.03447 0.03447 0.03447 0.03447	0.0 0.0 0.36693 30.3 3.5 5.2 3.5 7 1.87 0.312 0.0037 200.0 188.0 3.5 7 0.22907 200.0 188.0 3.5 0.03447 0.00447 0.00447 0.00447 0.00447 0.00447 0.00447 0.00447 0.00447 0.0040 0.0047 0.00400000000	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.0037 53.1 0.22996 200.0 3.5 0.22996 200.0 3.5 0.3427 0.45397 0.45397 0.563 1.0.4659 0.563
47 48 49 50 51 52 <b>Cable I</b> 53 54 55 56 57 58 59 60 61 61 62 62 <b>Cable I</b> 63 64 64 65 66 67	λ <sub>a</sub> λ <sub>b</sub> Coperation           ρT           b           pTI           Ts           b           pTJ           D           U           V           Y           Bm           Ts'           Do           DI           pT           Ts'           DO           DI           pT           Ts'           Bm           Ts'           DO           DI           pT           Ts'           DO           DI           pT           Ts'           DO           DI           Ts'           Ts'           Ts'           Ts'           Ts'           Ts'           Ts'	Pipe Loss Factor Armor Loss Factor Pipe Loss Factor Piec Co207-2 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coaling Thickness of Jacket/Pipe Coaling Thermal Resistance of Jacket/Pipe Coaling Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Coefficient Used in EC 60287-2-1 Clause 2.2.7.3 Coefficient Used in EC 60287-2-1 Cla	[mm] [K.m/W] [M.m/W] [M.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	0.0 0.0 0.36693 30.3 3.5 5.2 3.5 7 1.87 0.312 0.0312 0.0312 5.3 1.87 0.312 0.0312 5.3 1.87 0.312 0.0312 5.3 1.87 0.312 0.0419 0.045 1.0485 1.0485 1.0485	0.0 0.0 0.36693 30.3 3.5 5.2 3.5 0.0429 5.2 3.5 5.2 3.5 0.0312 0.0312 0.0312 0.0312 5.3.7 0.22907 200.0 188.0 3.5,7 0.22907 200.0 188.0 3.5,7 0.22907 200.0 188.0 3.5,7 0.22907 200.0 188.0 3.5,7 0.22907 200.0 188.0 3.5,7 0.22907 200.0 188.0 188.0 188.0 188.0 188.0 188.0 188.0 188.0 188.0 188.0 188.0 188.0 188.0 189.0 188.0 189.0 199.0	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 0.0429 0.0037 5.3.1 0.22996 200.0 188.0 3.5 0.03447 0.45397 0.453 10.485 1.40996
47 48 49 50 51 52 <b>Cable I</b> 53 55 55 55 55 55 56 60 61 62 63 64 63 64 65 66	λ.           Δ.           Operation           Tr.           μ           pTI           Ts.           μ           pTI           D           V           Y           θm           Tr.'           Do           Di           ρT           T.'.           n Duct Bi           x           y           db           LG	Pipe Loss Factor Armour Loss Factor EC 0027-2-1 EC 0027-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Dataket/Pipe Coating Thermal Resistance of Jacket/Pipe Coating Thermal Resistance of Lock 2017-2-1 Clause 2.2.7.1 Coefficient Used in IEC 40287-2-1 Clause 2.2.7.1 Coefficient Claus	[mm] [K.m/W] [M.m/W] [M.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.0037 53.1 0.22991 200.0 3.5 0.037 53.1 0.22991 200.0 3.5 0.0429 3.5 0.0447 0.45393 0.663 1.0465 1.40996 1.049	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.037 53.7 0.22907 200.0 3.5 0.22907 200.0 3.5 0.22907 200.0 188.0 3.5 0.0447 0.46196 0.563 10.4659 0.563 1.40996 1.049	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.0037 53.1 0.22996 200.0 3.5 0.22996 200.0 3.5 0.3427 0.45397 0.45397 0.563 1.0.4659 0.563
47 48 49 50 51 52 54 55 55 55 55 55 55 60 60 61 62 <b>Cable</b> 63 64 63 64 65 66 67 68	λ Δ Ο Operation Γ Γ Γ Γ Γ Γ Γ Γ Γ Γ Γ Γ Γ	Pipe Loss Factor Armour Loss Factor FEC 60287-21 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coaling Thermal Resistance of Jacket/Pipe Coaling Thermal Resistance of Jacket/Pipe Coaling Coefficient Used in EC 60287-21 Clause 2.2.7.1 Mean Temperature of the Medium Filing the Space Thermal Resistance of the Duct/Pipe Thermal Resistance of the Duct Bark/Backfill Coefficient Used in IC 60287-3-1 Clause 2.2.3 Number of Loaded Cables in the Duct Bark/Backfill	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] ["m] [mm] [K.m/W] [K.m/W] [K.m/M] [m] [m] [m] [m] [m]	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.0037 53.1 0.0037 53.1 0.22991 200.0 188.0 3.5 0.03447 0.45393 0.563 10.485 1.40996 0.563 1.049 0.54390 1.049 0.74399 3.0	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.0037 0.0037 53.7 0.22907 200.0 188.0 3.5 0.03447 0.46196 0.563 10.485 1.40996 0.563 1.049 0.5439 3.0	0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 0.0429 5.2 3.5 0.037 7 3.1 0.22996 200.0 188.0 3.5 0.03447 0.4597 0.563 10.685 1.40996 0.563 1.6485
47 48 49 50 51 52 <b>Cable</b> 53 55 55 55 55 57 58 59 60 61 62 <b>Cable</b> 62 <b>Cable</b> 63 64 65 66 67 68 69	λ. λ. Δ. Οperation μ μ μ μ μ μ μ μ μ μ μ μ μ	Pipe Loss Factor Armor Loss Factor Pipe Loss Factor Piec 0x027-21 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coaling Thickness of Jacket/Pipe Coaling Thermal Resistance of Jacket/Pipe Coaling Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Coefficient Used in EC 60287-2-1 Clause 2.2.7.3 Dept of Lanjng to the Duct/Pipe Course of the Duct Bank/Backfill Coefficient Used in EC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Coefficient Used in EC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Coefficient Used in EC 60287-2-1 Clause 2.2.7.3	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/M] [K.m/M] [K.m/M] [K.m/M] [K.m/M] [K.m/M] [K.m/M]	0.0 0.0 0.36693 30.3 3.5 5.2 3.5 0.0429 5.2 3.5 0.0327 0.0337 5.3.1 0.22991 200.0 188.0 3.5 0.03447 0.45393 0.563 10.4855 1.40996 1.0485 1.0499 3.0 1.0	0.0 0.0 0.36693 30.3 3.5 5.2 3.5 0.0429 5.2 3.5 0.0327 0.0337 0.0337 0.0337 0.0337 0.0337 0.0347 0.46196 0.563 10.485 1.04996 1.0485 1.0499 3.0 1.0	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 0.0429 5.2 1.87 0.312 0.0037 5.3.1 0.22996 200.0 188.0 3.5 0.03447 0.45397 0.4533 10.485 1.40996 1.0485 1.0499 3.0 1.0485
47 48 49 50 51 52 <b>Cable 1</b> 53 54 55 56 57 58 59 60 61 62 <b>Cable 6</b> 63 64 65 66 67 68 67 68 69 70	λ. λ. Δ. Ο Operation 2 μ. μ. μ. μ. μ. μ. μ. μ. μ. μ.	Pipe Loss Factor Armor Loss Factor Pipe Loss Factor Piec A0287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Insulation Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Coefficient Used In EC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Coefficient Used In EC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of Learth Around the Duct Bank/Backfill Thermal Resistivity of Le	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	0.0 0.0 0.36693 30.3 3.5 5.2 3.5 7 7 1.87 0.312 0.0037 5.3 5.3 0.312 0.22991 200.0 188.0 3.5 0.22991 200.0 188.0 3.5 0.02494 200.0 188.0 3.5 0.0449 0.04593 0.04593 0.04593 0.04593 0.04593 0.04593 0.04593 0.0459 0.000 0.0459 0.000 0.0459 0.000 0.0459 0.000 0.0459 0.000 0.0459 0.000 0.0459 0.0000 0.0000000000000000000000000000	0.0 0.0 0.36693 30.3 3.5 5.2 3.5 7 0.22907 200.0 188.0 3.5 0.22907 200.0 188.0 3.5 0.22907 200.0 188.0 3.5 0.22907 200.0 188.0 3.5 0.02447 0.046196 0.044196 0.044196 0.044196 0.0449 0.0449 0.044196 0.0441 0.045	0.0 0.0 0.36693 30.3 3.5 5.2 3.5 0.0429 5.2 3.5 0.312 0.037 53.1 0.22996 200.0 188.0 3.5 0.22996 200.0 188.0 3.5 0.0347 0.04597 0.45897 0.45897 0.45897 1.049 0.45397 0.4685
47 48 49 50 51 52 <b>Cable I</b> 53 54 55 56 57 58 59 60 61 61 62 <b>Cable</b> 61 62 <b>Cable I</b> 63 64 64 65 66 66 67 68 69 70 71	λ.           λ.           Δ.           Operation           φ1           T.           b           pTJ           D           U           V           Y           Bm           T.'           Do           DI           DI           DT           T.'           DO           DI           PT           T.'           DO           DI           DI      D	Pipe Loss Factor Armour Loss Factor EC 0027-2-1 Thermal Resistance Between Conductor and Screen Faulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Dacket/Pipe Coatisde Diameter of the Medium Filling the Space Thermal Resistivity of Dack Bank/Backfill Coatficient Used in EC 60287-2-1 Clause 2.2.7.1 Coatisde Diameter of the Duct/Pipe Dacket/Rill Installation Shorter Side of the Duct Bank/Backfill Coatficient Used in EC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistiti	[KmW] [KmW0] [KmW0 [KmW0] [KmW0] [KmW1 [KmW1] [KmW1 [KmW1] [KmW1 [KmW1] [KmW1]	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.037 53.1 0.23991 2200.0 188.0 3.5 0.03473 0.45393 3.0 1.0 0.655 3.0	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.037 53.7 53.7 0.22907 200.0 188.0 3.5 0.03447 0.046196 0.663 1.0495 1.049 0.045 0.085 0.046196	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.0037 53.1 0.2396 200.0 188.0 3.5 0.03447 0.045397 0.45397 1.0 0.45397
47 48 49 50 51 52 <b>Cable 1</b> 53 54 55 56 57 58 59 60 61 62 <b>Cable 6</b> 63 64 65 66 67 68 67 68 69 70	λ. λ. Δ. Ο Operation 2 μ. μ. μ. μ. μ. μ. μ. μ. μ. μ.	Pipe Loss Factor Armour Loss Factor Pipe Loss Factor Piec Co327-21 Thermal Resistance Between Conductor and Screen Instruction Thickness Between Conductor and Screen Instruction Thickness Between Conductor and Screen Instruction Thickness Between Conductor and Screen Instruction Instruction Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Mean Temporature of the Medium Fisite the Duct/Pipe Outside Diameter of the Duct/Pipe Instee Dameter of the Duct/Pipe Instee Dameter of the Duct/Pipe Instee Dameter of the Duct/Pipe Instee Insteastance of the Surrounding Medium InterMacktill Insteaster Deptif or Lanyin to the Contra Bark/Backfill Coefficient Used in EC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bark/Backfill Intermal Resistivity of Learth Around the Duct Bark	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	0.0 0.0 0.36693 30.3 3.5 5.2 3.5 7 7 1.87 0.312 0.0037 5.3 5.3 0.312 0.22991 200.0 188.0 3.5 0.22991 200.0 188.0 3.5 0.02494 200.0 188.0 3.5 0.0449 0.04593 0.04593 0.04593 0.04593 0.04593 0.04593 0.04593 0.0459 0.000 0.0459 0.000 0.0459 0.000 0.0459 0.000 0.0459 0.000 0.0459 0.000 0.0459 0.0000 0.0000000000000000000000000000	0.0 0.0 0.36693 30.3 3.5 5.2 3.5 7 0.22907 200.0 188.0 3.5 0.22907 200.0 188.0 3.5 0.22907 200.0 188.0 3.5 0.22907 200.0 188.0 3.5 0.02447 0.046196 0.044196 0.044196 0.044196 0.0449 0.0449 0.044196 0.0441 0.045	0.0 0.0 0.36693 30.3 3.5 5.2 3.5 0.0429 5.2 3.5 0.312 0.037 53.1 0.22996 200.0 188.0 3.5 0.22996 200.0 188.0 3.5 0.0347 0.04597 0.45897 0.45897 0.45897 1.049 0.45397 0.4685
47 48 49 50 51 52 55 55 55 55 57 58 59 60 61 62 <b>Cable</b> 63 64 63 64 65 66 67 68 69 70 71 72	λ. λ. Δ. Δ. Δ. Δ. Δ. Δ. Δ. Δ. Δ. Δ	Pipe Loss Factor Armor Loss Factor EC 0027-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Insulation Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Finand Resistance of the Duct/Pipe Internal Resistance of the Duct/Pipe Internal Resistance of the Surgervertup Coefficient Used In EC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Chermal Resistance of the Duct Bank/Backfill Internal Resistance of the Surgervertup Internal Resistance of the Surgervertup Internal Tresmal Resistance Internal Resistance Inte	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 7 7 1.87 0.312 0.0037 5.1 5.3 0.312 0.0037 5.2 3.5 7 7 0.312 0.0037 5.2 0.35 7 0.312 0.0037 1.87 0.0037 5.2 3.5 7 0.312 0.0037 1.87 0.0037 1.85 0.00429 1.80 0.0047 1.0047 1.0040	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 7 7 1.87 0.312 0.0037 5.7 5.7 5.7 5.7 5.7 0.22907 200.0 188.0 3.5 0.22907 200.0 188.0 3.5 0.22907 200.0 188.0 3.5 0.0347 200.0 188.0 3.5 0.044196 0.46196 0.7255	0.0 0.0 0.36693 30.3 3.5 5.2 3.5 7 7 1.87 0.312 0.0037 5.3 1.87 0.312 0.0037 5.3 5.3 0.312 0.0037 1.87 0.22996 200.0 188.0 3.5 0.0347 200.0 188.0 3.5 0.03447 200.0 188.0 3.5 0.03447 200.0 10.4597 0.74399 1.0 0.085 0.45397 0.7184
47 48 49 50 51 52 <b>Cable I</b> 53 54 55 56 57 58 59 60 61 61 62 <b>Cable</b> 61 62 <b>Cable I</b> 63 64 64 65 66 66 67 68 69 70 71	λ.           λ.           Δ.           Operation           φ1           T.           b           pTJ           D           U           V           Y           Bm           T.'           Do           DI           DI           DT           T.'           DO           DI           PT           T.'           DO           DI           DI      D	Pipe Loss Factor Armour Loss Factor Pipe Loss Factor Piec Co327-21 Thermal Resistance Between Conductor and Screen Instruction Thickness Between Conductor and Screen Instruction Thickness Between Conductor and Screen Instruction Thickness Between Conductor and Screen Instruction Instruction Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Mean Temporature of the Medium Fisite the Duct/Pipe Outside Diameter of the Duct/Pipe Instee Dameter of the Duct/Pipe Instee Dameter of the Duct/Pipe Instee Dameter of the Duct/Pipe Instee Insteastance of the Surrounding Medium InterMacktill Insteaster Deptif or Lanyin to the Contra Bark/Backfill Coefficient Used in EC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bark/Backfill Intermal Resistivity of Learth Around the Duct Bark	[KmW] [KmW0] [KmW0 [KmW0] [KmW0] [KmW1 [KmW1] [KmW1 [KmW1] [KmW1 [KmW1] [KmW1]	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.037 53.1 0.23991 2200.0 188.0 3.5 0.03473 0.45393 3.0 1.0 0.655 3.0	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.037 53.7 53.7 0.22907 2200.0 188.0 3.5 0.03447 0.046196 0.663 1.0495 1.049 0.045 0.085 0.045 0.085 0.046196	0.0 0.0 0.36693 30.3 3.5 0.0429 5.2 3.5 1.87 0.312 0.0037 53.1 0.2396 200.0 188.0 3.5 0.03447 0.045397 0.45397 1.0 0.45397

	Study Summary
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Extra wide (1ct 400kV CABLE) 3000sqmm Cond
Date:	20/03/2020 15:50:42

General Simulation Data	
Steady State Option	Equally Loaded
Consider Electrical interaction between circuits	No
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0
Conductor Resistances Computation Option:	IEC-228

Installation Type:Ductbank		
Ambient Soil Temperature at Installation Depth	[°C]	20.0
Native Soil Thermal Resistivity	[K.m/W]	1.2
Thermal Resistivity of Duct Bank	[K.m/W]	1.0
Depth of Center of Duct Bank	[m]	1.05
Duct Bank Width	[m]	10.49
Duct Bank Height	[m]	0.56



Results S	Summary									
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [m]	Y coordinate [m]	Conductor temperature [°C]	Ampacity [A]
1	400KV.032	1		А	50.0	1.0	-5.0	1.05	89.4	2271.1
2	400KV.032	1		В	50.0	1.0	0.0	1.05	90.0	2271.1
3	400KV.032	1		С	50.0	1.0	5.0	1.05	89.4	2271.1

	Steady State Summary		
CYMCAP Version	7.3 Revision 2		
Study:	Eirgrid Cp966 Feasibility study		
Execution:	Eirgrid - Extra wide (1ct 400kV CABLE) 3000sqmm Cond		
Date:	20/03/2020 15:50:42		

Simulation Data	
Installation type:	Ductbank
Steady State Option	Equally Loaded
Amblent temperature [°C]	20
Native Soll Thermal Resistivity [K.m/W]	1.2
Consider Non-Isothermal Earth Surface	No
Consider effect of soll dry out	No
Consider Electrical interaction between circuits	No
Induced current in metallic layers as a fraction of conductor current (applied to all single phase circuits)	0

Variable	e Description	Unit		Cables	
Cable No.	Cable Index Number		1	2	3
General Inp	ut Data				
Cable ID	Cable Equipment ID		400KV.032	400KV.032	400KV.032
Circuit No.	Circuit No.		1	1	1
Phase	Cable Phase		А	В	С
Fq	Operating Frequency	[Hz]	50.0	50.0	50.0
x	X coordinate	[m]	-5.0	0.0	5.0
у	Y coordinate	[m]	1.05	1.05	1.05
DLF	Daily Load Factor	[p.u.]	1.0	1.0	1.0
	Bonding Type		1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat
Ampacity					
I	Steady State Ampacity	[A]	2271.1	2271.1	2271.1
Temperatur	es				
θc	Conductor temperature	[°C]	89.4	90.0	89.4
θs	Sheath/Shield temperature	[°C]	69.0	69.5	69.0
θа	Armour temperature	[°C]	n/a	n/a	n/a
θsurf	Cable surface temperature	[°C]	66.5	67.0	66.5
Øduct	Duct surface temperature	[°C]	51.6	52.1	51.5
Resistances	3				
R₀	DC Resistance of the conductor at 20°C	[Ω/km]	0.00586	0.00586	0.00586
R	AC Resistance of the Conductor at Operating Temperature	[Ω/km]	0.01041	0.01042	0.01041
ys	Skin Effect Factor		0.39466	0.3937	0.39473
ур	Proximity Effect Factor		0.00008	0.00008	0.00008
Losses					
Wc	Conductor Losses	[W/m]	53.67911	53.73427	53.67506
Wd	Dielectric Losses	[W/m]	4.00787	4.00787	4.00787
Ws	Metallic Screen Losses	[W/m]	0.94059	0.91521	0.89109
Wa	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
Wt	Total Losses	[W/m]	58.62757	58.65735	58.57402
λ1	Screen Loss Factor		0.01752	0.01703	0.0166
λ <sub>2</sub>	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
Thermal res	Istances				
T1	Thermal resistance of insulation	[K.m/W]	0.36693	0.36693	0.36693
T2	Thermal resistance of bedding/medium inside pipe-type	[K.m/W]	n/a	n/a	n/a
Т3	Thermal resistance of outer covering	[K.m/W]	0.0429	0.0429	0.0429
Τ4	External thermal resistance	[K.m/W]	0.79311	0.80182	0.79321
Others					
Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
	Induced current on Metallic Screen	[A]	143.9	141.5	140.1

 Cables Report

 CYMCAP Version
 7.3 Revision 2

 Study:
 Elrgrid Cp966 Feasibility study

Eirgrid - Extra wide (1ct 400kV CABLE) 3000sqmm Cond

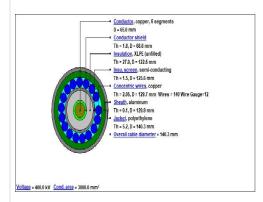
Execution:

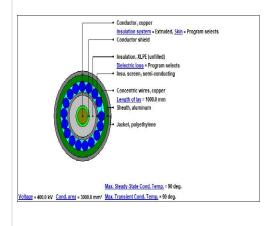
	Description	11-14	
No. Con	eral Cable Information	Unit	1
1	Cable Equipment ID		
-	Number of Cores		400KV.032
2	Voltage		Single Core
3	Conductor Area	[kV]	400
4	Cable Overall Diameter	[mm <sup>2</sup> ]	3000.0
5		[mm]	140.3
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	90
Con	ductor	т т	
8	Material		Copper
9	Electrical Resistivity at 20°C	[μΩ.cm]	1.7241
10	Temperature Coefficient at 20°C	[1/K]	0.00393
11	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
12	Volumetric Specific Heat (SH)	[J/(K*cm3)]	3.45
13	Construction	price and y	6 Segments
14	Conductor Insulation System		Extruded
15	Milliken Wires Construction		Bare Unidirectional Wires
16	Ks (Skin Effect Coefficient)		0.62
17	Kp (Proximity Effect Coefficient)		0.82
18	Diameter	[mm]	65.0
	ductor Shleld	[mm]	65.0
19	Thickness	[mm]	1.8
20	Diameter	[mm]	68.6
	ulation	[[TIII1]	00.0
21	Material		XLPE Unfilled
21	Thermal Resistivity	[K.m/W]	3.5
22	Dielectric Loss Factor - (tan delta)	[K.IIIW]	0.001
23	Relative Permittivity - ( epsilon )		2.5
24			2.5
25	Specific Insulation Resistance Constant at 60°F - (K)	[MQ.km]	65617.
26	Thickness	[mm]	27.0
27	Diameter	[mm]	122.6
insu	ulation Screen	1 1	
28	Material		Semi Conducting Screen
29	Thickness	[mm]	1.5
30	Diameter	[mm]	125.6
She			
31	Is Sheath Around Each Core?		n/a
32	Material		Aluminum
33	Electrical Resistivity at 20°C	[μΩ.cm]	2.84
34	Temperature Coefficient at 20°C	[1/K]	0.00403
35	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	228
36	Volumetric Specific Heat (SH)	[J/(K*cm <sup>2</sup> )]	2.5
37	Corrugation Type	erte ett.)	2.5 Non Corrugated
38	Thickness	[mm]	0.1
39	Diameter	[mm]	129.9
	centric neutral/Skid wires	(card	
	Are Concentric Neutral Wires Around Each Core?	I	
40		──┤	n/a
41	Material	<b>├</b>	Copper
42	Electrical Resistivity at 20°C	[μΩ.cm]	1.7241
43	Temperature Coefficient at 20°C	[1/K]	0.00393
44	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
45	Volumetric Specific Heat (SH)	[J/(K*cm3)]	3.45
46	Length of Lay	[mm]	1000.0
47	Number of Wires		140
48	Wire Gauge		12
49	Thickness	[mm]	2.05
50	Diameter	[mm]	129.7
Jac	ket	[]	127.1
51	Material		Polyethylene
52	Thermal Resistivity	[K.m/W]	3.5
52		[rearings]	0.0
53	Thickness	[mm]	5.2

No.	Description	Unit	1
Spe	cific Installation Data		
55	Cable Equipment ID		400KV.032
56	Cable Frequency	[Hz]	50
57	Sheath / Shield Bonding		1 Conductor Crossbonded Flat
58	Loss Factor Constant (ALOS)		0.3
59	Minor section length		Crossbonded Unknown Section Lengths UNKNOWN
60	Duct construction		Polyethylene in Concrete
61	Duct material thermal resistivity	[K.m/W]	3.5
62	Inside Diameter of the Duct/Pipe	[mm]	188.0
63	Outside Diameter of the Duct/Pipe	[mm]	200.0

#### Cable ID : 400KV.032

Cable Title 3000sqmm milliken Cu\_xlpe\_cws\_pe (Generic design)





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CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Extra wide (1ct 400kV CABLE) 3000sqmm Cond
Date:	20/03/2020 15:50:42

No.	Description	Unit	Cable No.1	Cable No.2	Cable No.3
1	Cable Equipment ID		400KV.032	400KV.032	400KV.032
Resi	stances				
2	DC Resistance of the conductor at 20°C	[Ω/km]	0.00586	0.00586	0.00586
3	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00746	0.00747	0.00746
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.00907	0.00907	0.00907
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01041	0.01042	0.01041
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.69646	0.69646	0.69646
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.83402	0.83553	0.83391
8	DC Resistance of Concentric Wires at 20°C	[Ω/km]	0.0402	0.0402	0.0402
9	DC Resistance of Concentric Wires at Operating Temperature	[Ω/km]	0.04794	0.04803	0.04794
Loss	es				
10	Conductor Losses	[W/m]	53.67911	53.73427	53.67506
11	Dielectric Losses	[W/m]	4.00787	4.00787	4.00787
12	Metallic Screen Losses	[W/m]	0.94059	0.91521	0.89109
13	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
14	Total Losses	[W/m]	58.62757	58.65735	58.57402
Сара	acitance, Inductance, Impedance				
15	Capacitance	[µF/km]	0.239	0.239	0.239
16	Inductance of Conductor	[mH/km]	1.05719	1.05719	1.05719
17	Reactance of Conductor	[Ω/km]	0.33213	0.33213	0.33213
18	Inductance of Metallic Sheath	[mH/km]	0.87053	0.87053	0.87053
19	Reactance of Metallic Sheath	[Ω/km]	0.27348	0.27348	0.27348
20	Positive Sequence Impedance	[Ω/km]	0.010410 + j0.332130	0.010420 + j0.332130	0.010410 + j0.332130
21	Negative Sequence Impedance	[Ω/km]	0.010410 + j0.332130	0.010420 + j0.332130	0.010410 + j0.332130
22	Zero Sequence Impedance	[Ω/km]	0.046180 + j0.273480	0.046180 + j0.273480	0.046180 + j0.273480
23	Surge Impedance	[Ω]	66.48051	66.48051	66.48051
Othe	rs	1	1		
24	Dielectric Stress at Conductor Surface	[kV/mm]	11.59585	11.59585	11.59585
25	Dielectric Stress at Insulation Surface	[kV/mm]	6.48838	6.48838	6.48838
26	Insulation Resistance at 60°F (15.8°C)	[MQ.km]	16546.34872	16546.34872	16546.34872
27	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a
28	Charging Current for One Phase	[A/km]	17.35457	17.35457	17.35457
29	Charging Capacity of three phase system at Uo	[kvar/km]	12023.60029	12023.60029	12023.60029
30	Voltage drop for Three Phase System	[V/A/km]	0.01803	0.01804	0.01802
31	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
32	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
33	Induced current on Metallic Screen	[A]	143.9	141.5	140.1

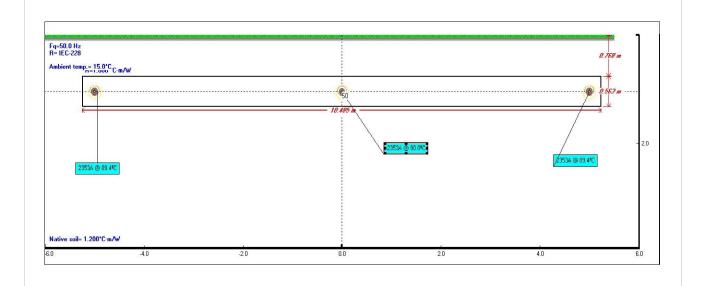
Cable Parameters under Normal Operation				
CYMCAP Version	7.3 Revision 2			
Study:	Eirgrid Cp966 Feasibility study			
Execution:	Eirgrid - Extra wide (1ct 400kV CABLE) 3000sqmm Cond			
Date:	20/03/2020 15:50:42			

No.	Symbol	Description	Unit	Cable No.1	Cable No.2	Cable No.3
1		Cable Equipment ID		400KV.032	400KV.032	400KV.032
		IEC 60287-1-1				
Conduc	tor AC Res	Istance				
2	Ro	DC Resistance of the conductor at 20°C	[Ω/km]	0.00586	0.00586	0.00586
3	R'	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00746	0.00747	0.00746
4	dc	Conductor Diameter	[mm]	65.0	65.0	65.0
5	S	Distance Between Conductor Axes	[mm]	5000.0	5000.0	5000.0
6	ks	Factor Used for xs Calculation (Skin Effect)		0.62	0.62	0.62
7	kp	Factor Used for xp Calculation (Proximity Effect)		0.37	0.37	0.37
8	xs	Component of Ys Calculation (Skin Effect)		3.23132	3.22855	3.23152
9	хр	Component of Yp Calculation (Proximity Effect)		2.49623	2.49409	2.49639
10	ys	Skin Effect Factor		0.39466	0.3937	0.39473
11	ур	Proximity Effect Factor		0.00008	0.00008	0.00008
12	R	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01041	0.01042	0.01041
Dielect	ric Losses			1		
13	tanð	Dielectric Loss Factor		0.001	0.001	0.001
14	3	Insulation Relative Permitivity		2.5	2.5	2.5
	_					
15	С	Cable Capacitance	[µF/km]	0.239	0.239	0.239
16	U. Wd	Voltage	[kV]	230.94011	230.94011	230.94011
17 Circula	ting Loss F	Cable Dielectric Losses Per Phase	[W/m]	4.00787	4.00787	4.00787
Circula				1		
18	Rs	AC Resistance used for Circulating Loss Factor computation	[Ω/km]	0.04534	0.04542	0.04533
		an among and a Muth Computered				
19	d	Mean diameter used for Circulating Loss Factor computation	[mm]	128.72949	128.72949	128.72949
20	х	Reactance used for Circulating Loss Factor computation	[Ω/km]	0.27348	0.27348	0.27348
21	Xm	Mutual Reactance	[Ω/km]	0.04355	0.04355	0.04355
	_				0	
22	Р	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.31704	0.31704	0.31704
23	Q	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.25897	0.25897	0.25897
2.5	4	Spacing Factor (applied when spacing between cable uneven or non	[ee:011]	0.23077	0.63077	0.20071
24	Fspacing	equal minor section length)		0.004	0.004	0.004
25	λ',	Screen Loss Factor Caused by Circulating Current		0.01749	0.01692	0.01657
Eddy L	oss Factor					
26	Rs	AC Resistance used for Eddy Loss Factor computation	[Ω/km]	0.83402	0.83553	0.83391
27	d	Mean diameter used for Eddy Loss Factor computation	[mm]	129.8	129.8	129.8
28	ρs	Electrical Resistivity used for Eddy Loss Factor computation	[Ω.m]	0.0	0.0	0.0
29	Ds	External diameter used for Eddy Loss Factor computation	[mm]	129.9	129.9	129.9
30	ts	Thickness used for Eddy Loss Factor computation	[mm]	0.1	0.1	0.1
31	β1	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		107.74034	107.6434	107.74747
32	gs	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		1.00005	1.00005	1.00005
34	m	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.03767	0.0376	0.03767
35	λo	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.0	0.0	0.0
36	Δ1	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		-0.00156	0.0	0.00008
37	$\Delta_2$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.0	0.0	0.0
38	F	Milliken conductor Effect		1.0	1.0	1.0
39	Fpipe	Magnetic effect factor due to pipe		1.0	1.0	1.0
40	Farmour	Magnetic effect factor due to armour		1.0	1.0	1.0
41 Metalik	λ": Screen Lo	Screen Loss Factor Caused by Eddy Current		0.00003	0.00011	0.00003
42	á.	Screen Loss Factor		0.01752	0.01703	0.0166
	and Pipe L		1	0.01752	0.01700	0.0100
43	λ₂a	Armour Loss Factor		0.0	0.0	0.0
44	λ₂pipe	Pipe Loss Factor		0.0	0.0	0.0
46	λ2	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
		IEC 60287-2-1				
47	T <sub>1</sub>	Thermal Resistance Between Conductor and Screen	[K.m/W]	0.36693	0.36693	0.36693
48	t,	Insulation Thickness Between Conductor and Screen	[mm]	30.3	30.3	30.3
49	ρΤί	Thermal Resistivity of Insulation	[K.m/W]	3.5	3.5	3.5
50	T3	Thermal Resistance of Jacket/Pipe Coating	[K.m/W]	0.0429	0.0429	0.0429
51	ta	Thickness of Jacket/Pipe Coating	[mm]	5.2	5.2	5.2
52	ρTJ	Thermal Resistivity of Jacket/Pipe Coating	[K.m/W]	3.5	3.5	3.5
Cable I	n Ducts					
53	U	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		1.87	1.87	1.87
54	v	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		0.312	0.312	0.312
55	Y	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		0.0037	0.0037	0.0037
56	θm	Mean Temperature of the Medium Filling the Space	[°C]	60.0	60.6	60.0
			1	1		
57	-					0.22019
	T4'	Thermal Resistance of the Medium Inside the Duct/Pipe	[K.m/W]	0.22015	0.2194	
58	Do	Outside Diameter of the Duct/Pipe	[mm]	200.0	200.0	200.0
59	Do Di	Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe	[mm] [mm]	200.0 188.0	200.0 188.0	188.0
59 60	Do Di pT	Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Material	[mm] [mm] [K.m/W]	200.0 188.0 3.5	200.0 188.0 3.5	188.0 3.5
59 60 61	Do Di pT T4"	Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Material Thermal Resistance of the Duct/Pipe	[mm] [mm] [K.m/W] [K.m/W]	200.0 188.0 3.5 0.03447	200.0 188.0 3.5 0.03447	188.0 3.5 0.03447
59 60 61 62	Do Di ρT Τ4" Τ4"	Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Material Thermal Resistance of the Surrour/Pipe Thermal Resistance of the Surrour/Ing Medium	[mm] [mm] [K.m/W]	200.0 188.0 3.5	200.0 188.0 3.5	188.0 3.5
59 60 61 62 Cable I	Do Di ρT T₄" T₄ <b>"</b> n a Duct Ba	Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Material Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium nk/Backfill Installation	[mm] [mm] [K.m/W] [K.m/W] [K.m/W]	200.0 188.0 3.5 0.03447 0.5385	200.0 188.0 3.5 0.03447 0.54795	188.0 3.5 0.03447 0.53855
59 60 61 62 Cable I 63	Do Di ρT T <sub>4</sub> " T <sub>4</sub> " n a Duct Be	Outside Diameter of the Duct/Pipe Tendie Diameter of the Duct/Pipe Thormal Resistivity of the Duct/Pipe Material Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>an/Backfill</b> Installation Shorter Side of the Duct Bank/Backfill	[mm] [mm] [K.m/W] [K.m/W] [K.m/W]	200.0 188.0 3.5 0.03447 0.5385 0.563	200.0 188.0 3.5 0.03447 0.54795 0.563	188.0 3.5 0.03447 0.53855 0.563
59 60 61 62 <b>Cable I</b> 63 64	Do Di pT T₄" n a Duct Be x y	Outside Diameter of the Duct/Pipe Texide Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Material Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>mKBackfill Installation</b> Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill	[mm] [mm] [K.m/W] [K.m/W] [K.m/W] [m] [m]	200.0 188.0 3.5 0.03447 0.5385 0.563 10.485	200.0 188.0 3.5 0.03447 0.54795 0.563 10.485	188.0 3.5 0.03447 0.53855 0.563 10.485
59 60 61 62 <b>Cable I</b> 63 64 65	Do Di ρT T₄" T₄" n a Duct Be x y rb	Outside Diameter of the Duct/Pipe Trisdie Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>mk/Backfill</b> Installation Shorter Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill	[mm] [mm] [K.m/W] [K.m/W] [K.m/W] [m] [m] [m]	200.0 188.0 3.5 0.03447 0.5385 0.563 10.485 1.40996	200.0 188.0 3.5 0.03447 0.54795 0.563 10.485 1.40996	188.0 3.5 0.03447 0.53855 0.563 10.485 1.40996
59 60 61 62 <b>Cable I</b> 63 64 65 66	Do Di pT T4" T4" <b>T</b> 4" <b>T</b> 4" <b>n a Duct Be</b> <b>x</b> y rb LG	Outside Diameter of the Duct/Pipe Texide Diameter of the Duct/Pipe Thormal Resistivity of the Duct/Pipe Material Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>in/Backfill</b> Installation Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill	[mm] [mm] [K.m/W] [K.m/W] [K.m/W] [m] [m]	200.0 188.0 3.5 0.03447 0.5385 0.563 10.485 1.40996 1.049	200.0 188.0 3.5 0.03447 0.54795 0.563 10.485 1.40996 1.049	188.0 3.5 0.03447 0.53855 0.563 10.485 1.40996 1.049
59 60 61 62 <b>Cable I</b> 63 64 65 66 66 67	Do Di pT Ta" Ta" x y rb LG u	Outside Diameter of the Duct/Pipe Texide Diameter of the Duct/Pipe Thermal Resistively of the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>inXBackfill Installation</b> Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Equinater Radius of Duct Bank/Backfill Coefficient Used in EC 60287-2-1 Clause 2.2.7.3	[mm] [mm] [K.m/W] [K.m/W] [K.m/W] [m] [m] [m]	200.0 188.0 3.5 0.03447 0.5385 0.563 10.485 1.40996 1.049 0.74399	200.0 188.0 3.5 0.03447 0.54795 0.563 10.485 1.40996 1.049 0.74399	188.0 3.5 0.03447 0.53855 0.563 10.485 1.40996 1.049 0.74399
59 60 61 62 <b>Cable I</b> 63 64 65 66	Do Di pT T4" T4" <b>T</b> 4" <b>T</b> 4" <b>n a Duct Be</b> <b>x</b> y rb LG	Outside Diameter of the Duct/Pipe Texide Diameter of the Duct/Pipe Thormal Resistivity of the Duct/Pipe Material Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>in/Backfill</b> Installation Shorter Side of the Duct Bank/Backfill Longer Side of the Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill	[mm] [mm] [K.m/W] [K.m/W] [K.m/W] [m] [m] [m]	200.0 188.0 3.5 0.03447 0.5385 0.563 10.485 1.40996 1.049	200.0 188.0 3.5 0.03447 0.54795 0.563 10.485 1.40996 1.049	188.0 3.5 0.03447 0.53855 0.563 10.485 1.40996 1.049
59 60 61 62 <b>Cable I</b> 63 64 65 66 66 67	Do Di PT T." n a Duct Be x y rb LG u N	Outside Diameter of the Duct/Pipe Tendie Diameter of the Duct/Pipe Thermal Resistively of the Duct/Pipe Material Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>anXBackfill</b> Installation Shorter Side of the Duct Bank/Backfill Equivalent Radus of Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill Coefficient Used in EC 60287-21 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill	[mm] [mm] [K.m/W] [K.m/W] [K.m/W] [m] [m] [m]	200.0 188.0 3.5 0.03447 0.5385 0.563 10.485 1.40996 1.049 0.74399	200.0 188.0 3.5 0.03447 0.54795 0.563 10.485 1.40996 1.049 0.74399	188.0 3.5 0.03447 0.53855 0.563 10.485 1.40996 1.049 0.74399
59 60 61 62 <b>Cable I</b> 63 64 65 66 67 68 69	Do Di PT Ta" Ta" n a Duct Be x y rb LG u N	Outside Diameter of the Duct/Pipe Texide Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>ink/Backfill</b> Installation Shorter Side of the Duct Bank/Backfill Eagwater Radius of Duct Bank/Backfill Eagwater Radius of Duct Bank/Backfill Coefficient Used in EC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill	[mm] [mm] [K.m/W] [K.m/W] [m] [m] [m] [m] [m]	200.0 188.0 3.5 0.03447 0.563 10.485 1.40996 1.049 0.74399 3.0 1.2	200.0 188.0 3.5 0.03447 0.563 10.485 1.40996 1.049 0.74399 3.0 1.2	188.0 3.5 0.03447 0.53855 0.563 10.485 1.40996 1.049 0.74399 3.0 1.2
59 60 61 62 <b>Cable I</b> 63 64 65 66 67 68 69 70	Do Di PT T." n a Duct Be x y rb LG u N	Outside Diameter of the Duct/Pipe Texide Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Duct/Pipe Norter Side of the Duct Pipe Role Statistication Role Role Role Role Role Role Role Role	[mm] [mm] [K.m/W] [K.m/W] [M] [m] [m] [m] [m] [m] [m] [m] [K.m/W]	200.0 188.0 3.5 0.03447 0.563 10.485 1.40996 1.049 0.74399 3.0 1.2 1.0	200.0 188.0 3.5 0.03447 0.54795 0.563 10.485 1.40996 1.049 0.74399 3.0 1.2 1.0	188.0 3.5 0.03447 0.53855 0.563 1.0.485 1.40996 1.049 0.74399 3.0 1.2 1.0
59 60 61 62 <b>Cable I</b> 63 64 65 66 67 68 69 70 71	Do Di ρT Ta" Ta" n a Duct Be x y rb LG LG U N N Pe ρc Ta"	Outside Diameter of the Duct/Pipe Texide Diameter of the Duct/Pipe Thormal Resistivity of the Duct/Pipe Material Thormal Resistance of the Duct/Pipe Thormal Resistance of the Surrounding Medium <b>in/Backfill</b> Installation Shorter Side of the Duct Bank/Backfill Equivalent Ratixe of Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill Coefficient Used in EC 40287-21 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill	[mm] [mm] [K.m/W] [K.m/W] [K.m/W] [m] [m] [m] [m] [m] [m] [K.m/W] [K.m/W]	200.0 188.0 3.5 0.03447 0.563 10.485 1.04996 1.049 0.74399 3.0 1.2 1.0 0.5385	200.0 188.0 3.5 0.03447 0.54795 0.563 10.485 1.40996 0.74399 3.0 1.2 1.0 0.54795	188.0 3.5 0.03447 0.53855 0.563 10.485 1.40996 1.049 0.74399 3.0 1.2 1.0 0.53855
59 60 61 62 <b>Cable I</b> 63 64 65 66 67 68 69 70	Do Di ρT Ta" Ta" n a Duct Ba x y rb LG U U N N ρe ρc	Outside Diameter of the DucUPipe Texide Diameter of the DucUPipe Thermal Resistively of the DucUPipe Thermal Resistance of the DucUPipe Thermal Resistance of the Surrounding Medium <b>ANG Backfill</b> Installation Shorter Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill Coefficient Used in EC 40287-21 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill	[mm] [mm] [K.m/W] [K.m/W] [M] [m] [m] [m] [m] [m] [m] [m] [K.m/W]	200.0 188.0 3.5 0.03447 0.563 10.485 1.40996 1.049 0.74399 3.0 1.2 1.0	200.0 188.0 3.5 0.03447 0.54795 0.563 10.485 1.40996 1.049 0.74399 3.0 1.2 1.0	188.0 3.5 0.03447 0.53855 0.563 1.0.485 1.40996 1.049 0.74399 3.0 1.2 1.0
59 60 61 62 <b>Cable I</b> 63 64 65 66 67 68 69 70 71	Do Di ρT Ta" Ta" n a Duct Be x y rb LG LG U N N Pe ρc Ta"	Outside Diameter of the Duct/Pipe Tisside Diameter of the Duct/Pipe Thormal Resisitury of the Duct/Pipe Material Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium <b>ModBackfill Installation</b> Shorter Side of the Duct Bank/Backfill Equivalent Radius Of Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill Coefficient Used in EC 402872-1 Clause 2.2.7.3 Nimber of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill	[mm] [mm] [K.m/W] [K.m/W] [K.m/W] [m] [m] [m] [m] [K.m/W] [K.m/W] [K.m/W]	200.0 188.0 3.5 0.03447 0.563 10.485 1.04996 1.0499 0.74399 3.0 1.2 1.0 0.5385	200.0 188.0 3.5 0.03479 0.54795 1.0499 1.049 0.74399 3.0 1.2 1.0 0.54795 0.80182	188.0 3.5 0.03447 0.53855 0.563 10.485 1.40996 1.049 0.74399 3.0 1.2 1.0 0.53855
59 60 61 62 <b>Cable I</b> 63 64 65 66 67 68 67 68 69 70 71 72	Do Di pT Ta" n a Duct Be x y rb LG U U N N Pe pc Ta" Ta	Outside Diameter of the DucUPipe Texide Diameter of the DucUPipe Thermal Resistively of the DucUPipe Thermal Resistance of the DucUPipe Thermal Resistance of the Surrounding Medium <b>ANG Backfill</b> Installation Shorter Side of the Duct Bank/Backfill Equivalent Radius of Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill Coefficient Used in EC 40287-21 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bank/Backfill Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill	[mm] [mm] [K.m/W] [K.m/W] [K.m/W] [m] [m] [m] [m] [m] [m] [K.m/W] [K.m/W]	200.0 188.0 3.5 0.03447 0.563 10.489 1.40996 1.049 0.74399 3.0 1.2 1.0 0.5385 0.79311	200.0 188.0 3.5 0.03447 0.54795 0.563 10.485 1.40996 0.74399 3.0 1.2 1.0 0.54795	188.0 3.5 0.03447 0.5855 0.563 10.485 1.40996 1.049 0.74399 3.0 1.2 1.0 0.53855 0.79321

	Study Summary
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Extra wide (1ct 400kV CABLE) 3000sqmm Cond
Date:	20/03/2020 15:53:32

General Simulation Data	
Steady State Option	Equally Loaded
Consider Electrical interaction between circuits	No
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0
Conductor Resistances Computation Option:	IEC-228

Installation Type:Ductbank						
Ambient Soil Temperature at Installation Depth	[°C]	15.0				
Native Soil Thermal Resistivity	[K.m/W]	1.2				
Thermal Resistivity of Duct Bank	[K.m/W]	1.0				
Depth of Center of Duct Bank	[m]	1.05				
Duct Bank Width	[m]	10.49				
Duct Bank Height	[m]	0.56				



Results S	Results Summary									
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [m]	Y coordinate [m]	Conductor temperature [°C]	Ampacity [A]
1	400KV.032	1		А	50.0	1.0	-5.0	1.05	89.4	2352.7
2	400KV.032	1		В	50.0	1.0	0.0	1.05	90.0	2352.7
3	400KV.032	1		С	50.0	1.0	5.0	1.05	89.4	2352.7

	Steady State Summary
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Extra wide (1ct 400kV CABLE) 3000sqmm Cond
Date:	20/03/2020 15:53:32

Simulation Data	
Installation type:	Ductbank
Steady State Option	Equally Loaded
Amblent temperature [°C]	15
Native Soll Thermal Resistivity [K.m/W]	1.2
Consider Non-Isothermal Earth Surface	No
Consider effect of soll dry out	No
Consider Electrical interaction between circuits	No
Induced current in metallic layers as a fraction of conductor current (applied to all single phase circuits)	0

Variable	e Description	Unit		Cables	
Cable No.	Cable Index Number		1	2	3
General Inp	ut Data				
Cable ID	Cable Equipment ID		400KV.032	400KV.032	400KV.032
Circuit No.	Circuit No.		1	1	1
Phase	Cable Phase		А	В	С
Fq	Operating Frequency	[Hz]	50.0	50.0	50.0
x	X coordinate	[m]	-5.0	0.0	5.0
у	Y coordinate	[m]	1.05	1.05	1.05
DLF	Daily Load Factor	[p.u.]	1.0	1.0	1.0
	Bonding Type		1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat
Ampacity					
I	Steady State Ampacity	[A]	2352.7	2352.7	2352.7
Temperatur	es				
θc	Conductor temperature	[°C]	89.4	90.0	89.4
θs	Sheath/Shield temperature	[°C]	67.5	68.1	67.5
θa	Armour temperature	[°C]	n/a	n/a	n/a
θsurf	Cable surface temperature	[°C]	64.8	65.4	64.8
0 duct	Duct surface temperature	[°C]	48.7	49.3	48.7
Resistance	S				
R₀	DC Resistance of the conductor at 20°C	[Ω/km]	0.00586	0.00586	0.00586
R	AC Resistance of the Conductor at Operating Temperature	[Ω/km]	0.01041	0.01042	0.01041
ys	Skin Effect Factor		0.39472	0.3937	0.3948
ур	Proximity Effect Factor		0.00008	0.00008	0.00008
Losses				•	•
Wc	Conductor Losses	[W/m]	57.60398	57.6673	57.59933
Wd	Dielectric Losses	[W/m]	4.00787	4.00787	4.00787
Ws	Metallic Screen Losses	[W/m]	1.00463	0.97787	0.95199
Wa	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
Wt	Total Losses	[W/m]	62.61647	62.65303	62.55918
<b>λ</b> 1	Screen Loss Factor		0.01744	0.01696	0.01653
λ <sub>2</sub>	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
Thermal res	sistances				
T1	Thermal resistance of insulation	[K.m/W]	0.36693	0.36693	0.36693
T2	Thermal resistance of bedding/medium inside pipe-type	[K.m/W]	n/a	n/a	n/a
Т3	Thermal resistance of outer covering	[K.m/W]	0.0429	0.0429	0.0429
Τ4	External thermal resistance	[K.m/W]	0.79609	0.80472	0.79619
Others					
Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
	Induced current on Metallic Screen	[A]	149.1	146.6	145.1

1.1.1	_	
10		

Cables Report

 CYMCAP Version
 7.3 Revision 2

 Study:
 Eirgrid Cp966 F

 Execution:
 Eirgrid - Extra w

Eirgrid Cp966 Feasibility study Eirgrid - Extra wide (1ct 400kV CABLE) 3000sqmm Cond

Date: 20/03/2020 15:53:32

No.	Description	Unit	1
Gene	eral Cable Information		
1	Cable Equipment ID		400KV.032
2	Number of Cores		Single Core
3	Voltage	[kV]	400
	Conductor Area	[mm <sup>2</sup> ]	3000.0
_	Cable Overall Diameter	[mm]	140.3
		[mm]	140.5
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[*C]	90
Cond	luctor		
8	Material		Copper
9 E	Electrical Resistivity at 20°C	[μΩ.cm]	1.7241
10	Temperature Coefficient at 20°C	[1/K]	0.00393
	Reciprocal of Temperature Coefficient of Resistance		
	(BETA)	[K]	234.5
12	Volumetric Specific Heat (SH)	[J/(K*cm3)]	3.45
13	Construction		6 Segments
14	Conductor Insulation System		Extruded
15	Milliken Wires Construction		Bare Unidirectional Wires
16	Ks (Skin Effect Coefficient)		0.62
17	Kp (Proximity Effect Coefficient)		0.37
	Diameter	[mm]	65.0
_	luctor Shleld	· · · ·	
19	Thickness	[mm]	1.8
	Diameter	[mm]	68.6
nsula		[ITHT]	08.0
	Material		
21	Thermal Resistivity		XLPE Unfilled
		[K.m/W]	3.5
	Dielectric Loss Factor - (tan delta)		0.001
24	Relative Permittivity - ( epsilon )		2.5
25	Specific Insulation Resistance Constant at 60°F - ( K )	[MQ.km]	65617.
_	Thickness	[mm]	27.0
	Diameter	[mm]	122.6
21	ation Screen	(ITHIT)	122.0
	Vaterial		
28	Thickness		Semi Conducting Screen
27		[mm]	1.5
50	Diameter	[mm]	125.6
Shea		1	
01	s Sheath Around Each Core?		n/a
32	Material		Aluminum
33	Electrical Resistivity at 20°C	[μΩ.cm]	2.84
34 1	Temperature Coefficient at 20°C	[1/K]	0.00403
	Reciprocal of Temperature Coefficient of Resistance		
	(BETA)	[K]	228
00	Volumetric Specific Heat (SH)	[J/(K*cm3)]	2.5
	Corrugation Type		Non Corrugated
50	Thickness	[mm]	0.1
39 [	Diameter	[mm]	129.9
Conc	entric neutral/Skid wires		
/	Are Concentric Neutral Wires Around Each Core?		
		1	n/a
40			
40 41	Material		Copper
40 41 42	Material Electrical Resistivity at 20°C	[μΩ.cm]	Copper 1.7241
40 41 42 43	Vlaterial Electrical Resistivity at 20°C Fernperature Coefficient at 20°C	[μΩ.cm] [1/K]	
40 41 P 42 E 43 T	Material Electrical Resistivity at 20°C	[1/K]	1.7241 0.00393
40 41 42 43 43 43 44	Waterial Electrical Resistivity at 20°C Temperature Coefficient at 20°C Occiprocal of Temperature Coefficient of Resistance BETA)	[1/K] [K]	1.7241 0.00393 234.5
40 41 42 43 43 44 44	Waterial Electrical Resistivity at 20°C Temperature Coefficient at 20°C ecciprocal of Temperature Coefficient of Resistance BETA) //olumetric Specific Heat (SH)	[1/K] [K] [J/(K*cm <sup>3</sup> )]	1.7241 0.00393 234.5 3.45
40 41 42 43 43 43 43 44 45	Waterial Electrical Resistivity at 20°C Temperature Coefficient at 20°C ecciprocal of Temperature Coefficient of Resistance BETA) /olumetric Specific Heat (SH) .ength of Lay	[1/K] [K]	1.7241 0.00393 234.5 3.45 1000.0
40 41 42 43 7 44 45 45 46 46	Waterial Electrical Resistivity at 20°C Temperature Coefficient at 20°C exciprocal of Temperature Coefficient of Resistance BETA) /olumetric Specific Heat (SH) .ength of Lay Number of Wires	[1/K] [K] [J/(K*cm <sup>3</sup> )]	1.7241 0.00393 234.5 3.45 1000.0 140
40 41 42 43 1 43 1 43 43 44 45 46 47 7 48	Waterial Electrical Resistivity at 20°C Temperature Coefficient at 20°C ecciprocal of Temperature Coefficient of Resistance BETA) /olumetric Specific Heat (SH) .ength of Lay Vumber of Wires Wire Gauge	[1/K] [K] [J/(K*cm <sup>3</sup> )]	1.7241 0.00393 234.5 3.45 1000.0
40 41 P 42 E 43 T 44 Q 45 V 46 L 47 P 48 V 49 T	Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C ecciprocal of Temperature Coefficient of Resistance BETA) Volumetric Specific Heat (SH) 	[1/K] [K] [J/(K*cm <sup>3</sup> )]	1.7241 0.00393 234.5 3.45 1000.0 140
40 41 42 43 43 44 45 46 46 47 48 49	Waterial Electrical Resistivity at 20°C Temperature Coefficient at 20°C ecciprocal of Temperature Coefficient of Resistance BETA) /olumetric Specific Heat (SH) .ength of Lay Vumber of Wires Wire Gauge	[1/K] [K] [J/(K*cm*)] [mm]	1.7241 0.00393 234.5 3.45 1000.0 140 12
40       41     1       42     1       43     1       44     1       44     1       44     1       44     1       46     1       47     1       48     1       49     1       50     1	Waterial Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance BETA) Volumetric Specific Heat (SH)ength of Lay Number of Wires Write Gauge Thickness Diameter	[1/K] [K] [J/(K*cm*)] [mm] [mm]	1.7241 0.00393 234.5 3.45 1000.0 140 12 2.05
40 41 1 4 42 8 43 7 44 6 45 1 46 1 47 7 48 1 48 1 49 7 50 1 50 1	Waterial Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance BETA) Volumetric Specific Heat (SH)ength of Lay Number of Wires Write Gauge Thickness Diameter	[1/K] [K] [J/(K*cm*)] [mm] [mm]	1.7241 0.00393 234.5 3.45 1000.0 140 12 2.05
40           41           41           42           43           43           43           44           45           46           47           48           49           50           51	Waterial Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance BETA) Volumetric Specific Heat (SH)ength of Lay Number of Wires Write Gauge Thickness Diameter Et	[1/K] [K] [J/(K'cm?)] [mm] [mm] [mm]	1.7241 0.00393 234.5 3.45 1000.0 140 12 2.05 129.7 Polyethylene
40         40           41         1           42         8           43         1           43         1           44         0           45         1           46         1           47         1           48         1           49         1           50         1           51         1           52         1	Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance BETA) Volumetric Specific Heat (SH)ength of Lay Number of Wires Wrie Gauge Thickness Diameter et Vaterial	[1/K] [K] [J/(K*cm*)] [mm] [mm]	1.7241 0.00393 234.5 3.45 1000.0 140 12 2.05 129.7

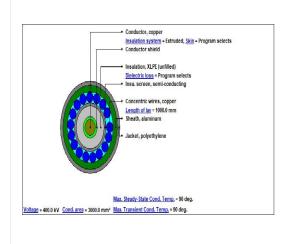
Description	Unit	1
cific Installation Data		
Cable Equipment ID		400KV.032
Cable Frequency	[Hz]	50
Sheath / Shield Bonding		1 Conductor Crossbonded Flat
Loss Factor Constant (ALOS)		0.3
Minor section length		Crossbonded Unknown Section Lengths UNKNOWN
Duct construction		Polyethylene in Concrete
Duct material thermal resistivity	[K.m/W]	3.5
Inside Diameter of the Duct/Pipe	[mm]	188.0
Outside Diameter of the Duct/Pipe	[mm]	200.0
	Cable Equipment ID         Cable Equipment ID         Cable Frequency         Sheath / Sheld Bonding         Loss Factor Constant (ALOS)         Mnor section length         Duct construction         Duct construction         Duct deniated thermal resistivity         Inside Diameter of the Duct/Pipe	Child         Data           Cable Equipment ID

#### Cable ID : 400KV.032

Cable Title 3000sqmm milliken Cu\_xlpe\_cws\_pe (Generic design)

Conductor, copper, § segments           0 = 65.0 mm           Conductor shield           Th = 18, 0 = 86.8 mm           Insustation, XLPE (unfilled)           Th = 72.0, 0 = 122.8 mm           Insus, screent, semi-conducting           Th = 15, 0 = 125.8 mm           Concentric wires, copper           Th = 20, 0 = 128.7 mm Wires = 140 Wire Gauge=12           Sheeth, alumnum           Th = 40, 1 = 128.8 mm           Jackel, poylethylene           Th = 52, 0 = 40.0 mm           Overall cable diameter = 140.3 mm

#### Voltage = 400.0 kV Cond. area = 3000.0 mm<sup>2</sup>



# 

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Extra wide (1ct 400kV CABLE) 3000sqmm Cond
Date:	20/03/2020 15:53:32

No.	Description	Unit	Cable No.1	Cable No.2	Cable No.3
1	Cable Equipment ID		400KV.032	400KV.032	400KV.032
Resi	stances		1		
2	DC Resistance of the conductor at 20°C	[Ω/km]	0.00586	0.00586	0.00586
3	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00746	0.00747	0.00746
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.00907	0.00907	0.00907
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01041	0.01042	0.01041
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.69646	0.69646	0.69646
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.82987	0.83148	0.82976
8	DC Resistance of Concentric Wires at 20°C	[Ω/km]	0.0402	0.0402	0.0402
9	DC Resistance of Concentric Wires at Operating Temperature	[Ω/km]	0.04771	0.0478	0.0477
Loss	es				
10	Conductor Losses	[W/m]	57.60398	57.6673	57.59933
11	Dielectric Losses	[W/m]	4.00787	4.00787	4.00787
12	Metallic Screen Losses	[W/m]	1.00463	0.97787	0.95199
13	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
14	Total Losses	[W/m]	62.61647	62.65303	62.55918
Сара	acitance, Inductance, Impedance				
15	Capacitance	[µF/km]	0.239	0.239	0.239
16	Inductance of Conductor	[mH/km]	1.05719	1.05719	1.05719
17	Reactance of Conductor	[Ω/km]	0.33213	0.33213	0.33213
18	Inductance of Metallic Sheath	[mH/km]	0.87053	0.87053	0.87053
19	Reactance of Metallic Sheath	[Ω/km]	0.27348	0.27348	0.27348
20	Positive Sequence Impedance	[Ω/km]	0.010410 + j0.332130	0.010420 + j0.332130	0.010410 + j0.332130
21	Negative Sequence Impedance	[Ω/km]	0.010410 + j0.332130	0.010420 + j0.332130	0.010410 + j0.332130
22	Zero Sequence Impedance	[Ω/km]	0.046180 + j0.273480	0.046180 + j0.273480	0.046180 + j0.273480
23	Surge Impedance	[Ω]	66.48051	66.48051	66.48051
Othe	rs	r	ſ		ſ
24	Dielectric Stress at Conductor Surface	[kV/mm]	11.59585	11.59585	11.59585
25	Dielectric Stress at Insulation Surface	[kV/mm]	6.48838	6.48838	6.48838
26	Insulation Resistance at 60°F (15.8°C)	[MQ.km]	16546.34872	16546.34872	16546.34872
27	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a
28	Charging Current for One Phase	[A/km]	17.35457	17.35457	17.35457
29	Charging Capacity of three phase system at Uo	[kvar/km]	12023.60029	12023.60029	12023.60029
30	Voltage drop for Three Phase System	[V/A/km]	0.01802	0.01804	0.01802
31	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
32	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
33	Induced current on Metallic Screen	[A]	149.1	146.6	145.1

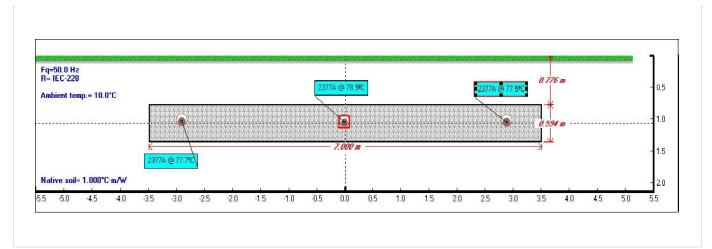
	Cable Parameters under Normal Operation						
CYMCAP Version	7.3 Revision 2						
Study:	Eirgrid Cp966 Feasibility study						
Execution:	Eirgrid - Extra wide (1ct 400kV CABLE) 3000sqmm Cond						
Date:	20/03/2020 15:53:32						

No.	Symbol	Description	Unit	Cable No.1	Cable No.2	Cable No.3
1 Norma	Operation	Cable Equipment ID IEC 60287-1-1		400KV.032	400KV.032	400KV.032
	ctor AC Res					
2	Re	DC Resistance of the conductor at 20°C	[Ω/km]	0.00586	0.00586	0.00586
3	R'	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00746	0.00747	0.00746
4	dc	Conductor Diameter	[mm]	65.0	65.0	65.0
5	s	Distance Between Conductor Axes	[mm]	5000.0	5000.0	5000.0
6	ks	Factor Used for xs Calculation (Skin Effect)		0.62	0.62	0.62
8	kp xs	Factor Used for xp Calculation (Proximity Effect) Component of Ys Calculation (Skin Effect)		0.37 3.23151	0.37 3.22855	0.37 3.23173
9	хр	Component of Yp Calculation (Proximity Effect)		2.49638	2.49409	2.49655
10	ys	Skin Effect Factor		0.39472	0.3937	0.3948
11	ур	Proximity Effect Factor		0.00008	0.00008	0.00008
12	R	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01041	0.01042	0.01041
Dielect	ric Losses	r				
13	tanō	Dielectric Loss Factor		0.001	0.001	0.001
14	ε	Insulation Relative Permitivity		2.5	2.5	2.5
15	с	Cable Capacitance	[µF/km]	0.239	0.239	0.239
16	U.	Voltage	[kV]	230.94011	230.94011	230.94011
17	Wd	Cable Dielectric Losses Per Phase	[W/m]	4.00787	4.00787	4.00787
Circula	ting Loss F	actor		-	-	
18	Rs	AC Resistance used for Circulating Loss Factor computation	[Ω/km]	0.04512	0.0452	0.04511
19	d	Mean diameter used for Circulating Loss Factor computation	[mm]	128.72949	128.72949	128.72949
.,		and a second second second comparately				
20	х	Reactance used for Circulating Loss Factor computation	[Ω/km]	0.27348	0.27348	0.27348
21	Xm	Mutual Reactance	[Ω/km]	0.04355	0.04355	0.04355
		Companyed for Circulating Lass Fully Function (Circuit Com	IOF	0.21704	0.21704	0.01704
22	Р	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.31704	0.31704	0.31704
23	Q	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.25897	0.25897	0.25897
		Spacing Factor (applied when spacing between cable uneven or non-				
24	Fspacing	equal minor section length)		0.004	0.004	0.004
25 Eddy I	۸'، oss Factor.	Screen Loss Factor Caused by Circulating Current		0.01741	0.01684	0.0165
26	Rs	AC Resistance used for Eddy Loss Factor computation	íΩ/km1	0.82987	0.83148	0.82976
26	d	Mean diameter used for Eddy Loss Factor computation Mean diameter used for Eddy Loss Factor computation	[Ω/Km]	129.8	129.8	129.8
21	u u	mean asimeter abea for Edgy Edgy ractor comparation	((()))	127.0	127.0	127.0
28	ρs	Electrical Resistivity used for Eddy Loss Factor computation	[Ω.m]	0.0	0.0	0.0
29	Ds	External diameter used for Eddy Loss Factor computation	[mm]	129.9	129.9	129.9
30 31	ts β1	Thickness used for Eddy Loss Factor computation Coefficient used in IEC 60287-1-1 Clause 2.3.6.1	[mm]	0.1	0.1	0.1
32	qs	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		1.00005	1.00005	1.00005
34	m	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.03786	0.03778	0.03786
35	λo	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.0	0.0	0.0
36	Δ,	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		-0.00156	0.0	0.00008
37	$\Delta_2$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.0	0.0	0.0
38	F	Milliken conductor Effect		1.0	1.0	1.0
39	Fpipe	Magnetic effect factor due to pipe		1.0	1.0	1.0
40	Farmour λ*1	Magnetic effect factor due to armour Screen Loss Factor Caused by Eddy Current		1.0	1.0	1.0
	c Screen Lo			0.00003	0.00012	0.00003
42	λ,	Screen Loss Factor		0.01744	0.01696	0.01653
Armou	r and Pipe L		•			
43	Å <sub>2</sub> a	Armour Loss Factor		0.0	0.0	0.0
44	λ₂pipe	Pipe Loss Factor		0.0	0.0	0.0
46	λz	Armour Loss Factor + Pipe Loss Factor IEC 60287-2-1		0.0	0.0	0.0
	· ·					
47 48	T <sub>1</sub>	Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen	[K.m/W] [mm]	0.36693 30.3	0.36693 30.3	0.36693 30.3
48	ρTi	Insulation Encodes Between Conductor and Screen Thermal Resistivity of Insulation	[K.m/W]	30.3	30.3	30.3
50	Ta	Thermal Resistance of Jacket/Pipe Coating	[K.m/W]	0.0429	0.0429	0.0429
51	ta	Thickness of Jacket/Pipe Coating	[mm]	5.2	5.2	5.2
52	ρTJ	Thermal Resistivity of Jacket/Pipe Coating	[K.m/W]	3.5	3.5	3.5
	in Ducts					
53 54	U V	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		1.87	1.87	1.87
54	Y	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		0.312	0.312	0.312
56	θm	Mean Temperature of the Medium Filling the Space	[°C]	57.9	58.5	57.8
			( -J			
57	T4	Thermal Resistance of the Medium Inside the Duct/Pipe	[K.m/W]	0.22312	0.22231	0.22317
58	Do	Outside Diameter of the Duct/Pipe	[mm]	200.0	200.0	200.0
59	Di	Inside Diameter of the Duct/Pipe	[mm]	188.0	188.0	188.0
60	ρT	Thermal Resistivity of the Duct/Pipe Material	[K.m/W]	3.5	3.5	3.5
61	T4"	Thermal Resistance of the Duct/Pipe Thermal Resistance of the Surrounding Medium	[K.m/W] [K.m/W]	0.03447 0.5385	0.03447 0.54794	0.03447 0.53855
02		I hermal Resistance of the Surrounding Medium ank/Backfill Installation	IV:10/MI	0.5385	0.54794	0.03855
63	x	Shorter Side of the Duct Bank/Backfill	[m]	0.563	0.563	0.563
64	у	Longer Side of the Duct Bank/Backfill	[m]	10.485	10.485	10.485
65	rb	Equivalent Radius of Duct Bank/Backfill	[m]	1.40996	1.40996	1.40996
66	LG	Depth of Laying to the Centre of Duct Bank/Backfill	[m]	1.049	1.049	1.049
67	u	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3		0.74399	0.74399	0.74399
68	N	Number of Loaded Cables in the Duct Bank/Backfill		3.0	3.0	3.0
69	pe	Thermal Resistivity of Earth Around the Duct Bank/Backfill	[K.m/W]	1.2	1.2	1.2
70	Pc.	Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill	[K.m/W]	1.2	1.2	1.2
	pc					
71	рс Т4'''		[K.m/W]	0.5385	0.54794	0.53855
		Thermal Resistance of the Surrounding Medium Total External Thermal Resistance	[K.m/W] [K.m/W]	0.5385	0.54794 0.80472	0.53855 0.79619
71 72	T4"'' T4	Thermal Resistance of the Surrounding Medium Total External Thermal Resistance Temperature Rise at the Surface of the Cable Due to Other	[K.m/W]	0.79609	0.80472	0.79619
71	T4'''	Thermal Resistance of the Surrounding Medium Total External Thermal Resistance				

Study Summary			
.3 Revision 2			
irgrid Cp966 Feasibility study			
irgrid - Extra wide Trench (1ct 220kV CABLE)			
3/03/2020 15:21:09			
irg			

General Simulation Data	
Steady State Option	Temperature
Consider Electrical interaction between circuits	No
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0
Conductor Resistances Computation Option:	IEC-228

Installation Type:Ductbank								
Ambient Soil Temperature at Installation Depth	[°C]	10.0						
Native Soil Thermal Resistivity	[K.m/W]	1.0						
Thermal Resistivity of Duct Bank	[K.m/W]	0.9						
Depth of Center of Duct Bank	[m]	1.07						
Duct Bank Width	[m]	7.0						
Duct Bank Height	[m]	0.59						



Results S	Results Summary									
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Dally Load Factor	X coordinate [m]	Y coordinate [m]	Conductor temperature [°C]	Ampacity [A]
1	220KV.011	1		А	50.0	1.0	-2.9	1.05	77.7	2377.0
2	220KV.011	1		В	50.0	1.0	0.0	1.05	78.9	2377.0
3	220KV.011	1		С	50.0	1.0	2.89	1.05	77.5	2377.0

	Steady State Summary	
CYMCAP Version	7.3 Revision 2	
Study:	Eirgrid Cp966 Feasibility study	
Execution:	Eirgrid - Extra wide Trench (1ct 220kV CABLE)	
Date:	23/03/2020 15:21:09	

Simulation Data		
Installation type:	Ductbank	
Steady State Option	Temperature	
Amblent temperature [°C]	10	
Native Soli Thermal Resistivity [K.m/W]	1.0	
Consider Non-Isothermal Earth Surface	No	
Consider effect of soil dry out	No	
Consider Electrical interaction between circuits	No	
Induced current in metallic layers as a fraction of conductor current (applied to all single phase circuits)	0	

Variable	e Description	Unit		Cables	
Cable No.	Cable Index Number		1	2	3
General Inp	ut Data		· ·		
Cable ID	Cable Equipment ID		220KV.011	220KV.011	220KV.011
Circuit No.	Circuit No.		1	1	1
Phase	Cable Phase		А	В	С
Fq	Operating Frequency	[Hz]	50.0	50.0	50.0
x	X coordinate	[m]	-2.9	0.0	2.89
у	Y coordinate	[m]	1.05	1.05	1.05
DLF	Daily Load Factor	[p.u.]	1.0	1.0	1.0
	Bonding Type		1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat
Ampacity					
I	Steady State Ampacity	[A]	2377.0	2377.0	2377.0
Temperatur	es				
θc	Conductor temperature	[°C]	77.7	78.9	77.5
θs	Sheath/Shield temperature	[°C]	58.5	59.6	58.4
θа	Armour temperature	[°C]	n/a	n/a	n/a
θsurf	Cable surface temperature	[°C]	55.8	56.9	55.6
Øduct	Duct surface temperature	[°C]	38.8	40.0	38.7
Resistances	5				
R₀	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
R	AC Resistance of the Conductor at Operating Temperature	[Ω/km]	0.00987	0.0099	0.00986
ys	Skin Effect Factor		0.11703	0.11625	0.11715
ур	Proximity Effect Factor		0.00007	0.00007	0.00007
Losses					
Wc	Conductor Losses	[W/m]	55.75545	55.92081	55.72848
Wd	Dielectric Losses	[W/m]	1.37316	1.37316	1.37316
Ws	Metallic Screen Losses	[W/m]	2.07944	1.91366	1.83477
Wa	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
Wt	Total Losses	[W/m]	59.20805	59.20763	58.93641
<b>λ</b> 1	Screen Loss Factor		0.0373	0.03422	0.03292
λ <sub>2</sub>	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
Thermal res	sistances	1			1
T1	Thermal resistance of insulation	[K.m/W]	0.3402	0.3402	0.3402
T2	Thermal resistance of bedding/medium inside pipe-type	[K.m/W]	n/a	n/a	n/a
Т3	Thermal resistance of outer covering	[K.m/W]	0.04631	0.04631	0.04631
Τ4	External thermal resistance	[K.m/W]	0.7114	0.70953	0.71162
Others					
Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
	Induced current on Metallic Screen	[A]	146.0	138.6	137.1

	Cables Report		
CYMCAP Version	7.3 Revision 2		
Study:	Eirgrid Cp966 Feasibility study		
Execution:	Eirgrid - Extra wide Trench (1ct 220kV CABLE)		

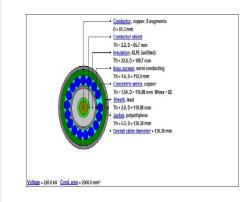
Date: 23/03/2020 15:21:09

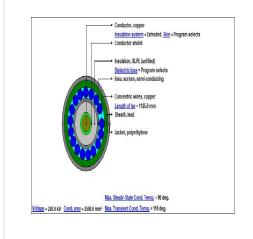
0.	Description	Unit	1
_	I Cable Information		
Cat	ble Equipment ID		220KV.011
Nur	mber of Cores		Single Core
Volt	tage	[kV]	220
Cor	nductor Area	[mm <sup>2</sup> ]	2500.0
Cat	ole Overall Diameter	[mm]	130.38
	ximum Steady-State Conductor Temperature		
5		[°C]	90
	ximum Emergency Conductor Temperature	[°C]	110
onduc	ctor		
Mat	terial		Copper
Elei	ctrical Resistivity at 20°C	[μΩ.cm]	1.7241
o Ten	nperature Coefficient at 20°C	[1/K]	0.00393
Rec	ciprocal of Temperature Coefficient of Resistance		
· ·	TA)	[K]	234.5
-	umetric Specific Heat (SH)	[J/(K*cm3)]	3.45
3 Cor	nstruction		6 Segments
4 Cor	nductor Insulation System		Extruded
5 Milli	ken Wires Construction		Insulated Wires
6 Ks	(Skin Effect Coefficient)		0.35
7 Kp	(Proximity Effect Coefficient)		0.2
	meter	[mm]	61.3
	ctor Shield	[rmi]	01.5
77.6.1	ckness		
7	meter	[mm]	2.2
sulati		[mm]	65.7
_		1 1	
1	lerial		XLPE Unfilled
2 The	ermal Resistivity	[K.m/W]	3.5
3 Diel	lectric Loss Factor - ( tan delta )		0.001
4 Rel	ative Permittivity - ( epsilon )		2.5
Spe	ecific Insulation Resistance Constant at 60°F - (K)		
5	ckness	[MQ.km]	65617.
6		[mm]	22.0
/	meter	[mm]	109.7
_	lon Screen		
8 Mat	terial		Semi Conducting Screen
9 Thi	ckness	[mm]	1.6
o Dia	meter	[mm]	112.9
heath			
1 Is S	heath Around Each Core?		n/a
	terial		
Elei	ctrical Resistivity at 20°C	for and	Lead
Top	ctrical Resistivity at 20°C	[μΩ.cm]	Lead 21.4
4 Ter	nperature Coefficient at 20°C	[μΩ.cm] [1/K]	Lead
4 Ten Rec			Lead 21.4
4 Ten Rec 5 (BE	nperature Coefficient at 20°C ciprocal of Temperature Coefficient of Resistance	[1/K] [K]	Lead 21.4 0.004 230
4 Ten Rec 5 (BE 6 Voli	nperature Coefficient at 20°C ciprocal of Temperature Coefficient of Resistance TA)	[1/K]	Lead 21.4 0.004 230 1.45
4 Ten Rec 5 (BE 6 Voli 7 Cor	nperature Coefficient at 20°C ciprocal of Temperature Coefficient of Resistance (TA) urmetric Specific Heat (SH)	[1/K] [K] [J/(K*cm*)]	Lead 21.4 0.004 230 1.45 Non Corrugated
4 Ten Rec (BE 6 Voli 7 Cor 8 This	nperature Coefficient at 20°C ciprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) rugation Type kkness	[1/K] [K] [J/(K*cm <sup>3</sup> )] [mm]	Lead 21.4 0.004 230 1.45 Non Corrugated 2.0
4 Ten 5 Rec 6 Volu 7 Cor 8 Thic 9 Dian	nperature Coefficient at 20°C ciprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) rugation Type kkness meter	[1/K] [K] [J/(K*cm*)]	Lead 21.4 0.004 230 1.45 Non Corrugated
4 Ten 5 Rec 6 Volu 7 Cor 8 Thic 9 Dian	nperature Coefficient at 20°C ciprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) rugation Type kkness	[1/K] [K] [J/(K*cm <sup>3</sup> )] [mm]	Lead 21.4 0.004 230 1.45 Non Corrugated 2.0
4 Ten 6 Kec 6 Voli 7 Cor 8 This 9 Dial 0 Dial 0 Cer	nperature Coefficient at 20°C ciprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) rugation Type kkness meter	[1/K] [K] [J/(K*cm <sup>3</sup> )] [mm]	Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98
4 Ten 6 Rec 7 Cor 8 This 9 Dia 0 Are	nperature Coefficient at 20°C ciprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) rugation Type ckness meter htric neutral/Skid wires	[1/K] [K] [J/(K*cm <sup>3</sup> )] [mm]	Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a
4         Ten           4         Ten           6         Kei           6         Voli           7         Cor           8         This           9         Diai           Oncer           0         Are           1         Mate	nperature Coefficient at 20°C siprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) rugation Type ckness meter meter <b>tric neutral/Skid wires</b> Concentric Neutral Wires Around Each Core?	[1/K] [K] [J/(K*cm*)] [mm] [mm]	Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper
4 Ten 5 Rec 6 Volu 7 Cor 8 Thia 9 Dian 0 Are 1 Mat 2 Eleu	nperature Coefficient at 20°C sprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) rugalion Type ckness meter meter meter Concentric Neutral/Skid wires Concentric Neutral Wires Around Each Core? terial circlal Resistivity at 20°C	[1/K] [K] [/(K'cm')] [mm] [mm] [mm]	Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241
4         Ter           4         Ter           5         Rec (BE           6         Volution           7         Corror           7         Corror           8         Thir           9         Dial           0         Are           1         Mat           2         Elevior           3         Ter	nperature Coefficient at 20°C siprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) rugation Type ckness meter htric neutral/Skid wires Concentric Neutral Wires Around Each Core? eral ctrical Resistivity at 20°C nperature Coefficient at 20°C	[1/K] [K] [J/(K*cm*)] [mm] [mm]	Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper
4         Ter           4         Ter           5         Rec (BE           6         Volution           7         Corror           8         This           9         Dial           0         Are           1         Mat           2         Election           3         Ter	nperature Coefficient at 20°C sprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) rugalion Type ckness meter meter meter Concentric Neutral/Skid wires Concentric Neutral Wires Around Each Core? terial circlal Resistivity at 20°C	[1/K] [K] [J/(K'cm?)] [mm] [mm] [µΩ.cm] [J/K]	Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 Na Copper 1.7241 0.00393
A Termination of the second se	nperature Coefficient at 20°C ciprocal of Temperature Coefficient of Resistance TA) uruetric Specific Heat (SH) rrugation Type kness meter htric neutral/Skld wires Concentric Neutral/Wires Around Each Core? erial crical Resistivity at 20°C nperature Coefficient of Resistance ciprocal of Temperature Coefficient of Resistance	[1/K] [K] [J/(K*cm?)] [mm] [mm] [μΩ.cm] [μΩ.cm] [1/K] [K]	Lead 214 0.004 230 1.45 Non Corrugated 2.0 119.98 Na Copper 1.7241 0.00393 234.5
4         Ter           4         Ter           6         Velocity           6         Volto           7         Corr           7         Corr           8         Thir           9         Dial           0         Are           1         Matta           2         Eleition           3         Ter           5         Volto	nperature Coefficient at 20°C iprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) rugation Type ckness meter <b>Tkric neutral/Skid wires</b> Concentric Neutral Wires Around Each Core? erial ctical Resistivity at 20°C nperature Coefficient of Resistance TA)	[1/K] [K] [J/(K*cm?)] [mm] [mm] [μΩ.cm] [μΩ.cm] [1/K] [K] [J/(K*cm?)]	Lead 214 0.004 230 1.45 Non Corrugated 2.0 119.98 Va Copper 1.7241 0.00393 234.5 3.45
4         Ter           4         Ter           6         Velte           6         Velte           7         Cor           7         Cor           7         Cor           7         Cor           7         Dial           9         Dial           0         Are           0         Are           1         Mat           2         Election           3         Ter           5         Velto           6         Lenn	nperature Coefficient at 20°C ciprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) rugation Type ckness meter Thric neutral/Skid wires Concentric Neutral Wires Around Each Core? erial ctrical Resistivity at 20°C nperature Coefficient at 20°C iprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) gth of Lay	[1/K] [K] [J/(K*cm?)] [mm] [mm] [μΩ.cm] [μΩ.cm] [1/K] [K]	Lead 214 0.004 230 1.45 Non Corrugated 2.0 119.98 Copper 1.7241 0.00393 234.5 3.45 1125.0
4         Ter           4         Ter           4         Ter           5         Rec (BE           6         Vol           7         Coro           8         Thir           9         Dial           0         Are           1         Matt           2         Elei           3         Ter           5         Vol           6         Len           7         Nur	nperature Coefficient at 20°C iprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) rugation Type ckness meter Thric neutral/Skid wires Concentric Neutral Wires Around Each Core? terial chical Resistivity at 20°C mperature Coefficient at 20°C iprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) gth of Lay theor of Wires	[1/K] [K] [J/(K*cm?)] [mm] [mm] [μΩ.cm] [μΩ.cm] [1/K] [K] [J/(K*cm?)]	Lead 214 0.004 230 1.45 Non Corrugated 2.0 119.98 Copper 1.7241 0.00393 234.5 3.45 1125.0 82
4         Term           4         Term           6         Volk           6         Volk           7         Cor           8         Thick           9         Dial           9         Dial           1         Matt           2         Electron           3         Term           5         Volk           5         Volk           6         Lenn           7         Nur           8         Wint	nperature Coefficient at 20°C iprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) rugation Type ckness meter meter Concentric Neutral/Skid wires Concentric Neutral Wires Around Each Core? erial ctrical Resistivity at 20°C mperature Coefficient at 20°C iprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) ugft of Lay ber of Wires e Gauge	[1/K] [K] [J/(K*cm?)] [mm] [mm] [μΩ.cm] [μΩ.cm] [1/K] [K] [J/(K*cm?)]	Lead 214 0.004 230 1.45 Non Corrugated 2.0 119.98 Copper 1.7241 0.00393 234.5 3.45 1125.0
4         Term           4         Term           6         Volte           6         Volte           7         Corr           8         Thik           9         Dial           0         Are           0         Are           1         Matt           2         Elect           5         Volt           6         Lenn           5         Volt           6         Lenn           7         Nurr           8         Wirr           9         Thik	nperature Coefficient at 20°C siprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) rugation Type ckness chocentric Neutral/Skid wires Concentric Neutral/Wires Around Each Core? erfal ctrical Resistivity at 20°C mperature Coefficient at 20°C ciprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) ugith of Lay theor of Wires e Gauge ckness	[1/K] [K] [J/(K*cm?)] [mm] [mm] [μΩ.cm] [μΩ.cm] [1/K] [K] [J/(K*cm?)]	Lead 214 0.004 230 1.45 Non Corrugated 2.0 119.98 Copper 1.7241 0.00393 234.5 3.45 1125.0 82
4         Term           4         Term           6         Volt           6         Volt           7         Cor           8         Thild           9         Dial           0         Are           0         Are           1         Mat           2         Eleit           3         Term           4         Rec           5         Volt           6         Lenn           7         Nur           8         Wirr           9         Thild           9         Other	nperature Coefficient at 20°C iprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) rugation Type ckness meter meter Concentric Neutral/Skid wires Concentric Neutral Wires Around Each Core? erial ctrical Resistivity at 20°C mperature Coefficient at 20°C iprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) ugft of Lay ber of Wires e Gauge	[1/K] [K] [J/(K*cm?)] [mm] [mm] [J/(K*cm?)] [J/(K*cm?)] [[mm]	Lead 214 0.004 230 1.45 Non Corrugated 2.0 119.98 Copper 1.7241 0.00393 234.5 3.45 1125.0 82 Undefined
4         Term           4         Term           6         Volt           6         Volt           7         Cor           8         Thild           9         Dial           0         Are           1         Mat           2         Eleit           3         Term           5         Volt           6         Lenn           7         Nur           8         Wirr           9         Thild	nperature Coefficient at 20°C siprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) rugation Type ckness chocentric Neutral/Skid wires Concentric Neutral/Wires Around Each Core? erfal ctrical Resistivity at 20°C mperature Coefficient at 20°C ciprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) ugith of Lay theor of Wires e Gauge ckness	[1/K] [K] [J/(K*cm*)] [mm] [mm] [μΩ.cm] [μΩ.cm] [L/(K] [K] [L/(K*cm*)] [mm] [mm]	Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 Na Copper 1.7241 0.00393 234.5 3.45 1125.0 82 Undefined 1.54
4 Term 5 (BE 6 Vollo 8 This 9 Diala 9 Diala 9 Diala 9 Diala 1 Mat 2 Elele 3 Term 4 (BE 5 Vollo 6 Lern 7 Nur 8 Win 9 This 9 This 9 Diala 1 Mat 1	nperature Coefficient at 20°C siprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) rugation Type ckness chocentric Neutral/Skid wires Concentric Neutral/Wires Around Each Core? erfal ctrical Resistivity at 20°C mperature Coefficient at 20°C ciprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) ugith of Lay theor of Wires e Gauge ckness	[1/K] [K] [J/(K*cm*)] [mm] [mm] [μΩ.cm] [μΩ.cm] [L/(K] [K] [L/(K*cm*)] [mm] [mm]	Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 Na Copper 1.7241 0.00393 234.5 3.45 1125.0 82 Undefined 1.54
4         Term           4         Term           5         Received           6         Voll           9         Diala           9         Diala           1         Mate           0         Åren           1         Mate           2         Electron           3         Terr           5         Vollo           6         Lenn           7         Nur           8         Wirr           9         This           9         This           9         This	nperature Coefficient at 20°C siprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) rugation Type ckness meter Concentric Neutral/Skid wires Concentric Neutral Wires Around Each Core? terial critical Resistivity at 20°C nperature Coefficient of Resistance TA) umetric Specific Heat (SH)	[1/K] [K] [J/(K*cm*)] [mm] [mm] [mm] [μΩ.cm] [J/(K] [L] [K] [J/(K*cm*)] [mm] [mm] [mm] [mm]	Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 0 0 0 0 0 0 0 0 0 0 0 0 0
4         Term           5         Rec (BE           6         Volid           7         Cor           8         Thiking           9         Dial           0         Are           0         Are           1         Mata           2         Elector           5         Volid           6         Len           7         Nur           8         Wirr           9         Thik           9         Thik           1         Mata           2         The	nperature Coefficient at 20°C siprocal of Temperature Coefficient of Resistance TA) umetric Specific Heat (SH) rugation Type ckness meter Concentric Neutral/Skid wires Concentric Neutral/Wires Around Each Core? terial ctrical Resistivity at 20°C imperature Coefficient of Resistance TA) umetric Specific Heat (SH) gth of Lay mber of Wires a Gauge ckness meter terial terial terial	[1/K] [K] [J/(K*cm*)] [mm] [mm] [μΩ.cm] [μΩ.cm] [L/(K] [K] [L/(K*cm*)] [mm] [mm]	Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 Na Copper 1.7241 0.00393 234.5 3.45 1125.0 82 Undefined 1.54 115.98

No.	Description	Unit	1			
Spe	Specific Installation Data					
55	Cable Equipment ID		220KV.011			
56	Cable Frequency	[Hz]	50			
57	Sheath / Shield Bonding		1 Conductor Crossbonded Flat			
58	Loss Factor Constant (ALOS)		0.3			
59	Minor section length		Crossbonded Unknown Section Lengths UNKNOWN			
60	Duct construction		Polyethylene in Concrete			
61	Duct material thermal resistivity	[K.m/W]	3.5			
62	Inside Diameter of the Duct/Pipe	[mm]	188.0			
63	Outside Diameter of the Duct/Pipe	[mm]	200.0			

#### Cable ID : 220KV.011

Cable Title 2500sqmm Cu (insulated Wires)\_XLPE\_CWS+Pb\_PE NKT for Eirgrid





# CYME

## **Electrical Parameters**

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Extra wide Trench (1ct 220kV CABLE)
Date:	23/03/2020 15:21:09

No.	Description	Unit	Cable No.1	Cable No.2	Cable No.3
1	Cable Equipment ID		220KV.011	220KV.011	220KV.011
Resi	stances				
2	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00883	0.00887	0.00883
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.00841	0.00841	0.00841
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00987	0.0099	0.00986
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.28869	0.28869	0.28869
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.33318	0.33443	0.33298
8	DC Resistance of Concentric Wires at 20°C	[Ω/km]	0.1185	0.1185	0.1185
9	DC Resistance of Concentric Wires at Operating Temperature	[Ω/km]	0.13645	0.13696	0.13637
Loss	es				
10	Conductor Losses	[W/m]	55.75545	55.92081	55.72848
11	Dielectric Losses	[W/m]	1.37316	1.37316	1.37316
12	Metallic Screen Losses	[W/m]	2.07944	1.91366	1.83477
13	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
14	Total Losses	[W/m]	59.20805	59.20763	58.93641
Сара	acitance, Inductance, Impedance				
15	Capacitance	[µF/km]	0.271	0.271	0.271
16	Inductance of Conductor	[mH/km]	0.95962	0.95962	0.95962
17	Reactance of Conductor	[Ω/km]	0.30147	0.30147	0.30147
18	Inductance of Metallic Sheath	[mH/km]	0.78167	0.78167	0.78167
19	Reactance of Metallic Sheath	[Ω/km]	0.24557	0.24557	0.24557
20	Positive Sequence Impedance	[Ω/km]	0.009870 + j0.301470	0.009900 + j0.301470	0.009860 + j0.301470
21	Negative Sequence Impedance	[Ω/km]	0.009870 + j0.301470	0.009900 + j0.301470	0.009860 + j0.301470
22	Zero Sequence Impedance	[Ω/km]	0.092060 + j0.245570	0.092050 + j0.245570	0.092060 + j0.245570
23	Surge Impedance	[Ω]	59.51506	59.51506	59.51506
Othe	rs	1			
24	Dielectric Stress at Conductor Surface	[kV/mm]	7.54233	7.54233	7.54233
25	Dielectric Stress at Insulation Surface	[kV/mm]	4.51715	4.51715	4.51715
26	Insulation Resistance at 60°F (15.8°C)	[MQ.km]	14609.00643	14609.00643	14609.00643
27	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a
28	Charging Current for One Phase	[A/km]	10.81081	10.81081	10.81081
29	Charging Capacity of three phase system at Uo	[kvar/km]	4119.47055	4119.47055	4119.47055
30	Voltage drop for Three Phase System	[V/A/km]	0.01709	0.01714	0.01708
31	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
32	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
33	Induced current on Metallic Screen	[A]	146.0	138.6	137.1

CYME	
INTERNATIONAL TEO	

Cable Parameters under Normal Operation

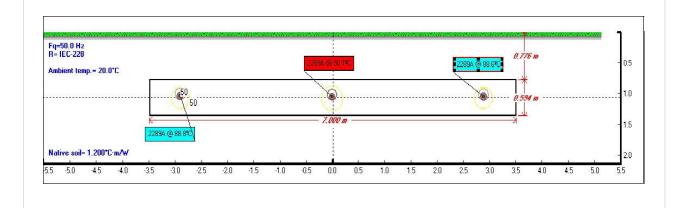
INTERNATIONAL TED	
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Extra wide Trench (1ct 220kV CABLE)
Date:	23/03/2020 15:21:09

	Symbol	Description	Unit	Cable No.1	Cable No.2	Cable No
		Cable Equipment ID		220KV.011	220KV.011	220KV.01
		IEC 60287-1-1				
Conduc	tor AC Res					
2	R.	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	R'	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00883	0.00887	0.00883
4	dc	Conductor Diameter	[mm]	61.3	61.3	61.3
5	5	Distance Between Conductor Axes	[mm]	2894 99578	2894 99578	2894.995
6	ks	Factor Used for xs Calculation (Skin Effect)	(mm)	0.35	0.35	0.35
7	kp	Factor Used for xp Calculation (Proximity Effect)		0.2	0.2	0.2
8	xs	Component of Ys Calculation (Polimity Effect)		2.23136	2.22729	2.23203
9	xp	Component of Yp Calculation (Skin Effect)		1.68675	1.68367	1.68725
10		Skin Effect Factor		0.11703	0.11625	0.11715
	ys					
11	ур	Proximity Effect Factor		0.00007	0.00007	0.00007
12	R ric Losses	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00987	0.0099	0.00986
			1			
13	tanð	Dielectric Loss Factor		0.001	0.001	0.001
14	3	Insulation Relative Permitivity		2.5	2.5	2.5
15	С	Cable Capacitance	[µF/km]	0.271	0.271	0.271
16	U.	Voltage	[kV]	127.01706	127.01706	127.017
17	Wd	Cable Dielectric Losses Per Phase	[W/m]	1.37316	1.37316	1.3731
	ting Loss F		(1111)			
18	Rs	AC Resistance used for Circulating Loss Factor computation	[Ω/km]	0.0968	0.09716	0.0967
19	d	Mean diameter used for Circulating Loss Factor computation	[mm]	116.22348	116.22348	116.223
20	×	Descince used for Circulation Lans Faster	[O/km]	0.24557	0 24557	0.2455
		Reactance used for Circulating Loss Factor computation Mutual Reactance	[221111]			
21	Xm	maaan weduldhud	[Ω/km]	0.04355	0.04355	0.0435
22	Р	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.28912	0.28912	0.2891
23	Q	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.23105	0.23105	0.2310
		Spacing Factor (applied when spacing between cable uneven or non				
24	Fspacing	equal minor section length)		0.004	0.004	0.004
25	λ'1	Screen Loss Factor Caused by Circulating Current	I	0.037	0.03337	0.0326
	oss Factor		1	1		
26	Rs	AC Resistance used for Eddy Loss Factor computation	[Ω/km]	0.33318	0.33443	0.3329
27	d	Mean diameter used for Eddy Loss Factor computation	[mm]	117.98	117.98	117.98
28	-	Electrical Resistivity used for Eddy Loss Factor computation	[Ω.m]	0.0	0.0	0.0
28	ρs	Electrical Resistivity used for Eddy Loss Factor computation	[£2.M]	0.0	0.0	0.0
29	Ds	External diameter used for Eddy Loss Factor computation	[mm]	119.98	119.98	119.98
30	ts	Thickness used for Eddy Loss Factor computation	[mm]	2.0	2.0	2.0
31	β,	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		39.98031	39.90524	39,992
32	qs	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		1.00258	1.00257	1.0025
34	m	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.09429	0.09394	0.0943
35	λe	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.00001	0.00002	0.0000
36	Δ,	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		-0.00329	0.00002	0.0003
37	$\Delta_2$	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.0	0.0	0.0
38	F	Milliken conductor Effect		1.0	1.0	1.0
39	Fpipe	Magnetic effect factor due to pipe		1.0	1.0	1.0
40	Farmour	Magnetic effect factor due to armour		1.0	1.0	1.0
	λ",	Screen Loss Factor Caused by Eddy Current		0.0003	0.00085	0.0003
41						
	: Screen Lo					
	Screen Lo λ1			0.0373	0.03422	0.0329
Metailic 42		ss factor Screen Loss Factor		0.0373	0.03422	0.0329
Metailic 42	λ,	ss factor Screen Loss Factor		0.0373	0.03422	0.0329
42 Armour	۸, and Pipe L	ss factor Screen Loss Factor oss Factor		1	1	
42 42 43 44 46	λ <sub>1</sub> and Pipe L λ <sub>2</sub> a λ <sub>2</sub> pipe λ <sub>2</sub>	ss factor Soreen Loss Factor Soss Factor Armour Loss Factor Pipe Loss Factor + Armour Loss Factor + Ope Loss Factor		0.0	0.0	0.0
42 42 43 44 46	λ <sub>1</sub> and Pipe L λ <sub>2</sub> a λ <sub>2</sub> pipe λ <sub>2</sub>	ss factor Screen Loss Factor Des Factor Armour Loss Factor Pipe Loss Factor		0.0	0.0	0.0
42 47 43 44 46 Normal 47	λ <sub>1</sub> and Pipe L λ <sub>2</sub> a λ <sub>2</sub> pipe λ <sub>2</sub>	ss factor Screen Loss Factor Soss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor - Pipe Loss Factor Ec 60287-2-1 Thermal Resistance Between Conductor and Screen	[K.m/W]	0.0 0.0 0.0 0.3402	0.0 0.0 0.0	0.0 0.0 0.0 0.3402
Metallic 42 Armour 43 44 46 Normal 47 48	λ1           and Pipe L           λ33           λ2pipe           λ2           Operation           T1           t1	ss factor Screen Loss Factor Sos Factor Pipe Loss Factor Pipe Loss Factor Pipe Loss Factor Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Pseulation Thickness Between Conductor and Screen	[mm]	0.0 0.0 0.3402 25.8	0.0 0.0 0.3402 25.8	0.0 0.0 0.3402 25.8
Metallic           42           Armour           43           44           46           Normal           47           48           49	λ1           and Pipe L           λ30           λ30           λ20           λ2           Operation           T1           L1           ρTi	ss factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Thermal Resistalistic Michaeses Thermal Resistalistic Michaeses	[mm] [K.m/W]	0.0 0.0 0.3402 25.8 3.5	0.0 0.0 0.3402 25.8 3.5	0.0 0.0 0.3402 25.8 3.5
Metallic 42 Armour 43 44 46 Normal 47 48 49 50	λ1           and Pipe L           λ30           λ30           λ2           Operation           T1           L1           ρTi           T3	ss factor Screen Loss Factor Screen Loss Factor Sas Factor Pipe Loss Factor Pipe Loss Factor Ec 60287-2.1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistance of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W]	0.0 0.0 0.3402 25.8 3.5 0.04631	0.0 0.0 0.3402 25.8 3.5 0.04631	0.0 0.0 0.3402 25.8 3.5 0.0463
Metallic 42 Armour 43 44 46 Normal 47 48 49 50 51	λ₁           and Pipe L           λ₂aa           λ₂pipe           λ₂           Operation           T₁           t₁           pTi           T₃           t₅	ss factor Screen Loss Factor Screen Loss Factor Sas Factor Armour Loss Factor Pele Loss Factor Ec 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jackte/Pipe Coaling Thickness of Jackte/Pipe Coaling	[mm] [K.m/W] [K.m/W] [mm]	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2	0.0 0.0 0.3402 25.8 3.5 0.0463 5.2
Metallic 42 Armour 43 44 46 Normal 47 48 49 50 51 52	λ,           and Pipe L           λ <sub>3</sub> a           λ <sub>p</sub> ipe           λ <sub>2</sub> Operation           T,           t,           pTi           T <sub>3</sub> L <sub>3</sub> pTJ	ss factor Screen Loss Factor Screen Loss Factor Sas Factor Pipe Loss Factor Pipe Loss Factor Ec 60287-2.1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistance of Jacket/Pipe Coating	[mm] [K.m/W] [K.m/W]	0.0 0.0 0.3402 25.8 3.5 0.04631	0.0 0.0 0.3402 25.8 3.5 0.04631	0.0 0.0 0.3402 25.8 3.5 0.0463
Metallic 42 Armour 43 44 46 Normal 47 48 49 50 51 52 Cable II	λ,           and Pipe L           λ <sub>3</sub> a           λ <sub>3</sub> pipe           λ <sub>2</sub> Operation           T,           t,           pTi           T,           ta           pTi           ta           pTJ           n Ducts	ss factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Themal Resistance of Jacket/Pipe Coaling Thickness of Jacket/Pipe Coaling Thermal Resistivity of Jacket/Pipe Coaling Thermal Resistivity of Jacket/Pipe Coaling	[mm] [K.m/W] [K.m/W] [mm]	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5	0.0 0.0 0.3402 25.8 3.5 0.0463 5.2 3.5
Metallic           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable II           53	λ,           and Pipe L           λ <sub>3</sub> pipe           λ <sub>2</sub> pipe           λ <sub>2</sub> Operation           T,           t,           pTi           Ts           La           pTJ           n Ducts           U	ss factor Screen Loss Factor Screen Loss Factor Sas Factor Armour Loss Factor Pipe Loss Factor CodeData Pipe Loss Factor Ed 60287-2.1 Thermal Resistance Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistance of Jacket/Pipe Coating Coefficient Used in IEC 60287-2.1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm]	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87	0.0 0.0 0.3402 25.8 3.5 0.0463 5.2 3.5
Metallic           42           47           43           44           46           Normal           47           48           49           50           51           52           Cable In           53           54	λ,           and Pipe L           λ <sub>s</sub> a           λ <sub>s</sub> pipe           λ <sub>s</sub> Operation           T,           t,           ρTi           Ts           b           ρTJ           Ducts           U           V	ss factor Screen Loss Factor Screen Loss Factor Screen Loss Factor Pipe Loss Factor Armour Loss Factor Pipe Loss Factor EC 60287-2-1 Thermal Resistance of Jacket/Pipe Coaling Coefficient Used in EC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm]	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312	0.0 0.0 0.3402 25.8 3.5 0.0463 5.2 3.5 1.87 0.312
42 42 43 44 46 Normal 44 46 Normal 47 48 49 50 51 52 52 52 52 52 53 54 55	λ,           and Pipe L           Å <sub>s</sub> a           Å <sub>s</sub> pipe           Å <sub>s</sub> Operation           T,           t,           pTi           T,           b,           pTJ           Ducts           U           V           Y	ss factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Immulation Thickness Between Conductor and Screen Immulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm] [K.m/W]	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037	0.0 0.0 0.3402 25.8 3.5 0.0463 5.2 3.5 1.87 0.312 0.0037
Metallic           42           47           43           44           46           Normal           47           48           49           50           51           52           Cable In           53           54	λ,           and Pipe L           λ <sub>s</sub> a           λ <sub>s</sub> pipe           λ <sub>s</sub> Operation           T,           t,           ρTi           Ts           b           ρTJ           Ducts           U           V	ss factor Screen Loss Factor Screen Loss Factor Screen Loss Factor Pipe Loss Factor Armour Loss Factor Pipe Loss Factor EC 60287-2-1 Thermal Resistance of Jacket/Pipe Coaling Coefficient Used in EC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm]	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312	0.0 0.0 0.3402 25.8 3.5 0.0463 5.2 3.5 1.87 0.312
42 42 43 44 46 Normal 44 46 Normal 47 48 49 50 51 52 52 52 52 52 53 54 55	λ,           and Pipe L           λ <sub>s</sub> a           λ <sub>s</sub> pipe           λ <sub>s</sub> Operation           T,           b,           ρTi           Ts           b,           pTJ           DUcts           U           V           Y           θm	ss factor Screen Loss Factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Thermal Resistance Determined Conductor and Screen Thermal Resistance of Jacket/Pipe Coaling Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space	[mm] [K.m/W] [K.m/W] [mm] [K.m/W]	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037	0.0 0.0 0.3402 25.8 3.5 0.0463 5.2 3.5 1.87 0.312 0.0037 48.2
42 42 43 44 46 <b>Normal</b> 47 48 49 50 51 52 <b>Cable I</b> 53 54 55 55 56	λ,           and Pipe L           λ <sub>s</sub> a           λ <sub>s</sub> pipe           λ <sub>s</sub> Operation           T,           b,           ρTi           Ts           b,           pTJ           DUcts           U           V           Y           θm	ss factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Immulation Thickness Between Conductor and Screen Immulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [*C] [*C]	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 48.3	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 49.4	0.0 0.0 0.0 25.8 3.5 0.0463 5.2 3.5 1.87 0.312 0.0037 48.2 0.2529
42 42 43 43 44 46 Normal 47 48 49 50 51 52 53 53 54 55 55 56 57	λ1           and Pipe L           λ38           λpipe           λ2           Λ38           Λpipe           λ3           Λpipe           Λ3           Λ	ss factor Soreen Loss Factor Soreen Loss Factor Soreen Loss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Thermal Resistance Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thichness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used III Coefficient Used IIII Coefficient Used IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [*C] [K.m/W]	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 48.3 0.25276	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 49.4 0.2509	0.0 0.0 0.3402 25.8 3.5 0.0463 5.2 3.5 1.87 0.312 0.037 48.2 0.2529 200.0
Metallik           42           Armour           43           44           46           Normal           47           48           49           50           51           52           Cable Is           53           54           55           56           57           58	λ,           and Pipe L           λs8           λpppe           λs           Operation           Tr           t,           pTi           ts           pTJ           n Ducts           V           Y           θm           Ta           Do	ss factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Finulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Filling the Ducl/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [*C] [*C]	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 48.3 0.25276 200.0	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 49.4 0.2509 200.0	0.0 0.0 0.3402 25.8 3.5 0.0463 5.2 3.5 1.87 0.312 0.037 48.2 0.2529 200.0
42 47 43 44 46 Normal 47 48 49 50 51 52 55 55 55 55 55 55 55 55 55 55 55 55	λ,           and Pipe L           λ <sub>x8</sub> λ <sub>p</sub> pipe           λ <sub>x</sub> γ           Operation           T,           t,           pTi           t,           pTJ           n Ducts           U           V           Y           8m           T_*           Do           Di	ss factor Screen Loss Factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used on IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used III Coefficient Used IIII Coefficient Used IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] ['C] [K.m/W] [mm] [mm]	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.004531 48.3 0.25276 200.0 188.0	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 49.4 9.4 9.2509 2200.0 188.0	0.0 0.0 0.3402 25.8 3.5 0.0463 5.2 3.5 1.87 0.312 0.0037 48.2 0.2529 200.0 188.0 3.5
Metallicitation           42           43           44           46           Normal           47           48           49           50           51           52           53           54           55           56           57           58           59           60	λ,           and Pipe L           λsia           λspipe           λs           γ           φTi           Ts           ts           φTi           Ts           ts           φTi           ΦU           V           Y           θm           Ts           Do           Di           ρT	ss factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Tec 60287-2-1 Termal Resistance Between Conductor and Screen Imulation Thickness Between Conductor and Screen Imulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space Thermal Resistance of the Medium Filling the Dact/Pipe Codiside Diameter of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistivity of the Duct/Pipe Thermal Resistivity of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [*C] [*C] [K.m/W] [mm] [mm] [K.m/W]	0.0 0.0 0.0 25.8 3.5 0.4631 5.2 3.5 1.87 0.312 0.0037 48.3 0.25276 200.0 188.0 3.5	0.0 0.0 0.0 25.8 3.5 0.4631 5.2 3.5 1.87 0.312 0.0037 49.4 0.2509 200.0 188.0 188.0	0.0 0.0 0.3402 25.8 3.5 0.0463 5.2 3.5 1.87 0.312 0.0037 48.2 0.2529 200.0 188.0 3.5
Metallicita           42           47           43           44           46           Normal           47           48           49           50           51           52           Cable II           53           54           55           56           57           58           59           60           61	λ,           and Plpe L           λ <sub>s</sub> al           λ <sub>s</sub> pipe           λ <sub>s</sub> Λ <sub>s</sub> Γ           Φ           φTi           σ           φTJ           m           U           V           Y           θm           T <sub>s</sub> Do           Di           ρT           T <sub>s</sub>	ss factor Soreen Loss Factor Soreen Loss Factor Soreen Loss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Thermal Resistance of Loss Factor Coold Contemport Thermal Resistance of Loss Factor Thermal Resistance of Loss Pactor Thermal Resistance of Loss Pactor Coofficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used on IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used on IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used on IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used on IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Coefficient Used in	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [*C] [*C] [K.m/W] [mm] [K.m/W] [K.m/W]	00 00 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0312 0.025276 200.0 188.0 3.5 0.025276	00 00 0.0 0.3402 25.8 3.5 0.4631 5.2 3.5 1.87 0.312 0.0312 49.4 0.2509 200.0 188.0 3.5 0.2509	0.0 0.0 0.3402 25.8 3.5 0.0463 5.2 3.5 1.87 0.312 0.0037 48.2 0.2529 200.0 188.0 3.5
Metallicita           42           47           43           44           46           Normal           47           48           49           50           51           52           Cable II           53           54           55           56           57           58           59           60           61	λ,           and Plpe L           λ <sub>s</sub> al           λ <sub>s</sub> pipe           λ <sub>s</sub> Λ <sub>s</sub> Γ           Φ           φTi           σ           φTJ           m           U           V           Y           θm           T <sub>s</sub> Do           Di           ρT           T <sub>s</sub>	ss factor Screen Loss Factor Screen Loss Factor Sereen Loss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor EC 60287-2-1 Thermal Resistance of Loss Factor Thermal Resistance of Jacket/Pipe Coating Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Coefficient Used in EC 60287-2-1 Coefficient Used i	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [*C] [*C] [K.m/W] [mm] [K.m/W] [K.m/W]	00 00 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0312 0.025276 200.0 188.0 3.5 0.025276	00 00 0.0 0.3402 25.8 3.5 0.4631 5.2 3.5 1.87 0.312 0.0312 49.4 0.2509 200.0 188.0 3.5 0.2509	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
Metallic           42           43           44           46           7           48           49           50           51           52           54           55           56           57           58           59           60           61           62           Cable In	λ,           and Plpe L           λ <sub>s</sub> al           λ <sub>s</sub> pipe           λ <sub>s</sub> Λ <sub>s</sub> Γ           Φ           φTi           σ           φTJ           m           U           V           Y           θm           T <sub>s</sub> Do           Di           ρT           T <sub>s</sub>	ss factor Screen Loss Factor Screen Loss Factor Serie Totor Armour Loss Factor Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coaling Thickness of Jacket/Pipe Coaling Thickness of Jacket/Pipe Coaling Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Coefficient Used In EC 60287-2-1 Coefficient Us	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [*C] [*C] [K.m/W] [mm] [K.m/W] [K.m/W]	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 48.3 0.25276 200.0 188.0 3.5 0.03447 0.42417	0.0 0.0 0.0 25.8 3.5 0.4631 5.2 3.5 1.87 0.312 0.0037 49.4 0.2509 200.0 188.0 3.5 0.03447 0.42417	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
Armour           42           43           44           46           7           48           49           50           51           52           53           54           55           56           57           58           59           60           61           62           Cable Is	λ.           A.and Pipe           A.an           Δ.pipe           Δ.pipe           T.           pTI           T.           DO           DU           V           Y           Brm           T.'           Do           Di           Di           pT           T.'           Do           T.'           Do           PI           T.'           Di           PI           T.'           Di           PI           T.'	ss factor Soreen Loss Factor Soreen Loss Factor Soreen Loss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Thermal Resistance of Loss Factor Thermal Resistive Conductor and Screen Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Use	[mm] [K.m/W] [K.m/W] [M.m/W] [K.m/W] ["C] ["C] [K.m/W] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	00 00 00 03402 25.8 3.5 0.04631 5.2 3.5 	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.312 0.312 0.312 0.2509 200.0 188.0 3.5 0.2509 200.0 188.0 3.5 0.2509 200.0	0.0 0.0 0.402258 0.52 0.52 0.52 0.003 0.52 0.003 0.52 0.003 0.52 0.003 0.55 0.0344 0.454 0.00 0.00 0.00 0.4022 0.00 0.402 0.402 0.00 0.402
Metallicit           42           43           44           46           Normal           47           48           49           50           51           52           Cable In           53           54           55           56           57           58           59           60           61           62           Cable In           63           64	λ.           and Pipe L           λ.a           λ.ppp           λ.           Oparation           T.           b.           pTi           t.           b.           pTi           b.           pTi           t.           b.           pTi           t.           v           v           em           T.           Do           Di           pT           t.           T.           Do           Di           pT           t.           T.           b.           pT           t.           T. <tr td=""></tr>	ss factor Screen Loss Factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Thermal Resistance Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coaling Thermal Resistance of the Medum Filing the Space Thermal Resistance of the Medum Filing the Space Thermal Resistance of the Duct/Pipe Oudside Diameter of the Duct/Pipe Thermal Resistance of the SuruPipe Thermal Resistance of the SuruPipe Thermal Resistance of the SuruPipe Thermal Resistance of the Duct/Pipe Thermal	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	00 00 00 03402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.037 48.3 0.25276 2000 188.0 3.5 0.25276 2000 188.0 3.5 0.03447 0.42417	0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.037 49.4 0.2509 200.0 188.0 3.5 0.03417 0.034417	0.00 0.00 258 3.5 0.0463 5.2 3.5 0.0463 5.2 3.5 0.0463 5.2 3.5 0.0463 4.8 2 0.0324 0.0324 0.0324 0.0324 0.0324 0.0340 0.0340 0.0340 0.0340 0.0340 0.0000 0.00000 0.0000 0.0000 0.000000
Metallic 42 47 43 44 46 46 87 48 49 50 51 52 <b>Cable I</b> 53 54 55 55 55 55 55 55 55 56 57 55 56 57 57 58 59 60 61 62 <b>Cable I</b> 62 <b>Cable I</b> 63 64 65	λ,           and Pipe A           λa9           Λa9           Λa	ss factor Soreen Loss Factor Soreen Loss Factor Soreen Loss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Thermal Resistance of Loss Factor Thermal Resistivity of Jusclet/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Thermal Resistance of the Mudum Filling the Space Thermal Resistance of the Duct/Pipe Thermal Resistance of Duct Bark/Rackfil Diped Laying the Certic of Duct Bark/Rackfil	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 48.3 0.25276 20037 48.3 0.25276 20037 48.3 0.25276 0.004417 0.54447 7.0 1.26566	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 49.4 0.2509 200.0 188.0 3.5 0.034417 0.42417 0.594 7.0 1.26566	0.00 0.00 0.34002 25.8 3.5 0.0463 5.2 3.5 0.312 0.0463 5.2 0.055 0.0463 1.87 0.052 0.052 0.0464 3.5 0.0464 3.5 0.0464 3.5 0.0464 3.5 0.0464 3.5 0.0464 3.5 0.0464 3.5 0.0464 3.5 0.0464 3.5 0.0464 1.87 0.0464 1.87 0.0464 1.87 0.0464 1.87 0.0464 1.87 0.0464 1.87 0.0464 1.87 0.0464 1.87 0.0464 1.87 0.0464 1.88 0.0464 1.0474 1.0464 1.
Metallicki 42 47mour 43 44 46 Normal 47 48 49 49 50 51 50 51 52 53 53 54 55 55 55 55 56 57 58 59 60 61 62 62 63 64 63 64 65 66 66 67	λ.           λ.and Pipe           λ.and Appe           Δ.and App	ss factor Screen Loss Factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Thormal Resistance of Jacket/Pipe Coaling Thermal Resistance of Jacket/Pipe Coaling Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Coefficient Used on EC 60287-2-1 Clause 2.2.7.1 Coefficient Used the Duct/Pipe Thermal Resistance of the Suct/Pipe Thermal Resistance of the Suct/Pipe Thermal Resistance of the Suct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Duct/Pipe Dided Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Dided Diameter Radus of Out Bark/Backfill Coefficient Used in EC 60287-2-1 Clause 2.2.7.3	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	00 00 00 00 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.312 0.312 0.312 0.25276 200.0 188.0 3.5 0.25276 200.0 188.0 3.5 0.25276 200.0 188.0 3.5 0.25276 200.0 188.0 3.5 0.25276 200.0 188.0 3.5 0.25276 200.0 188.0 3.5 0.25276 200.0 188.0 3.5 0.25276 200.0 188.0 189.0 199.	0.0 0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.312 0.312 0.312 0.2509 200.0 188.0 3.5 0.2509 200.0 188.0 3.5 0.03447 0.42417 0.594 7.0 1.26564 1.2756 1.073	0.00 0.00 0.34002 25.8 3.5 0.0463 5.2 3.5 0.312 0.0463 5.2 0.055 0.0463 1.87 0.052 0.052 0.0464 3.5 0.0464 3.5 0.0464 3.5 0.0464 3.5 0.0464 3.5 0.0464 3.5 0.0464 3.5 0.0464 3.5 0.0464 3.5 0.0464 1.87 0.0464 1.87 0.0464 1.87 0.0464 1.87 0.0464 1.87 0.0464 1.87 0.0464 1.87 0.0464 1.87 0.0464 1.87 0.0464 1.88 0.0464 1.0474 1.0464 1.
Metallicit           42           43           44           46           Normal           47           48           49           50           51           52           53           54           55           56           57           58           59           60           61           62           63           64           65           66	λ.           λ.and Pipe           λ.and           λ.and           Δ.pope           Λ.           Δ      <	ss factor Soreen Loss Factor Soreen Loss Factor Soreen Loss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Thermal Resistance of Loss Factor Thermal Resistivity of Jusclet/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Thermal Resistance of the Mudum Filling the Space Thermal Resistance of the Duct/Pipe Thermal Resistance of Duct Bark/Rackfil Diped Laying the Certic of Duct Bark/Rackfil	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	00 00 00 03402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.037 48.3 0.25276 200.0 188.0 3.5 0.25276 200.0 188.0 3.5 0.03447 0.42417 0.594 7.0 1.26566 1.073 0.64778	0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.037 49.4 0.2509 200.0 188.0 3.5 0.0347 0.0347 0.0347 0.594 7.0 1.26566 1.073 0.684778	0.0 0.0 0.3400258.8 3.5 0.0463 5.2 0.258.8 0.0463 5.2 0.352 0.0312 0.0312 0.0312 0.0312 0.0312 0.0312 0.0312 0.0312 0.0314 0.0312 0.0314 0.0315 0.0463 0.04241 0.0594 0.04241 0.0594
Metallicit           42           Armour           43           44           46           Normal           47           48           47           48           50           51           52           53           54           55           56           57           58           59           60           61           62           Cable Is           63           64           65           66           67	λ.           λ.and Pipe           λ.and           λ.and           Δ.pope           Λ.           Δ      <	ss factor Screen Loss Factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Thormal Resistance of Jacket/Pipe Coaling Thermal Resistance of Jacket/Pipe Coaling Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Coefficient Used on EC 60287-2-1 Clause 2.2.7.1 Coefficient Used the Duct/Pipe Thermal Resistance of the Suct/Pipe Thermal Resistance of the Suct/Pipe Thermal Resistance of the Suct/Pipe Thermal Resistance of the Duct/Pipe Thermal Resistance of the Duct/Pipe Dided Diameter of the Duct/Pipe Thermal Resistance of the Duct/Pipe Dided Diameter Radus of Out Bark/Backfill Coefficient Used in EC 60287-2-1 Clause 2.2.7.3	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	00 00 00 03402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.037 48.3 0.25276 200.0 188.0 3.5 0.25276 200.0 188.0 3.5 0.03447 0.42417 0.594 7.0 1.26566 1.073 0.64778	0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.037 49.4 0.2509 200.0 188.0 3.5 0.0347 0.0347 0.0347 0.594 7.0 1.26566 1.073 0.684778	0.0 0.0 0.3400258.8 3.5 0.0463 5.2 0.258.8 0.0463 5.2 0.352 0.0312 0.0312 0.0312 0.0312 0.0312 0.0312 0.0312 0.0312 0.0314 0.0312 0.0314 0.0315 0.0463 0.04241 0.0594 0.04241 0.0594
Metallic 42 47 43 44 46 Normal 47 48 49 50 51 52 55 55 55 55 55 55 55 55 55	λ.           λ.           and Pipe A           λ.           Δ           Φ           Λ.           Δ           Φ           Γ.           Γ.           Φ	ss factor Soreen Loss Factor Soreen Loss Factor Soreen Loss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Thermal Resistance Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistance of the Medium Filling the Space Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used on IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bark/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bark/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bark/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bark/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Comber of Loaded Cables in the Duct Bark/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Comber of Loaded Cables in the Duct Bark/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Comber	[mm] [K.m/W] [K.m/W] [Mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [M] [m] [m] [m] [m] [m]	00 00 00 03402 25.8 3.5 0.4631 5.2 3.5 1.87 0.312 0.037 48.3 0.25276 200.0 188.0 3.5 0.025276 200.0 188.0 3.5 0.025276 200.0 188.0 3.5 0.025276 200.0 188.0 3.5 0.025276 200.0 1.265647 0.025447 7.0 1.26564 7.0 1.26564 7.0 1.26564 7.0 1.26564 7.0 1.26564 7.0 1.26564 7.0 1.26564 7.0 1.26564 7.0 1.26564 7.0 1.26564 7.0 1.26564 7.0 1.26564 7.0 1.265647 7.0 1.265767 7.0 1.265767 7.0 1.265776 7.0 1.255767 7.0 1.255776 7.0 1.27577777777777777777777777777777777777	00 00 00 03402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0312 49.4 0.2509 200.0 188.0 3.5 0.03447 0.42417 0.2564 1.073 0.6944 7.0 1.265666 1.073 0.84778 3.0	0.00 0.00 0.34002 528.8.35 0.0463 5.2 0.312 0.0037 48.2 0.0037 1.0
Metallic 42 47 47 43 44 46 Normal 47 48 49 50 51 52 53 53 54 55 55 55 55 55 55 55 55 55 55 55 55	λ.           λ.and Pipe           λ.and           λ.and           Δ.pope           Λ.           Δ      <	ss factor Screen Loss Factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coaling Thermal Resistance of the Medium Filing the Space Thermal Resistance of the Medium Filing the Space Thermal Resistance of the Duct/Pipe Thermal Resistance of Duct Bark/Backfill Coafficient Used of the Duct Bark/Backfill Coafficient Geologe 1: Coaling 2: 2: 3 Number of Loaded Cables in the Duct Bark/Backfill Thermal Resistance of Duct Bark/Backfill Coafficient Used In the Coaling 2: 1: Clause 2: 2: 3 Number of Loaded Cables in the Duct Bark/Backfill Coafficient Used In the Coaling 2: 1: Clause 2: 1: Clau	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [m] [m] [m] [m] [m] [m] [m] [m] [m]	00 00 00 03402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0312 0.0317 48.3 0.25276 22020 188.0 3.5 0.25276 22020 188.0 3.5 0.03447 0.42417 0.594 7.0 1.26566 1.073 3.0	0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.037 49.4 49.4 0.2509 200.0 188.0 3.5 0.0347 49.4 49.4 49.4 49.4 49.4 49.4 49.4 49	0.0 0.0 0.400205 0.400205 0.400205 0.4525 0.04635 5.2 1.87 0.312 0.0033 48.2 0.00334 48.2 0.00344 0.4241 1880.0 0.0444 0.4241 1.87 7.0 1.2556 0.044 1.87 1.80 0.0033 1.87 1.97 1.25 1.07 1.25 1.07 1.25 1.07 1.25 1.07 1
Metallicki 42 47 47 43 44 46 Normal 47 48 49 50 51 52 52 Cable II 53 54 55 55 56 55 56 56 55 56 56 56 56 60 61 62 Cable II 62 Cable II 63 64 65 64 65 66 66 66 66 67 70 70 70 70 70 70 70 70 70 70 70 70 70	λ,           λ,           and Pipe           λa           λa           Appe           T           T           b           pTJ           DO           V           V           V           V           V           OUT           DO           DI           DI           T."           N           DO           DI           DI           DI           T."           N           DO           DI           DI           DI           DI           DI           DI           T."           ADUC180           X           Y           N           PC	ss factor Screen Loss Factor Screen Loss Factor Screen Loss Factor Armour Loss Factor Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Thermal Resistance Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coaling Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Coefficient Used in EC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bark/Backfill Coefficient Used in EC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bark/Backfill Thermal Resistivity of Earth Around the Duct Bark/Backfill Coefficient Used in EC 60287-2-1 Clause 2.2.7.3 Number of Loaded Ca	[mm] [K.mW] [K.mW] [mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [m] [m] [m] [m] [m] [m]	00 00 00 00 25.8 35 52 35 1.87 0.32 48.3 0.04631 48.3 0.0327 0.0337 0.0337 0.0337 0.0337 0.025276 200.0 188.0 0.25276 200.0 1.86 0.0347 0.42417 0.5566 1.073 0.04478 3.0 0.05478 1.00 0.05478 1.00 0.05478 0.05588 0.05478 0.05478 0.055888 0.055888 0.055888 0.055888 0.055888 0.055888 0.055888 0.055888 0.055888 0.055888 0.055888 0.055888888 0.05588888888 0.0558888 0.0558888888888	0.0 0.0 0.3402 25.8 3.5 0.4631 5.2 3.5 1.87 0.312 49.4 0.2509 200.0 188.0 0.2509 200.0 3.5 0.335 0.337 0.42417 0.42417 0.5266 1.073 0.64478 3.0 1.26566	0.00 0.00 0.34022 25.8 3.5 0.0463 3.5 0.0463 3.5 0.0312 0.0312 0.0312 0.0312 0.032 0.032 0.032 0.032 0.035 0.035 0.04211 0.035 0.035 0.035 0.035 0.04211
Metallicki 42 47 47 43 44 46 47 48 49 50 52 52 55 55 55 55 55 55 55 55 55 55 55	λ.           λ.and Pipe L           λ.and Nappe           λ.pipe           λ.           Operation           T.           b.           ρTJ           T.           b.           ρTJ           DU           V           W           Q           0           U           V           0           D           D           Q           0           D           Q           0           D           V           V           V           0      0 <t< td=""><td>ss factor Soreen Loss Factor Soreen Loss Factor Soreen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor Pipe Loss Factor Thermal Resistance of the Loss Factor Coolding Thermal Resistance of the Loss Factor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistance of Lacket/Pipe Coating Thermal Resistance of the Medium Filling the Space Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used on IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used on IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bark/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bark/Backfill Thermal Resistance of the Surcurding Medum Thermal Resistance of the Surcurding Medum</td><td>[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]</td><td>00 00 00 03402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0312 0.0312 0.0312 0.025276 200.0 188.0 3.5 0.025276 200.0 188.0 3.5 0.03447 0.42417 1.0 0.84778 3.0 1.0 0.84778 3.0</td><td>00 00 00 03402 25.8 3.5 0.4631 5.2 3.5 1.87 0.312 0.0312 49.4 0.2509 200.0 188.0 3.5 0.03447 0.42417 0.694 7.0 1.26566 1.073 0.84778 3.0 1.0 0.84778 3.0</td><td>0.0 0.340202 25.8 3.5 5.2 3.5 1.87 0.312 0.0443 4.82 2.02599 200.0 188.0 0.322 200.0 188.0 1.87 0.312 2.05 1.87 0.35 1.87 1.85 1.87 1.87 1.87 1.87 1.87 1.85 1.87 1.85 1.85 1.85 1.85 1.85 1.95 1.85 1.95 1.95 1.95 1.95 1.95 1.97 1.07</td></t<>	ss factor Soreen Loss Factor Soreen Loss Factor Soreen Loss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor Pipe Loss Factor Thermal Resistance of the Loss Factor Coolding Thermal Resistance of the Loss Factor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistance of Lacket/Pipe Coating Thermal Resistance of the Medium Filling the Space Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used on IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used on IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bark/Backfill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bark/Backfill Thermal Resistance of the Surcurding Medum Thermal Resistance of the Surcurding Medum	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	00 00 00 03402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0312 0.0312 0.0312 0.025276 200.0 188.0 3.5 0.025276 200.0 188.0 3.5 0.03447 0.42417 1.0 0.84778 3.0 1.0 0.84778 3.0	00 00 00 03402 25.8 3.5 0.4631 5.2 3.5 1.87 0.312 0.0312 49.4 0.2509 200.0 188.0 3.5 0.03447 0.42417 0.694 7.0 1.26566 1.073 0.84778 3.0 1.0 0.84778 3.0	0.0 0.340202 25.8 3.5 5.2 3.5 1.87 0.312 0.0443 4.82 2.02599 200.0 188.0 0.322 200.0 188.0 1.87 0.312 2.05 1.87 0.35 1.87 1.85 1.87 1.87 1.87 1.87 1.87 1.85 1.87 1.85 1.85 1.85 1.85 1.85 1.95 1.85 1.95 1.95 1.95 1.95 1.95 1.97 1.07

	Study Summary			
CYMCAP Version	7.3 Revision 2			
Study:	Eirgrid Cp966 Feasibility study			
Execution:	Eirgrid - Extra wide Trench (1ct 220kV CABLE)			
Date:	23/03/2020 15:04:56			

General Simulation Data	
Steady State Option	Temperature
Consider Electrical interaction between circuits	No
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0
Conductor Resistances Computation Option:	IEC-228

Installation Type:Ductbank		
Ambient Soil Temperature at Installation Depth	[°C]	20.0
Native Soil Thermal Resistivity	[K.m/W]	1.2
Thermal Resistivity of Duct Bank	[K.m/W]	1.0
Depth of Center of Duct Bank	[m]	1.07
Duct Bank Width	[m]	7.0
Duct Bank Height	[m]	0.59



Results Summary										
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Dally Load Factor	X coordinate [m]	Y coordinate [m]	Conductor temperature [°C]	Ampacity [A]
1	220KV.011	1		А	50.0	1.0	-2.9	1.05	88.8	2289.0
2	220KV.011	1		В	50.0	1.0	0.0	1.05	90.1	2289.0
3	220KV.011	1		С	50.0	1.0	2.89	1.05	88.6	2289.0

	Steady State Summary			
CYMCAP Version	7.3 Revision 2			
Study:	Eirgrid Cp966 Feasibility study			
Execution:	Eirgrid - Extra wide Trench (1ct 220kV CABLE)			
Date:	23/03/2020 15:04:56			

Simulation Data	
Installation type:	Ductbank
Steady State Option	Temperature
Amblent temperature [°C]	20
Native Soll Thermal Resistivity [K.m/W]	1.2
Consider Non-Isothermal Earth Surface	No
Consider effect of soil dry out	No
Consider Electrical interaction between circuits	No
Induced current in metallic layers as a fraction of conductor current (applied to all single phase circuits)	0

Variable Description Unit Cables Cable Index Number Cable No. 1 2 3 General Input Data Cable Equipment ID Cable ID 220KV.011 220KV.011 220KV.011 Circuit No. Circuit No. 1 1 1 Cable Phase С Phase А В Operating Frequency Fq [Hz] 50.0 50.0 50.0 X coordinate [m] -2.9 0.0 2.89 х Y coordinate [m] 1.05 1.05 1.05 y Daily Load Factor DLF [p.u.] 1.0 1.0 1.0 1 Conductor 1 Conductor 1 Conductor Bonding Type Crossbonded Flat Crossbonded Flat Crossbonded Flat Ampacity Steady State Ampacity [A] 2289.0 2289.0 2289.0 Temperatures Conductor temperature [°C] 88.8 90.1 88.6 Sheath/Shield temperature θs [°C] 70.4 71.7 70.2 Armour temperature [°C] θа n/a n/a n/a Cable surface temperature [°C] 69.1 67.6 θsur 67.8 Duct surface temperature [°C] 52.7 54.0 52.6 θduc Resistances DC Resistance of the conductor at 20°C R [Ω/km] 0.0072 0.0072 0.0072 AC Resistance of the Conductor at Operating Temperature R [Ω/km] 0.01015 0.01018 0.01015 Skin Effect Factor 0.10987 0.10906 0.10999 ys Proximity Effect Factor 0.00007 0.00007 0.00007 ур Losses Conductor Losses [W/m] 53.18612 53.36265 53.15954 Wc Dielectric Losses [W/m] 1.37316 1.37316 1.37316 Wd Metallic Screen Losses [W/m] 1.99067 1.82164 1.74995 Ws Armor/Pipe Losses [W/m] 0.0 0.0 0.0 Wa Total Losses [W/m] 56.54994 56.55745 56.28265 Wt Screen Loss Factor 0.03743 0.03414 0.03292 Ť۱ Armour Loss Factor + Pipe Loss Factor 0.0 0.0 0.0 λ, Thermal resistances Thermal resistance of insulation [K.m/W] 0.3402 0.3402 0.3402 Τ1 Thermal resistance of bedding/medium inside pipe-type Т2 [K.m/W] n/a n/a n/a Thermal resistance of outer covering Т3 [K.m/W] 0.04631 0.04631 0.04631 External thermal resistance Т4 [K.m/W] 0.7686 0.76679 0.76881 Others Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements Δθint [°C] 0.0 0.0 0.0 Induced Voltage (standing) on Sheath [V/km] 0.0 0.0 0.0 Induced Voltage (standing) on Concentric Wires [V/km] 0.0 0.0 0.0 Induced current on Metallic Screen 131.3 [A] 140.0 132.6

	Cables Report			
CYMCAP Version	7.3 Revision 2			
Study:	Eirgrid Cp966 Feasibility study			
Execution:	Eirgrid - Extra wide Trench (1ct 220kV CABLE)			
Date:	23/03/2020 15:04:56			

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No.	Description	Unit	1
Gen	eral Cable Information		
1	Cable Equipment ID		220KV.011
2	Number of Cores		Single Core
3	Voltage	[kV]	220
4	Conductor Area	[mm <sup>2</sup> ]	2500.0
5	Cable Overall Diameter	[mm]	130.38
	Maximum Steady-State Conductor Temperature		
6	Maximum Emergency Conductor Temperature	[°C]	90
7 Con	ductor	[°C]	110
	Material		
8	Electrical Resistivity at 20°C	(	Copper
	Temperature Coefficient at 20°C	[μΩ.cm]	1.7241
10	Reciprocal of Temperature Coefficient of Resistance	[1/K]	0.00393
11	(BETA)	[K]	234.5
12	Volumetric Specific Heat (SH)	[J/(K*cm3)]	3.45
13	Construction		6 Segments
14	Conductor Insulation System		Extruded
15	Milliken Wires Construction		Insulated Wires
16	Ks (Skin Effect Coefficient)		0.35
17	Kp (Proximity Effect Coefficient)	-	0.2
18	Diameter	[mm]	61.3
Con	ductor Shield		
19	Thickness	[mm]	2.2
20	Diameter	[mm]	65.7
Insu	lation	1	<b></b>
21	Material		XLPE Unfilled
22	Thermal Resistivity	[K.m/W]	3.5
23	Dielectric Loss Factor - ( tan delta )		0.001
24	Relative Permittivity - ( epsilon )		2.5
25	Specific Insulation Resistance Constant at 60°F - ( K )	[MQ.km]	65617.
26	Thickness	[mm]	22.0
27	Diameter		
21		[mm]	109.7
-	lation Screen	[mm]	109.7
-		[mm]	109.7 Semi Conducting Screen
Insu	lation Screen	[mm] [mm]	
<b>Insu</b> 28	Ilation Screen		Semi Conducting Screen
28 29	lation Screen Material Thickness Diameter	[mm]	Semi Conducting Screen 1.6
28 29 30	lation Screen Material Thickness Diameter	[mm]	Semi Conducting Screen 1.6
28 29 30 She	lation Screen Material Thickness Diameter ath	[mm]	Semi Conducting Screen 1.6 112.9
28 29 30 She 31	lation Screen Material Thickness Diameter ath Is Sheath Around Each Core?	[mm]	Semi Conducting Screen 1.6 112.9 n/a
28 29 30 <b>She</b> 31 32	lation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material	[mm] [mm]	Semi Conducting Screen 1.6 112.9 n/a Lead
28 29 30 <b>She</b> 31 32 33 34	lation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance	[mm] [mm] [μΩ.cm] [1/K]	Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004
Insu           28           29           30           She           31           32           33           34	lation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C	[mm] [mm] [μΩ.cm] [1/K] [K]	Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230
Insu 28 29 30 <b>She</b> 31 32 33 34 35 36	lation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA)	[mm] [mm] [μΩ.cm] [1/K]	Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45
28 29 30 <b>She</b> 31 32 33 34 35 36 37	lation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Z0°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH)	[mm] [mm] [mm] [μ£cm] [1/K] [K] [K]	Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated
28 29 30 <b>She</b> 31 32 33 34 35 36 37 38	lation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type	(mm) (mm) (mm) (mm) (µ£1cm) (1/K) (K) (K) (K) (K)	Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0
28 29 30 <b>She</b> 31 32 33 34 35 36 37 38 39	lation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness	[mm] [mm] [mm] [μ£cm] [1/K] [K] [K]	Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated
28 29 30 <b>She</b> 31 32 33 34 35 36 37 38 39	lation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral//Skid wires	(mm) (mm) (mm) (mm) (µ£1cm) (1/K) (K) (K) (K) (K)	Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0
28 29 30 <b>She</b> 31 32 33 34 35 36 37 38 39	Iation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Zo°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core?	(mm) (mm) (mm) (µ£1cm) (1/K) (K) (K) (K) (K)	Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0
Insu 28 29 30 <b>She</b> 31 32 33 34 35 36 37 38 39 <b>Con</b>	lation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Zo°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material	(mm) (mm) (mm) (µ£1cm) (1/K) (K) (K) (K) (K)	Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98
28 29 30 <b>She</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40	lation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Zo°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C	(mm) (mm) (mm) (µ£1cm) (1/K) (K) (K) (K) (K)	Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a
28 29 30 <b>She</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41	Iation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter contric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C	[mm] [mm] [µΩcm] [µΩcm] [µΩcm] [µΩcm] [µΩ] [µΩ] [µΩ] [mm] [mm]	Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper
Insu           28           29           30           She           31           32           33           34           35           36           37           38           39           Con           40           41	lation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Zo°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C	[mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm]	Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241
Insu           28           29           30           She           31           32           33           34           35           36           37           38           39           Con           40           41           42           43	Iation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of 20°C	[mm] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [K] [/(K'cm)] [mm] [mm] [mm] [mm] [mm] [mm] [mm]	Semi Conducting Screen 1.6 112.9 
Insu           28           29           30           She           31           32           33           34           35           36           37           38           39           Con           40           41           42           43           44	lation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Corrugation Type Thickness Diameter Centric neutral/SkId wires Are Concentric Neutral/Wres Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA)	[mm] [mm] [μελcm] [μελcm] [μελcm] [μελcm] [μελcm] [μελcm] [μελcm] [μελcm] [mm] [μελcm] [μελ] [με] [μελ] [με	Semi Conducting Screen 1.6 112.9 
Insu 28 29 30 <b>She</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 42 43 44	lation Screen Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Corrugation Type Thickness Diameter Centric neutral/SkId wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH)	[mm] [mm] [μελ.cm] [μελ.cm] [1/K] [K] [μελ.cm] [mm] [mm] [mm] [μελ.cm] [mm]	Semi Conducting Screen 1.6 112.9 
Insu           28           29           30           She           31           32           33           34           35           36           37           38           39           Con           40           41           42           43           44           45           46	lation Screen Material Thickness Dameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Longth of Lay	[mm] [mm] [μελcm] [μελcm] [μελcm] [μελcm] [μελcm] [μελcm] [μελcm] [μελcm] [mm] [μελcm] [μελ] [με] [μελ] [με	Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241 0.00393 234.5 3.45 1125.0 82
Insu           28           29           30           She           31           32           33           34           35           36           37           38           39           Con           40           41           42           43           44           45           46           47	Iation Screen Material Material Thickness Diameter ath Is Sheath Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Centric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires	(mm) (mm) (mm) (mm) (mm) (jµ2.cm) (jµ2.cm) (jµ2.cm) (jµ2.cm) (jµ2.cm) (jµ2.cm) (mm) (mm) (mm) (jµ2.cm) (mm) (jµ2.cm) (mm)	Semi Conducting Screen 1.6 112.9 
Insu           28           29           30           31           32           33           34           35           36           37           38           39           Con           40           41           42           43           44           45           46           47           48           49	Iation Screen           Material           Thickness           Dameter           ath           Is Sheath Around Each Core?           Material           Is Sheath Around Each Core?           Material           Electrical Resistivity at 20°C           Temperature Coefficient at 20°C           Reciprocal of Temperature Coefficient of Resistance (BETA)           Volumetric Specific Heat (SH)           Corrugation Type           Thickness           Diameter           Centric neutral/Skid wires           Are Concentric Neutral Wires Around Each Core?           Material           Electrical Resistivity at 20°C           Temperature Coefficient at 20°C           Reciprocal of Temperature Coefficient of Resistance (BETA)           Volumetric Specific Heat (SH)           Length of Lay           Number of Wires           Wire Gauge	(mm) (mm) (mm) (mm) (mm) (mm) (1/K) (K) (mm) (mm) (mm) (mm) (mm) (mm) (K) (K) (K) (K) (K) (K) (K) (K	Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241 0.00393 234.5 3.45 1125.0 82 Undefined 1.54
Insu           28           29           30           31           32           33           34           35           36           37           38           39           Con           40           41           42           43           44           45           46           47           48	Iation Screen           Material           Thickness           Diameter           ath           Is Sheath Around Each Core?           Material           Electrical Resistivity at 20°C           Temperature Coefficient at 20°C           Reciprocal of Temperature Coefficient of Resistance (BETA)           Volumetric Specific Heat (SH)           Corrugation Type           Thickness           Diameter           centric Neutral/VSkid wires           Are Concentric Neutral Wires Around Each Core?           Material           Electrical Resistivity at 20°C           Temperature Coefficient of Resistance (BETA)           Volumetric Specific Heat (SH)           Length of Lay           Number of Wires           Wire Gauge           Thickness           Diameter	(mm) (mm) (mm) (mm) (mm) (jµ2.cm) (jµ2.cm) (jµ2.cm) (jµ2.cm) (jµ2.cm) (jµ2.cm) (mm) (mm) (mm) (jµ2.cm) (mm) (jµ2.cm) (mm)	Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241 0.00393 234.5 3.45 1125.0 82 Undefined
Insu           28           29           30           31           32           33           34           35           36           37           38           39           Con           40           41           42           43           44           45           46           47           48           49           50	Iation Screen           Material           Thickness           Diameter           ath           Is Sheath Around Each Core?           Material           Electrical Resistivity at 20°C           Temperature Coefficient at 20°C           Reciprocal of Temperature Coefficient of Resistance (BETA)           Volumetric Specific Heat (SH)           Corrugation Type           Thickness           Diameter           centric Neutral/VSkid wires           Are Concentric Neutral Wires Around Each Core?           Material           Electrical Resistivity at 20°C           Temperature Coefficient of Resistance (BETA)           Volumetric Specific Heat (SH)           Length of Lay           Number of Wires           Wire Gauge           Thickness           Diameter	(mm) (mm) (mm) (mm) (mm) (mm) (1/K) (K) (mm) (mm) (mm) (mm) (mm) (mm) (K) (K) (K) (K) (K) (K) (K) (K	Semi Conducting Screen 1.6 112.9 n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 0 0 0 119.98 0 0 0 0 1.7241 0.00393 234.5 3.45 1.7241 0.00393 234.5 3.45 1.125.0 82 Undefined 1.54 115.98
Insu 28 29 30 <b>She</b> 31 32 33 34 35 36 37 38 39 <b>Con</b> 40 41 41 42 43 44 45 46 47 48 49 50 <b>Jac</b> l	Iation Screen           Material           Thickness           Dameter           ath           Is Sheath Around Each Core?           Material           Electrical Resistivity at 20°C           Temperature Coefficient at 20°C           Reciprocal of Temperature Coefficient of Resistance (BETA)           Volumetric Specific Heat (SH)           Corrugation Type           Thickness           Diameter           centric neutral/Skid wires           Are Concentric Neutral Wires Around Each Core?           Material           Electrical Resistivity at 20°C           Temperature Coefficient of Resistance (BETA)           Volumetric Specific Heat (SH)           Length of Lay           Number of Wires           Wire Gauge           Thickness           Diameter	(mm) (mm) (mm) (mm) (mm) (j(d, cm) (j(d, cm)) (mm) (mm) (j(d, cm) (mm) (j(d, cm)) (mm) (j(d, cm) (mm) (mm) (mm)	Semi Conducting Screen 1.6 1.2.9 
Insu           28           29           30           She           31           32           33           34           35           36           37           38           39           Con           40           41           42           43           44           45           46           47           48           49           50           Jac	Iation Screen           Material           Thickness           Diameter           ath           Is Sheath Around Each Core?           Material           Electrical Resistivity at 20°C           Temperature Coefficient at 20°C           Reciprocal of Temperature Coefficient of Resistance (BETA)           Volumetric Specific Heat (SH)           Corrugation Type           Thickness           Diameter           centric neutral/Skild wires           Are Concentric Neutral Wires Around Each Core?           Material           Electrical Resistivity at 20°C           Temperature Coefficient at 20°C           Reciprocal of Temperature Coefficient of Resistance (BETA)           Volumetric Specific Heat (SH)           Length of Lay           Number of Wires           Wire Gauge           Thickness           Diameter	[mm]           [mm]           [μ1 cm]           [μ2 cm]           [μ2 cm]           [μ2 cm]           [μ2 cm]           [μ2 cm]           [μ3]           [μ4]           [μ3]           [μ4]           [μ3]           [μ4]	Semi Conducting Screen 1.6 1.2,9 
Insu           28           29           30           31           32           33           34           35           36           37           38           39           Con           40           41           42           43           44           45           46           47           48           49           50           51           52	Iation Screen           Material           Thickness           Dameter           ath           Is Sheath Around Each Core?           Material           Electrical Resistivity at 20°C           Temperature Coefficient at 20°C           Reciprocal of Temperature Coefficient of Resistance (BETA)           Volumetric Specific Heat (SH)           Corrugation Type           Thickness           Dameter           centric neutral/Skid wires           Are Concentric Neutral Wires Around Each Core?           Material           Electrical Resistivity at 20°C           Temperature Coefficient at 20°C           Reciprocal of Temperature Coefficient of Resistance (BETA)           Volumetric Specific Heat (SH)           Length of Lay           Number of Wires           Wire Gauge           Thickness           Dameter           cet           Material           Thermal Resistivity	(mm) (mm) (mm) (mm) (mm) (j(d, cm) (j(d, cm)) (mm) (mm) (j(d, cm) (mm) (j(d, cm)) (mm) (j(d, cm) (mm) (mm) (mm)	Semi Conducting Screen 1.6 1.2.9 

No.	Description	Unit	1					
Spe	Specific Installation Data							
55	Cable Equipment ID		220KV.011					
56	Cable Frequency	[Hz]	50					
57	Sheath / Shield Bonding		1 Conductor Crossbonded Flat					
58	Loss Factor Constant (ALOS)		0.3					
59	Minor section length		Crossbonded Unknown Section Lengths UNKNOWN					
60	Duct construction		Polyethylene in Concrete					
61	Duct material thermal resistivity	[K.m/W]	3.5					
62	Inside Diameter of the Duct/Pipe	[mm]	188.0					
63	Outside Diameter of the Duct/Pipe	[mm]	200.0					

### Cable ID : 220KV.011

Cable Title	2500sgmm Cu (insulated Wires)_XLPE_CWS+Pb_PE NKT for Eirgrid
Cable Title	2500sqmm Cu (insulated Wires)_XLPE_CWS+Pb_PE NKT for Eirgrid
	The - 22, 0 = 11938 mm • <u>dredt</u> , polethylere The - 52, 0 = 11938 mm • <u>Overall cable dameter</u> + 11038 mm
<u>vonage</u> = 220.0	NV <u>Cond. sreg</u> = 2500.0 mm <sup>2</sup>
	Conductor, copper     Insulations system - Extruded, <u>Skin</u> - Program selects     Conductor shield
	Insulation, XLPE (unfilled) <u>Dielectric loss</u> = Program selects Insu. screen, semi-conducting

 Concentric wires, copper <u>Length of lay</u> = 1125.0 mm
 Sheath, lead
 Jacket, polyethylene

 Max. Steady-State Cond. Temp. = 90 deg.

 Voltage = 220.0 KV
 Cond. area = 2500.0 mm\*
 Max. Transient Cond. Temp. = 110 deg.

## CYME

## **Electrical Parameters**

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Extra wide Trench (1ct 220kV CABLE)
Date:	23/03/2020 15:04:56

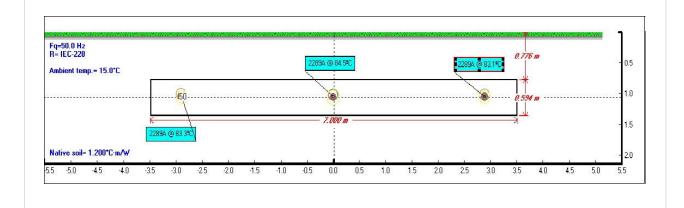
No.	Description	Unit	Cable No.1	Cable No.2	Cable No.3
1	Cable Equipment ID		220KV.011	220KV.011	220KV.011
Resi	stances		•		
2	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00915	0.00918	0.00914
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.00841	0.00841	0.00841
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01015	0.01018	0.01015
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.28869	0.28869	0.28869
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.34692	0.34836	0.3467
8	DC Resistance of Concentric Wires at 20°C	[Ω/km]	0.1185	0.1185	0.1185
9	DC Resistance of Concentric Wires at Operating Temperature	[Ω/km]	0.14199	0.14257	0.1419
Loss	es				
10	Conductor Losses	[W/m]	53.18612	53.36265	53.15954
11	Dielectric Losses	[W/m]	1.37316	1.37316	1.37316
12	Metallic Screen Losses	[W/m]	1.99067	1.82164	1.74995
13	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
14	Total Losses	[W/m]	56.54994	56.55745	56.28265
Cap	acitance, Inductance, Impedance				
15	Capacitance	[µF/km]	0.271	0.271	0.271
16	Inductance of Conductor	[mH/km]	0.95962	0.95962	0.95962
17	Reactance of Conductor	[Ω/km]	0.30147	0.30147	0.30147
18	Inductance of Metallic Sheath	[mH/km]	0.78167	0.78167	0.78167
19	Reactance of Metallic Sheath	[Ω/km]	0.24557	0.24557	0.24557
20	Positive Sequence Impedance	[Ω/km]	0.010150 + j0.301470	0.010180 + j0.301470	0.010150 + j0.301470
21	Negative Sequence Impedance	[Ω/km]	0.010150 + j0.301470	0.010180 + j0.301470	0.010150 + j0.301470
22	Zero Sequence Impedance	[Ω/km]	0.092010 + j0.245570	0.092000 + j0.245570	0.092010 + j0.245570
23	Surge Impedance	[Ω]	59.51506	59.51506	59.51506
Othe	rs		1		
24	Dielectric Stress at Conductor Surface	[kV/mm]	7.54233	7.54233	7.54233
25	Dielectric Stress at Insulation Surface	[kV/mm]	4.51715	4.51715	4.51715
26	Insulation Resistance at 60°F (15.8°C)	[MQ.km]	14609.00643	14609.00643	14609.00643
27	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a
28	Charging Current for One Phase	[A/km]	10.81081	10.81081	10.81081
29	Charging Capacity of three phase system at Uo	[kvar/km]	4119.47055	4119.47055	4119.47055
30	Voltage drop for Three Phase System	[V/A/km]	0.01758	0.01764	0.01757
31	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
32	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
33	Induced current on Metallic Screen	[A]	140.0	132.6	131.3

CYMC	AP Version	7.3 Revision 2				
Study: Execution:		Eirgrid Cp966 Feasibility study				
		Eirgrid - Extra wide Trench (1ct 220kV CABLE)				
Date:		23/03/2020 15:04:56				
No.	Symbol	Description	Unit	Cable No.1	Cable No.2	Cable N
1		Cable Equipment ID	U.I.I.	220KV.011	220KV.011	220KV.0
	Operation	IEC 60287-1-1				
2	Ro Ro	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	R'	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00915	0.00918	0.00914
4	dc	Conductor Diameter	[mm]	61.3	61.3	61.3
5	s	Distance Between Conductor Axes	[mm]	2894.99578	2894.99578	2894.995
6	ks	Factor Used for xs Calculation (Skin Effect)		0.35	0.35	0.35
7	kp	Factor Used for xp Calculation (Proximity Effect)		0.2	0.2	0.2
9	xs	Component of Ys Calculation (Skin Effect) Component of Yp Calculation (Proximity Effect)		2.19298	2.18855	2.19365
10	ys	Skin Effect Factor		0.10987	0.10906	0.10999
11	уp	Proximity Effect Factor		0.00007	0.00007	0.00007
12 Dielect	R R Losses	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01015	0.01018	0.01015
13	tanō	Dielectric Loss Factor		0.001	0.001	0.001
14	٤	Insulation Relative Permitivity		2.5	2.5	2.5
15	с	Cable Capacitance	[uF/km]	0.271	0.271	0.271
16	U.	Voltage	[kV]	127.01706	127.01706	127.0170
17 Circula	Wd ting Loss F	Cable Dielectric Losses Per Phase	[W/m]	1.37316	1.37316	1.37316
oncula	ang Loss F					
18	Rs	AC Resistance used for Circulating Loss Factor computation	[Ω/km]	0.10075	0.10117	0.10069
19	d	Mean diameter used for Circulating Loss Factor computation	[mm]	116.22348	116.22348	116.2234
20	X	Reactance used for Circulating Loss Factor computation Mutual Reactance	[Ω/km]	0.24557	0.24557 0.04355	0.24557
21	Xm	Innuai Redutative	[Ω/km]	0.04355	u.04355	0.04355
22	Р	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.28912	0.28912	0.28912
23	Q	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.23105	0.23105	0.23105
		Spacing Factor (applied when spacing between cable uneven or non-				
24 25	Fspacing	equal minor section length) Screen Loss Factor Caused by Circulating Current		0.004	0.004	0.004
	oss Factor	Screen coss ractor caused by circulating current		0.03713	0.03334	0.03204
26	Rs	AC Resistance used for Eddy Loss Factor computation	[Ω/km]	0.34692	0.34836	0.3467
27	d	Mean diameter used for Eddy Loss Factor computation	[mm]	117.98	117.98	117.98
28	ρs	Electrical Resistivity used for Eddy Loss Factor computation	[Ω.m]	0.0	0.0	0.0
29	Ds	External diameter used for Eddy Loss Factor computation	[mm]	119.98	119.98	119.98
30	ts	Thickness used for Eddy Loss Factor computation	[mm]	2.0	2.0	2.0
31	β,	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		39.18066	39.09948	39.1929
32 34	qs m	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		1.0025	1.00249 0.09018	1.0025
34	٨o	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.09038	0.00002	0.0908
36	Δ,	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		-0.00326	0.00002	0.00034
37 38	Δ2 F	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.0	0.0	0.0
38	Fpipe	Milliken conductor Effect Magnetic effect factor due to pipe		1.0	1.0	1.0
40	Farmour	Magnetic effect factor due to armour		1.0	1.0	1.0
41 Metalik	۸°، Screen Lo	Screen Loss Factor Caused by Eddy Current		0.00028	0.0008	0.00028
42	λ1	Screen Loss Factor		0.03743	0.03414	0.03292
Armou	and Pipe I	Loss Factor	1			
43	۸₂a	Armour Loss Factor Pipe Loss Factor		0.0	0.0	0.0
44	λ <sub>a</sub> pipe λ <sub>a</sub>	Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
		IEC 60287-2-1	1	1	1	
47	Т,	Thermal Resistance Between Conductor and Screen	[K.m/W]	0.3402	0.3402	0.3402
48 49	tι pTi	Insulation Thickness Between Conductor and Screen Thermal Resistivity of Insulation	[mm] [K.m/W]	25.8 3.5	25.8 3.5	25.8 3.5
50	Та	Thermal Resistance of Jacket/Pipe Coating	[K.m/W]	0.04631	0.04631	0.04631
51	ta T	Thickness of Jacket/Pipe Coating	[mm]	5.2	5.2	5.2
52 Cable I	ρΤJ n Ducts	Thermal Resistivity of Jacket/Pipe Coating	[K.m/W]	3.5	3.5	3.5
53	U	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		1.87	1.87	1.87
54	V	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1		0.312	0.312	0.312
55 56	Υ θm	Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space	[°C]	0.0037 61.2	0.0037 62.5	0.0037
ad	VIII	The second s	19	01.2	02.3	01.1
57	T4'	Thermal Resistance of the Medium Inside the Duct/Pipe	[K.m/W]	0.23314	0.23133	0.23335
58 59	Do	Outside Diameter of the Duct/Pipe Inside Diameter of the Duct/Pipe	[mm] [mm]	200.0	200.0 188.0	200.0
60	ρΤ	Thermal Resistivity of the Duct/Pipe Material	[K.m/W]	3.5	3.5	3.5
61	T4"	Thermal Resistance of the Duct/Pipe	[K.m/W]	0.03447	0.03447	0.03447
62 Cable I	T₄‴ na Duct Ba	Thermal Resistance of the Surrounding Medium ank/Backfill Installation	[K.m/W]	0.501	0.501	0.501
63	x	Shorter Side of the Duct Bank/Backfill	[m]	0.594	0.594	0.594
	У	Longer Side of the Duct Bank/Backfill	[m]	7.0	7.0	7.0
64	rb LG	Equivalent Radius of Duct Bank/Backfill Depth of Laying to the Centre of Duct Bank/Backfill	[m] [m]	1.26566	1.26566	1.26566
65	LO	Depth of Laying to the Centre of Duct Bank/Backhill Coefficient Used in IEC 60287-2-1 Clause 2.2.7.3	[111]	0.84778	0.84778	0.84778
	u	Number of Loaded Cables in the Duct Bank/Backfill		3.0	3.0	3.0
65 66	N			1	1	
65 66 67	N		[K m/M	1.2	1.2	1.2
65 66 67 68		Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill	[K.m/W] [K.m/W]	1.2	1.2	1.2
65 66 67 68 69 70 71	Ν ρε ρc Τ4**	Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill Thermal Resistance of the Surrounding Medium	[K.m/W] [K.m/W]	1.0 0.501	1.0 0.501	1.0 0.501
65 66 67 68 69 70	N pe pc	Thermal Resistivity of Earth Around the Duct Bank/Backfill Thermal Resistivity of the Duct Bank/Backfill	[K.m/W]	1.0	1.0	1.0

	Study Summary			
CYMCAP Version	7.3 Revision 2			
Study:	Eirgrid Cp966 Feasibility study			
Execution:	Eirgrid - Extra wide Trench (1ct 220kV CABLE)			
Date:	23/03/2020 15:17:41			

General Simulation Data					
Steady State Option	Temperature				
Consider Electrical interaction between circuits	No				
Induced currents in metallic layers as a fraction of conductor current (applied to all single phase circuits) :	0.0				
Conductor Resistances Computation Option:	IEC-228				

Installation Type:Ductbank						
Ambient Soil Temperature at Installation Depth	[°C]	15.0				
Native Soil Thermal Resistivity	[K.m/W]	1.2				
Thermal Resistivity of Duct Bank	[K.m/W]	1.0				
Depth of Center of Duct Bank	[m]	1.07				
Duct Bank Width	[m]	7.0				
Duct Bank Height	[m]	0.59				



Results Summary										
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Dally Load Factor	X coordinate [m]	Y coordinate [m]	Conductor temperature [°C]	Ampacity [A]
1	220KV.011	1		А	50.0	1.0	-2.9	1.05	83.3	2289.0
2	220KV.011	1		В	50.0	1.0	0.0	1.05	84.5	2289.0
3	220KV.011	1		С	50.0	1.0	2.89	1.05	83.1	2289.0

	Steady State Summary
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution: Eirgrid - Extra wide Trench (1ct 220kV CABLE)	
Date:	23/03/2020 15:17:41

Simulation Data			
Installation type:	Ductbank		
Steady State Option	Temperature		
Amblent temperature [°C]	15		
Native Soll Thermal Resistivity [K.m/W]	1.2		
Consider Non-Isothermal Earth Surface	No		
Consider effect of soll dry out	No		
Consider Electrical Interaction between circuits	No		
Induced current in metailic layers as a fraction of conductor current (applied to all single phase circuits)	0		

Variable	e Description	Unit		Cables	
Cable No.	Cable Index Number		1	2	3
General Inp	ut Data				
Cable ID	Cable Equipment ID		220KV.011	220KV.011	220KV.011
Circuit No.	Circuit No.		1	1	1
Phase	Cable Phase		А	В	С
Fq	Operating Frequency	[Hz]	50.0	50.0	50.0
х	X coordinate	[m]	-2.9	0.0	2.89
у	Y coordinate	[m]	1.05	1.05	1.05
DLF	Daily Load Factor	[p.u.]	1.0	1.0	1.0
	Bonding Type		1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat	1 Conductor Crossbonded Flat
Ampacity					
I	Steady State Ampacity	[A]	2289.0	2289.0	2289.0
Temperature	es				
θс	Conductor temperature	[°C]	83.3	84.5	83.1
θs	Sheath/Shield temperature	[°C]	65.2	66.4	65.0
θа	Armour temperature	[°C]	n/a	n/a	n/a
θsurf	Cable surface temperature	[°C]	62.6	63.8	62.4
00000	Duct surface temperature	[°C]	47.2	48.6	47.1
Resistances	3				
R₀	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
R	AC Resistance of the Conductor at Operating Temperature	[Ω/km]	0.01001	0.01004	0.01
ys	Skin Effect Factor		0.11336	0.11253	0.11349
ур	Proximity Effect Factor		0.00007	0.00007	0.00007
Losses					
Wc	Conductor Losses	[W/m]	52.44476	52.61814	52.41874
Wd	Dielectric Losses	[W/m]	1.37316	1.37316	1.37316
Ws	Metallic Screen Losses	[W/m]	1.96335	1.80131	1.72872
Wa	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
Wt	Total Losses	[W/m]	55.78127	55.79261	55.52062
<b>λ</b> 1	Screen Loss Factor		0.03744	0.03423	0.03298
λ <sub>2</sub>	Armour Loss Factor + Pipe Loss Factor		0.0	0.0	0.0
Thermal res	istances				
T1	Thermal resistance of insulation	[K.m/W]	0.3402	0.3402	0.3402
T2	Thermal resistance of bedding/medium inside pipe-type	[K.m/W]	n/a	n/a	n/a
Т3	Thermal resistance of outer covering	[K.m/W]	0.04631	0.04631	0.04631
Τ4	External thermal resistance	[K.m/W]	0.77634	0.77444	0.77656
Others					
Δθint	Temperature Rise at the Surface of the Cable Due to Other Surrounding Elements	[°C]	0.0	0.0	0.0
	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
	5 ( 5,				
	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0

	Cables Report
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Extra wide Trench (1ct 220kV CABLE)

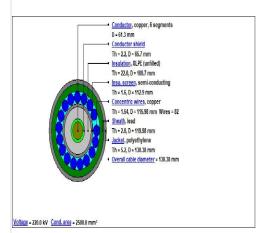
Date: 23/03/2020 15:17:41

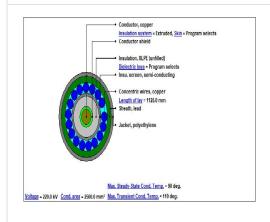
Mo	Description	Unit	1
No. Gene	eral Cable Information	Unit	<b>!</b>
6	Cable Equipment ID		
	Number of Cores		220KV.011
-	Voltage		Single Core
3	Conductor Area	[kV]	220
4	Cable Overall Diameter	[mm <sup>2</sup> ]	2500.0
5		[mm]	130.38
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	110
Cond	luctor		
8	Material		Copper
9 E	Electrical Resistivity at 20°C	[μΩ.cm]	1.7241
10	Temperature Coefficient at 20°C	[1/K]	0.00393
	Reciprocal of Temperature Coefficient of Resistance		
	(BETA)	[K]	234.5
12	Volumetric Specific Heat (SH)	[J/(K*cm3)]	3.45
13	Construction		6 Segments
14	Conductor Insulation System		Extruded
15	Millken Wires Construction		Insulated Wires
10	Ks (Skin Effect Coefficient)		0.35
17	Kp (Proximity Effect Coefficient)		0.2
10	Diameter	[mm]	61.3
	luctor Shield	1	
14	Thickness	[mm]	2.2
20	Diameter	[mm]	65.7
insula	ation		
21	Material		XLPE Unfilled
22	Thermal Resistivity	[K.m/W]	3.5
23	Dielectric Loss Factor - ( tan delta )		0.001
24 F	Relative Permittivity - ( epsilon )		2.5
5	Specific Insulation Resistance Constant at 60°F - (K)		
25	Thickness	[MQ.km]	65617.
20	Diameter	[mm]	22.0
21	ation Screen	[mm]	109.7
	Material		
20			Semi Conducting Screen
29	Thickness	[mm]	1.6
30	Diameter	[mm]	112.9
Shea	III		
51			
	Is Sheath Around Each Core?		n/a
32	Material		
32		[μΩ.cm]	n/a
32 33	Material	[μΩ.cm] [1/K]	n/a Lead
32 33 34 F	Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance	[1/K]	n/a Lead 21.4 0.004
32 33 34 35	Waterial Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA)	[1/K] [K]	n/a Lead 21.4 0.004 230
32 33 34 35 36	Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH)	[1/K]	n/a Lead 21.4 0.004 230 1.45
32 33 34 35 36 37	Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type	[1/K] [K] [J/(K*cm <sup>3</sup> )]	n/a Lead 21.4 0.004 230 1.45 Non Corrugated
32 33 <sup>F</sup> 34 <sup>T</sup> 35 <sup>C</sup> 36 <sup>V</sup> 37 <sup>C</sup> 38 <sup>T</sup>	Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness	[1/K] [K] [J/(K*cm <sup>3</sup> )] [mm]	n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0
32 33 F 34 F 35 C 36 V 37 C 38 T 39 F	Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter	[1/K] [K] [J/(K*cm <sup>3</sup> )]	n/a Lead 21.4 0.004 230 1.45 Non Corrugated
32 33 F 34 F 35 C 36 V 37 C 38 T 39 F	Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness	[1/K] [K] [J/(K*cm <sup>3</sup> )] [mm]	n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0
32 33 34 1 35 36 37 38 39 <b>Conc</b>	Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter	[1/K] [K] [J/(K*cm <sup>3</sup> )] [mm]	n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0
32 33 34 35 36 37 38 39 Conc 40	Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter seentric neutral/Skld wires	[1/K] [K] [J/(K*cm <sup>3</sup> )] [mm]	n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98
32         33         F           33         F         7           35         (         35           36         V         35           37         (         38           38         1         39           39         [         C           40         4         4	Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter sentric neutral/Skid wires Are Concentric Neutral Wires Around Each Core?	[1/K] [K] [/(K*cm?)] [mm] [mm]	n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper
32         33         F         33         F         33         F         33         F         34         7 </td <td>Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter seentric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material</td> <td>[1/K] [K] [/(K*cm?)] [mm] [mm] [mm]</td> <td>n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241</td>	Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter seentric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material	[1/K] [K] [/(K*cm?)] [mm] [mm] [mm]	n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241
32         33         F           33         F         5         0           34         1         1         5         0           35         0         0         35         0           36         V         36         V         37           38         1         38         1         38         1           39         1         COORC         COORC         40         41         N           40         41         N         42         43         1         1         43         1	Material  Electrical Resistivity at 20°C  Temperature Coefficient at 20°C  Reciprocal of Temperature Coefficient of Resistance (BETA)  Volumetric Specific Heat (SH)  Corrugation Type  Thickness  Diameter  Reconcentric Neutral/Skld wires Are Concentric Neutral Wires Around Each Core?  Material  Electrical Resistivity at 20°C  Temperature Coefficient at 20°C  Reciprocal of Temperature Coefficient of Resistance	[1/K] [K] [J/(K*cm <sup>3</sup> )] [mm] [mm] [mm] [mm] [mm]	n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241 0.00393
32         33         F           33         F         7         7           35         0         1         1           35         0         1         1           36         1         1         1           37         0         2         3           38         1         1         1           40         4         4         4           41         N         4         4           44         0         4         1	Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BE TA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Rentric neutral/SkId wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BE TA)	[1/K] [K] [/(K*cm?)] [mm] [mm] [mm]	n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241
32         33         E           33         E         1           34         1         1           35         (         1           35         (         1           35         (         1           36         \lambda         1           37         (         3           38         1         1           39         1         1           40         ////////////////////////////////////	Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BE TA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Diameter Electrical Resistivity at 20°C Reciprocal of Temperature Coefficient of Resistance (BE TA) Volumetric Specific Heat (SH)	[1/K] [K] [J/(K*cm <sup>3</sup> )] [mm] [mm] [mm] [mm] [mm]	n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241 0.00393
332         5           33         F           34         1           35         (           36         \V           37         (           38         1           37         (           38         1           39         (           40         ////////////////////////////////////	Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Sentric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay	[1/K] [K] [μ/(K*cm?)] [mm] [mm] [mm] [μΩ.cm] [μΩ.cm] [1/K] [K]	n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 n/a Copper 1.7241 0.00393 234.5
332         F           333         F           334         1           35         (           36         \V           36         \V           37         (           38         1           39         (           40         ////////////////////////////////////	Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Corrugation Type Thickness Diameter Sentric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires	[1/K] [K] [μ/(K*cm?)] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μ] [K] [J/(K*cm?)]	n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 Non Corrugated 2.0 119.98 Non Corrugated 2.0 119.98 Non Corrugated 2.0 119.98 Non Corrugated 2.0 119.98 Non Corrugated 2.0 119.98 Non Corrugated 2.0 12,0 12,0 12,0 12,0 12,0 12,0 12,0 12,
32         33         E           33         E         33         F           34         1         1         1           35         Q         X         X           36         X         X         X           37         Q         X         X           38         1         X         X           39         E         X         X           40         A         A         X           41         M         A         A           42         E         E         A           43         1         X         A           44         Q         K         X           46         L         A         A	Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Sentric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay	[1/K] [K] [μ/(K*cm?)] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μ] [K] [J/(K*cm?)]	n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 Na Copper 1.7241 0.00393 234.5 3.45 1125.0
32         33         F         33         F         34         1         1         1         1         1         1         1         35         0         0         37         0         36         N         N         37         0         37         0         38         1         1         38         1         37         0         38         1         1         37         0         38         1	Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Corrugation Type Thickness Diameter Sentric neutral/Skid wires Are Concentric Neutral Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires	[1/K] [K] [μ/(K*cm?)] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μ] [K] [J/(K*cm?)]	n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 Na Copper 1.7241 0.00393 234.5 3.45 3.45 1125.0 82
32         33         F           33         F         1           34         1         1           35         0         0           36         N         1           37         0         1           38         1         1           39         1         1           40         4         1           41         N         4           42         1         1           43         1         1           44         0         1           45         N         4           46         4         1           48         N         4	Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Corrugation Type Thickness Diameter Concentric Neutral/SkId wires Area Concentric Neutral/Wires Around Each Core? Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires	[1/K] [K] [J/(K*cm?)] [mm] [mm] [J/(K] [L/(K*cm?)] [M] [mm] [mm]	n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 Na Copper 1.7241 0.00393 234.5 3.45 3.45 1125.0 82 Undefined
32         33         F           33         F         1           34         1         1           35         C         0           36         V         1           37         C         0           38         1         1           37         C         0           38         1         1           39         C         C           40         A         1           42         E         C           43         1         1           44         C         4           45         V         4           46         L         4           47         1         1           48         V         4           49         1         1           50         L         1	Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge Thickness Diameter	[1/K] [K] [J/(K*cm?)] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μm] [mm]	n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 0 0 0.0393 234.5 3.45 3.45 1125.0 82 Undefined 1.54
32         33         F           33         F         1           34         1         1           35         C         V           36         V         1           37         C         38           38         1         1           39         I         1           40         A         1           41         N         4           43         1         1           44         C         C           45         V         4           46         L         4           47         N         4           49         1         50           50         I         I	Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge Thickness Diameter	[1/K] [K] [J/(K*cm?)] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μm] [mm]	n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 0 0 0.0393 234.5 3.45 3.45 1125.0 82 Undefined 1.54
32         33         F         1           33         F         6         1           34         1         1         1           35         0         1         1           35         0         1         1           36         1         1         1           37         0         0         1           38         1         1         1           40         1         1         1           42         E         4         4           43         1         1         1           44         4         4         4         4           46         L         4         4         4           47         1         1         1         1           48         V         1         1         1           50         1         1         1         1           51         1         1         1         1	Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Electrical Resistivity at 20°C Reciprocal of Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge Thickness Diameter El	[1/K] [K] [J/(K*cm?)] [mm] [mm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μΩ.cm] [μm] [mm]	n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 Copper 1.7241 0.00393 234.5 3.45 1125.0 82 Undefined 1.54 115.98
32         33         F         1           33         F         1         1           34         1         1         1           35         0         1         1           35         0         1         1           36         1         1         1           37         0         0         1           38         1         1         1           40         4         1         1           42         6         4         1           43         1         1         1           44         5         1         1           44         45         1         1           46         4         4         1           47         7         7         1           50         1         1         1           50         1         1         1           51         1         1         1	Material Electrical Resistivity at 20°C Temperature Coefficient at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Corrugation Type Thickness Diameter Electrical Resistivity at 20°C Reciprocal of Temperature Coefficient of Resistance (BETA) Volumetric Specific Heat (SH) Length of Lay Number of Wires Wire Gauge Thickness Diameter Et Material	[1/K] [K] [J/(K*cm <sup>3</sup> )] [mm] [mm] [J/(K*cm <sup>3</sup> )] [J/(K*cm <sup>3</sup> )] [J/(K*cm <sup>3</sup> )] [mm] [mm] [mm] [mm]	n/a Lead 21.4 0.004 230 1.45 Non Corrugated 2.0 119.98 0 0 0 0 0 0 119.98 0 0 0 0 0 0 0 0 0 0 0 0 0

No.	Description	Unit	1
Spe	cific Installation Data	-	
55	Cable Equipment ID		220KV.011
56	Cable Frequency	[Hz]	50
57	Sheath / Shield Bonding		1 Conductor Crossbonded Flat
58	Loss Factor Constant (ALOS)		0.3
59	Minor section length		Crossbonded Unknown Section Lengths UNKNOWN
60	Duct construction		Polyethylene in Concrete
61	Duct material thermal resistivity	[K.m/W]	3.5
62	Inside Diameter of the Duct/Pipe	[mm]	188.0
63	Outside Diameter of the Duct/Pipe	[mm]	200.0

### Cable ID : 220KV.011

Cable Title 2500sqmm Cu (insulated Wires)\_XLPE\_CWS+Pb\_PE NKT for Eirgrid





	Electrical Parameters
CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Extra wide Trench (1ct 220kV CABLE)
Date:	23/03/2020 15:17:41

No.	Description	Unit	Cable No.1	Cable No.2	Cable No.3
1	Cable Equipment ID		220KV.011	220KV.011	220KV.011
Resi	stances				
2	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00899	0.00903	0.00898
4	AC Resistance of Conductor at 20°C	[Ω/km]	0.00841	0.00841	0.00841
5	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01001	0.01004	0.01
6	DC Resistance of Sheath at 20°C	[Ω/km]	0.28869	0.28869	0.28869
7	DC Resistance of Sheath at Operating Temperature	[Ω/km]	0.34085	0.34227	0.34064
8	DC Resistance of Concentric Wires at 20°C	[Ω/km]	0.1185	0.1185	0.1185
9	DC Resistance of Concentric Wires at Operating Temperature	[Ω/km]	0.13954	0.14012	0.13946
Loss	ies				
10	Conductor Losses	[W/m]	52.44476	52.61814	52.41874
11	Dielectric Losses	[W/m]	1.37316	1.37316	1.37316
12	Metallic Screen Losses	[W/m]	1.96335	1.80131	1.72872
13	Armor/Pipe Losses	[W/m]	0.0	0.0	0.0
14	Total Losses	[W/m]	55.78127	55.79261	55.52062
Cap	acitance, Inductance, Impedance				
15	Capacitance	[µF/km]	0.271	0.271	0.271
16	Inductance of Conductor	[mH/km]	0.95962	0.95962	0.95962
17	Reactance of Conductor	[Ω/km]	0.30147	0.30147	0.30147
18	Inductance of Metallic Sheath	[mH/km]	0.78167	0.78167	0.78167
19	Reactance of Metallic Sheath	[Ω/km]	0.24557	0.24557	0.24557
20	Positive Sequence Impedance	[Ω/km]	0.010010 + j0.301470	0.010040 + j0.301470	0.010000 + j0.301470
21	Negative Sequence Impedance	[Ω/km]	0.010010 + j0.301470	0.010040 + j0.301470	0.010000 + j0.301470
22	Zero Sequence Impedance	[Ω/km]	0.092030 + j0.245570	0.092030 + j0.245570	0.092030 + j0.245570
23	Surge Impedance	[Ω]	59.51506	59.51506	59.51506
Othe	ers				
24	Dielectric Stress at Conductor Surface	[kV/mm]	7.54233	7.54233	7.54233
25	Dielectric Stress at Insulation Surface	[kV/mm]	4.51715	4.51715	4.51715
26	Insulation Resistance at 60°F (15.8°C)	[MQ.km]	14609.00643	14609.00643	14609.00643
27	Reduction Factor (2pt bonded & single metallic screen)		n/a	n/a	n/a
28	Charging Current for One Phase	[A/km]	10.81081	10.81081	10.81081
29	Charging Capacity of three phase system at Uo	[kvar/km]	4119.47055	4119.47055	4119.47055
30	Voltage drop for Three Phase System	[V/A/km]	0.01734	0.01739	0.01733

31	Induced Voltage (standing) on Sheath	[V/km]	0.0	0.0	0.0
32	Induced Voltage (standing) on Concentric Wires	[V/km]	0.0	0.0	0.0
33	Induced current on Metallic Screen	[A]	140.3	133.0	131.6

		0
		-
	110	-
INTERNA.	TITALA	7.0.0

Cable Parameters under Normal Operation

CYMCAP Version	7.3 Revision 2
Study:	Eirgrid Cp966 Feasibility study
Execution:	Eirgrid - Extra wide Trench (1ct 220kV CABLE)
Date:	23/03/2020 15:17:41

	Symbol	Description	Unit	Cable No.1	Cable No.2	Cable No.
	Operation	Cable Equipment ID IEC 60287-1-1		220KV.011	220KV.011	220KV.01
Conduc	ctor AC Res					
2	R.	DC Resistance of the conductor at 20°C	[Ω/km]	0.0072	0.0072	0.0072
3	R'	DC Resistance of Conductor at Operating Temperature	[Ω/km]	0.00899	0.00903	0.00898
4	dc	Conductor Diameter	[mm]	61.3	61.3	61.3
5	s	Distance Between Conductor Axes	[mm]	2894.99578	2894.99578	2894.9957
6	ks	Factor Used for xs Calculation (Skin Effect)		0.35	0.35	0.35
8	kp	Factor Used for xp Calculation (Proximity Effect)		0.2	0.2	0.2
9	xs xp	Component of Ys Calculation (Skin Effect) Component of Yp Calculation (Proximity Effect)		2.2119	2.20743	1.67255
10		Skin Effect Eactor		0.11336	0.11253	0.11349
	ys					
11	ур	Proximity Effect Factor	[Ollow]	0.00007	0.00007	0.00007
	R R	AC Resistance of Conductor at Operating Temperature	[Ω/km]	0.01001	0.01004	0.01
13	tanõ	Dielectric Loss Factor	1	0.001	0.001	0.001
14	ε	Insulation Relative Permitivity		2.5	2.5	2.5
	-	· · · · · · · · · · · · · · · · · · ·				
15	с	Cable Capacitance	[µF/km]	0.271	0.271	0.271
16	U,	Voltage	[kV]	127.01706	127.01706	127.01706
17	Wd	Cable Dielectric Losses Per Phase	[W/m]	1.37316	1.37316	1.37316
Circula	ting Loss F	actor		1		
18	Rs	AC Resistance used for Circulating Loss Factor computation	[Ω/km]	0.09901	0.09942	0.09895
19	d	Mean diameter used for Circulating Loss Factor computation	[mm]	116.22348	116.22348	116.22348
	ŭ	mean dameter data to "orcalaring 2055 Factor comparator	[]	110.22040	110.22040	110.22.540
20	х	Reactance used for Circulating Loss Factor computation	[Ω/km]	0.24557	0.24557	0.24557
21	Xm	Mutual Reactance	[Ω/km]	0.04355	0.04355	0.04355
	_					
22	Р	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.28912	0.28912	0.28912
20		Company for Circulation Lass Factor Francis (Circus 7.7.7)	101-11	0.00105	0.00405	0.23105
23	Q	Component for Circulating Loss Factor Formula (Clause 2.3.3)	[Ω/km]	0.23105	0.23105	0.23105
24	Fspacing	Spacing Factor (applied when spacing between cable uneven or non equal minor section length)		0.004	0.004	0.004
25	λ'ı	Screen Loss Factor Caused by Circulating Current		0.03715	0.03341	0.03269
Eddy L	oss Factor					
26	Rs	AC Resistance used for Eddy Loss Factor computation	[Ω/km]	0.34085	0.34227	0.34064
27	d	Mean diameter used for Eddy Loss Factor computation	[mm]	117.98	117.98	117.98
28	ps	Electrical Resistivity used for Eddy Loss Factor computation	[Ω.m]	0.0	0.0	0.0
29	Ds	External diameter used for Eddy Loss Factor computation	[mm]	119.98	119.98	119.98
30	ts	Thickness used for Eddy Loss Factor computation	[mm] [mm]	2.0	2.0	2.0
31	βι	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1	tunui	39.52777	39.44569	39.54014
32		Coefficient used in IEC 60287-1-1 Clause 2.3.6.1				1.00253
32	gs m	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.09217	1.00252 0.09179	0.09223
35	λe	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1				0.00001
36	Δ1	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Coefficient used in IEC 60287-1-1 Clause 2.3.6.1		0.00001	0.00002	0.00035
37	Δ1			0.00327	0.00002	0.00035
38	E E	Coefficient used in IEC 60287-1-1 Clause 2.3.6.1 Milliken conductor Effect		1.0	1.0	1.0
39	Fpipe	Magnetic effect factor due to pipe		1.0	1.0	1.0
40	Farmour	Magnetic effect factor due to pipe		1.0	1.0	1.0
41	λ"1	Screen Loss Factor Caused by Eddy Current		0.00029	0.00082	0.00029
	c Screen Lo					
Metallie		35 140101				
<b>Vietallik</b> 42	Â1			0.03744	0.03423	0.03298
42	λ,	Screen Loss Factor		0.03744	0.03423	0.03298
42	λ,	Screen Loss Factor coss Factor		0.03744	0.03423	0.03298
42 Armoui	λ <sub>1</sub> and Pipe L	Screen Loss Factor oss Factor Armour Loss Factor		1	1	
42 Armou 43	λ <sub>1</sub> and Pipe L λ <sub>2</sub> a	Screen Loss Factor coss Factor		0.0	0.0	0.0
42 Armoui 43 44 46	λ <sub>1</sub> and Pipe I λ <sub>2</sub> a λ <sub>3</sub> pipe λ <sub>2</sub>	Screen Loss Factor oss Factor Armour Loss Factor Pipe Loss Factor		0.0	0.0	0.0
42 Armoui 43 44 46	λ <sub>1</sub> and Pipe I λ <sub>2</sub> a λ <sub>3</sub> pipe λ <sub>2</sub>	Screen Loss Factor oss Factor Armour Loss Factor Ppe Loss Factor Armour Loss Factor + Pipe Loss Factor	[K.m/W]	0.0	0.0	0.0
42 Armoui 43 44 46 Normal	λ1       r and Pipe I       λ2a       λ2pipe       λ2       Operation	Screen Loss Factor oss Factor Armour Loss Factor Pipe Loss Factor Armour Loss Factor + Armour Loss Factor + Pipe Loss Factor EC 60287-2-1	[K.m/W] [mm]	0.0	0.0	0.0 0.0 0.0
42 Armou 43 44 46 Normal 47	λ1       and Pipe I       λ2       λ2       λ2       Operation       T1	Screen Loss Factor doss Factor Amour Loss Factor Pipe Loss Factor Amour Loss Factor + Pipe Loss Factor EC 602872-4 Thermal Resistance Between Conductor and Screen		0.0 0.0 0.0 0.3402	0.0 0.0 0.0 0.3402	0.0 0.0 0.0 0.3402
42 Armou 43 44 46 Normal 47 48	λ <sub>1</sub> μα                 λ <sub>2</sub>	Screen Loss Factor oss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen	[mm]	0.0 0.0 0.0 0.3402 25.8	0.0 0.0 0.3402 25.8	0.0 0.0 0.3402 25.8
42 Armout 43 44 46 Normal 47 48 49 50 51	λ1           r and Pipe I           λ23           λ2pipe           λ2           IOperation           T1           L1           PTi           T3           L3	Screen Loss Factor Oss Factor Pop Loss Factor Pop Loss Factor Pop Loss Factor Pop Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coaling Thickness of Jacket/Pipe Coaling	[mm] [K.m/W] [K.m/W] [mm]	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2
42 Armout 43 44 46 Normal 47 48 49 50 51 51 52	λ1           r and Pipe I           λ20           λ20     <	Screen Loss Factor oss Factor Armour Loss Factor Pepe Loss Factor Pepe Loss Factor Pepe Loss Factor PeC 60287-2-1 Thermal Resistance Between Conductor and Screen Themal Resistance Between Conductor and Screen Thermal Resistance Internative Insulation Thermal Resistance of Jacket/Pipe Coaling	[mm] [K.m/W] [K.m/W]	0.0 0.0 0.0 0.3402 25.8 3.5 0.04631	0.0 0.0 0.3402 25.8 3.5 0.04631	0.0 0.0 0.3402 25.8 3.5 0.04631
42 Armou 43 44 46 Normal 47 48 49 50 51 52 Cable I	λ1           and Pipe I           λ30           λspipe           λ2           Operation           T1           t1           ρTi           T3           t3           ρTJ           n Ducts	Screen Loss Factor oss Factor Armour Loss Factor Pepe Loss Factor Pepe Loss Factor Pepe Loss Factor PeC 60297-2-1 Thermal Resistance Between Conductor and Screen Themal Resistance Between Conductor and Screen Themal Resistance of Jacket/Pipe Coating Thermal Resistance of Jacket/Pipe Coating Thermal Resistance of Jacket/Pipe Coating Thermal Resistance	[mm] [K.m/W] [K.m/W] [mm]	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5
42 Armoul 43 44 46 Normal 47 48 49 50 51 52 Cable I 53	λ1           r and Pipe I           λ30           λ3pipe           λ2           Operation           T1           11           PTI           T3           15           PTJ           Ducts           U	Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Ref 0287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Lacket/Pipe Coating Thermal Resistivity of Insulation Thermal Resistivity of Jacket/Pipe Coating Themal Resistivity of Jacket/Pipe Coating Coefficient Used in EC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm]	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87
42 43 44 46 46 47 48 49 50 51 52 52 <b>Cable I</b> 53 53	λ1           r and Pipe I           λ3pipe           λ3           λ3pipe           λ3           Operation           T1           β           β           β           β           β           δ           δ           δ           β           δ           β           δ           β           δ           δ           δ           β           δ </td <td>Screen Loss Factor oss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Pipe Loss Factor Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Taulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistance of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1</td> <td>[mm] [K.m/W] [K.m/W] [mm]</td> <td>0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312</td> <td>0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 5.2 3.5 1.87 0.312</td> <td>0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312</td>	Screen Loss Factor oss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Pipe Loss Factor Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Taulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistance of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm]	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 5.2 3.5 1.87 0.312	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312
42 47 43 44 46 Normal 47 48 49 50 51 52 Cable I 53 54 55	λ1           Λad           Λapipe           Λapipe </td <td>Screen Loss Factor Screen Loss Factor Screen Loss Factor Pipe Loss Factor Pipe Loss Factor Pipe Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Pinulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistance of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in EC 60287-21 Clause 2.2.7.1 Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Coefficient Used in EC 60287-2-1 Clause 2.2.7.1</td> <td>[mm] [K.m/W] [K.m/W] [mm] [K.m/W]</td> <td>0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 0.04631 0.04631 0.04631 0.04631 0.00000000000000000000000000000000000</td> <td>0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037</td> <td>0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037</td>	Screen Loss Factor Screen Loss Factor Screen Loss Factor Pipe Loss Factor Pipe Loss Factor Pipe Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Pinulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistance of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in EC 60287-21 Clause 2.2.7.1 Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Coefficient Used in EC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm] [K.m/W]	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 0.04631 0.04631 0.04631 0.04631 0.00000000000000000000000000000000000	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037
42 43 44 46 46 47 48 49 50 51 52 52 <b>Cable I</b> 53 53	λ1           r and Pipe I           λ3pipe           λ3           λ3pipe           λ3           Operation           T1           β           β           β           β           β           δ           δ           δ           β           δ           β           δ           β           δ           δ           δ           β           δ </td <td>Screen Loss Factor oss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Pipe Loss Factor Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Taulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistance of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1</td> <td>[mm] [K.m/W] [K.m/W] [mm]</td> <td>0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312</td> <td>0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 5.2 3.5 1.87 0.312</td> <td>0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312</td>	Screen Loss Factor oss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Pipe Loss Factor Factor Armour Loss Factor + Pipe Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Taulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistance of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1	[mm] [K.m/W] [K.m/W] [mm]	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 5.2 3.5 1.87 0.312	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312
42 Armout 43 44 46 Normal 47 48 49 50 51 52 52 52 54 55 56	λ1           and Pipe I           λaa           λapipe           λa           Operation           Ts           Is           pTi           Ts           ts           pTJ           n Ducts           U           V           qmm	Screen Loss Factor Oss Factor Armour Loss Factor Pep Loss Factor Pep Loss Factor Pep Loss Factor Armour Loss Factor  Pep Loss Factor Thermal Resistance Between Conductor and Screen Thudation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thermal Resistance of Jacket/Pipe Coating Thermal Resistivity of Jacket/Pipe Coating Coefficient Used in IEC 40287.2-1 Clause 2.2.7.1 Coefficient Used in IEC 40287.2-1 Clause 2.2.7.1 Coefficient Used in IEC 40287.2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filling the Space	[mm] [K.m/W] [K.m/W] [mm] [K.m/W]	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.000000000000000000000000000000000	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 7 1.87 0.312 0.0037 55.7
42 Armout 43 44 46 Normal 47 48 49 50 51 52 Cable I 53 54 55 56 57	λ,           r and Pipe I           λsa           λspipe           λa           IOperation           T,           It,           pTi           Ts           b,           pTJ           n Ducts           U           V           Y           θm           T_*	Screen Loss Factor Oss Factor Armour Loss Factor Pepe Loss Factor Pepe Loss Factor Pepe Loss Factor Pec Co227.2-1 Thermal Resistance Between Conductor and Screen Thermal Resistance of JacketPepe Coating Coefficient Used in IEC 60287.2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filing the Space Thermal Resistance of the Medium Filing the Space	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [*C] [*C]	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 0.04631 5.2 3.5 0.04631 0.04631 0.04631 0.04631 0.04631 0.00000000000000000000000000000000000	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 57.2 0.23897	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037
42 Armoun 43 44 46 Normal 47 48 49 50 51 52 53 54 55 56 57 58	λ1           r and Pipe I           λa8           λapipe           λa           Operation           T1           It           T3           Is           pTJ           n Dets           U           V           Y           θm           T4'           Do	Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Ref Oss Factor Ref Ref Oss Factor Ref Ref Oss Factor Ref Ref Oss Factor Ref	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [*C] [K.m/W]	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 0.4631 5.2 3.5 0.4631 0.30 0.4631 5.5 9 0.24088 200.0	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 57.2	0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 55.7 0.2411 200.0
42 Armoun 43 44 46 Normal 47 48 49 50 51 52 Cable I 53 54 55 56 57 58 59	λ,           r and Pipe I           λsa           λspipe           λa           IOperation           T,           It,           pTi           Ts           b,           pTJ           n Ducts           U           V           Y           θm           T_*	Screen Loss Factor Oss Factor Armour Loss Factor Pepe Loss Factor Pepe Loss Factor Pepe Loss Factor Pec Co227.2-1 Thermal Resistance Between Conductor and Screen Thermal Resistance of JacketPepe Coating Coefficient Used in IEC 60287.2-1 Clause 2.2.7.1 Mean Temperature of the Medium Filing the Space Thermal Resistance of the Medium Filing the Space	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [*C] [*C]	0.0 0.0 0.0 25.8 0.04631 5.2 3.5 0.04631 5.2 3.5 1.87 0.312 0.037 55.9 0.24088 200.0 188.0	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 57.2 0.23897 200.0 188.0	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 55.7 0.2411 200.0 188.0
42 Armou 43 44 46 Normal 47 48 49 50 51 52 51 53 54 55 56 55 56 57 58	λ,           r and Ptype I           λ <sub>s</sub> ai           λ <sub>p</sub> pipe           λ <sub>s</sub> T,           It           pTI           T,           b,           pTI           T,           b,           pTI           T,           b,           pTJ           n Ducts           U           V           Y           0m           T_*           Do           Di           pT	Screen Loss Factor  Screen Loss Factor  Armour Loss Factor  Pipe Loss Factor  Pice Co297.2-1  Thermal Resistance Between Conductor and Screen  Thermal Resistance of Jacket/Pipe Coating  Coefficient Used in IEC 40287.2-1 Clause 2.2.7.1  Mean Temperature of the Medium Filing the Space  Thermal Resistance of the Medium Filing the Space  Thermal Resistance of the Medium Filing the Space  Thermal Resistance of the Duct/Pipe  Cuside Diameter of the Duct/Pipe  Thermal Resistivity of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] ['C] ['C] [K.m/W] [mm] [K.m/W]	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 0.4631 5.2 3.5 0.4631 0.30 0.4631 5.5 9 0.24088 200.0	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 57.2 0.23897 200.0	0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 55.7 0.2411 200.0
42 Armou 43 44 46 Normal 47 48 49 50 51 52 Cable I 53 54 55 56 57 58 59 60	λ1           r and Pipe I           λs8           λspipe           λs           Operation           Ti           It           pTJ           Dott           V           Y           0mm           Ta*           Do           Di	Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Pipe Loss Factor Pipe Loss Factor Pice Access Pipe Loss Factor Pice Access Pipe Loss Factor Pice Access Pipe Pipe Pipe Loss Factor Pice Access Pipe Pipe Pipe Pipe Pipe Pipe Pipe Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] ['C] ['C] [K.m/W] [mm] [K.m/W] [K.m/W]	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 5.9 0.24088 200.0 188.0 3.5	0.0 0.0 0.0 25.8 3.5 0.4631 5.2 3.5 1.87 0.312 0.0037 5.2 0.23897 200.0 188.0 3.5	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 55.7 0.2411 200.0 188.0 1.88.0
42 Armoul 43 44 46 Normal 47 48 49 50 51 52 Cable I 53 54 55 56 57 58 59 60 61 62	λ,           r and Ptype I           λ <sub>s</sub> ag           λ <sub>s</sub> pipe           λ <sub>s</sub> Coperation           T <sub>s</sub> Is           ρTi           T <sub>s</sub> μ           ρTJ           n Ducts           U           V           Ψ           Θm           T <sub>s</sub> *           Do           Di           ρT           T <sub>s</sub> *	Screen Loss Factor  Screen Loss Factor  Armour Loss Factor  Pipe Loss Factor  Pice Co297.2.1  Thermal Resistance Between Conductor and Screen  Thermal Resistance of Jacket/Pipe Coating  Coefficient Used in IEC 40287.2.1 Clause 2.2.7.1  Mean Temperature of the Medium Filing the Space  Thermal Resistance of the Medium Filing the Space  Thermal Resistance of the Medium Filing the Space  Thermal Resistance of the Duct/Pipe  Cuside Diameter of the Duct/Pipe  Thermal Resistivity of the Duct/Pipe	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] ['C] ['C] [K.m/W] [mm] [K.m/W]	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.037 5.5,9 0.24088 200.0 188.0 3.5 0.03447	00 00 00 03402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 57.2 0.23897 200.0 188.0 3.5 0.03447	0.0 0.0 0.0 25.8 3.5 0.46431 5.2 3.5 1.87 0.312 0.037 55.7 0.2411 200.0 188.0 3.5 0.03447
42 Armoul 43 44 46 Normal 47 48 49 50 51 52 Cable I 53 54 55 56 57 58 59 60 61 62	λ,           r and Ptype I           λ <sub>s</sub> ag           λ <sub>s</sub> pipe           λ <sub>s</sub> Coperation           T <sub>s</sub> Is           ρTi           T <sub>s</sub> μ           ρTJ           n Ducts           U           V           θm           T <sub>s</sub> *           Do           Di           ρT           T <sub>s</sub> *           T <sub>s</sub> *	Screen Loss Factor  Screen Loss Factor  Armour Loss Factor  Pipe Loss Factor  Codification  Pipe Loss Factor  Codification  Co	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] ['C] ['C] [K.m/W] [mm] [K.m/W] [K.m/W]	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.037 5.5,9 0.24088 200.0 188.0 3.5 0.03447	00 00 00 03402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 57.2 0.23897 200.0 188.0 3.5 0.03447	0.0 0.0 0.0 25.8 3.5 0.46431 5.2 3.5 1.87 0.312 0.037 55.7 0.2411 200.0 188.0 3.5 0.03447
42 Armoul 43 44 46 Normal 47 48 49 50 51 52 53 55 55 55 55 55 55 56 57 58 59 60 61 62 Cable I	λ,           r and Ptype I           λ <sub>s</sub> ag           λ <sub>s</sub> pipe           λ <sub>s</sub> Coperation           T <sub>s</sub> Is           ρTi           T <sub>s</sub> μ           ρTJ           n Ducts           U           V           θm           T <sub>s</sub> *           Do           Di           ρT           T <sub>s</sub> *           T <sub>s</sub> *	Screen Loss Factor  Screen Loss Factor  Armour Loss Factor  Pipe Loss Factor  Pipe Loss Factor  Pipe Loss Factor  Pice Co2872-2-1  Thermal Resistance Between Conductor and Screen  Insmall Resistance of Installation  Thermal Resistance of Loss Factor  Coefficient Used in EC 60287-2-1 Clause 2.2.7.1  Coefficient Used In EC 60287-2-1  Coefficient Used In	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	00 00 00 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0007 55.9 0.24068 2000 188.0 3.5 0.03447 0.501	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 57.2 0.23897 200.0 188.0 3.5 0.03447 0.501	0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 55.7 0.2411 200.0 188.0 3.5 0.03447 0.0301
42 Armoul 43 44 46 Normal 47 48 50 51 52 Cable I 53 54 55 55 56 57 58 59 60 61 62 Cable I 63	λ,           and Pipe           λaa           Λappe           λ           Operation           T,           b           pTi           Ts           b           pTi           To           Dotestion           V           Y           Bm           Ts'           Do           Di           Di           pT           Ts'           Do           Ts'           Do           Ts'           Do           Di           pT           Ts'           Do           Di           pT           Ts''	Screen Loss Factor Ocss Factor Armour Loss Factor Pope Loss Factor Pope Loss Factor Rec 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coaling Thickness of Jacket/Pipe Coaling Thermal Resistance of Jacket/Pipe Coaling Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used IIEC 60287-2.1 Coeffi	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.037 5.2 0.24088 200.0 188.0 3.5 0.24088 200.0 188.0 3.5 0.03447 0.501	0.0 0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.037 5.7 2.0 0.312 0.037 5.7 2.0 0.23897 200.0 188.0 3.5 0.03447 0.501	0.0 0.0 0.3402 258 3.5 0.04631 5.2 3.5 1.87 5.7 0.312 0.0037 5.7 0.2411 200.0 1.830 0.3447 0.501 0.504 0.504 0.504 0.504 0.504 0.504 0.504 0.504 0.504 0.504 0.504 0.50 0.504 0.50
42 Armout 43 44 46 77 48 47 50 51 52 Cable I 53 55 55 55 55 56 57 58 59 60 61 62 Cable I 63 64	λ           and Pipe 1           Asa           Asa           Appin           Ar           Operation           Tr           ti           pTI           Tr           Duration           OU           V           Y           Generation           Do           DO           Tr           Do           Dir           Tr           na           Ducts           X           Y	Screen Loss Factor  Screen Loss Factor  Armour Loss Factor  Pipe Loss Factor  Conflictent Used in EC 40287-21  Conflictent  Confli	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	00 00 00 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.312 0.312 0.312 0.24088 200.0 188.0 3.5 0.24088 200.0 188.0 3.5 0.24088 200.0 188.0 3.5 0.24088 200.0 189.0 199.0 1	00 00 00 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.312 0.312 0.23897 200.0 188.0 3.5 0.23897 200.0 188.0 3.5 0.23897 200.0 188.0 3.5 0.23897 200.0 188.0 3.5 0.23897 200.0 188.0 3.5 0.23897 200.0 188.0 3.5 0.23897 200.0 188.0 189.0 189.0 189.0 189.0 189.0 199.0 1	0.0 0.0 0.34022 25.8 3.5 0.04631 5.2 0.3557 1.877 0.24111 200.0 1.820 0.03477 0.501 0.501 0.594 7.0
42 Armoul 43 44 46 47 48 49 50 51 52 Cable I 53 54 55 56 57 58 59 60 61 62 Cable I 63 64 65	λ           rand Pipe 1         λai           λajapo         λai           pTi         bi           pTi         bi           pTi         Do           Di         Di           pTi         Tai           pTi         Tai           pTi         Tai           pTi         Tai           pTi         Tai           pTi         Tai	Screen Loss Factor Ocss Factor Armour Loss Factor Pope Loss Factor Pope Loss Factor Rec 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coaling Thickness of Jacket/Pipe Coaling Thermal Resistance of Jacket/Pipe Coaling Coefficient Used in IEC 60287-2-1 Clause 2.2.7.1 Coefficient Used IIEC 60287-2.1 Coeffi	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	00 00 00 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0007 55.9 0.24088 200.0 188.0 3.5 0.0447 0.594 7.0 1.26566	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0037 57.2 0.20897 200.0 188.0 3.5 0.03447 0.501 0.504 7.0 1.26566	0.0 0.0 0.3402 2.5.8 3.5 0.04631 3.5 0.04631 3.5 0.04631 0.312 0.0037 55.7 0.312 0.0037 55.7 0.2411 2000 0.35 0.3447 4.7 0.501 0.504 1.26566 0.504 1.26566 1.26564 1.26566 1.26564 1.26566 1.26564 1.26566 1.265644 1.26564 1.26564 1.265644 1.26564 1.2656444 1.2656444 1.2656444 1.2656444 1.265644444444444444444444444444444444444
42 43 44 46 47 47 48 49 50 51 52 53 53 54 55 55 55 55 55 55 55 57 58 59 60 61 62 63 64 63 64 65 66	λ           rand Pipe 1           λaa           β	Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Pipe Loss Factor Pipe Loss Factor Pipe Loss Factor Pice Co2872-2-1 Thermal Resistance Between Conductor and Screen Pinulation Thickness Between Conductor and Screen Thermal Resistance of Installation Thermal Resistance of LasteetPipe Coating Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Mean Temperature of the Medium Fiside the Duct/Pipe Codside Diameter of the Duct/Pipe Thermal Resistance of the Surrounding Medium Thermal Resistance of the Surrounding Medium Thermal Resistance of the Surrounding Medium ConfordSectIII Installation Shorter Side of the Duct Bark/Backfill Longer Side of the Duct Bark/Backfill Depth of Laying to the Centre of Duct Bark/Backfill Depth of Laying to the Centre of Duct Bark/Backfill	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	00 00 00 00 25.8 3.5 0.04631 3.5 0.04631 3.5 0.04631 3.5 0.04631 55.9 0.24068 200.0 188.0 3.5 0.24068 200.0 188.0 3.5 0.024068 200.0 188.0 3.5 0.02407 2.5,0 1.2056 1.2256 1.25566 1.25566 1.25566 1.25566 1.25566 1.25566 1.25566 1.2556	00 00 00 03402 25.8 3.5 0.04631 5.2 3.5 7 1.87 0.312 0.0312 57.2 0.23897 200.0 188.0 3.5 0.23897 200.0 188.0 3.5 0.03447 0.501 0.594 7.0 1.26566	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
42 43 44 46 47 47 48 49 50 51 52 53 54 55 55 55 55 56 57 58 59 60 61 62 64 64 65 66 67	λ           and Pipe 1           λa3           λayapo           λ           Tr           h           pTim           tr	Screen Loss Factor Oss Factor Armour Loss Factor Pope Loss Factor Pope Loss Factor Factor Armour Loss Factor Pope Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Internal Resistance of LockUP/pipe Coating Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Coefficient Used in EC 60287-2-1 Clause 2.2.7.3 Coefficient U	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.037 5.2 0.24088 200.0 188.0 3.5 0.24088 200.0 188.0 3.5 0.03447 0.501	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	00 00 00 00 258 35 004631 557 557 557 557 557 557 557 557 557 55
42 Armount 43 44 46 47 48 47 48 49 50 51 52 53 54 55 55 55 57 58 59 60 61 62 63 64 65 66 67	λ           and Pipe 1           λa3           λayapo           λ           Tr           h           pTim           tr	Screen Loss Factor Oss Factor Armour Loss Factor Pope Loss Factor Pope Loss Factor Factor Armour Loss Factor Pope Loss Factor EC 60287-2-1 Thermal Resistance Between Conductor and Screen Insulation Thickness Between Conductor and Screen Insulation Internal Resistance of LockUP/pipe Coating Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Coefficient Used in EC 60287-2-1 Clause 2.2.7.3 Coefficient U	[mm] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W] [K.m/W]	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.037 5.2 0.24088 200.0 188.0 3.5 0.24088 200.0 188.0 3.5 0.03447 0.501	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0,0 0,0 0,0 0,0 0,0 0,0 0,0 0,0 0,0 0,0
42 43 44 46 Vormal 47 48 49 50 51 52 Cable I 53 54 55 56 57 58 59 60 61 62 Cable I 63 64 65 66 67 68	λ           and Pipe 1           λsa           λagapo           λ           γ           γ           φT           τ           τ           σ           γ           ψ           V           V           V           Φ           σ	Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Pice Accord Pipe Loss Factor EC 40287-2-1 Thermal Resistance Between Conductor and Screen Instaltion Thickness Between Conductor and Screen Internal Resistance of JacketPipe Coating Thermal Resistance of JacketPipe Coating Thermal Resistance of JacketPipe Coating Coefficient Used in EC 60287-2-1 Clause 2.2.7.1 Coefficient Used In Duct Bark/Backfil Longer Side of the Duct Bark/Backfil Dopt of Laying In the Centre of Duct Bark/Backfil Coefficient Used In EC 60287-2-1 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bark/Backfil	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.037 55.9 0.24088 200.0 188.0 35.5 0.03447 0.501 0.501 0.594 7.0 1.26564 1.073 0.84778 3.0	00 00 00 03402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.0347 200.0 188.0 3.5 0.03447 0.031 2000 126564 7.0 126564 1.073 0.84778 3.0	0,0 0,0 0,0 0,0 0,0 0,0 0,0 0,0 0,0 0,0
42 Armou 43 44 46 Normal 47 48 49 50 51 52 Cable I 53 54 55 56 57 58 56 60 61 62 Cable I 63 64 65 66 67 68 69	λ.           rand Pipe 1 I           λ.an           λ.pipe           λ.an           λ.pipe           λ.an           λ.pipe           λ.an           λ.pipe           λ.an           λ.pipe           λ.an           λ.an           λ.pipe           λ.an           λ.pipe           μ      μ           μ <tr< td=""><td>Screen Loss Factor  Screen Loss Factor  Armour Loss Factor  Pipe Loss Factor  EC 60287.2-1  Thermal Resistance Between Conductor and Screen  Thermal Resistance of Jacket/Pipe Coaling  Thermal Resistance of Jacket/Pipe Coaling  Thermal Resistance of Loss Factor  Coefficient Used in EC 60287.2-1 Clause 2.2.7.1  Coefficient Used in EC 60287.2-1 Clause 2.2.7.3  Number of Loaded Cables in the Duct Bark/Backfill  Chermal Resistance of Duct Bark/Backfill  Coefficient Used in EC 60287.2-1 Clause 2.2.7.3  Number of Loaded Cables in the Duct Bark/Backfill  Thermal Resistance of Duct Bark/Backfill  Coefficient Used in EC 60287.2-1 Clause 2.2.7.3  Coefficient Used In</td><td>[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [C.] [C] [C] [C] [C] [C] [C] [C] [C] [C] [C</td><td>0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.037 5.2 0.24088 200.0 188.0 3.5 0.24088 200.0 188.0 3.5 0.03447 0.501 0.03447 0.501</td><td>0.0 0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.037 5.2 0.23897 200.0 188.0 3.5 0.23897 200.0 188.0 3.5 0.03447 0.501 0.594 7.0 1.26566 3.0 0.594 1.2</td><td>0,0 0,0 0,0 0,0 0,0 0,0 0,0 0,0 0,0 0,0</td></tr<>	Screen Loss Factor  Screen Loss Factor  Armour Loss Factor  Pipe Loss Factor  EC 60287.2-1  Thermal Resistance Between Conductor and Screen  Thermal Resistance of Jacket/Pipe Coaling  Thermal Resistance of Jacket/Pipe Coaling  Thermal Resistance of Loss Factor  Coefficient Used in EC 60287.2-1 Clause 2.2.7.1  Coefficient Used in EC 60287.2-1 Clause 2.2.7.3  Number of Loaded Cables in the Duct Bark/Backfill  Chermal Resistance of Duct Bark/Backfill  Coefficient Used in EC 60287.2-1 Clause 2.2.7.3  Number of Loaded Cables in the Duct Bark/Backfill  Thermal Resistance of Duct Bark/Backfill  Coefficient Used in EC 60287.2-1 Clause 2.2.7.3  Coefficient Used In	[mm] [K.m/W] [K.m/W] [mm] [K.m/W] [C.] [C] [C] [C] [C] [C] [C] [C] [C] [C] [C	0.0 0.0 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.037 5.2 0.24088 200.0 188.0 3.5 0.24088 200.0 188.0 3.5 0.03447 0.501 0.03447 0.501	0.0 0.0 0.0 0.0 25.8 3.5 0.04631 5.2 3.5 1.87 0.312 0.037 5.2 0.23897 200.0 188.0 3.5 0.23897 200.0 188.0 3.5 0.03447 0.501 0.594 7.0 1.26566 3.0 0.594 1.2	0,0 0,0 0,0 0,0 0,0 0,0 0,0 0,0 0,0 0,0
42 Armou 43 44 46 Normal 47 48 49 50 51 52 Cable I 53 54 55 56 57 58 56 60 61 62 60 61 62 64 65 66 67 68 69 70	λ           rand Pipe 1           λag           β           β           β           γ	Screen Loss Factor Oss Factor Armour Loss Factor Pep Loss Factor Pep Loss Factor Pep Loss Factor Pep Loss Factor Pet Co2972-0  Thermal Resistance Between Conductor and Screen Permal Resistance of Loss Factor Permal Resistance of Loss Factor Coefficient Used in EC 40287-2:1 Clause 2.2.7.1  Coefficient Used in EC 40287-2:1 Clause 2.2.7.3  Number of Loaded Clabis in the Duct Bark/Backfill  Coefficient Used In EC 40287-2:1 Clause 2.7.3  Number of Loaded Clabis in the Duct Bark/Backfill  Thermal Resistivity of tarth Around the Duct Bark/Backfill  Thermal Resistivity of tarth Around the Duct Bark/Backfill  Thermal Resistivity of tarth Around the Duct Bark/Backfill	[mm] [K-mW] [K-mW] [mm] [K-mW] [K-mW] [mm] [mm] [mm] [mm] [mm] [mm] [mm] [mm] [mm] [mm] [K-mW]	00 00 00 00 25.8 35 52 35 1.87 0.312 0.00631 55.9 0.24088 200.0 188.0 35 0.024088 200.0 188.0 35 0.024088 200.0 188.0 35 0.024478 0.501 0.501 2.5566 1.073 0.84778 3.0 0.501 2.5566 1.073 2.0.501 2.5566 1.073 2.0.501 2.5566 1.073 2.0.501 2.5566 1.073 2.0.501 2.5566 1.073 2.0.501 2.5566 1.073 2.0.501 2.5566 1.073 2.0.501 2.5566 1.073 2.0.501 2.5566 1.073 2.0.501 2.5566 1.073 2.0.501 2.5566 1.073 2.0.501 2.5566 2.0.501 2.5566 1.073 2.0.501 2.5566 1.073 2.0.501 2.5566 1.073 2.0.501 2.5566 1.073 2.0.501 2.5566 1.073 2.0.501 2.5566 1.073 2.0.501 2.556 2.001 2.5577 2.557 2.5577 2.5577 2.5577 2.55777 2.557777777777	00 00 0.0 0.3402 25.8 3.5 0.04631 5.2 3.5 1.87 0.33 5.2 3.5 1.87 0.33 5.2 0.0037 57.2 0.0037 57.2 0.23897 200.0 188.0 0.35 0.0347 0.501 1.26566 1.073 0.04478 3.0 0 1.2 1.0	00 00 03402 258 35 52 35 52 35 52 35 52 35 52 0342 557 0312 557 0312 557 0312 557 0312 557 0312 0000 380 0347 4 0501 4 0501 4 000 00 00 00 00 00 00 00 00 00 00 00
42 Armou 43 44 46 Normal 47 48 49 50 51 52 2able 1 53 54 55 55 55 55 55 57 58 59 60 61 62 2able 1 63 64 65 64 65 65 67 68 69 70 71	λ           Asa           Asa           Appo           Asa           Appo           Tr           b           pTI           Tr           b           pTJ           D           V           V           V           O           D           D           Di           Tr'           B           DO           Di           Tr'           Tr'           Tr'           Tr'           Tr'           Do           Di           Di           Tr'           Tr'           Y           B           A           Y           B           LG           u           N           pe           pc           Tr'	Screen Loss Factor Oss Factor Armour Loss Factor Pipe Loss Factor Pice Available Construction and Screen Pisulation Thickness Between Conductor and Screen Pisulation Thickness Between Conductor and Screen Pisulation Thickness Between Conductor and Screen Thermal Resistance of Jacket/Pipe Coating Thickness of Jacket/Pipe Coating Thermal Resistence of Jacket/Pipe Coating Coefficient Used in EC 60287-21 Clause 2.2.7.1 Piseta Temparature of the Medum Fisitig the Space Thermal Resistance of the Surcu/Pipe Thermal Resistance of the Surcu/Pipe Thermal Resistance of the Duct/Pipe Dept of Larying to the Carter of Duct Bark/Backfill Coefficient Used in EC 60287-21 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bark/Backfill Coefficient Used in EC 60287-21 Clause 2.2.7.3 Number of Loaded Cables in the Duct Bark/Backfill Thermal Resistivity of the Duct/Bark/Backfill Thermal Resistivity of the Duct/Bark/Backfill Thermal Resistivity of Hen Duct Bark/Backfill	[mm] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW] [K.mW]	00 00 00 00 258 35 004631 52 35 1.87 0.312 0.037 55.9 0.24088 200.0 188.0 35 0.03447 0.501 0.594 7.0 1.26564 1.073 0.84778 3.0 0.24078 3.0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	00 00 03402 25.8 35 52 35 52 35 52 35 52 35 52 35 52 0342 1.87 0.312 2000 0.312 2000 0.342 80 0.3417 80 0000000000000000000000000000000000