

APPENDIX F TRENCHLESS CROSSINGS AMPACITY MEMO

Memorandum



Date: 11/05/2024

To: Corey Anderson

From: Gustavo Contreras

Subject: Dominion Golden to Mars - 230kV and 500-kV Underground Cable Preliminary Ampacity Study – Trenchless Crossings

In support of the 230-kV and 500-kV Dominion (DEV) Golden to Mars UG Transmission Line project, Burns & McDonnell Engineering Company, Inc. (BMcD) has performed preliminary ampacity calculations to identify the underground conductor size, and the number of cables-per-phase (CPP) needed to meet the target circuit loading requirements. In a previous study, it was determined that for open-cut installation of both 230-kV and 500-kV circuits in the same right of way (ROW), a five (5) CPP configuration was required to meet the ampacity ratings for the 500-kV circuit, within a single duct bank, and a four (4) CPP configuration was required for the 230-kV circuit, within a single duct bank. Dominion has requested BMcD additional ampacity calculations to evaluate the minimum ROW required considering both circuits in the same ROW for trenchless installations of four (4) new routes provided by Dominion.

The trenchless installations considered correspond to three (3) alternatives: Jack & Bore (J&B), Microtunneling, and Horizontal directional Drilling (HDD). J&B and Microtunneling are analyzed with two (2) maximum probable bore depths that are assumed to cover all the J&B and Microtunneling crossings in these new routes; 40 feet and 30 feet. HDD is considered as an alternative to Microtunneling at Horsepen Pond and WMATA Dulles Railway crossing on Loudoun Water Sewer route and is analyzed with 45 feet maximum probable depth of cover. These trenchless installations are investigated with the same number of CPP for open-cut installation from the previous study to determine the minimum trenchless ROW required to meet cable ratings. This is accomplished by running the cables to their maximum operating temperature of 90°C at different bore depths and adjusting the bores center-to-center separation. The following writeup summarizes the results for these installations.

Ampacity calculations were computed using the CYMCAP ampacity program by CYME. The CYMCAP software utilizes the Neher-McGrath method of calculating the achievable ampacities of underground cables and conforms to IEC standards 60287 and 60853. This software is accepted as the industry standard for performing ampacity calculations for underground electrical systems. The individual CYMCAP execution reports and an ampacity table for all calculations included as part of this Memo can be seen in Appendix A.

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DESIGN PARAMETERS AND INSTALLATION CONDITIONS

The parameters for these ampacity calculations are based on engineering judgment and the design criteria established for this project in Sections 3.1 and 3.2 of Dominion Golden to Mars – 230-kV and 500-kV Underground Feasibility Report, Revision 4 dated 09/10/2024. The design parameters used for the 230-kV and 500-kV circuits can be seen below in Table 1 and Table 2, respectively. Since these circuits' purpose is to feed data centers, a single daily load factor (DLF) equal to 1.0 was used hereinafter. The underground cable systems operating environment can be seen below in Table 3.

Table 1 230-kV Design Parameters

Design Parameter	Parameter Value	Source
Nominal Operating Voltage	230-kV	Dominion
Nominal Frequency	60 Hz	Industry Standard
Circuit Rating	3,950 A	Dominion
Maximum Normal Conductor Temperature	90°C	Industry Standard
Maximum Emergency Conductor Temperature	105°C	Industry Standard
Daily Load Factor (DLF)	100 %	Dominion
Sheath Bonding	Single Point	Assumed

Table 2 500-kV Design Parameters

Design Parameter	Parameter Value	Source
Nominal Operating Voltage	500-kV	Dominion
Nominal Frequency	60 Hz	Industry Standard
Circuit Rating	5,000 A	Dominion
Maximum Normal Conductor Temperature	90°C	Industry Standard
Maximum Emergency Conductor Temperature	105°C	Industry Standard
Daily Load Factor (DLF)	100 %	Dominion
Sheath Bonding	Single Point	Assumed

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Table 3 Environmental Criteria

Description	Value	Source
Summer Ambient Earth Temperature (20' <= d)	12°C	Assumed
Native Soil Thermal Resistivity*	115°C-cm/W - 100% DLF	Assumed
Grout Thermal Resistivity	80°C-cm/W	Assumed
Minimum Burial Depth to Top of Bore	10 feet	Assumed
Installation Conditions	Bore Casign	BMcD Preliminary Study

*Actual native soil thermal resistivity is unknown. This value is being assumed equal to the one used for DLF=1.0 in Dominion Golden to Mars – 230-kV and 500-kV Underground Feasibility Report, Revision 4 dated 09/10/2024. When data from filed investigations are available this value may need to be revised and analysis results in this memo may change.

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THERMAL PINCH POINT IDENTIFICATION AND NEW INSTALLATION SCENARIOS

A previous study found that the 230-kV circuit would need four (4) cables per phase and 500-kV would need five (5) cables per phase to meet rating requirements for both circuits in the same ROW with open-cut installation. The new routes provided by DEV are assumed to be covered by those previous analysis for the open-cut segments. Following the request from DEV for additional calculations for trenchless crossings of those new routes, to determine the minimum 230-kV bores center-to-center spacing and minimum 500-kV bores center-to-center spacing in the same ROW able to satisfy the required load defined in Table 1 and Table 2, a series of parametric studies were performed for three (3) different installation cases iterating the spacing between bores until the minimum ratings were met or slightly exceeded with cables at 90°C operating temperature. The following sections detail the installation scenarios for each case.

CASE 1 INSTALLATION SCENARIOS – MICROTUNNELING AND J&B AT 40 FEET MAXIMUM DEPTH

As part of the new study request, in this Case 1, both 230-kV and 500-kV circuits are set in the same trenchless ROW, then the bore is modeled at 40 feet maximum depth to calculate the minimum ROW required to meet cable ampacities.

Below are the installation scenarios that were modeled as part of this Case 1 study:

1. Each 230-kV and 500-kV CPP is set in a single bore, that is:
 - a. Four (4) 230-kV bores and five (5) 500-kV bores in the same ROW, nine (9) bores in total.
 - i. Each bore will have a 36" HOBAS casing, with three (3) cables conduits and one (1) spare conduit. See Figure 1 for bore cross section.
2. Two (2) 230-kV CPP are set in the same bore, and each 500-kV CPP is set in a single bore, that is:
 - a. Two (2) 230-kV bores and five (5) 500-kV bores in the same ROW, seven (7) bores in total.
 - i. Each 230-kV bore will have a 48" HOBAS casing, with six (6) cables conduits and two (2) spare conduits. See Figure 2 for bore cross section.
 - ii. Each 500-kV bore will have a 36" HOBAS casing, with three (3) cables conduits and one (1) spare conduit. See Figure 1 for bore cross section.

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Figure 1 Preliminary 230-kV and 500-kV Single Phase XLPE Microtunneling and J&B Cross Section (Section A) Not to Scale (NTS)

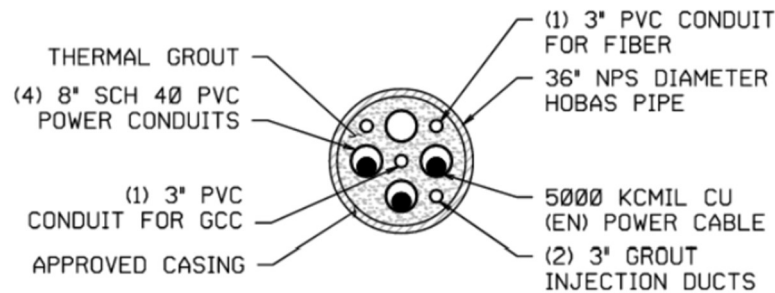
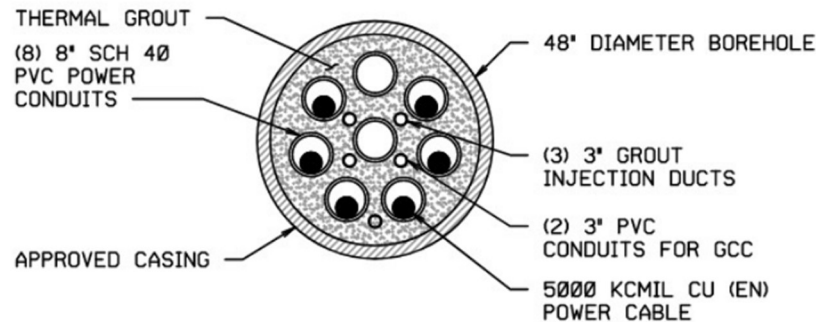


Figure 2 Preliminary 230-kV Double Phase XLPE Microtunneling and J&B Cross Section (Section B) NTS



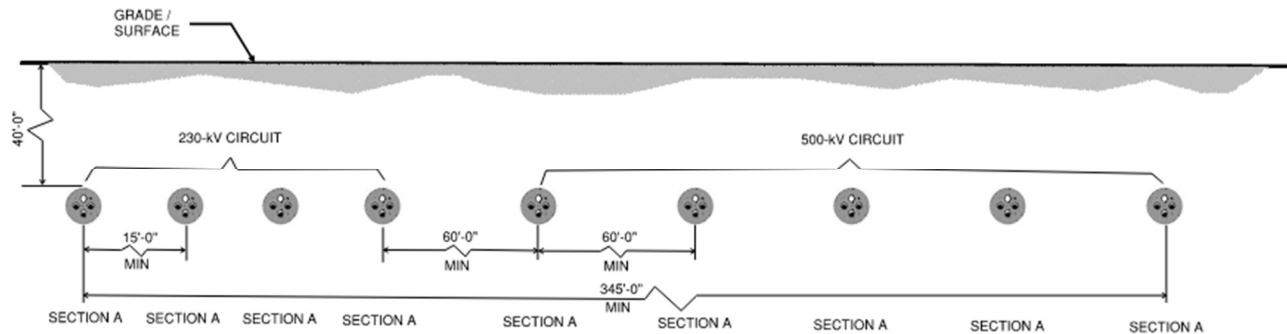
Case 1: Four (4) 230-kV 36" Bores and Five (5) 500-kV 36" Bores - Nine (9) Bores at 40 Feet Depth in the Same ROW

The parametric study detailed in H execution series, showed that 230-kV and 500-kV circuits meet the minimum ampacity requirements with a bore center-to-center separation of 15 feet between 230-kV 36" bores, 60 feet between 230-kV 36" and 500-kV 36" bores, and 60 feet between 500-kV 36" bores, for a total minimum ROW required of 375 feet, including 15 feet at each end assumed for work space and steering tolerances, for all nine (9) bores to be installed in the same ROW. The convergence case, detailed in execution H105, indicates that ampacities achieved are 3,972A for 230-kV circuit and 5,140A for 500-kV with 375 feet ROW. Figure 3 below shows the Microtunneling and J&B configuration for this case.

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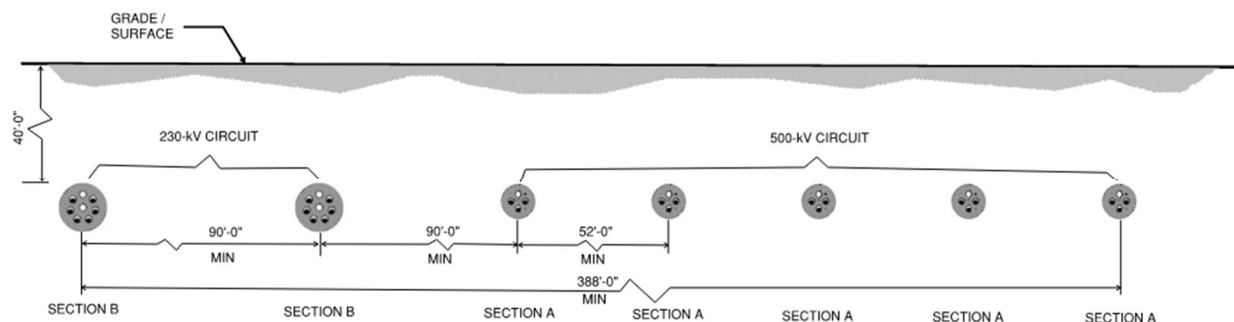
Figure 3 Preliminary Microtunneling and J&B Configuration for Nine 36" Bores - 230-kV and 500-kV Circuits in the Same ROW at 40 Feet Depth NTS



Case 1: Two (2) 230-kV 48" Bores and Five (5) 500-kV 36" Bores - Nine (9) Bores at 40 Feet Depth in the Same ROW

The parametric study detailed in G execution series, showed that 230-kV and 500-kV circuits meet the minimum ampacity requirements with a bore center-to-center separation of 90 feet between 230-kV 48" bores, 90 feet between 230-kV 48" and 500-kV 36" bores, and 52 feet between 500-kV 36" bores, for a total minimum ROW required of 418 feet, including 15 feet at each end assumed for work space and steering tolerances, for all nine (9) bores to be installed in the same ROW. The convergence case, detailed in execution G104, indicates that ampacities achieved are 3,974A for 230-kV circuit and 5,084A for 500-kV with 418 feet ROW. Figure 4 below shows the Microtunneling and J&B configuration for this case.

Figure 4 Microtunneling and J&B Configuration for Two 48" Bores and Five 36" Bores - 230-kV and 500-kV Circuits in the Same ROW at 40 Feet Depth NTS



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CASE 2 INSTALLATION SCENARIOS – MICROTUNNELING AND J&B AT 30 FEET MAXIMUM DEPTH

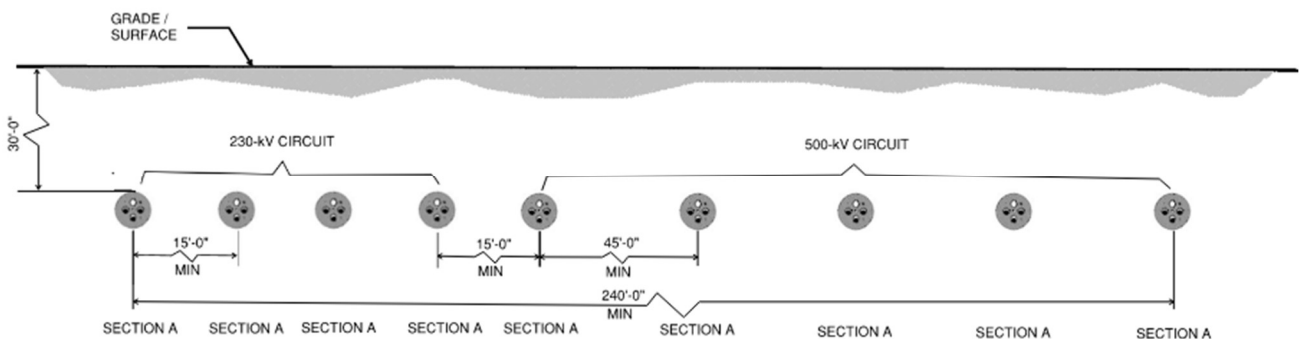
Similar to Case 1, both 230-kV and 500-kV circuits are set in the same trenchless ROW, then the bore is modeled at 30 feet maximum depth to calculate the minimum ROW required to meet cable ampacities.

The installation scenarios that were modeled as part of this Case 2 study are similar to the ones detailed in Case 1, but the assumed maximum depth is changed to 30 feet of cover.

Case 2: Four (4) 230-kV 36" Bores and Five (5) 500-kV 36" Bores - Nine (9) Bores at 30 Feet Depth in the Same ROW

The parametric study detailed in J execution series, showed that 230-kV and 500-kV circuits meet the minimum ampacity requirements with a bore center-to-center separation of 15 feet between 230-kV 36" bores, 15 feet between 230-kV 36" and 500-kV 36" bores, and 45 feet between 500-kV 36" bores, for a total minimum ROW required of 270 feet, including 15 feet at each end assumed for work space and steering tolerances, for all nine (9) bores to be installed in the same ROW. The convergence case, detailed in execution J103, indicates that ampacities achieved are 4,047A for 230-kV circuit and 5,043A for 500-kV with 270 feet ROW. Figure 5 below shows the Microtunneling and J&B configuration for this case.

Figure 5 Microtunneling and J&B Configuration for Nine 36" Bores - 230-kV and 500-kV Circuits in the Same ROW at 30 Feet Depth NTS



Case 2: Two (2) 230-kV 48" Bores and Five (5) 500-kV 36" Bores - Nine (9) Bores at 30 Feet Depth in the Same ROW

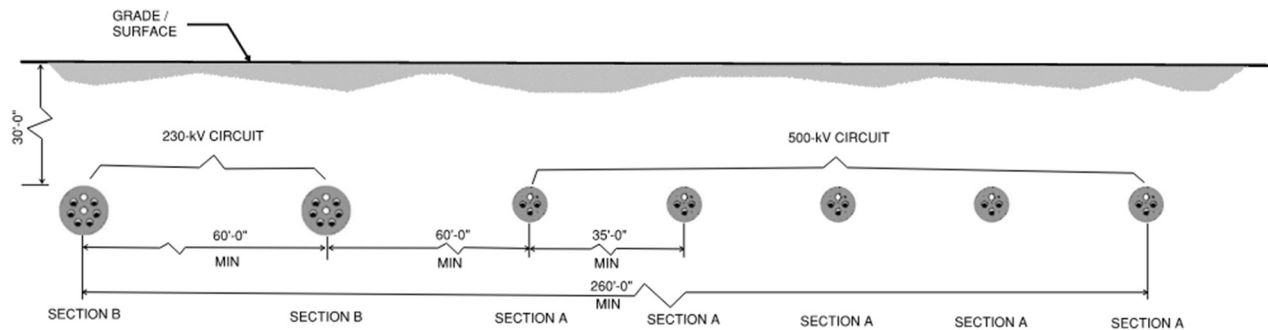
The parametric study detailed in I execution series, showed that 230-kV and 500-kV circuits meet the minimum ampacity requirements with a bore center-to-center separation of 60 feet between 230-kV 48" bores, 60 feet between 230-kV 48" and 500-kV 36" bores, and 35 feet between 500-kV 36" bores, for a total minimum ROW required of 290 feet, including 15 feet at each end assumed for work space and steering tolerances, for all nine (9) bores to be installed in

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the same ROW. The convergence case, detailed in execution I103, indicates that ampacities achieved are 4,016A for 230-kV circuit and 5,043A for 500-kV with 290 feet ROW. Figure 6 below shows the Microtunneling and J&B configuration for this case.

Figure 6 Microtunneling and J&B Configuration for Two 48" Bores and Five 36" Bores - 230-kV and 500-kV Circuits in the Same ROW at 30 Feet Depth NTS



CASE 3 INSTALLATION SCENARIO – HDD AT 45 FEET MAXIMUM DEPTH

In this Case 3, both 230-kV and 500-kV circuits are set in the same trenchless ROW, then the bore is modeled at 45 feet maximum depth to calculate the minimum HDD ROW required to meet cable ampacities.

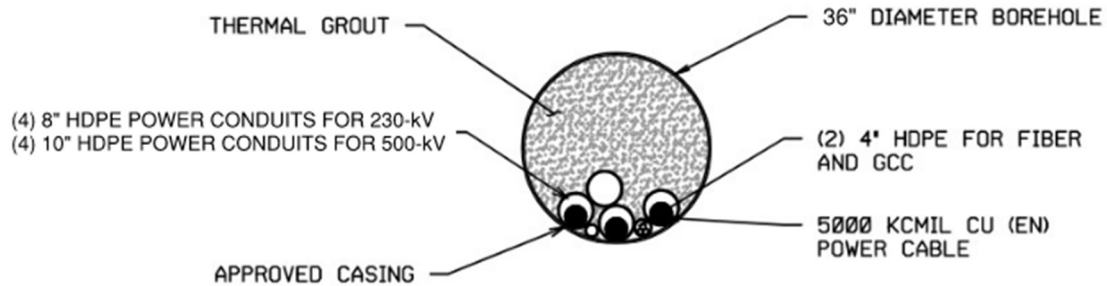
Since Case 1 and Case 2 showed that trenchless installation scenarios with double phase bores yielded larger ROW, for Case 3 the only installation scenario considered corresponds to single phase bores as indicated below:

1. Each 230-kV and 500-kV CPP is set in a single bore, that is:
 - a. Four (4) 230-kV bores and five (5) 500-kV bores in the same ROW, nine (9) bores in total.
 - i. Each bore will have a 36" HDPE DR 13.5 casing, with three (3) cables conduits and one (1) spare conduit. See Figure 7 for bore cross section.

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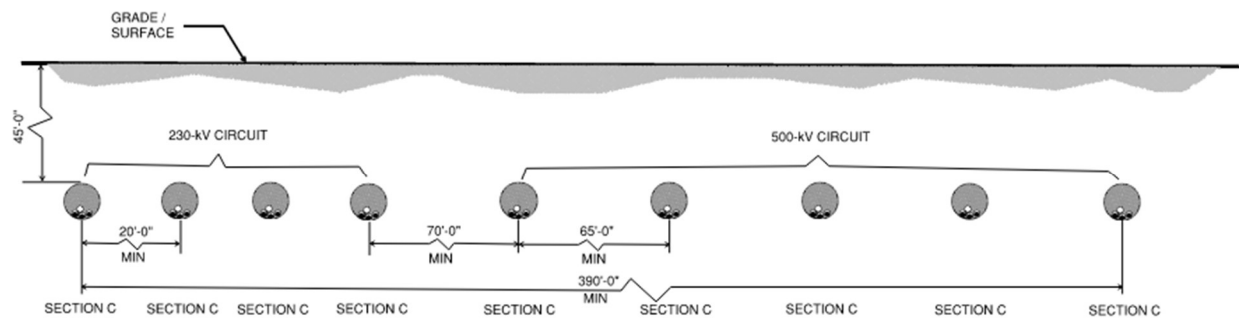
Figure 7 Preliminary 230-kV and 500-kV Single Phase XLPE HDD Cross Section (Section C) NTS



Case 3: Four (4) 230-kV 36" Bores and Five (5) 500-kV 36" Bores - Nine (9) Bores at 45 Feet Depth in the Same ROW

The parametric study detailed in K execution series, showed that 230-kV and 500-kV circuits meet the minimum ampacity requirements with a bore center-to-center separation of 20 feet between 230-kV 36" bores, 70 feet between 230-kV 36" and 500-kV 36" bores, and 65 feet between 500-kV 36" bores, for a total minimum ROW required of 420 feet, including 15 feet at each end assumed for work space and steering tolerances, for all nine (9) bores to be installed in the same ROW. The convergence case, detailed in execution K104, indicates that ampacities achieved are 4,061A for 230-kV circuit and 5,006A for 500-kV with 420 feet ROW. Figure 8 below shows the HDD configuration for this case.

Figure 8 HDD Configuration for Nine 36" Bores - 230-kV and 500-kV Circuits in the Same ROW at 45 Feet Depth NTS



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SUMMARY OF RESULTS

The following summarizes the results of the additional ampacity case studies for the 230-kV and 500-kV cable systems when operating under the design parameters and installation conditions outlined in this memo.

For Case 1 and Case 2, microtunneling and J&B Installations at 40 feet and 30 feet maximum depths, respectively, the trenchless installations analyzed yielded consistently to a larger ROW for the case of two (2) 48" bores and five (5) 36" bores in the same corridor, when compared with nine (9) 36" bores configuration. Therefore, at 40 feet maximum installation depth, the minimum ROW achieved in the parametric study was 375 feet, corresponding to (9) 36" single phase bores for the parallel 230-kV and 500-kV cable systems arriving to 3,972A and 5,140A, respectively, meeting the required target ratings of 3,950A for 230-kV and 5,000A for 500-kV. Likewise, at 30 feet maximum installation depth, the (9) 36" single phase bores configuration produced the minimum ROW equal to 270 feet, arriving to 4,047A and 5,043A for 230-kV and 500-kV cable systems in parallel, respectively. These values meet the target ratings.

Case 3 – HDD Installation at 45 Feet Maximum Depth

The parametric analysis performed arrived to a minimum ROW equal to 420 for (9) 36" single phase bores in this HDD installation, where the parallel 230-kV and 500-kV cable systems are in the same corridor, yielding to 4,061A and 5,006A, respectively, satisfying the target ratings.

For ampacity calculation summary table and detailed results of all executions refer to Appendix A. See Appendix B for UG cable cut sheets used for this ampacity analysis.

Sincerely,

Gustavo Contreras
Underground Transmission Lead Engineer, BMcD

Appendix A: Ampacity Execution Reports
Appendix B: UG Cable Cutsheets

APPENDIX A AMPACITY SUMMARY TABLE AND EXECUTION REPORTS



Study Summary

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	G100-230_500kV_40_DOC_60_5000kcmilInCu_@3772_5169A DLF1
Date:	11/3/2024 11:40:46 PM

General Simulation Data

Steady State Option	Unequally 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

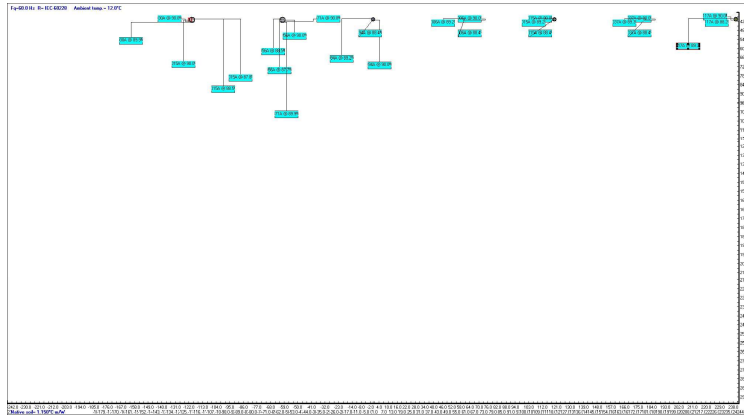
Standard Settings Options

General guidance	Custom
Factor on RAC due to magnetic armour	CIGREGuidance
Factor on RAC due to magnetic duct	CIGREGuidance
Factor on λ_1 due to magnetic armour	CYMCAPGuidance
Factor on λ_1 due to magnetic duct	CIGREGuidance
Factor on λ_2 due to λ_1	CYMCAPGuidance
λ''_1 computation	CIGREGuidance
λ_2 pipe computation	CYMCAPGuidance
Wd computation	CIGREGuidance
T_2 computation	CIGREGuidance
T_4 computation	CYMCAPGuidance

Installation Type:Multiple Ductbanks/Backfills

Ambient Soil Temperature at Installation Depth	[°C]	12.0
Native Soil Thermal Resistivity	[K.m/W]	1.15
Consider Non-Isothermal Earth Surface		No

Layer Name	X [ft]	Y [ft]	Width [ft]	Height [ft]	Thermal Resistivity [K.m/W]
NSTD DB1	-60.0	41.933	3.517	3.517	0.8
NSTD DB2	0.0	41.429	2.6	2.6	0.8
NSTD DB3	-120.0	41.933	3.517	3.517	0.8
NSTD DB4	60.0	41.429	2.6	2.6	0.8
NSTD DB5	120.0	41.429	2.6	2.6	0.8
NSTD DB6	180.001	41.429	2.6	2.6	0.8
NSTD DB7	240.001	41.429	2.6	2.6	0.8



Results Summary

Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [ft]	Y coordinate [ft]	Conductor temperature [°C]	Ampacity [A]
1	230C5.00X1	1		A	60.0	1.0	-61.08	41.88	90.0	956.0
2	230C5.00X1	1		B	60.0	1.0	-60.5	41.05	88.5	956.0
3	230C5.00X1	1		C	60.0	1.0	-59.5	41.05	87.7	956.0
4	230C5.00X1	2		A	60.0	1.0	-60.0	43.38	89.9	871.2
5	230C5.00X1	2		B	60.0	1.0	-59.22	42.88	88.4	871.2
6	230C5.00X1	2		C	60.0	1.0	-60.78	42.88	90.0	871.2
7	500C5.00X	3		A	60.0	1.0	-0.5	41.93	90.0	994.0
8	500C5.00X	3		B	60.0	1.0	-0.5	40.93	89.2	994.0
9	500C5.00X	3		C	60.0	1.0	0.5	40.93	88.4	994.0
10	230C5.00X1	4		A	60.0	1.0	-121.08	41.88	90.0	1014.5
11	230C5.00X1	4		B	60.0	1.0	-120.5	41.05	88.5	1014.5
12	230C5.00X1	4		C	60.0	1.0	-119.5	41.05	87.8	1014.5
13	230C5.00X1	5		A	60.0	1.0	-120.0	43.38	89.9	929.9
14	230C5.00X1	5		B	60.0	1.0	-119.22	42.88	88.5	929.9
15	230C5.00X1	5		C	60.0	1.0	-120.78	42.88	90.0	929.9
16	500C5.00X	6		A	60.0	1.0	59.5	41.93	90.0	1005.6
17	500C5.00X	6		B	60.0	1.0	59.5	40.93	89.2	1005.6
18	500C5.00X	6		C	60.0	1.0	60.5	40.93	88.4	1005.6
19	500C5.00X	7		A	60.0	1.0	119.5	41.93	90.0	1014.7
20	500C5.00X	7		B	60.0	1.0	119.5	40.93	89.2	1014.7
21	500C5.00X	7		C	60.0	1.0	120.5	40.93	88.4	1014.7
22	500C5.00X	8		A	60.0	1.0	179.5	41.93	90.0	1037.2
23	500C5.00X	8		B	60.0	1.0	179.5	40.93	89.3	1037.2
24	500C5.00X	8		C	60.0	1.0	180.5	40.93	88.4	1037.2
25	500C5.00X	9		A	60.0	1.0	239.5	41.93	90.0	1117.4
26	500C5.00X	9		B	60.0	1.0	239.5	40.93	89.3	1117.4
27	500C5.00X	9		C	60.0	1.0	240.5	40.93	88.2	1117.4

CYMCAP Version	8.1, Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	G:\00-230_500\40_DOC\60_500\cmrInCu@3772_5169A.D\F1
Date:	11/3/2024 11:40:45 PM

Simulation Data

Installation type:	Multiple Ductbanks
Steady State Option	Unequally Loaded
Ambient temperature (°C)	12
Native Soil Thermal Resistivity (K.m/W)	1.15
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

[illegible]



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	G100-230_500kV,40_DOC,60_5000kcmillnCu,@3772_5169A DLF1
Date:	11/3/2024 11:40:46 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		230C5.00X1
2	Number of Cores		Single Core
3	Voltage	[kV]	230
4	Conductor Area	[in²]	3.931
5	Cable Overall Diameter	[in]	5.22
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.54
Conductor Shield			
19	Thickness	[in]	0.1
20	Diameter	[in]	2.74
Insulation			
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.1000ft]	1858
26	Thickness	[in]	0.906
27	Diameter	[in]	4.552
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.05
30	Diameter	[in]	4.652
Non Metallic Layer - Water Swellable Tape 1			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.02
34	Diameter	[in]	4.692
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		46
44	Wire Gauge		14
45	Thickness	[in]	0.064
46	Diameter	[in]	4.82
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Longitudinally Corrugated
54	Corrugation height	[in]	0.006
55	Tape overlap	[in]	0.499999999
56	Tape width	[in]	15.91299998
57	Tape thickness	[in]	0.008
58	Accumulation factor		1.2
59	Thickness	[in]	0.006
60	Diameter	[in]	4.912
Jacket			
61	Material		Polyethylene
62	Thermal Resistivity	[K.m/W]	3.5
63	Thickness	[in]	0.154
64	Diameter	[in]	5.22



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	G100-230_500kV,40_DOC,60_5000kcmilInCu,@3772_5169A DLF1
Date:	11/3/2024 11:40:46 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		500C5.00X
2	Number of Cores		Single Core
3	Voltage	[kV]	500
4	Conductor Area	[in²]	3.93
5	Cable Overall Diameter	[in]	5.99
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.49
Conductor Shield			
19	Thickness	[in]	0.059
20	Diameter	[in]	2.608
Insulation			
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.1000ft]	1858
26	Thickness	[in]	1.22
27	Diameter	[in]	5.049
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.059
30	Diameter	[in]	5.167
Non Metallic Layer - Water Swellable Tape			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.037
34	Diameter	[in]	5.241
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		36
44	Wire Gauge		Undefined
45	Thickness	[in]	0.087
46	Diameter	[in]	5.414
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Non Corrugated
54	Thickness	[in]	0.011
55	Diameter	[in]	5.436
Jacket			
56	Material		Polyethylene
57	Thermal Resistivity	[K.m/W]	3.5
58	Thickness	[in]	0.277
59	Diameter	[in]	5.99



Study Summary

CYMECAP Version	6.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	G101-230_500kV_40_DOC_70_50_5000kcmilInCu.@3844_4985A DLF1
Date:	11/3/2024 10:29:35 PM

General Simulation Data

Steady State Option	Unequally 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

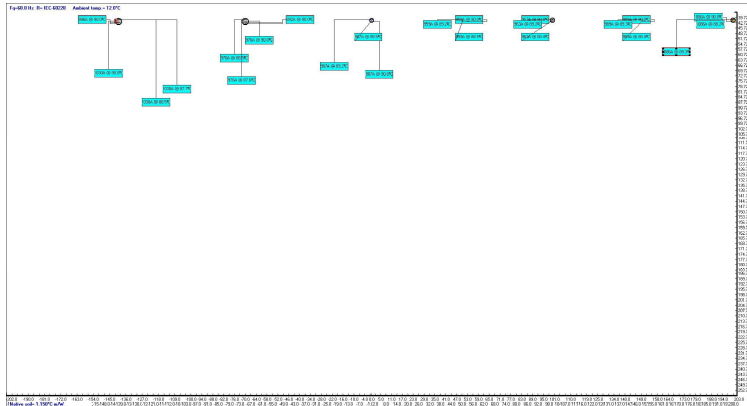
Standard Settings Options

General guidance	Custom
Factor on RAC due to magnetic armour	CIGREGuidance
Factor on RAC due to magnetic duct	CIGREGuidance
Factor on λ_2 due to magnetic armour	CYMECAPGuidance
Factor on λ_2 due to magnetic duct	CIGREGuidance
Factor on λ_2 due to λ'_1	CYMECAPGuidance
λ'_1 computation	CIGREGuidance
λ_2 pipe computation	CYMECAPGuidance
Wd computation	CIGREGuidance
T_2 computation	CIGREGuidance
T_4 computation	CYMECAPGuidance

Installation Type:Multiple Ductbanks/Backfills

Ambient Soil Temperature at Installation Depth	[°C]	12.0
Native Soil Thermal Resistivity	[K.m/W]	1.15
Consider Non-Isothermal Earth Surface		No

Layer Name	X [ft]	Y [ft]	Width [ft]	Height [ft]	Thermal Resistivity [K.m/W]
NSTD DB1	-70.0	41.933	3.517	3.517	0.8
NSTD DB2	0.0	41.429	2.6	2.6	0.8
NSTD DB3	-140.0	41.933	3.517	3.517	0.8
NSTD DB4	50.0	41.429	2.6	2.6	0.8
NSTD DB5	100.0	41.429	2.6	2.6	0.8
NSTD DB6	150.0	41.429	2.6	2.6	0.8
NSTD DB7	200.001	41.429	2.6	2.6	0.8



Results Summary

Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [ft]	Y coordinate [ft]	Conductor temperature [°C]	Ampacity [A]
1	230C5.00X1	1		A	60.0	1.0	-71.08	41.88	90.0	976.5
2	230C5.00X1	1		B	60.0	1.0	-70.5	41.05	88.5	976.5
3	230C5.00X1	1		C	60.0	1.0	-69.5	41.05	87.6	976.5
4	230C5.00X1	2		A	60.0	1.0	-70.0	43.38	89.8	891.8
5	230C5.00X1	2		B	60.0	1.0	-69.22	42.88	88.3	891.8
6	230C5.00X1	2		C	60.0	1.0	-70.78	42.88	90.0	891.8
7	500C5.00X	3		A	60.0	1.0	-0.5	41.93	90.0	987.3
8	500C5.00X	3		B	60.0	1.0	-0.5	40.93	89.2	987.3
9	500C5.00X	3		C	60.0	1.0	0.5	40.93	88.5	987.3
10	230C5.00X1	4		A	60.0	1.0	-141.08	41.88	90.0	1029.8
11	230C5.00X1	4		B	60.0	1.0	-140.5	41.05	88.5	1029.8
12	230C5.00X1	4		C	60.0	1.0	-139.5	41.05	87.7	1029.8
13	230C5.00X1	5		A	60.0	1.0	-140.0	43.38	89.9	946.2
14	230C5.00X1	5		B	60.0	1.0	-139.22	42.88	88.4	946.2
15	230C5.00X1	5		C	60.0	1.0	-140.78	42.88	90.0	946.2
16	500C5.00X	6		A	60.0	1.0	49.5	41.93	90.0	959.5
17	500C5.00X	6		B	60.0	1.0	49.5	40.93	89.2	959.5
18	500C5.00X	6		C	60.0	1.0	50.5	40.93	88.5	959.5
19	500C5.00X	7		A	60.0	1.0	99.5	41.93	90.0	962.6
20	500C5.00X	7		B	60.0	1.0	99.5	40.93	89.2	962.6
21	500C5.00X	7		C	60.0	1.0	100.5	40.93	88.4	962.6
22	500C5.00X	8		A	60.0	1.0	149.5	41.93	90.0	989.3
23	500C5.00X	8		B	60.0	1.0	149.5	40.93	89.3	989.3
24	500C5.00X	8		C	60.0	1.0	150.5	40.93	88.4	989.3
25	500C5.00X	9		A	60.0	1.0	199.5	41.93	90.0	1085.9
26	500C5.00X	9		B	60.0	1.0	199.5	40.93	89.3	1085.9
27	500C5.00X	9		C	60.0	1.0	200.5	40.93	88.2	1085.9

Insulation type	Multiple Options
Steely State Option	Unusually Loaded
Ambient temperature [°C]	12
Native Soil Thermal Resistivity (K.m/W)	1-15
Consider Non-Isothermal Earth Surface	No
Consider effect of soil dry out	No
Consider Electrical interaction between circuits	No
Included current in metallic layers as a fraction of conductor current (applied to all single phase circuits)	0

Variable		Description	Unit	Cables																										
Cable No.	Grade Line Number			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
General Test Data																														
Grade ID	Cable Response ID		290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1	290C500Y1
Cable No.	Grade No.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
Phase	Cable Phase		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A
Fq	Operating Frequency	Hz	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
V	Voltage	V	27.28	27.03	26.85	26.70	26.52	26.35	26.18	26.01	25.84	25.67	25.50	25.33	25.16	24.99	24.82	24.65	24.48	24.31	24.14	23.97	23.80	23.63	23.46	23.29	23.12	22.95	22.78	22.61
I	Current	A	41.28	41.28	41.28	41.28	41.28	41.28	41.28	41.28	41.28	41.28	41.28	41.28	41.28	41.28	41.28	41.28	41.28	41.28	41.28	41.28	41.28	41.28	41.28	41.28	41.28	41.28	41.28	41.28
Eff	Efficiency Factor	%	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Winding Type	Winding Type		1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer	1-Generator / 1-Point Bonded Transducer
Temperature	Steady State Temperature	°A	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53
Amplitude	Steady State Amplitude	°A	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53	97.53
W	Conductor Temperature	°C	90.0	88.0	87.0	86.0	85.0	84.0	83.0	82.0	81.0	80.0	79.0	78.0	77.0	76.0	75.0	74.0	73.0	72.0	71.0	70.0	69.0	68.0	67.0	66.0	65.0	64.0	63.0	62.0
W	Sheath Temperature	°C	90.0	88.0	87.0	86.0	85.0	84.0	83.0	82.0	81.0	80.0	79.0	78.0	77.0	76.0	75.0	74.0	73.0	72.0	71.0	70.0	69.0	68.0	67.0	66.0	65.0	64.0	63.0	62.0
W	Soil Temperature	°C	90.0	88.0	87.0	86.0	85.0	84.0	83.0	82.0	81.0	80.0	7																	



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	G101-230_500kV,40_DOC,70__50__5000kcmilInCu.@3844_4985A DLF1
Date:	11/3/2024 10:29:35 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		230C5.00X1
2	Number of Cores		Single Core
3	Voltage	[kV]	230
4	Conductor Area	[in²]	3.931
5	Cable Overall Diameter	[in]	5.22
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.54
Conductor Shield			
19	Thickness	[in]	0.1
20	Diameter	[in]	2.74
Insulation			
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.1000ft]	1858
26	Thickness	[in]	0.906
27	Diameter	[in]	4.552
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.05
30	Diameter	[in]	4.652
Non Metallic Layer - Water Swellable Tape 1			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.02
34	Diameter	[in]	4.692
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		46
44	Wire Gauge		14
45	Thickness	[in]	0.064
46	Diameter	[in]	4.82
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Longitudinally Corrugated
54	Corrugation height	[in]	0.006
55	Tape overlap	[in]	0.499999999
56	Tape width	[in]	15.91299998
57	Tape thickness	[in]	0.008
58	Accumulation factor		1.2
59	Thickness	[in]	0.006
60	Diameter	[in]	4.912
Jacket			
61	Material		Polyethylene
62	Thermal Resistivity	[K.m/W]	3.5
63	Thickness	[in]	0.154
64	Diameter	[in]	5.22



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	G101-230_500kV,40_DOC,70_50_5000kcmilInCu,@3844_4985A DLF1
Date:	11/3/2024 10:29:35 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		500C5.00X
2	Number of Cores		Single Core
3	Voltage	[kV]	500
4	Conductor Area	[in²]	3.93
5	Cable Overall Diameter	[in]	5.99
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.49
Conductor Shield			
19	Thickness	[in]	0.059
20	Diameter	[in]	2.608
Insulation			
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.1000ft]	1858
26	Thickness	[in]	1.22
27	Diameter	[in]	5.049
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.059
30	Diameter	[in]	5.167
Non Metallic Layer - Water Swellable Tape			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.037
34	Diameter	[in]	5.241
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		36
44	Wire Gauge		Undefined
45	Thickness	[in]	0.087
46	Diameter	[in]	5.414
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Non Corrugated
54	Thickness	[in]	0.011
55	Diameter	[in]	5.436
Jacket			
56	Material		Polyethylene
57	Thermal Resistivity	[K.m/W]	3.5
58	Thickness	[in]	0.277
59	Diameter	[in]	5.99



Study Summary

CYMCAP Version	6.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	G102-230_500kV_40_DOC_80_55_5000kcmilInCu.@3919_5127A DLF1
Date:	11/3/2024 9:03:50 PM

General Simulation Data

Steady State Option	Unequally 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

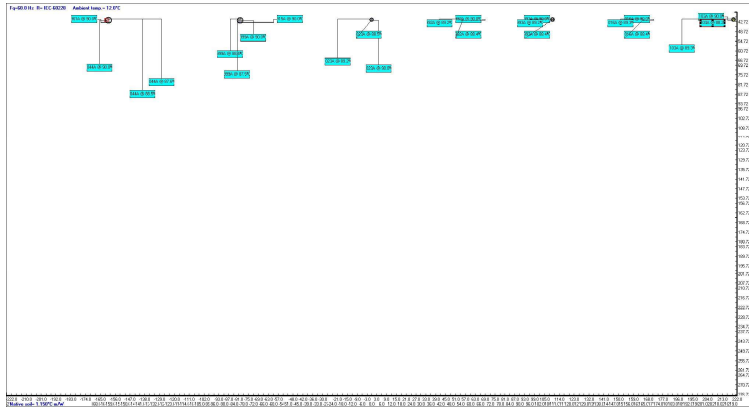
Standard Settings Options

General guidance	Custom
Factor on RAC due to magnetic armour	CIGREGuidance
Factor on RAC due to magnetic duct	CIGREGuidance
Factor on λ_2 due to magnetic armour	CYMCAPGuidance
Factor on λ_2 due to magnetic duct	CIGREGuidance
Factor on λ_2 due to λ'_1	CYMCAPGuidance
λ'_1 computation	CIGREGuidance
λ_2 pipe computation	CYMCAPGuidance
Wd computation	CIGREGuidance
T_2 computation	CIGREGuidance
T_4 computation	CYMCAPGuidance

Installation Type:Multiple Ductbanks/Backfills

Ambient Soil Temperature at Installation Depth	[°C]	12.0
Native Soil Thermal Resistivity	[K.m/W]	1.15
Consider Non-Isothermal Earth Surface		No

Layer Name	X [ft]	Y [ft]	Width [ft]	Height [ft]	Thermal Resistivity [K.m/W]
NSTD DB1	-80.0	41.933	3.517	3.517	0.8
NSTD DB2	0.0	41.429	2.6	2.6	0.8
NSTD DB3	-160.001	41.933	3.517	3.517	0.8
NSTD DB4	55.0	41.429	2.6	2.6	0.8
NSTD DB5	110.0	41.429	2.6	2.6	0.8
NSTD DB6	165.001	41.429	2.6	2.6	0.8
NSTD DB7	220.001	41.429	2.6	2.6	0.8



Results Summary

Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [ft]	Y coordinate [ft]	Conductor temperature [°C]	Ampacity [A]
1	230C5.00X1	1		A	60.0	1.0	-81.08	41.88	90.0	999.0
2	230C5.00X1	1		B	60.0	1.0	-80.5	41.05	88.5	999.0
3	230C5.00X1	1		C	60.0	1.0	-79.5	41.05	87.5	999.0
4	230C5.00X1	2		A	60.0	1.0	-80.0	43.38	89.8	915.3
5	230C5.00X1	2		B	60.0	1.0	-79.22	42.88	88.2	915.3
6	230C5.00X1	2		C	60.0	1.0	-80.78	42.88	90.0	915.3
7	500C5.00X	3		A	60.0	1.0	-0.5	41.93	90.0	1022.6
8	500C5.00X	3		B	60.0	1.0	-0.5	40.93	89.2	1022.6
9	500C5.00X	3		C	60.0	1.0	0.5	40.93	88.5	1022.6
10	230C5.00X1	4		A	60.0	1.0	-161.08	41.88	90.0	1043.6
11	230C5.00X1	4		B	60.0	1.0	-160.5	41.05	88.5	1043.6
12	230C5.00X1	4		C	60.0	1.0	-159.5	41.05	87.6	1043.6
13	230C5.00X1	5		A	60.0	1.0	-160.0	43.38	89.8	961.1
14	230C5.00X1	5		B	60.0	1.0	-159.22	42.88	88.3	961.1
15	230C5.00X1	5		C	60.0	1.0	-160.78	42.88	90.0	961.1
16	500C5.00X	6		A	60.0	1.0	54.5	41.93	90.0	992.2
17	500C5.00X	6		B	60.0	1.0	54.5	40.93	89.2	992.2
18	500C5.00X	6		C	60.0	1.0	55.5	40.93	88.4	992.2
19	500C5.00X	7		A	60.0	1.0	109.5	41.93	90.0	993.1
20	500C5.00X	7		B	60.0	1.0	109.5	40.93	89.2	993.1
21	500C5.00X	7		C	60.0	1.0	110.5	40.93	88.4	993.1
22	500C5.00X	8		A	60.0	1.0	164.5	41.93	90.0	1015.8
23	500C5.00X	8		B	60.0	1.0	164.5	40.93	89.3	1015.8
24	500C5.00X	8		C	60.0	1.0	165.5	40.93	88.4	1015.8
25	500C5.00X	9		A	60.0	1.0	219.5	41.93	90.0	1103.2
26	500C5.00X	9		B	60.0	1.0	219.5	40.93	89.3	1103.2
27	500C5.00X	9		C	60.0	1.0	220.5	40.93	88.2	1103.2



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	G102-230_500kV_40_DOC,80__55_5000kcmilInCu.@3919_5127A DLF1
Date:	11/3/2024 9:03:50 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		230C5.00X1
2	Number of Cores		Single Core
3	Voltage	[kV]	230
4	Conductor Area	[in²]	3.931
5	Cable Overall Diameter	[in]	5.22
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.54
Conductor Shield			
19	Thickness	[in]	0.1
20	Diameter	[in]	2.74
Insulation			
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.1000ft]	1858
26	Thickness	[in]	0.906
27	Diameter	[in]	4.552
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.05
30	Diameter	[in]	4.652
Non Metallic Layer - Water Swellable Tape 1			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.02
34	Diameter	[in]	4.692
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		46
44	Wire Gauge		14
45	Thickness	[in]	0.064
46	Diameter	[in]	4.82
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Longitudinally Corrugated
54	Corrugation height	[in]	0.006
55	Tape overlap	[in]	0.499999999
56	Tape width	[in]	15.91299998
57	Tape thickness	[in]	0.008
58	Accumulation factor		1.2
59	Thickness	[in]	0.006
60	Diameter	[in]	4.912
Jacket			
61	Material		Polyethylene
62	Thermal Resistivity	[K.m/W]	3.5
63	Thickness	[in]	0.154
64	Diameter	[in]	5.22

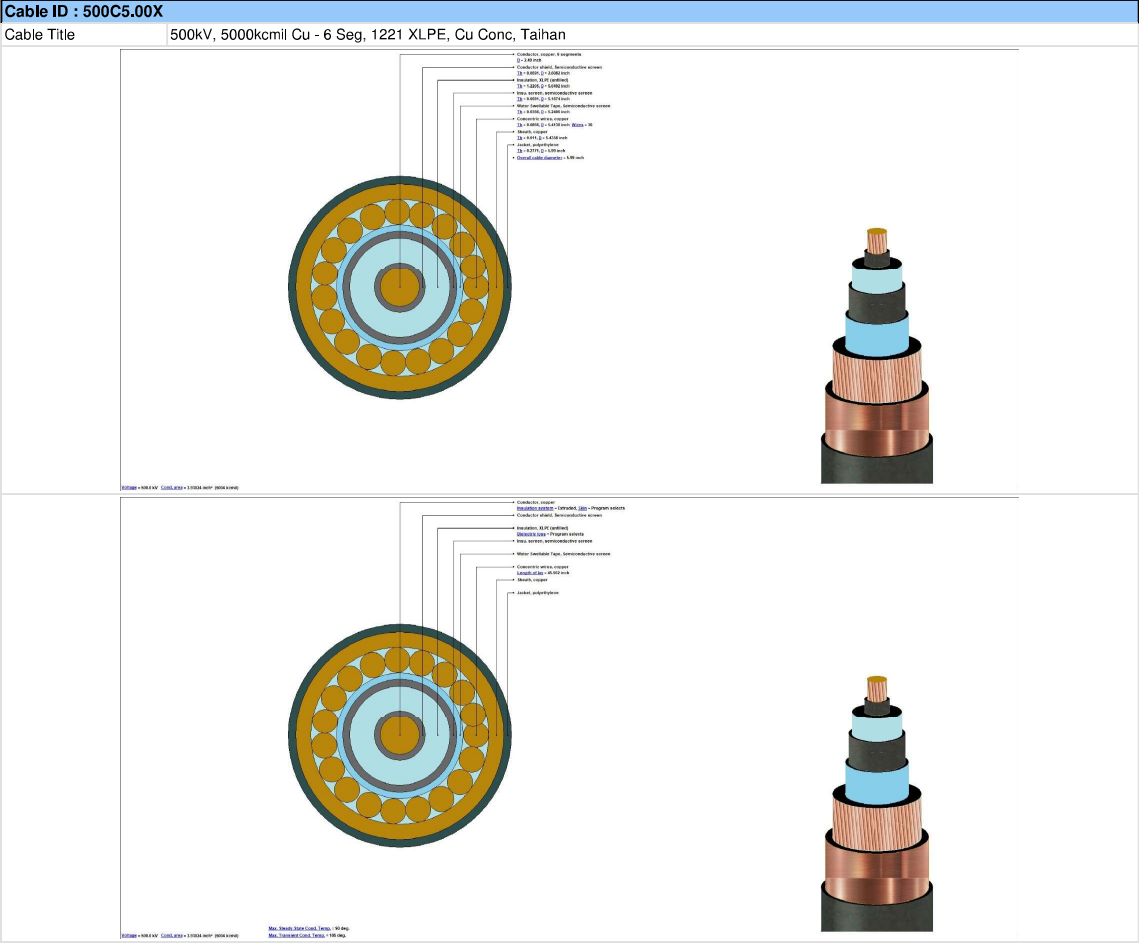


Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	G102-230_500kV,40_DOC,80_55_5000kcmilInCu,@3919_5127A DLF1
Date:	11/3/2024 9:03:50 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		500C5.00X
2	Number of Cores		Single Core
3	Voltage	[kV]	500
4	Conductor Area	[in²]	3.93
5	Cable Overall Diameter	[in]	5.99
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.49
Conductor Shield			
19	Thickness	[in]	0.059
20	Diameter	[in]	2.608
Insulation			
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.1000ft]	1858
26	Thickness	[in]	1.22
27	Diameter	[in]	5.049
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.059
30	Diameter	[in]	5.167
Non Metallic Layer - Water Swellable Tape			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.037
34	Diameter	[in]	5.241
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		36
44	Wire Gauge		Undefined
45	Thickness	[in]	0.087
46	Diameter	[in]	5.414
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Non Corrugated
54	Thickness	[in]	0.011
55	Diameter	[in]	5.436
Jacket			
56	Material		Polyethylene
57	Thermal Resistivity	[K.m/W]	3.5
58	Thickness	[in]	0.277
59	Diameter	[in]	5.99

No.	Description	Unit	1
Specific Installation Data			
60	Cable Equipment ID		500C5.00X
61	Cable Frequency	[Hz]	60
62	Sheath / Shield Bonding		1 Conductor 1 Point Bonded Triangular
63	Loss Factor Constant (ALOS)		0.3
64	Spacing Between Cables in Section		n/a
65	Duct construction		PVC Duct in Concrete
66	Duct material thermal resistivity	[K.m/W]	6
67	Duct filling material		Air
68	Inner diameter of the conduit	[in]	7.942
69	Outer diameter of the conduit	[in]	8.625



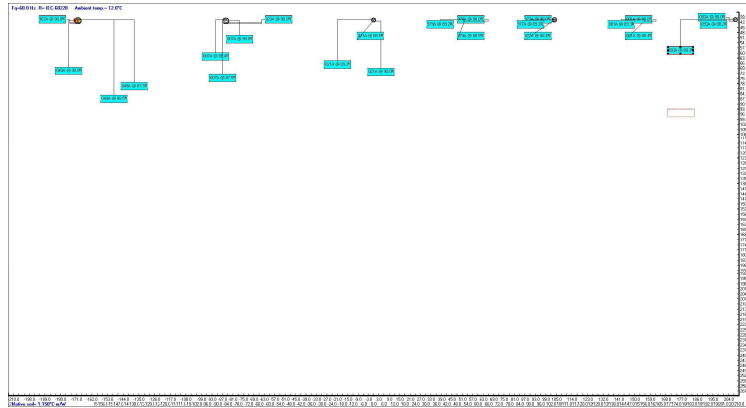
CYMCAP Version	6.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	G103-230_500kV_40_DOC_85_52_5000kcmilInCu.@3946_5072A DLF1
Date:	11/3/2024 7:30:44 PM

General Simulation Data	
Steady State Option	Unequally 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

Standard Settings Options	
General guidance	Custom
Factor on RAC due to magnetic armour	CIGREGuidance
Factor on RAC due to magnetic duct	CIGREGuidance
Factor on λ_2 due to magnetic armour	CYMCAPGuidance
Factor on λ_2 due to magnetic duct	CIGREGuidance
Factor on λ_2 due to λ'_1	CYMCAPGuidance
λ'_1 computation	CIGREGuidance
λ_2 pipe computation	CYMCAPGuidance
Wd computation	CIGREGuidance
T_2 computation	CIGREGuidance
T_4 computation	CYMCAPGuidance

Installation Type: Multiple Ductbanks/Backfills		
Ambient Soil Temperature at Installation Depth	[°C]	12.0
Native Soil Thermal Resistivity	[K.m/W]	1.15
Consider Non-Isothermal Earth Surface		No

Layer Name	X [ft]	Y [ft]	Width [ft]	Height [ft]	Thermal Resistivity [K.m/W]
NSTD DB1	-85.0	41.933	3.517	3.517	0.8
NSTD DB2	0.0	41.429	2.6	2.6	0.8
NSTD DB3	-170.001	41.933	3.517	3.517	0.8
NSTD DB4	52.0	41.429	2.6	2.6	0.8
NSTD DB5	104.0	41.429	2.6	2.6	0.8
NSTD DB6	156.001	41.429	2.6	2.6	0.8
NSTD DB7	208.001	41.429	2.6	2.6	0.8



Results Summary										
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [ft]	Y coordinate [ft]	Conductor temperature [°C]	Ampacity [A]
1	230C5.00X1	1		A	60.0	1.0	-86.08	41.88	90.0	1006.8
2	230C5.00X1	1		B	60.0	1.0	-85.5	41.05	88.4	1006.8
3	230C5.00X1	1		C	60.0	1.0	-84.5	41.05	87.5	1006.8
4	230C5.00X1	2		A	60.0	1.0	-85.0	43.38	89.8	923.4
5	230C5.00X1	2		B	60.0	1.0	-84.22	42.88	88.2	923.4
6	230C5.00X1	2		C	60.0	1.0	-85.78	42.88	90.0	923.4
7	500C5.00X	3		A	60.0	1.0	-0.5	41.93	90.0	1021.3
8	500C5.00X	3		B	60.0	1.0	-0.5	40.93	89.2	1021.3
9	500C5.00X	3		C	60.0	1.0	0.5	40.93	88.5	1021.3
10	230C5.00X1	4		A	60.0	1.0	-171.08	41.88	90.0	1049.1
11	230C5.00X1	4		B	60.0	1.0	-170.5	41.05	88.5	1049.1
12	230C5.00X1	4		C	60.0	1.0	-169.5	41.05	87.5	1049.1
13	230C5.00X1	5		A	60.0	1.0	-170.0	43.38	89.8	967.0
14	230C5.00X1	5		B	60.0	1.0	-169.22	42.88	88.2	967.0
15	230C5.00X1	5		C	60.0	1.0	-170.78	42.88	90.0	967.0
16	500C5.00X	6		A	60.0	1.0	51.5	41.93	90.0	978.8
17	500C5.00X	6		B	60.0	1.0	51.5	40.93	89.2	978.8
18	500C5.00X	6		C	60.0	1.0	52.5	40.93	88.5	978.8
19	500C5.00X	7		A	60.0	1.0	103.5	41.93	90.0	977.4
20	500C5.00X	7		B	60.0	1.0	103.5	40.93	89.2	977.4
21	500C5.00X	7		C	60.0	1.0	104.5	40.93	88.4	977.4
22	500C5.00X	8		A	60.0	1.0	155.5	41.93	90.0	1001.2
23	500C5.00X	8		B	60.0	1.0	155.5	40.93	89.3	1001.2
24	500C5.00X	8		C	60.0	1.0	156.5	40.93	88.4	1001.2
25	500C5.00X	9		A	60.0	1.0	207.5	41.93	90.0	1093.5
26	500C5.00X	9		B	60.0	1.0	207.5	40.93	89.3	1093.5
27	500C5.00X	9		C	60.0	1.0	208.5	40.93	88.2	1093.5

Simulation Data

Installation type:	Multiple Ductbanks
Steady State Option	Unusually Loaded
Ambient temperature [°C]	12
Native Soil Thermal Resistivity [K.m/W]	1.15
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 Identifier	Cable Number		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
General Input Data																															
Cable ID	Cable Equipment ID		2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	2905C.X001	
Cable No.	Cable No.		1	1	1	2	2	2	3	3	3	4	4	4	5	5	5	6	6	6	7	7	7	8	8	8	9	9	9	9	
Phase	Cable Phase		A	A	A	B	B	B	C	C	C	A	A	A	B	B	B	C	C	C	A	A	A	B	B	B	C	C	C	A	
Fs	Cable Frequency	[Hz]	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	
Rs	Cable Resistance	[Ω]	45.68	45.61	44.51	45.78	45.78	45.78	45.41	45.41	45.41	45.15	45.15	45.15	45.68	45.68	45.68	45.15	45.15	45.15	45.68	45.68	45.68	45.15	45.15	45.15	45.68	45.68	45.68	45.15	
Z	Cable Impedance	[Ω]	41.88	41.05	41.05	43.38	42.88	42.88	41.05	41.05	41.05	40.93	40.93	40.93	41.88	41.05	41.05	43.38	42.88	42.88	41.05	41.05	41.05	40.93	40.93	40.93	41.88	41.05	41.05	40.93	
DLF	Full Load Factor	[a.u.]	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Cable Running Type																															
Cable ID	Cable Running Type		Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	Conductor 1 Point Bonded Transducer	
I	Steady State Amplitude	[A]	1006.8	1006.8	1006.8	970.4	970.4	970.4	1021.3	1021.3	1021.3	1049.1	1049.1	1049.1	967.8	967.8	967.8	970.4	970.4	970.4	978.8	978.8	978.8	977.4	977.4	977.4	1001.2	1001.2	1001.2	1069.5	1069.5
Temperatures																															
Cable Temperature		[°C]	80.0	88.4	87.5	88.0	88.0	88.0	89.0	89.0	89.0	89.0	89.0	89.0	89.0	89.0	89.0	89.0	89.0	89.0	89.0	89.0	89.0	89.0	89.0	89.0	89.0	89.0	89.0	89.0	
Sheath/SHM Temperature		[°C]	86.3	84.7	83.6	86.6	86.6	86.6	84.3	83.5	82.8	86.0	84.4	83.5	86.4	84.8	85.3	84.7	83.9	83.1	84.7	83.9	83.1	84.7	83.9	83.1	84.5	83.7	83.9	83.7	83.0
Amour Temperature		[°C]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Guard Cable Temperature		[°C]	85.8	84.7	83.4	86.7	86.6	86.6	84.6	83.6	82.8	85.5	84.0	83.1	85.9	84.4	84.1	83.7	83.0	82.7	83.7	83.0	82.7	83.7	83.0	82.7	83.5	82.9	81.9	82.6	82.8
Heat	Heat Surface Temperature	[°C]	82.2	80.7	79.7	82.1	82.1	82.1	8																						



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	G103-230_500kV,40_DOC,85__52__5000kcmilInCu,@3946_5072A DLF1
Date:	11/3/2024 7:30:44 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		230C5.00X1
2	Number of Cores		Single Core
3	Voltage	[kV]	230
4	Conductor Area	[in²]	3.931
5	Cable Overall Diameter	[in]	5.22
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.54
Conductor Shield			
19	Thickness	[in]	0.1
20	Diameter	[in]	2.74
Insulation			
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.1000ft]	1858
26	Thickness	[in]	0.906
27	Diameter	[in]	4.552
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.05
30	Diameter	[in]	4.652
Non Metallic Layer - Water Swellable Tape 1			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.02
34	Diameter	[in]	4.692
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		46
44	Wire Gauge		14
45	Thickness	[in]	0.064
46	Diameter	[in]	4.82
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Longitudinally Corrugated
54	Corrugation height	[in]	0.006
55	Tape overlap	[in]	0.499999999
56	Tape width	[in]	15.91299998
57	Tape thickness	[in]	0.008
58	Accumulation factor		1.2
59	Thickness	[in]	0.006
60	Diameter	[in]	4.912
Jacket			
61	Material		Polyethylene
62	Thermal Resistivity	[K.m/W]	3.5
63	Thickness	[in]	0.154
64	Diameter	[in]	5.22



Cables Report

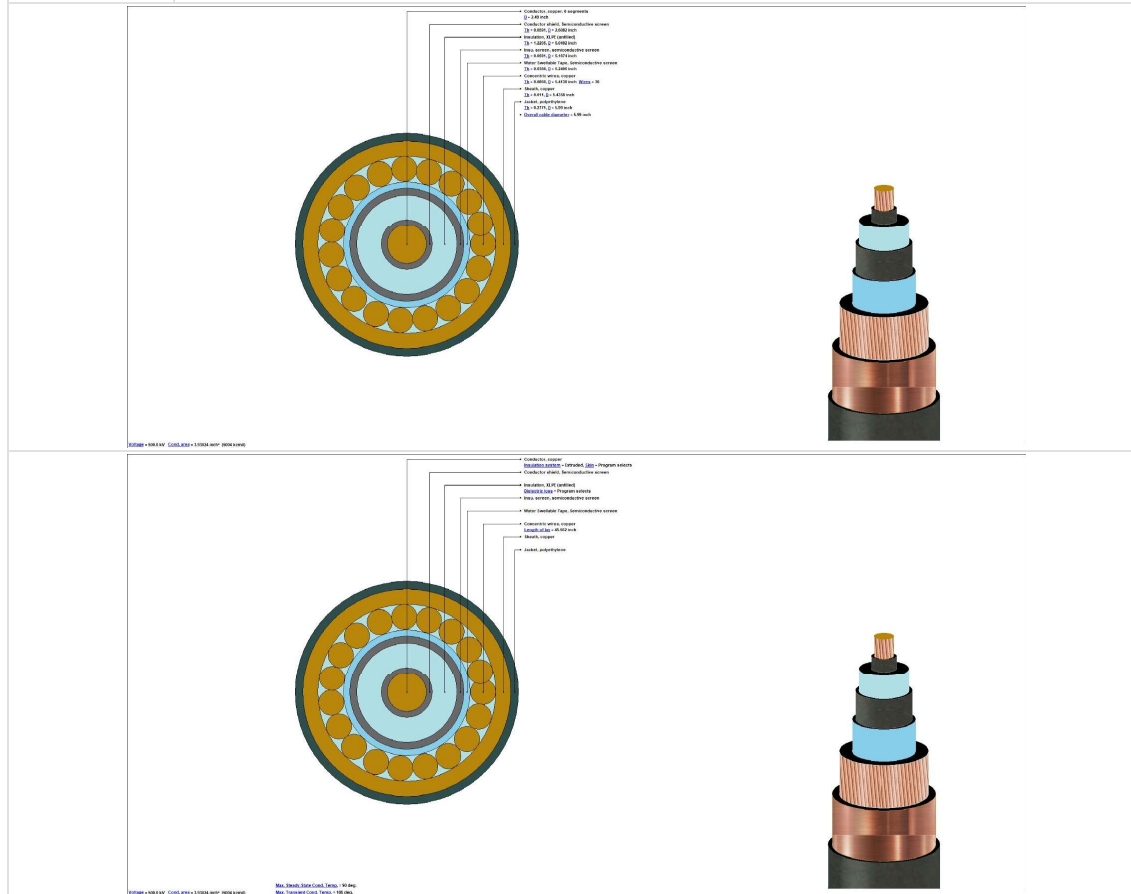
CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	G103-230_500kV,40_DOC,85_52_5000kcmilInCu,@3946_5072A DLF1
Date:	11/3/2024 7:30:44 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		500C5.00X
2	Number of Cores		Single Core
3	Voltage	[kV]	500
4	Conductor Area	[in²]	3.93
5	Cable Overall Diameter	[in]	5.99
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.49
Conductor Shield			
19	Thickness	[in]	0.059
20	Diameter	[in]	2.608
Insulation			
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.1000ft]	1858
26	Thickness	[in]	1.22
27	Diameter	[in]	5.049
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.059
30	Diameter	[in]	5.167
Non Metallic Layer - Water Swellable Tape			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.037
34	Diameter	[in]	5.241
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		36
44	Wire Gauge		Undefined
45	Thickness	[in]	0.087
46	Diameter	[in]	5.414
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Non Corrugated
54	Thickness	[in]	0.011
55	Diameter	[in]	5.436
Jacket			
56	Material		Polyethylene
57	Thermal Resistivity	[K.m/W]	3.5
58	Thickness	[in]	0.277
59	Diameter	[in]	5.99

No.	Description	Unit	1
Specific Installation Data			
60	Cable Equipment ID		500C5.00X
61	Cable Frequency	[Hz]	60
62	Sheath / Shield Bonding		1 Conductor 1 Point Bonded Triangular
63	Loss Factor Constant (ALOS)		0.3
64	Spacing Between Cables in Section		n/a
65	Duct construction		PVC Duct in Concrete
66	Duct material thermal resistivity	[K.m/W]	6
67	Duct filling material		Air
68	Inner diameter of the conduit	[in]	7.942
69	Outer diameter of the conduit	[in]	8.625

Cable ID : 500C5.00X

Cable Title	500kV, 5000kcmil Cu - 6 Seg, 1221 XLPE, Cu Conc, Taihan
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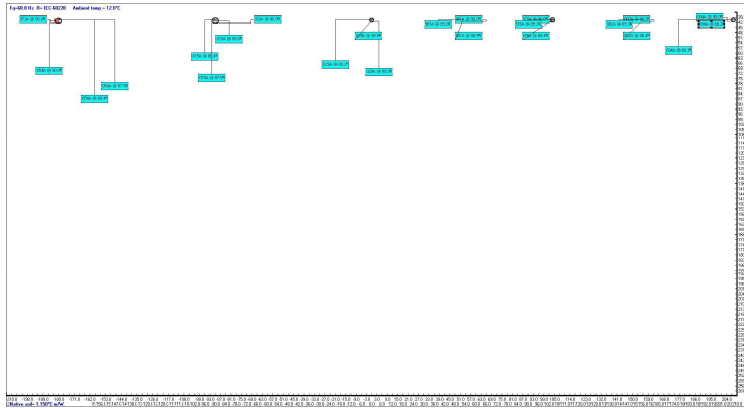
CYMCAP Version	6.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	G104-230_500kV_40_DOC_90_52_5000kcmilInCu.@3974_5084A DLF1
Date:	11/3/2024 5:42:47 PM

General Simulation Data	
Steady State Option	Unequally 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

Standard Settings Options	
General guidance	Custom
Factor on RAC due to magnetic armour	CIGREGuidance
Factor on RAC due to magnetic duct	CIGREGuidance
Factor on λ_2 due to magnetic armour	CYMCAPGuidance
Factor on λ_2 due to magnetic duct	CIGREGuidance
Factor on λ_2 due to λ'_1	CYMCAPGuidance
λ'_1 computation	CIGREGuidance
λ_2 pipe computation	CYMCAPGuidance
Wd computation	CIGREGuidance
T_2 computation	CIGREGuidance
T_4 computation	CYMCAPGuidance

Installation Type:Multiple Ductbanks/Backfills		
Ambient Soil Temperature at Installation Depth	[°C]	12.0
Native Soil Thermal Resistivity	[K.m/W]	1.15
Consider Non-Isothermal Earth Surface		No

Layer Name	X [ft]	Y [ft]	Width [ft]	Height [ft]	Thermal Resistivity [K.m/W]
NSTD DB1	-90.0	41.933	3.517	3.517	0.8
NSTD DB2	0.0	41.429	2.6	2.6	0.8
NSTD DB3	-180.001	41.933	3.517	3.517	0.8
NSTD DB4	52.0	41.429	2.6	2.6	0.8
NSTD DB5	104.0	41.429	2.6	2.6	0.8
NSTD DB6	156.001	41.429	2.6	2.6	0.8
NSTD DB7	208.001	41.429	2.6	2.6	0.8



Results Summary										
Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [ft]	Y coordinate [ft]	Conductor temperature [°C]	Ampacity [A]
1	230C5.00X1	1		A	60.0	1.0	-91.08	41.88	90.0	1014.9
2	230C5.00X1	1		B	60.0	1.0	-90.5	41.05	88.4	1014.9
3	230C5.00X1	1		C	60.0	1.0	-89.5	41.05	87.5	1014.9
4	230C5.00X1	2		A	60.0	1.0	-90.0	43.38	89.8	931.9
5	230C5.00X1	2		B	60.0	1.0	-89.22	42.88	88.2	931.9
6	230C5.00X1	2		C	60.0	1.0	-90.78	42.88	90.0	931.9
7	500C5.00X	3		A	60.0	1.0	-0.5	41.93	90.0	1028.6
8	500C5.00X	3		B	60.0	1.0	-0.5	40.93	89.2	1028.6
9	500C5.00X	3		C	60.0	1.0	0.5	40.93	88.5	1028.6
10	230C5.00X1	4		A	60.0	1.0	-181.08	41.88	90.0	1054.2
11	230C5.00X1	4		B	60.0	1.0	-180.5	41.05	88.4	1054.2
12	230C5.00X1	4		C	60.0	1.0	-179.5	41.05	87.5	1054.2
13	230C5.00X1	5		A	60.0	1.0	-180.0	43.38	89.8	972.5
14	230C5.00X1	5		B	60.0	1.0	-179.22	42.88	88.2	972.5
15	230C5.00X1	5		C	60.0	1.0	-180.78	42.88	90.0	972.5
16	500C5.00X	6		A	60.0	1.0	51.5	41.93	90.0	981.1
17	500C5.00X	6		B	60.0	1.0	51.5	40.93	89.2	981.1
18	500C5.00X	6		C	60.0	1.0	52.5	40.93	88.5	981.1
19	500C5.00X	7		A	60.0	1.0	103.5	41.93	90.0	978.3
20	500C5.00X	7		B	60.0	1.0	103.5	40.93	89.2	978.3
21	500C5.00X	7		C	60.0	1.0	104.5	40.93	88.4	978.3
22	500C5.00X	8		A	60.0	1.0	155.5	41.93	90.0	1001.5
23	500C5.00X	8		B	60.0	1.0	155.5	40.93	89.3	1001.5
24	500C5.00X	8		C	60.0	1.0	156.5	40.93	88.4	1001.5
25	500C5.00X	9		A	60.0	1.0	207.5	41.93	90.0	1093.6
26	500C5.00X	9		B	60.0	1.0	207.5	40.93	89.3	1093.6
27	500C5.00X	9		C	60.0	1.0	208.5	40.93	88.2	1093.6



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	G104-230_500kV,40_DOC,90__52__5000kcmilInCu,@3974_5084A DLF1
Date:	11/3/2024 5:42:47 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		230C5.00X1
2	Number of Cores		Single Core
3	Voltage	[kV]	230
4	Conductor Area	[in²]	3.931
5	Cable Overall Diameter	[in]	5.22
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.54
Conductor Shield			
19	Thickness	[in]	0.1
20	Diameter	[in]	2.74
Insulation			
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.1000ft]	1858
26	Thickness	[in]	0.906
27	Diameter	[in]	4.552
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.05
30	Diameter	[in]	4.652
Non Metallic Layer - Water Swellable Tape 1			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.02
34	Diameter	[in]	4.692
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		46
44	Wire Gauge		14
45	Thickness	[in]	0.064
46	Diameter	[in]	4.82
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Longitudinally Corrugated
54	Corrugation height	[in]	0.006
55	Tape overlap	[in]	0.499999999
56	Tape width	[in]	15.91299998
57	Tape thickness	[in]	0.008
58	Accumulation factor		1.2
59	Thickness	[in]	0.006
60	Diameter	[in]	4.912
Jacket			
61	Material		Polyethylene
62	Thermal Resistivity	[K.m/W]	3.5
63	Thickness	[in]	0.154
64	Diameter	[in]	5.22



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	G104-230_500kV,40_DOC,90_52_5000kcmilInCu,@3974_5084A DLF1
Date:	11/3/2024 5:42:47 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		500C5.00X
2	Number of Cores		Single Core
3	Voltage	[kV]	500
4	Conductor Area	[in²]	3.93
5	Cable Overall Diameter	[in]	5.99
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.49
Conductor Shield			
19	Thickness	[in]	0.059
20	Diameter	[in]	2.608
Insulation			
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.1000ft]	1858
26	Thickness	[in]	1.22
27	Diameter	[in]	5.049
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.059
30	Diameter	[in]	5.167
Non Metallic Layer - Water Swellable Tape			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.037
34	Diameter	[in]	5.241
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		36
44	Wire Gauge		Undefined
45	Thickness	[in]	0.087
46	Diameter	[in]	5.414
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Non Corrugated
54	Thickness	[in]	0.011
55	Diameter	[in]	5.436
Jacket			
56	Material		Polyethylene
57	Thermal Resistivity	[K.m/W]	3.5
58	Thickness	[in]	0.277
59	Diameter	[in]	5.99



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	H101-230_500kV,40_DOC,30_50_5000kcmilInCu,@4369_4789A DLF1
Date:	11/4/2024 5:04:45 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		500C5.00X
2	Number of Cores		Single Core
3	Voltage	[kV]	500
4	Conductor Area	[in²]	3.93
5	Cable Overall Diameter	[in]	5.99
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.49
Conductor Shield			
19	Thickness	[in]	0.059
20	Diameter	[in]	2.608
Insulation			
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.1000ft]	1858
26	Thickness	[in]	1.22
27	Diameter	[in]	5.049
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.059
30	Diameter	[in]	5.167
Non Metallic Layer - Water Swellable Tape			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.037
34	Diameter	[in]	5.241
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		36
44	Wire Gauge		Undefined
45	Thickness	[in]	0.087
46	Diameter	[in]	5.414
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Non Corrugated
54	Thickness	[in]	0.011
55	Diameter	[in]	5.436
Jacket			
56	Material		Polyethylene
57	Thermal Resistivity	[K.m/W]	3.5
58	Thickness	[in]	0.277
59	Diameter	[in]	5.99



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	H101-230_500kV,40_DOC,30_50_5000kcmilInCu,@4369_4789A DLF1
Date:	11/4/2024 5:04:45 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		230C5.00X1
2	Number of Cores		Single Core
3	Voltage	[kV]	230
4	Conductor Area	[in²]	3.931
5	Cable Overall Diameter	[in]	5.22
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.54
Conductor Shield			
19	Thickness	[in]	0.1
20	Diameter	[in]	2.74
Insulation			
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.1000ft]	1858
26	Thickness	[in]	0.906
27	Diameter	[in]	4.552
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.05
30	Diameter	[in]	4.652
Non Metallic Layer - Water Swellable Tape 1			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.02
34	Diameter	[in]	4.692
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		46
44	Wire Gauge		14
45	Thickness	[in]	0.064
46	Diameter	[in]	4.82
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Longitudinally Corrugated
54	Corrugation height	[in]	0.006
55	Tape overlap	[in]	0.499999999
56	Tape width	[in]	15.91299998
57	Tape thickness	[in]	0.008
58	Accumulation factor		1.2
59	Thickness	[in]	0.006
60	Diameter	[in]	4.912
Jacket			
61	Material		Polyethylene
62	Thermal Resistivity	[K.m/W]	3.5
63	Thickness	[in]	0.154
64	Diameter	[in]	5.22



Study Summary

CYMCAP Version	6.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	H102-230_500kV_40_DOC_30_50_5000kcmillnCu.@4454_4893A DLF1
Date:	11/4/2024 2:45:57 PM

General Simulation Data

Steady State Option	Unequally 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

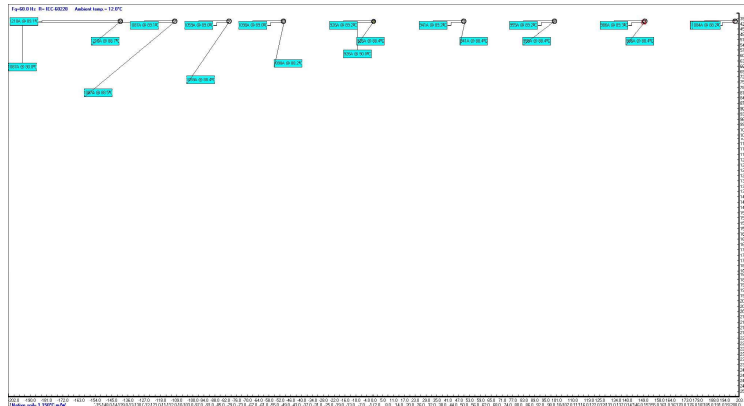
Standard Settings Options

General guidance	Custom
Factor on RAC due to magnetic armour	CIGREGuidance
Factor on RAC due to magnetic duct	CIGREGuidance
Factor on λ_2 due to magnetic armour	CYMCAPGuidance
Factor on λ_2 due to magnetic duct	CIGREGuidance
Factor on λ_2 due to λ'_1	CYMCAPGuidance
λ'_1 computation	CIGREGuidance
λ_2 pipe computation	CYMCAPGuidance
Wd computation	CIGREGuidance
T_2 computation	CIGREGuidance
T_4 computation	CYMCAPGuidance

Installation Type: Multiple Ductbanks/Backfills

Ambient Soil Temperature at Installation Depth	[°C]	12.0
Native Soil Thermal Resistivity	[K.m/W]	1.15
Consider Non-Isothermal Earth Surface		No

Layer Name	X [ft]	Y [ft]	Width [ft]	Height [ft]	Thermal Resistivity [K.m/W]
NSTD DB2	0.0	41.429	2.6	2.6	0.8
NSTD DB4	50.0	41.429	2.6	2.6	0.8
NSTD DB5	100.0	41.429	2.6	2.6	0.8
NSTD DB6	150.0	41.429	2.6	2.6	0.8
NSTD DB7	200.001	41.429	2.6	2.6	0.8
NSTD DB6	-50.0	41.429	2.6	2.6	0.8
NSTD DB7	-80.0	41.429	2.6	2.6	0.8
NSTD DB8	-110.0	41.429	2.6	2.6	0.8
NSTD DB9	-140.0	41.429	2.6	2.6	0.8



Results Summary

Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [ft]	Y coordinate [ft]	Conductor temperature [°C]	Ampacity [A]
1	500C5.00X	1		A	60.0	1.0	-0.5	41.93	90.0	926.3
2	500C5.00X	1		B	60.0	1.0	-0.5	40.93	89.2	926.3
3	500C5.00X	1		C	60.0	1.0	0.5	40.93	88.4	926.3
4	500C5.00X	2		A	60.0	1.0	49.5	41.93	90.0	941.4
5	500C5.00X	2		B	60.0	1.0	49.5	40.93	89.2	941.4
6	500C5.00X	2		C	60.0	1.0	50.5	40.93	88.4	941.4
7	500C5.00X	3		A	60.0	1.0	99.5	41.93	90.0	955.4
8	500C5.00X	3		B	60.0	1.0	99.5	40.93	89.2	955.4
9	500C5.00X	3		C	60.0	1.0	100.5	40.93	88.4	955.4
10	500C5.00X	4		A	60.0	1.0	149.5	41.93	90.0	986.0
11	500C5.00X	4		B	60.0	1.0	149.5	40.93	89.3	986.0
12	500C5.00X	4		C	60.0	1.0	150.5	40.93	88.4	986.0
13	500C5.00X	5		A	60.0	1.0	199.5	41.93	90.0	1064.3
14	500C5.00X	5		B	60.0	1.0	199.5	40.93	89.3	1064.3
15	500C5.00X	5		C	60.0	1.0	200.5	40.93	88.2	1064.3
16	230C5.00X1	6		A	60.0	1.0	-50.5	41.93	90.0	1098.2
17	230C5.00X1	6		B	60.0	1.0	-50.5	40.93	89.0	1098.2
18	230C5.00X1	6		C	60.0	1.0	-49.5	40.93	88.2	1098.2
19	230C5.00X1	7		A	60.0	1.0	-80.5	41.93	90.0	1059.5
20	230C5.00X1	7		B	60.0	1.0	-80.5	40.93	89.0	1059.5
21	230C5.00X1	7		C	60.0	1.0	-79.5	40.93	88.4	1059.5
22	230C5.00X1	8		A	60.0	1.0	-110.5	41.93	90.0	1087.0
23	230C5.00X1	8		B	60.0	1.0	-110.5	40.93	89.1	1087.0
24	230C5.00X1	8		C	60.0	1.0	-109.5	40.93	88.5	1087.0
25	230C5.00X1	9		A	60.0	1.0	-140.5	41.93	90.0	1209.9
26	230C5.00X1	9		B	60.0	1.0	-140.5	40.93	89.1	1209.9
27	230C5.00X1	9		C	60.0	1.0	-139.5	40.93	88.7	1209.9

Simulation Data	
Installation type:	Multiple Ductbanks
Steady State Option	Unequally Loaded
Ambient Temperature [°C]	12
Native Soil Thermal Resistivity [K.m/W]	1.15
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

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Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	H102-230_500kV,40_DOC,30_50_5000kcmilInCu,@4454_4893A DLF1
Date:	11/4/2024 2:45:57 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		500C5.00X
2	Number of Cores		Single Core
3	Voltage	[kV]	500
4	Conductor Area	[in²]	3.93
5	Cable Overall Diameter	[in]	5.99
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.49
Conductor Shield			
19	Thickness	[in]	0.059
20	Diameter	[in]	2.608
Insulation			
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.1000ft]	1858
26	Thickness	[in]	1.22
27	Diameter	[in]	5.049
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.059
30	Diameter	[in]	5.167
Non Metallic Layer - Water Swellable Tape			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.037
34	Diameter	[in]	5.241
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		36
44	Wire Gauge		Undefined
45	Thickness	[in]	0.087
46	Diameter	[in]	5.414
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Non Corrugated
54	Thickness	[in]	0.011
55	Diameter	[in]	5.436
Jacket			
56	Material		Polyethylene
57	Thermal Resistivity	[K.m/W]	3.5
58	Thickness	[in]	0.277
59	Diameter	[in]	5.99



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	H102-230_500kV,40_DOC,30_50_5000kcmilInCu,@4454_4893A DLF1
Date:	11/4/2024 2:45:57 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		230C5.00X1
2	Number of Cores		Single Core
3	Voltage	[kV]	230
4	Conductor Area	[in²]	3.931
5	Cable Overall Diameter	[in]	5.22
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.54
Conductor Shield			
19	Thickness	[in]	0.1
20	Diameter	[in]	2.74
Insulation			
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.1000ft]	1858
26	Thickness	[in]	0.906
27	Diameter	[in]	4.552
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.05
30	Diameter	[in]	4.652
Non Metallic Layer - Water Swellable Tape 1			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.02
34	Diameter	[in]	4.692
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		46
44	Wire Gauge		14
45	Thickness	[in]	0.064
46	Diameter	[in]	4.82
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Longitudinally Corrugated
54	Corrugation height	[in]	0.006
55	Tape overlap	[in]	0.499999999
56	Tape width	[in]	15.91299998
57	Tape thickness	[in]	0.008
58	Accumulation factor		1.2
59	Thickness	[in]	0.006
60	Diameter	[in]	4.912
Jacket			
61	Material		Polyethylene
62	Thermal Resistivity	[K.m/W]	3.5
63	Thickness	[in]	0.154
64	Diameter	[in]	5.22



Study Summary

CYMCAP Version	6.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	H103-230_500kV_40_DOC_30_60_5000kcmilInCu.@4499_5152A DLF1
Date:	11/4/2024 12:54:32 PM

General Simulation Data

Steady State Option	Unequally 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

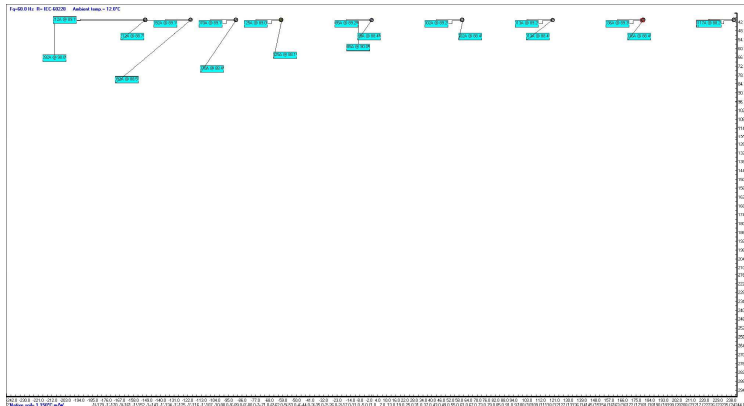
Standard Settings Options

General guidance	Custom
Factor on RAC due to magnetic armour	CIGREGuidance
Factor on RAC due to magnetic duct	CIGREGuidance
Factor on λ_2 due to magnetic armour	CYMCAPGuidance
Factor on λ_2 due to magnetic duct	CIGREGuidance
Factor on λ_2 due to λ'_1	CYMCAPGuidance
λ'_1 computation	CIGREGuidance
λ_2 pipe computation	CYMCAPGuidance
Wd computation	CIGREGuidance
T_2 computation	CIGREGuidance
T_4 computation	CYMCAPGuidance

Installation Type: Multiple Ductbanks/Backfills

Ambient Soil Temperature at Installation Depth	[°C]	12.0
Native Soil Thermal Resistivity	[K.m/W]	1.15
Consider Non-Isothermal Earth Surface		No

Layer Name	X [ft]	Y [ft]	Width [ft]	Height [ft]	Thermal Resistivity [K.m/W]
NSTD DB2	0.0	41.429	2.6	2.6	0.8
NSTD DB4	60.0	41.429	2.6	2.6	0.8
NSTD DB5	120.0	41.429	2.6	2.6	0.8
NSTD DB6	180.001	41.429	2.6	2.6	0.8
NSTD DB7	240.001	41.429	2.6	2.6	0.8
NSTD DB6	-60.0	41.429	2.6	2.6	0.8
NSTD DB7	-90.0	41.429	2.6	2.6	0.8
NSTD DB8	-120.0	41.429	2.6	2.6	0.8
NSTD DB9	-150.0	41.429	2.6	2.6	0.8



Results Summary

Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [ft]	Y coordinate [ft]	Conductor temperature [°C]	Ampacity [A]
1	500C5.00X	1		A	60.0	1.0	-0.5	41.93	90.0	984.9
2	500C5.00X	1		B	60.0	1.0	-0.5	40.93	89.2	984.9
3	500C5.00X	1		C	60.0	1.0	0.5	40.93	88.4	984.9
4	500C5.00X	2		A	60.0	1.0	59.5	41.93	90.0	1001.9
5	500C5.00X	2		B	60.0	1.0	59.5	40.93	89.2	1001.9
6	500C5.00X	2		C	60.0	1.0	60.5	40.93	88.4	1001.9
7	500C5.00X	3		A	60.0	1.0	119.5	41.93	90.0	1013.0
8	500C5.00X	3		B	60.0	1.0	119.5	40.93	89.2	1013.0
9	500C5.00X	3		C	60.0	1.0	120.5	40.93	88.4	1013.0
10	500C5.00X	4		A	60.0	1.0	179.5	41.93	90.0	1036.1
11	500C5.00X	4		B	60.0	1.0	179.5	40.93	89.3	1036.1
12	500C5.00X	4		C	60.0	1.0	180.5	40.93	88.4	1036.1
13	500C5.00X	5		A	60.0	1.0	239.5	41.93	90.0	1116.6
14	500C5.00X	5		B	60.0	1.0	239.5	40.93	89.3	1116.6
15	500C5.00X	5		C	60.0	1.0	240.5	40.93	88.2	1116.6
16	230C5.00X1	6		A	60.0	1.0	-60.5	41.93	90.0	1125.0
17	230C5.00X1	6		B	60.0	1.0	-60.5	40.93	89.0	1125.0
18	230C5.00X1	6		C	60.0	1.0	-59.5	40.93	88.1	1125.0
19	230C5.00X1	7		A	60.0	1.0	-90.5	41.93	90.0	1069.9
20	230C5.00X1	7		B	60.0	1.0	-90.5	40.93	89.1	1069.9
21	230C5.00X1	7		C	60.0	1.0	-89.5	40.93	88.4	1069.9
22	230C5.00X1	8		A	60.0	1.0	-120.5	41.93	90.0	1091.8
23	230C5.00X1	8		B	60.0	1.0	-120.5	40.93	89.1	1091.8
24	230C5.00X1	8		C	60.0	1.0	-119.5	40.93	88.5	1091.8
25	230C5.00X1	9		A	60.0	1.0	-150.5	41.93	90.0	1212.4
26	230C5.00X1	9		B	60.0	1.0	-150.5	40.93	89.1	1212.4
27	230C5.00X1	9		C	60.0	1.0	-149.5	40.93	88.7	1212.4

Simulation Data	
Installation type:	Multiple Ductbanks
Steady State Option	Unequally Loaded
Ambient Temperature [°C]	12
Native Soil Thermal Resistivity [K.m/W]	1.15
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	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
General Data																													
Cable ID	Cable Equipment ID		00052,000	00052,000	00052,000	00052,000	00052,000	00052,000	00052,000	00052,000	00052,000	00052,000	00052,000	00052,000	00052,000	00052,000	00052,000	00052,000	00052,000	00052,000	00052,000	00052,000	00052,000	00052,000	00052,000	00052,000	00052,000	00052,000	00052,000
Cable No.	Cable No.		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Phase	Cable Phase		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
IC	Operating Frequency	[Hz]	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
V	V coordinate	[m]	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
V	V coordinate	[m]	41.33	40.83	40.83	41.33	40.83	40.83	41.33	40.83	40.83	41.33	40.83	40.83	41.33	40.83	40.83	41.33	40.83	40.83	41.33	40.83	40.83	41.33	40.83	40.83	41.33	40.83	40.83
IC	Line Load Factor	[m]	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Rating	Rating	Rating Type	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo
			1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo	1 Conductor 1 Point Banded Transpo
Capacity	Steady State Capacity	[A]	984.9	984.9	984.9	1001.9	1001.9	1001.9	1001.9	1013.0	1013.0	1013.0	1013.0	1036.1	1036.1	1036.1	1116.6	1116.6	1116.6	1116.6	1116.6	1116.6	1116.6	1116.6	1116.6	1116.6	1116.6	1116.6	1116.6
Temperatures																													
IC	Conductor temperature	[C]	90.0	89.0	89.0	90.0	89.0	89.0	90.0	90.0	89.0	89.0	90.0	90.0	89.0	89.0	90.0	89.0	89.0	90.0	89.0	89.0	90.0	89.0	89.0	90.0	89.0	89.0	89.0
IC	Insulation temperature	[C]	85.0	84.0	84.0	85.0	84.0	84.0	85.0	84.0																			



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	H103-230_500kV,40_DOC,30_60_5000kcmilInCu,@4499_5152A DLF1
Date:	11/4/2024 12:54:32 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		500C5.00X
2	Number of Cores		Single Core
3	Voltage	[kV]	500
4	Conductor Area	[in²]	3.93
5	Cable Overall Diameter	[in]	5.99
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.49
Conductor Shield			
19	Thickness	[in]	0.059
20	Diameter	[in]	2.608
Insulation			
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.1000ft]	1858
26	Thickness	[in]	1.22
27	Diameter	[in]	5.049
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.059
30	Diameter	[in]	5.167
Non Metallic Layer - Water Swellable Tape			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.037
34	Diameter	[in]	5.241
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		36
44	Wire Gauge		Undefined
45	Thickness	[in]	0.087
46	Diameter	[in]	5.414
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Non Corrugated
54	Thickness	[in]	0.011
55	Diameter	[in]	5.436
Jacket			
56	Material		Polyethylene
57	Thermal Resistivity	[K.m/W]	3.5
58	Thickness	[in]	0.277
59	Diameter	[in]	5.99



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	H103-230_500kV,40_DOC,30_60_,5000kcmilInCu,@4499_5152A DLF1
Date:	11/4/2024 12:54:32 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		230C5.00X1
2	Number of Cores		Single Core
3	Voltage	[kV]	230
4	Conductor Area	[in²]	3.931
5	Cable Overall Diameter	[in]	5.22
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.54
Conductor Shield			
19	Thickness	[in]	0.1
20	Diameter	[in]	2.74
Insulation			
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.1000ft]	1858
26	Thickness	[in]	0.906
27	Diameter	[in]	4.552
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.05
30	Diameter	[in]	4.652
Non Metallic Layer - Water Swellable Tape 1			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.02
34	Diameter	[in]	4.692
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		46
44	Wire Gauge		14
45	Thickness	[in]	0.064
46	Diameter	[in]	4.82
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Longitudinally Corrugated
54	Corrugation height	[in]	0.006
55	Tape overlap	[in]	0.499999999
56	Tape width	[in]	15.91299998
57	Tape thickness	[in]	0.008
58	Accumulation factor		1.2
59	Thickness	[in]	0.006
60	Diameter	[in]	4.912
Jacket			
61	Material		Polyethylene
62	Thermal Resistivity	[K.m/W]	3.5
63	Thickness	[in]	0.154
64	Diameter	[in]	5.22



Study Summary

CYMCAP Version	6.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	H104-230_500kV_40_DOC_25_60_5000kcmilInCu.@4355_5147A DLF1
Date:	11/4/2024 10:35:02 AM

General Simulation Data

Steady State Option	Unequally 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

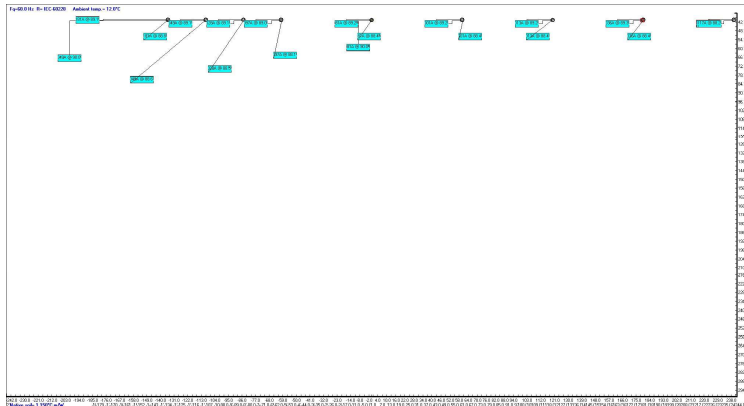
Standard Settings Options

General guidance	Custom
Factor on RAC due to magnetic armour	CIGREGuidance
Factor on RAC due to magnetic duct	CIGREGuidance
Factor on λ_2 due to magnetic armour	CYMCAPGuidance
Factor on λ_2 due to magnetic duct	CIGREGuidance
Factor on λ_2 due to λ'_1	CYMCAPGuidance
λ'_1 computation	CIGREGuidance
λ_2 pipe computation	CYMCAPGuidance
Wd computation	CIGREGuidance
T_2 computation	CIGREGuidance
T_4 computation	CYMCAPGuidance

Installation Type: Multiple Ductbanks/Backfills

Ambient Soil Temperature at Installation Depth	[°C]	12.0
Native Soil Thermal Resistivity	[K.m/W]	1.15
Consider Non-Isothermal Earth Surface		No

Layer Name	X [ft]	Y [ft]	Width [ft]	Height [ft]	Thermal Resistivity [K.m/W]
NSTD DB2	0.0	41.429	2.6	2.6	0.8
NSTD DB4	60.0	41.429	2.6	2.6	0.8
NSTD DB5	120.0	41.429	2.6	2.6	0.8
NSTD DB6	180.001	41.429	2.6	2.6	0.8
NSTD DB7	240.001	41.429	2.6	2.6	0.8
NSTD DB6	-60.0	41.429	2.6	2.6	0.8
NSTD DB7	-85.0	41.429	2.6	2.6	0.8
NSTD DB8	-110.0	41.429	2.6	2.6	0.8
NSTD DB9	-135.0	41.429	2.6	2.6	0.8



Results Summary

Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [ft]	Y coordinate [ft]	Conductor temperature [°C]	Ampacity [A]
1	500C5.00X	1		A	60.0	1.0	-0.5	41.93	90.0	981.0
2	500C5.00X	1		B	60.0	1.0	-0.5	40.93	89.2	981.0
3	500C5.00X	1		C	60.0	1.0	0.5	40.93	88.4	981.0
4	500C5.00X	2		A	60.0	1.0	59.5	41.93	90.0	1000.9
5	500C5.00X	2		B	60.0	1.0	59.5	40.93	89.2	1000.9
6	500C5.00X	2		C	60.0	1.0	60.5	40.93	88.4	1000.9
7	500C5.00X	3		A	60.0	1.0	119.5	41.93	90.0	1012.7
8	500C5.00X	3		B	60.0	1.0	119.5	40.93	89.2	1012.7
9	500C5.00X	3		C	60.0	1.0	120.5	40.93	88.4	1012.7
10	500C5.00X	4		A	60.0	1.0	179.5	41.93	90.0	1035.9
11	500C5.00X	4		B	60.0	1.0	179.5	40.93	89.3	1035.9
12	500C5.00X	4		C	60.0	1.0	180.5	40.93	88.4	1035.9
13	500C5.00X	5		A	60.0	1.0	239.5	41.93	90.0	1116.5
14	500C5.00X	5		B	60.0	1.0	239.5	40.93	89.3	1116.5
15	500C5.00X	5		C	60.0	1.0	240.5	40.93	88.2	1116.5
16	230C5.00X1	6		A	60.0	1.0	-60.5	41.93	90.0	1096.7
17	230C5.00X1	6		B	60.0	1.0	-60.5	40.93	89.0	1096.7
18	230C5.00X1	6		C	60.0	1.0	-59.5	40.93	88.1	1096.7
19	230C5.00X1	7		A	60.0	1.0	-85.5	41.93	90.0	1027.6
20	230C5.00X1	7		B	60.0	1.0	-85.5	40.93	89.1	1027.6
21	230C5.00X1	7		C	60.0	1.0	-84.5	40.93	88.5	1027.6
22	230C5.00X1	8		A	60.0	1.0	-110.5	41.93	90.0	1049.4
23	230C5.00X1	8		B	60.0	1.0	-110.5	40.93	89.1	1049.4
24	230C5.00X1	8		C	60.0	1.0	-109.5	40.93	88.6	1049.4
25	230C5.00X1	9		A	60.0	1.0	-135.5	41.93	90.0	1180.8
26	230C5.00X1	9		B	60.0	1.0	-135.5	40.93	89.1	1180.8
27	230C5.00X1	9		C	60.0	1.0	-134.5	40.93	88.8	1180.8

Simulation Data	
Installation type:	Multiple Outcrops
Steady State Option	Unequally Loaded
Ambient temperature [°C]	12
Native Soil Thermal Resistivity [K.m/W]	1.15
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 Inlet Number		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
General Data																														
Cable ID	Cable Equipment ID	Cable	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X	0005.500X
Circuit No.	Circuit Name	Circuit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
Phase	Phase	Phase	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A
Fs	Operating Pressure	[Pa]	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	
Y	Y coordinate	[m]	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	
Z	Z coordinate	[m]	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	
DLF	Load Factor	[kPa]	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Running Type	Running Type	Running Type	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	Point Bonded Transverse	
Agency																														
I	Steady State Amplitude	[A]	981.0	981.0	981.0	1000.0	1000.0	1000.0	1000.0	1017.0	1017.0	1017.0	1035.0	1035.0	1035.0	1053.0	1053.0	1053.0	1071.0	1071.0	1071.0	1077.0	1077.0	1077.0	1084.0	1084.0	1084.0	1100.0	1100.0	1100.0
TC1	Conductor temperature	[°C]	90.0	88.2	88.4	90.0	89.0	88.2	88.4	90.0	89.0	88.2	88.4	90.0	89.0	88.2	88.4	90.0	89.0	88.2	88.4	90.0	89.0	88.2	88.4	90.0	89.0	88.2	88.4	90.0
TS	Sheath/BI&M temperature	[°C]	84.6	83.8	83.8	84.5	83.7	83.9	84.4	83.6	83.8	84.2	83.5	83.7	83.8	84.3	83.6	83.8	84.0	83.7	83.5	84.7	83.7	83.1	85.2	84.6	85.0	84.0	85.8	84.8
TSa	Armour temperature	[°C]	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
TC2	Cable surface temperature	[°C]	83.7	83.9	84.1	83.3	83.7	83.9	83.4	83.6	83.8	83.2	83.4	83																

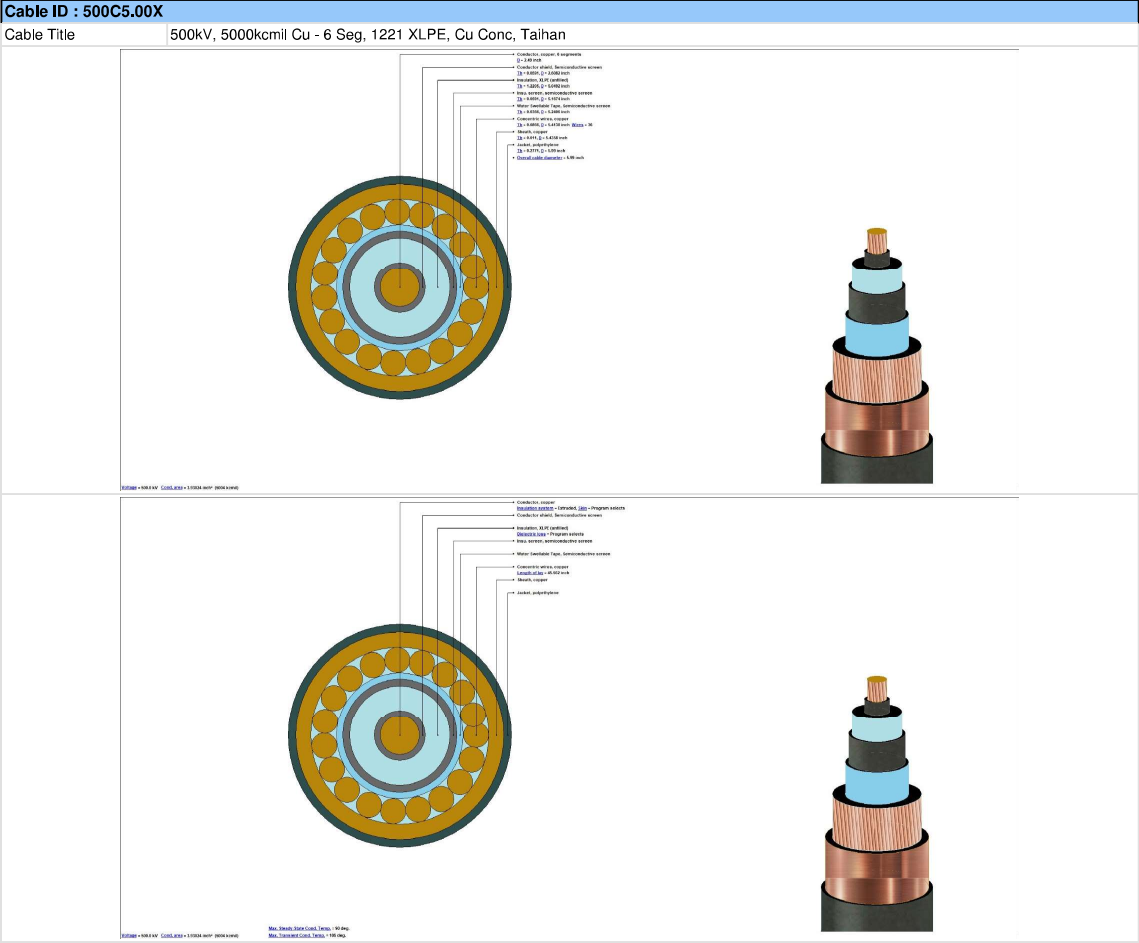


Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	H104-230_500kV_40_DOC_25_60_5000kcmilInCu.@4355_5147A DLF1
Date:	11/4/2024 10:35:02 AM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		500C5.00X
2	Number of Cores		Single Core
3	Voltage	[kV]	500
4	Conductor Area	[in²]	3.93
5	Cable Overall Diameter	[in]	5.99
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.49
Conductor Shield			
19	Thickness	[in]	0.059
20	Diameter	[in]	2.608
Insulation			
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.1000ft]	1858
26	Thickness	[in]	1.22
27	Diameter	[in]	5.049
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.059
30	Diameter	[in]	5.167
Non Metallic Layer - Water Swellable Tape			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.037
34	Diameter	[in]	5.241
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		36
44	Wire Gauge		Undefined
45	Thickness	[in]	0.087
46	Diameter	[in]	5.414
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Non Corrugated
54	Thickness	[in]	0.011
55	Diameter	[in]	5.436
Jacket			
56	Material		Polyethylene
57	Thermal Resistivity	[K.m/W]	3.5
58	Thickness	[in]	0.277
59	Diameter	[in]	5.99

No.	Description	Unit	1
Specific Installation Data			
60	Cable Equipment ID		500C5.00X
61	Cable Frequency	[Hz]	60
62	Sheath / Shield Bonding		1 Conductor 1 Point Bonded Triangular
63	Loss Factor Constant (ALOS)		0.3
64	Spacing Between Cables in Section		n/a
65	Duct construction		PVC Duct in Concrete
66	Duct material thermal resistivity	[K.m/W]	6
67	Duct filling material		Air
68	Inner diameter of the conduit	[in]	7.942
69	Outer diameter of the conduit	[in]	8.625





Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	H104-230_500kV,40_DOC,25_60_,5000kcmilInCu,@4355_5147A DLF1
Date:	11/4/2024 10:35:02 AM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		230C5.00X1
2	Number of Cores		Single Core
3	Voltage	[kV]	230
4	Conductor Area	[in²]	3.931
5	Cable Overall Diameter	[in]	5.22
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.54
Conductor Shield			
19	Thickness	[in]	0.1
20	Diameter	[in]	2.74
Insulation			
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.1000ft]	1858
26	Thickness	[in]	0.906
27	Diameter	[in]	4.552
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.05
30	Diameter	[in]	4.652
Non Metallic Layer - Water Swellable Tape 1			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.02
34	Diameter	[in]	4.692
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		46
44	Wire Gauge		14
45	Thickness	[in]	0.064
46	Diameter	[in]	4.82
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Longitudinally Corrugated
54	Corrugation height	[in]	0.006
55	Tape overlap	[in]	0.499999999
56	Tape width	[in]	15.91299998
57	Tape thickness	[in]	0.008
58	Accumulation factor		1.2
59	Thickness	[in]	0.006
60	Diameter	[in]	4.912
Jacket			
61	Material		Polyethylene
62	Thermal Resistivity	[K.m/W]	3.5
63	Thickness	[in]	0.154
64	Diameter	[in]	5.22



Study Summary

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	H105-230_500kV_40_DOC_15__60_5000kcmilInCu_@3972_5140A DLF1
Date:	11/4/2024 8:26:44 AM

General Simulation Data

Steady State Option	Unequally 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

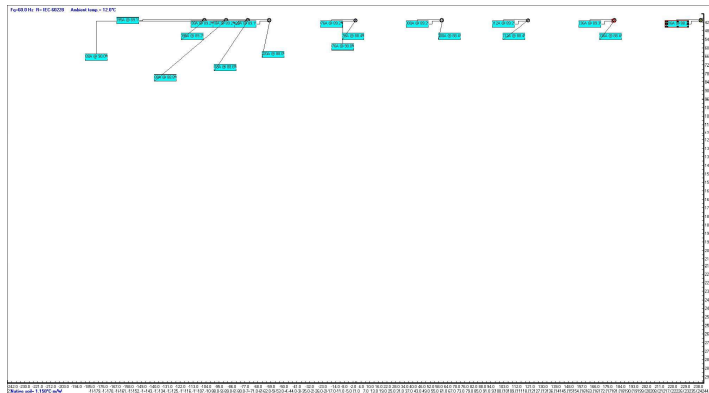
Standard Settings Options

General guidance	Custom
Factor on RAC due to magnetic armour	CIGREGuidance
Factor on RAC due to magnetic duct	CIGREGuidance
Factor on λ_s due to magnetic armour	CYMCAPGuidance
Factor on λ_s due to magnetic duct	CIGREGuidance
Factor on λ_s due to λ_1	CYMCAPGuidance
λ_1 computation	CIGREGuidance
λ_2 pipe computation	CYMCAPGuidance
Wd computation	CIGREGuidance
T_2 computation	CIGREGuidance
T_4 computation	CYMCAPGuidance

Installation Type:Multiple Ductbanks/Backfills

Ambient Soil Temperature at Installation Depth	[°C]	12.0
Native Soil Thermal Resistivity	[K.m/W]	1.15
Consider Non-Isothermal Earth Surface		No

Layer Name	X [ft]	Y [ft]	Width [ft]	Height [ft]	Thermal Resistivity [K.m/W]
NSTD DB2	0.0	41.429	2.6	2.6	0.8
NSTD DB4	60.0	41.429	2.6	2.6	0.8
NSTD DB5	120.0	41.429	2.6	2.6	0.8
NSTD DB6	180.001	41.429	2.6	2.6	0.8
NSTD DB7	240.001	41.429	2.6	2.6	0.8
NSTD DB6	-60.0	41.429	2.6	2.6	0.8
NSTD DB7	-75.0	41.429	2.6	2.6	0.8
NSTD DB8	-90.0	41.429	2.6	2.6	0.8
NSTD DB9	-105.0	41.429	2.6	2.6	0.8



Results Summary

Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [ft]	Y coordinate [ft]	Conductor temperature [°C]	Ampacity [A]
1	500C5.00X	1		A	60.0	1.0	-0.5	41.93	90.0	975.5
2	500C5.00X	1		B	60.0	1.0	-0.5	40.93	89.2	975.5
3	500C5.00X	1		C	60.0	1.0	0.5	40.93	88.4	975.5
4	500C5.00X	2		A	60.0	1.0	59.5	41.93	90.0	999.8
5	500C5.00X	2		B	60.0	1.0	59.5	40.93	89.2	999.8
6	500C5.00X	2		C	60.0	1.0	60.5	40.93	88.4	999.8
7	500C5.00X	3		A	60.0	1.0	119.5	41.93	90.0	1012.4
8	500C5.00X	3		B	60.0	1.0	119.5	40.93	89.2	1012.4
9	500C5.00X	3		C	60.0	1.0	120.5	40.93	88.4	1012.4
10	500C5.00X	4		A	60.0	1.0	179.5	41.93	90.0	1035.9
11	500C5.00X	4		B	60.0	1.0	179.5	40.93	89.3	1035.9
12	500C5.00X	4		C	60.0	1.0	180.5	40.93	88.4	1035.9
13	500C5.00X	5		A	60.0	1.0	239.5	41.93	90.0	1116.5
14	500C5.00X	5		B	60.0	1.0	239.5	40.93	89.3	1116.5
15	500C5.00X	5		C	60.0	1.0	240.5	40.93	88.2	1116.5
16	230C5.00X1	6		A	60.0	1.0	-60.5	41.93	90.0	1020.1
17	230C5.00X1	6		B	60.0	1.0	-60.5	40.93	89.1	1020.1
18	230C5.00X1	6		C	60.0	1.0	-59.5	40.93	88.0	1020.1
19	230C5.00X1	7		A	60.0	1.0	-75.5	41.93	90.0	918.1
20	230C5.00X1	7		B	60.0	1.0	-75.5	40.93	89.2	918.1
21	230C5.00X1	7		C	60.0	1.0	-74.5	40.93	88.6	918.1
22	230C5.00X1	8		A	60.0	1.0	-90.5	41.93	90.0	938.2
23	230C5.00X1	8		B	60.0	1.0	-90.5	40.93	89.2	938.2
24	230C5.00X1	8		C	60.0	1.0	-89.5	40.93	88.8	938.2
25	230C5.00X1	9		A	60.0	1.0	-105.5	41.93	90.0	1095.4
26	230C5.00X1	9		B	60.0	1.0	-105.5	40.93	89.1	1095.4
27	230C5.00X1	9		C	60.0	1.0	-104.5	40.93	89.2	1095.4

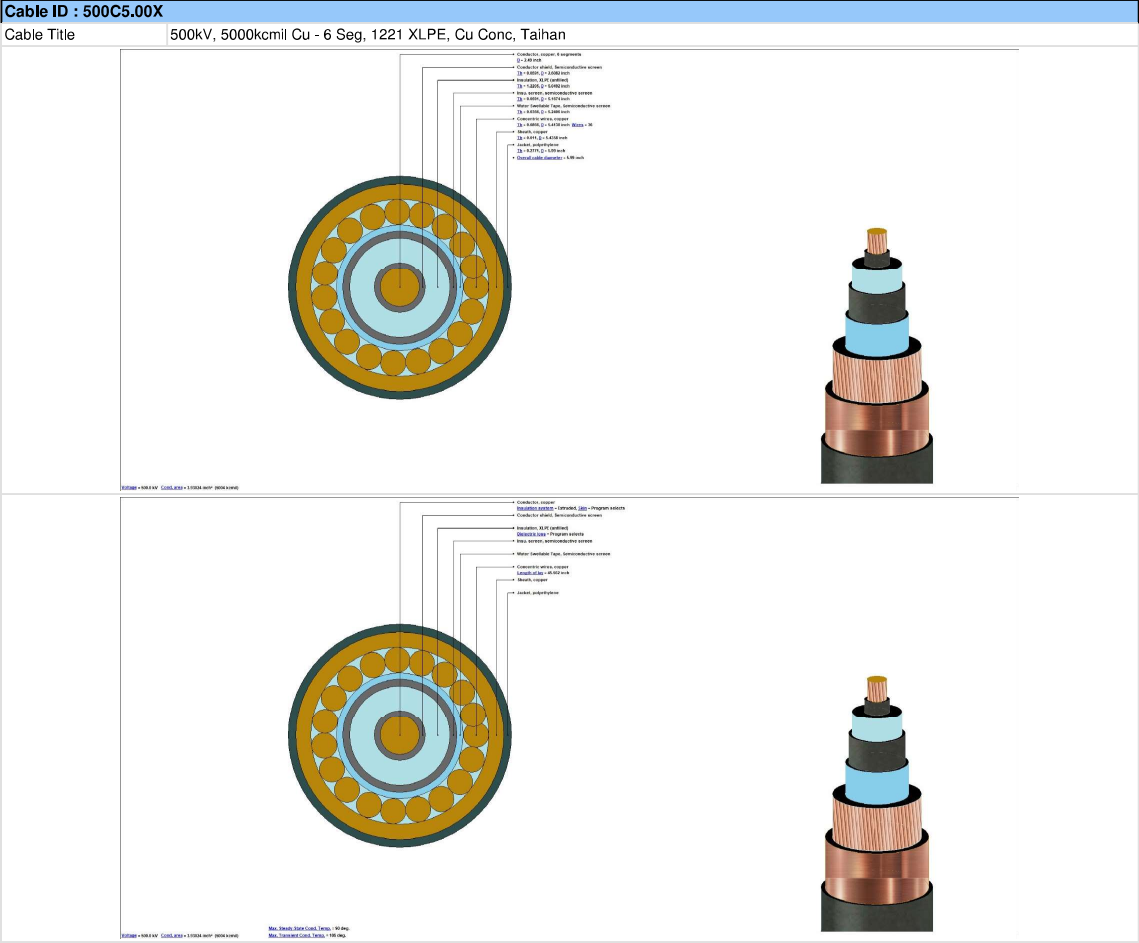


Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	H105-230_500kV,40_DOC,15_60_5000kcmilInCu,@3972_5140A DLF1
Date:	11/4/2024 8:26:44 AM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		500C5.00X
2	Number of Cores		Single Core
3	Voltage	[kV]	500
4	Conductor Area	[in²]	3.93
5	Cable Overall Diameter	[in]	5.99
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.49
Conductor Shield			
19	Thickness	[in]	0.059
20	Diameter	[in]	2.608
Insulation			
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.1000ft]	1858
26	Thickness	[in]	1.22
27	Diameter	[in]	5.049
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.059
30	Diameter	[in]	5.167
Non Metallic Layer - Water Swellable Tape			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.037
34	Diameter	[in]	5.241
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		36
44	Wire Gauge		Undefined
45	Thickness	[in]	0.087
46	Diameter	[in]	5.414
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Non Corrugated
54	Thickness	[in]	0.011
55	Diameter	[in]	5.436
Jacket			
56	Material		Polyethylene
57	Thermal Resistivity	[K.m/W]	3.5
58	Thickness	[in]	0.277
59	Diameter	[in]	5.99

No.	Description	Unit	1
Specific Installation Data			
60	Cable Equipment ID		500C5.00X
61	Cable Frequency	[Hz]	60
62	Sheath / Shield Bonding		1 Conductor 1 Point Bonded Triangular
63	Loss Factor Constant (ALOS)		0.3
64	Spacing Between Cables in Section		n/a
65	Duct construction		PVC Duct in Concrete
66	Duct material thermal resistivity	[K.m/W]	6
67	Duct filling material		Air
68	Inner diameter of the conduit	[in]	7.942
69	Outer diameter of the conduit	[in]	8.625





Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	H105-230_500kV_40_DOC;15__60__5000kcmilInCu.@3972_5140A DLF1
Date:	11/4/2024 8:26:44 AM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		230C5.00X1
2	Number of Cores		Single Core
3	Voltage	[kV]	230
4	Conductor Area	[in²]	3.931
5	Cable Overall Diameter	[in]	5.22
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.54
Conductor Shield			
19	Thickness	[in]	0.1
20	Diameter	[in]	2.74
Insulation			
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.1000ft]	1858
26	Thickness	[in]	0.906
27	Diameter	[in]	4.552
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.05
30	Diameter	[in]	4.652
Non Metallic Layer - Water Swellable Tape 1			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.02
34	Diameter	[in]	4.692
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		46
44	Wire Gauge		14
45	Thickness	[in]	0.064
46	Diameter	[in]	4.82
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Longitudinally Corrugated
54	Corrugation height	[in]	0.006
55	Tape overlap	[in]	0.499999999
56	Tape width	[in]	15.91299998
57	Tape thickness	[in]	0.008
58	Accumulation factor		1.2
59	Thickness	[in]	0.006
60	Diameter	[in]	4.912
Jacket			
61	Material		Polyethylene
62	Thermal Resistivity	[K.m/W]	3.5
63	Thickness	[in]	0.154
64	Diameter	[in]	5.22



Study Summary

CYMCAP Version	6.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	I100-230_500kV_30_DOC_90_52_5000kcmilnCcu.@4222_5590A DLF1
Date:	11/3/2024 3:21:12 PM

General Simulation Data

Steady State Option	Unequally 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

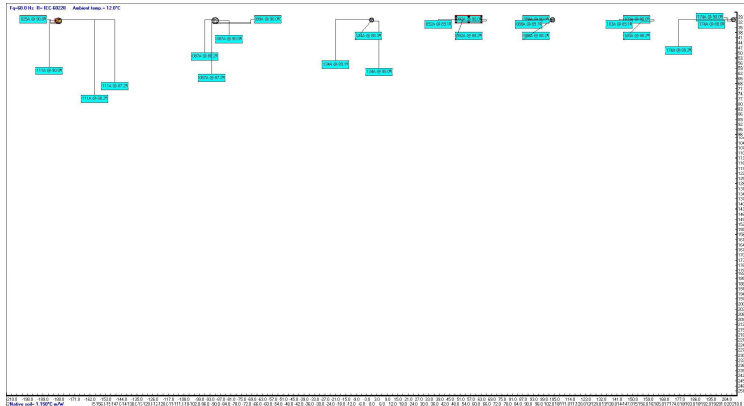
Standard Settings Options

General guidance	Custom
Factor on RAC due to magnetic armour	CIGREGuidance
Factor on RAC due to magnetic duct	CIGREGuidance
Factor on λ_2 due to magnetic armour	CYMCAPGuidance
Factor on λ_2 due to magnetic duct	CIGREGuidance
Factor on λ_2 due to λ'_1	CYMCAPGuidance
λ'_1 computation	CIGREGuidance
λ_2 pipe computation	CYMCAPGuidance
Wd computation	CIGREGuidance
T_2 computation	CIGREGuidance
T_4 computation	CYMCAPGuidance

Installation Type: Multiple Ductbanks/Backfills

Ambient Soil Temperature at Installation Depth	[°C]	12.0
Native Soil Thermal Resistivity	[K.m/W]	1.15
Consider Non-Isothermal Earth Surface		No

Layer Name	X [ft]	Y [ft]	Width [ft]	Height [ft]	Thermal Resistivity [K.m/W]
NSTD DB1	-90.0	31.933	3.517	3.517	0.8
NSTD DB2	0.0	31.429	2.6	2.6	0.8
NSTD DB3	-180.001	31.933	3.517	3.517	0.8
NSTD DB4	52.0	31.429	2.6	2.6	0.8
NSTD DB5	104.0	31.429	2.6	2.6	0.8
NSTD DB6	156.001	31.429	2.6	2.6	0.8
NSTD DB7	208.001	31.429	2.6	2.6	0.8



Results Summary

Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [ft]	Y coordinate [ft]	Conductor temperature [°C]	Ampacity [A]
1	230C5.00X1	1		A	60.0	1.0	-91.08	31.88	90.0	1086.9
2	230C5.00X1	1		B	60.0	1.0	-90.5	31.05	88.2	1086.9
3	230C5.00X1	1		C	60.0	1.0	-89.5	31.05	87.2	1086.9
4	230C5.00X1	2		A	60.0	1.0	-90.0	33.38	89.8	999.1
5	230C5.00X1	2		B	60.0	1.0	-89.22	32.88	88.0	999.1
6	230C5.00X1	2		C	60.0	1.0	-90.78	32.88	90.0	999.1
7	500C5.00X	3		A	60.0	1.0	-0.5	31.93	90.0	1133.7
8	500C5.00X	3		B	60.0	1.0	-0.5	30.93	89.1	1133.7
9	500C5.00X	3		C	60.0	1.0	0.5	30.93	88.3	1133.7
10	230C5.00X1	4		A	60.0	1.0	-181.08	31.88	90.0	1111.5
11	230C5.00X1	4		B	60.0	1.0	-180.5	31.05	88.2	1111.5
12	230C5.00X1	4		C	60.0	1.0	-179.5	31.05	87.2	1111.5
13	230C5.00X1	5		A	60.0	1.0	-180.0	33.38	89.8	1024.9
14	230C5.00X1	5		B	60.0	1.0	-179.22	32.88	88.0	1024.9
15	230C5.00X1	5		C	60.0	1.0	-180.78	32.88	90.0	1024.9
16	500C5.00X	6		A	60.0	1.0	51.5	31.93	90.0	1091.9
17	500C5.00X	6		B	60.0	1.0	51.5	30.93	89.1	1091.9
18	500C5.00X	6		C	60.0	1.0	52.5	30.93	88.2	1091.9
19	500C5.00X	7		A	60.0	1.0	103.5	31.93	90.0	1087.5
20	500C5.00X	7		B	60.0	1.0	103.5	30.93	89.1	1087.5
21	500C5.00X	7		C	60.0	1.0	104.5	30.93	88.2	1087.5
22	500C5.00X	8		A	60.0	1.0	155.5	31.93	90.0	1102.7
23	500C5.00X	8		B	60.0	1.0	155.5	30.93	89.1	1102.7
24	500C5.00X	8		C	60.0	1.0	156.5	30.93	88.2	1102.7
25	500C5.00X	9		A	60.0	1.0	207.5	31.93	90.0	1173.9
26	500C5.00X	9		B	60.0	1.0	207.5	30.93	89.2	1173.9
27	500C5.00X	9		C	60.0	1.0	208.5	30.93	88.0	1173.9

5

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Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	I100-230_500kV,30_DOC,90_52_5000kcmilInCu,@4222_5590A DLF1
Date:	11/3/2024 3:21:12 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		230C5.00X1
2	Number of Cores		Single Core
3	Voltage	[kV]	230
4	Conductor Area	[in²]	3.931
5	Cable Overall Diameter	[in]	5.22
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.54
Conductor Shield			
19	Thickness	[in]	0.1
20	Diameter	[in]	2.74
Insulation			
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.1000ft]	1858
26	Thickness	[in]	0.906
27	Diameter	[in]	4.552
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.05
30	Diameter	[in]	4.652
Non Metallic Layer - Water Swellable Tape 1			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.02
34	Diameter	[in]	4.692
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		46
44	Wire Gauge		14
45	Thickness	[in]	0.064
46	Diameter	[in]	4.82
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Longitudinally Corrugated
54	Corrugation height	[in]	0.006
55	Tape overlap	[in]	0.499999999
56	Tape width	[in]	15.91299998
57	Tape thickness	[in]	0.008
58	Accumulation factor		1.2
59	Thickness	[in]	0.006
60	Diameter	[in]	4.912
Jacket			
61	Material		Polyethylene
62	Thermal Resistivity	[K.m/W]	3.5
63	Thickness	[in]	0.154
64	Diameter	[in]	5.22



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	H00-230_500kV_30_DOC,90_52_,5000kcmilInCu.@4222_5590A DLF1
Date:	11/3/2024 3:21:12 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		500C5.00X
2	Number of Cores		Single Core
3	Voltage	[kV]	500
4	Conductor Area	[in²]	3.93
5	Cable Overall Diameter	[in]	5.99
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.49
Conductor Shield			
19	Thickness	[in]	0.059
20	Diameter	[in]	2.608
Insulation			
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.1000ft]	1858
26	Thickness	[in]	1.22
27	Diameter	[in]	5.049
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.059
30	Diameter	[in]	5.167
Non Metallic Layer - Water Swellable Tape			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.037
34	Diameter	[in]	5.241
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		36
44	Wire Gauge		Undefined
45	Thickness	[in]	0.087
46	Diameter	[in]	5.414
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Non Corrugated
54	Thickness	[in]	0.011
55	Diameter	[in]	5.436
Jacket			
56	Material		Polyethylene
57	Thermal Resistivity	[K.m/W]	3.5
58	Thickness	[in]	0.277
59	Diameter	[in]	5.99



Study Summary

CYMCAP Version	6.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	I101-230_500kV_30_DOC_85_-45_5000kcmilInCu_@4195_5420A DLF1
Date:	11/3/2024 2:11:08 PM

General Simulation Data

Steady State Option	Unequally 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

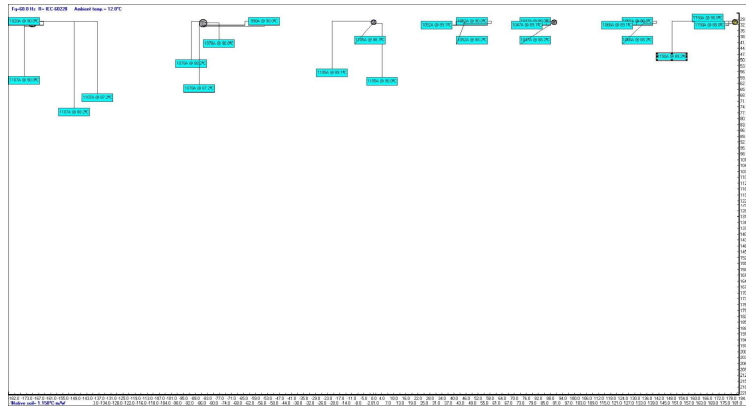
Standard Settings Options

General guidance	Custom
Factor on RAC due to magnetic armour	CIGREGuidance
Factor on RAC due to magnetic duct	CIGREGuidance
Factor on λ_2 due to magnetic armour	CYMCAPGuidance
Factor on λ_2 due to magnetic duct	CIGREGuidance
Factor on λ_2 due to λ'_1	CYMCAPGuidance
λ'_1 computation	CIGREGuidance
λ_2 pipe computation	CYMCAPGuidance
Wd computation	CIGREGuidance
T_2 computation	CIGREGuidance
T_4 computation	CYMCAPGuidance

Installation Type:Multiple Ductbanks/Backfills

Ambient Soil Temperature at Installation Depth	[°C]	12.0
Native Soil Thermal Resistivity	[K.m/W]	1.15
Consider Non-Isothermal Earth Surface		No

Layer Name	X [ft]	Y [ft]	Width [ft]	Height [ft]	Thermal Resistivity [K.m/W]
NSTD DB1	-85.0	31.933	3.517	3.517	0.8
NSTD DB2	0.0	31.429	2.6	2.6	0.8
NSTD DB3	-170.001	31.933	3.517	3.517	0.8
NSTD DB4	45.0	31.429	2.6	2.6	0.8
NSTD DB5	90.0	31.429	2.6	2.6	0.8
NSTD DB6	135.0	31.429	2.6	2.6	0.8
NSTD DB7	180.001	31.429	2.6	2.6	0.8



Results Summary

Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [ft]	Y coordinate [ft]	Conductor temperature [°C]	Ampacity [A]
1	230C5.00X1	1		A	60.0	1.0	-86.08	31.88	90.0	1078.3
2	230C5.00X1	1		B	60.0	1.0	-85.5	31.05	88.2	1078.3
3	230C5.00X1	1		C	60.0	1.0	-84.5	31.05	87.2	1078.3
4	230C5.00X1	2		A	60.0	1.0	-85.0	33.38	89.8	989.7
5	230C5.00X1	2		B	60.0	1.0	-84.22	32.88	88.0	989.7
6	230C5.00X1	2		C	60.0	1.0	-85.78	32.88	90.0	989.7
7	500C5.00X	3		A	60.0	1.0	-0.5	31.93	90.0	1105.1
8	500C5.00X	3		B	60.0	1.0	-0.5	30.93	89.1	1105.1
9	500C5.00X	3		C	60.0	1.0	0.5	30.93	88.3	1105.1
10	230C5.00X1	4		A	60.0	1.0	-171.08	31.88	90.0	1107.1
11	230C5.00X1	4		B	60.0	1.0	-170.5	31.05	88.2	1107.1
12	230C5.00X1	4		C	60.0	1.0	-169.5	31.05	87.2	1107.1
13	230C5.00X1	5		A	60.0	1.0	-170.0	33.38	89.8	1020.1
14	230C5.00X1	5		B	60.0	1.0	-169.22	32.88	88.0	1020.1
15	230C5.00X1	5		C	60.0	1.0	-170.78	32.88	90.0	1020.1
16	500C5.00X	6		A	60.0	1.0	44.5	31.93	90.0	1052.4
17	500C5.00X	6		B	60.0	1.0	44.5	30.93	89.1	1052.4
18	500C5.00X	6		C	60.0	1.0	45.5	30.93	88.2	1052.4
19	500C5.00X	7		A	60.0	1.0	89.5	31.93	90.0	1046.8
20	500C5.00X	7		B	60.0	1.0	89.5	30.93	89.1	1046.8
21	500C5.00X	7		C	60.0	1.0	90.5	30.93	88.2	1046.8
22	500C5.00X	8		A	60.0	1.0	134.5	31.93	90.0	1065.9
23	500C5.00X	8		B	60.0	1.0	134.5	30.93	89.1	1065.9
24	500C5.00X	8		C	60.0	1.0	135.5	30.93	88.2	1065.9
25	500C5.00X	9		A	60.0	1.0	179.5	31.93	90.0	1150.4
26	500C5.00X	9		B	60.0	1.0	179.5	30.93	89.2	1150.4
27	500C5.00X	9		C	60.0	1.0	180.5	30.93	88.0	1150.4



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	I101-230_500kV,30_DOC,85_45_5000kcmilInCu,@4195_5420A DLF1
Date:	11/3/2024 2:11:08 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		230C5.00X1
2	Number of Cores		Single Core
3	Voltage	[kV]	230
4	Conductor Area	[in²]	3.931
5	Cable Overall Diameter	[in]	5.22
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.54
Conductor Shield			
19	Thickness	[in]	0.1
20	Diameter	[in]	2.74
Insulation			
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.1000ft]	1858
26	Thickness	[in]	0.906
27	Diameter	[in]	4.552
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.05
30	Diameter	[in]	4.652
Non Metallic Layer - Water Swellable Tape 1			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.02
34	Diameter	[in]	4.692
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		46
44	Wire Gauge		14
45	Thickness	[in]	0.064
46	Diameter	[in]	4.82
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Longitudinally Corrugated
54	Corrugation height	[in]	0.006
55	Tape overlap	[in]	0.499999999
56	Tape width	[in]	15.91299998
57	Tape thickness	[in]	0.008
58	Accumulation factor		1.2
59	Thickness	[in]	0.006
60	Diameter	[in]	4.912
Jacket			
61	Material		Polyethylene
62	Thermal Resistivity	[K.m/W]	3.5
63	Thickness	[in]	0.154
64	Diameter	[in]	5.22



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	H01-230_500kV.30_DOC.85_45_.5000kcmilInCu.@4195_5420A DLF1
Date:	11/3/2024 2:11:08 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		500C5.00X
2	Number of Cores		Single Core
3	Voltage	[kV]	500
4	Conductor Area	[in²]	3.93
5	Cable Overall Diameter	[in]	5.99
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.49
Conductor Shield			
19	Thickness	[in]	0.059
20	Diameter	[in]	2.608
Insulation			
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.1000ft]	1858
26	Thickness	[in]	1.22
27	Diameter	[in]	5.049
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.059
30	Diameter	[in]	5.167
Non Metallic Layer - Water Swellable Tape			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.037
34	Diameter	[in]	5.241
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		36
44	Wire Gauge		Undefined
45	Thickness	[in]	0.087
46	Diameter	[in]	5.414
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Non Corrugated
54	Thickness	[in]	0.011
55	Diameter	[in]	5.436
Jacket			
56	Material		Polyethylene
57	Thermal Resistivity	[K.m/W]	3.5
58	Thickness	[in]	0.277
59	Diameter	[in]	5.99



Study Summary

CYMECAP Version	6.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	I102-230_500kV_30_DOC_65_30_5000kcmilnCcu@4052_4857A DLF1
Date:	11/3/2024 11:03:17 AM

General Simulation Data

Steady State Option	Unequally 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

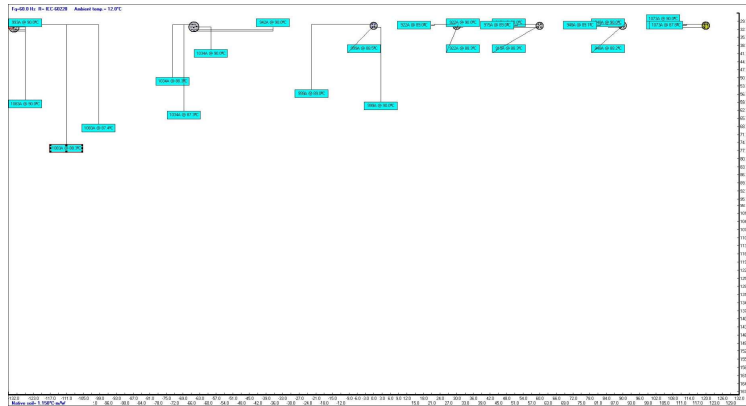
Standard Settings Options

General guidance	Custom
Factor on RAC due to magnetic armour	CIGREGuidance
Factor on RAC due to magnetic duct	CIGREGuidance
Factor on λ_2 due to magnetic armour	CYMECAPGuidance
Factor on λ_2 due to magnetic duct	CIGREGuidance
Factor on λ_2 due to λ'_1	CYMECAPGuidance
λ'_1 computation	CIGREGuidance
λ_2 pipe computation	CYMECAPGuidance
Wd computation	CIGREGuidance
T_2 computation	CIGREGuidance
T_4 computation	CYMECAPGuidance

Installation Type:Multiple Ductbanks/Backfills

Ambient Soil Temperature at Installation Depth	[°C]	12.0
Native Soil Thermal Resistivity	[K.m/W]	1.15
Consider Non-Isothermal Earth Surface		No

Layer Name	X [ft]	Y [ft]	Width [ft]	Height [ft]	Thermal Resistivity [K.m/W]
NSTD DB1	-65.0	31.933	3.517	3.517	0.8
NSTD DB2	0.0	31.429	2.6	2.6	0.8
NSTD DB3	-130.0	31.933	3.517	3.517	0.8
NSTD DB4	30.0	31.429	2.6	2.6	0.8
NSTD DB5	60.0	31.429	2.6	2.6	0.8
NSTD DB6	90.0	31.429	2.6	2.6	0.8
NSTD DB7	120.0	31.429	2.6	2.6	0.8



Results Summary

Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [ft]	Y coordinate [ft]	Conductor temperature [°C]	Ampacity [A]
1	230C5.00X1	1		A	60.0	1.0	-66.08	31.88	90.0	1034.3
2	230C5.00X1	1		B	60.0	1.0	-65.5	31.05	88.3	1034.3
3	230C5.00X1	1		C	60.0	1.0	-64.5	31.05	87.3	1034.3
4	230C5.00X1	2		A	60.0	1.0	-65.0	33.38	89.9	942.1
5	230C5.00X1	2		B	60.0	1.0	-64.22	32.88	88.1	942.1
6	230C5.00X1	2		C	60.0	1.0	-65.78	32.88	90.0	942.1
7	500C5.00X	3		A	60.0	1.0	-0.5	31.93	90.0	998.6
8	500C5.00X	3		B	60.0	1.0	-0.5	30.93	89.0	998.6
9	500C5.00X	3		C	60.0	1.0	0.5	30.93	88.5	998.6
10	230C5.00X1	4		A	60.0	1.0	-131.08	31.88	90.0	1083.0
11	230C5.00X1	4		B	60.0	1.0	-130.5	31.05	88.3	1083.0
12	230C5.00X1	4		C	60.0	1.0	-129.5	31.05	87.4	1083.0
13	230C5.00X1	5		A	60.0	1.0	-130.0	33.38	89.9	993.3
14	230C5.00X1	5		B	60.0	1.0	-129.22	32.88	88.2	993.3
15	230C5.00X1	5		C	60.0	1.0	-130.78	32.88	90.0	993.3
16	500C5.00X	6		A	60.0	1.0	29.5	31.93	90.0	921.6
17	500C5.00X	6		B	60.0	1.0	29.5	30.93	89.0	921.6
18	500C5.00X	6		C	60.0	1.0	30.5	30.93	88.3	921.6
19	500C5.00X	7		A	60.0	1.0	59.5	31.93	90.0	915.2
20	500C5.00X	7		B	60.0	1.0	59.5	30.93	89.0	915.2
21	500C5.00X	7		C	60.0	1.0	60.5	30.93	88.3	915.2
22	500C5.00X	8		A	60.0	1.0	89.5	31.93	90.0	948.1
23	500C5.00X	8		B	60.0	1.0	89.5	30.93	89.1	948.1
24	500C5.00X	8		C	60.0	1.0	90.5	30.93	88.2	948.1
25	500C5.00X	9		A	60.0	1.0	119.5	31.93	90.0	1072.6
26	500C5.00X	9		B	60.0	1.0	119.5	30.93	89.1	1072.6
27	500C5.00X	9		C	60.0	1.0	120.5	30.93	87.8	1072.6

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_Nave 3 Routes
Execution:	I:\00-230_500xV30_DOC\65_30_5000km\In-CAD\4462_4857A.D.F
Date:	11/3/2024 11:03:17 AM

Simulation Data

Installation type:	Multiple Ductbanks
Steady State Option	Unequally Loaded
Ambient temperature [°C]	12
Native Soil Thermal Resistivity (K.m/W)	1.15
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.	Stack Index Number		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
General Data	Grade ID	Client No.	PSCS-001	PSCS-001	PSCS-001	PSCS-001	PSCS-001	PSCS-001	PSCS-001	PSCS-001	PSCS-001	PSCS-001	PSCS-001	PSCS-001	PSCS-001	PSCS-001	PSCS-001	PSCS-001	PSCS-001	PSCS-001	PSCS-001	PSCS-001	PSCS-001	PSCS-001	PSCS-001	PSCS-001	PSCS-001	PSCS-001	PSCS-001	
	Client No.	Phase	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A
	Fd	Operating Frequency	Hz	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
	Temperature	°C	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
	Power	W	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	DF	DF	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	Binding Type	Binding Type	1-Generator 1-Generator																											



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	I102-230_500kV,30_DOC,65_30_5000kcmilInCu,@4052_4857A DLF1
Date:	11/3/2024 11:03:17 AM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		230C5.00X1
2	Number of Cores		Single Core
3	Voltage	[kV]	230
4	Conductor Area	[in²]	3.931
5	Cable Overall Diameter	[in]	5.22
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.54
Conductor Shield			
19	Thickness	[in]	0.1
20	Diameter	[in]	2.74
Insulation			
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.1000ft]	1858
26	Thickness	[in]	0.906
27	Diameter	[in]	4.552
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.05
30	Diameter	[in]	4.652
Non Metallic Layer - Water Swellable Tape 1			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.02
34	Diameter	[in]	4.692
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		46
44	Wire Gauge		14
45	Thickness	[in]	0.064
46	Diameter	[in]	4.82
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Longitudinally Corrugated
54	Corrugation height	[in]	0.006
55	Tape overlap	[in]	0.499999999
56	Tape width	[in]	15.91299998
57	Tape thickness	[in]	0.008
58	Accumulation factor		1.2
59	Thickness	[in]	0.006
60	Diameter	[in]	4.912
Jacket			
61	Material		Polyethylene
62	Thermal Resistivity	[K.m/W]	3.5
63	Thickness	[in]	0.154
64	Diameter	[in]	5.22



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	H02-230_500kV_30_DOC,65_30_,5000kcmilInCu,@4052_4857A DLF1
Date:	11/3/2024 11:03:17 AM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		500C5.00X
2	Number of Cores		Single Core
3	Voltage	[kV]	500
4	Conductor Area	[in²]	3.93
5	Cable Overall Diameter	[in]	5.99
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.49
Conductor Shield			
19	Thickness	[in]	0.059
20	Diameter	[in]	2.608
Insulation			
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.1000ft]	1858
26	Thickness	[in]	1.22
27	Diameter	[in]	5.049
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.059
30	Diameter	[in]	5.167
Non Metallic Layer - Water Swellable Tape			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.037
34	Diameter	[in]	5.241
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		36
44	Wire Gauge		Undefined
45	Thickness	[in]	0.087
46	Diameter	[in]	5.414
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Non Corrugated
54	Thickness	[in]	0.011
55	Diameter	[in]	5.436
Jacket			
56	Material		Polyethylene
57	Thermal Resistivity	[K.m/W]	3.5
58	Thickness	[in]	0.277
59	Diameter	[in]	5.99



Study Summary

CYMECAP Version	6.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	I103-230_500kV_30_DOC.60_35_5000kcmilnCcu@4016_5043A DLF1
Date:	11/3/2024 9:06:24 AM

General Simulation Data

Steady State Option	Unequally 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

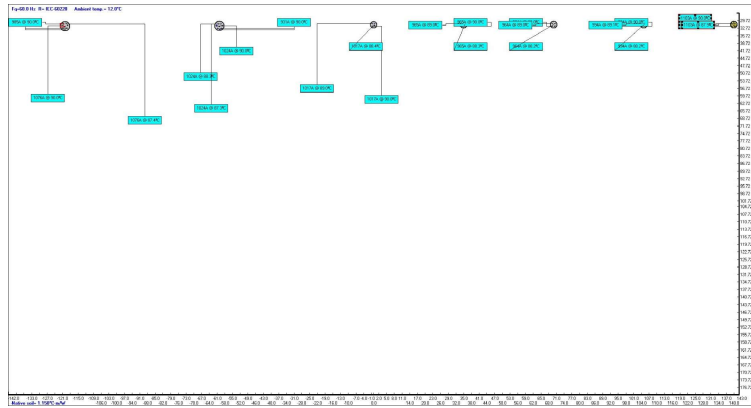
Standard Settings Options

General guidance	Custom
Factor on RAC due to magnetic armour	CIGREGuidance
Factor on RAC due to magnetic duct	CIGREGuidance
Factor on λ_2 due to magnetic armour	CYMECAPGuidance
Factor on λ_2 due to magnetic duct	CIGREGuidance
Factor on λ_2 due to λ'_1	CYMECAPGuidance
λ'_1 computation	CIGREGuidance
λ_2 pipe computation	CYMECAPGuidance
Wd computation	CIGREGuidance
T_2 computation	CIGREGuidance
T_4 computation	CYMECAPGuidance

Installation Type:Multiple Ductbanks/Backfills

Ambient Soil Temperature at Installation Depth	[°C]	12.0
Native Soil Thermal Resistivity	[K.m/W]	1.15
Consider Non-isothermal Earth Surface		No

Layer Name	X [ft]	Y [ft]	Width [ft]	Height [ft]	Thermal Resistivity [K.m/W]
NSTD DB1	-60.0	31.933	3.517	3.517	0.8
NSTD DB2	0.0	31.429	2.6	2.6	0.8
NSTD DB3	-120.0	31.933	3.517	3.517	0.8
NSTD DB4	35.0	31.429	2.6	2.6	0.8
NSTD DB5	70.0	31.429	2.6	2.6	0.8
NSTD DB6	105.0	31.429	2.6	2.6	0.8
NSTD DB7	140.0	31.429	2.6	2.6	0.8



Results Summary

Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [ft]	Y coordinate [ft]	Conductor temperature [°C]	Ampacity [A]
1	230C5.00X1	1		A	60.0	1.0	-61.08	31.88	90.0	1024.2
2	230C5.00X1	1		B	60.0	1.0	-60.5	31.05	88.3	1024.2
3	230C5.00X1	1		C	60.0	1.0	-59.5	31.05	87.3	1024.2
4	230C5.00X1	2		A	60.0	1.0	-60.0	33.38	89.9	931.5
5	230C5.00X1	2		B	60.0	1.0	-59.22	32.88	88.2	931.5
6	230C5.00X1	2		C	60.0	1.0	-60.78	32.88	90.0	931.5
7	500C5.00X	3		A	60.0	1.0	-0.5	31.93	90.0	1016.5
8	500C5.00X	3		B	60.0	1.0	-0.5	30.93	89.0	1016.5
9	500C5.00X	3		C	60.0	1.0	0.5	30.93	88.4	1016.5
10	230C5.00X1	4		A	60.0	1.0	-121.08	31.88	90.0	1075.6
11	230C5.00X1	4		B	60.0	1.0	-120.5	31.05	88.3	1075.6
12	230C5.00X1	4		C	60.0	1.0	-119.5	31.05	87.4	1075.6
13	230C5.00X1	5		A	60.0	1.0	-120.0	33.38	89.9	985.1
14	230C5.00X1	5		B	60.0	1.0	-119.22	32.88	88.2	985.1
15	230C5.00X1	5		C	60.0	1.0	-120.78	32.88	90.0	985.1
16	500C5.00X	6		A	60.0	1.0	34.5	31.93	90.0	965.4
17	500C5.00X	6		B	60.0	1.0	34.5	30.93	89.0	965.4
18	500C5.00X	6		C	60.0	1.0	35.5	30.93	88.3	965.4
19	500C5.00X	7		A	60.0	1.0	69.5	31.93	90.0	964.4
20	500C5.00X	7		B	60.0	1.0	69.5	30.93	89.0	964.4
21	500C5.00X	7		C	60.0	1.0	70.5	30.93	88.2	964.4
22	500C5.00X	8		A	60.0	1.0	104.5	31.93	90.0	993.7
23	500C5.00X	8		B	60.0	1.0	104.5	30.93	89.1	993.7
24	500C5.00X	8		C	60.0	1.0	105.5	30.93	88.2	993.7
25	500C5.00X	9		A	60.0	1.0	139.5	31.93	90.0	1103.4
26	500C5.00X	9		B	60.0	1.0	139.5	30.93	89.1	1103.4
27	500C5.00X	9		C	60.0	1.0	140.5	30.93	87.9	1103.4



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	I103-230_500kV,30_DOC,60_35_5000kcmilInCu,@4016_5043A DLF1
Date:	11/3/2024 9:06:24 AM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		230C5.00X1
2	Number of Cores		Single Core
3	Voltage	[kV]	230
4	Conductor Area	[in²]	3.931
5	Cable Overall Diameter	[in]	5.22
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.54
Conductor Shield			
19	Thickness	[in]	0.1
20	Diameter	[in]	2.74
Insulation			
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.1000ft]	1858
26	Thickness	[in]	0.906
27	Diameter	[in]	4.552
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.05
30	Diameter	[in]	4.652
Non Metallic Layer - Water Swellable Tape 1			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.02
34	Diameter	[in]	4.692
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		46
44	Wire Gauge		14
45	Thickness	[in]	0.064
46	Diameter	[in]	4.82
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Longitudinally Corrugated
54	Corrugation height	[in]	0.006
55	Tape overlap	[in]	0.499999999
56	Tape width	[in]	15.91299998
57	Tape thickness	[in]	0.008
58	Accumulation factor		1.2
59	Thickness	[in]	0.006
60	Diameter	[in]	4.912
Jacket			
61	Material		Polyethylene
62	Thermal Resistivity	[K.m/W]	3.5
63	Thickness	[in]	0.154
64	Diameter	[in]	5.22



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	H03-230_500kV.30_DOC.60_35_.5000kcmilInCu.@4016_5043A DLF1
Date:	11/3/2024 9:06:24 AM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		500C5.00X
2	Number of Cores		Single Core
3	Voltage	[kV]	500
4	Conductor Area	[in²]	3.93
5	Cable Overall Diameter	[in]	5.99
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.49
Conductor Shield			
19	Thickness	[in]	0.059
20	Diameter	[in]	2.608
Insulation			
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.1000ft]	1858
26	Thickness	[in]	1.22
27	Diameter	[in]	5.049
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.059
30	Diameter	[in]	5.167
Non Metallic Layer - Water Swellable Tape			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.037
34	Diameter	[in]	5.241
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		36
44	Wire Gauge		Undefined
45	Thickness	[in]	0.087
46	Diameter	[in]	5.414
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Non Corrugated
54	Thickness	[in]	0.011
55	Diameter	[in]	5.436
Jacket			
56	Material		Polyethylene
57	Thermal Resistivity	[K.m/W]	3.5
58	Thickness	[in]	0.277
59	Diameter	[in]	5.99



Study Summary

CYMCAP Version	6.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	J100-230_500kV_30_DOC_15_60_5000kcmilInCu_@4307_5650A DLF1
Date:	11/3/2024 2:09:47 AM

General Simulation Data

Steady State Option	Unequally 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

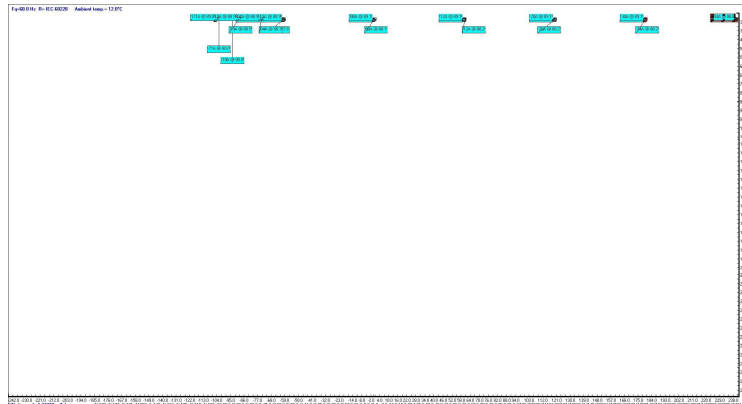
Standard Settings Options

General guidance	Custom
Factor on RAC due to magnetic armour	CIGREGuidance
Factor on RAC due to magnetic duct	CIGREGuidance
Factor on λ_2 due to magnetic armour	CYMCAPGuidance
Factor on λ_2 due to magnetic duct	CIGREGuidance
Factor on λ_2 due to λ'_1	CYMCAPGuidance
λ'_1 computation	CIGREGuidance
λ_2 pipe computation	CYMCAPGuidance
Wd computation	CIGREGuidance
T_2 computation	CIGREGuidance
T_4 computation	CYMCAPGuidance

Installation Type: Multiple Ductbanks/Backfills

Ambient Soil Temperature at Installation Depth	[°C]	12.0
Native Soil Thermal Resistivity	[K.m/W]	1.15
Consider Non-Isothermal Earth Surface		No

Layer Name	X [ft]	Y [ft]	Width [ft]	Height [ft]	Thermal Resistivity [K.m/W]
NSTD DB2	0.0	31.429	2.6	2.6	0.8
NSTD DB4	60.0	31.429	2.6	2.6	0.8
NSTD DB5	120.0	31.429	2.6	2.6	0.8
NSTD DB6	180.001	31.429	2.6	2.6	0.8
NSTD DB7	240.001	31.429	2.6	2.6	0.8
NSTD DB6	-60.0	31.429	2.6	2.6	0.8
NSTD DB7	-75.0	31.429	2.6	2.6	0.8
NSTD DB8	-90.0	31.429	2.6	2.6	0.8
NSTD DB9	-105.0	31.429	2.6	2.6	0.8



Results Summary

Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [ft]	Y coordinate [ft]	Conductor temperature [°C]	Ampacity [A]
1	500C5.00X	1		A	60.0	1.0	-0.5	31.93	90.0	1089.8
2	500C5.00X	1		B	60.0	1.0	-0.5	30.93	89.1	1089.8
3	500C5.00X	1		C	60.0	1.0	0.5	30.93	88.1	1089.8
4	500C5.00X	2		A	60.0	1.0	59.5	31.93	90.0	1112.1
5	500C5.00X	2		B	60.0	1.0	59.5	30.93	89.1	1112.1
6	500C5.00X	2		C	60.0	1.0	60.5	30.93	88.2	1112.1
7	500C5.00X	3		A	60.0	1.0	119.5	31.93	90.0	1120.1
8	500C5.00X	3		B	60.0	1.0	119.5	30.93	89.1	1120.1
9	500C5.00X	3		C	60.0	1.0	120.5	30.93	88.2	1120.1
10	500C5.00X	4		A	60.0	1.0	179.5	31.93	90.0	1134.2
11	500C5.00X	4		B	60.0	1.0	179.5	30.93	89.1	1134.2
12	500C5.00X	4		C	60.0	1.0	180.5	30.93	88.2	1134.2
13	500C5.00X	5		A	60.0	1.0	239.5	31.93	90.0	1193.4
14	500C5.00X	5		B	60.0	1.0	239.5	30.93	89.2	1193.4
15	500C5.00X	5		C	60.0	1.0	240.5	30.93	88.0	1193.4
16	230C5.00X1	6		A	60.0	1.0	-60.5	31.93	90.0	1113.5
17	230C5.00X1	6		B	60.0	1.0	-60.5	30.93	88.9	1113.5
18	230C5.00X1	6		C	60.0	1.0	-59.5	30.93	87.6	1113.5
19	230C5.00X1	7		A	60.0	1.0	-75.5	31.93	90.0	1004.0
20	230C5.00X1	7		B	60.0	1.0	-75.5	30.93	88.9	1004.0
21	230C5.00X1	7		C	60.0	1.0	-74.5	30.93	88.3	1004.0
22	230C5.00X1	8		A	60.0	1.0	-90.5	31.93	90.0	1018.6
23	230C5.00X1	8		B	60.0	1.0	-90.5	30.93	88.9	1018.6
24	230C5.00X1	8		C	60.0	1.0	-89.5	30.93	88.5	1018.6
25	230C5.00X1	9		A	60.0	1.0	-105.5	31.93	90.0	1170.9
26	230C5.00X1	9		B	60.0	1.0	-105.5	30.93	88.9	1170.9
27	230C5.00X1	9		C	60.0	1.0	-104.5	30.93	89.0	1170.9



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	J100-230_500kV,30_DOC,15_60_5000kcmilInCu,@4307_5650A DLF1
Date:	11/3/2024 2:09:47 AM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		500C5.00X
2	Number of Cores		Single Core
3	Voltage	[kV]	500
4	Conductor Area	[in²]	3.93
5	Cable Overall Diameter	[in]	5.99
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.49
Conductor Shield			
19	Thickness	[in]	0.059
20	Diameter	[in]	2.608
Insulation			
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.1000ft]	1858
26	Thickness	[in]	1.22
27	Diameter	[in]	5.049
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.059
30	Diameter	[in]	5.167
Non Metallic Layer - Water Swellable Tape			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.037
34	Diameter	[in]	5.241
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		36
44	Wire Gauge		Undefined
45	Thickness	[in]	0.087
46	Diameter	[in]	5.414
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Non Corrugated
54	Thickness	[in]	0.011
55	Diameter	[in]	5.436
Jacket			
56	Material		Polyethylene
57	Thermal Resistivity	[K.m/W]	3.5
58	Thickness	[in]	0.277
59	Diameter	[in]	5.99



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	J100-230_500kV,30_DOC,15__60_,5000kcmilInCu,@4307_5650A DLF1
Date:	11/3/2024 2:09:47 AM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		230C5.00X1
2	Number of Cores		Single Core
3	Voltage	[kV]	230
4	Conductor Area	[in²]	3.931
5	Cable Overall Diameter	[in]	5.22
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.54
Conductor Shield			
19	Thickness	[in]	0.1
20	Diameter	[in]	2.74
Insulation			
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.1000ft]	1858
26	Thickness	[in]	0.906
27	Diameter	[in]	4.552
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.05
30	Diameter	[in]	4.652
Non Metallic Layer - Water Swellable Tape 1			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.02
34	Diameter	[in]	4.692
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		46
44	Wire Gauge		14
45	Thickness	[in]	0.064
46	Diameter	[in]	4.82
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Longitudinally Corrugated
54	Corrugation height	[in]	0.006
55	Tape overlap	[in]	0.499999999
56	Tape width	[in]	15.91299998
57	Tape thickness	[in]	0.008
58	Accumulation factor		1.2
59	Thickness	[in]	0.006
60	Diameter	[in]	4.912
Jacket			
61	Material		Polyethylene
62	Thermal Resistivity	[K.m/W]	3.5
63	Thickness	[in]	0.154
64	Diameter	[in]	5.22



Study Summary

CYMCAP Version	6.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	J101-230_500kV_30_DOC_15_35_5000kcmilInCu_@4162_4888A DLF1
Date:	11/3/2024 1:28:03 AM

General Simulation Data

Steady State Option	Unequally 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

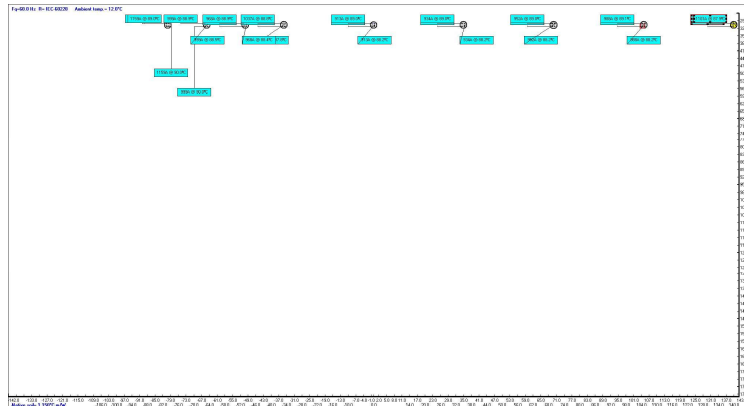
Standard Settings Options

General guidance	Custom
Factor on RAC due to magnetic armour	CIGREGuidance
Factor on RAC due to magnetic duct	CIGREGuidance
Factor on λ_2 due to magnetic armour	CYMCAPGuidance
Factor on λ_2 due to magnetic duct	CIGREGuidance
Factor on λ_2 due to λ'_1	CYMCAPGuidance
λ'_1 computation	CIGREGuidance
λ_2 pipe computation	CYMCAPGuidance
Wd computation	CIGREGuidance
T_2 computation	CIGREGuidance
T_4 computation	CYMCAPGuidance

Installation Type:Multiple Ductbanks/Backfills

Ambient Soil Temperature at Installation Depth	[°C]	12.0
Native Soil Thermal Resistivity	[K.m/W]	1.15
Consider Non-Isothermal Earth Surface		No

Layer Name	X [ft]	Y [ft]	Width [ft]	Height [ft]	Thermal Resistivity [K.m/W]
NSTD DB2	0.0	31.429	2.6	2.6	0.8
NSTD DB4	35.0	31.429	2.6	2.6	0.8
NSTD DB5	70.0	31.429	2.6	2.6	0.8
NSTD DB6	105.0	31.429	2.6	2.6	0.8
NSTD DB7	140.0	31.429	2.6	2.6	0.8
NSTD DB6	-35.0	31.429	2.6	2.6	0.8
NSTD DB7	-50.0	31.429	2.6	2.6	0.8
NSTD DB8	-65.0	31.429	2.6	2.6	0.8
NSTD DB9	-80.0	31.429	2.6	2.6	0.8



Results Summary

Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [ft]	Y coordinate [ft]	Conductor temperature [°C]	Ampacity [A]
1	500C5.00X	1		A	60.0	1.0	-0.5	31.93	90.0	913.2
2	500C5.00X	1		B	60.0	1.0	-0.5	30.93	89.0	913.2
3	500C5.00X	1		C	60.0	1.0	0.5	30.93	88.2	913.2
4	500C5.00X	2		A	60.0	1.0	34.5	31.93	90.0	934.4
5	500C5.00X	2		B	60.0	1.0	34.5	30.93	89.0	934.4
6	500C5.00X	2		C	60.0	1.0	35.5	30.93	88.2	934.4
7	500C5.00X	3		A	60.0	1.0	69.5	31.93	90.0	951.8
8	500C5.00X	3		B	60.0	1.0	69.5	30.93	89.0	951.8
9	500C5.00X	3		C	60.0	1.0	70.5	30.93	88.2	951.8
10	500C5.00X	4		A	60.0	1.0	104.5	31.93	90.0	967.8
11	500C5.00X	4		B	60.0	1.0	104.5	30.93	89.1	967.8
12	500C5.00X	4		C	60.0	1.0	105.5	30.93	88.2	967.8
13	500C5.00X	5		A	60.0	1.0	139.5	31.93	90.0	1100.6
14	500C5.00X	5		B	60.0	1.0	139.5	30.93	89.1	1100.6
15	500C5.00X	5		C	60.0	1.0	140.5	30.93	87.9	1100.6
16	230C5.00X1	6		A	60.0	1.0	-35.5	31.93	90.0	1036.7
17	230C5.00X1	6		B	60.0	1.0	-35.5	30.93	88.8	1036.7
18	230C5.00X1	6		C	60.0	1.0	-34.5	30.93	87.8	1036.7
19	230C5.00X1	7		A	60.0	1.0	-50.5	31.93	90.0	967.6
20	230C5.00X1	7		B	60.0	1.0	-50.5	30.93	88.9	967.6
21	230C5.00X1	7		C	60.0	1.0	-49.5	30.93	88.4	967.6
22	230C5.00X1	8		A	60.0	1.0	-65.5	31.93	90.0	999.0
23	230C5.00X1	8		B	60.0	1.0	-65.5	30.93	88.9	999.0
24	230C5.00X1	8		C	60.0	1.0	-64.5	30.93	88.5	999.0
25	230C5.00X1	9		A	60.0	1.0	-80.5	31.93	90.0	1158.9
26	230C5.00X1	9		B	60.0	1.0	-80.5	30.93	88.9	1158.9
27	230C5.00X1	9		C	60.0	1.0	-79.5	30.93	89.0	1158.9



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	J101-230_500kV,30_DOC,15__35__5000kcmilInCu,@4162_4888A DLF1
Date:	11/3/2024 1:28:03 AM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		500C5.00X
2	Number of Cores		Single Core
3	Voltage	[kV]	500
4	Conductor Area	[in²]	3.93
5	Cable Overall Diameter	[in]	5.99
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.49
Conductor Shield			
19	Thickness	[in]	0.059
20	Diameter	[in]	2.608
Insulation			
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.1000ft]	1858
26	Thickness	[in]	1.22
27	Diameter	[in]	5.049
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.059
30	Diameter	[in]	5.167
Non Metallic Layer - Water Swellable Tape			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.037
34	Diameter	[in]	5.241
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		36
44	Wire Gauge		Undefined
45	Thickness	[in]	0.087
46	Diameter	[in]	5.414
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Non Corrugated
54	Thickness	[in]	0.011
55	Diameter	[in]	5.436
Jacket			
56	Material		Polyethylene
57	Thermal Resistivity	[K.m/W]	3.5
58	Thickness	[in]	0.277
59	Diameter	[in]	5.99



Cables Report

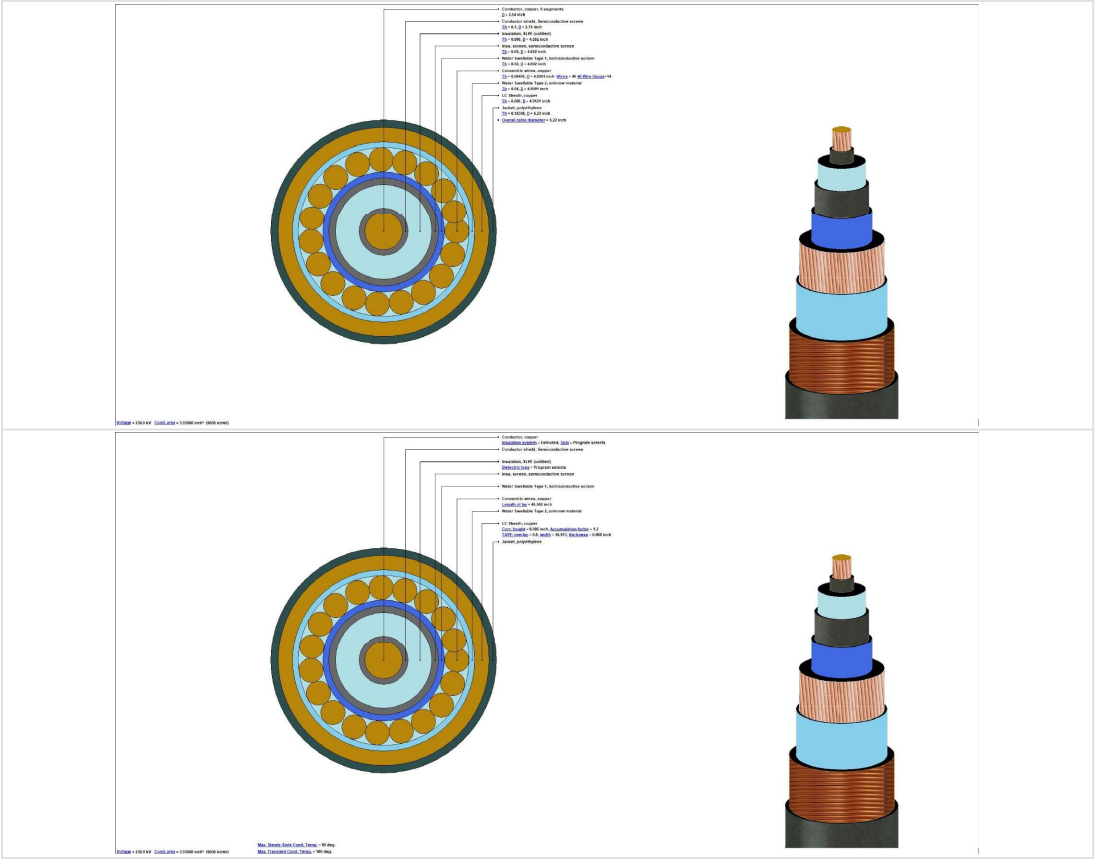
CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	J101-230_500kV,30_DOC,15_35_5000kcmilInCu,@4162_4888A DLF1
Date:	11/3/2024 1:28:03 AM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		230C5.00X1
2	Number of Cores		Single Core
3	Voltage	[kV]	230
4	Conductor Area	[in²]	3.931
5	Cable Overall Diameter	[in]	5.22
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.54
Conductor Shield			
19	Thickness	[in]	0.1
20	Diameter	[in]	2.74
Insulation			
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.1000ft]	1858
26	Thickness	[in]	0.906
27	Diameter	[in]	4.552
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.05
30	Diameter	[in]	4.652
Non Metallic Layer - Water Swellable Tape 1			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.02
34	Diameter	[in]	4.692
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		46
44	Wire Gauge		14
45	Thickness	[in]	0.064
46	Diameter	[in]	4.82
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Longitudinally Corrugated
54	Corrugation height	[in]	0.006
55	Tape overlap	[in]	0.499999999
56	Tape width	[in]	15.91299998
57	Tape thickness	[in]	0.008
58	Accumulation factor		1.2
59	Thickness	[in]	0.006
60	Diameter	[in]	4.912
Jacket			
61	Material		Polyethylene
62	Thermal Resistivity	[K.m/W]	3.5
63	Thickness	[in]	0.154
64	Diameter	[in]	5.22

No.	Description	Unit	1
Specific Installation Data			
65	Cable Equipment ID		230C5.00X1
66	Cable Frequency	[Hz]	60
67	Sheath / Shield Bonding		1 Conductor 1 Point Bonded Triangular
68	Loss Factor Constant (ALOS)		0.3
69	Spacing Between Cables in Section		n/a
70	Duct construction		PVC Duct in Concrete
71	Duct material thermal resistivity	[K.m/W]	6
72	Duct filling material		Air
73	Inner diameter of the conduit	[in]	7.942
74	Outer diameter of the conduit	[in]	8.625

Cable ID : 230C5.00X1

Cable Title 230kV, 5000 kcmil Cu - 6 Seg, 906 XLPE, Cu cn, Prysmian





Study Summary

CYMCAP Version	6.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	J102-230_500kV_30_DOC_15_45_5000kcmilInCu.@4156_5184A DLF1
Date:	11/3/2024 12:40:13 AM

General Simulation Data

Steady State Option	Unequally 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

Standard Settings Options

General guidance	Custom
Factor on RAC due to magnetic armour	CIGREGuidance
Factor on RAC due to magnetic duct	CIGREGuidance
Factor on λ_2 due to magnetic armour	CYMCAPGuidance
Factor on λ_2 due to magnetic duct	CIGREGuidance
Factor on λ_2 due to λ'_1	CYMCAPGuidance
λ'_1 computation	CIGREGuidance
λ_2 pipe computation	CYMCAPGuidance
Wd computation	CIGREGuidance
T_2 computation	CIGREGuidance
T_4 computation	CYMCAPGuidance

Installation Type:Multiple Ductbanks/Backfills

Ambient Soil Temperature at Installation Depth	[°C]	12.0
Native Soil Thermal Resistivity	[K.m/W]	1.15
Consider Non-Isothermal Earth Surface		No

Layer Name	X [ft]	Y [ft]	Width [ft]	Height [ft]	Thermal Resistivity [K.m/W]
NSTD DB2	0.0	31.429	2.6	2.6	0.8
NSTD DB4	45.0	31.429	2.6	2.6	0.8
NSTD DB5	90.0	31.429	2.6	2.6	0.8
NSTD DB6	135.0	31.429	2.6	2.6	0.8
NSTD DB7	180.001	31.429	2.6	2.6	0.8
NSTD DB6	-30.0	31.429	2.6	2.6	0.8
NSTD DB7	-45.0	31.429	2.6	2.6	0.8
NSTD DB8	-60.0	31.429	2.6	2.6	0.8
NSTD DB9	-75.0	31.429	2.6	2.6	0.8



Results Summary

Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [ft]	Y coordinate [ft]	Conductor temperature [°C]	Ampacity [A]
1	500C5.00X	1		A	60.0	1.0	-0.5	31.93	90.0	932.0
2	500C5.00X	1		B	60.0	1.0	-0.5	30.93	89.0	932.0
3	500C5.00X	1		C	60.0	1.0	0.5	30.93	88.0	932.0
4	500C5.00X	2		A	60.0	1.0	44.5	31.93	90.0	1011.1
5	500C5.00X	2		B	60.0	1.0	44.5	30.93	89.0	1011.1
6	500C5.00X	2		C	60.0	1.0	45.5	30.93	88.2	1011.1
7	500C5.00X	3		A	60.0	1.0	89.5	31.93	90.0	1033.0
8	500C5.00X	3		B	60.0	1.0	89.5	30.93	89.0	1033.0
9	500C5.00X	3		C	60.0	1.0	90.5	30.93	88.2	1033.0
10	500C5.00X	4		A	60.0	1.0	134.5	31.93	90.0	1060.5
11	500C5.00X	4		B	60.0	1.0	134.5	30.93	89.1	1060.5
12	500C5.00X	4		C	60.0	1.0	135.5	30.93	88.2	1060.5
13	500C5.00X	5		A	60.0	1.0	179.5	31.93	90.0	1147.9
14	500C5.00X	5		B	60.0	1.0	179.5	30.93	89.2	1147.9
15	500C5.00X	5		C	60.0	1.0	180.5	30.93	88.0	1147.9
16	230C5.00X1	6		A	60.0	1.0	-30.5	31.93	90.0	1029.9
17	230C5.00X1	6		B	60.0	1.0	-30.5	30.93	88.8	1029.9
18	230C5.00X1	6		C	60.0	1.0	-29.5	30.93	87.9	1029.9
19	230C5.00X1	7		A	60.0	1.0	-45.5	31.93	90.0	966.8
20	230C5.00X1	7		B	60.0	1.0	-45.5	30.93	88.9	966.8
21	230C5.00X1	7		C	60.0	1.0	-44.5	30.93	88.4	966.8
22	230C5.00X1	8		A	60.0	1.0	-60.5	31.93	90.0	999.4
23	230C5.00X1	8		B	60.0	1.0	-60.5	30.93	88.9	999.4
24	230C5.00X1	8		C	60.0	1.0	-59.5	30.93	88.6	999.4
25	230C5.00X1	9		A	60.0	1.0	-75.5	31.93	90.0	1159.4
26	230C5.00X1	9		B	60.0	1.0	-75.5	30.93	88.9	1159.4
27	230C5.00X1	9		C	60.0	1.0	-74.5	30.93	89.0	1159.4

Installation type:
Cloud, Bare-Metal

Installation type:
Steady State Op
Ambient tempera
Native Soil Therm
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G28J_Near 3 Routes
V30_DOC15_45_5000kmInCu@4156_5184A.DLF1
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Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	J102-230_500kV,30_DOC,15__45_5000kcmilInCu,@4156_5184A DLF1
Date:	11/3/2024 12:40:13 AM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		500C5.00X
2	Number of Cores		Single Core
3	Voltage	[kV]	500
4	Conductor Area	[in²]	3.93
5	Cable Overall Diameter	[in]	5.99
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.49
Conductor Shield			
19	Thickness	[in]	0.059
20	Diameter	[in]	2.608
Insulation			
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.1000ft]	1858
26	Thickness	[in]	1.22
27	Diameter	[in]	5.049
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.059
30	Diameter	[in]	5.167
Non Metallic Layer - Water Swellable Tape			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.037
34	Diameter	[in]	5.241
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		36
44	Wire Gauge		Undefined
45	Thickness	[in]	0.087
46	Diameter	[in]	5.414
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Non Corrugated
54	Thickness	[in]	0.011
55	Diameter	[in]	5.436
Jacket			
56	Material		Polyethylene
57	Thermal Resistivity	[K.m/W]	3.5
58	Thickness	[in]	0.277
59	Diameter	[in]	5.99



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	J102-230_500kV,30_DOC,15__45_,5000kcmilInCu,@4156_5184A DLF1
Date:	11/3/2024 12:40:13 AM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		230C5.00X1
2	Number of Cores		Single Core
3	Voltage	[kV]	230
4	Conductor Area	[in²]	3.931
5	Cable Overall Diameter	[in]	5.22
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.54
Conductor Shield			
19	Thickness	[in]	0.1
20	Diameter	[in]	2.74
Insulation			
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.1000ft]	1858
26	Thickness	[in]	0.906
27	Diameter	[in]	4.552
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.05
30	Diameter	[in]	4.652
Non Metallic Layer - Water Swellable Tape 1			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.02
34	Diameter	[in]	4.692
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		46
44	Wire Gauge		14
45	Thickness	[in]	0.064
46	Diameter	[in]	4.82
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Longitudinally Corrugated
54	Corrugation height	[in]	0.006
55	Tape overlap	[in]	0.499999999
56	Tape width	[in]	15.91299998
57	Tape thickness	[in]	0.008
58	Accumulation factor		1.2
59	Thickness	[in]	0.006
60	Diameter	[in]	4.912
Jacket			
61	Material		Polyethylene
62	Thermal Resistivity	[K.m/W]	3.5
63	Thickness	[in]	0.154
64	Diameter	[in]	5.22



Study Summary

CYMCAP Version	6.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	J103-230_500kV_30_DOC_15_45_5000kcmilInCu_@4047_5043A DLF1
Date:	11/3/2024 12:00:14 AM

General Simulation Data

Steady State Option	Unequally 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

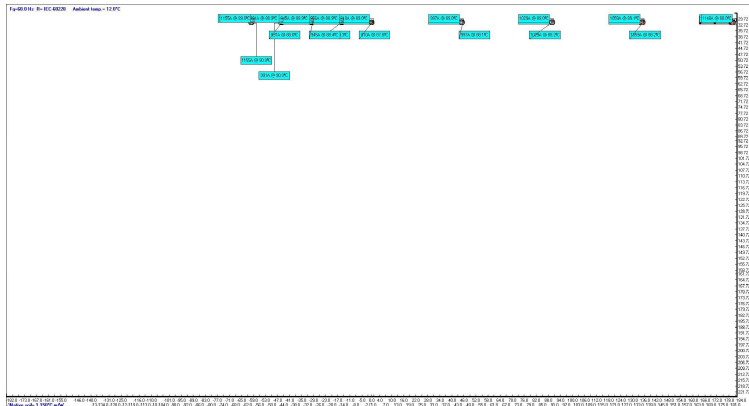
Standard Settings Options

General guidance	Custom
Factor on RAC due to magnetic armour	CIGREGuidance
Factor on RAC due to magnetic duct	CIGREGuidance
Factor on λ_2 due to magnetic armour	CYMCAPGuidance
Factor on λ_2 due to magnetic duct	CIGREGuidance
Factor on λ_2 due to λ'_1	CYMCAPGuidance
λ'_1 computation	CIGREGuidance
λ_2 pipe computation	CYMCAPGuidance
Wd computation	CIGREGuidance
T_2 computation	CIGREGuidance
T_4 computation	CYMCAPGuidance

Installation Type: Multiple Ductbanks/Backfills

Ambient Soil Temperature at Installation Depth	[°C]	12.0
Native Soil Thermal Resistivity	[K.m/W]	1.15
Consider Non-Isothermal Earth Surface		No

Layer Name	X [ft]	Y [ft]	Width [ft]	Height [ft]	Thermal Resistivity [K.m/W]
NSTD DB2	0.0	31.429	2.6	2.6	0.8
NSTD DB4	45.0	31.429	2.6	2.6	0.8
NSTD DB5	90.0	31.429	2.6	2.6	0.8
NSTD DB6	135.0	31.429	2.6	2.6	0.8
NSTD DB7	180.001	31.429	2.6	2.6	0.8
NSTD DB6	-15.0	31.429	2.6	2.6	0.8
NSTD DB7	-30.0	31.429	2.6	2.6	0.8
NSTD DB8	-45.0	31.429	2.6	2.6	0.8
NSTD DB9	-60.0	31.429	2.6	2.6	0.8



Results Summary

Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [ft]	Y coordinate [ft]	Conductor temperature [°C]	Ampacity [A]
1	500C5.00X	1		A	60.0	1.0	-0.5	31.93	90.0	809.5
2	500C5.00X	1		B	60.0	1.0	-0.5	30.93	89.0	809.5
3	500C5.00X	1		C	60.0	1.0	0.5	30.93	87.8	809.5
4	500C5.00X	2		A	60.0	1.0	44.5	31.93	90.0	997.3
5	500C5.00X	2		B	60.0	1.0	44.5	30.93	89.0	997.3
6	500C5.00X	2		C	60.0	1.0	45.5	30.93	88.1	997.3
7	500C5.00X	3		A	60.0	1.0	89.5	31.93	90.0	1029.4
8	500C5.00X	3		B	60.0	1.0	89.5	30.93	89.0	1029.4
9	500C5.00X	3		C	60.0	1.0	90.5	30.93	88.2	1029.4
10	500C5.00X	4		A	60.0	1.0	134.5	31.93	90.0	1059.3
11	500C5.00X	4		B	60.0	1.0	134.5	30.93	89.1	1059.3
12	500C5.00X	4		C	60.0	1.0	135.5	30.93	88.2	1059.3
13	500C5.00X	5		A	60.0	1.0	179.5	31.93	90.0	1147.5
14	500C5.00X	5		B	60.0	1.0	179.5	30.93	89.2	1147.5
15	500C5.00X	5		C	60.0	1.0	180.5	30.93	88.0	1147.5
16	230C5.00X1	6		A	60.0	1.0	-15.5	31.93	90.0	955.6
17	230C5.00X1	6		B	60.0	1.0	-15.5	30.93	88.9	955.6
18	230C5.00X1	6		C	60.0	1.0	-14.5	30.93	88.3	955.6
19	230C5.00X1	7		A	60.0	1.0	-30.5	31.93	90.0	945.4
20	230C5.00X1	7		B	60.0	1.0	-30.5	30.93	88.9	945.4
21	230C5.00X1	7		C	60.0	1.0	-29.5	30.93	88.4	945.4
22	230C5.00X1	8		A	60.0	1.0	-45.5	31.93	90.0	991.0
23	230C5.00X1	8		B	60.0	1.0	-45.5	30.93	88.9	991.0
24	230C5.00X1	8		C	60.0	1.0	-44.5	30.93	88.6	991.0
25	230C5.00X1	9		A	60.0	1.0	-60.5	31.93	90.0	1155.3
26	230C5.00X1	9		B	60.0	1.0	-60.5	30.93	88.9	1155.3
27	230C5.00X1	9		C	60.0	1.0	-59.5	30.93	89.0	1155.3



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	J103-230_500kV,30_DOC,15__45_5000kcmilInCu,@4047_5043A DLF1
Date:	11/3/2024 12:00:14 AM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		500C5.00X
2	Number of Cores		Single Core
3	Voltage	[kV]	500
4	Conductor Area	[in²]	3.93
5	Cable Overall Diameter	[in]	5.99
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.49
Conductor Shield			
19	Thickness	[in]	0.059
20	Diameter	[in]	2.608
Insulation			
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.1000ft]	1858
26	Thickness	[in]	1.22
27	Diameter	[in]	5.049
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.059
30	Diameter	[in]	5.167
Non Metallic Layer - Water Swellable Tape			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.037
34	Diameter	[in]	5.241
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		36
44	Wire Gauge		Undefined
45	Thickness	[in]	0.087
46	Diameter	[in]	5.414
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Non Corrugated
54	Thickness	[in]	0.011
55	Diameter	[in]	5.436
Jacket			
56	Material		Polyethylene
57	Thermal Resistivity	[K.m/W]	3.5
58	Thickness	[in]	0.277
59	Diameter	[in]	5.99



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	J103-230_500kV,30_DOC,15__45_,5000kcmilInCu,@4047_5043A DLF1
Date:	11/3/2024 12:00:14 AM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		230C5.00X1
2	Number of Cores		Single Core
3	Voltage	[kV]	230
4	Conductor Area	[in²]	3.931
5	Cable Overall Diameter	[in]	5.22
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.54
Conductor Shield			
19	Thickness	[in]	0.1
20	Diameter	[in]	2.74
Insulation			
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.1000ft]	1858
26	Thickness	[in]	0.906
27	Diameter	[in]	4.552
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.05
30	Diameter	[in]	4.652
Non Metallic Layer - Water Swellable Tape 1			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.02
34	Diameter	[in]	4.692
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		46
44	Wire Gauge		14
45	Thickness	[in]	0.064
46	Diameter	[in]	4.82
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Longitudinally Corrugated
54	Corrugation height	[in]	0.006
55	Tape overlap	[in]	0.499999999
56	Tape width	[in]	15.91299998
57	Tape thickness	[in]	0.008
58	Accumulation factor		1.2
59	Thickness	[in]	0.006
60	Diameter	[in]	4.912
Jacket			
61	Material		Polyethylene
62	Thermal Resistivity	[K.m/W]	3.5
63	Thickness	[in]	0.154
64	Diameter	[in]	5.22



INTERNATIONAL LTD

Study Summary

CYMCAP Version	6.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	K100-230_500kV_45_DOC_15_60_5000kcmilInCu.@3825_4878A DLF1
Date:	11/2/2024 9:43:17 PM

General Simulation Data

Steady State Option	Unequally 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

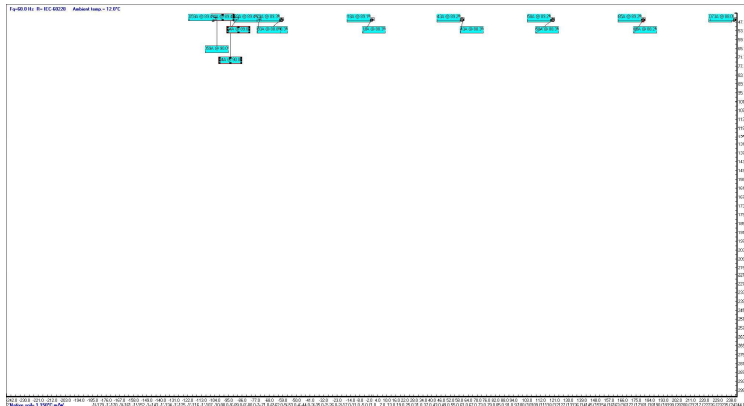
Standard Settings Options

General guidance	Custom
Factor on RAC due to magnetic armour	CIGREGuidance
Factor on RAC due to magnetic duct	CIGREGuidance
Factor on λ_2 due to magnetic armour	CYMCAPGuidance
Factor on λ_2 due to magnetic duct	CIGREGuidance
Factor on λ_2 due to λ'_1	CYMCAPGuidance
λ'_1 computation	CIGREGuidance
λ_2 pipe computation	CYMCAPGuidance
Wd computation	CIGREGuidance
T_2 computation	CIGREGuidance
T_4 computation	CYMCAPGuidance

Installation Type: Multiple Ductbanks/Backfills

Ambient Soil Temperature at Installation Depth	[°C]	12.0
Native Soil Thermal Resistivity	[K.m/W]	1.15
Consider Non-Isothermal Earth Surface		No

Layer Name	X [ft]	Y [ft]	Width [ft]	Height [ft]	Thermal Resistivity [K.m/W]
NSTD DB2	0.0	46.265	2.3	2.3	0.8
NSTD DB4	60.0	46.265	2.3	2.3	0.8
NSTD DB5	120.0	46.265	2.3	2.3	0.8
NSTD DB6	180.001	46.265	2.3	2.3	0.8
NSTD DB7	240.001	46.265	2.3	2.3	0.8
NSTD DB6	-60.0	46.265	2.3	2.3	0.8
NSTD DB7	-75.0	46.265	2.3	2.3	0.8
NSTD DB8	-90.0	46.265	2.3	2.3	0.8
NSTD DB9	-105.0	46.265	2.3	2.3	0.8



Results Summary

Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [ft]	Y coordinate [ft]	Conductor temperature [°C]	Ampacity [A]
1	500C5.00X	1		A	60.0	1.0	-0.5	46.76	90.0	918.5
2	500C5.00X	1		B	60.0	1.0	-0.5	45.76	89.1	918.5
3	500C5.00X	1		C	60.0	1.0	0.5	45.76	88.3	918.5
4	500C5.00X	2		A	60.0	1.0	59.5	46.76	90.0	943.4
5	500C5.00X	2		B	60.0	1.0	59.5	45.76	89.2	943.4
6	500C5.00X	2		C	60.0	1.0	60.5	45.76	88.3	943.4
7	500C5.00X	3		A	60.0	1.0	119.5	46.76	90.0	957.9
8	500C5.00X	3		B	60.0	1.0	119.5	45.76	89.2	957.9
9	500C5.00X	3		C	60.0	1.0	120.5	45.76	88.3	957.9
10	500C5.00X	4		A	60.0	1.0	179.5	46.76	90.0	985.2
11	500C5.00X	4		B	60.0	1.0	179.5	45.76	89.2	985.2
12	500C5.00X	4		C	60.0	1.0	180.5	45.76	88.2	985.2
13	500C5.00X	5		A	60.0	1.0	239.5	46.76	90.0	1072.8
14	500C5.00X	5		B	60.0	1.0	239.5	45.76	89.2	1072.8
15	500C5.00X	5		C	60.0	1.0	240.5	45.76	88.0	1072.8
16	230C5.00X1	6		A	60.0	1.0	-60.5	46.76	90.0	978.7
17	230C5.00X1	6		B	60.0	1.0	-60.5	45.76	89.3	978.7
18	230C5.00X1	6		C	60.0	1.0	-59.5	45.76	88.3	978.7
19	230C5.00X1	7		A	60.0	1.0	-75.5	46.76	90.0	882.6
20	230C5.00X1	7		B	60.0	1.0	-75.5	45.76	89.4	882.6
21	230C5.00X1	7		C	60.0	1.0	-74.5	45.76	88.8	882.6
22	230C5.00X1	8		A	60.0	1.0	-90.5	46.76	90.0	904.5
23	230C5.00X1	8		B	60.0	1.0	-90.5	45.76	89.4	904.5
24	230C5.00X1	8		C	60.0	1.0	-89.5	45.76	89.0	904.5
25	230C5.00X1	9		A	60.0	1.0	-105.5	46.76	90.0	1058.9
26	230C5.00X1	9		B	60.0	1.0	-105.5	45.76	89.4	1058.9
27	230C5.00X1	9		C	60.0	1.0	-104.5	45.76	89.4	1058.9

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_GRII-New 3 Routes
Execution:	K:\00-230_500kv_45_DOC\15_60_5000kvmlr-Cu @3825_4578A.DLF
Date:	11/2/2024 9:43:17 PM

Installation type:	Multiple Outbars
Steady State Option	Unequally Loaded
Ambient temperature [°C]	12
Native Soil Thermal Resistivity (K.m/W)	1.15
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

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Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	K100-230_500kV,45_DOC,15_60_,5000kcmilInCu.@3825_4878A DLF1
Date:	11/2/2024 9:43:17 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		500C5.00X
2	Number of Cores		Single Core
3	Voltage	[kV]	500
4	Conductor Area	[in²]	3.93
5	Cable Overall Diameter	[in]	5.99
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.49
Conductor Shield			
19	Thickness	[in]	0.059
20	Diameter	[in]	2.608
Insulation			
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.1000ft]	1858
26	Thickness	[in]	1.22
27	Diameter	[in]	5.049
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.059
30	Diameter	[in]	5.167
Non Metallic Layer - Water Swellable Tape			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.037
34	Diameter	[in]	5.241
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		36
44	Wire Gauge		Undefined
45	Thickness	[in]	0.087
46	Diameter	[in]	5.414
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Non Corrugated
54	Thickness	[in]	0.011
55	Diameter	[in]	5.436
Jacket			
56	Material		Polyethylene
57	Thermal Resistivity	[K.m/W]	3.5
58	Thickness	[in]	0.277
59	Diameter	[in]	5.99



Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	K100-230_500kV_45_DOC,15_60_5000kcmilInCu.@3825_4878A DLF1
Date:	11/2/2024 9:43:17 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		230C5.00X1
2	Number of Cores		Single Core
3	Voltage	[kV]	230
4	Conductor Area	[in²]	3.931
5	Cable Overall Diameter	[in]	5.22
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.54
Conductor Shield			
19	Thickness	[in]	0.1
20	Diameter	[in]	2.74
Insulation			
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.1000ft]	1858
26	Thickness	[in]	0.906
27	Diameter	[in]	4.552
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.05
30	Diameter	[in]	4.652
Non Metallic Layer - Water Swellable Tape 1			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.02
34	Diameter	[in]	4.692
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		46
44	Wire Gauge		14
45	Thickness	[in]	0.064
46	Diameter	[in]	4.82
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Longitudinally Corrugated
54	Corrugation height	[in]	0.006
55	Tape overlap	[in]	0.499999999
56	Tape width	[in]	15.91299998
57	Tape thickness	[in]	0.008
58	Accumulation factor		1.2
59	Thickness	[in]	0.006
60	Diameter	[in]	4.912
Jacket			
61	Material		Polyethylene
62	Thermal Resistivity	[K.m/W]	3.5
63	Thickness	[in]	0.154
64	Diameter	[in]	5.22

No.	Description	Unit	1
Specific Installation Data			
65	Cable Equipment ID		230C5.00X1
66	Cable Frequency	[Hz]	60
67	Sheath / Shield Bonding		1 Conductor 1 Point Bonded Triangular
68	Loss Factor Constant (ALOS)		0.3
69	Spacing Between Cables in Section		n/a
70	Duct construction		Polyethylene in Concrete
71	Duct material thermal resistivity	[K.m/W]	3.5
72	Duct filling material		Air
73	Inner diameter of the conduit	[in]	6.963
74	Outer diameter of the conduit	[in]	8.625

Cable ID : 230C5.00X1

Cable Title

230kV, 5000 kcmil Cu - 6 Seg, 906 XLPE, Cu cn, Prysmian

Study Summary

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	K101-230_500kV_45_DOC_25_70_5000kcmlinCu,@4229_5092A DLF1
Date:	11/2/2024 7:22:55 PM

General Simulation Data

Steady State Option	Unequally 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

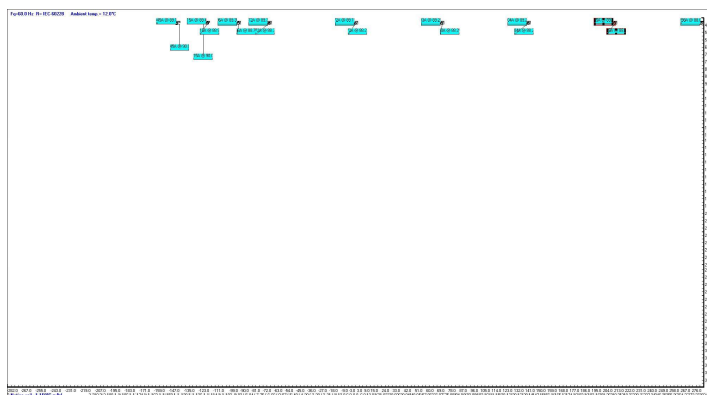
Standard Settings Options

General guidance	Custom
Factor on RAC due to magnetic armour	CIGREGuidance
Factor on RAC due to magnetic duct	CIGREGuidance
Factor on λ_1 due to magnetic armour	CYMCAPGuidance
Factor on λ_1 due to magnetic duct	CIGREGuidance
Factor on λ_2 due to λ_1	CYMCAPGuidance
λ_1^* computation	CIGREGuidance
λ_2 -pipe computation	CYMCAPGuidance
W_d computation	CIGREGuidance
T_2 computation	CIGREGuidance
T_x computation	CYMCAPGuidance

Installation Type: Multiple Ductbanks/Backfills

Ambient Soil Temperature at Installation Depth	[°C]	12.0
Native Soil Thermal Resistivity	[K.m/W]	1.15
Consider Non-Isothermal Earth Surface		No

Layer Name	X [ft]	Y [ft]	Width [ft]	Height [ft]	Thermal Resistivity [K,m/W]
NSTD DB2	0.0	46.265	2.3	2.3	0.8
NSTD DB4	70.0	46.265	2.3	2.3	0.8
NSTD DB5	140.0	46.265	2.3	2.3	0.8
NSTD DB6	210.001	46.265	2.3	2.3	0.8
NSTD DB7	280.001	46.265	2.3	2.3	0.8
NSTD DB6	-70.0	46.265	2.3	2.3	0.8
NSTD DB7	-95.0	46.265	2.3	2.3	0.8
NSTD DB8	-120.0	46.265	2.3	2.3	0.8
NSTD DB9	-145.0	46.265	2.3	2.3	0.8



Results Summary

Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [ft]	Y coordinate [ft]	Conductor temperature [°C]	Ampacity [A]
1	500C5.00X	1		A	60.0	1.0	-0.5	46.76	90.0	971.5
2	500C5.00X	1		B	60.0	1.0	-0.5	45.76	89.1	971.5
3	500C5.00X	1		C	60.0	1.0	0.5	45.76	88.2	971.5
4	500C5.00X	2		A	60.0	1.0	69.5	46.76	90.0	993.0
5	500C5.00X	2		B	60.0	1.0	69.5	45.76	89.2	993.0
6	500C5.00X	2		C	60.0	1.0	70.5	45.76	88.2	993.0
7	500C5.00X	3		A	60.0	1.0	139.5	46.76	90.0	1004.2
8	500C5.00X	3		B	60.0	1.0	139.5	45.76	89.2	1004.2
9	500C5.00X	3		C	60.0	1.0	140.5	45.76	88.2	1004.2
10	500C5.00X	4		A	60.0	1.0	209.5	46.76	90.0	1025.1
11	500C5.00X	4		B	60.0	1.0	209.5	45.76	89.2	1025.1
12	500C5.00X	4		C	60.0	1.0	210.5	45.76	88.2	1025.1
13	500C5.00X	5		A	60.0	1.0	279.5	46.76	90.0	1098.3
14	500C5.00X	5		B	60.0	1.0	279.5	45.76	89.3	1098.3
15	500C5.00X	5		C	60.0	1.0	280.5	45.76	88.0	1098.3
16	230C5.00X1	6		A	60.0	1.0	-70.5	46.76	90.0	1072.5
17	230C5.00X1	6		B	60.0	1.0	-70.5	45.76	89.3	1072.5
18	230C5.00X1	6		C	60.0	1.0	-69.5	45.76	88.3	1072.5
19	230C5.00X1	7		A	60.0	1.0	-95.5	46.76	90.0	996.0
20	230C5.00X1	7		B	60.0	1.0	-95.5	45.76	89.3	996.0
21	230C5.00X1	7		C	60.0	1.0	-94.5	45.76	88.7	996.0
22	230C5.00X1	8		A	60.0	1.0	-120.5	46.76	90.0	1015.4
23	230C5.00X1	8		B	60.0	1.0	-120.5	45.76	89.4	1015.4
24	230C5.00X1	8		C	60.0	1.0	-119.5	45.76	88.9	1015.4
25	230C5.00X1	9		A	60.0	1.0	-145.5	46.76	90.0	1145.3
26	230C5.00X1	9		B	60.0	1.0	-145.5	45.76	89.4	1145.3
27	230C5.00X1	9		C	60.0	1.0	-144.5	45.76	89.1	1145.3

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mary_GSM_Near 3 Routers
Execution:	K101-230_500kV_45_DOC.25_70_5000vcmItrCu @4229_5000A.DLF1
Date:	11/2/2024 7:22:55 PM

Simulation Data

Installation type:	Multiple Ductbanks
Steady State Option	Unequally Loaded
Ambient temperature (°C)	12
Native Soil Thermal Resistivity (K.m/W)	1.15
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.	Rank-Incr Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27				
General Data																																
Cable ID	Equipment ID	900C.001	900C.001	900C.001	900C.001	900C.001	900C.001	900C.001	900C.001	900C.001	900C.001	900C.001	900C.001	900C.001	900C.001	900C.001	900C.001	900C.001	900C.001	900C.001	900C.001	900C.001	900C.001	900C.001	900C.001	900C.001	900C.001	900C.001				
Cable No.	Cable No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27				
Phase	Phase	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C				
Pa	Shielding	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes				
Co	Conductor	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes				
C	Conductor	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes				
OT	Outer Jacket	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes				
BT	Butt Joint	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes				
W	Winding	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes	Conductor 1 Post Boxes				
Anatomy																																
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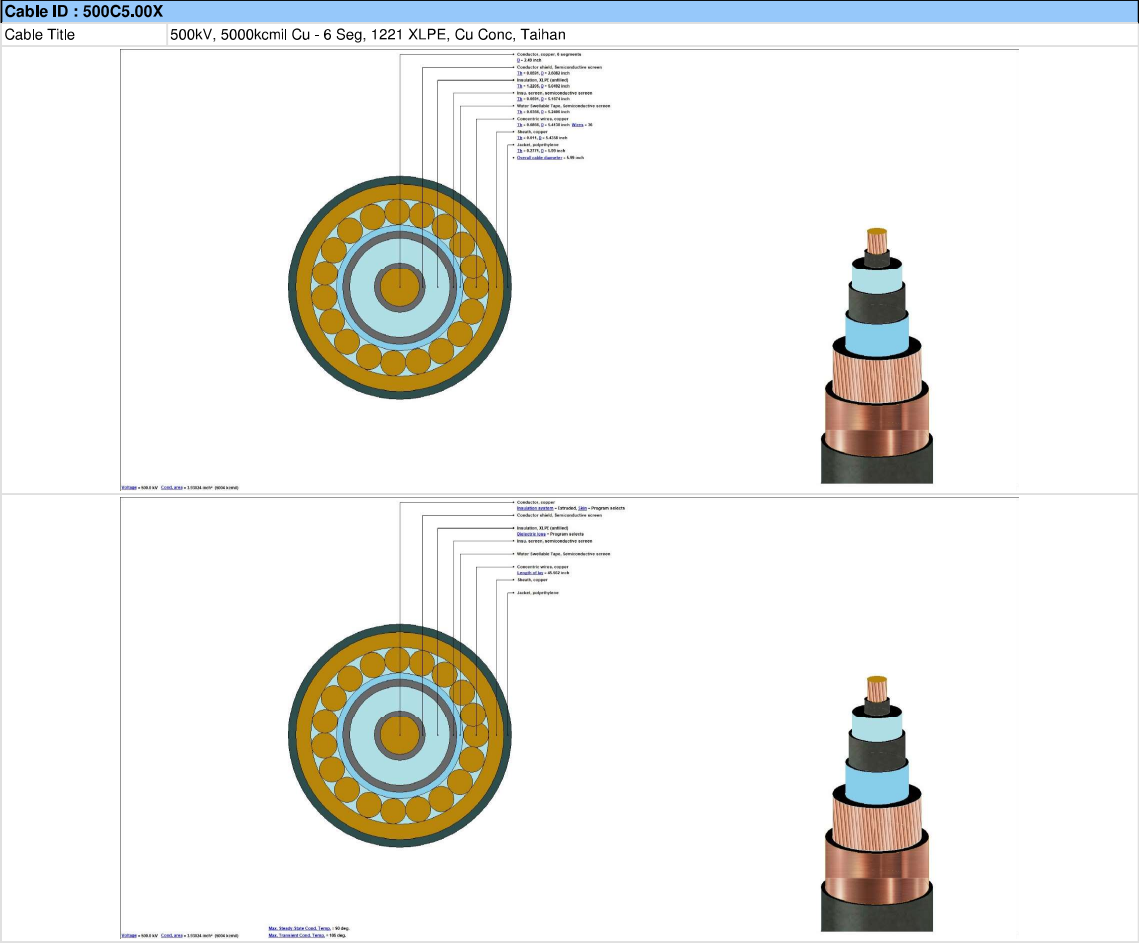


Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	K101-230_500kV,45_DOC,25__70_,5000kcmilInCu.@4229_5092A DLF1
Date:	11/2/2024 7:22:55 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		500C5.00X
2	Number of Cores		Single Core
3	Voltage	[kV]	500
4	Conductor Area	[in²]	3.93
5	Cable Overall Diameter	[in]	5.99
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.49
Conductor Shield			
19	Thickness	[in]	0.059
20	Diameter	[in]	2.608
Insulation			
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.1000ft]	1858
26	Thickness	[in]	1.22
27	Diameter	[in]	5.049
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.059
30	Diameter	[in]	5.167
Non Metallic Layer - Water Swellable Tape			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.037
34	Diameter	[in]	5.241
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		36
44	Wire Gauge		Undefined
45	Thickness	[in]	0.087
46	Diameter	[in]	5.414
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Non Corrugated
54	Thickness	[in]	0.011
55	Diameter	[in]	5.436
Jacket			
56	Material		Polyethylene
57	Thermal Resistivity	[K.m/W]	3.5
58	Thickness	[in]	0.277
59	Diameter	[in]	5.99

No.	Description	Unit	1
Specific Installation Data			
60	Cable Equipment ID		500C5.00X
61	Cable Frequency	[Hz]	60
62	Sheath / Shield Bonding		1 Conductor 1 Point Bonded Triangular
63	Loss Factor Constant (ALOS)		0.3
64	Spacing Between Cables in Section		n/a
65	Duct construction		Polyethylene in Concrete
66	Duct material thermal resistivity	[K.m/W]	3.5
67	Duct filling material		Air
68	Inner diameter of the conduit	[in]	8.678
69	Outer diameter of the conduit	[in]	10.75





Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	K101-230_500kV,45_DOC,25__70__5000kcmilInCu.@4229_5092A DLF1
Date:	11/2/2024 7:22:55 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		230C5.00X1
2	Number of Cores		Single Core
3	Voltage	[kV]	230
4	Conductor Area	[in²]	3.931
5	Cable Overall Diameter	[in]	5.22
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.54
Conductor Shield			
19	Thickness	[in]	0.1
20	Diameter	[in]	2.74
Insulation			
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.1000ft]	1858
26	Thickness	[in]	0.906
27	Diameter	[in]	4.552
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.05
30	Diameter	[in]	4.652
Non Metallic Layer - Water Swellable Tape 1			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.02
34	Diameter	[in]	4.692
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		46
44	Wire Gauge		14
45	Thickness	[in]	0.064
46	Diameter	[in]	4.82
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Longitudinally Corrugated
54	Corrugation height	[in]	0.006
55	Tape overlap	[in]	0.499999999
56	Tape width	[in]	15.91299998
57	Tape thickness	[in]	0.008
58	Accumulation factor		1.2
59	Thickness	[in]	0.006
60	Diameter	[in]	4.912
Jacket			
61	Material		Polyethylene
62	Thermal Resistivity	[K.m/W]	3.5
63	Thickness	[in]	0.154
64	Diameter	[in]	5.22

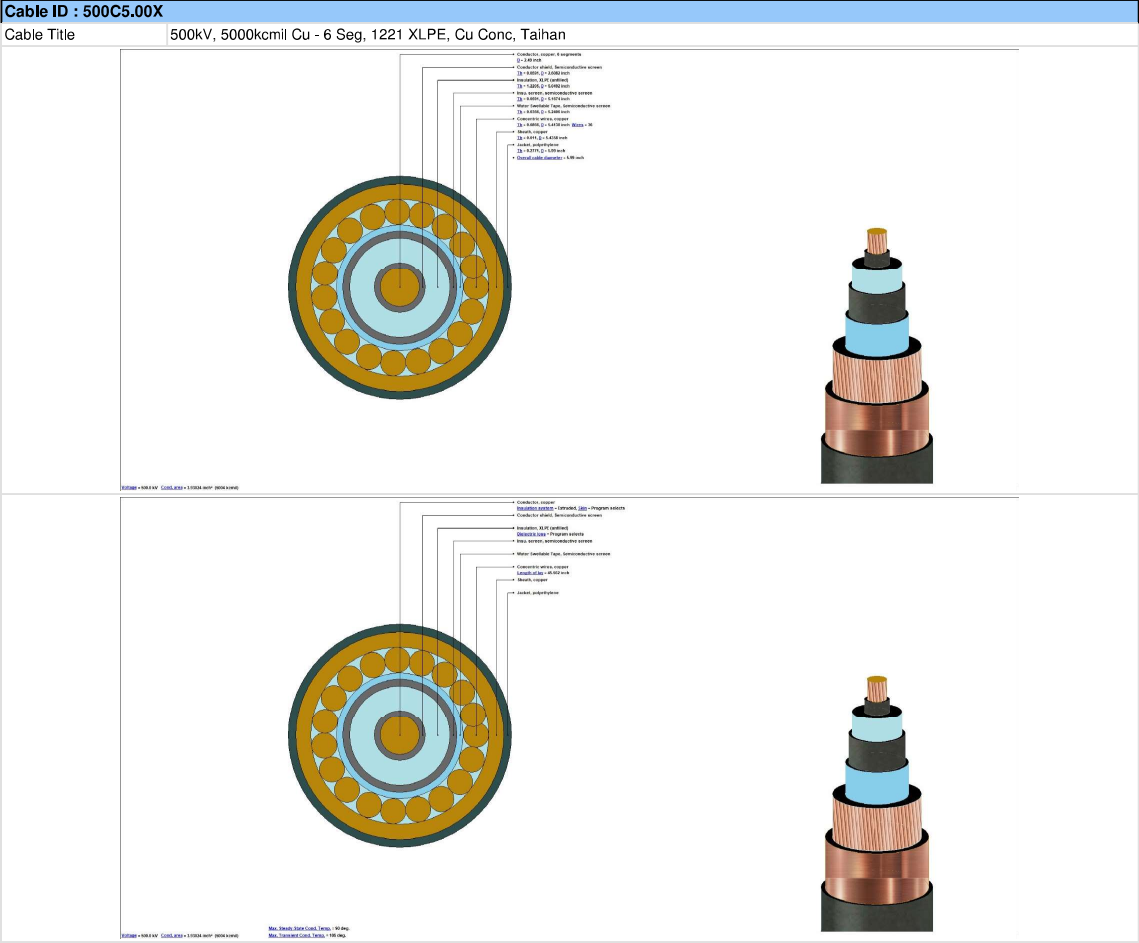


Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	K102-230_500kV,45_DOC,20_65_5000kcmilInCu.@4032_4974A DLF1
Date:	11/2/2024 5:01:41 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		500C5.00X
2	Number of Cores		Single Core
3	Voltage	[kV]	500
4	Conductor Area	[in²]	3.93
5	Cable Overall Diameter	[in]	5.99
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.49
Conductor Shield			
19	Thickness	[in]	0.059
20	Diameter	[in]	2.608
Insulation			
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.1000ft]	1858
26	Thickness	[in]	1.22
27	Diameter	[in]	5.049
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.059
30	Diameter	[in]	5.167
Non Metallic Layer - Water Swellable Tape			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.037
34	Diameter	[in]	5.241
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		36
44	Wire Gauge		Undefined
45	Thickness	[in]	0.087
46	Diameter	[in]	5.414
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Non Corrugated
54	Thickness	[in]	0.011
55	Diameter	[in]	5.436
Jacket			
56	Material		Polyethylene
57	Thermal Resistivity	[K.m/W]	3.5
58	Thickness	[in]	0.277
59	Diameter	[in]	5.99

No.	Description	Unit	1
Specific Installation Data			
60	Cable Equipment ID		500C5.00X
61	Cable Frequency	[Hz]	60
62	Sheath / Shield Bonding		1 Conductor 1 Point Bonded Triangular
63	Loss Factor Constant (ALOS)		0.3
64	Spacing Between Cables in Section		n/a
65	Duct construction		Polyethylene in Concrete
66	Duct material thermal resistivity	[K.m/W]	3.5
67	Duct filling material		Air
68	Inner diameter of the conduit	[in]	8.678
69	Outer diameter of the conduit	[in]	10.75





Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	K102-230_500kV_45_DOC_20_65_5000kcmilInCu.@4032_4974A DLF1
Date:	11/2/2024 5:01:41 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		230C5.00X1
2	Number of Cores		Single Core
3	Voltage	[kV]	230
4	Conductor Area	[in²]	3.931
5	Cable Overall Diameter	[in]	5.22
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.54
Conductor Shield			
19	Thickness	[in]	0.1
20	Diameter	[in]	2.74
Insulation			
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.1000ft]	1858
26	Thickness	[in]	0.906
27	Diameter	[in]	4.552
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.05
30	Diameter	[in]	4.652
Non Metallic Layer - Water Swellable Tape 1			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.02
34	Diameter	[in]	4.692
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		46
44	Wire Gauge		14
45	Thickness	[in]	0.064
46	Diameter	[in]	4.82
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Longitudinally Corrugated
54	Corrugation height	[in]	0.006
55	Tape overlap	[in]	0.499999999
56	Tape width	[in]	15.91299998
57	Tape thickness	[in]	0.008
58	Accumulation factor		1.2
59	Thickness	[in]	0.006
60	Diameter	[in]	4.912
Jacket			
61	Material		Polyethylene
62	Thermal Resistivity	[K.m/W]	3.5
63	Thickness	[in]	0.154
64	Diameter	[in]	5.22



Study Summary

CYMCAP Version	6.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	K103-230_500kV.45_DOC.20_65_5000kcmilinCu.@4047_4990A DLF1
Date:	11/2/2024 12:58:32 PM

General Simulation Data

Steady State Option	Unequally 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

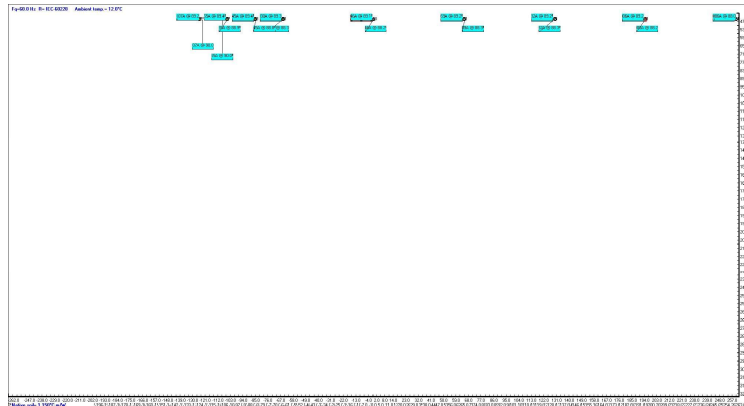
Standard Settings Options

General guidance	Custom
Factor on RAC due to magnetic armour	CIGREGuidance
Factor on RAC due to magnetic duct	CIGREGuidance
Factor on λ_2 due to magnetic armour	CYMCAPGuidance
Factor on λ_2 due to magnetic duct	CIGREGuidance
Factor on λ_2 due to λ'_1	CYMCAPGuidance
λ'_1 computation	CIGREGuidance
λ_2 pipe computation	CYMCAPGuidance
Wd computation	CIGREGuidance
T_2 computation	CIGREGuidance
T_4 computation	CYMCAPGuidance

Installation Type: Multiple Ductbanks/Backfills

Ambient Soil Temperature at Installation Depth	[°C]	12.0
Native Soil Thermal Resistivity	[K.m/W]	1.15
Consider Non-Isothermal Earth Surface		No

Layer Name	X [ft]	Y [ft]	Width [ft]	Height [ft]	Thermal Resistivity [K.m/W]
NSTD DB2	0.0	46.265	2.3	2.3	0.8
NSTD DB4	65.0	46.265	2.3	2.3	0.8
NSTD DB5	130.0	46.265	2.3	2.3	0.8
NSTD DB6	195.001	46.265	2.3	2.3	0.8
NSTD DB7	260.001	46.265	2.3	2.3	0.8
NSTD DB6	-65.0	46.265	2.3	2.3	0.8
NSTD DB7	-85.0	46.265	2.3	2.3	0.8
NSTD DB8	-105.0	46.265	2.3	2.3	0.8
NSTD DB9	-125.0	46.265	2.3	2.3	0.8



Results Summary

Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [ft]	Y coordinate [ft]	Conductor temperature [°C]	Ampacity [A]
1	500C5.00X	1		A	60.0	1.0	-0.5	46.76	90.0	946.0
2	500C5.00X	1		B	60.0	1.0	-0.5	45.76	89.1	946.0
3	500C5.00X	1		C	60.0	1.0	0.5	45.76	88.2	946.0
4	500C5.00X	2		A	60.0	1.0	64.5	46.76	90.0	969.4
5	500C5.00X	2		B	60.0	1.0	64.5	45.76	89.2	969.4
6	500C5.00X	2		C	60.0	1.0	65.5	45.76	88.3	969.4
7	500C5.00X	3		A	60.0	1.0	129.5	46.76	90.0	982.3
8	500C5.00X	3		B	60.0	1.0	129.5	45.76	89.2	982.3
9	500C5.00X	3		C	60.0	1.0	130.5	45.76	88.3	982.3
10	500C5.00X	4		A	60.0	1.0	194.5	46.76	90.0	1006.3
11	500C5.00X	4		B	60.0	1.0	194.5	45.76	89.2	1006.3
12	500C5.00X	4		C	60.0	1.0	195.5	45.76	88.2	1006.3
13	500C5.00X	5		A	60.0	1.0	259.5	46.76	90.0	1086.4
14	500C5.00X	5		B	60.0	1.0	259.5	45.76	89.3	1086.4
15	500C5.00X	5		C	60.0	1.0	260.5	45.76	88.0	1086.4
16	230C5.00X1	6		A	60.0	1.0	-65.5	46.76	90.0	1029.9
17	230C5.00X1	6		B	60.0	1.0	-65.5	45.76	89.3	1029.9
18	230C5.00X1	6		C	60.0	1.0	-64.5	45.76	88.3	1029.9
19	230C5.00X1	7		A	60.0	1.0	-85.5	46.76	90.0	944.7
20	230C5.00X1	7		B	60.0	1.0	-85.5	45.76	89.4	944.7
21	230C5.00X1	7		C	60.0	1.0	-84.5	45.76	88.8	944.7
22	230C5.00X1	8		A	60.0	1.0	-105.5	46.76	90.0	965.5
23	230C5.00X1	8		B	60.0	1.0	-105.5	45.76	89.4	965.5
24	230C5.00X1	8		C	60.0	1.0	-104.5	45.76	88.9	965.5
25	230C5.00X1	9		A	60.0	1.0	-125.5	46.76	90.0	1106.9
26	230C5.00X1	9		B	60.0	1.0	-125.5	45.76	89.4	1106.9
27	230C5.00X1	9		C	60.0	1.0	-124.5	45.76	89.2	1106.9

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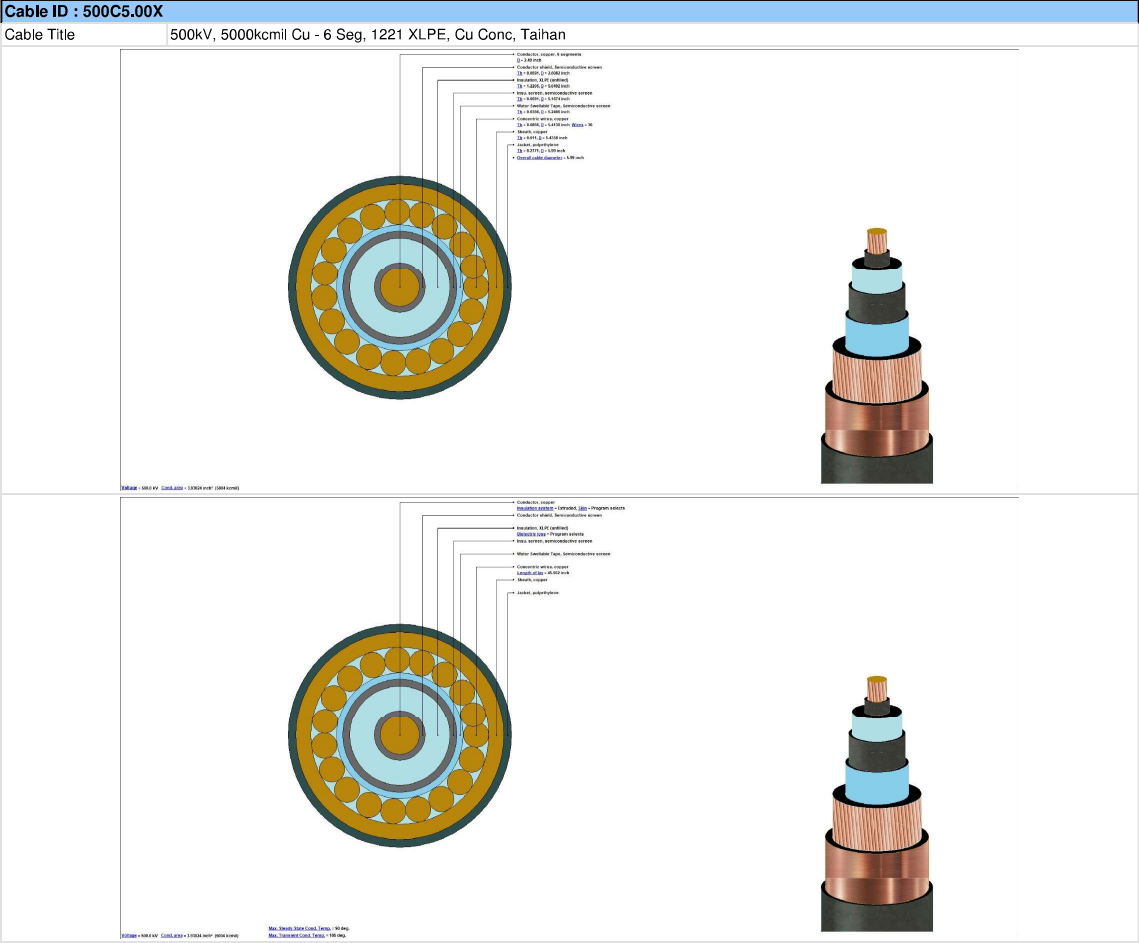


Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	K103-230_500kV,45_DOC,20_65_5000kcmilInCu.@4047_4990A DLF1
Date:	11/2/2024 12:58:32 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		500C5.00X
2	Number of Cores		Single Core
3	Voltage	[kV]	500
4	Conductor Area	[in²]	3.93
5	Cable Overall Diameter	[in]	5.99
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.49
Conductor Shield			
19	Thickness	[in]	0.059
20	Diameter	[in]	2.608
Insulation			
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.1000ft]	1858
26	Thickness	[in]	1.22
27	Diameter	[in]	5.049
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.059
30	Diameter	[in]	5.167
Non Metallic Layer - Water Swellable Tape			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.037
34	Diameter	[in]	5.241
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		36
44	Wire Gauge		Undefined
45	Thickness	[in]	0.087
46	Diameter	[in]	5.414
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Non Corrugated
54	Thickness	[in]	0.011
55	Diameter	[in]	5.436
Jacket			
56	Material		Polyethylene
57	Thermal Resistivity	[K.m/W]	3.5
58	Thickness	[in]	0.277
59	Diameter	[in]	5.99

No.	Description	Unit	1
Specific Installation Data			
60	Cable Equipment ID		500C5.00X
61	Cable Frequency	[Hz]	60
62	Sheath / Shield Bonding		1 Conductor 1 Point Bonded Triangular
63	Loss Factor Constant (ALOS)		0.3
64	Spacing Between Cables in Section		n/a
65	Duct construction		Polyethylene in Concrete
66	Duct material thermal resistivity	[K.m/W]	3.5
67	Duct filling material		Air
68	Inner diameter of the conduit	[in]	8.678
69	Outer diameter of the conduit	[in]	10.75





Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	K103-230_500kV_45_DOC_20_65_5000kcmilInCu.@4047_4990A DLF1
Date:	11/2/2024 12:58:32 PM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		230C5.00X1
2	Number of Cores		Single Core
3	Voltage	[kV]	230
4	Conductor Area	[in²]	3.931
5	Cable Overall Diameter	[in]	5.22
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.54
Conductor Shield			
19	Thickness	[in]	0.1
20	Diameter	[in]	2.74
Insulation			
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.1000ft]	1858
26	Thickness	[in]	0.906
27	Diameter	[in]	4.552
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.05
30	Diameter	[in]	4.652
Non Metallic Layer - Water Swellable Tape 1			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.02
34	Diameter	[in]	4.692
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		46
44	Wire Gauge		14
45	Thickness	[in]	0.064
46	Diameter	[in]	4.82
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Longitudinally Corrugated
54	Corrugation height	[in]	0.006
55	Tape overlap	[in]	0.499999999
56	Tape width	[in]	15.91299998
57	Tape thickness	[in]	0.008
58	Accumulation factor		1.2
59	Thickness	[in]	0.006
60	Diameter	[in]	4.912
Jacket			
61	Material		Polyethylene
62	Thermal Resistivity	[K.m/W]	3.5
63	Thickness	[in]	0.154
64	Diameter	[in]	5.22



Study Summary

CYMECAP Version	6.1 Revision 2
Study:	Giddon to Mars_G2M_New 3 Routes
Execution:	K104-230_500kV_45_DOC_20_65_5000kcmilKCu@4061_5006A DLF1
Date:	11/2/2024 10:42:47 AM

General Simulation Data

Steady State Option:	Unequally 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-238

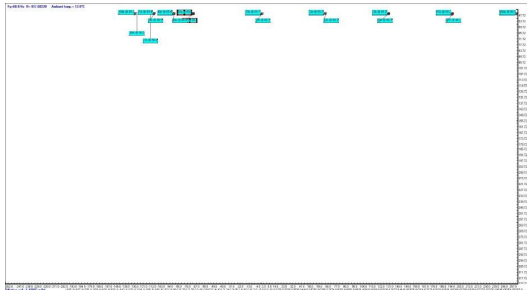
Standard Settings Options

General guidance	Custom
Factor on RAC due to magnetic armour	CXIREGuidance
Factor on RAC due to magnetic duct	CXIREGuidance
Factor on I_{sc} due to magnetic armour	CYMECAPGuidance
Factor on I_{sc} due to magnetic duct	CXIREGuidance
Factor on I_{sc} due to I_{sc}	CYMECAPGuidance
I_{sc} computation	CXIREGuidance
Supra computation	CYMECAPGuidance
Wtg computation	CXIREGuidance
T_1 computation	CXIREGuidance
T_2 computation	CYMECAPGuidance

Installation Type:Multiple Ductbanks/Backfills

Ambient Soil Temperature at Installation Depth:	[°C]	12.0
Native Soil Thermal Resistivity	[K.m/W]	1.15
Consider Non-isothermal Earth Surface		No

Layer Name	X [ft]	Y [ft]	Width [ft]	Height [ft]	Thermal Resistivity [K.m/W]
NSTD DB2	0.0	46.265	2.3	2.3	0.8
NSTD DB4	65.0	46.265	2.3	2.3	0.8
NSTD DB5	130.0	46.265	2.3	2.3	0.8
NSTD DB6	195.001	46.265	2.3	2.3	0.8
NSTD DB7	260.001	46.265	2.3	2.3	0.8
NSTD DB6	-70.0	46.265	2.3	2.3	0.8
NSTD DB7	-90.0	46.265	2.3	2.3	0.8
NSTD DB8	-110.0	46.265	2.3	2.3	0.8
NSTD DB9	-130.0	46.265	2.3	2.3	0.8



Results Summary

Cable No.	Cable ID	Circuit No.	Feeder ID	Cable Phase	Cable Frequency	Daily Load Factor	X coordinate [ft]	Y coordinate [ft]	Conductor temperature [°C]	Ampacity [A]
1	500C5.00X	1		A	60.0	1.0	-3.5	46.76	90.0	957.4
2	500C5.00X	1		B	60.0	1.0	-3.5	45.76	89.1	957.4
3	500C5.00X	1		C	60.0	1.0	0.5	45.76	88.3	957.4
4	500C5.00X	2		A	60.0	1.0	84.5	46.76	90.0	972.0
5	500C5.00X	2		B	60.0	1.0	84.5	45.76	89.2	972.0
6	500C5.00X	2		C	60.0	1.0	65.5	45.76	86.3	972.0
7	500C5.00X	3		A	60.0	1.0	129.5	46.76	90.0	983.2
8	500C5.00X	3		B	60.0	1.0	129.5	45.76	89.2	983.2
9	500C5.00X	3		C	60.0	1.0	130.5	45.76	88.3	983.2
10	500C5.00X	4		A	60.0	1.0	194.5	46.76	90.0	1006.6
11	500C5.00X	4		B	60.0	1.0	194.5	45.76	89.2	1006.6
12	500C5.00X	4		C	60.0	1.0	195.5	45.76	88.3	1006.6
13	500C5.00X	5		A	60.0	1.0	259.5	46.76	90.0	1086.5
14	500C5.00X	5		B	60.0	1.0	259.5	45.76	89.3	1086.5
15	500C5.00X	5		C	60.0	1.0	260.5	45.76	88.0	1086.5
16	230C5.00X1	6		A	60.0	1.0	-70.5	46.76	90.0	1037.3
17	230C5.00X1	6		B	60.0	1.0	-70.5	45.76	89.3	1037.3
18	230C5.00X1	6		C	60.0	1.0	-69.5	45.76	88.3	1037.3
19	230C5.00X1	7		A	60.0	1.0	-90.5	46.76	90.0	948.2
20	230C5.00X1	7		B	60.0	1.0	-90.5	45.76	89.4	948.2
21	230C5.00X1	7		C	60.0	1.0	-89.5	45.76	86.8	948.2
22	230C5.00X1	8		A	60.0	1.0	-110.5	46.76	90.0	967.4
23	230C5.00X1	8		B	60.0	1.0	-110.5	45.76	89.4	967.4
24	230C5.00X1	8		C	60.0	1.0	-109.5	45.76	86.9	967.4
25	230C5.00X1	9		A	60.0	1.0	-130.5	46.76	90.0	1108.2
26	230C5.00X1	9		B	60.0	1.0	-130.5	45.76	89.4	1108.2
27	230C5.00X1	9		C	60.0	1.0	-129.5	45.76	89.2	1108.2

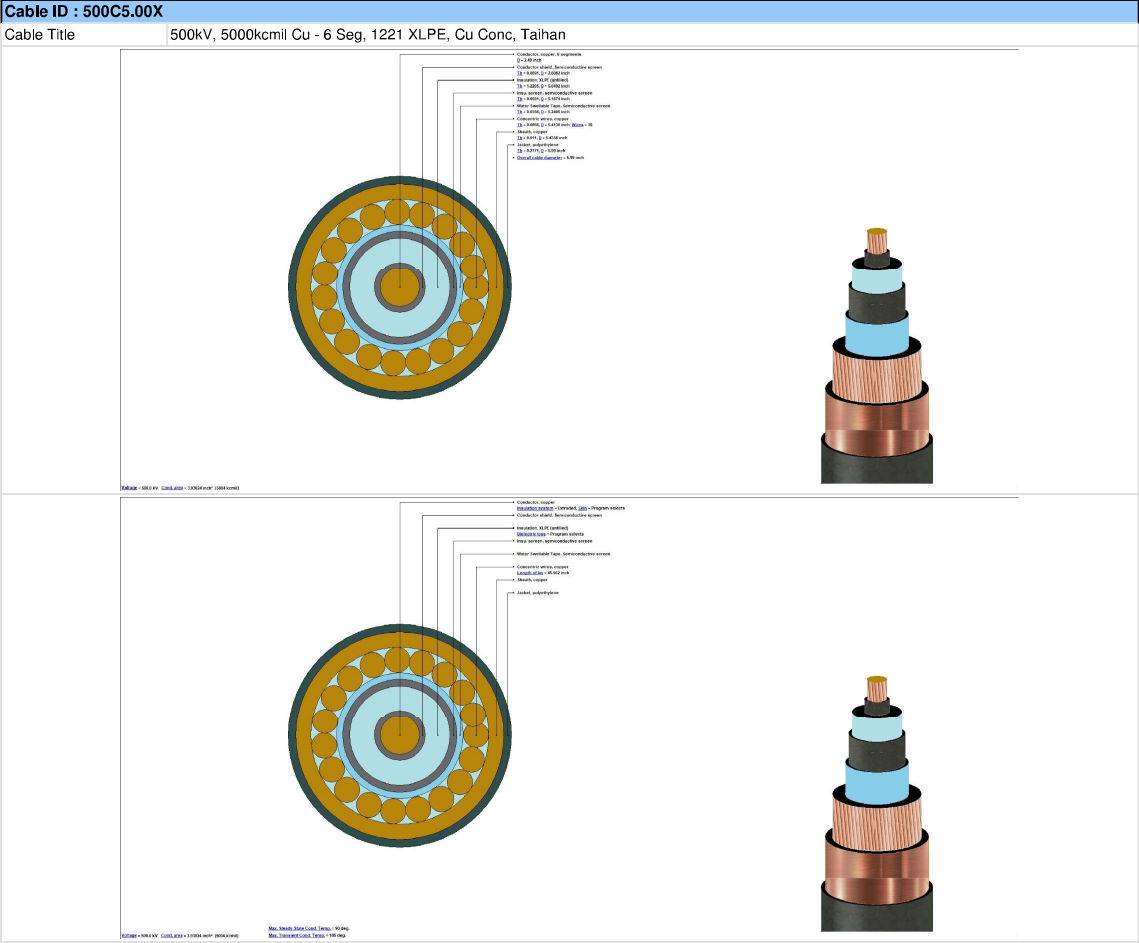


Cables Report

CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	K104-230_500kV,45_DOC,20_65_5000kcmilInCu.@4061_5006A DLF1
Date:	11/2/2024 10:42:47 AM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		500C5.00X
2	Number of Cores		Single Core
3	Voltage	[kV]	500
4	Conductor Area	[in²]	3.93
5	Cable Overall Diameter	[in]	5.99
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.49
Conductor Shield			
19	Thickness	[in]	0.059
20	Diameter	[in]	2.608
Insulation			
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.1000ft]	1858
26	Thickness	[in]	1.22
27	Diameter	[in]	5.049
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.059
30	Diameter	[in]	5.167
Non Metallic Layer - Water Swellable Tape			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.037
34	Diameter	[in]	5.241
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		36
44	Wire Gauge		Undefined
45	Thickness	[in]	0.087
46	Diameter	[in]	5.414
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Non Corrugated
54	Thickness	[in]	0.011
55	Diameter	[in]	5.436
Jacket			
56	Material		Polyethylene
57	Thermal Resistivity	[K.m/W]	3.5
58	Thickness	[in]	0.277
59	Diameter	[in]	5.99

No.	Description	Unit	1
Specific Installation Data			
60	Cable Equipment ID		500C5.00X
61	Cable Frequency	[Hz]	60
62	Sheath / Shield Bonding		1 Conductor 1 Point Bonded Triangular
63	Loss Factor Constant (ALOS)		0.3
64	Spacing Between Cables in Section		n/a
65	Duct construction		Polyethylene in Concrete
66	Duct material thermal resistivity	[K.m/W]	3.5
67	Duct filling material		Air
68	Inner diameter of the conduit	[in]	8.678
69	Outer diameter of the conduit	[in]	10.75





Cables Report

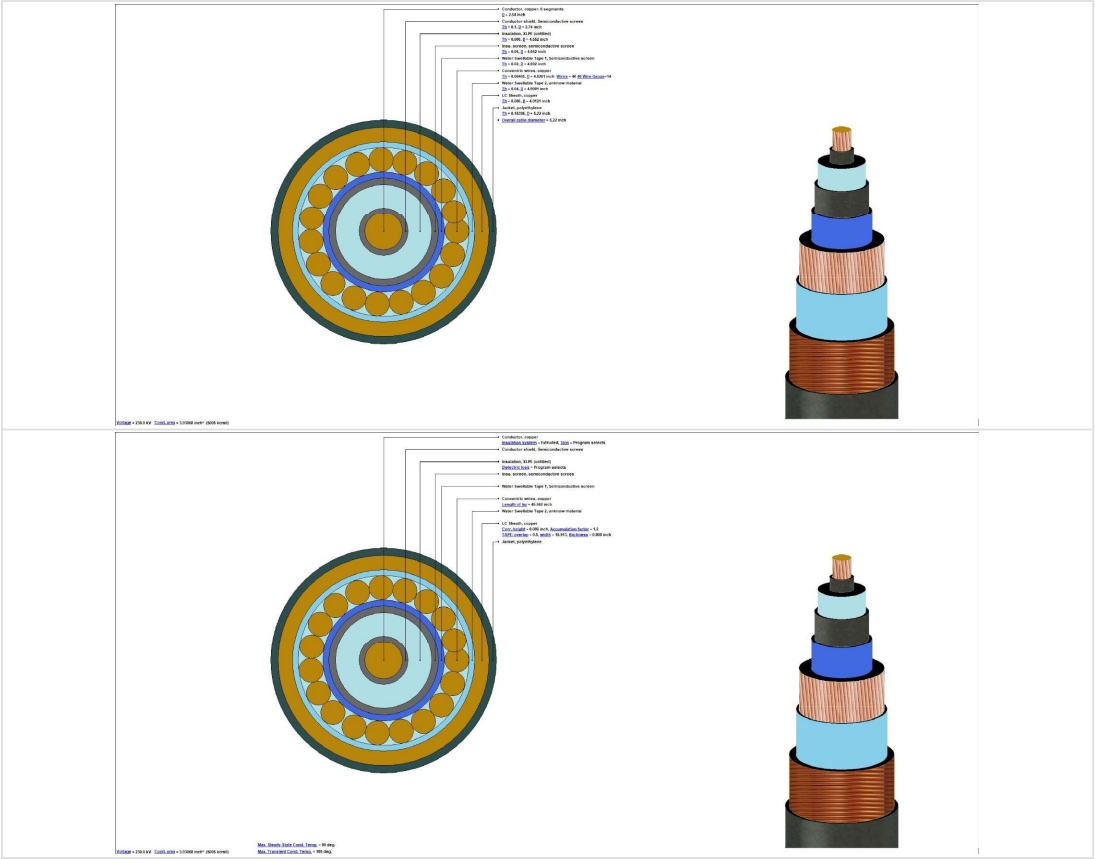
CYMCAP Version	8.1 Revision 2
Study:	Golden to Mars_G2M_New 3 Routes
Execution:	K104-230_500kV,45_DOC,20_65_5000kcmilInCu.@4061_5006A DLF1
Date:	11/2/2024 10:42:47 AM

No.	Description	Unit	1
General Cable Information			
1	Cable Equipment ID		230C5.00X1
2	Number of Cores		Single Core
3	Voltage	[kV]	230
4	Conductor Area	[in²]	3.931
5	Cable Overall Diameter	[in]	5.22
6	Maximum Steady-State Conductor Temperature	[°C]	90
7	Maximum Emergency Conductor Temperature	[°C]	105
Conductor			
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]	234.4529262
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	[in]	2.54
Conductor Shield			
19	Thickness	[in]	0.1
20	Diameter	[in]	2.74
Insulation			
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.1000ft]	1858
26	Thickness	[in]	0.906
27	Diameter	[in]	4.552
Insulation Screen			
28	Material		Semi Conducting Screen
29	Thickness	[in]	0.05
30	Diameter	[in]	4.652
Non Metallic Layer - Water Swellable Tape 1			
31	Material		EXTRUDED SEMICONDUCTIVE SCREEN
32	Thermal Resistivity	[K.m/W]	2.5
33	Thickness	[in]	0.02
34	Diameter	[in]	4.692
Concentric neutral/Skid wires			
35	Are Concentric Neutral Wires Around Each Core?		n/a
36	Material		Copper
37	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
38	Temperature Coefficient at 20 °C	[1/K]	0.00393
39	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
40	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
41	Wire Type		Round Wires
42	Length of Lay	[in]	45.562
43	Number of Wires		46
44	Wire Gauge		14
45	Thickness	[in]	0.064
46	Diameter	[in]	4.82
Sheath			
47	Is Sheath Around Each Core?		n/a
48	Material		Copper
49	Electrical Resistivity at 20 °C	[μΩ.cm]	1.7241
50	Temperature Coefficient at 20 °C	[1/K]	0.00393
51	Reciprocal of Temperature Coefficient of Resistance (BETA)	[K]	234.5
52	Volumetric Specific Heat (SH)	[J/(K*cm³)]	3.45
53	Corrugation Type		Longitudinally Corrugated
54	Corrugation height	[in]	0.006
55	Tape overlap	[in]	0.499999999
56	Tape width	[in]	15.91299998
57	Tape thickness	[in]	0.008
58	Accumulation factor		1.2
59	Thickness	[in]	0.006
60	Diameter	[in]	4.912
Jacket			
61	Material		Polyethylene
62	Thermal Resistivity	[K.m/W]	3.5
63	Thickness	[in]	0.154
64	Diameter	[in]	5.22

No.	Description	Unit	1
Specific Installation Data			
65	Cable Equipment ID		230C5.00X1
66	Cable Frequency	[Hz]	60
67	Sheath / Shield Bonding		1 Conductor 1 Point Bonded Triangular
68	Loss Factor Constant (ALOS)		0.3
69	Spacing Between Cables in Section		n/a
70	Duct construction		Polyethylene in Concrete
71	Duct material thermal resistivity	[K.m/W]	3.5
72	Duct filling material		Air
73	Inner diameter of the conduit	[in]	6.963
74	Outer diameter of the conduit	[in]	8.625

Cable ID : 230C5.00X1

Cable Title 230kV, 5000 kcmil Cu - 6 Seg, 906 XLPE, Cu cn, Prysmian



APPENDIX B UG CABLE CUTSHEETS

Prysmian Group HV Engineering Department	SPECIFICATION P/N 20235918	01/03/2018 Page 1 of 3 Rev. 0
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XLPE insulated, concentric neutral high voltage power cable with segmental oxidized Copper conductor, metal moisture barrier tape, HDPE jacket

Type Designation:	P/N 20235918 5000 kcmil Segmental Oxidized Copper 230kV		
Reference Standards	ICEA S-108-720, AEIC CS9		
Temperature Rating	Maximum conductor operating temperature:	90° C	
	Maximum conductor emergency operation temperature:	105° C	
	Maximum permissible conductor temperature at short circuit:	250° C	
Construction:			
Conductor	Class B segmental compacted oxidized Copper conductor		
	Nominal cross-sectional area	5000 kcmil	2535 mm²
	Number of segments	6	
	Number of strands per segment (1 Aluminum center wire)	85	
	Approximate diameter	2.540 inches	64.5 mm
Conductor Shield	[2] Semi-conducting tape applied helical intercalated	50% overlap	
	[2] Semi-conducting tape applied helical intercalated	50% overlap	
	[1] Extruded semi-conducting thermoset	Super Smooth	
	Minimum point thickness	30 mils	0.76 mm
Insulation	Extruded cross-linked polyethylene compound	Super Clean	
	Minimum point thickness	815 mils	20.7 mm
	Nominal thickness	906 mils	23.0 mm
	Maximum eccentricity (Tmax-Tmin)/Tmax	10%	
Insulation Shield	[1] Extruded semi-conducting thermoset		
	Minimum point thickness	40 mils	1.02 mm
	Maximum point thickness	100 mils	2.54 mm
Bedding	[2] Water swellable semi-conducting tape applied helical intercalated	50% overlap	
Concentric Neutral	[46] Wires, #14 AWG, solid bare soft drawn copper		1.63 mm
Bedding	[1] Copper tape	gapped	
	[2] Water swellable semi-conducting tape applied helical	50% overlap	
Metal Moisture Barrier	[1] Laminated Copper tape applied longitudinally folded and bonded to the jacket	6 mils	0.15 mm
Jacket	Extruded black high density polyethylene compound, graphite coated		
	Minimum point thickness	125 mils	3.18 mm
	Maximum point thickness	185 mils	4.70 mm
Complete Cable	Approximate diameter	5.22 inches	132.5 mm
	Approximate weight	22.8 lbs/ft	33.9 kg/m

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Marking:

Marks of Origin

Emboss or indent print on the outer sheath: manufacturer, type of insulation, insulation thickness, conductor size and material, rated voltage, year of manufacture at intervals of not more than three feet.
Length marking

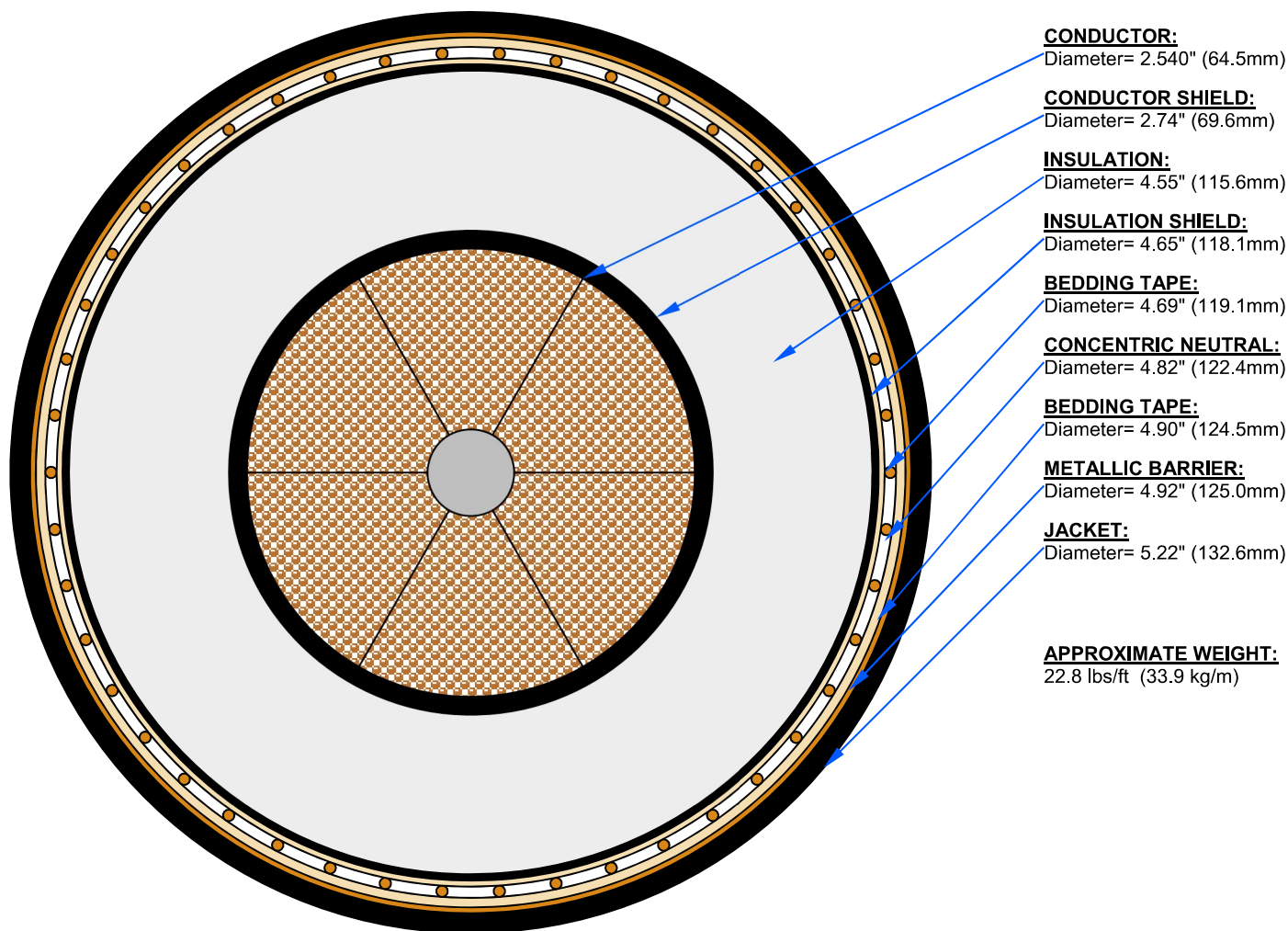
Electrical Data:

Nominal voltage	230 kV	
Highest system voltage	242 kV	
Basic impulse insulation level (BIL)	1050 kV	
Maximum DC resistance of conductor at 25 °C	0.00224 Ω/kft	
Maximum voltage stress (conductor shield / insulation interface)	196 V/mil	7.7 kV/mm
Minimum voltage stress (insulation / insulation shield interface)	117 V/mil	4.6 kV/mm
Capacitance (nominal)	0.080 µF/kft	0.262 µF/km
Dielectric Constant	2.4	
Maximum permissible short-circuit current (thermal)	15 Cycles	
Composite Metallic Sheath (concentric neutral and laminated copper sheath) - ICEA P-45-482 (T _{init} at 75 °C and T _{final} 200 °C)	40 kA	

Mechanical Data:

Minimum bending radius	104 inches	2.64 m
Maximum pulling tension (with pulling eye)	40,000 lbs	18,143.7 kg
Maximum sidewall-pressure	1,500 lbs/ft	2,232.2 kg/m

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**Notes:**

1. All dimensions are nominal and subject to manufacturing tolerances
2. Drawing is not to scale

Prepared by:

Dale Vinczi

Approved by:

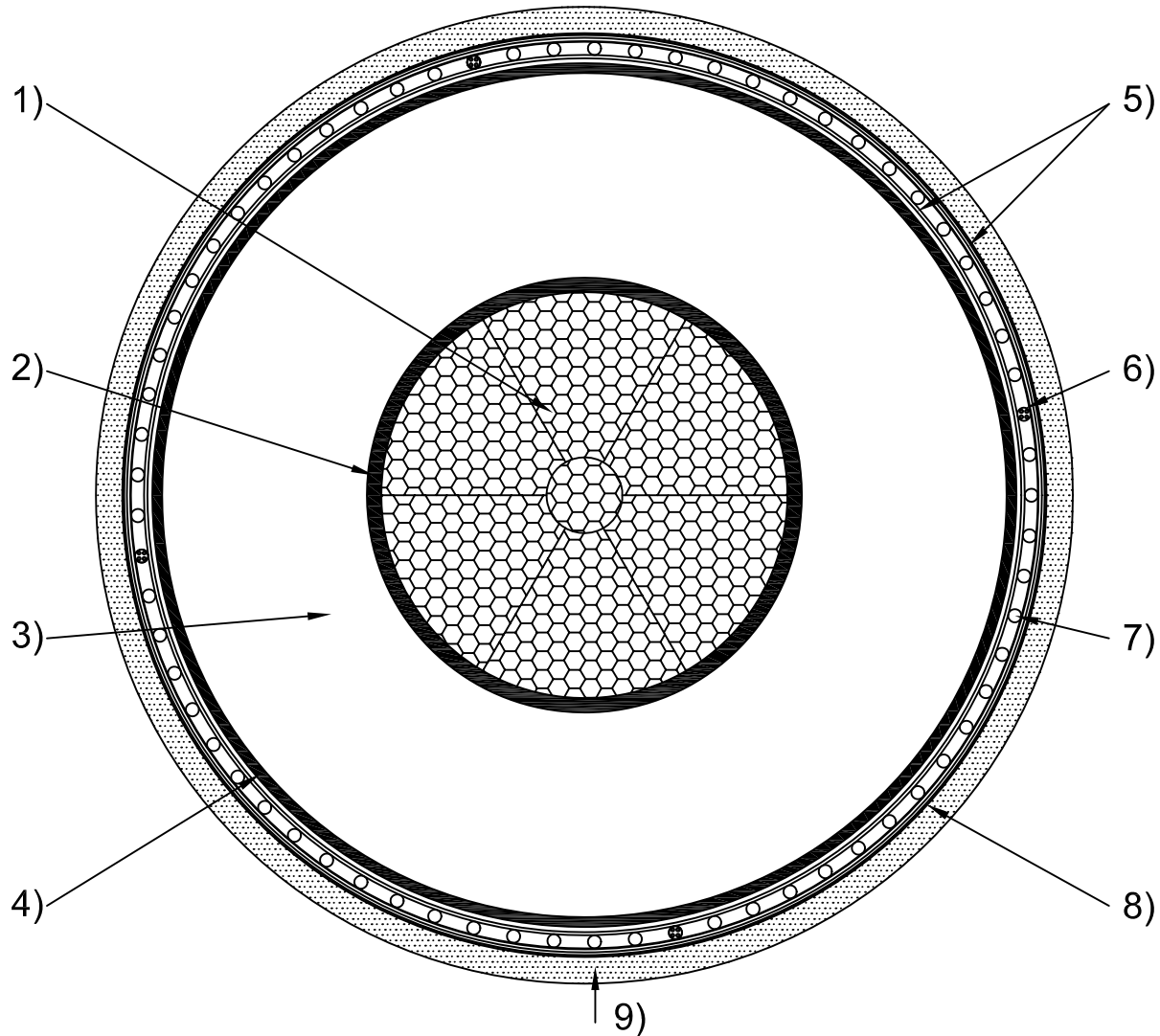
Frank Kuchta

Cross section of 500kV 1C x 5000KCMIL XLPE CABLE (CU / XLPE / CWS / MDPE)
6 Seg, compacted enamel coated copper conductor, XLPE insulation, Copper wire screen + CU-foil sheath,
MDPE + Semi-con PE outer jacket

RATED VOLTAGE : 500 kV

CONDUCTOR SIZE : 5000 kcmil

BASIC STANDARD : AEIC CS9



No.	DESCRIPTION	MATERIAL	Thickness (mil)	Diameter Approx., inch					
1)	CONDUCTOR	1 Central + 6 seg, Enamel coated copper wires	-	2.49					
2)	CONDUCTOR SCREEN	Semi - conductive tape & Semi - conductive compound	59.1	2.67					
3)	INSULATION	Cross - linked polyethylene [XLPE]	1220.5	5.12					
4)	INSULATION SCREEN	Semi-conductive compound	59.1	5.23					
5)	WATER BLOCKING LAYER	Semi-conductive swellable tape	Each 19.7 / 16.9	-					
6)	FIBER OPTIC CABLE	4 Single mode fiber optic cable in S/S	78.7 x 4EA	5.49					
7)	METALLIC SCREEN	Annealed copper wires with equalizing tape	86.6 x 36EA	5.51					
8)	METALLIC SHEATH	PE Laminated copper tape	11.0	5.60					
9)	OUTER JACKET	Black MDPE & Semi-con PE Outer Jacket	157.5 39.4	5.99					
COMPLETED CABLE		- Weight : Approx. 25.5 lb/ft - Fault Duty : 25 kA / 0.5 sec - Maximum D.C. resistance of conductor at 20°C : 0.00219 ohm/1000ft - Power frequency test (Withstand) voltage : A.C 580 kV for 60 min							
DWG. No.	500E5000IXOWE-C180118	REV.	0	DIM.	inch	Scale	N/S	taihan	



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