UNIVERSITY of TASMANIA

School of Engineering

ENG 333 Power Systems 1

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Major Project: New Wind Farm Connection Design

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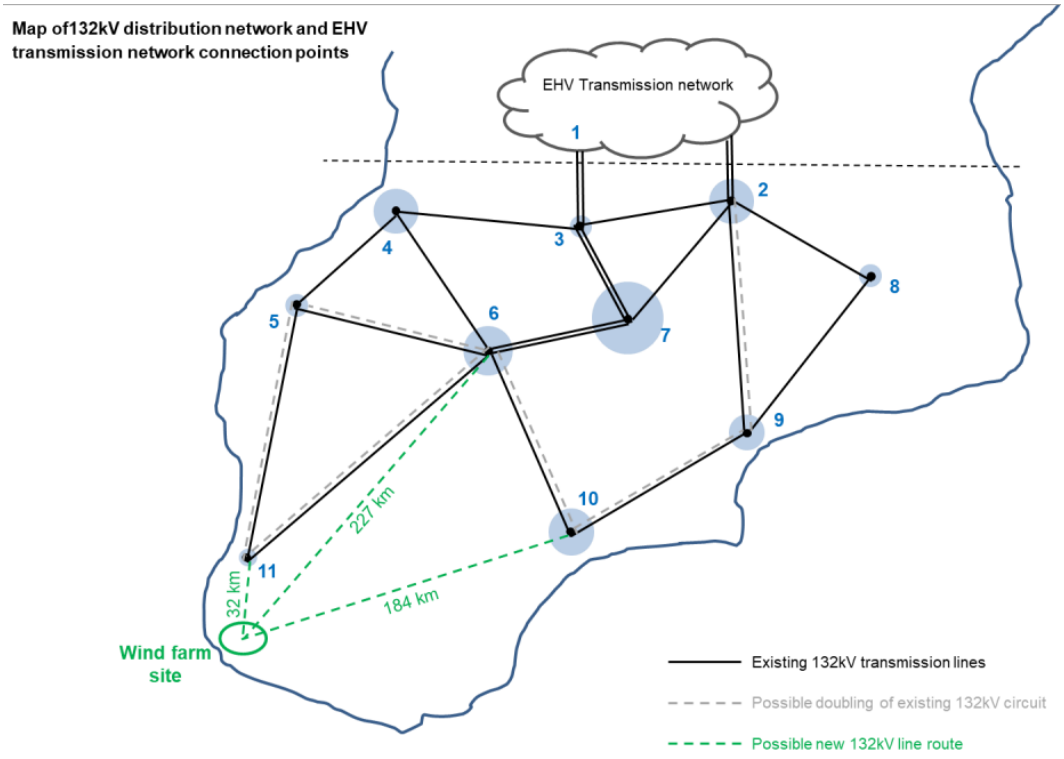


Table of Contents

1. Executive Summary

There is a proposition to connect a 160 MW windfarm to a fictional 132 kV transmission network. This report outlines my design of the entire system, including connection site, transmission components, network upgrades and operating conditions.

As energy from wind is projected to increase over the coming decades it is important to understand and model how these generators will interact with the network. Many parallels can be drawn from this project to the Tasmanian network, in fact there is a similar 168 MW wind farm at Mussel roe bay in the states Northeast that supplies 5% of Tasmania's energy needs.

Initial N-1 redundancy simulation of the gid in Power World shows the need for more generation in the south and suggest the current network has an over reliance on the EHV network to the north, especially during peak load times. There is an existing hydro generator in the south, but it only has a maximum capacity of 60 MW and is at the mercy of seasonal rain fall, only able to generate 50% of the year. A wind farm offers a renewable independent generator that doesn't rely on the same resource as the Hydro plant meaning both generators can supplement each other. This would mean more generation in the south and if designed correctly increase network stability.

The wind farm design must consider its connection point to the grid, line design, operating constraints, and effect on the remaining grid.

Bus 6 was selected as the connection point to the network. While it results in the longest line, bus 6 is the most inter-connected bus making the windfarms operation resistant to faults elsewhere in the network and minimizes the number of lines that need doubling.

To select the line components a python script was written that considers all possible combinations of components and produces a CSV file with each line's important information. From this CSV the cheapest line could be selected that satisfies all the design requirements given below.

- Do not exceed the thermal limit of the line
- Do not exceed the dynamic stability limit of the line
- Have power losses less than 5%
- Have a received voltage of above 0.95 pu when outputting 160MW at unity power factor

This selection process resulted in the following line.

Table 1. Proposed line design

Tower Type	A1
Bundling Type	2 conductors, 32 cm spacing
Conductor	31.5 mm
Length	227 km

To ensure N-1 fault redundancy and acceptable voltage regulation levels at all busses in the network the following upgrades should be made to the network.

Table 2. Proposed network upgrades

Bus	**Upgrade**
6	11x 15 MVA capacity
4	25 MVA Shunt capacitor

10	25 MVA Shunt capacitor
12	25 MVA Shunt capacitor

During minimum load and some fault conditions the wind farm's generation must be constricted below 160 MW as to not violate any line constraints, all different operating conditions are given in the report's *Operation limitations and power flow studies* and *System Security Studies* sections.

The line design costs $60,790,600 and the network upgrades costs $14,000,000 bringing the project to a total of $74,790,600.

2. Existing Network and operator

2.1 Initial observations

All loads in the network are less than 1 power factor suggesting there are no major problems with solar panels in the area. Therefore, inductive loads should only have to be added to the network if the windfarm is generating significant reactive power.

At peak load the Hydro plant must be generating otherwise bus 10 drops below 0.95 pu. This shows that changes are required in the network as the hydro plant cannot be trusted to generate power throughout the year. In fact, even with the hydro plant generating many parts of the network are close to below 0.95 pu. The low voltage at these busses can be boosted by enabling the existing shunt capacitors at bus 11 and bus 9, but still bus 10 still has a relatively low voltage of 0.96 pu.

The west side of the grid is heavily dependent on line 3-4. When this line faults during peak load bus 5 and 4 drop below 0.95 pu even with hydro generation at 60 MW. A similar situation occurs at bus 10 when line 9-10 fails, with bus 10 dropping below 0.95 pu. This all points towards more generation required in the south of the grid, good news for the wind farm!

The two lines to bus 10 are around 40% capacity are will most likely require to be doubled if the wind farm is connected at bus 10.

The 227 km connection to bus 6 offers the most fault resistant site as it is the most interconnected bus out of the possible connection sites. The other two connections points may be unsuitable for this reason, both bus 11 and bus 10 only have two transmission lines connecting them to the grid. If the wind farm is connected to either of these busses and one of these lines are disconnected from the network, the operation capacity of the wind farm may have to be severely limited as to not exceed capacity of the remaining line.

2.2 Operator Assumptions

The operator wants the ability to operate at maximum generation capacity no matter what network conditions assuming there are no faults, this includes if the hydro power plant is producing electricity or not.

If there is a fault in the system, the operator finds it acceptable to limit power generation but would like to keep it at a minimum.

The operator is looking to build an N-1 redundant system but at minimum cost.

The operator is going to operator the wind farm at a unity power factor. This will minimize the losses in the line but may result in requiring more reactive power injection throughout the network. This can be supplied by the 25 MVAr shunt capacitors available for purchase.

3. Line model design

3.1 Possible configurations

There are three main selections that must be made for designing a transmission line in this project. The conductor of which there are 5 types with different conductor diameters and thermal limits. The type of tower, 7 different designs with different phase layouts. Finally, the bundling type, 6 different types of bundling including no bundling.

All up that's 210 possible different configurations for each possible line! Because of this, the selection of the line was automated to find the optimal transmission line for each connection point.

This was done by a python script which calculates the ABCD parameters, receiving voltage, dynamic stability limit, line losses and cost things for each possible configuration of the line. This information is then written to a CSV file where the data can be sorted by cost and examined to find the most suitable line for a given distance.

3.1.1 Conductors

Table 3. Conductor Types

Conductor Type	Current Rating (Summer no wind)	Current Rating (Winter, wind > 2m/s)	Conductor Cost
AAC 9.0 mm diameter	110 A	308 A	$ 4,300 per km
AAC 16.3 mm diameter	216 A	636 A	$ 6,700 per km
AAC 21.0 mm diameter	299 A	875 A	$ 9,000 per km
AAC 26.3 mm diameter	405 A	997 A	$ 12,300 per km
AAC 31.5 mm diameter	495 A	1224 A	$ 16,300 per km

All conductors are assumed to be constructed from aluminum. While aluminum is not as conductive as copper it is around twice as light and much cheaper making it ideal for transmission lines. Aluminum has a resistivity coefficient of $2.83 \times 10^{-8}\ \Omega\, m$ at 20˚C with temperature coefficient of 228 ˚C.

The conductors are assumed to be operating at 50 degrees centigrade increasing the resistance. All conductors also have a packing factor of 90% meaning that only 90% of the cross-sectional area is aluminum. Finally, all conductor's resistance is increased by 10% due to skin effect.

The conductor selection essentially comes down to the tradeoff between price and diameter. Conductors with a larger diameter with have less losses in the line and will hence have a better power transfer and higher thermal limit but they will also cost more.

3.1.2 Towers

Table 4. Tower Types

Component	Phase Layout	Phase Spacing	Cost
Tower Type A1	Horizontal phasing	2.2 m	$62,000 per km
Tower Type A2	Horizontal phasing	2.7 m	$76,000 per km

Tower Type B1	Vertical phasing	2.4 m	$75,000 per km
Tower Type B2	Vertical phasing	3.2 m	$86,000 per km
Tower Type B1 - Double	Vertical phasing x 2	2.3 m & 5.5 m between ccts	$82,000 per km
Tower Type B2 - Double	Vertical phasing x 2	3.1 m & 7 m between ccts	$95,000 per km
Tower Type C	Triangle	3.2 m	$76,000 per km

There are 7 different tower designs to choose from. Towers with bigger phase spacing will have less flux linkage between lines and hence will have lower inductance and capacitance, the phase layout also effects these parameters. There were two main assumptions made about these towers.

The first is that the horizontal and vertical phase layout lines are transposed over the distance of the line, balancing the capacitance and inductance of each line. The second assumption is that the two parallel circuits in double line towers do not have any flux linkage and hence do not affect the inductance and capacitance of the lines.

3.1.3 Bundling

Table 5. Possible Bundling options

Conductor bundling options	Bundle pattern	Line installation cost (incl. bundling spacers)
No bundling – 1 conductor	N/A	$30,000 per km
Bundling spacer – 2 conductor, 24 cm	Horizontal, 24 cm spacing	$35,000 per km
Bundling spacer – 2 conductor, 32 cm	Horizontal, 32 cm spacing	$36,000 per km
Bundling spacer – 3 conductor, 23 cm	Triangle, 23 cm sides	$40,000 per km
Bundling spacer – 3 conductor, 33 cm	Triangle, 33 cm sides	$42,000 per km
Bundling spacer – 4 conductor, 26 cm	Square, 25 cm sides	$45,000 per km

Line bundling has many advantages for transmission lines. The increased surface area results in better cooling, the larger effective radius reduces the skin effect , also each individual line in the bundle doesn't have to carry as much current meaning the thermal current limit of the line is less of an issue. The simulation doesn't consider any of these benefits but does take into account the decreased capacitance and inductance of the line that results from bundling.

The main draw back for bundling is the increased cost per km as well as the extra conductors required.

3.2 Line model algorithm

The following dot points give the pseudo code for the line model algorithm python script. The algorithm takes in the length of the transmission line, a list of conductors, a list of bundle types and a list of tower designs and produces a CSV file.

- Create models for each conductor, tower and bundle type.
- Chose a tower
    - Chose a conductor
        - Chose a bundling type
            - Calculate line ABCD parameters per km
            - Calculate the receiving voltage and current when the wind farm is producing 160 MW at unity power factor with a sending end voltage of 132 kV
            - Calculate the power losses in the line
            - Calculate the cost of the line

        - Calculate the dynamic stability limit of the line
        - Store information in a data structure
        - Move onto the next bundling type and repeat
    - Move onto the next Conductor and repeat
- Move onto the next tower and repeat
- Create a CSV file and write all the data to it from the data structure

3.3 Calculations

3.4.1 Geometric mean radius calculation

The geometric radius of a bundle was calculated differently for each bundle type.

- For a single line with no bundling

$$GMR = e^{-\frac{1}{4}} r, \qquad r = conductor\ radius$$

- Two-line bundling

$$GMR = \sqrt{e^{-\frac{1}{4}} r * D}, \qquad D = spacing\ between\ conductors$$

- Three-line bundling

$$GMR = \left(e^{-\frac{1}{4}} r * D^2\right)^{\frac{1}{3}}$$

- Four-line bundling

$$GMR = \left(\sqrt{2} e^{-\frac{1}{4}} r * D^3\right)^{\frac{1}{4}}$$

3.4.2 Geometric mean distance calculation

GMD was calculated differently for each tower,

- For the tower C

$$GMD = D$$

- For all other towers

$$GMD = 2^{\frac{1}{3}} D$$

3.4.2 Line resistance

With a packing factor of 90%, the area of each conductor was calculated with,

$$A = 0.9\pi r^2$$

The resistance per km at 20℃ and a skin effect of 10% was then calculated with

$$R_1 = \rho \frac{1000}{A} * 1.1, \qquad \rho = resistivity\ constant$$

Finally, to adjust for the increase of temperature to 50℃

$$R = R_1 \frac{T + 50}{T + 20}\ ohm\ km^{-1}, \qquad T = temperature\ coefficient$$

3.4.3 Line inductance

The line inductance per km was calculated by,

$$l = 0.2 \times \ln\left(\frac{\text{GMD}}{\text{GMR}}\right) \text{m}H\ km^{-1}$$

3.4.4 Line Capacitance

The line capacitance per km was calculated by,

$$c = \frac{0.0556}{\ln \frac{GMD}{GMR}}\ \mu F\ km^{-1}$$

3.4.5 ABCD Parameters

Once the per km resistance, inductance, and capacitance the line is calculated the line impedance Z and line admittance Y is calculated with

$$z = r + j2\pi fl, \qquad y = j2\pi fc$$

The propagation constant is then calculated by

$$\gamma = \sqrt{zy}$$

And the characteristic impedance is calculated by

$$Z_c = \sqrt{\frac{z}{y}}$$

Finally, this allows us to calculate the ABCD parameters of each line with the equations

$$A = \cosh \gamma l \qquad B = Z_c \sinh \gamma l$$
$$C = \frac{1}{Z_c} \sinh \gamma l \qquad D = \cosh \gamma l$$

3.4.6 Sending end voltage and current

As discussed above it was assumed that the wind warm operates at unity power factor with a sending end voltage of 132 kV $\angle 0^{\circ}$. Therefore, the sending end current is calculated with the equation

$$I_s = \frac{S_{3\varphi}}{\sqrt{3} V_S}$$

3.4.7 Receiving end Voltage and current.

The ABCD parameters give the equations,

$$V_s = AV_R + BI_r \qquad I_s = CV_R + DI_R$$

Rearranging these simultaneous equations for V_R gives,

$$V_R = \frac{1}{C - \frac{AD}{B}} I_s - \frac{D}{B} V_s$$

Using this V_r you can then solve for I_R

$$I_R = \frac{V_S - A * V_R}{B}$$

3.4.8 Loss percentage

The power loss percentage is given by

$$\eta = 100 - \frac{P_s - P_R}{P_s} * 100$$

Where,

$$P_S = 160\ MW \qquad P_R = \sqrt{3} V_R I_R^* \cos\theta$$

3.4.9 Dynamic Stability limit

The power of the receiving end is given by the equation.

$$P_{R(3\varphi)} = \frac{|V_S||V_R|}{|B|}\cos(\theta_b - \delta) - \frac{|A||V_S|}{|B|}\cos(\theta_b - \theta_a)$$

As θ_a and θ_b are fixed constants the maximum power transfer occurs at $\cos(\theta_b - \delta) = 1$, at the steady state stability angle

$$\delta = \theta_b$$

If a higher power is transmitted through the line the generator can lose synchronism and power transfer will cease. The dynamic stability limit angle is half that of the steady state stability angle, therefore the line will not exceed its power transfer limit.

$$\delta = \frac{\theta_b}{2}$$

3.4.10 Cost function

Finally, the cost function of the line takes the length of the line and multiplies it by the cost of each component per km.

$$cost = l(3 \times cost_{bundle} + cost_{tower} + 3 \times cost_{conductor} \times N_{conductors\ per\ phase})$$

3.4.11 Power and current flow limits

The line must have a dynamic stability limit of below $200\ MW$, this gives a 25% buffer above the maximum capacity of the wind farm.

The line also must not surpass a current 75% that of the summer current rating. While the wind farm may never be generating at max capacity during the summer due to low winds, this limit means the transmission line should never exceed its thermal limit.

3.4.12 Received voltage

The received voltage should not drop below 0.95 per unit at the receiving end.

3.4.13 Power loss

The loss in power due to the line should not exceed 5%.

3.5 Possible connection sites and lines overviews

3.5.1 32 Km Connection

Tower Type	B1 - Doubled
Bundling Type	No Bundling
Conductor	31.5 mm
Received voltage	$131.6\angle -3.6$
Power Loss	0.45%
Thermal current	Under limit
Dynamic stability limit	972.84 MW
Cost	8.9 million $

Discussion:

Due to the short distance the thermal limit of the line was the main limiting factor for the line combinations.

This connection site will result in the cheapest line as it's the shortest distance to the wind farm. However, it is a relatively isolated bus making it vulnerable to faults in the network. Also, the connecting lines 5-11, 6-11 will almost certainly need to be doubled to facilitate the power transfer from the wind farm.

Because of the connectivity issues that buss 11 has I will not be choosing this connection site for my final design.

3.5.2 184 km connection

Tower Type	A1
Bundling Type	2 conductors, 24 cm spacing
Conductor	31.5 mm
Received voltage	$130.2\angle -13.9$
Power Loss	2.42%
Thermal current	Under limit
Dynamic stability limit	243.44 MW
Cost	48.7 million $

Discussion:

Again the thermal limit was the main constraint for each line configuration.

This line connection site will not be chosen due the under connected nature of bus 10. Just one fault on either line 6-10 or 9-10 would result in all the wind farms power being transmitted through one line, this would mean that the windfarms power output would have to be significantly limited.

3.5.3 227 km connection

Tower Type	A1
Bundling Type	2 conductors, 32 cm spacing
Conductor	31.5 mm
Received voltage	$129.8\angle -16.6\ (0.983\ p.u.)$
Power Loss	2.98%
Thermal current	Under limit
Dynamic stability limit	204.15 MW
Cost	60.8 million $

Discussion:

The longer line length meant that the dynamic stability limit began to be the main limiting factor for each line combination.

This is line configuration and connection site will be the one chose for the final design.

While it is the most expensive line it offers the most interconnected bus connection, great for N-1 fault redundancy. Also, because of bus 6's highly connected set up its likely that there will be minimal substation and line doubling upgrades required.

4. Proposed design

4.1 Line specifications

Tower Type	A1
Bundling Type	2 conductors, 32 cm spacing
Conductor	31.5 mm
Length	227 km

Impedance (Ω per km)	$0.025 + 0.238j$
Admittance (Ω^-1 per km)	4.609×10^{-6}
Impedance (pu)	$0.0326 + 0.310j$
Admittance (pu)	6.00×10^{-6}

A	$0.972 + 0.003j$
B	$5.541 + 53.549j$
C	$0 + 0.001j$
D	$0.972 + 0.003j$

Sending end	
Voltage	$132 \angle 0 \quad (1\ p.u. reference)$
Current	$700 \angle 0 \quad (unity\ power\ factor)$

Receiving end	
Voltage	$129.8 \angle -16.6$ (0.983 pu)
Current	$693.5 \angle -11.2$ (0.99 pu)

Power Loss	2.98%
Thermal current	Under limit
Steady Stability limit	286.08 MW
Dynamic Stability limit	204.15 MW

Cost	60.8 million $

4.2 Grid upgrades

Bus	Upgrade

6	11x 15 MVA capacity
4	25 MVA Shunt capacitor
10	25 MVA Shunt capacitor
12	25 MVA Shunt capacitor

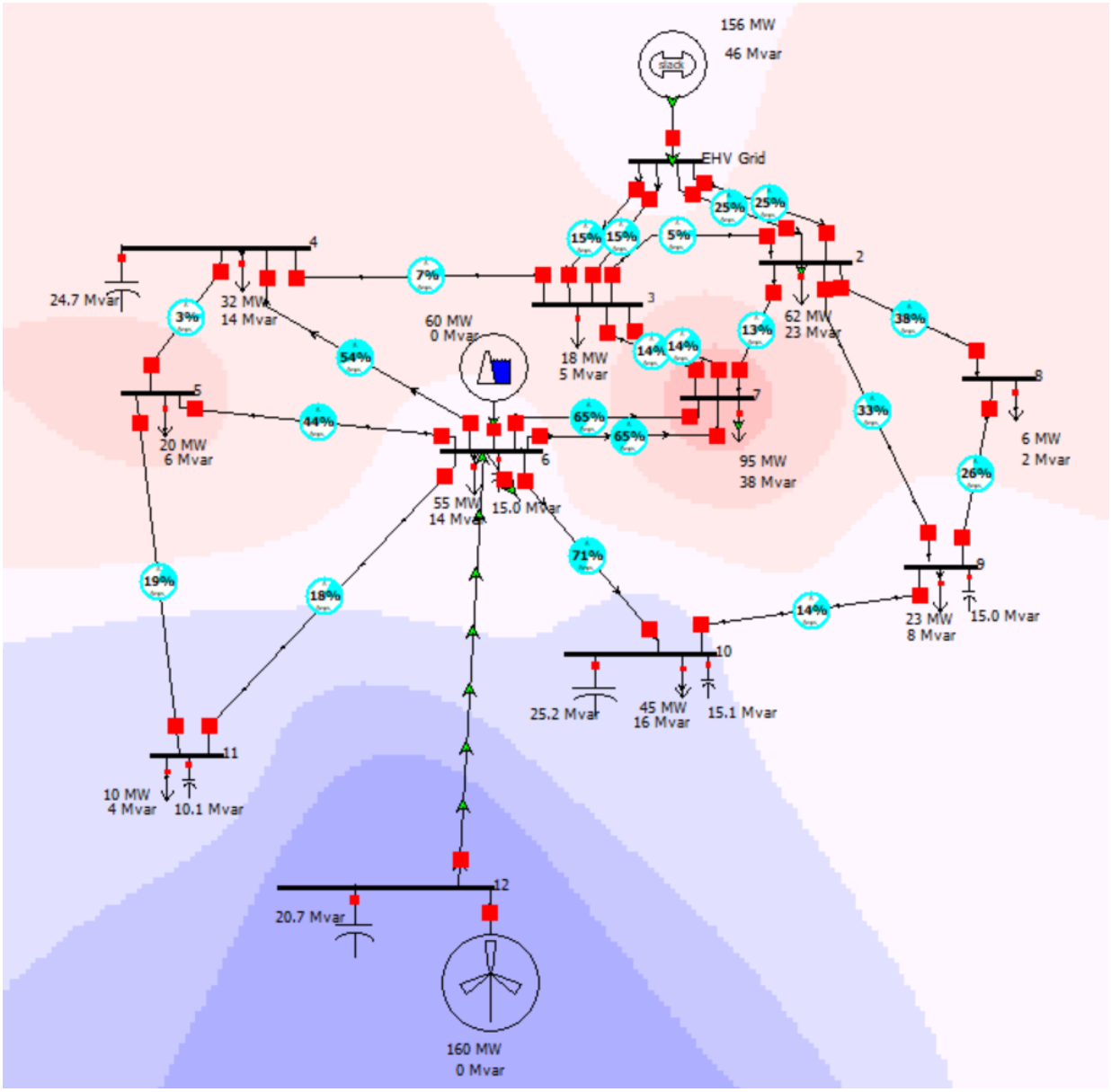


Figure 1. Final Grid and connection Design

Justifications:

Bus 6 11x 15 MVA Connection capacity:

This upgrade is necessary to allow up to 160 MW to be transferred from the wind farm to the grid. It's required for all connection sites so there is not much we can do to avoid the cost other than limit the output of the wind farm which is unacceptable.

Bus 4 25 MVA shunt capacitor:

This shunt capacitor increases the voltage of the west side of the network and makes the network failure resistant to line 4-3 going out of service. When the hydro plant is not producing power and line 3-4 fails, the voltage at bus 4 and 5 drops below 0.95 pu, adding a shunt capacitor boosts voltage and brings both busses within acceptable voltage ranges under these conditions.

As discussed in the initial overview of the network this was already an existing issue within the so maybe the cost of this capacitor bank can be subsidized.

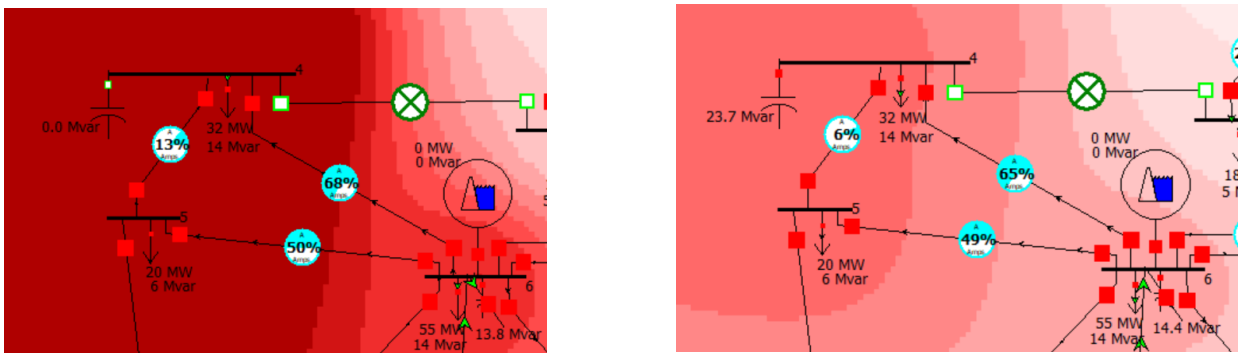


Figure 2. Voltage before and after 25 MVA shunt capacitor is added to bus 4

Bus 10 25 MVA shunt capacitor:

This shunt capacitor is added to the network to boost the voltage of bus 10 when lines 6-10 or 9-10 fail. When either of these lines fail the voltage at bus 10 will drop below 0.95 pu, adding a shunt capacitor boosts voltage to an acceptable range.

Like capacitor at bus 4 this was already an existing issue within the network and could be subsidized.

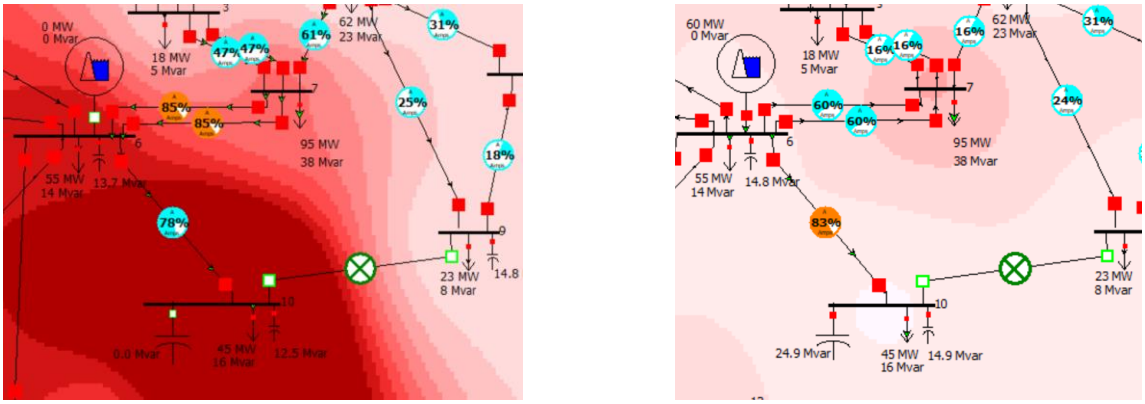


Figure 3. Voltage before and after 25 MVA shunt capacitor is added to bus 10

Bus 12 25 MVA shunt capacitor:

This is an *optional* shunt capacitor that is used to inject reactive power at the wind farm. If no reactive power is injected or produced by the wind farm at bus 12 the voltage will drop below 0.95 pu. Due to the assumption that the operator will operate the wind farm at a unity power, not producing any reactive power, the shunt capacitor banks are required to inject reactive power and boost the voltage. If the

operator determines that it is cheaper to produce up to 25 MVar at the wind farm then this shunt capacitor should be removed from the design.

5. Operation limitations and power flow studies

5.1 Normal operating conditions

There are three main factors that can affect how the network behaves. The first is the amount of wind generation available to the wind farm. The second is the operation of the hydro power plant. The last is the time of day, this will determine peak/off peak loads.

To model all these operating conditions the following cases will be considered.

Table 6. Operating cases for the network

Case	Hydro Generation	Wind Generation	Load
1	60	160	Off peak
2	0	160	Off peak
3	60	0	Off peak
4	0	0	Off peak
5	60	160	On peak
6	0	160	On peak
7	60	0	On peak
8	0	0	On peak

All transmission lines in the network should not exceed its power transfer limit and all voltage busses should remain in $1.05 - 0.95\ p.u.$ under any of these conditions.

5.2 Network operation

Each of the cases give in Table 6 were simulated in Power World to make sure no limitations are exceeded. Table 7 shows the configuration of the network to operate under each case

Table 7. Operating conditions for the network

Case	4 C_{new}	6 C_{old}	9 C_{old}	10 C_{old}	10 C_{new}	11 C_{old}	12 C_{new}
1*	Off	On	On	On	Off	Off	Off
2	Off	On	On	On	Off	Off	On
3	Off	On	On	On	Off	Off	Off
4	Off	On	On	On	Off	Off	Off
5	On	On	On	On	On	On	On
6	On	On	On	On	On	On	On
7	On	On	On	On	On	On	Off
8	On	On	On	On	On	On	Off

C_{new} = New shunt capacitor

C_{old} = Old shunt capacitor

Discussion:

When operating at case 1 the power limits of lines 6-7 are exceeded, shown in Figure 4. To avoid this the line could be doubled to increase the power transfer capacity, however this would require expensive upgrades to the network for a time of the day where there is ample power supply and not much demand, resulting in off-peak energy prices. Such an investment is likely to never pay off. Instead, the windfarms operation will be limited to 130 MW, bringing the line within acceptable power transfer limits.

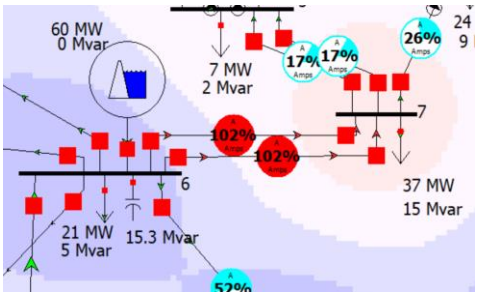


Figure 4. Lines 6-7 exceeding their limits during off-peak demand with the wind farm generating 160 MW

Table 8. Demand and network efficiency for each operating condition

Case	Hydro Generation	Wind Generation	EHV Grid	Demand	Efficiency
1	60	160	-67	141	91.5
2	0	160	-11	141	94.3
3	60	0	82	141	99.3
4	0	0	143	141	98.63
5	60	160	156	366	92.9
6	0	160	216	366	92.9
7	60	0	311	366	96.5
8	0	0	374	366	94.3

6. System Security Studies

6.1 Methodology

All power distribution and transmission networks must be tested for vulnerabilities, in this project the network will be tested for N-1 redundancy. N-1 redundancy means that the network should not fail if any individual line is taken out of service, giving a good overview for the robustness of the network. N-1 redundancy is not flawless however as line outages are often not independent events and can happen simultaneously (for example a storm).

N-1 redundancy was performed for each case outlined in Table 6. If any problems arose, the network was adjusted to mitigate the issue, this included toggling shunt capacitors and limiting the output of the wind farm. Because the network can be controlled no extra components or line doubling were required which mitigates the cost of new expensive components.

6.2 Results

6.2.1 Case 1

Fault:	Line 6-7 Outage
Issue:	The remaining line 6-7 exceeds the line limit
Solution	Reduce windfarm generation to 70 MW

Discussion: At this operating condition pre-fault the windfarm already had been limited to 130 MW due to the parallel circuits 6-7 being overloaded. When a line outage occurs on one of these parallel lines the problem is compounded, and the output of the wind farm must be lowered to 70 MW. This brings the remain transmission line at 80% of its capacity.

Fault:	Line 3-4 Outage
Issue:	The line 6-7 exceeds its capacity
Solution	Reduce windfarm generation to 90 MW

Discussion: Brings lines 6-7 under 80% capacity.

6.2.2 Case 2

Fault:	Line 4-6 or 6-10 outage
Issue:	Lines 6-7 at around 80 percent capacity
Solution	Possibly reduce wind farm generation

Discussion: While the lines are still with in capacity it should be noted that when line 4-6 or 6-10 is isolated the lines 6-7 are above 80% capacity. Depending on weather conditions (summer or winter) and length of transmission line (thermal limit reached or dynamic stability limit) this may require the wind farm generation to be reduced.

Fault:	Line 6-7 outage
Issue:	Remaining line 6-7 above capacity
Solution	Reduce wind farm generation to 130MW

Discussion: Remaining line now at 80% capacity

6.2.3 Case 3

Fault:	Line 2-8 outage
Issue:	East side of grid increases in voltage
Solution	Turn off the shunt capacitor at bus 9

Discussion: While the voltage doesn't rise above 1.05 it can be brought closer to 1 pu by disconnecting the capacitor bank at bus 9.

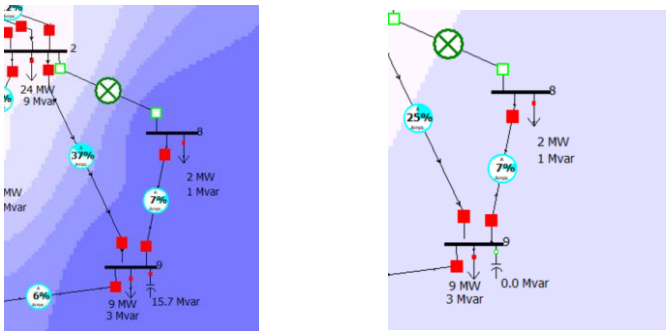


Figure 5. Voltage on east side of grid being reduced by disconnecting the shunt capacitor at bus 9

6.2.4 Case 4

There were no issues found in case 4.

6.2.5 Case 5

Fault:	Line 6-7 outage
Issue:	Remaining line 6-7 above capacity
Solution	Reduce wind farm generation to 130 MW

Discussion: Remaining line 6-7 now at 74% capacity.

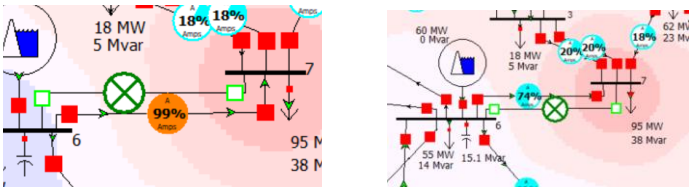


Figure 6. Line 6-7 before and after the wind farms generation was limited

6.2.6 Case 6

Fault:	Line 6-10 outage
Issue:	Line 9-10 and parallel lines 6-7 at 90% capacity
Solution	Reduce wind farm generation to 140 MW

Discussion: Reducing the generation brings lines 6-7 under 80% capacity but this does nothing to reduce the load traveling through line 9-10. To lower the load on line 9-10 the circuit could be doubled, however because the line is still under capacity, no upgrades will be made to the network.

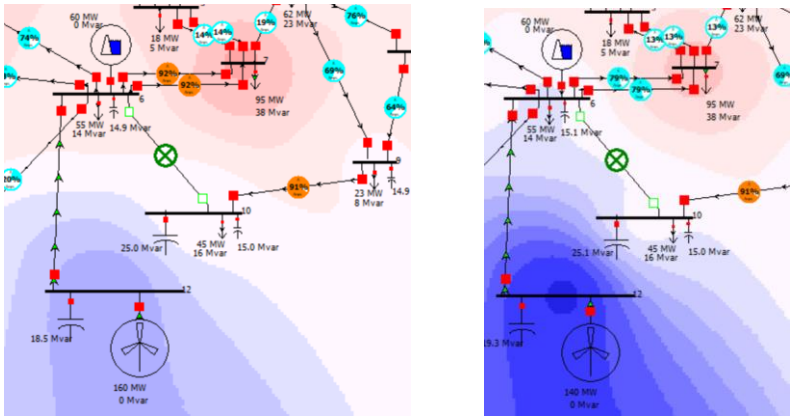


Figure 7. Loads on lines 6-7 being lowered by reducing the generation at the wind farm

6.2.7 Case 7

There were no issues found in case 7.

6.2.8 Case 8

Fault:	Line 6-7 outage
Issue:	Remaining line 6-7 at exceeds limit, line 4-3 also reaches 90%
Solution	Begin generation at either the wind farm or the hydro plant.

Discussion: When there is no generation occurring in the south, the grid is purely reliant on importing energy from the north EHV grid. This results the remaining 6-7 line exceeding its limit when the other is down. When energy is generated either at the hydro powerplant or the wind farm the limit is no longer exceeded.

This may be an issue due to the generation consistency of the wind farm and hydro plant. As outlined in the document the hydro plant cannot run consistently throughout the year, however when supplemented with the wind farm energy generation is more consistent in the south, showing the need for more diverse and uncorrelated energy sources in the south.

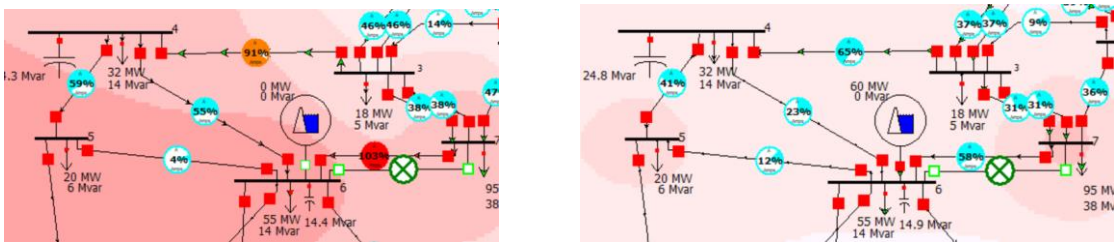


Figure 8. Line loads at 3-4 and 6-7 being lowered by generation of 60 MW at the hydro plant

7. Fault analysis

7.1 Method

For calculating fault currents on the new transmission line only balanced 3-phase faults were considered. While a balanced short across all 3-phases is rare it provides an upper limit for the fault current supplied by each generator.

The following assumptions were made about the network to perform the fault analysis.

- All generators are outputting 1 pu of voltage at 0 degrees
- Shunt capacitance of the lines is neglected
- Only the inductive reactance is considered
- All loads at the busses are neglected (this current is already being supplied)

The wind farm was assumed to contribute no fault current to the system. This is due to the power electronics not being capable of producing such a high current, something that may change in the future.

All calculations were made with a base power $S_B = 100\ MVA$, and a base voltage of $V_B = 132\ kV$, giving a base current of $I_B = 437.4\ A$ and base impedance of $Z_B = 174.24\ \Omega$.

The network was simplified down from its representation in power world to a simplified parallel circuit through a series of reduction steps. This entire process is given Appendix 1 but is summarized below in Figure 9.

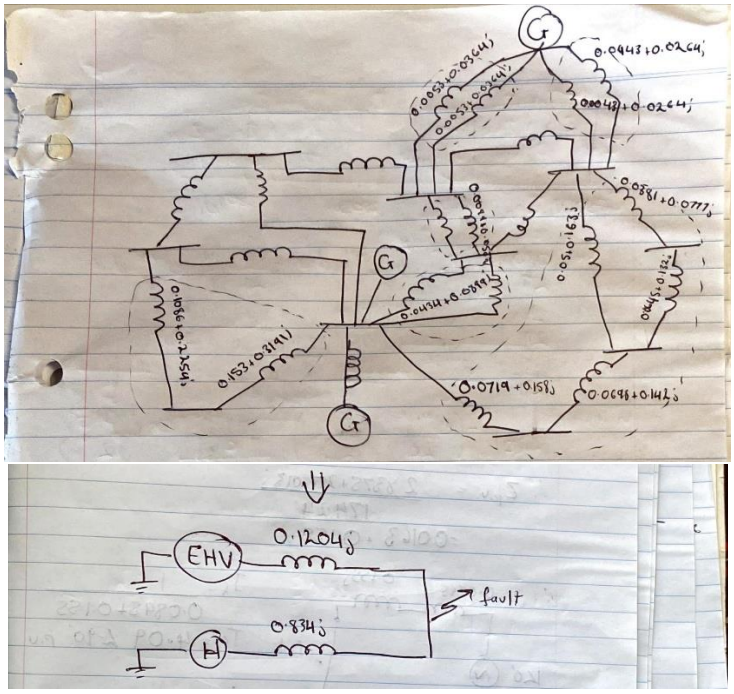


Figure 9. Network simplification for fault current analysis

7.2 Results

Table 9. Fault currents for each case, full working out shown in Appendix 2

3-Phase Fault Location	Hydro Generator	Fault current pu	Fault current	Current supplied from Hydro pu	Current supplied from EHV pu
Connection to bus 6	On	9.50	4151 A	1.2	8.3
Mid way down line	On	3.84	1678 A	0.48	8.36
Connection to wind farm	On	2.41	1053 A	0.3	2.11
Connection to bus 6	Off	8.31	3631 A	0	8.31
Mid way down line	Off	3.63	1586 A	0	3.63
Connection to wind farm	Off	2.32	1014	0	2.32

Discussion:

The Fault current for faults at the connection point to bus 6 is very high and meaning it would be easy to detect. This is because there is less line between the fault and the interconnected network. For faults further down the line this fault current may be harder to detect as the fault current is as low as 2.32 pu. If equipment is not sensitive enough or calibrated properly this may look like a high load and not be noticed by network operators, especially true for the more common unbalanced faults as they have less fault current and will be even harder to differentiate from a high load.

8. Final Cost

8.1 Transmission line Cost

Transmission line break down			
Component	Cost	Quantity	Total
Tower A1	$62,000	227	$14,074,000
Bundling Spacer – 2 conductor, 32 cm	$36,000	681	$24,516,000
AAC 31.5 mm	$16,300	1,362	$22,200,600
		Total	**$60,790,600**

8.2 Network Cost

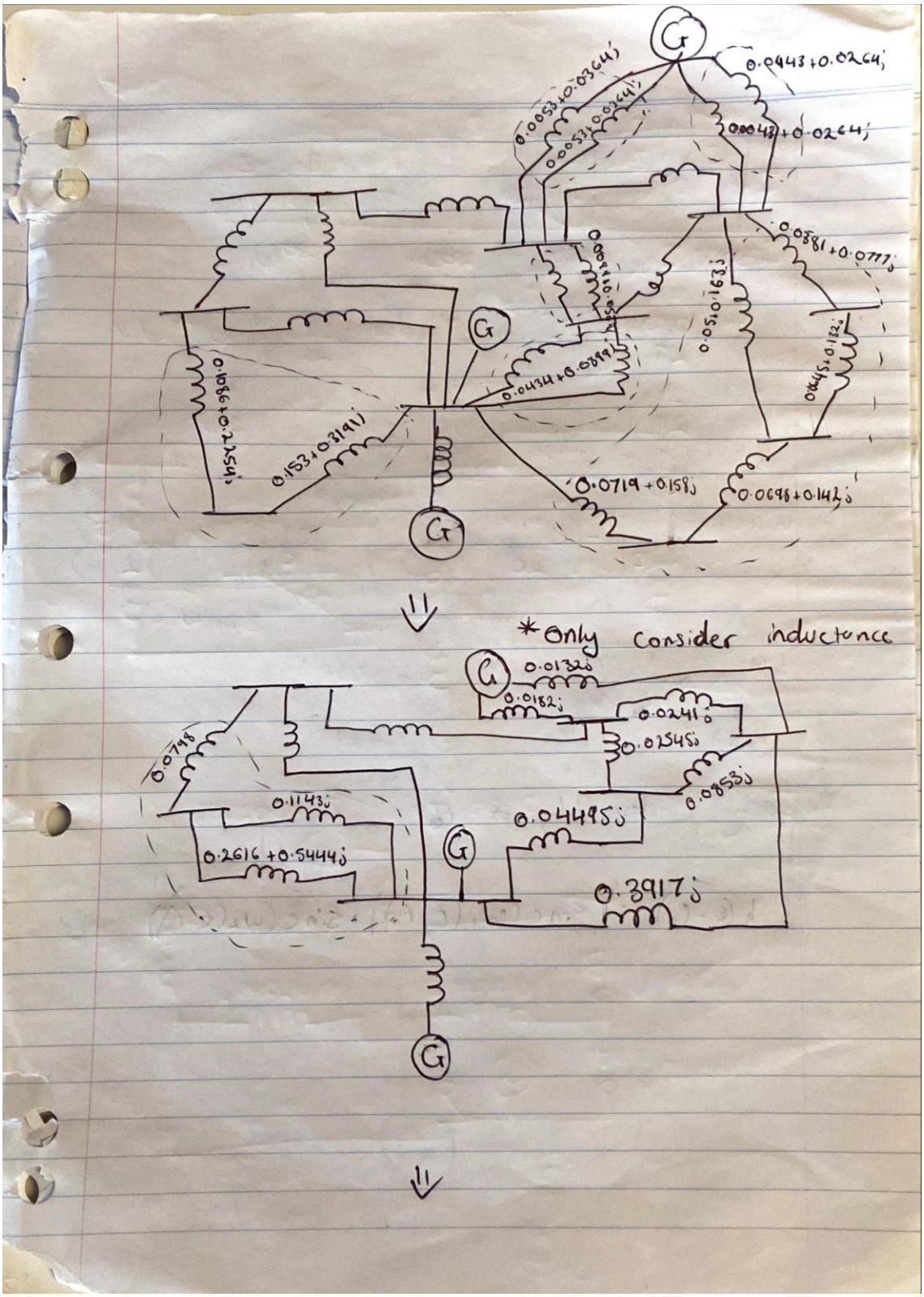
Network adjustment's break down			
Component	Cost	Quantity	Total
15 MVA Capacity to substation	$1,000,000	11	$11,000,000
25 MVAr	$1,000,000	3	$3,000,000
		Total	**$14,000,000**

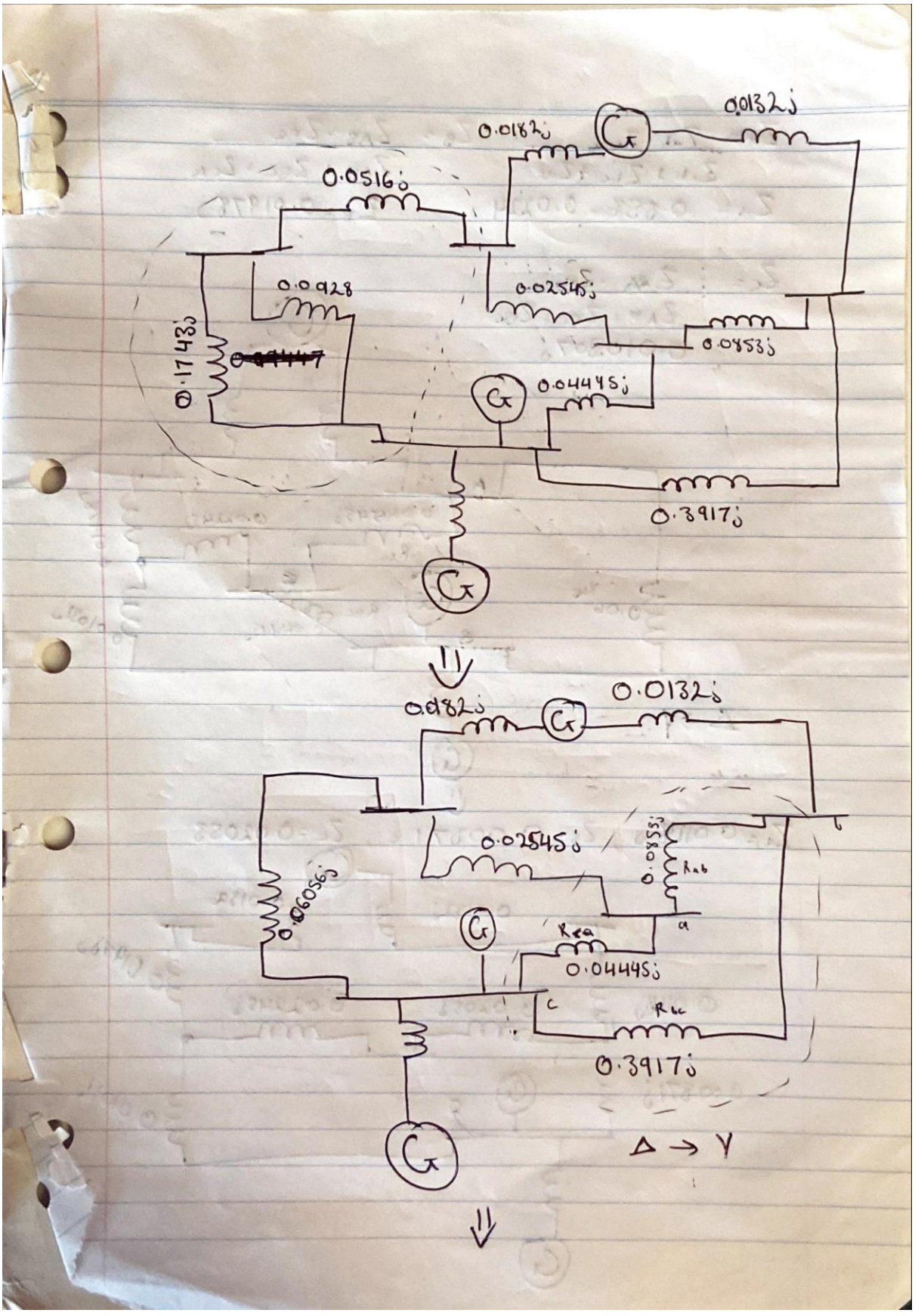
8.3 Total cost

Final Cost Breakdown	
Component	Cost
Transmission line	$49,690,300
Network upgrades	$14,000,000
Consultants design fees	$0
Total	**$74,790,600**

9. Appendix

Appendix 1. Network simplification for fault analysis



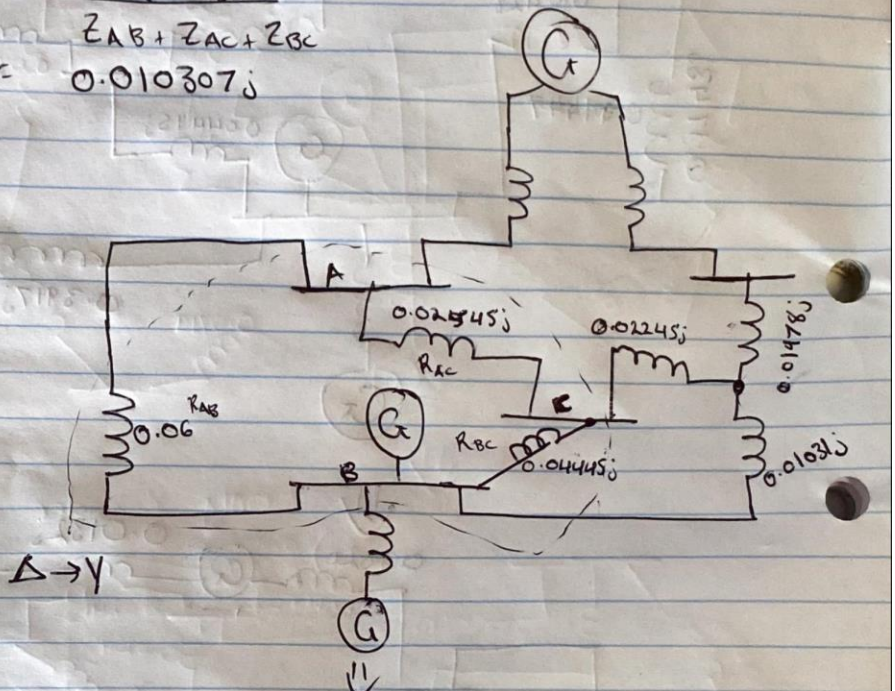

0.0182j
0.0132j
0.0516j
0.0928
0.02545j
0.1743j
0.0853j
0.04445j
0.3917j
0.0182j
0.0132j
0.02545j
0.0855j
Rab
0.06056j
Rca
0.04445j
Rbc
0.3917j
Δ → Y

$$Z_a = \frac{Z_{ab} \cdot Z_{ca}}{Z_{ab} + Z_{bc} + Z_{ac}} \qquad Z_B = \frac{Z_{AB} \cdot Z_{BC}}{Z_{AB} + Z_{BC} + Z_{CA}}$$

$Z_a = 0.0224j$ $\qquad Z_B = 0.01978j$

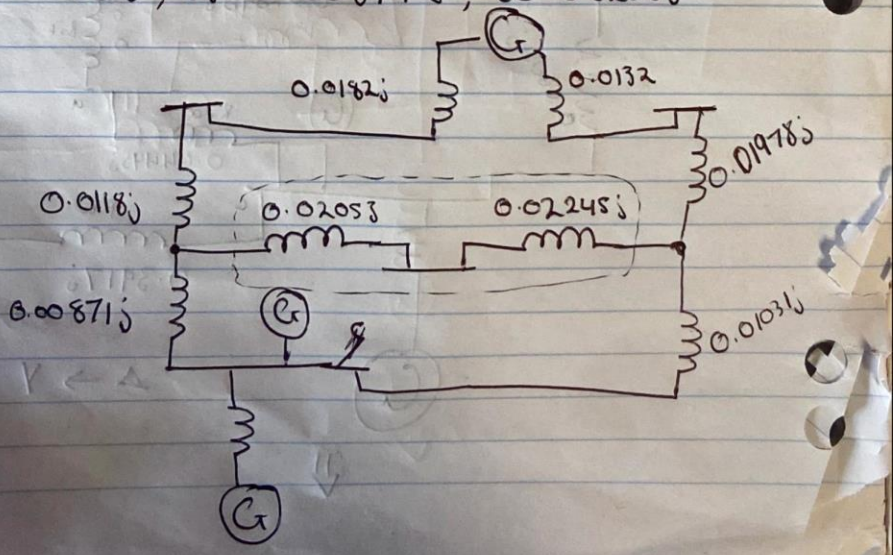
$$Z_c = \frac{Z_{CA} \cdot Z_{BC}}{Z_{AB} + Z_{AC} + Z_{BC}}$$

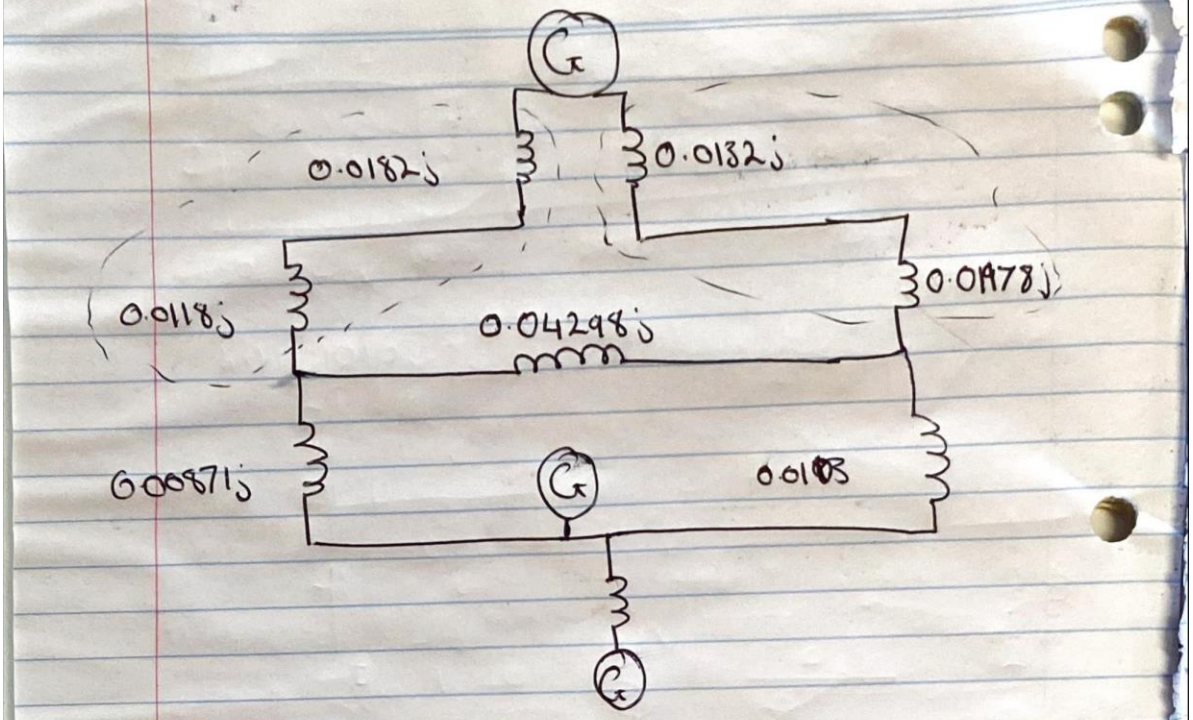
$= 0.010307j$

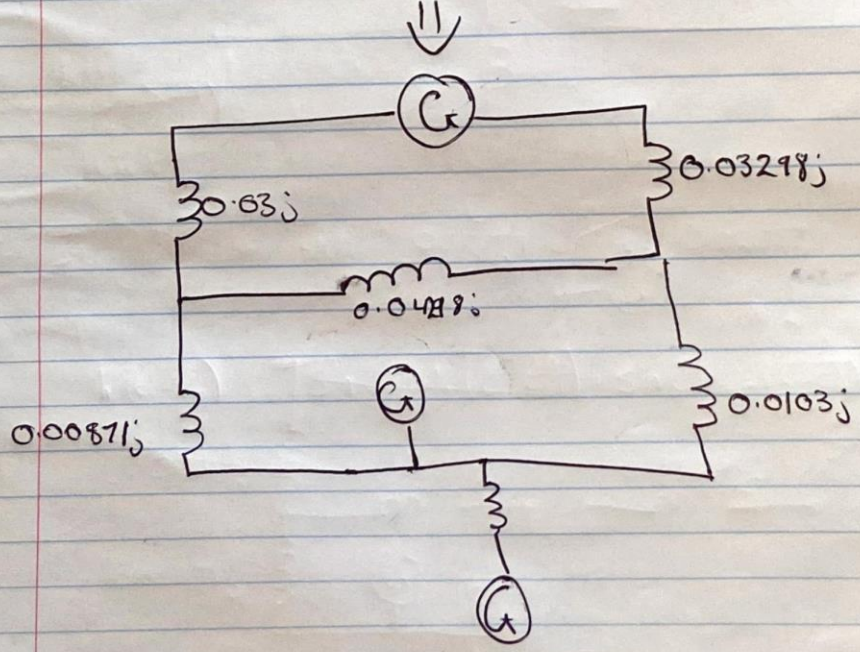


$\Delta \rightarrow Y$

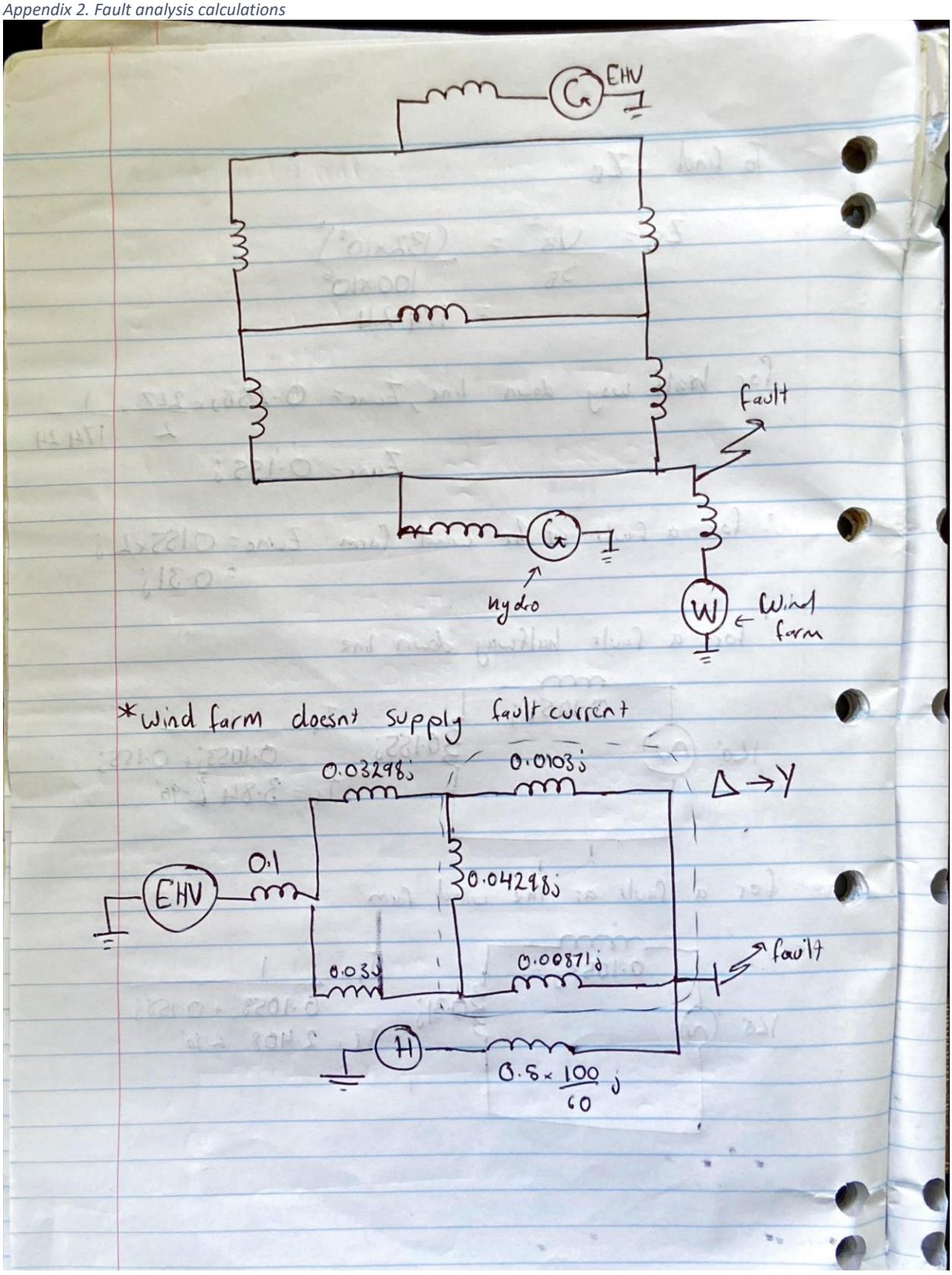
$Z_a = 0.0118j$, $Z_B = 0.00871j$, $Z_c = 0.02053$

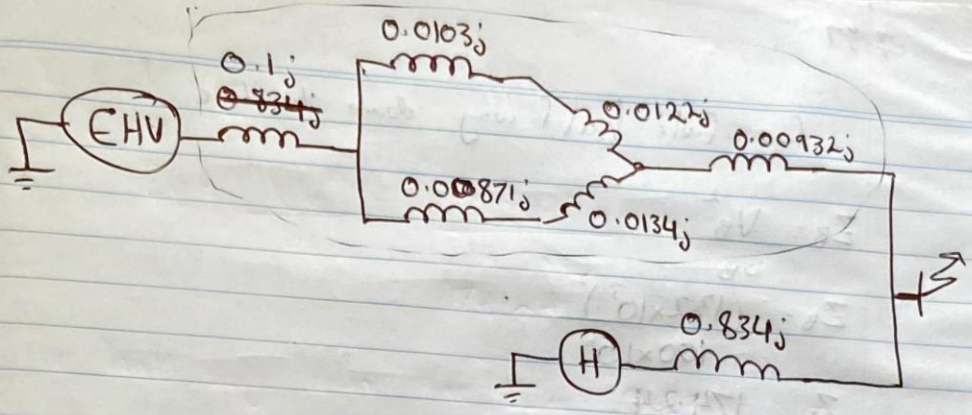



0.0182j
0.0182j
0.0118j
0.042984j
0.00871j
0.0103


0.03298j
0.03j
0.00871j
0.0103j

Appendix 2. Fault analysis calculations

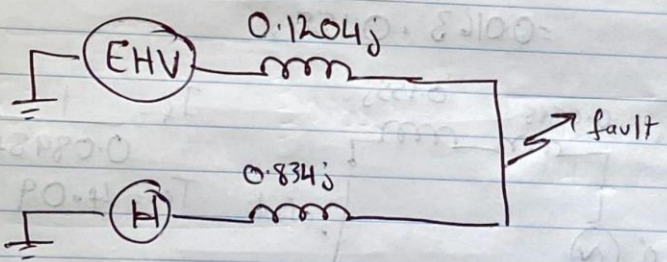




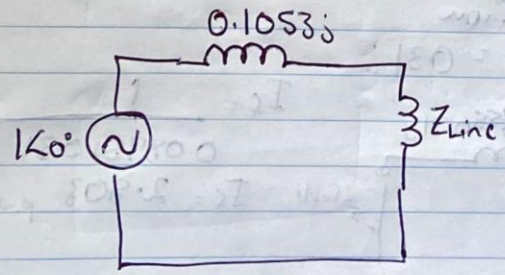
$$R = 0.1j + \frac{(0.0103j + 0.0122j)(0.00871j + 0.0134j) + 0.00932j}{0.0103j + 0.0122j + 0.00871j + 0.0134j}$$

$$R = 0.1j + 0.0111j + 0.00932j$$

$$R = 0.1204j$$



∴ with line resistance and hydro on



for fault at bus 6, $Z_{Line} = 0$

$$\therefore I_f = \frac{1}{0.1053j} = 9.50 \text{ p.u.}$$

To find Z_B

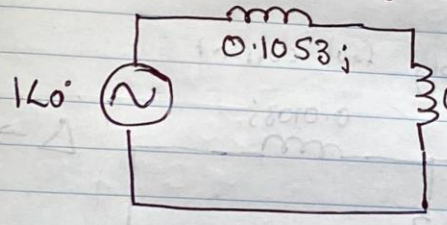
$$Z_B = \frac{V_B^2}{S_B} = \frac{(132\times10^3)^2}{100\times10^6}$$
$$= 174.24$$

for half way down line, $Z_{Line} = 0.238j \times \frac{227}{2} \times \frac{1}{174.24}$

$$Z_{Line} = 0.155j$$

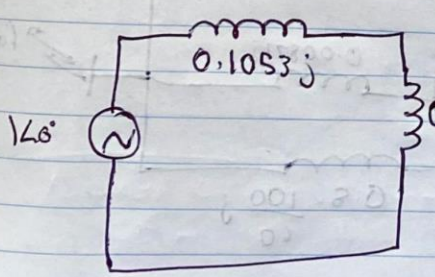
∴ for a fault at the wind farm $Z_{Line} = 0.155\times2\,j$
$$= 0.31j$$

∴ for a fault halfway down line



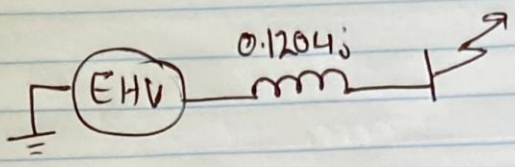
$$I_f = \frac{1}{0.1053j + 0.155j}$$
$$I_f = 3.84\ \angle -90°$$

for a fault at the wind farm

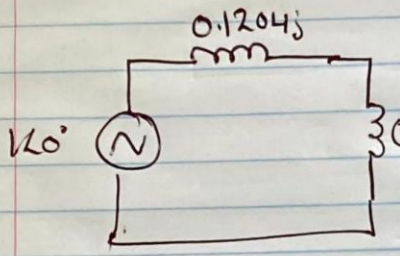


$$I_f = \frac{1}{0.1053j + 0.155j}$$
$$I_f = 2.408\ \angle -90°$$

If hydro is off,



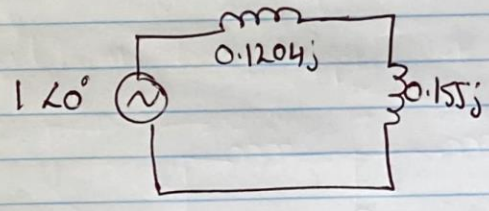
∴ for a fault at bus 6



$$I_f = \frac{1}{0.1204j}$$

$$I_f = 8.31 \angle -90°$$

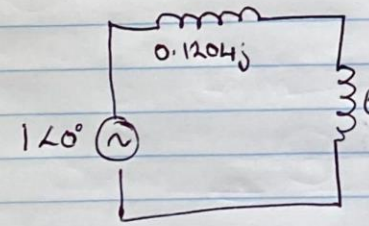
for a fault halfway down the line



$$I_f = \frac{1}{0.1204j + 0.155j}$$

$$I_f = 3.65 \angle -90°$$

for a fault at the wind farm



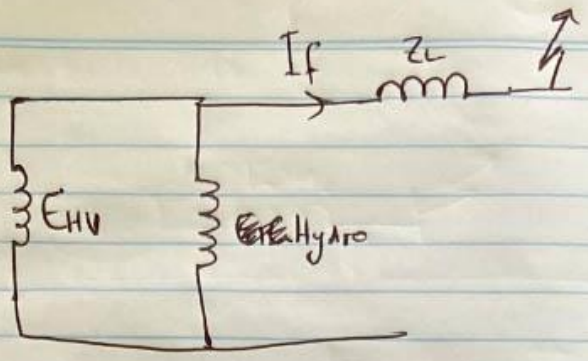
$$I_f = \frac{1}{0.1204j + 0.31j}$$

$$I_f = 2.32 \angle -90°$$

Now $S_B = 100 \times 10^6$, $V_B = 132 \times 10^3$

$$\therefore I_B = \frac{100 \times 10^6}{\sqrt{3} \times 132 \times 10^3} = 437.4 \text{ A}$$

$$I_{f_{actual}} = I_B \times I_{f_{p.u.}}$$



Current supplied by EHV:

$$I_{f\,EHV} = \frac{Z_{Hydro}}{Z_{EHV} + Z_{Hydro}} \times I_f$$

∴ for fault at bus 6

$$I_{f\,EHV} = \frac{0.834}{0.1204 + 0.834} \times I_f$$

$$= 0.874 \times 9.5$$

$$= 8.30 \text{ p.u}$$

∴ $I_{Hydro} = 1.2$ p.u.

for fault half way down the line

$$I_{f\,EHV} = 0.874 \times 3.84 = 3.36 \text{ p.u.}$$

∴ $I_{f\,Hydro} = 0.48$ p.u.

for fault at wind farm

$$I_{f\,EHV} = 0.874 \times 2.41 = 2.11 \text{ p.u.}$$

∴ $I_{f\,Hydro} = 0.3$ p.u.

Appendix 3. Resistance, Inductance, capacitance and power stability limit functions

```python
def resistance(rho_conductor, temp_coefficient, diameter, packing_factor, skin_effect):
    Area = math.pi * math.pow(diameter / 2, 2) * packing_factor
    R = rho_conductor * (1000 / Area) * skin_effect  # ohms @ 20 degrees C
    return R * (temp_coefficient + 50) / (temp_coefficient + 20)  # ohms @ 50 degrees C


def inductance(GMD, GMR):
    l = 0.2 * np.log(GMD / GMR)  # mH/km
    return l / 1000


def capacitance(GMD, GMR):
    c = 0.0556 / np.log(GMD / GMR)  # uF/km
    return c / 1000000


def power_stability_limit(Vs, Vr, A, B, delta):
    # delta in radians
    return (abs(Vs)*abs(Vr) / abs(B)) * math.cos(cmath.polar(B)[1] - delta) - (
                abs(A) * math.pow(abs(Vr), 2) / abs(B)) * math.cos(cmath.polar(B)[1]-cmath.polar(A)[1])
```

Appendix 4. Calculating line params for CSV

```python
def gen_csv(length, conductor_list, bundle_list, tower_list):
    configurations = []  # list of configurations (list of configuration)

    for tower in tower_list:

        for conductor in conductor_list:

            for bundle in bundle_list:

                if tower == Towers.B2_double or tower == Towers.B1_double:
                    conductor_count_per_phase = 2 * bundle[BUNDLE_WIRE_COUNT]
                else:
                    conductor_count_per_phase = bundle[BUNDLE_WIRE_COUNT]

                # getting the GMR of the line considering bundle and conductor
                radius_prime = math.pow(math.e, -1 / 4) * conductor[DIAMETER_KEY] / 2
                if bundle[BUNDLE_WIRE_COUNT] == 1:
                    GMR = radius_prime
                elif bundle[BUNDLE_WIRE_COUNT] == 2:
                    GMR = math.pow(radius_prime * bundle[BUNDLE_SPACING_KEY], 1 / 2)
                elif bundle[BUNDLE_WIRE_COUNT] == 3:
                    GMR = math.pow((radius_prime * math.pow(bundle[BUNDLE_SPACING_KEY], 2)), 1 / 3)
```

```
        else:
            GMR = math.pow((radius_prime * math.sqrt(2) * math.pow(bundle[BUNDLE_SPACING_KEY], 3)), 1 / 4)

        r = resistance(rho_conductor=rho_aluminium, temp_coefficient=temp_coefficient_aluminium,
                       diameter=conductor[DIAMETER_KEY], packing_factor=line_packing_factor,
                       skin_effect=line_skin_effect) / conductor_count_per_phase
        l = inductance(GMD=tower[GMD_KEY], GMR=GMR)
        c = capacitance(GMD=tower[GMD_KEY], GMR=GMR)

        z = r + 2j * math.pi * l * frequency
        y = 2j * math.pi * c * frequency

        gamma = cmath.sqrt(z * y)

        Zc = cmath.sqrt(z / y)
        A = cmath.cosh(gamma * length)
        B = Zc * cmath.sinh(gamma * length)
        C = (1 / Zc) * cmath.sinh(gamma * length)
        D = cmath.cosh(gamma * length)
```

```
        """Line voltages and power"""
        Vs = 132 * math.pow(10, 3)
        S_3_phase_sent = 160 * math.pow(10, 6)
        Is = S_3_phase_sent / (math.sqrt(3) * Vs)

        Vr = (1 / (C - (A * D / B))) * (Is - (D / B) * Vs)

        Ir = (Vs - A * Vr) / B

        Cost = (3 * bundle[COST_PER_KM_KEY] + tower[COST_PER_KM_KEY] + 3 * conductor[
            COST_PER_KM_KEY] * conductor_count_per_phase) * length
        Losses = (160 * math.pow(10, 6) - (math.sqrt(3) * Vr * Ir.conjugate()).real) / (
                160 * math.pow(10, 6)) * 100

        stability_limit_angle = cmath.polar(B)[1]
        stability_limit = power_stability_limit(Vs=Vs, Vr=Vr, A=A, B=B, delta=stability_limit_angle)
        stability_limit_angle = cmath.polar(B)[1] * 180 / math.pi  # Convert to degrees for csv

        dynamic_stability_limit_angle = cmath.polar(B)[1]/2
        dynamic_stability_limit = power_stability_limit(Vs=Vs, Vr=Vr, A=A, B=B, delta=dynamic_stability_limit_angle)
        dynamic_stability_limit_angle = dynamic_stability_limit_angle * 180 / math.pi  # Convert to degrees for CSV
```

```
        current_per_conductor = round(Is.real/(tower[CIRCUITS_PER_PHASE_KEY]*bundle[BUNDLE_WIRE_COUNT]))
        if (current_per_conductor>conductor[CURRENT_SUMMER_KEY]*.75):
            surpassed = True
        else:
            surpassed = False

        # Convert to polar for excel
        Vr = cmath.polar(Vr)
        Ir = cmath.polar(Ir)
```

Appendix 5. Writing to CSV Code

```
with open(str(length) + "km.csv", "w", newline="") as file:
    fieldnames = [CSV_TOWER_TYPE_KEY, CSV_BUNDLE_TYPE_KEY, CSV_CONDUCTOR_TYPE_KEY, CSV_IMPEDANCE_KEY,
                  CSV_ADMITTANCE_KEY, CSV_A_KEY, CSV_B_KEY,
                  CSV_C_KEY, CSV_D_KEY, CSV_VS_KEY, CSV_IS_KEY, CSV_VR_MAGNITUDE_KEY, CSV_VR_ANGLE_KEY,
                  CSV_IR_MAGNITUDE_KEY, CSV_IR_ANGLE_KEY, CSV_COST_KEY, CSV_POWER_LOSS_KEY, CSV_THERMAL_CURRENT_LIMIT_BOoLEAN
                  CSV_SUMMER_CURRENT_MAX_KEY, CSV_WINTER_CURRENT_MAX_KEY, CSV_STABILITY_LIMIT_KEY,
                  CSV_STABILITY_LIMIT_ANGLE_KEY, CSV_DYNAMIC_STABILITY_LIMIT_KEY,
                  CSV_DYNAMIC_STABILITY_LIMIT_ANGLE_KEY]
    writer = csv.DictWriter(file, fieldnames=fieldnames)
    writer.writeheader()

    for configuration in configurations:
        writer.writerow(configuration)
```

Appendix 6. 227 Km CSV file

Bundle Type	Conductor Type	Impedance	Admittance	A	B	C	D	Vs	Is	Vr (KV)	Vr angle (Degrees)	Ir (A)	Ir angle (Degrees)	Cost (Million $)	Real Power loss (%)	Thermal limit surpassed	Current limit (Summer)	Stability limit (MVA)	Stability limit angle	Dynamic Stability limit (MVA)	Dynamic Stability limit angle
No bundling – 1 conductor	AAC 9.0 mm diameter	(0.609+0.419j)	2.617529257620 4276e-06j	(0.972+0.041j)	(135.746+96.163j)	(-0+0.001j)	(0.972+0.041j)	132	699.8	70.3	-61.8	682.8	-4.1	37.4	72.19	TRUE	110	31.53	35.3	28.9	17.7
No bundling – 1 conductor	AAC 16.3 mm diameter	(0.186+0.382j)	2.873261183176 3078e-06j	(0.972+0.014j)	(41.386+86.084j)	(-0+0.001j)	(0.972+0.014j)	132	699.8	115.2	-30.5	684.7	-6.4	39.1	22.04	TRUE	216	99	64.3	74.57	32.2
No bundling – 1 conductor	AAC 9.0 mm diameter	(0.609+0.425j)	2.583838690689 2727e-06j	(0.972+0.04j)	(135.746+97.369j)	(-0+0.001j)	(0.972+0.04j)	132	699.8	71.1	-62.1	682.7	-4.1	40.4	72.18	TRUE	110	31.58	35.7	28.88	17.8
No bundling – 1 conductor	AAC 21.0 mm diameter	(0.112+0.366j)	2.998214147623 3003e-06j	(0.972+0.009j)	(24.934+82.385j)	(-0+0.001j)	(0.972+0.009j)	132	699.8	124.4	-27	685.4	-7	40.6	13.29	TRUE	299	138.69	73.2	101.11	36.6
No bundling – 1 conductor	AAC 9.0 mm diameter	(0.609+0.432j)	2.539591335873 495e-06j	(0.972+0.04j)	(135.746+99.001j)	(-0+0.001j)	(0.972+0.04j)	132	699.8	72.2	-62.6	682.6	-4	40.6	72.18	TRUE	110	31.64	36.1	28.85	18.1
No bundling – 1 conductor	AAC 9.0 mm diameter	(0.609+0.428j)	2.562372613885 4928e-06j	(0.972+0.04j)	(135.746+98.153j)	(-0+0.001j)	(0.972+0.04j)	132	699.8	71.6	-62.3	682.7	-4	40.6	72.18	TRUE	110	31.61	35.9	28.87	17.9
No bundling – 1 conductor	AAC 16.3 mm diameter	(0.186+0.387j)	2.832716897228 5187e-06j	(0.972+0.013j)	(41.386+87.311j)	(-0+0.001j)	(0.972+0.013j)	132	699.8	115.7	-30.9	684.6	-6.3	42	22.04	TRUE	216	98.71	64.6	74.22	32.3
No bundling – 1 conductor	AAC 16.3 mm diameter	(0.186+0.395j)	2.779622694823 6015e-06j	(0.972+0.013j)	(41.386+88.971j)	(-0+0.001j)	(0.972+0.013j)	132	699.8	116.3	-31.4	684.4	-6.1	42.2	22.04	TRUE	216	98.3	65.1	73.76	32.5
No bundling – 1 conductor	AAC 16.3 mm diameter	(0.186+0.391j)	2.806937020325 698e-06j	(0.972+0.013j)	(41.386+88.109j)	(-0+0.001j)	(0.972+0.013j)	132	699.8	116	-31.1	684.5	-6.2	42.2	22.04	TRUE	216	98.51	64.8	74	32.4
No bundling – 1 conductor	AAC 26.3 mm diameter	(0.071+0.352j)	3.118684936231 8125e-06j	(0.972+0.006j)	(15.897+79.164j)	(-0+0.001j)	(0.972+0.006j)	132	699.8	129.3	-25	686	-7.4	42.9	8.48	TRUE	405	170.59	78.6	122.74	39.3
No bundling – 1 conductor	AAC 9.0 mm diameter	(0.609+0.443j)	2.478370903710 8816e-06j	(0.972+0.039j)	(135.747+101.357j)	(-0+0.001j)	(0.972+0.039j)	132	699.8	73.8	-63.2	682.5	-3.9	42.9	72.17	TRUE	110	31.73	36.7	28.8	18.4
No bundling – 1 conductor	AAC 9.0 mm diameter	(0.305+0.425j)	2.583838690689 2727e-06j	(0.972+0.02j)	(67.876+95.977j)	(-0+0.001j)	(0.972+0.02j)	132	699.8	103.4	-38.6	683.5	-5.3	43.3	36.11	TRUE	110	63.58	54.7	50.59	27.4
No bundling – 1 conductor	AAC 21.0 mm diameter	(0.112+0.372j)	2.954093861857 4357e-06j	(0.972+0.008j)	(24.934+83.614j)	(-0+0.001j)	(0.972+0.008j)	132	699.8	124.8	-27.4	685.3	-6.9	43.6	13.29	TRUE	299	137.8	73.4	100.37	36.7
Bundling spacer – 2 conductor, 24 cm	AAC 9.0 mm diameter	(0.305+0.287j)	3.830619442439 883e-06j	(0.972+0.03j)	(67.875+65.113j)	(-0+0.001j)	(0.972+0.03j)	132	699.8	90.9	-27.3	687.5	-7.8	43.8	36.26	TRUE	110	64.16	43.8	54.95	21.9
No bundling – 1 conductor	AAC 21.0 mm diameter	(0.112+0.379j)	2.896398528440 1345e-06j	(0.972+0.008j)	(24.934+85.276j)	(-0+0.001j)	(0.972+0.008j)	132	699.8	125.4	-27.9	685.1	-6.7	43.8	13.28	TRUE	299	136.6	73.7	99.39	36.9
No bundling – 1 conductor	AAC 21.0 mm diameter	(0.112+0.375j)	2.926068337133 677e-06j	(0.972+0.008j)	(24.934+84.413j)	(-0+0.001j)	(0.972+0.008j)	132	699.8	125.1	-27.6	685.2	-6.8	43.8	13.29	TRUE	299	137.22	73.5	99.9	36.8
Bundling spacer – 2 conductor, 32 cm	AAC 9.0 mm diameter	(0.305+0.277j)	3.955391288305 364e-06j	(0.972+0.031j)	(67.875+63.104j)	(-0+0.001j)	(0.972+0.031j)	132	699.8	90.2	-26.4	687.9	-8	44.4	36.28	TRUE	110	64.16	42.9	55.26	21.5
No bundling – 1 conductor	AAC 16.3 mm diameter	(0.186+0.406j)	2.706449498016 5873e-06j	(0.972+0.013j)	(41.386+91.367j)	(-0+0.001j)	(0.972+0.013j)	132	699.8	117.2	-32.1	684.2	-6	44.5	22.03	TRUE	216	97.73	65.6	73.11	32.8
No bundling – 1 conductor	AAC 31.5 mm diameter	(0.05+0.341j)	3.222490296750 9506e-06j	(0.972+0.004j)	(11.082+76.599j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	131.7	-23.8	686.6	-7.8	45.6	5.91	TRUE	495	192.51	81.8	137.72	40.9
No bundling – 1 conductor	AAC 26.3 mm diameter	(0.071+0.357j)	3.070976046612 2096e-06j	(0.972+0.006j)	(15.897+80.393j)	(-0+0.001j)	(0.972+0.006j)	132	699.8	129.6	-25.4	685.9	-7.3	45.8	8.48	TRUE	405	169.04	78.8	121.56	39.4
No bundling – 1 conductor	AAC 9.0 mm diameter	(0.305+0.443j)	2.478370903710 8816e-06j	(0.972+0.019j)	(67.876+100.023j)	(-0+0.001j)	(0.972+0.019j)	132	699.8	105.2	-39.9	683.2	-5	45.8	36.1	TRUE	110	63.46	55.8	50.09	27.9
No bundling – 1 conductor	AAC 26.3 mm diameter	(0.071+0.365j)	3.008672970122 985e-06j	(0.972+0.005j)	(15.897+82.056j)	(-0+0.001j)	(0.972+0.005j)	132	699.8	130.2	-25.8	685.6	-7.2	46.1	8.47	TRUE	405	167	79	120.02	39.5
No bundling – 1 conductor	AAC 21.0 mm diameter	(0.112+0.39j)	2.817035738387 6282e-06j	(0.972+0.008j)	(24.934+87.675j)	(-0+0.001j)	(0.972+0.008j)	132	699.8	126.2	-28.5	684.8	-6.5	46.1	13.28	TRUE	299	134.93	74.1	98.02	37.1
No bundling – 1 conductor	AAC 26.3 mm diameter	(0.071+0.361j)	3.040700287446 0686e-06j	(0.972+0.006j)	(15.897+81.192j)	(-0+0.001j)	(0.972+0.006j)	132	699.8	129.9	-25.6	685.8	-7.2	46.1	8.48	TRUE	405	168.05	78.9	120.81	39.5

No bundling – 1 conductor	AAC 16.3 mm diameter	(0.093+0.387j)	2.832716897228 5187e-06j	(0.972+0.007j)	(20.693+87.169j)	(-0+0.001j)	(0.972+0.007j)	132	699.8	128.7	-27.8	68 4.9	-6.7	46.6	11.02	TRUE	216	146.92	76.6	106.06	38.3
Bundling spacer – 2 conductor, 24 cm	AAC 9.0 mm diameter	(0.305+0.292j)	3.758892828460 1294e-06j	(0.972+0.029j)	(67.875+66.33j)	(-0+0.001j)	(0.972+0.029j)	132	699.8	91.3	-27.8	68 7.2	-7.6	46.7	36.25	TRUE	110	64.15	44.3	54.76	22.2
Bundling spacer – 2 conductor, 24 cm	AAC 9.0 mm diameter	(0.305+0.299j)	3.665973232613 3328e-06j	(0.972+0.029j)	(67.875+67.977j)	(-0+0.001j)	(0.972+0.029j)	132	699.8	91.9	-28.5	68 6.8	-7.4	46.9	36.24	TRUE	110	64.14	45	54.51	22.5
Bundling spacer – 2 conductor, 24 cm	AAC 9.0 mm diameter	(0.305+0.296j)	3.713633924568 1814e-06j	(0.972+0.029j)	(67.875+67.122j)	(-0+0.001j)	(0.972+0.029j)	132	699.8	91.6	-28.1	68 7	-7.5	46.9	36.24	TRUE	110	64.15	44.7	54.64	22.3
Bundling spacer – 2 conductor, 24 cm	AAC 16.3 mm diameter	(0.093+0.268j)	4.097473272576 863e-06j	(0.972+0.01j)	(20.693+60.298j)	(-0+0.001j)	(0.972+0.01j)	132	699.8	120.9	-19.8	69 0.1	-9.6	47	11.08	TRUE	216	175.92	71.1	129.3	35.5
Bundling spacer – 2 conductor, 32 cm	AAC 9.0 mm diameter	(0.305+0.283j)	3.878962597219 783e-06j	(0.972+0.03j)	(67.875+64.319j)	(-0+0.001j)	(0.972+0.03j)	132	699.8	90.6	-26.9	68 7.6	-7.9	47.4	36.27	TRUE	110	64.16	43.5	55.07	21.7
Bundling spacer – 2 conductor, 32 cm	AAC 9.0 mm diameter	(0.305+0.29j)	3.780090029162 843e-06j	(0.972+0.029j)	(67.875+65.966j)	(-0+0.001j)	(0.972+0.029j)	132	699.8	91.2	-27.6	68 7.3	-7.7	47.6	36.25	TRUE	110	64.15	44.2	54.82	22.1
Bundling spacer – 2 conductor, 32 cm	AAC 9.0 mm diameter	(0.305+0.286j)	3.830784645977 888e-06j	(0.972+0.03j)	(67.875+65.111j)	(-0+0.001j)	(0.972+0.03j)	132	699.8	90.9	-27.3	68 7.5	-7.8	47.6	36.26	TRUE	110	64.16	43.8	54.95	21.9
Bundling spacer – 2 conductor, 32 cm	AAC 16.3 mm diameter	(0.093+0.259j)	4.240559362273 198e-06j	(0.972+0.01j)	(20.693+58.268j)	(-0+0.001j)	(0.972+0.01j)	132	699.8	120.4	-19.1	69 0.8	-9.9	47.7	11.09	TRUE	216	178.59	70.4	131.52	35.2
No bundling – 1 conductor	AAC 26.3 mm diameter	(0.071+0.375j)	2.923129035169 5497e-06j	(0.972+0.005j)	(15.897+84.456j)	(-0+0.001j)	(0.972+0.005j)	132	699.8	130.9	-26.5	68 5.3	-7	48.3	8.47	TRUE	405	164.18	79.3	117.88	39.7
No bundling – 1 conductor	AAC 31.5 mm diameter	(0.05+0.346j)	3.171578495780 0177e-06j	(0.972+0.004j)	(11.082+77.828j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	132	-24.1	68 6.4	-7.6	48.6	5.91	TRUE	495	190.45	81.9	136.19	40.9
No bundling – 1 conductor	AAC 31.5 mm diameter	(0.05+0.353j)	3.105170706307 9695e-06j	(0.972+0.004j)	(11.082+79.492j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	132.5	-24.6	68 6.1	-7.5	48.8	5.91	TRUE	495	187.74	82.1	134.2	41
No bundling – 1 conductor	AAC 31.5 mm diameter	(0.05+0.35j)	3.139297057569 788e-06j	(0.972+0.004j)	(11.082+78.628j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	132.3	-24.3	68 6.2	-7.6	48.8	5.91	TRUE	495	189.14	82	135.23	41
No bundling – 1 conductor	AAC 16.3 mm diameter	(0.093+0.406j)	2.706449498016 5873e-06j	(0.972+0.006j)	(20.693+91.231j)	(-0+0.001j)	(0.972+0.006j)	132	699.8	130.1	-29	68 4.5	-6.4	49.1	11.02	TRUE	216	143.53	77.2	103.41	38.6
Bundling spacer – 2 conductor, 24 cm	AAC 9.0 mm diameter	(0.305+0.31j)	3.539753133477 0054e-06j	(0.972+0.028j)	(67.875+70.355j)	(-0+0.001j)	(0.972+0.028j)	132	699.8	92.8	-29.4	68 6.4	-7.2	49.2	36.22	TRUE	110	64.12	46	54.15	23
No bundling – 1 conductor	AAC 21.0 mm diameter	(0.056+0.372j)	2.954093861857 4357e-06j	(0.972+0.004j)	(12.467+83.56j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	132.9	-25.8	68 5.5	-7.1	49.7	6.64	TRUE	299	176.74	81.5	126.4	40.8
Bundling spacer – 2 conductor, 32 cm	AAC 9.0 mm diameter	(0.305+0.301j)	3.646033178574 553e-06j	(0.972+0.028j)	(67.875+68.342j)	(-0+0.001j)	(0.972+0.028j)	132	699.8	92	-28.6	68 6.8	-7.4	49.9	36.24	TRUE	110	64.14	45.2	54.46	22.6
Bundling spacer – 2 conductor, 24 cm	AAC 16.3 mm diameter	(0.093+0.273j)	4.015512047731 2335e-06j	(0.972+0.01j)	(20.693+61.526j)	(-0+0.001j)	(0.972+0.01j)	132	699.8	121.2	-20.2	68 9.7	-9.4	50	11.08	TRUE	216	174.34	71.4	128	35.7
Bundling spacer – 3 conductor, 23 cm	AAC 9.0 mm diameter	(0.203+0.244j)	4.497407605134 836e-06j	(0.972+0.023j)	(45.25+55.233j)	(-0+0.001j)	(0.972+0.023j)	132	699.8	102.9	-20.2	69 1.1	-9.8	50.1	24.26	TRUE	110	96.23	50.7	77.92	25.3
Bundling spacer – 2 conductor, 24 cm	AAC 21.0 mm diameter	(0.056+0.26j)	4.222964204081 824e-06j	(0.972+0.006j)	(12.467+58.466j)	(-0+0.001j)	(0.972+0.006j)	132	699.8	126.1	-18.5	69 1.1	-10.1	50.2	6.68	TRUE	299	222.97	78	160.97	39
Bundling spacer – 2 conductor, 24 cm	AAC 16.3 mm diameter	(0.093+0.281j)	3.909650806437 302e-06j	(0.972+0.009j)	(20.693+63.189j)	(-0+0.001j)	(0.972+0.009j)	132	699.8	121.7	-20.7	68 9.2	-9.1	50.2	11.07	TRUE	216	172.23	71.9	126.27	35.9
Bundling spacer – 2 conductor, 24 cm	AAC 16.3 mm diameter	(0.093+0.277j)	3.963904982018 061e-06j	(0.972+0.009j)	(20.693+62.326j)	(-0+0.001j)	(0.972+0.009j)	132	699.8	121.4	-20.4	68 9.5	-9.3	50.2	11.07	TRUE	216	173.32	71.6	127.16	35.8
Bundling spacer – 2 conductor, 32 cm	AAC 16.3 mm diameter	(0.093+0.264j)	4.152835201603 0125e-06j	(0.972+0.01j)	(20.693+59.496j)	(-0+0.001j)	(0.972+0.01j)	132	699.8	120.7	-19.5	69 0.4	-9.7	50.7	11.08	TRUE	216	176.97	70.8	130.17	35.4
Bundling spacer – 2 conductor, 32 cm	AAC 21.0 mm diameter	(0.056+0.251j)	4.375111654726 636e-06j	(0.972+0.006j)	(12.467+56.434j)	(-0+0.001j)	(0.972+0.006j)	132	699.8	125.7	-17.9	69 1.9	-10.5	50.8	6.69	TRUE	299	228.05	77.5	164.81	38.8
Bundling spacer – 2 conductor, 32 cm	AAC 16.3 mm diameter	(0.093+0.272j)	4.039711621790 552e-06j	(0.972+0.01j)	(20.693+61.159j)	(-0+0.001j)	(0.972+0.01j)	132	699.8	121.1	-20.1	68 9.9	-9.4	50.9	11.08	TRUE	216	174.81	71.3	128.39	35.7
Bundling spacer – 2 conductor, 32 cm	AAC 16.3 mm diameter	(0.093+0.268j)	4.097662295680 7475e-06j	(0.972+0.01j)	(20.693+60.296j)	(-0+0.001j)	(0.972+0.01j)	132	699.8	120.9	-19.8	69 0.1	-9.6	50.9	11.08	TRUE	216	175.93	71.1	129.31	35.5

No bundling – 1 conductor	AAC 31.5 mm diameter	(0.05+0.364j)	3.014134457367 6314e-06j	(0.972+0.004j)	(11.082+81.892j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	133.2	-25.2	68 5.8	-7.3	51.1	5.91	TRUE	495	184.02	82.3	131.46	41.1
Bundling spacer – 3 conductor, 33 cm	AAC 9.0 mm diameter	(0.203+0.229j)	4.794515586144 e-06j	(0.972+0.025j)	(45.25+51.856j)	(-0+0.001j)	(0.972+0.025j)	132	699.8	102.1	-18.9	69 2.6	-10.4	51.5	24.29	TRUE	110	96.21	48.9	78.66	24.4
No bundling – 1 conductor	AAC 21.0 mm diameter	(0.056+0.39j)	2.817035738387 6282e-06j	(0.972+0.004j)	(12.467+87.624j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	134.1	-27	68 5	-6.8	52.2	6.64	TRUE	299	171.4	81.9	122.45	41
Bundling spacer – 2 conductor, 24 cm	AAC 16.3 mm diameter	(0.093+0.291j)	3.766421101720 2773e-06j	(0.972+0.009j)	(20.693+65.587j)	(-0+0.001j)	(0.972+0.009j)	132	699.8	122.3	-21.5	68 8.6	-8.8	52.5	11.06	TRUE	216	169.26	72.5	123.85	36.2
Bundling spacer – 2 conductor, 24 cm	AAC 9.0 mm diameter	(0.152+0.292j)	3.758892828460 1294e-06j	(0.972+0.015j)	(33.938+65.824j)	(-0+0.001j)	(0.972+0.015j)	132	699.8	113.5	-22.9	68 8.2	-8.5	52.6	18.14	TRUE	110	122.56	62.7	93.01	31.4
Bundling spacer – 3 conductor, 23 cm	AAC 9.0 mm diameter	(0.203+0.249j)	4.398858292644 2925e-06j	(0.972+0.023j)	(45.25+56.454j)	(-0+0.001j)	(0.972+0.023j)	132	699.8	103.3	-20.7	69 0.6	-9.6	53	24.25	TRUE	110	96.2	51.3	77.64	25.6
Bundling spacer – 2 conductor, 24 cm	AAC 21.0 mm diameter	(0.056+0.265j)	4.135959044669 734e-06j	(0.972+0.006j)	(12.467+59.695j)	(-0+0.001j)	(0.972+0.006j)	132	699.8	126.4	-18.9	69 0.6	-9.9	53.1	6.68	TRUE	299	220.02	78.2	158.75	39.1
Bundling spacer – 2 conductor, 32 cm	AAC 16.3 mm diameter	(0.093+0.282j)	3.886980013919 2675e-06j	(0.972+0.009j)	(20.693+63.557j)	(-0+0.001j)	(0.972+0.009j)	132	699.8	121.7	-20.8	68 9.1	-9.1	53.2	11.07	TRUE	216	171.77	72	125.89	36
Bundling spacer – 3 conductor, 23 cm	AAC 9.0 mm diameter	(0.203+0.257j)	4.272138805808 9785e-06j	(0.972+0.022j)	(45.25+58.108j)	(-0+0.001j)	(0.972+0.022j)	132	699.8	103.7	-21.3	69 0	-9.3	53.3	24.23	TRUE	110	96.13	52.1	77.25	26
Bundling spacer – 2 conductor, 24 cm	AAC 21.0 mm diameter	(0.056+0.273j)	4.023740590288 976e-06j	(0.972+0.006j)	(12.467+61.358j)	(-0+0.001j)	(0.972+0.006j)	132	699.8	126.8	-19.4	69 0.1	-9.6	53.3	6.67	TRUE	299	216.16	78.5	155.84	39.3
Bundling spacer – 2 conductor, 32 cm	AAC 9.0 mm diameter	(0.152+0.283j)	3.878962597219 783e-06j	(0.972+0.015j)	(33.938+63.797j)	(-0+0.001j)	(0.972+0.015j)	132	699.8	112.9	-22.2	68 8.7	-8.7	53.3	18.15	TRUE	110	123.37	62	93.93	31
Bundling spacer – 3 conductor, 23 cm	AAC 9.0 mm diameter	(0.203+0.253j)	4.337003305287 532e-06j	(0.972+0.022j)	(45.25+57.25j)	(-0+0.001j)	(0.972+0.022j)	132	699.8	103.5	-21	69 0.4	-9.4	53.3	24.24	TRUE	110	96.17	51.7	77.46	25.8
Bundling spacer – 2 conductor, 24 cm	AAC 21.0 mm diameter	(0.056+0.269j)	4.081230692578 939e-06j	(0.972+0.006j)	(12.467+60.494j)	(-0+0.001j)	(0.972+0.006j)	132	699.8	126.6	-19.2	69 0.4	-9.8	53.3	6.68	TRUE	299	218.15	78.4	157.33	39.2
Bundling spacer – 2 conductor, 32 cm	AAC 21.0 mm diameter	(0.056+0.256j)	4.281793480174 3536e-06j	(0.972+0.006j)	(12.467+57.663j)	(-0+0.001j)	(0.972+0.006j)	132	699.8	125.9	-18.3	69 1.4	-10.2	53.8	6.68	TRUE	299	224.95	77.8	162.47	38.9
Bundling spacer – 2 conductor, 32 cm	AAC 21.0 mm diameter	(0.056+0.264j)	4.161636786518 278e-06j	(0.972+0.006j)	(12.467+59.327j)	(-0+0.001j)	(0.972+0.006j)	132	699.8	126.3	-18.8	69 0.8	-10	54	6.68	TRUE	299	220.9	78.1	159.41	39.1
Bundling spacer – 2 conductor, 32 cm	AAC 21.0 mm diameter	(0.056+0.26j)	4.223164982970 1965e-06j	(0.972+0.006j)	(12.467+58.463j)	(-0+0.001j)	(0.972+0.006j)	132	699.8	126.1	-18.5	69 1.1	-10.1	54	6.68	TRUE	299	222.98	78	160.98	39
No bundling – 1 conductor	AAC 26.3 mm diameter	(0.036+0.357j)	3.070976046612 2096e-06j	(0.972+0.003j)	(7.949+80.37j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	134.8	-24.5	68 6	-7.5	54.2	4.24	TRUE	405	198.23	84.4	141.17	42.2
Bundling spacer – 3 conductor, 33 cm	AAC 9.0 mm diameter	(0.203+0.234j)	4.682677340496 768e-06j	(0.972+0.024j)	(45.25+53.077j)	(-0+0.001j)	(0.972+0.024j)	132	699.8	102.4	-19.4	69 2	-10.2	54.4	24.28	TRUE	110	96.24	49.6	78.4	24.8
Bundling spacer – 3 conductor, 33 cm	AAC 9.0 mm diameter	(0.203+0.242j)	4.539344580389 231e-06j	(0.972+0.024j)	(45.25+54.729j)	(-0+0.001j)	(0.972+0.024j)	132	699.8	102.8	-20	69 1.3	-9.9	54.6	24.26	TRUE	110	96.24	50.4	78.04	25.2
Bundling spacer – 3 conductor, 33 cm	AAC 9.0 mm diameter	(0.203+0.238j)	4.612646489574 854e-06j	(0.972+0.024j)	(45.25+53.871j)	(-0+0.001j)	(0.972+0.024j)	132	699.8	102.6	-19.7	69 1.7	-10	54.6	24.27	TRUE	110	96.24	50	78.23	25
Bundling spacer – 2 conductor, 24 cm	AAC 26.3 mm diameter	(0.036+0.253j)	4.341058981694 303e-06j	(0.972+0.004j)	(7.949+56.861j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	128.9	-17.7	69 1.9	-10.5	54.7	4.26	TRUE	405	256.2	82	183.47	41
Bundling spacer – 3 conductor, 23 cm	AAC 16.3 mm diameter	(0.062+0.232j)	4.738978162261 975e-06j	(0.972+0.007j)	(13.796+52.112j)	(-0+0.001j)	(0.972+0.007j)	132	699.8	123.8	-16.7	69 3.8	-11.3	55	7.41	TRUE	216	230.4	75.2	167.47	37.6
Bundling spacer – 2 conductor, 24 cm	AAC 9.0 mm diameter	(0.152+0.31j)	3.539753133477 0054e-06j	(0.972+0.014j)	(33.938+69.879j)	(-0+0.001j)	(0.972+0.014j)	132	699.8	114.6	-24.2	68 7.2	-8	55.1	18.12	TRUE	110	120.88	64.1	91.19	32
Bundling spacer – 2 conductor, 32 cm	AAC 26.3 mm diameter	(0.036+0.244j)	4.501997144985 102e-06j	(0.972+0.004j)	(7.949+54.829j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	128.4	-17.1	69 2.8	-10.9	55.3	4.27	TRUE	405	263.26	81.8	188.64	40.9
Bundling spacer – 3 conductor, 23 cm	AAC 9.0 mm diameter	(0.203+0.268j)	4.101697355857 075e-06j	(0.972+0.021j)	(45.25+60.495j)	(-0+0.001j)	(0.972+0.021j)	132	699.8	104.4	-22.3	68 9.3	-8.9	55.5	24.21	TRUE	110	95.98	53.2	76.67	26.6
Bundling spacer – 2 conductor, 24 cm	AAC 21.0 mm diameter	(0.056+0.283j)	3.872191594001 406e-06j	(0.972+0.006j)	(12.467+63.758j)	(-0+0.001j)	(0.972+0.006j)	132	699.8	127.4	-20.2	68 9.3	-9.3	55.6	6.67	TRUE	299	210.86	78.9	151.85	39.5

Bundling spacer – 2 conductor, 32 cm	AAC 9.0 mm diameter	(0.152+0.301j)	3.646033178574553e-06j	(0.972+0.014j)	(33.938+67.851j)	(-0+0.001j)	(0.972+0.014j)	132	699.8	114	-23.6	68	7.7	-8.2	55.8	18.13	TRUE	110	121.73	63.4	92.1	31.7
Bundling spacer – 2 conductor, 32 cm	AAC 21.0 mm diameter	(0.056+0.274j)	3.999731415782102e-06j	(0.972+0.006j)	(12.467+61.726j)	(-0+0.001j)	(0.972+0.006j)	132	699.8	126.9	-19.5	69	0	-9.6	56.3	6.67	TRUE	299	215.33	78.6	155.21	39.3
Bundling spacer – 4 conductor, 26 cm	AAC 9.0 mm diameter	(0.152+0.213j)	5.158664593667276e-06j	(0.972+0.02j)	(33.938+48.072j)	(-0+0.001j)	(0.972+0.02j)	132	699.8	109	-16.5	69	5.2	-11.5	56.4	18.26	TRUE	110	128.04	54.8	100.63	27.4
Bundling spacer – 3 conductor, 33 cm	AAC 16.3 mm diameter	(0.062+0.216j)	5.070035355472591e-06j	(0.972+0.008j)	(13.796+48.714j)	(-0+0.001j)	(0.972+0.008j)	132	699.8	123.1	-15.6	69	5.8	-12	56.4	7.43	TRUE	216	239.43	74.2	174.46	37.1
No bundling – 1 conductor	AAC 26.3 mm diameter	(0.036+0.375j)	2.923129035169 5497e-06j	(0.972+0.003j)	(7.949+84.434j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	136.1	-25.6	68	5.5	-7.1	56.7	4.24	TRUE	405	191.3	84.6	136.14	42.3
Bundling spacer – 3 conductor, 33 cm	AAC 9.0 mm diameter	(0.203+0.252j)	4.347394433587209e-06j	(0.972+0.023j)	(45.25+57.114j)	(-0+0.001j)	(0.972+0.023j)	132	699.8	103.4	-21	69	0.4	-9.4	56.9	24.24	TRUE	110	96.18	51.6	77.49	25.8
Bundling spacer – 2 conductor, 24 cm	AAC 26.3 mm diameter	(0.036+0.258j)	4.249172540753887e-06j	(0.972+0.004j)	(7.949+58.09j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	129.1	-18.1	69	1.4	-10.3	57.6	4.26	TRUE	405	252.14	82.2	180.49	41.1
Bundling spacer – 2 conductor, 24 cm	AAC 26.3 mm diameter	(0.036+0.266j)	4.130814401780984e-06j	(0.972+0.004j)	(7.949+59.754j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	129.5	-18.6	69	0.8	-10	57.8	4.26	TRUE	405	246.87	82.4	176.63	41.2
Bundling spacer – 2 conductor, 24 cm	AAC 26.3 mm diameter	(0.036+0.262j)	4.191427941951168e-06j	(0.972+0.004j)	(7.949+58.89j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	129.3	-18.4	69	1.1	-10.1	57.8	4.26	TRUE	405	249.57	82.3	178.61	41.2
Bundling spacer – 3 conductor, 23 cm	AAC 16.3 mm diameter	(0.062+0.237j)	4.629686343379485e-06j	(0.972+0.007j)	(13.796+53.341j)	(-0+0.001j)	(0.972+0.007j)	132	699.8	124.1	-17	69	3.2	-11	58	7.41	TRUE	216	227.29	75.5	165.07	37.7
Bundling spacer – 3 conductor, 23 cm	AAC 16.3 mm diameter	(0.062+0.244j)	4.489530698635078e-06j	(0.972+0.007j)	(13.796+55.004j)	(-0+0.001j)	(0.972+0.007j)	132	699.8	124.4	-17.6	69	2.4	-10.7	58.2	7.4	TRUE	216	223.21	75.9	161.94	38
Bundling spacer – 3 conductor, 23 cm	AAC 16.3 mm diameter	(0.062+0.241j)	4.561219929670155e-06j	(0.972+0.007j)	(13.796+54.14j)	(-0+0.001j)	(0.972+0.007j)	132	699.8	124.2	-17.3	69	2.8	-10.8	58.2	7.41	TRUE	216	225.31	75.7	163.55	37.9
Bundling spacer – 2 conductor, 32 cm	AAC 26.3 mm diameter	(0.036+0.249j)	4.403248801698 3794e-06j	(0.972+0.004j)	(7.949+56.058j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	128.7	-17.5	69	2.2	-10.6	58.3	4.26	TRUE	405	258.94	81.9	185.47	41
Bundling spacer – 2 conductor, 32 cm	AAC 26.3 mm diameter	(0.036+0.257j)	4.276279881386 31e-06j	(0.972+0.004j)	(7.949+57.722j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	129	-18	69	1.5	-10.3	58.5	4.26	TRUE	405	253.34	82.2	181.37	41.1
Bundling spacer – 2 conductor, 32 cm	AAC 26.3 mm diameter	(0.036+0.253j)	4.341271147404662e-06j	(0.972+0.004j)	(7.949+56.858j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	128.9	-17.7	69	1.9	-10.5	58.5	4.26	TRUE	405	256.21	82	183.47	41
Bundling spacer – 2 conductor, 24 cm	AAC 16.3 mm diameter	(0.046+0.273j)	4.015512047731 2335e-06j	(0.972+0.005j)	(10.347+61.476j)	(-0+0.001j)	(0.972+0.005j)	132	699.8	128.3	-19.3	69	0.1	-9.7	59.1	5.54	TRUE	216	227.76	80.4	163.55	40.2
Bundling spacer – 3 conductor, 33 cm	AAC 16.3 mm diameter	(0.062+0.222j)	4.945141495600 5e-06j	(0.972+0.008j)	(13.796+49.942j)	(-0+0.001j)	(0.972+0.008j)	132	699.8	123.4	-16	69	5	-11.7	59.3	7.42	TRUE	216	236.09	74.6	171.87	37.3
Bundling spacer – 4 conductor, 26 cm	AAC 9.0 mm diameter	(0.152+0.218j)	5.029421686258565e-06j	(0.972+0.02j)	(33.938+49.295j)	(-0+0.001j)	(0.972+0.02j)	132	699.8	109.3	-17	69	4.4	-11.3	59.4	18.25	TRUE	110	127.85	55.5	100.17	27.7
Bundling spacer – 3 conductor, 33 cm	AAC 16.3 mm diameter	(0.062+0.229j)	4.785564609711747e-06j	(0.972+0.008j)	(13.796+51.605j)	(-0+0.001j)	(0.972+0.008j)	132	699.8	123.7	-16.5	69	4.1	-11.4	59.5	7.41	TRUE	216	231.71	75	168.48	37.5
Bundling spacer – 3 conductor, 33 cm	AAC 16.3 mm diameter	(0.062+0.225j)	4.867105587550069e-06j	(0.972+0.008j)	(13.796+50.742j)	(-0+0.001j)	(0.972+0.008j)	132	699.8	123.5	-16.2	69	4.6	-11.6	59.5	7.42	TRUE	216	233.97	74.8	170.22	37.4
Bundling spacer – 4 conductor, 26 cm	AAC 9.0 mm diameter	(0.152+0.226j)	4.864449831231781e-06j	(0.972+0.019j)	(33.938+50.952j)	(-0+0.001j)	(0.972+0.019j)	132	699.8	109.7	-17.6	69	3.5	-10.9	59.6	18.23	TRUE	110	127.53	56.3	99.53	28.2
Bundling spacer – 4 conductor, 26 cm	AAC 9.0 mm diameter	(0.152+0.222j)	4.948724877966 18e-06j	(0.972+0.019j)	(33.938+50.092j)	(-0+0.001j)	(0.972+0.019j)	132	699.8	109.5	-17.3	69	4	-11.1	59.6	18.24	TRUE	110	127.71	55.9	99.87	27.9
Bundling spacer – 3 conductor, 23 cm	AAC 21.0 mm diameter	(0.037+0.226j)	4.850106164457482e-06j	(0.972+0.005j)	(8.311+50.897j)	(-0+0.001j)	(0.972+0.005j)	132	699.8	127.4	-16	69	4.7	-11.7	59.7	4.47	TRUE	299	275.31	80.7	197.71	40.4
No bundling – 1 conductor	AAC 31.5 mm diameter	(0.025+0.346j)	3.171578495780 0177e-06j	(0.972+0.002j)	(5.541+77.817j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	135.7	-23.5	68	6.5	-7.8	59.7	2.96	FALSE	495	212.83	85.9	151.25	43
Bundling spacer – 2 conductor, 32 cm	AAC 16.3 mm diameter	(0.046+0.264j)	4.152835201603 0125e-06j	(0.972+0.005j)	(10.347+59.444j)	(-0+0.001j)	(0.972+0.005j)	132	699.8	127.8	-18.7	69	0.8	-10	59.8	5.54	TRUE	216	233.14	80.1	167.54	40.1
Bundling spacer – 2 conductor, 24 cm	AAC 31.5 mm diameter	(0.025+0.247j)	4.440614520198643e-06j	(0.972+0.003j)	(5.541+55.581j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	130.2	-17.2	69	2.5	-10.8	60.1	2.97	FALSE	495	277.64	84.3	198.04	42.2

Bundling spacer – 2 conductor, 24 cm	AAC 26.3 mm diameter	(0.036+0.276j)	3.971252417961687e-06j	(0.972+0.004j)	(7.949+62.154j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	130	-19.3	690	-9.6	60.1	4.25	TRUE	405	239.71	82.7	171.39	41.4
Bundling spacer – 3 conductor, 23 cm	AAC 16.3 mm diameter	(0.062+0.255j)	4.301683115058902e-06j	(0.972+0.007j)	(13.796+57.403j)	(-0+0.001j)	(0.972+0.007j)	132	699.8	125	-18.3	691.4	-10.2	60.5	7.4	TRUE	216	217.58	76.5	157.62	38.2
Bundling spacer – 2 conductor, 32 cm	AAC 31.5 mm diameter	(0.025+0.238j)	4.609162371815347e-06j	(0.972+0.003j)	(5.541+53.549j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	129.8	-16.6	693.5	-11.2	60.8	2.98	FALSE	495	286.08	84.1	204.15	42
Bundling spacer – 2 conductor, 32 cm	AAC 26.3 mm diameter	(0.036+0.267j)	4.105514450056337 5e-06j	(0.972+0.004j)	(7.949+60.122j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	129.6	-18.7	690.6	-9.9	60.8	4.26	TRUE	405	245.74	82.5	175.8	41.2
Bundling spacer – 3 conductor, 33 cm	AAC 21.0 mm diameter	(0.037+0.211j)	5.197440831920063e-06j	(0.972+0.005j)	(8.311+47.497j)	(-0+0.001j)	(0.972+0.005j)	132	699.8	126.7	-14.9	696.9	-12.5	61.1	4.48	TRUE	299	289.5	80.1	208.19	40
Bundling spacer – 2 conductor, 24 cm	AAC 16.3 mm diameter	(0.046+0.291j)	3.766421101720277 3e-06j	(0.972+0.004j)	(10.347+65.54j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	129.2	-20.5	688.9	-9.1	61.6	5.53	TRUE	216	217.84	81	156.2	40.5
Bundling spacer – 3 conductor, 33 cm	AAC 16.3 mm diameter	(0.062+0.24j)	4.572714666294702e-06j	(0.972+0.007j)	(13.796+54.004j)	(-0+0.001j)	(0.972+0.007j)	132	699.8	124.2	-17.3	692.9	-10.9	61.8	7.41	TRUE	216	225.65	75.7	163.81	37.8
Bundling spacer – 3 conductor, 23 cm	AAC 9.0 mm diameter	(0.102+0.249j)	4.398858292644292 5e-06j	(0.972+0.011j)	(22.625+56.191j)	(-0+0.001j)	(0.972+0.011j)	132	699.8	118.6	-18.6	691.6	-10.2	61.8	12.13	TRUE	110	171.72	68.1	127.44	34
Bundling spacer – 4 conductor, 26 cm	AAC 9.0 mm diameter	(0.152+0.236j)	4.644685940719138e-06j	(0.972+0.018j)	(33.938+53.342j)	(-0+0.001j)	(0.972+0.018j)	132	699.8	110.2	-18.5	692.3	-10.4	61.9	18.21	TRUE	110	126.95	57.5	98.56	28.8
No bundling – 1 conductor	AAC 31.5 mm diameter	(0.025+0.364j)	3.014134457367631 4e-06j	(0.972+0.002j)	(5.541+81.881j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	136.9	-24.6	685.9	-7.4	62.2	2.95	FALSE	495	204.72	86.1	145.41	43.1
Bundling spacer – 2 conductor, 32 cm	AAC 16.3 mm diameter	(0.046+0.282j)	3.886980013919267 5e-06j	(0.972+0.005j)	(10.347+63.508j)	(-0+0.001j)	(0.972+0.005j)	132	699.8	128.7	-19.9	689.5	-9.4	62.3	5.54	TRUE	216	222.67	80.7	159.78	40.4
Bundling spacer – 3 conductor, 23 cm	AAC 21.0 mm diameter	(0.037+0.232j)	4.735690385091749e-06j	(0.972+0.005j)	(8.311+52.126j)	(-0+0.001j)	(0.972+0.005j)	132	699.8	127.6	-16.3	694.1	-11.4	62.7	4.47	TRUE	299	270.55	80.9	194.19	40.5
Bundling spacer – 3 conductor, 23 cm	AAC 21.0 mm diameter	(0.037+0.239j)	4.589144668605896e-06j	(0.972+0.004j)	(8.311+53.789j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	128	-16.8	693.2	-11.1	62.9	4.46	TRUE	299	264.38	81.2	189.65	40.6
Bundling spacer – 3 conductor, 23 cm	AAC 21.0 mm diameter	(0.037+0.235j)	4.664077031277323e-06j	(0.972+0.004j)	(8.311+52.926j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	127.8	-16.6	693.7	-11.3	62.9	4.46	TRUE	299	267.54	81.1	191.98	40.5
Bundling spacer – 4 conductor, 26 cm	AAC 16.3 mm diameter	(0.046+0.203j)	5.395260950863109 5e-06j	(0.972+0.006j)	(10.347+45.765j)	(-0+0.001j)	(0.972+0.006j)	132	699.8	125	-14.4	698	-12.9	63	5.58	TRUE	216	278.21	77.3	201.27	38.6
Bundling spacer – 2 conductor, 24 cm	AAC 31.5 mm diameter	(0.025+0.253j)	4.344511853575704e-06j	(0.972+0.003j)	(5.541+56.81j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	130.5	-17.6	692	-10.6	63.1	2.97	FALSE	495	272.81	84.4	194.54	42.2
Bundling spacer – 3 conductor, 33 cm	AAC 9.0 mm diameter	(0.102+0.234j)	4.682677340496768e-06j	(0.972+0.012j)	(22.625+52.796j)	(-0+0.001j)	(0.972+0.012j)	132	699.8	117.9	-17.4	693.1	-10.9	63.2	12.15	TRUE	110	175.58	66.8	130.84	33.4
Bundling spacer – 2 conductor, 24 cm	AAC 31.5 mm diameter	(0.025+0.26j)	4.220860170933272e-06j	(0.972+0.003j)	(5.541+58.474j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	130.9	-18.1	691.3	-10.3	63.3	2.97	FALSE	495	266.57	84.6	190.02	42.3
Bundling spacer – 2 conductor, 24 cm	AAC 31.5 mm diameter	(0.025+0.256j)	4.284165336836702e-06j	(0.972+0.003j)	(5.541+57.61j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	130.7	-17.8	691.7	-10.4	63.3	2.97	FALSE	495	269.77	84.5	192.34	42.3
Bundling spacer – 2 conductor, 32 cm	AAC 31.5 mm diameter	(0.025+0.244j)	4.505710892106696e-06j	(0.972+0.003j)	(5.541+54.778j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	130.1	-17	692.9	-11	63.7	2.97	FALSE	495	280.91	84.2	200.4	42.1
Bundling spacer – 2 conductor, 32 cm	AAC 31.5 mm diameter	(0.025+0.251j)	4.372853320256 86e-06j	(0.972+0.003j)	(5.541+56.442j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	130.4	-17.5	692.2	-10.6	64	2.97	FALSE	495	274.24	84.4	195.57	42.2
Bundling spacer – 3 conductor, 33 cm	AAC 21.0 mm diameter	(0.037+0.217j)	5.066272358331339e-06j	(0.972+0.005j)	(8.311+48.726j)	(-0+0.001j)	(0.972+0.005j)	132	699.8	127	-15.3	696.1	-12.2	64	4.48	TRUE	299	284.2	80.3	204.27	40.2
Bundling spacer – 2 conductor, 32 cm	AAC 31.5 mm diameter	(0.025+0.247j)	4.440836529136301e-06j	(0.972+0.003j)	(5.541+55.578j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	130.2	-17.2	692.5	-10.8	64	2.97	FALSE	495	277.66	84.3	198.05	42.2
Bundling spacer – 3 conductor, 33 cm	AAC 21.0 mm diameter	(0.037+0.224j)	4.898914364853833e-06j	(0.972+0.005j)	(8.311+50.39j)	(-0+0.001j)	(0.972+0.005j)	132	699.8	127.3	-15.8	695	-11.8	64.2	4.47	TRUE	299	277.33	80.6	199.2	40.3
Bundling spacer – 3 conductor, 33 cm	AAC 21.0 mm diameter	(0.037+0.22j)	4.984398308843734e-06j	(0.972+0.005j)	(8.311+49.526j)	(-0+0.001j)	(0.972+0.005j)	132	699.8	127.1	-15.5	695.6	-12	64.2	4.47	TRUE	299	280.85	80.5	201.8	40.2
Bundling spacer – 3 conductor, 23 cm	AAC 9.0 mm diameter	(0.102+0.268j)	4.101697355857075e-06j	(0.972+0.011j)	(22.625+60.25j)	(-0+0.001j)	(0.972+0.011j)	132	699.8	119.6	-19.9	690.1	-9.5	64.3	12.11	TRUE	110	167.16	69.4	123.51	34.7

Bundling spacer – 3 conductor, 23 cm	AAC 21.0 mm diameter	(0.037+0.25j)	4.393050708387671e-06j	(0.972+0.004j)	(8.311+56.189j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	128.5	-17.6	69 2.1	-10.6	65.1	4.46	TRUE	299	256.01	81.6	183.49	40.8
Bundling spacer – 2 conductor, 24 cm	AAC 21.0 mm diameter	(0.028+0.265j)	4.135959044669734e-06j	(0.972+0.003j)	(6.234+59.676j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	130.6	-18.5	69 0.9	-10.1	65.4	3.34	FALSE	299	257.86	84	183.97	42
Bundling spacer – 2 conductor, 24 cm	AAC 31.5 mm diameter	(0.025+0.271j)	4.054406084151245e-06j	(0.972+0.003j)	(5.541+60.875j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	131.4	-18.8	69 0.5	-9.9	65.6	2.97	FALSE	495	258.13	84.8	183.92	42.4
Bundling spacer – 3 conductor, 33 cm	AAC 9.0 mm diameter	(0.102+0.252j)	4.347394433587209e-06j	(0.972+0.011j)	(22.625+56.854j)	(-0+0.001j)	(0.972+0.011j)	132	699.8	118.8	-18.8	69 1.3	-10.1	65.7	12.13	TRUE	110	170.97	68.3	126.79	34.1
Bundling spacer – 4 conductor, 26 cm	AAC 16.3 mm diameter	(0.046+0.209j)	5.254053275215045e-06j	(0.972+0.006j)	(10.347+46.993j)	(-0+0.001j)	(0.972+0.006j)	132	699.8	125.2	-14.8	69 7.1	-12.6	65.9	5.58	TRUE	216	273.42	77.6	197.66	38.8
Bundling spacer – 4 conductor, 26 cm	AAC 16.3 mm diameter	(0.046+0.216j)	5.074279261009 9525e-06j	(0.972+0.006j)	(10.347+48.657j)	(-0+0.001j)	(0.972+0.006j)	132	699.8	125.5	-15.4	69 6	-12.1	66.1	5.57	TRUE	216	267.2	78	192.98	39
Bundling spacer – 2 conductor, 32 cm	AAC 21.0 mm diameter	(0.028+0.256j)	4.281793480174 3536e-06j	(0.972+0.003j)	(6.234+57.644j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	130.2	-17.9	69 1.6	-10.4	66.1	3.34	FALSE	299	264.98	83.8	189.14	41.9
Bundling spacer – 4 conductor, 26 cm	AAC 16.3 mm diameter	(0.046+0.212j)	5.166050151517751e-06j	(0.972+0.006j)	(10.347+47.793j)	(-0+0.001j)	(0.972+0.006j)	132	699.8	125.4	-15.1	69 6.6	-12.4	66.1	5.57	TRUE	216	270.4	77.8	195.38	38.9
Bundling spacer – 2 conductor, 32 cm	AAC 31.5 mm diameter	(0.025+0.262j)	4.194448718848093e-06j	(0.972+0.003j)	(5.541+58.843j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	130.9	-18.2	69 1.2	-10.2	66.2	2.97	FALSE	495	265.23	84.6	189.06	42.3
Bundling spacer – 3 conductor, 23 cm	AAC 26.3 mm diameter	(0.024+0.222j)	4.953280217015424e-06j	(0.972+0.003j)	(5.299+49.829j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	129.3	-15.5	69 5.5	-12	66.4	2.85	FALSE	405	305.23	83.9	217.91	42
Bundling spacer – 3 conductor, 33 cm	AAC 21.0 mm diameter	(0.037+0.235j)	4.676096716900 5954e-06j	(0.972+0.004j)	(8.311+52.79j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	127.8	-16.5	69 3.7	-11.3	66.5	4.47	TRUE	299	268.05	81.1	192.35	40.5
Bundling spacer – 3 conductor, 33 cm	AAC 26.3 mm diameter	(0.024+0.206j)	5.316102164005732e-06j	(0.972+0.003j)	(5.299+46.429j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	128.6	-14.4	69 7.8	-12.9	67.8	2.86	FALSE	405	323.2	83.5	230.95	41.7
Bundling spacer – 2 conductor, 24 cm	AAC 21.0 mm diameter	(0.028+0.283j)	3.872191594001406e-06j	(0.972+0.003j)	(6.234+63.74j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	131.6	-19.6	68 9.6	-9.4	67.9	3.34	FALSE	299	244.89	84.4	174.57	42.2
Bundling spacer – 4 conductor, 26 cm	AAC 16.3 mm diameter	(0.046+0.227j)	4.835612411215029e-06j	(0.972+0.006j)	(10.347+51.056j)	(-0+0.001j)	(0.972+0.006j)	132	699.8	126	-16.1	69 4.6	-11.6	68.4	5.56	TRUE	216	258.72	78.5	186.62	39.3
Bundling spacer – 2 conductor, 32 cm	AAC 21.0 mm diameter	(0.028+0.274j)	3.999731415782102e-06j	(0.972+0.003j)	(6.234+61.708j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	131.1	-19.1	69 0.2	-9.7	68.6	3.34	FALSE	299	251.17	84.2	179.13	42.1
Bundling spacer – 4 conductor, 26 cm	AAC 21.0 mm diameter	(0.028+0.199j)	5.502920994225 6775e-06j	(0.972+0.004j)	(6.234+44.856j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	127.7	-14	69 9	-13.3	69.2	3.37	FALSE	299	322.66	82.1	231.17	41
Bundling spacer – 3 conductor, 23 cm	AAC 26.3 mm diameter	(0.024+0.227j)	4.834004690487 2875e-06j	(0.972+0.003j)	(5.299+51.058j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	129.5	-15.8	69 4.8	-11.7	69.4	2.85	FALSE	405	299.26	84.1	213.59	42
Bundling spacer – 3 conductor, 23 cm	AAC 26.3 mm diameter	(0.024+0.234j)	4.681409182544531e-06j	(0.972+0.003j)	(5.299+52.722j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	129.8	-16.3	69 3.9	-11.4	69.6	2.85	FALSE	405	291.59	84.3	208.03	42.1
Bundling spacer – 3 conductor, 23 cm	AAC 26.3 mm diameter	(0.024+0.231j)	4.759410462059674e-06j	(0.972+0.003j)	(5.299+51.858j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	129.6	-16.1	69 4.4	-11.6	69.6	2.85	FALSE	405	295.51	84.2	210.87	42.1
Bundling spacer – 3 conductor, 33 cm	AAC 26.3 mm diameter	(0.024+0.212j)	5.178954999437324e-06j	(0.972+0.003j)	(5.299+47.658j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	128.9	-14.8	69 7	-12.6	70.8	2.86	FALSE	405	316.44	83.7	226.04	41.8
Bundling spacer – 3 conductor, 33 cm	AAC 26.3 mm diameter	(0.024+0.219j)	5.004197952510292e-06j	(0.972+0.003j)	(5.299+49.322j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	129.2	-15.3	69 5.9	-12.1	71	2.85	FALSE	405	307.77	83.9	219.75	41.9
Bundling spacer – 3 conductor, 33 cm	AAC 26.3 mm diameter	(0.024+0.215j)	5.093429148383911e-06j	(0.972+0.003j)	(5.299+48.458j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	129	-15.1	69 6.4	-12.4	71	2.85	FALSE	405	312.2	83.8	222.97	41.9
Bundling spacer – 4 conductor, 26 cm	AAC 9.0 mm diameter	(0.076+0.218j)	5.029421686258565e-06j	(0.972+0.01j)	(16.969+49.126j)	(-0+0.001j)	(0.972+0.01j)	132	699.8	121	-15.9	69 5.4	-11.8	71.1	9.13	TRUE	110	215.34	70.9	158.29	35.5
Bundling spacer – 3 conductor, 23 cm	AAC 16.3 mm diameter	(0.031+0.237j)	4.629686343379485e-06j	(0.972+0.004j)	(6.898+53.315j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	128.8	-16.6	69 3.5	-11.2	71.6	3.7	FALSE	216	276.72	82.6	197.98	41.3
Bundling spacer – 3 conductor, 23 cm	AAC 26.3 mm diameter	(0.024+0.245j)	4.477526194262683e-06j	(0.972+0.003j)	(5.299+55.123j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	130.3	-17.1	69 2.7	-10.9	71.9	2.84	FALSE	405	281.26	84.5	200.56	42.3
Bundling spacer – 4 conductor, 26 cm	AAC 21.0 mm diameter	(0.028+0.205j)	5.356098298432733e-06j	(0.972+0.004j)	(6.234+46.085j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	127.9	-14.4	69 8.1	-12.9	72.2	3.36	FALSE	299	315.93	82.3	226.25	41.1

Bundling spacer – 4 conductor, 26 cm	AAC 21.0 mm diameter	(0.028+0.212j)	5.169397346013 9205e-06j	(0.972+0.004j)	(6.234+47.749j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	128.2	-14.9	69 6.8	-12.5	72.4	3.36	FALSE	299	307.28	82.6	219.93	41.3
Bundling spacer – 4 conductor, 26 cm	AAC 21.0 mm diameter	(0.028+0.208j)	5.264673299753 775e-06j	(0.972+0.004j)	(6.234+46.885j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	128.1	-14.6	69 7.5	-12.7	72.4	3.36	FALSE	299	311.71	82.4	223.16	41.2
Bundling spacer – 3 conductor, 33 cm	AAC 16.3 mm diameter	(0.031+0.222j)	4.945141495600 5e-06j	(0.972+0.004j)	(6.898+49.915j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	128.2	-15.6	69 5.4	-12	73	3.71	FALSE	216	291.11	82.1	208.5	41.1
Bundling spacer – 3 conductor, 33 cm	AAC 26.3 mm diameter	(0.024+0.23j)	4.771927191903 771e-06j	(0.972+0.003j)	(5.299+51.722j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	129.6	-16	69 4.4	-11.6	73.3	2.85	FALSE	405	296.14	84.2	211.33	42.1
Bundling spacer – 4 conductor, 26 cm	AAC 9.0 mm diameter	(0.076+0.236j)	4.644685940719 138e-06j	(0.972+0.009j)	(16.969+53.186j)	(-0+0.001j)	(0.972+0.009j)	132	699.8	121.9	-17.2	69 3.1	-10.9	73.6	9.11	TRUE	110	207.26	72.3	151.78	36.2
Bundling spacer – 3 conductor, 23 cm	AAC 16.3 mm diameter	(0.031+0.255j)	4.301683115058 902e-06j	(0.972+0.003j)	(6.898+57.379j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	129.7	-17.8	69 1.7	-10.4	74.1	3.7	FALSE	216	261.47	83.1	186.86	41.6
Bundling spacer – 2 conductor, 24 cm	AAC 26.3 mm diameter	(0.018+0.258j)	4.249172540753 887e-06j	(0.972+0.002j)	(3.974+58.082j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	131.8	-17.8	69 1.6	-10.4	74.4	2.13	FALSE	405	278.55	86.1	198.09	43
Bundling spacer – 3 conductor, 23 cm	AAC 31.5 mm diameter	(0.017+0.218j)	5.039219470421 16e-06j	(0.972+0.002j)	(3.694+48.977j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	130.2	-15.1	69 6.2	-12.3	74.6	1.99	FALSE	495	323.99	85.7	230.63	42.8
Bundling spacer – 4 conductor, 26 cm	AAC 21.0 mm diameter	(0.028+0.223j)	4.921917141501 634e-06j	(0.972+0.004j)	(6.234+50.149j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	128.7	-15.6	69 5.3	-11.9	74.7	3.35	FALSE	299	295.68	82.9	211.47	41.5
Bundling spacer – 2 conductor, 32 cm	AAC 26.3 mm diameter	(0.018+0.249j)	4.403248801698 3794e-06j	(0.972+0.002j)	(3.974+56.05j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	131.4	-17.2	69 2.4	-10.8	75	2.13	FALSE	405	286.96	85.9	204.13	43
Bundling spacer – 3 conductor, 33 cm	AAC 16.3 mm diameter	(0.031+0.24j)	4.572714666294 702e-06j	(0.972+0.004j)	(6.898+53.979j)	(-0+0.001j)	(0.972+0.004j)	132	699.8	129	-16.8	69 3.2	-11.1	75.5	3.7	FALSE	216	274.09	82.7	196.06	41.4
Bundling spacer – 3 conductor, 33 cm	AAC 31.5 mm diameter	(0.017+0.203j)	5.415218376692 445e-06j	(0.972+0.002j)	(3.694+45.576j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	129.6	-14.1	69 8.6	-13.2	76	1.99	FALSE	495	344.47	85.4	245.36	42.7
Bundling spacer – 2 conductor, 24 cm	AAC 26.3 mm diameter	(0.018+0.276j)	3.971252417961 687e-06j	(0.972+0.002j)	(3.974+62.147j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	132.7	-19	69 0.1	-9.7	76.9	2.13	FALSE	405	263.32	86.3	187.16	43.2
Bundling spacer – 2 conductor, 32 cm	AAC 26.3 mm diameter	(0.018+0.267j)	4.105514450056 3375e-06j	(0.972+0.002j)	(3.974+60.115j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	132.3	-18.4	69 0.8	-10.1	77.5	2.13	FALSE	405	270.68	86.2	192.44	43.1
Bundling spacer – 3 conductor, 23 cm	AAC 31.5 mm diameter	(0.017+0.223j)	4.915820740910 5975e-06j	(0.972+0.002j)	(3.694+50.206j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	130.4	-15.5	69 5.4	-12	77.6	1.99	FALSE	495	317.23	85.8	225.77	42.9
Bundling spacer – 3 conductor, 23 cm	AAC 31.5 mm diameter	(0.017+0.231j)	4.758100396014 43e-06j	(0.972+0.002j)	(3.694+51.87j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	130.8	-16	69 4.4	-11.6	77.8	1.99	FALSE	495	308.57	85.9	219.54	43
Bundling spacer – 3 conductor, 23 cm	AAC 31.5 mm diameter	(0.017+0.227j)	4.838700255411 803e-06j	(0.972+0.002j)	(3.694+51.006j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	130.6	-15.7	69 4.9	-11.8	77.8	1.99	FALSE	495	313	85.9	222.72	42.9
Bundling spacer – 4 conductor, 26 cm	AAC 26.3 mm diameter	(0.018+0.196j)	5.602219103226 575e-06j	(0.972+0.003j)	(3.974+44.056j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	129.2	-13.7	69 9.9	-13.6	78.2	2.15	FALSE	405	351.52	84.8	250.62	42.4
Bundling spacer – 3 conductor, 33 cm	AAC 31.5 mm diameter	(0.017+0.208j)	5.272977866755 299e-06j	(0.972+0.002j)	(3.694+46.806j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	129.8	-14.5	69 7.7	-12.8	78.9	1.99	FALSE	495	336.74	85.5	239.8	42.7
Bundling spacer – 3 conductor, 33 cm	AAC 31.5 mm diameter	(0.017+0.216j)	5.091928776152 022e-06j	(0.972+0.002j)	(3.694+48.47j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	130.1	-15	69 6.5	-12.4	79.2	1.99	FALSE	495	326.87	85.6	232.7	42.8
Bundling spacer – 3 conductor, 33 cm	AAC 31.5 mm diameter	(0.017+0.212j)	5.184344991107 786e-06j	(0.972+0.002j)	(3.694+47.606j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	130	-14.7	69 7.1	-12.6	79.2	1.99	FALSE	495	331.91	85.6	236.33	42.8
Bundling spacer – 3 conductor, 23 cm	AAC 31.5 mm diameter	(0.017+0.241j)	4.547632798356 005e-06j	(0.972+0.002j)	(3.694+54.27j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	131.2	-16.7	69 3.2	-11.1	80.1	1.98	FALSE	495	296.97	86.1	211.21	43.1
Bundling spacer – 3 conductor, 23 cm	AAC 21.0 mm diameter	(0.019+0.232j)	4.735690385091 749e-06j	(0.972+0.002j)	(4.156+52.116j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	130.5	-16.1	69 4.3	-11.5	81	2.23	FALSE	299	303.57	85.4	216.15	42.7
Bundling spacer – 4 conductor, 26 cm	AAC 26.3 mm diameter	(0.018+0.201j)	5.450123107753 459e-06j	(0.972+0.002j)	(3.974+45.285j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	129.4	-14	69 8.8	-13.2	81.2	2.15	FALSE	405	343.44	85	244.79	42.5
Bundling spacer – 4 conductor, 26 cm	AAC 26.3 mm diameter	(0.018+0.209j)	5.256927873195 806e-06j	(0.972+0.002j)	(3.974+46.949j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	129.7	-14.5	69 7.5	-12.8	81.4	2.14	FALSE	405	333.13	85.2	237.36	42.6
Bundling spacer – 3 conductor, 33 cm	AAC 31.5 mm diameter	(0.017+0.226j)	4.851638073011 554e-06j	(0.972+0.002j)	(3.694+50.87j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	130.6	-15.7	69 5	-11.8	81.4	1.99	FALSE	495	313.71	85.8	223.23	42.9

Bundling spacer – 4 conductor, 26 cm	AAC 26.3 mm diameter	(0.018+0.205j)	5.355488411203889e-06j	(0.972+0.002j)	(3.974+46.085j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	129.5	-14.3	68.2	-13	81.4	2.14	FALSE	405	338.4	85.1	241.15	42.5
Bundling spacer – 3 conductor, 33 cm	AAC 21.0 mm diameter	(0.019+0.217j)	5.066272358331339e-06j	(0.972+0.002j)	(4.156+48.716j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	129.8	-15.1	69 6.3	-12.3	82.4	2.24	FALSE	299	321.24	85.1	228.89	42.6
Bundling spacer – 3 conductor, 23 cm	AAC 21.0 mm diameter	(0.019+0.25j)	4.393050708387671e-06j	(0.972+0.002j)	(4.156+56.181j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	131.3	-17.3	69 2.3	-10.7	83.5	2.23	FALSE	299	285.11	85.8	202.87	42.9
Bundling spacer – 4 conductor, 26 cm	AAC 26.3 mm diameter	(0.018+0.219j)	5.001203122149354e-06j	(0.972+0.002j)	(3.974+49.349j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	130.1	-15.3	69 5.9	-12.2	83.7	2.14	FALSE	405	319.4	85.4	227.46	42.7
Bundling spacer – 4 conductor, 26 cm	AAC 16.3 mm diameter	(0.023+0.209j)	5.254053275215045e-06j	(0.972+0.003j)	(5.173+46.977j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	128.8	-14.6	69 7.4	-12.7	84.2	2.79	FALSE	216	321.36	83.7	229.54	41.9
Bundling spacer – 3 conductor, 33 cm	AAC 21.0 mm diameter	(0.019+0.235j)	4.676096716900 5954e-06j	(0.972+0.002j)	(4.156+52.78j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	130.6	-16.3	69 3.9	-11.4	84.9	2.23	FALSE	299	300.37	85.5	213.85	42.7
Bundling spacer – 2 conductor, 24 cm	AAC 31.5 mm diameter	(0.012+0.253j)	4.344511853575704e-06j	(0.972+0.001j)	(2.77+56.807j)	(-0+0.001j)	(0.972+0.001j)	132	699.8	132.4	-17.4	69 2.1	-10.7	85.3	1.49	FALSE	495	292.27	87.2	207.5	43.6
Bundling spacer – 2 conductor, 32 cm	AAC 31.5 mm diameter	(0.012+0.244j)	4.505710892106696e-06j	(0.972+0.001j)	(2.77+54.774j)	(-0+0.001j)	(0.972+0.001j)	132	699.8	132	-16.8	69 3	-11	85.9	1.49	FALSE	495	301.6	87.1	214.17	43.6
Bundling spacer – 4 conductor, 26 cm	AAC 16.3 mm diameter	(0.023+0.227j)	4.835612411215029e-06j	(0.972+0.003j)	(5.173+51.041j)	(-0+0.001j)	(0.972+0.003j)	132	699.8	129.6	-15.8	69 4.8	-11.8	86.7	2.78	FALSE	216	300.39	84.2	214.34	42.1
Bundling spacer – 2 conductor, 24 cm	AAC 31.5 mm diameter	(0.012+0.271j)	4.054406084151 2455e-06j	(0.972+0.001j)	(2.77+60.871j)	(-0+0.001j)	(0.972+0.001j)	132	699.8	133.3	-18.6	69 0.6	-10	87.8	1.48	FALSE	495	275.47	87.4	195.49	43.7
Bundling spacer – 2 conductor, 32 cm	AAC 31.5 mm diameter	(0.012+0.262j)	4.194448718848093e-06j	(0.972+0.001j)	(2.77+58.839j)	(-0+0.001j)	(0.972+0.001j)	132	699.8	132.8	-18	69 1.3	-10.3	88.4	1.48	FALSE	495	283.58	87.3	201.29	43.7
Bundling spacer – 4 conductor, 26 cm	AAC 31.5 mm diameter	(0.012+0.193j)	5.684451956469492e-06j	(0.972+0.002j)	(2.77+43.417j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	129.9	-13.4	70 0.5	-13.8	89.1	1.5	FALSE	495	369.41	86.3	262.71	43.2
Bundling spacer – 4 conductor, 26 cm	AAC 31.5 mm diameter	(0.012+0.199j)	5.527920450937468e-06j	(0.972+0.002j)	(2.77+44.646j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	130.1	-13.8	69 9.4	-13.5	92.1	1.5	FALSE	495	360.47	86.4	256.3	43.2
Bundling spacer – 4 conductor, 26 cm	AAC 31.5 mm diameter	(0.012+0.206j)	5.329270867716 66e-06j	(0.972+0.002j)	(2.77+46.31j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	130.4	-14.3	69 8.1	-13	92.3	1.49	FALSE	495	349.08	86.6	248.15	43.3
Bundling spacer – 4 conductor, 26 cm	AAC 31.5 mm diameter	(0.012+0.202j)	5.430588885394342e-06j	(0.972+0.002j)	(2.77+45.446j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	130.2	-14	69 8.8	-13.2	92.3	1.5	FALSE	495	354.89	86.5	252.31	43.3
Bundling spacer – 3 conductor, 23 cm	AAC 26.3 mm diameter	(0.012+0.227j)	4.834004690487 2875e-06j	(0.972+0.001j)	(2.65+51.054j)	(-0+0.001j)	(0.972+0.001j)	132	699.8	131.3	-15.7	69 5	-11.8	94.5	1.42	FALSE	405	321.61	87	228.42	43.5
Bundling spacer – 4 conductor, 26 cm	AAC 31.5 mm diameter	(0.012+0.217j)	5.066635213222634e-06j	(0.972+0.002j)	(2.77+48.711j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	130.8	-15	69 6.4	-12.4	94.6	1.49	FALSE	495	333.99	86.7	237.34	43.4
Bundling spacer – 3 conductor, 33 cm	AAC 26.3 mm diameter	(0.012+0.212j)	5.178954999437324e-06j	(0.972+0.002j)	(2.65+47.654j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	130.7	-14.7	69 7.1	-12.6	95.9	1.43	FALSE	405	341.61	86.8	242.73	43.4
Bundling spacer – 4 conductor, 26 cm	AAC 21.0 mm diameter	(0.014+0.205j)	5.356098298432733e-06j	(0.972+0.002j)	(3.117+46.079j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	130.1	-14.2	69 8.3	-13	96.7	1.68	FALSE	299	347.1	86.1	246.92	43.1
Bundling spacer – 3 conductor, 23 cm	AAC 26.3 mm diameter	(0.012+0.245j)	4.477526194262683e-06j	(0.972+0.001j)	(2.65+55.119j)	(-0+0.001j)	(0.972+0.001j)	132	699.8	132.1	-16.9	69 2.9	-11	97	1.42	FALSE	405	300.87	87.2	213.6	43.6
Bundling spacer – 3 conductor, 33 cm	AAC 26.3 mm diameter	(0.012+0.23j)	4.771927191903771e-06j	(0.972+0.001j)	(2.65+51.719j)	(-0+0.001j)	(0.972+0.001j)	132	699.8	131.5	-15.9	69 4.6	-11.7	98.4	1.42	FALSE	405	318	87.1	225.84	43.5
Bundling spacer – 4 conductor, 26 cm	AAC 21.0 mm diameter	(0.014+0.223j)	4.921917141501634e-06j	(0.972+0.002j)	(3.117+50.143j)	(-0+0.001j)	(0.972+0.002j)	132	699.8	130.8	-15.5	69 5.5	-12	99.2	1.68	FALSE	299	322.61	86.4	229.35	43.2
Bundling spacer – 3 conductor, 23 cm	AAC 31.5 mm diameter	(0.008+0.223j)	4.915820740910 5975e-06j	(0.972+0.001j)	(1.847+50.204j)	(-0+0.001j)	(0.972+0.001j)	132	699.8	131.7	-15.4	69 5.5	-12	110.9	0.99	FALSE	495	333.41	87.9	236.49	43.9
Bundling spacer – 3 conductor, 33 cm	AAC 31.5 mm diameter	(0.008+0.208j)	5.272977866755299e-06j	(0.972+0.001j)	(1.847+46.804j)	(-0+0.001j)	(0.972+0.001j)	132	699.8	131.1	-14.4	69 7.8	-12.9	112.2	1	FALSE	495	355.01	87.7	251.89	43.9
Bundling spacer – 3 conductor, 23 cm	AAC 31.5 mm diameter	(0.008+0.241j)	4.547632798356005e-06j	(0.972+0.001j)	(1.847+54.269j)	(-0+0.001j)	(0.972+0.001j)	132	699.8	132.5	-16.6	69 3.3	-11.2	113.4	0.99	FALSE	495	311.13	88.1	220.62	44
Bundling spacer – 4 conductor, 26 cm	AAC 26.3 mm diameter	(0.009+0.201j)	5.450123107753459e-06j	(0.972+0.001j)	(1.987+45.283j)	(-0+0.001j)	(0.972+0.001j)	132	699.8	130.8	-14	69 9	-13.3	114.7	1.07	FALSE	405	364.24	87.5	258.55	43.7

Bundling spacer – 3 conductor, 33 cm	AAC 31.5 mm diameter	(0.008+0.226j)	4.851638073011554e-06j	(0.972+0.001j)	(1.847+50.868j)	(-0+0.001j)	(0.972+0.001j)	132	699.8	131.9	-15.6	69 5.1	-11.9	114.7	0.99	FALSE	495	329.53	87.9	233.73	44
Bundling spacer – 4 conductor, 26 cm	AAC 26.3 mm diameter	(0.009+0.219j)	5.001203122149354e-06j	(0.972+0.001j)	(1.987+49.347j)	(-0+0.001j)	(0.972+0.001j)	132	699.8	131.5	-15.2	69 6	-12.2	117.2	1.07	FALSE	405	337.31	87.7	239.34	43.8
Bundling spacer – 4 conductor, 26 cm	AAC 31.5 mm diameter	(0.006+0.199j)	5.527920450937468e-06j	(0.972+0.001j)	(1.385+44.645j)	(-0+0.001j)	(0.972+0.001j)	132	699.8	131.1	-13.7	69 9.5	-13.5	136.5	0.75	FALSE	495	375.4	88.2	266.17	44.1
Bundling spacer – 4 conductor, 26 cm	AAC 31.5 mm diameter	(0.006+0.217j)	5.066635213222634e-06j	(0.972+0.001j)	(1.385+48.709j)	(-0+0.001j)	(0.972+0.001j)	132	699.8	131.8	-14.9	69 6.5	-12.4	139	0.75	FALSE	495	346.82	88.4	245.83	44.2

Appendix 7. CSV for 184 km connection

Tower Type	Bundle Type	Conductor Type	Impedance	Admittance	A	B	C	D	Vs	Is	Vr (KV)	Vr angle (Degrees)	Ir (A)	Ir angle (Degrees)	Cost (Million $)	Real Power loss (%)	Thermal limit surpassed	Current limit (Summer)	Stability limit (MVA)	Stability limit angle	Dynamic Stability limit (MVA)	Dynamic Stability limit angle
Tower Type A1	No bundling – 1 conductor	AAC 9.0 mm diameter	(0.609+0.419j)	2.617529257620427 6e-06j	(0.981+0.027j)	(110.755+77.676j)	(-0+0j)	(0.981+0.027j)	132	699.8	72.7	-44.3	688.8	-3.7	30.3	58.84	TRUE	110	38.95	35	35.66	17.5
Tower Type A1	No bundling – 1 conductor	AAC 16.3 mm diameter	(0.186+0.382j)	2.873261183176307 8e-06j	(0.981+0.009j)	(33.766+69.95j)	(-0+0.001j)	(0.981+0.009j)	132	699.8	116.2	-24.3	689.9	-5.2	31.7	17.96	TRUE	216	121.9	64.2	91.68	32.1
Tower Type B1	No bundling – 1 conductor	AAC 9.0 mm diameter	(0.609+0.425j)	2.583838690689272 7e-06j	(0.981+0.026j)	(110.755+78.663j)	(-0+0j)	(0.981+0.026j)	132	699.8	73.2	-44.7	688.7	-3.6	32.7	58.84	TRUE	110	38.97	35.4	35.6	17.7
Tower Type A1	No bundling – 1 conductor	AAC 21.0 mm diameter	(0.112+0.366j)	2.998214147623300 3e-06j	(0.981+0.006j)	(20.343+66.976j)	(-0+0.001j)	(0.981+0.006j)	132	699.8	124.2	-21.8	690.4	-5.7	32.9	10.82	TRUE	299	170.16	73.1	124.1	36.6
Tower Type A2	No bundling – 1 conductor	AAC 9.0 mm diameter	(0.609+0.432j)	2.539591335873495 e-06j	(0.981+0.026j)	(110.755+79.999j)	(-0+0j)	(0.981+0.026j)	132	699.8	73.9	-45.3	688.7	-3.6	32.9	58.84	TRUE	110	38.99	35.8	35.53	17.9
Tower Type C	No bundling – 1 conductor	AAC 9.0 mm diameter	(0.609+0.428j)	2.562372613885492 8e-06j	(0.981+0.026j)	(110.755+79.305j)	(-0+0j)	(0.981+0.026j)	132	699.8	73.6	-45	688.7	-3.6	32.9	58.84	TRUE	110	38.98	35.6	35.57	17.8
Tower Type B1	No bundling – 1 conductor	AAC 16.3 mm diameter	(0.186+0.387j)	2.832716897228518 7e-06j	(0.981+0.009j)	(33.766+70.949j)	(-0+0.001j)	(0.981+0.009j)	132	699.8	116.5	-24.6	689.9	-5.2	34.1	17.96	TRUE	216	121.48	64.5	91.24	32.3
Tower Type A2	No bundling – 1 conductor	AAC 16.3 mm diameter	(0.186+0.395j)	2.779622694823601 5e-06j	(0.981+0.009j)	(33.766+72.3j)	(-0+0.001j)	(0.981+0.009j)	132	699.8	116.9	-25	689.7	-5.1	34.2	17.95	TRUE	216	120.9	65	90.65	32.5
Tower Type C	No bundling – 1 conductor	AAC 16.3 mm diameter	(0.186+0.391j)	2.806937020325698e-06j	(0.981+0.009j)	(33.766+71.599j)	(-0+0.001j)	(0.981+0.009j)	132	699.8	116.7	-24.8	689.8	-5.1	34.2	17.95	TRUE	216	121.2	64.8	90.96	32.4
Tower Type A1	No bundling – 1 conductor	AAC 26.3 mm diameter	(0.071+0.352j)	3.118684936231812 5e-06j	(0.981+0.004j)	(12.97+64.368j)	(-0+0.001j)	(0.981+0.004j)	132	699.8	128.5	-20.3	690.8	-6	34.8	6.9	TRUE	405	208.59	78.6	150.18	39.3
Tower Type B2	No bundling – 1 conductor	AAC 9.0 mm diameter	(0.609+0.443j)	2.478370903710881 6e-06j	(0.981+0.025j)	(110.756+81.928j)	(-0+0j)	(0.981+0.025j)	132	699.8	75	-46.1	688.6	-3.5	34.8	58.83	TRUE	110	39.03	36.5	35.42	18.2
Tower Type B1 – Double	No bundling – 1 conductor	AAC 9.0 mm diameter	(0.305+0.425j)	2.583838690689272 7e-06j	(0.981+0.013j)	(55.379+77.92j)	(-0+0j)	(0.981+0.013j)	132	699.8	105	-30.2	689.2	-4.4	35.1	29.43	TRUE	110	78.17	54.6	62.02	27.3
Tower Type B1	No bundling – 1 conductor	AAC 21.0 mm diameter	(0.112+0.372j)	2.954093861857435 7e-06j	(0.981+0.006j)	(20.343+67.975j)	(-0+0.001j)	(0.981+0.006j)	132	699.8	124.5	-22.1	690.3	-5.6	35.3	10.82	TRUE	299	168.95	73.3	123.12	36.7
Tower Type A1	Bundling spacer – 2 conductor, 24 cm	AAC 9.0 mm diameter	(0.305+0.287j)	3.830619442439883e-06j	(0.981+0.02j)	(55.378+52.759j)	(-0+0.001j)	(0.981+0.02j)	132	699.8	97.1	-20.7	691.9	-6.5	35.5	29.51	TRUE	110	78.32	43.6	66.33	21.8
Tower Type A2	No bundling – 1 conductor	AAC 21.0 mm diameter	(0.112+0.379j)	2.896398528440134 5e-06j	(0.981+0.005j)	(20.343+69.328j)	(-0+0.001j)	(0.981+0.005j)	132	699.8	124.8	-22.5	690.2	-5.5	35.5	10.82	TRUE	299	167.33	73.6	121.83	36.8
Tower Type C	No bundling – 1 conductor	AAC 21.0 mm diameter	(0.112+0.375j)	2.926068337133677e-06j	(0.981+0.006j)	(20.343+68.625j)	(-0+0.001j)	(0.981+0.006j)	132	699.8	124.6	-22.3	690.2	-5.6	35.5	10.82	TRUE	299	168.17	73.5	122.5	36.7
Tower Type A1	Bundling spacer – 2 conductor, 32 cm	AAC 9.0 mm diameter	(0.305+0.277j)	3.955391288305364e-06j	(0.981+0.02j)	(55.378+51.118j)	(-0+0.001j)	(0.981+0.02j)	132	699.8	96.6	-20	692.2	-6.7	36	29.52	TRUE	110	78.19	42.7	66.57	21.4
Tower Type B2	No bundling – 1 conductor	AAC 16.3 mm diameter	(0.186+0.406j)	2.706449498016587 3e-06j	(0.981+0.008j)	(33.766+74.25j)	(-0+0j)	(0.981+0.008j)	132	699.8	117.5	-25.6	689.6	-4.9	36.1	17.95	TRUE	216	120.07	65.5	89.81	32.8
Tower Type A1	No bundling – 1 conductor	AAC 31.5 mm diameter	(0.05+0.341j)	3.222490296750950 6e-06j	(0.981+0.003j)	(9.041+62.287j)	(-0+0.001j)	(0.981+0.003j)	132	699.8	130.6	-19.3	691.1	-6.3	37	4.81	TRUE	495	234.96	81.7	168.18	40.9
Tower Type B1	No bundling – 1 conductor	AAC 26.3 mm diameter	(0.071+0.357j)	3.070976046612209 6e-06j	(0.981+0.004j)	(12.97+65.367j)	(-0+0.001j)	(0.981+0.004j)	132	699.8	128.7	-20.6	690.7	-5.9	37.1	6.9	TRUE	405	206.54	78.8	148.64	39.4
Tower Type B2 – Double	No bundling – 1 conductor	AAC 9.0 mm diameter	(0.305+0.443j)	2.478370903710881 6e-06j	(0.981+0.013j)	(55.379+81.215j)	(-0+0j)	(0.981+0.013j)	132	699.8	106.2	-31.3	689	-4.2	37.1	29.42	TRUE	110	77.97	55.7	61.44	27.9
Tower Type A2	No bundling – 1 conductor	AAC 26.3 mm diameter	(0.071+0.365j)	3.008672970122985e-06j	(0.981+0.004j)	(12.97+66.72j)	(-0+0.001j)	(0.981+0.004j)	132	699.8	129	-21	690.5	-5.8	37.3	6.9	TRUE	405	203.85	79	146.62	39.5

Tower Type C	No bundling – 1 conductor	AAC 26.3 mm diameter	(0.071+0.361j)	3.0407002874460686e-06j	(0.981+0.004j)	(12.97+66.018j)	(-0+0.001j)	(0.981+0.004j)	132	699.8	128.9	-20.8	690.6	-5.9	37.3	6.9	TRUE	405	205.24	78.9	147.66	39.4
Tower Type B2	No bundling – 1 conductor	AAC 21.0 mm diameter	(0.112+0.39j)	2.8170357383876282e-06j	(0.981+0.005j)	(20.343+71.279j)	(-0+0.001j)	(0.981+0.005j)	132	699.8	125.4	-23.1	690	-5.3	37.4	10.82	TRUE	299	165.06	74.1	120.02	37
Tower Type B1 – Double	No bundling – 1 conductor	AAC 16.3 mm diameter	(0.093+0.387j)	2.8327168972285187e-06j	(0.981+0.004j)	(16.883+70.873j)	(-0+0.001j)	(0.981+0.004j)	132	699.8	127.5	-22.6	690.1	-5.4	37.8	8.98	TRUE	216	179.33	76.6	129.6	38.3
Tower Type B1	Bundling spacer – 2 conductor, 24 cm	AAC 9.0 mm diameter	(0.305+0.292j)	3.7588928284601294e-06j	(0.981+0.019j)	(55.378+53.752j)	(-0+0.001j)	(0.981+0.019j)	132	699.8	97.3	-21.1	691.7	-6.4	37.9	29.51	TRUE	110	78.38	44.1	66.18	22.1
Tower Type A1	Bundling spacer – 2 conductor, 24 cm	AAC 16.3 mm diameter	(0.093+0.268j)	4.097473272576863e-06j	(0.981+0.006j)	(16.883+49.016j)	(-0+0.001j)	(0.981+0.006j)	132	699.8	122.4	-15.9	693.5	-7.8	38.1	9.01	TRUE	216	217.53	71	159.61	35.5
Tower Type A2	Bundling spacer – 2 conductor, 24 cm	AAC 9.0 mm diameter	(0.305+0.299j)	3.6659732326133328e-06j	(0.981+0.019j)	(55.378+55.096j)	(-0+0.001j)	(0.981+0.019j)	132	699.8	97.7	-21.7	691.5	-6.3	38.1	29.5	TRUE	110	78.46	44.9	65.97	22.4
Tower Type C	Bundling spacer – 2 conductor, 24 cm	AAC 9.0 mm diameter	(0.305+0.296j)	3.7136339245681814e-06j	(0.981+0.019j)	(55.378+54.398j)	(-0+0.001j)	(0.981+0.019j)	132	699.8	97.5	-21.4	691.6	-6.3	38.1	29.5	TRUE	110	78.42	44.5	66.08	22.2
Tower Type B1	Bundling spacer – 2 conductor, 32 cm	AAC 9.0 mm diameter	(0.305+0.283j)	3.8789625972197783e-06j	(0.981+0.02j)	(55.378+52.11j)	(-0+0.001j)	(0.981+0.02j)	132	699.8	96.9	-20.4	692	-6.6	38.4	29.52	TRUE	110	78.27	43.3	66.43	21.6
Tower Type A2	Bundling spacer – 2 conductor, 32 cm	AAC 9.0 mm diameter	(0.305+0.29j)	3.7800900291628843e-06j	(0.981+0.019j)	(55.378+53.454j)	(-0+0.001j)	(0.981+0.019j)	132	699.8	97.3	-21	691.8	-6.4	38.6	29.51	TRUE	110	78.36	44	66.23	22
Tower Type C	Bundling spacer – 2 conductor, 32 cm	AAC 9.0 mm diameter	(0.305+0.286j)	3.8307846459778888e-06j	(0.981+0.02j)	(55.378+52.756j)	(-0+0.001j)	(0.981+0.02j)	132	699.8	97.1	-20.7	691.9	-6.5	38.6	29.51	TRUE	110	78.32	43.6	66.33	21.8
Tower Type A1	Bundling spacer – 2 conductor, 32 cm	AAC 16.3 mm diameter	(0.093+0.259j)	4.2405593622731198e-06j	(0.981+0.007j)	(16.883+47.365j)	(-0+0.001j)	(0.981+0.007j)	132	699.8	122.1	-15.3	694	-8.1	38.7	9.01	TRUE	216	220.95	70.4	162.38	35.2
Tower Type B2	No bundling – 1 conductor	AAC 26.3 mm diameter	(0.071+0.375j)	2.9231290351695497e-06j	(0.981+0.004j)	(12.97+68.672j)	(-0+0.001j)	(0.981+0.004j)	132	699.8	129.5	-21.6	690.3	-5.7	39.2	6.9	TRUE	405	200.11	79.3	143.82	39.7
Tower Type B1	No bundling – 1 conductor	AAC 31.5 mm diameter	(0.05+0.346j)	3.1715784957800177e-06j	(0.981+0.003j)	(9.041+63.286j)	(-0+0.001j)	(0.981+0.003j)	132	699.8	130.8	-19.6	691	-6.2	39.4	4.81	TRUE	495	232.26	81.9	166.2	40.9
Tower Type A2	No bundling – 1 conductor	AAC 31.5 mm diameter	(0.05+0.353j)	3.1051707063079695e-06j	(0.981+0.003j)	(9.041+64.639j)	(-0+0.001j)	(0.981+0.003j)	132	699.8	131.2	-20	690.8	-6.1	39.5	4.81	TRUE	495	228.73	82	163.61	41
Tower Type C	No bundling – 1 conductor	AAC 31.5 mm diameter	(0.05+0.35j)	3.1392970575697788e-06j	(0.981+0.003j)	(9.041+63.937j)	(-0+0.001j)	(0.981+0.003j)	132	699.8	131	-19.8	690.9	-6.1	39.5	4.81	TRUE	495	230.55	82	164.95	41
Tower Type B2 – Double	No bundling – 1 conductor	AAC 16.3 mm diameter	(0.093+0.406j)	2.7064494980165873e-06j	(0.981+0.004j)	(16.883+74.177j)	(-0+0j)	(0.981+0.004j)	132	699.8	128.5	-23.6	689.8	-5.2	39.8	8.98	TRUE	216	174.74	77.2	126.08	38.6
Tower Type B2	Bundling spacer – 2 conductor, 24 cm	AAC 9.0 mm diameter	(0.305+0.31j)	3.5397531334770054e-06j	(0.981+0.018j)	(55.378+57.036j)	(-0+0.001j)	(0.981+0.018j)	132	699.8	98.2	-22.5	691.2	-6	39.9	29.49	TRUE	110	78.54	45.8	65.66	22.9
Tower Type B1 – Double	No bundling – 1 conductor	AAC 21.0 mm diameter	(0.056+0.372j)	2.9540938618574357e-06j	(0.981+0.003j)	(10.172+67.946j)	(-0+0.001j)	(0.981+0.003j)	132	699.8	131.2	-21.1	690.4	-5.8	40.3	5.41	TRUE	299	215	81.5	153.9	40.7
Tower Type B2	Bundling spacer – 2 conductor, 32 cm	AAC 9.0 mm diameter	(0.305+0.301j)	3.6460331785745553e-06j	(0.981+0.019j)	(55.378+55.393j)	(-0+0.001j)	(0.981+0.019j)	132	699.8	97.8	-21.8	691.4	-6.2	40.4	29.5	TRUE	110	78.47	45	65.92	22.5
Tower Type B1	Bundling spacer – 2 conductor, 24 cm	AAC 16.3 mm diameter	(0.093+0.273j)	4.0155120477312335e-06j	(0.981+0.006j)	(16.883+50.015j)	(-0+0.001j)	(0.981+0.006j)	132	699.8	122.6	-16.2	693.3	-7.7	40.5	9.01	TRUE	216	215.49	71.3	157.97	35.7
Tower Type A1	Bundling spacer – 3 conductor, 23 cm	AAC 9.0 mm diameter	(0.203+0.244j)	4.4974076051348836e-06j	(0.981+0.015j)	(36.919+44.816j)	(-0+0.001j)	(0.981+0.015j)	132	699.8	107.8	-15.8	694.3	-8.1	40.6	19.72	TRUE	110	117.8	50.5	94.37	25.3
Tower Type A1	Bundling spacer – 2 conductor, 24 cm	AAC 21.0 mm diameter	(0.056+0.26j)	4.2229642040818824e-06j	(0.981+0.004j)	(10.172+47.538j)	(-0+0.001j)	(0.981+0.004j)	132	699.8	126.7	-15	694.1	-8.2	40.7	5.43	TRUE	299	274.99	77.9	198.45	39
Tower Type A2	Bundling spacer – 2 conductor, 24 cm	AAC 16.3 mm diameter	(0.093+0.281j)	3.9096508064373302e-06j	(0.981+0.006j)	(16.883+51.367j)	(-0+0.001j)	(0.981+0.006j)	132	699.8	122.9	-16.6	692.9	-7.5	40.7	9	TRUE	216	212.77	71.8	155.78	35.9
Tower Type C	Bundling spacer – 2 conductor, 24 cm	AAC 16.3 mm diameter	(0.093+0.277j)	3.9639049820180061e-06j	(0.981+0.006j)	(16.883+50.665j)	(-0+0.001j)	(0.981+0.006j)	132	699.8	122.7	-16.4	693.1	-7.6	40.7	9.01	TRUE	216	214.18	71.6	156.91	35.8
Tower Type B1	Bundling spacer – 2 conductor, 32 cm	AAC 16.3 mm diameter	(0.093+0.264j)	4.1528352016030125e-06j	(0.981+0.006j)	(16.883+48.363j)	(-0+0.001j)	(0.981+0.006j)	132	699.8	122.3	-15.7	693.7	-7.9	41.1	9.01	TRUE	216	218.88	70.8	160.7	35.4
Tower Type A1	Bundling spacer – 2 conductor, 32 cm	AAC 21.0 mm diameter	(0.056+0.251j)	4.3751116547266636e-06j	(0.981+0.004j)	(10.172+45.885j)	(-0+0.001j)	(0.981+0.004j)	132	699.8	126.4	-14.5	694.6	-8.5	41.2	5.43	TRUE	299	281.49	77.5	203.32	38.8
Tower Type A2	Bundling spacer – 2 conductor, 32 cm	AAC 16.3 mm diameter	(0.093+0.272j)	4.0397116217905552e-06j	(0.981+0.006j)	(16.883+49.716j)	(-0+0.001j)	(0.981+0.006j)	132	699.8	122.5	-16.1	693.3	-7.7	41.3	9.01	TRUE	216	216.1	71.2	158.46	35.6

Tower Type C	Bundling spacer – 2 conductor, 32 cm	AAC 16.3 mm diameter	(0.093+0.268j)	4.097662295680 7475e-06j	(0.981+0.006j)	(16.883+49.014j)	(-0+0.001j)	(0.981+0.006j)	132	699.8	122.4	-15.9	693.5	-7.8	41.3	9.01	TRUE	216	217.54	71	159.62	35.5
Tower Type B2	No bundling – 1 conductor	AAC 31.5 mm diameter	(0.05+0.364j)	3.014134457367 6314e-06j	(0.981+0.003j)	(9.041+66.591j)	(-0+0.001j)	(0.981+0.003j)	132	699.8	131.6	-20.6	690.6	-5.9	41.4	4.81	TRUE	495	223.86	82.3	160.04	41.1
Tower Type A1	Bundling spacer – 3 conductor, 33 cm	AAC 9.0 mm diameter	(0.203+0.229j)	4.794515586144 e-06j	(0.981+0.016j)	(36.919+42.063j)	(-0+0.001j)	(0.981+0.016j)	132	699.8	107.2	-14.7	695.3	-8.6	41.7	19.74	TRUE	110	117.37	48.7	94.84	24.4
Tower Type B2 – Double	No bundling – 1 conductor	AAC 21.0 mm diameter	(0.056+0.39j)	2.817035738387 6282e-06j	(0.981+0.003j)	(10.172+71.251j)	(-0+0.001j)	(0.981+0.003j)	132	699.8	132.1	-22	690.1	-5.5	42.3	5.41	TRUE	299	207.96	81.9	148.72	40.9
Tower Type B2	Bundling spacer – 2 conductor, 24 cm	AAC 16.3 mm diameter	(0.093+0.291j)	3.766421101720 2773e-06j	(0.981+0.006j)	(16.883+53.318j)	(-0+0.001j)	(0.981+0.006j)	132	699.8	123.3	-17.2	692.5	-7.2	42.5	9	TRUE	216	208.93	72.4	152.71	36.2
Tower Type B1 – Double	Bundling spacer – 2 conductor, 24 cm	AAC 9.0 mm diameter	(0.152+0.292j)	3.758892828460 1294e-06j	(0.981+0.01j)	(27.689+53.481j)	(-0+0.001j)	(0.981+0.01j)	132	699.8	116	-18.2	692.3	-7	42.6	14.76	TRUE	110	151.5	62.6	114.47	31.3
Tower Type B1	Bundling spacer – 3 conductor, 23 cm	AAC 9.0 mm diameter	(0.203+0.249j)	4.398858292644 2925e-06j	(0.981+0.015j)	(36.919+45.811j)	(-0+0.001j)	(0.981+0.015j)	132	699.8	108	-16.2	694	-7.9	43	19.71	TRUE	110	117.89	51.1	94.17	25.6
Tower Type B1	Bundling spacer – 2 conductor, 24 cm	AAC 21.0 mm diameter	(0.056+0.265j)	4.135959044669 734e-06j	(0.981+0.004j)	(10.172+48.537j)	(-0+0.001j)	(0.981+0.004j)	132	699.8	126.9	-15.3	693.8	-8	43.1	5.43	TRUE	299	271.21	78.2	195.61	39.1
Tower Type B2	Bundling spacer – 2 conductor, 32 cm	AAC 16.3 mm diameter	(0.093+0.282j)	3.886980013919 2675e-06j	(0.981+0.006j)	(16.883+51.666j)	(-0+0.001j)	(0.981+0.006j)	132	699.8	122.9	-16.7	692.9	-7.4	43.1	9	TRUE	216	212.17	71.9	155.31	36
Tower Type A2	Bundling spacer – 3 conductor, 23 cm	AAC 9.0 mm diameter	(0.203+0.257j)	4.272138805808 9785e-06j	(0.981+0.015j)	(36.919+47.159j)	(-0+0.001j)	(0.981+0.015j)	132	699.8	108.3	-16.7	693.6	-7.7	43.2	19.7	TRUE	110	117.96	51.9	93.86	26
Tower Type A2	Bundling spacer – 2 conductor, 24 cm	AAC 21.0 mm diameter	(0.056+0.273j)	4.023740590288 976e-06j	(0.981+0.004j)	(10.172+49.89j)	(-0+0.001j)	(0.981+0.004j)	132	699.8	127.2	-15.7	693.4	-7.8	43.2	5.43	TRUE	299	266.25	78.5	191.91	39.2
Tower Type B1 – Double	Bundling spacer – 2 conductor, 32 cm	AAC 9.0 mm diameter	(0.152+0.283j)	3.878962597219 783e-06j	(0.981+0.01j)	(27.689+51.831j)	(-0+0.001j)	(0.981+0.01j)	132	699.8	115.6	-17.6	692.6	-7.2	43.2	14.76	TRUE	110	152.5	61.9	115.55	30.9
Tower Type C	Bundling spacer – 3 conductor, 23 cm	AAC 9.0 mm diameter	(0.203+0.253j)	4.337003305287 532e-06j	(0.981+0.015j)	(36.919+46.459j)	(-0+0.001j)	(0.981+0.015j)	132	699.8	108.1	-16.4	693.8	-7.8	43.2	19.71	TRUE	110	117.93	51.5	94.03	25.8
Tower Type C	Bundling spacer – 2 conductor, 24 cm	AAC 21.0 mm diameter	(0.056+0.269j)	4.081230692578 939e-06j	(0.981+0.004j)	(10.172+49.188j)	(-0+0.001j)	(0.981+0.004j)	132	699.8	127	-15.5	693.6	-7.9	43.2	5.43	TRUE	299	268.8	78.3	193.81	39.2
Tower Type B1	Bundling spacer – 2 conductor, 32 cm	AAC 21.0 mm diameter	(0.056+0.256j)	4.281793480174 3536e-06j	(0.981+0.004j)	(10.172+46.885j)	(-0+0.001j)	(0.981+0.004j)	132	699.8	126.6	-14.8	694.3	-8.3	43.6	5.43	TRUE	299	277.53	77.8	200.35	38.9
Tower Type A2	Bundling spacer – 2 conductor, 32 cm	AAC 21.0 mm diameter	(0.056+0.264j)	4.161636786518 278e-06j	(0.981+0.004j)	(10.172+48.238j)	(-0+0.001j)	(0.981+0.004j)	132	699.8	126.9	-15.2	693.9	-8.1	43.8	5.43	TRUE	299	272.33	78.1	196.45	39
Tower Type C	Bundling spacer – 2 conductor, 32 cm	AAC 21.0 mm diameter	(0.056+0.26j)	4.223164982970 1965e-06j	(0.981+0.004j)	(10.172+47.535j)	(-0+0.001j)	(0.981+0.004j)	132	699.8	126.7	-15	694.1	-8.2	43.8	5.43	TRUE	299	275	77.9	198.46	39
Tower Type B1 – Double	No bundling – 1 conductor	AAC 26.3 mm diameter	(0.036+0.357j)	3.070976046612 2096e-06j	(0.981+0.002j)	(6.485+65.355j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	133	-20	690.8	-6.1	43.9	3.45	TRUE	405	240.77	84.3	171.57	42.2
Tower Type B1	Bundling spacer – 3 conductor, 33 cm	AAC 9.0 mm diameter	(0.203+0.234j)	4.682677340496 768e-06j	(0.981+0.016j)	(36.919+43.058j)	(-0+0.001j)	(0.981+0.016j)	132	699.8	107.4	-15.1	694.9	-8.4	44.1	19.73	TRUE	110	117.56	49.4	94.69	24.7
Tower Type A1	Bundling spacer – 2 conductor, 24 cm	AAC 26.3 mm diameter	(0.036+0.253j)	4.341058981694 303e-06j	(0.981+0.003j)	(6.485+46.237j)	(-0+0.001j)	(0.981+0.003j)	132	699.8	129.1	-14.4	694.6	-8.5	44.3	3.46	TRUE	405	315.3	82	225.78	41
Tower Type A2	Bundling spacer – 3 conductor, 33 cm	AAC 9.0 mm diameter	(0.203+0.242j)	4.539344580389 231e-06j	(0.981+0.016j)	(36.919+44.405j)	(-0+0.001j)	(0.981+0.016j)	132	699.8	107.7	-15.6	694.5	-8.2	44.3	19.72	TRUE	110	117.75	50.3	94.45	25.1
Tower Type C	Bundling spacer – 3 conductor, 33 cm	AAC 9.0 mm diameter	(0.203+0.238j)	4.612646489574 854e-06j	(0.981+0.016j)	(36.919+43.706j)	(-0+0.001j)	(0.981+0.016j)	132	699.8	107.6	-15.4	694.7	-8.3	44.3	19.73	TRUE	110	117.66	49.8	94.58	24.9
Tower Type A1	Bundling spacer – 3 conductor, 23 cm	AAC 16.3 mm diameter	(0.062+0.232j)	4.738978162261 975e-06j	(0.981+0.005j)	(11.255+42.368j)	(-0+0.001j)	(0.981+0.005j)	132	699.8	125.1	-13.4	695.9	-9.2	44.6	6.02	TRUE	216	285	75.1	206.92	37.6
Tower Type B2 – Double	Bundling spacer – 2 conductor, 24 cm	AAC 9.0 mm diameter	(0.152+0.31j)	3.539753133477 0054e-06j	(0.981+0.009j)	(27.689+56.781j)	(-0+0.001j)	(0.981+0.009j)	132	699.8	116.7	-19.3	691.6	-6.6	44.6	14.75	TRUE	110	149.36	64	112.29	32
Tower Type A1	Bundling spacer – 2 conductor, 32 cm	AAC 26.3 mm diameter	(0.036+0.244j)	4.501997144985 102e-06j	(0.981+0.003j)	(6.485+44.584j)	(-0+0.001j)	(0.981+0.003j)	132	699.8	128.8	-13.9	695.2	-8.8	44.9	3.47	TRUE	405	324.29	81.7	232.34	40.9
Tower Type B2	Bundling spacer – 3 conductor, 23 cm	AAC 9.0 mm diameter	(0.203+0.268j)	4.101697355857 075e-06j	(0.981+0.014j)	(36.919+49.104j)	(-0+0.001j)	(0.981+0.014j)	132	699.8	108.7	-17.4	693.1	-7.4	45	19.69	TRUE	110	117.96	53.1	93.37	26.5

Tower Type B2	Bundling spacer – 2 conductor, 24 cm	AAC 21.0 mm diameter	(0.056+0.283j)	3.872191594001406e-06j	(0.981+0.004j)	(10.172+51.842j)	(-0+0.001j)	(0.981+0.004j)	13	2	699.8	127.6	-16.3	693	-7.5	45.1	5.42	TRUE	299	259.42	78.9	186.81	39.4
Tower Type B2 – Double	Bundling spacer – 2 conductor, 32 cm	AAC 9.0 mm diameter	(0.152+0.301j)	3.646033178574553e-06j	(0.981+0.009j)	(27.689+55.131j)	(-0+0.001j)	(0.981+0.009j)	13	2	699.8	116.3	-18.7	691.9	-6.8	45.2	14.75	TRUE	110	150.44	63.3	113.39	31.7
Tower Type B2	Bundling spacer – 2 conductor, 32 cm	AAC 21.0 mm diameter	(0.056+0.274j)	3.999731415782102e-06j	(0.981+0.004j)	(10.172+50.189j)	(-0+0.001j)	(0.981+0.004j)	13	2	699.8	127.2	-15.8	693.4	-7.8	45.6	5.43	TRUE	299	265.18	78.5	191.1	39.3
Tower Type A1	Bundling spacer – 4 conductor, 26 cm	AAC 9.0 mm diameter	(0.152+0.213j)	5.158664593667276e-06j	(0.981+0.013j)	(27.689+39.027j)	(-0+0.001j)	(0.981+0.013j)	13	2	699.8	113.1	-13.1	697	-9.5	45.7	14.83	TRUE	110	157.29	54.6	122.49	27.3
Tower Type A1	Bundling spacer – 3 conductor, 33 cm	AAC 16.3 mm diameter	(0.062+0.216j)	5.070035355472591e-06j	(0.981+0.005j)	(11.255+39.604j)	(-0+0.001j)	(0.981+0.005j)	13	2	699.8	124.6	-12.5	697.2	-9.8	45.7	6.03	TRUE	216	296.45	74.1	215.7	37.1
Tower Type B2 – Double	No bundling – 1 conductor	AAC 26.3 mm diameter	(0.036+0.375j)	2.923129035169 5497e-06j	(0.981+0.002j)	(6.485+68.66j)	(-0+0.001j)	(0.981+0.002j)	13	2	699.8	133.8	-20.9	690.4	-5.8	46	3.45	TRUE	405	231.76	84.6	165.05	42.3
Tower Type B2	Bundling spacer – 3 conductor, 33 cm	AAC 9.0 mm diameter	(0.203+0.252j)	4.347394433587209e-06j	(0.981+0.015j)	(36.919+46.349j)	(-0+0.001j)	(0.981+0.015j)	13	2	699.8	108.1	-16.4	693.8	-7.8	46.1	19.71	TRUE	110	117.93	51.5	94.05	25.7
Tower Type B1	Bundling spacer – 2 conductor, 24 cm	AAC 26.3 mm diameter	(0.036+0.258j)	4.249172540753887e-06j	(0.981+0.003j)	(6.485+47.236j)	(-0+0.001j)	(0.981+0.003j)	13	2	699.8	129.2	-14.7	694.3	-8.3	46.7	3.46	TRUE	405	310.12	82.2	221.99	41.1
Tower Type A2	Bundling spacer – 2 conductor, 24 cm	AAC 26.3 mm diameter	(0.036+0.266j)	4.130814401780984e-06j	(0.981+0.002j)	(6.485+48.589j)	(-0+0.001j)	(0.981+0.002j)	13	2	699.8	129.5	-15.1	693.9	-8.1	46.9	3.46	TRUE	405	303.4	82.4	217.08	41.2
Tower Type C	Bundling spacer – 2 conductor, 24 cm	AAC 26.3 mm diameter	(0.036+0.262j)	4.191427941951168e-06j	(0.981+0.003j)	(6.485+47.887j)	(-0+0.001j)	(0.981+0.003j)	13	2	699.8	129.3	-14.9	694.1	-8.2	46.9	3.46	TRUE	405	306.85	82.3	219.6	41.1
Tower Type B1	Bundling spacer – 3 conductor, 23 cm	AAC 16.3 mm diameter	(0.062+0.237j)	4.629686343379485e-06j	(0.981+0.005j)	(11.255+43.367j)	(-0+0.001j)	(0.981+0.005j)	13	2	699.8	125.3	-13.7	695.5	-9	47	6.02	TRUE	216	281.05	75.5	203.9	37.7
Tower Type A2	Bundling spacer – 3 conductor, 23 cm	AAC 16.3 mm diameter	(0.062+0.244j)	4.489530698635078e-06j	(0.981+0.005j)	(11.255+44.72j)	(-0+0.001j)	(0.981+0.005j)	13	2	699.8	125.5	-14.2	695	-8.7	47.2	6.01	TRUE	216	275.85	75.9	199.95	37.9
Tower Type C	Bundling spacer – 3 conductor, 23 cm	AAC 16.3 mm diameter	(0.062+0.241j)	4.561219929670155e-06j	(0.981+0.005j)	(11.255+44.018j)	(-0+0.001j)	(0.981+0.005j)	13	2	699.8	125.4	-13.9	695.3	-8.8	47.2	6.02	TRUE	216	278.52	75.7	201.98	37.8
Tower Type B1	Bundling spacer – 2 conductor, 32 cm	AAC 26.3 mm diameter	(0.036+0.249j)	4.403248801698 3794e-06j	(0.981+0.003j)	(6.485+45.584j)	(-0+0.001j)	(0.981+0.003j)	13	2	699.8	128.9	-14.2	694.8	-8.6	47.3	3.46	TRUE	405	318.79	81.9	228.32	41
Tower Type A2	Bundling spacer – 2 conductor, 32 cm	AAC 26.3 mm diameter	(0.036+0.257j)	4.276279881386 31e-06j	(0.981+0.003j)	(6.485+46.937j)	(-0+0.001j)	(0.981+0.003j)	13	2	699.8	129.2	-14.6	694.4	-8.4	47.4	3.46	TRUE	405	311.65	82.1	223.11	41.1
Tower Type C	Bundling spacer – 2 conductor, 32 cm	AAC 26.3 mm diameter	(0.036+0.253j)	4.341271147404662e-06j	(0.981+0.003j)	(6.485+46.235j)	(-0+0.001j)	(0.981+0.003j)	13	2	699.8	129.1	-14.4	694.6	-8.5	47.4	3.46	TRUE	405	315.31	82	225.78	41
Tower Type B1 – Double	Bundling spacer – 2 conductor, 24 cm	AAC 16.3 mm diameter	(0.046+0.273j)	4.015512047731 2335e-06j	(0.981+0.003j)	(8.442+49.988j)	(-0+0.001j)	(0.981+0.003j)	13	2	699.8	128.4	-15.6	693.5	-7.9	47.9	4.5	TRUE	216	280.15	80.4	201.16	40.2
Tower Type B1	Bundling spacer – 4 conductor, 26 cm	AAC 9.0 mm diameter	(0.152+0.218j)	5.029421686258565e-06j	(0.981+0.013j)	(27.689+40.024j)	(-0+0.001j)	(0.981+0.013j)	13	2	699.8	113.3	-13.4	696.5	-9.3	48.1	14.82	TRUE	110	157.22	55.3	122.1	27.7
Tower Type B1	Bundling spacer – 3 conductor, 33 cm	AAC 16.3 mm diameter	(0.062+0.222j)	4.945141495600 5e-06j	(0.981+0.005j)	(11.255+40.603j)	(-0+0.001j)	(0.981+0.005j)	13	2	699.8	124.8	-12.8	696.7	-9.6	48.1	6.02	TRUE	216	292.22	74.5	212.45	37.3
Tower Type A2	Bundling spacer – 4 conductor, 26 cm	AAC 9.0 mm diameter	(0.152+0.226j)	4.864449831231781e-06j	(0.981+0.012j)	(27.689+41.373j)	(-0+0.001j)	(0.981+0.012j)	13	2	699.8	113.5	-13.9	695.9	-9	48.3	14.81	TRUE	110	157.01	56.2	121.52	28.1
Tower Type A2	Bundling spacer – 3 conductor, 33 cm	AAC 16.3 mm diameter	(0.062+0.229j)	4.785564609711747e-06j	(0.981+0.005j)	(11.255+41.956j)	(-0+0.001j)	(0.981+0.005j)	13	2	699.8	125	-13.3	696.1	-9.3	48.3	6.02	TRUE	216	286.66	75	208.19	37.5
Tower Type C	Bundling spacer – 4 conductor, 26 cm	AAC 9.0 mm diameter	(0.152+0.222j)	4.948724877966 18e-06j	(0.981+0.013j)	(27.689+40.673j)	(-0+0.001j)	(0.981+0.013j)	13	2	699.8	113.4	-13.7	696.2	-9.1	48.3	14.82	TRUE	110	157.13	55.8	121.83	27.9
Tower Type C	Bundling spacer – 3 conductor, 33 cm	AAC 16.3 mm diameter	(0.062+0.225j)	4.867105587550069e-06j	(0.981+0.005j)	(11.255+41.254j)	(-0+0.001j)	(0.981+0.005j)	13	2	699.8	124.9	-13	696.4	-9.4	48.3	6.02	TRUE	216	289.53	74.7	210.39	37.4
Tower Type A1	Bundling spacer – 3 conductor, 23 cm	AAC 21.0 mm diameter	(0.037+0.226j)	4.850106164457482e-06j	(0.981+0.003j)	(6.781+41.386j)	(-0+0.001j)	(0.981+0.003j)	13	2	699.8	128	-12.9	696.5	-9.5	48.4	3.63	TRUE	299	339.79	80.7	243.93	40.3
Tower Type B1 – Double	No bundling – 1 conductor	AAC 31.5 mm diameter	(0.025+0.346j)	3.171578495780 0177e-06j	(0.981+0.001j)	(4.521+63.28j)	(-0+0.001j)	(0.981+0.001j)	13	2	699.8	133.9	-19.2	691	-6.3	48.4	2.41	FALSE	495	258.4	85.9	183.72	43
Tower Type B1 – Double	Bundling spacer – 2 conductor, 32 cm	AAC 16.3 mm diameter	(0.046+0.264j)	4.152835201603 0125e-06j	(0.981+0.003j)	(8.442+48.336j)	(-0+0.001j)	(0.981+0.003j)	13	2	699.8	128.1	-15.1	693.9	-8.1	48.5	4.51	TRUE	216	287.03	80.1	206.24	40

Tower Type A1	Bundling spacer – 2 conductor, 24 cm	AAC 31.5 mm diameter	(0.025+0.247j)	4.440614520198643e-06j	(0.981+0.002j)	(4.521+45.197j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	130.2	-13.9	695	-8.8	48.7	2.42	FALSE	495	341.29	84.3	243.44	42.1
Tower Type B2	Bundling spacer – 2 conductor, 24 cm	AAC 26.3 mm diameter	(0.036+0.276j)	3.971252417961687e-06j	(0.981+0.002j)	(6.485+50.541j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	129.8	-15.7	693.4	-7.8	48.7	3.46	TRUE	405	294.24	82.7	210.4	41.3
Tower Type B2	Bundling spacer – 3 conductor, 23 cm	AAC 16.3 mm diameter	(0.062+0.255j)	4.301683115058902e-06j	(0.981+0.004j)	(11.255+46.671j)	(-0+0.001j)	(0.981+0.004j)	132	699.8	125.8	-14.8	694.4	-8.3	49	6.01	TRUE	216	268.65	76.4	194.48	38.2
Tower Type A1	Bundling spacer – 2 conductor, 32 cm	AAC 31.5 mm diameter	(0.025+0.238j)	4.609162371815347e-06j	(0.981+0.002j)	(4.521+43.545j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	130	-13.4	695.7	-9.1	49.3	2.42	FALSE	495	351.99	84.1	251.18	42
Tower Type B2	Bundling spacer – 2 conductor, 32 cm	AAC 26.3 mm diameter	(0.036+0.267j)	4.105514450056337 5e-06j	(0.981+0.002j)	(6.485+48.889j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	129.5	-15.2	693.8	-8.1	49.3	3.46	TRUE	405	301.95	82.4	216.03	41.2
Tower Type A1	Bundling spacer – 3 conductor, 33 cm	AAC 21.0 mm diameter	(0.037+0.211j)	5.197440831920063e-06j	(0.981+0.003j)	(6.781+38.621j)	(-0+0.001j)	(0.981+0.003j)	132	699.8	127.6	-12	697.9	-10.2	49.5	3.63	TRUE	299	357.76	80	257.16	40
Tower Type B2 – Double	Bundling spacer – 2 conductor, 24 cm	AAC 16.3 mm diameter	(0.046+0.291j)	3.766421101720277 3e-06j	(0.981+0.003j)	(8.442+53.293j)	(-0+0.001j)	(0.981+0.003j)	132	699.8	129	-16.6	692.7	-7.4	49.9	4.5	TRUE	216	267.39	81	191.76	40.5
Tower Type B2	Bundling spacer – 3 conductor, 33 cm	AAC 16.3 mm diameter	(0.062+0.24j)	4.572714666294702e-06j	(0.981+0.005j)	(11.255+43.907j)	(-0+0.001j)	(0.981+0.005j)	132	699.8	125.3	-13.9	695.3	-8.9	50.1	6.02	TRUE	216	278.95	75.6	202.31	37.8
Tower Type B1 – Double	Bundling spacer – 3 conductor, 23 cm	AAC 9.0 mm diameter	(0.102+0.249j)	4.398858292644292 5e-06j	(0.981+0.008j)	(18.46+45.67j)	(-0+0.001j)	(0.981+0.008j)	132	699.8	120.7	-14.9	694.5	-8.4	50.1	9.86	TRUE	110	212.58	68	157.31	34
Tower Type B2	Bundling spacer – 4 conductor, 26 cm	AAC 9.0 mm diameter	(0.152+0.236j)	4.644685940719138e-06j	(0.981+0.012j)	(27.689+43.32j)	(-0+0.001j)	(0.981+0.012j)	132	699.8	113.9	-14.6	695.1	-8.6	50.2	14.8	TRUE	110	156.52	57.4	120.58	28.7
Tower Type B2 – Double	No bundling – 1 conductor	AAC 31.5 mm diameter	(0.025+0.364j)	3.014134457367631 4e-06j	(0.981+0.001j)	(4.521+66.585j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	134.7	-20.2	690.6	-6	50.4	2.41	FALSE	495	247.92	86.1	176.19	43.1
Tower Type B2 – Double	Bundling spacer – 2 conductor, 32 cm	AAC 16.3 mm diameter	(0.046+0.282j)	3.886980013919267 5e-06j	(0.981+0.003j)	(8.442+51.64j)	(-0+0.001j)	(0.981+0.003j)	132	699.8	128.7	-16.1	693	-7.6	50.5	4.5	TRUE	216	273.61	80.7	196.34	40.4
Tower Type B1	Bundling spacer – 3 conductor, 23 cm	AAC 21.0 mm diameter	(0.037+0.232j)	4.735690385091749e-06j	(0.981+0.003j)	(6.781+42.385j)	(-0+0.001j)	(0.981+0.003j)	132	699.8	128.2	-13.2	696.1	-9.3	50.8	3.63	TRUE	299	333.74	80.9	239.48	40.5
Tower Type A1	Bundling spacer – 4 conductor, 26 cm	AAC 16.3 mm diameter	(0.046+0.203j)	5.395260950863109 5e-06j	(0.981+0.004j)	(8.442+37.21j)	(-0+0.001j)	(0.981+0.004j)	132	699.8	126.2	-11.6	698.7	-10.5	51	4.53	TRUE	216	344.33	77.2	248.87	38.6
Tower Type A2	Bundling spacer – 3 conductor, 23 cm	AAC 21.0 mm diameter	(0.037+0.239j)	4.589144668605896e-06j	(0.981+0.003j)	(6.781+43.738j)	(-0+0.001j)	(0.981+0.003j)	132	699.8	128.4	-13.6	695.5	-9	51	3.63	TRUE	299	325.9	81.2	233.73	40.6
Tower Type C	Bundling spacer – 3 conductor, 23 cm	AAC 21.0 mm diameter	(0.037+0.235j)	4.664077031277323e-06j	(0.981+0.003j)	(6.781+43.036j)	(-0+0.001j)	(0.981+0.003j)	132	699.8	128.3	-13.4	695.8	-9.1	51	3.63	TRUE	299	329.92	81	236.68	40.5
Tower Type B1	Bundling spacer – 2 conductor, 24 cm	AAC 31.5 mm diameter	(0.025+0.253j)	4.344511853575704e-06j	(0.981+0.002j)	(4.521+46.197j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	130.4	-14.2	694.7	-8.6	51.1	2.41	FALSE	495	335.15	84.4	239.01	42.2
Tower Type B1 – Double	Bundling spacer – 3 conductor, 33 cm	AAC 9.0 mm diameter	(0.102+0.234j)	4.682677340496768e-06j	(0.981+0.008j)	(18.46+42.908j)	(-0+0.001j)	(0.981+0.008j)	132	699.8	120.2	-13.9	695.5	-8.9	51.2	9.87	TRUE	110	217.41	66.7	161.45	33.4
Tower Type A2	Bundling spacer – 2 conductor, 24 cm	AAC 31.5 mm diameter	(0.025+0.26j)	4.220860170933272e-06j	(0.981+0.002j)	(4.521+47.55j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	130.6	-14.7	694.3	-8.3	51.3	2.41	FALSE	495	327.21	84.6	233.27	42.3
Tower Type C	Bundling spacer – 2 conductor, 24 cm	AAC 31.5 mm diameter	(0.025+0.256j)	4.284165336836702e-06j	(0.981+0.002j)	(4.521+46.848j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	130.5	-14.4	694.5	-8.5	51.3	2.41	FALSE	495	331.28	84.5	236.21	42.2
Tower Type B1	Bundling spacer – 2 conductor, 32 cm	AAC 31.5 mm diameter	(0.025+0.244j)	4.505710892106696e-06j	(0.981+0.002j)	(4.521+44.545j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	130.1	-13.7	695.3	-8.9	51.7	2.42	FALSE	495	345.43	84.2	246.44	42.1
Tower Type A2	Bundling spacer – 2 conductor, 32 cm	AAC 31.5 mm diameter	(0.025+0.251j)	4.372853320256 86e-06j	(0.981+0.002j)	(4.521+45.898j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	130.3	-14.2	694.8	-8.6	51.9	2.42	FALSE	495	336.96	84.4	240.32	42.2
Tower Type B1	Bundling spacer – 3 conductor, 33 cm	AAC 21.0 mm diameter	(0.037+0.217j)	5.066272358331339e-06j	(0.981+0.003j)	(6.781+39.621j)	(-0+0.001j)	(0.981+0.003j)	132	699.8	127.8	-12.3	697.4	-9.9	51.9	3.63	TRUE	299	351.04	80.3	252.21	40.1
Tower Type C	Bundling spacer – 2 conductor, 32 cm	AAC 31.5 mm diameter	(0.025+0.247j)	4.440836529136301e-06j	(0.981+0.002j)	(4.521+45.195j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	130.2	-13.9	695	-8.8	51.9	2.42	FALSE	495	341.3	84.3	243.45	42.1
Tower Type A2	Bundling spacer – 3 conductor, 33 cm	AAC 21.0 mm diameter	(0.037+0.224j)	4.898914364853833e-06j	(0.981+0.003j)	(6.781+40.974j)	(-0+0.001j)	(0.981+0.003j)	132	699.8	128	-12.8	696.7	-9.6	52.1	3.63	TRUE	299	342.35	80.6	245.81	40.3
Tower Type B2 – Double	Bundling spacer – 3 conductor, 23 cm	AAC 9.0 mm diameter	(0.102+0.268j)	4.101697355857075e-06j	(0.981+0.007j)	(18.46+48.973j)	(-0+0.001j)	(0.981+0.007j)	132	699.8	121.3	-16	693.5	-7.8	52.1	9.85	TRUE	110	206.78	69.3	152.44	34.7

Tower Type C	Bundling spacer – 3 conductor, 33 cm	AAC 21.0 mm diameter	(0.037+0.22j)	4.984398308843734e-06j	(0.981+0.003j)	(6.781+40.271j)	(-0+0.001j)	(0.981+0.003j)	132	699.8	127.9	-12.5	697.1	-9.8	52.1	3.63	TRUE	299	346.81	80.4	249.09	40.2
Tower Type B2	Bundling spacer – 3 conductor, 23 cm	AAC 21.0 mm diameter	(0.037+0.25j)	4.393050708387671e-06j	(0.981+0.003j)	(6.781+45.69j)	(-0+0.001j)	(0.981+0.003j)	132	699.8	128.8	-14.2	694.8	-8.6	52.8	3.62	TRUE	299	315.24	81.6	225.92	40.8
Tower Type B1 – Double	Bundling spacer – 2 conductor, 24 cm	AAC 21.0 mm diameter	(0.028+0.265j)	4.135959044669734e-06j	(0.981+0.002j)	(5.086+48.527j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	130.4	-15	693.9	-8.2	53	2.71	FALSE	299	316.5	84	225.84	42
Tower Type B2	Bundling spacer – 2 conductor, 24 cm	AAC 31.5 mm diameter	(0.025+0.271j)	4.054406084151 2455e-06j	(0.981+0.002j)	(4.521+49.502j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	131	-15.2	693.7	-8	53.1	2.41	FALSE	495	316.46	84.8	225.52	42.4
Tower Type B2 – Double	Bundling spacer – 3 conductor, 33 cm	AAC 9.0 mm diameter	(0.102+0.252j)	4.347394433587209e-06j	(0.981+0.007j)	(18.46+46.21j)	(-0+0.001j)	(0.981+0.007j)	132	699.8	120.8	-15	694.3	-8.3	53.2	9.86	TRUE	110	211.63	68.2	156.5	34.1
Tower Type B1	Bundling spacer – 4 conductor, 26 cm	AAC 16.3 mm diameter	(0.046+0.209j)	5.254053275215045e-06j	(0.981+0.004j)	(8.442+38.209j)	(-0+0.001j)	(0.981+0.004j)	132	699.8	126.4	-12	698.1	-10.2	53.4	4.52	TRUE	216	338.28	77.5	244.34	38.8
Tower Type B1 – Double	Bundling spacer – 2 conductor, 32 cm	AAC 21.0 mm diameter	(0.028+0.256j)	4.281793480174 3536e-06j	(0.981+0.002j)	(5.086+46.874j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	130.1	-14.5	694.4	-8.4	53.5	2.72	FALSE	299	325.57	83.8	232.4	41.9
Tower Type A2	Bundling spacer – 4 conductor, 26 cm	AAC 16.3 mm diameter	(0.046+0.216j)	5.074279261009 9525e-06j	(0.981+0.004j)	(8.442+39.562j)	(-0+0.001j)	(0.981+0.004j)	132	699.8	126.6	-12.4	697.4	-9.9	53.6	4.52	TRUE	216	330.41	78	238.45	39
Tower Type C	Bundling spacer – 4 conductor, 26 cm	AAC 16.3 mm diameter	(0.046+0.212j)	5.166050151517751e-06j	(0.981+0.004j)	(8.442+38.86j)	(-0+0.001j)	(0.981+0.004j)	132	699.8	126.5	-12.2	697.8	-10.1	53.6	4.52	TRUE	216	334.46	77.7	241.48	38.9
Tower Type B2	Bundling spacer – 2 conductor, 32 cm	AAC 31.5 mm diameter	(0.025+0.262j)	4.194448718848093e-06j	(0.981+0.002j)	(4.521+47.85j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	130.7	-14.7	694.2	-8.3	53.7	2.41	FALSE	495	325.51	84.6	232.05	42.3
Tower Type A1	Bundling spacer – 3 conductor, 23 cm	AAC 26.3 mm diameter	(0.024+0.222j)	4.953280217015424e-06j	(0.981+0.002j)	(4.323+40.52j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	129.6	-12.5	697	-9.8	53.9	2.31	FALSE	405	376.11	83.9	268.49	42
Tower Type B2	Bundling spacer – 3 conductor, 33 cm	AAC 21.0 mm diameter	(0.037+0.235j)	4.676096716900 5954e-06j	(0.981+0.003j)	(6.781+42.925j)	(-0+0.001j)	(0.981+0.003j)	132	699.8	128.3	-13.4	695.8	-9.2	53.9	3.63	TRUE	299	330.56	81	237.15	40.5
Tower Type A1	Bundling spacer – 3 conductor, 33 cm	AAC 26.3 mm diameter	(0.024+0.206j)	5.316102164005732e-06j	(0.981+0.002j)	(4.323+37.755j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	129.2	-11.7	698.6	-10.5	55	2.32	FALSE	405	398.81	83.5	284.93	41.7
Tower Type B2 – Double	Bundling spacer – 2 conductor, 24 cm	AAC 21.0 mm diameter	(0.028+0.283j)	3.872191594001406e-06j	(0.981+0.002j)	(5.086+51.832j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	131	-16	693.1	-7.6	55	2.71	FALSE	299	299.94	84.4	213.86	42.2
Tower Type B2	Bundling spacer – 4 conductor, 26 cm	AAC 16.3 mm diameter	(0.046+0.227j)	4.835612411215029e-06j	(0.981+0.004j)	(8.442+41.514j)	(-0+0.001j)	(0.981+0.004j)	132	699.8	126.9	-13	696.4	-9.4	55.5	4.52	TRUE	216	319.66	78.5	230.44	39.3
Tower Type B2 – Double	Bundling spacer – 2 conductor, 32 cm	AAC 21.0 mm diameter	(0.028+0.274j)	3.999731415782102e-06j	(0.981+0.002j)	(5.086+50.18j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	130.7	-15.5	693.5	-7.9	55.6	2.71	FALSE	299	307.97	84.2	219.67	42.1
Tower Type A1	Bundling spacer – 4 conductor, 26 cm	AAC 21.0 mm diameter	(0.028+0.199j)	5.502920994225 6775e-06j	(0.981+0.003j)	(5.086+36.474j)	(-0+0.001j)	(0.981+0.003j)	132	699.8	128.5	-11.3	699.4	-10.8	56.1	2.73	FALSE	299	398.63	82.1	285.5	41
Tower Type B1	Bundling spacer – 3 conductor, 23 cm	AAC 26.3 mm diameter	(0.024+0.227j)	4.834004690487 2875e-06j	(0.981+0.002j)	(4.323+41.519j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	129.8	-12.8	696.5	-9.5	56.2	2.31	FALSE	405	368.56	84.1	263.03	42
Tower Type A2	Bundling spacer – 3 conductor, 23 cm	AAC 26.3 mm diameter	(0.024+0.234j)	4.681409182544531e-06j	(0.981+0.002j)	(4.323+42.873j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	130	-13.2	695.9	-9.2	56.4	2.31	FALSE	405	358.84	84.2	256	42.1
Tower Type C	Bundling spacer – 3 conductor, 23 cm	AAC 26.3 mm diameter	(0.024+0.231j)	4.759410462059674e-06j	(0.981+0.002j)	(4.323+42.17j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	129.9	-13	696.3	-9.4	56.4	2.31	FALSE	405	363.81	84.1	259.6	42.1
Tower Type B1	Bundling spacer – 3 conductor, 33 cm	AAC 26.3 mm diameter	(0.024+0.212j)	5.178954999437324e-06j	(0.981+0.002j)	(4.323+38.754j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	129.3	-12	698	-10.2	57.4	2.32	FALSE	405	390.27	83.6	278.74	41.8
Tower Type A2	Bundling spacer – 3 conductor, 33 cm	AAC 26.3 mm diameter	(0.024+0.219j)	5.004197952510292e-06j	(0.981+0.002j)	(4.323+40.108j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	129.5	-12.4	697.2	-9.9	57.5	2.32	FALSE	405	379.32	83.8	270.81	41.9
Tower Type C	Bundling spacer – 3 conductor, 33 cm	AAC 26.3 mm diameter	(0.024+0.215j)	5.093429148383911e-06j	(0.981+0.002j)	(4.323+39.405j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	129.4	-12.2	697.6	-10	57.5	2.32	FALSE	405	384.92	83.7	274.87	41.9
Tower Type B1 – Double	Bundling spacer – 4 conductor, 26 cm	AAC 9.0 mm diameter	(0.076+0.218j)	5.029421686258565e-06j	(0.981+0.006j)	(13.845+39.934j)	(-0+0.001j)	(0.981+0.006j)	132	699.8	122.9	-12.7	697	-9.7	57.6	7.41	TRUE	110	266.75	70.9	195.64	35.4
Tower Type B1 – Double	Bundling spacer – 3 conductor, 23 cm	AAC 16.3 mm diameter	(0.031+0.237j)	4.629686343379485e-06j	(0.981+0.002j)	(5.628+43.353j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	129.2	-13.4	695.7	-9.1	58.1	3.01	FALSE	216	340.85	82.6	243.84	41.3
Tower Type B2	Bundling spacer – 3 conductor, 23 cm	AAC 26.3 mm diameter	(0.024+0.245j)	4.477526194262683e-06j	(0.981+0.002j)	(4.323+44.825j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	130.3	-13.8	695.2	-8.8	58.3	2.31	FALSE	405	345.75	84.5	246.54	42.2

Tower Type B1	Bundling spacer – 4 conductor, 26 cm	AAC 21.0 mm diameter	(0.028+0.205j)	5.356098298432733e-06j	(0.981+0.003j)	(5.086+37.474j)	(-0+0.001j)	(0.981+0.003j)	132	699.8	128.6	-11.6	698.7	-10.5	58.5	2.73	FALSE	299	390.13	82.3	279.3	41.1
Tower Type A2	Bundling spacer – 4 conductor, 26 cm	AAC 21.0 mm diameter	(0.028+0.212j)	5.169397346013 9205e-06j	(0.981+0.002j)	(5.086+38.827j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	128.8	-12	697.9	-10.2	58.7	2.73	FALSE	299	379.21	82.5	271.35	41.3
Tower Type C	Bundling spacer – 4 conductor, 26 cm	AAC 21.0 mm diameter	(0.028+0.208j)	5.264673299753775e-06j	(0.981+0.002j)	(5.086+38.125j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	128.7	-11.8	698.3	-10.3	58.7	2.73	FALSE	299	384.8	82.4	275.42	41.2
Tower Type B1 – Double	Bundling spacer – 3 conductor, 33 cm	AAC 16.3 mm diameter	(0.031+0.222j)	4.945141495600 5e-06j	(0.981+0.003j)	(5.628+40.589j)	(-0+0.001j)	(0.981+0.003j)	132	699.8	128.7	-12.6	696.9	-9.7	59.2	3.01	FALSE	216	359.1	82.1	257.14	41.1
Tower Type B2	Bundling spacer – 3 conductor, 33 cm	AAC 26.3 mm diameter	(0.024+0.23j)	4.771927191903771e-06j	(0.981+0.002j)	(4.323+42.06j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	129.9	-13	696.3	-9.4	59.4	2.31	FALSE	405	364.61	84.1	260.17	42.1
Tower Type B2 – Double	Bundling spacer – 4 conductor, 26 cm	AAC 9.0 mm diameter	(0.076+0.236j)	4.644685940719138e-06j	(0.981+0.006j)	(13.845+43.237j)	(-0+0.001j)	(0.981+0.006j)	132	699.8	123.4	-13.8	695.5	-8.9	59.7	7.4	TRUE	110	256.54	72.2	187.55	36.1
Tower Type B2 – Double	Bundling spacer – 3 conductor, 23 cm	AAC 16.3 mm diameter	(0.031+0.255j)	4.301683115058902e-06j	(0.981+0.002j)	(5.628+46.658j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	129.7	-14.4	694.5	-8.5	60.1	3.01	FALSE	216	321.46	83.1	229.74	41.6
Tower Type B1 – Double	Bundling spacer – 2 conductor, 24 cm	AAC 26.3 mm diameter	(0.018+0.258j)	4.249172540753887e-06j	(0.981+0.001j)	(3.243+47.232j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	131.5	-14.5	694.4	-8.4	60.3	1.73	FALSE	405	341.54	86.1	242.91	43
Tower Type A1	Bundling spacer – 3 conductor, 23 cm	AAC 31.5 mm diameter	(0.017+0.218j)	5.039219470421 16e-06j	(0.981+0.001j)	(3.014+39.827j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	130.4	-12.3	697.4	-10	60.5	1.61	FALSE	495	398.88	85.7	283.93	42.8
Tower Type B2	Bundling spacer – 4 conductor, 26 cm	AAC 21.0 mm diameter	(0.028+0.223j)	4.921917141501634e-06j	(0.981+0.002j)	(5.086+40.779j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	129.1	-12.6	696.9	-9.7	60.5	2.72	FALSE	299	364.53	82.9	260.67	41.4
Tower Type B1 – Double	Bundling spacer – 2 conductor, 32 cm	AAC 26.3 mm diameter	(0.018+0.249j)	4.403248801698 3794e-06j	(0.981+0.001j)	(3.243+45.58j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	131.2	-14	694.9	-8.7	60.8	1.73	FALSE	405	352.22	85.9	250.57	43
Tower Type B2 – Double	Bundling spacer – 3 conductor, 33 cm	AAC 16.3 mm diameter	(0.031+0.24j)	4.572714666294702e-06j	(0.981+0.002j)	(5.628+43.893j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	129.2	-13.6	695.5	-9	61.2	3.01	FALSE	216	337.51	82.7	241.41	41.3
Tower Type A1	Bundling spacer – 3 conductor, 33 cm	AAC 31.5 mm diameter	(0.017+0.203j)	5.415218376692445e-06j	(0.981+0.002j)	(3.014+37.062j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	130	-11.4	699.1	-10.7	61.6	1.62	FALSE	495	424.7	85.4	302.48	42.7
Tower Type B2 – Double	Bundling spacer – 2 conductor, 24 cm	AAC 26.3 mm diameter	(0.018+0.276j)	3.971252417961687e-06j	(0.981+0.001j)	(3.243+50.537j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	132.1	-15.5	693.4	-7.9	62.3	1.73	FALSE	405	322.18	86.3	229.03	43.2
Tower Type B1	Bundling spacer – 3 conductor, 23 cm	AAC 31.5 mm diameter	(0.017+0.223j)	4.915820740910 5975e-06j	(0.981+0.001j)	(3.014+40.827j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	130.6	-12.6	696.9	-9.7	62.9	1.61	FALSE	495	390.35	85.8	277.8	42.9
Tower Type B2 – Double	Bundling spacer – 2 conductor, 32 cm	AAC 26.3 mm diameter	(0.018+0.267j)	4.105514450056 3375e-06j	(0.981+0.001j)	(3.243+48.885j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	131.8	-15	693.9	-8.1	62.9	1.73	FALSE	405	331.55	86.2	235.75	43.1
Tower Type A2	Bundling spacer – 3 conductor, 23 cm	AAC 31.5 mm diameter	(0.017+0.231j)	4.758100396014 43e-06j	(0.981+0.001j)	(3.014+42.18j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	130.8	-13	696.3	-9.4	63.1	1.61	FALSE	495	379.4	85.9	269.94	43
Tower Type C	Bundling spacer – 3 conductor, 23 cm	AAC 31.5 mm diameter	(0.017+0.227j)	4.838700255411803e-06j	(0.981+0.001j)	(3.014+41.478j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	130.7	-12.8	696.6	-9.6	63.1	1.61	FALSE	495	385	85.8	273.96	42.9
Tower Type A1	Bundling spacer – 4 conductor, 26 cm	AAC 26.3 mm diameter	(0.018+0.196j)	5.602219103226575e-06j	(0.981+0.002j)	(3.243+35.825j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	129.7	-11	699.9	-11	63.4	1.74	FALSE	405	433.75	84.8	309.2	42.4
Tower Type B1	Bundling spacer – 3 conductor, 33 cm	AAC 31.5 mm diameter	(0.017+0.208j)	5.272977866755299e-06j	(0.981+0.001j)	(3.014+38.062j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	130.2	-11.7	698.4	-10.4	64	1.62	FALSE	495	414.96	85.5	295.48	42.7
Tower Type A2	Bundling spacer – 3 conductor, 33 cm	AAC 31.5 mm diameter	(0.017+0.216j)	5.091928776152022e-06j	(0.981+0.001j)	(3.014+39.415j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	130.4	-12.1	697.7	-10.1	64.2	1.61	FALSE	495	402.52	85.6	286.54	42.8
Tower Type C	Bundling spacer – 3 conductor, 33 cm	AAC 31.5 mm diameter	(0.017+0.212j)	5.184344991107786e-06j	(0.981+0.001j)	(3.014+38.713j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	130.3	-11.9	698	-10.2	64.2	1.62	FALSE	495	408.88	85.5	291.11	42.8
Tower Type B2	Bundling spacer – 3 conductor, 23 cm	AAC 31.5 mm diameter	(0.017+0.241j)	4.547632798356005e-06j	(0.981+0.001j)	(3.014+44.132j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	131.1	-13.6	695.5	-9	64.9	1.61	FALSE	495	364.72	86.1	259.41	43
Tower Type B1 – Double	Bundling spacer – 3 conductor, 23 cm	AAC 21.0 mm diameter	(0.019+0.232j)	4.735690385091749e-06j	(0.981+0.001j)	(3.391+42.38j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	130.6	-13	696.2	-9.4	65.7	1.81	FALSE	299	373.35	85.4	265.85	42.7
Tower Type B1	Bundling spacer – 4 conductor, 26 cm	AAC 26.3 mm diameter	(0.018+0.201j)	5.450123107753459e-06j	(0.981+0.002j)	(3.243+36.825j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	129.8	-11.4	699.2	-10.7	65.8	1.74	FALSE	405	423.57	85	301.87	42.5
Tower Type A2	Bundling spacer – 4 conductor, 26 cm	AAC 26.3 mm diameter	(0.018+0.209j)	5.256927873195806e-06j	(0.981+0.002j)	(3.243+38.178j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	130	-11.8	698.3	-10.4	66	1.74	FALSE	405	410.58	85.1	292.52	42.6

Tower Type B2	Bundling spacer – 3 conductor, 33 cm	AAC 31.5 mm diameter	(0.017+0.226j)	4.851638073011554e-06j	(0.981+0.001j)	(3.014+41.367j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	130.7	-12.7	696.7	-9.6	66	1.61	FALSE	495	385.9	85.8	274.61	42.9
Tower Type C	Bundling spacer – 4 conductor, 26 cm	AAC 26.3 mm diameter	(0.018+0.205j)	5.355488411203889e-06j	(0.981+0.002j)	(3.243+37.476j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	129.9	-11.6	698.8	-10.6	66	1.74	FALSE	405	417.22	85.1	297.3	42.5
Tower Type B1 – Double	Bundling spacer – 3 conductor, 33 cm	AAC 21.0 mm diameter	(0.019+0.217j)	5.066272358331339e-06j	(0.981+0.002j)	(3.391+39.615j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	130.1	-12.2	697.5	-10	66.8	1.82	FALSE	299	395.69	85.1	281.91	42.6
Tower Type B2 – Double	Bundling spacer – 3 conductor, 23 cm	AAC 21.0 mm diameter	(0.019+0.25j)	4.393050708387671e-06j	(0.981+0.001j)	(3.391+45.685j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	131.1	-14	694.9	-8.7	67.7	1.81	FALSE	299	349.97	85.8	249.04	42.9
Tower Type B2	Bundling spacer – 4 conductor, 26 cm	AAC 26.3 mm diameter	(0.018+0.219j)	5.001203122149354e-06j	(0.981+0.002j)	(3.243+40.13j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	130.3	-12.4	697.3	-9.9	67.8	1.74	FALSE	405	393.25	85.4	280.05	42.7
Tower Type B1 – Double	Bundling spacer – 4 conductor, 26 cm	AAC 16.3 mm diameter	(0.023+0.209j)	5.254053275215045e-06j	(0.981+0.002j)	(4.221+38.2j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	129.3	-11.8	698.3	-10.3	68.2	2.26	FALSE	216	396.41	83.7	283.1	41.8
Tower Type B2 – Double	Bundling spacer – 3 conductor, 33 cm	AAC 21.0 mm diameter	(0.019+0.235j)	4.676096716900 5954e-06j	(0.981+0.001j)	(3.391+42.92j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	130.6	-13.2	696	-9.2	68.8	1.81	FALSE	299	369.3	85.5	262.93	42.7
Tower Type B1 – Double	Bundling spacer – 2 conductor, 24 cm	AAC 31.5 mm diameter	(0.012+0.253j)	4.344511853575704e-06j	(0.981+0.001j)	(2.26+46.195j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	132	-14.1	694.8	-8.6	69.1	1.21	FALSE	495	358.23	87.2	254.35	43.6
Tower Type B1 – Double	Bundling spacer – 2 conductor, 32 cm	AAC 31.5 mm diameter	(0.012+0.244j)	4.505710892106696e-06j	(0.981+0.001j)	(2.26+44.542j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	131.7	-13.6	695.3	-8.9	69.7	1.21	FALSE	495	370.04	87.1	262.78	43.5
Tower Type B2 – Double	Bundling spacer – 4 conductor, 26 cm	AAC 16.3 mm diameter	(0.023+0.227j)	4.835612411215029e-06j	(0.981+0.002j)	(4.221+41.506j)	(-0+0.001j)	(0.981+0.002j)	132	699.8	129.8	-12.8	696.6	-9.5	70.3	2.26	FALSE	216	369.91	84.2	263.94	42.1
Tower Type B2 – Double	Bundling spacer – 2 conductor, 24 cm	AAC 31.5 mm diameter	(0.012+0.271j)	4.054406084151 2455e-06j	(0.981+0.001j)	(2.26+49.5j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	132.5	-15.1	693.7	-8.1	71.1	1.21	FALSE	495	336.92	87.4	239.13	43.7
Tower Type B2 – Double	Bundling spacer – 2 conductor, 32 cm	AAC 31.5 mm diameter	(0.012+0.262j)	4.194448718848093e-06j	(0.981+0.001j)	(2.26+47.848j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	132.3	-14.6	694.2	-8.3	71.7	1.21	FALSE	495	347.21	87.3	246.48	43.6
Tower Type A1	Bundling spacer – 4 conductor, 26 cm	AAC 31.5 mm diameter	(0.012+0.193j)	5.684451956469492e-06j	(0.981+0.001j)	(2.26+35.306j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	130.3	-10.9	700.3	-11.2	72.2	1.21	FALSE	495	455.52	86.3	323.93	43.2
Tower Type B1	Bundling spacer – 4 conductor, 26 cm	AAC 31.5 mm diameter	(0.012+0.199j)	5.527920450937468e-06j	(0.981+0.001j)	(2.26+36.306j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	130.4	-11.2	699.6	-10.9	74.6	1.21	FALSE	495	444.27	86.4	315.88	43.2
Tower Type A2	Bundling spacer – 4 conductor, 26 cm	AAC 31.5 mm diameter	(0.012+0.206j)	5.329270867716 66e-06j	(0.981+0.001j)	(2.26+37.659j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	130.6	-11.6	698.7	-10.5	74.8	1.21	FALSE	495	429.95	86.6	305.62	43.3
Tower Type C	Bundling spacer – 4 conductor, 26 cm	AAC 31.5 mm diameter	(0.012+0.202j)	5.430588885394342e-06j	(0.981+0.001j)	(2.26+36.957j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	130.5	-11.4	699.2	-10.7	74.8	1.21	FALSE	495	437.26	86.5	310.86	43.2
Tower Type B1 – Double	Bundling spacer – 3 conductor, 23 cm	AAC 26.3 mm diameter	(0.012+0.227j)	4.834004690487 2875e-06j	(0.981+0.001j)	(2.162+41.517j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	131.3	-12.7	696.6	-9.6	76.6	1.16	FALSE	405	395.24	87	280.73	43.5
Tower Type B2	Bundling spacer – 4 conductor, 26 cm	AAC 31.5 mm diameter	(0.012+0.217j)	5.066635213222634e-06j	(0.981+0.001j)	(2.26+39.611j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	130.9	-12.2	697.6	-10	76.7	1.21	FALSE	495	410.93	86.7	292.01	43.4
Tower Type B1 – Double	Bundling spacer – 3 conductor, 33 cm	AAC 26.3 mm diameter	(0.012+0.212j)	5.178954999437324e-06j	(0.981+0.001j)	(2.162+38.752j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	130.9	-11.9	698.1	-10.3	77.7	1.16	FALSE	405	420.46	86.8	298.76	43.4
Tower Type B1 – Double	Bundling spacer – 4 conductor, 26 cm	AAC 21.0 mm diameter	(0.014+0.205j)	5.356098298432733e-06j	(0.981+0.001j)	(2.543+37.471j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	130.4	-11.5	698.8	-10.6	78.4	1.36	FALSE	299	427.67	86.1	304.22	43.1
Tower Type B2 – Double	Bundling spacer – 3 conductor, 23 cm	AAC 26.3 mm diameter	(0.012+0.245j)	4.477526194262683e-06j	(0.981+0.001j)	(2.162+44.823j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	131.8	-13.7	695.2	-8.9	78.6	1.16	FALSE	405	369.05	87.2	262.02	43.6
Tower Type B2 – Double	Bundling spacer – 3 conductor, 33 cm	AAC 26.3 mm diameter	(0.012+0.23j)	4.771927191903771e-06j	(0.981+0.001j)	(2.162+42.057j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	131.4	-12.9	696.4	-9.5	79.7	1.16	FALSE	405	390.69	87.1	277.48	43.5
Tower Type B2 – Double	Bundling spacer – 4 conductor, 26 cm	AAC 21.0 mm diameter	(0.014+0.223j)	4.921917141501634e-06j	(0.981+0.001j)	(2.543+40.776j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	130.9	-12.5	697	-9.7	80.4	1.36	FALSE	299	396.79	86.4	282.1	43.2
Tower Type B1 – Double	Bundling spacer – 3 conductor, 23 cm	AAC 31.5 mm diameter	(0.008+0.223j)	4.915820740910 5975e-06j	(0.981+0.001j)	(1.507+40.826j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	131.6	-12.5	697	-9.8	89.9	0.81	FALSE	495	409.62	87.9	290.56	43.9
Tower Type B1 – Double	Bundling spacer – 3 conductor, 33 cm	AAC 31.5 mm diameter	(0.008+0.208j)	5.272977866755299e-06j	(0.981+0.001j)	(1.507+38.061j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	131.2	-11.7	698.5	-10.5	91	0.81	FALSE	495	436.82	87.7	309.94	43.9
Tower Type B2 – Double	Bundling spacer – 3 conductor, 23 cm	AAC 31.5 mm diameter	(0.008+0.241j)	4.547632798356005e-06j	(0.981+0.001j)	(1.507+44.131j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	132.1	-13.5	695.5	-9	91.9	0.81	FALSE	495	381.52	88	270.55	44

Tower Type B1 – Double	Bundling spacer – 4 conductor, 26 cm	AAC 26.3 mm diameter	(0.009+0.201j)	5.450123107753459e-06j	(0.981+0.001j)	(1.621+36.824j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	131	-11.3	699.3	-10.8	93	0.87	FALSE	405	448.52	87.5	318.37	43.7
Tower Type B2 – Double	Bundling spacer – 3 conductor, 33 cm	AAC 31.5 mm diameter	(0.008+0.226j)	4.851638073011554e-06j	(0.981+0.001j)	(1.507+41.366j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	131.7	-12.7	696.7	-9.6	93	0.81	FALSE	495	404.73	87.9	287.07	44
Tower Type B2 – Double	Bundling spacer – 4 conductor, 26 cm	AAC 26.3 mm diameter	(0.009+0.219j)	5.001203122149354e-06j	(0.981+0.001j)	(1.621+40.129j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	131.4	-12.3	697.3	-9.9	95	0.87	FALSE	405	414.62	87.7	294.2	43.8
Tower Type B1 – Double	Bundling spacer – 4 conductor, 26 cm	AAC 31.5 mm diameter	(0.006+0.199j)	5.527920450937468e-06j	(0.981+0.001j)	(1.13+36.305j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	131.2	-11.1	699.6	-11	110.6	0.61	FALSE	495	462.15	88.2	327.68	44.1
Tower Type B2 – Double	Bundling spacer – 4 conductor, 26 cm	AAC 31.5 mm diameter	(0.006+0.217j)	5.066635213222634e-06j	(0.981+0.001j)	(1.13+39.611j)	(-0+0.001j)	(0.981+0.001j)	132	699.8	131.7	-12.1	697.6	-10.1	112.6	0.61	FALSE	495	426.22	88.4	302.12	44.2

Appendix 8. 32 Km connection CSV

Tower Type	Bundle Type	Conductor Type	Impedance	Admittance	A	B	C	D	Vs	Is	Vr (KV)	Vr angle (Degrees)	Ir (A)	Ir angle (Degrees)	Cost (Million $)	Real Power loss (%)	Thermal limit surpassed	Current limit (Summer)	Current limit with 25% buffer	Stability limit (MVA)	Stability limit angle	Dynamic Stability limit (MVA)	Dynamic Stability limit angle
Tower Type A1	No bundling – 1 conductor	AAC 9.0 mm diameter	(0.609+0.419j)	2.6175292576204276e-06j	(0.999+0.001j)	(20.713+14.259j)	(-0+0j)	(0.999+0.001j)	132	69 9.8	117.8	-4.8	69 9.5	-0.9	5.6	10.98	TRUE	110	82.5	163.73	34.5	135.84	17.3
Tower Type A1	No bundling – 1 conductor	AAC 16.3 mm diameter	(0.186+0.382j)	2.8732611831763078e-06j	(0.999+0j)	(6.315+12.985j)	(-0+0j)	(0.999+0j)	132	69 9.8	127.8	-4.1	69 9.5	-1	5.9	3.35	TRUE	216	162	673.65	64.1	495.75	32
Tower Type B1	No bundling – 1 conductor	AAC 9.0 mm diameter	(0.609+0.425j)	2.5838386906892727e-06j	(0.999+0.001j)	(20.713+14.445j)	(-0+0j)	(0.999+0.001j)	132	69 9.8	117.8	-4.9	69 9.5	-0.9	6	10.98	TRUE	110	82.5	164.91	34.9	136.58	17.4
Tower Type A1	No bundling – 1 conductor	AAC 21.0 mm diameter	(0.112+0.366j)	2.9982141476233003e-06j	(0.999+0j)	(3.804+12.443j)	(-0+0j)	(0.999+0j)	132	69 9.8	129.5	-3.8	69 9.5	-1.1	6.1	2.02	TRUE	299	224.25	937.07	73	679.31	36.5
Tower Type A2	No bundling – 1 conductor	AAC 9.0 mm diameter	(0.609+0.432j)	2.5395913358734895e-06j	(0.999+0.001j)	(20.713+14.696j)	(-0+0j)	(0.999+0.001j)	132	69 9.8	117.9	-4.9	69 9.5	-0.9	6.1	10.98	TRUE	110	82.5	166.49	35.4	137.56	17.7
Tower Type C	No bundling – 1 conductor	AAC 9.0 mm diameter	(0.609+0.428j)	2.5623726138854928e-06j	(0.999+0.001j)	(20.713+14.566j)	(-0+0j)	(0.999+0.001j)	132	69 9.8	117.9	-4.9	69 9.5	-0.9	6.1	10.98	TRUE	110	82.5	165.68	35.1	137.06	17.6
Tower Type A2	No bundling – 1 conductor	AAC 16.3 mm diameter	(0.186+0.395j)	2.7796226948236015e-06j	(0.999+0j)	(6.315+13.422j)	(-0+0j)	(0.999+0j)	132	69 9.8	127.8	-4.2	69 9.5	-1	6.3	3.35	TRUE	216	162	668.58	64.8	491.46	32.4
Tower Type B1	No bundling – 1 conductor	AAC 16.3 mm diameter	(0.186+0.387j)	2.8327168972285187e-06j	(0.999+0j)	(6.315+13.171j)	(-0+0j)	(0.999+0j)	132	69 9.8	127.8	-4.1	69 9.5	-1	6.3	3.35	TRUE	216	162	671.55	64.4	493.96	32.2
Tower Type C	No bundling – 1 conductor	AAC 16.3 mm diameter	(0.186+0.391j)	2.8069370203256698e-06j	(0.999+0j)	(6.315+13.292j)	(-0+0j)	(0.999+0j)	132	69 9.8	127.8	-4.2	69 9.5	-1	6.3	3.35	TRUE	216	162	670.14	64.6	492.77	32.3
Tower Type A1	No bundling – 1 conductor	AAC 26.3 mm diameter	(0.071+0.352j)	3.1186849362318125e-06j	(0.999+0j)	(2.426+11.963j)	(-0+0j)	(0.999+0j)	132	69 9.8	130.5	-3.7	69 9.5	-1.1	6.4	1.29	TRUE	405	303.75	1133.92	78.5	815.26	39.3
Tower Type B2	No bundling – 1 conductor	AAC 9.0 mm diameter	(0.609+0.443j)	2.4783709037108816e-06j	(0.999+0.001j)	(20.713+15.059j)	(-0+0j)	(0.999+0.001j)	132	69 9.8	117.9	-5.1	69 9.5	-0.9	6.4	10.98	TRUE	110	82.5	168.72	36	138.95	18
Tower Type B1	No bundling – 1 conductor	AAC 21.0 mm diameter	(0.112+0.372j)	2.9540938618574357e-06j	(0.999+0j)	(3.804+12.629j)	(-0+0j)	(0.999+0j)	132	69 9.8	129.6	-3.9	69 9.5	-1.1	6.5	2.02	TRUE	299	224.25	929.49	73.2	673.6	36.6
Tower Type B1 – Double	No bundling – 1 conductor	AAC 9.0 mm diameter	(0.305+0.425j)	2.5838386906892727e-06j	(0.999+0j)	(10.357+14.44j)	(-0+0j)	(0.999+0j)	132	69 9.8	125.1	-4.6	69 9.5	-0.9	6.5	5.49	TRUE	110	82.5	416.01	54.4	313.45	27.2
Tower Type A1	Bundling spacer – 2 conductor, 24 cm	AAC 9.0 mm diameter	(0.305+0.287j)	3.8306194424339883e-06j	(0.999+0.001j)	(10.357+9.742j)	(-0+0j)	(0.999+0.001j)	132	69 9.8	124.8	-3.1	69 9.6	-1.4	6.6	5.49	TRUE	110	82.5	360.53	43.2	278.96	21.6
Tower Type A2	No bundling – 1 conductor	AAC 21.0 mm diameter	(0.112+0.379j)	2.8963985284401345e-06j	(0.999+0j)	(3.804+12.881j)	(-0+0j)	(0.999+0j)	132	69 9.8	129.6	-4	69 9.5	-1.1	6.6	2.02	TRUE	299	224.25	919.33	73.5	665.95	36.8
Tower Type C	No bundling – 1 conductor	AAC 21.0 mm diameter	(0.112+0.375j)	2.9260683371336773e-06j	(0.999+0j)	(3.804+12.75j)	(-0+0j)	(0.999+0j)	132	69 9.8	129.6	-3.9	69 9.5	-1.1	6.6	2.02	TRUE	299	224.25	924.59	73.4	669.91	36.7
Tower Type A1	Bundling spacer – 2 conductor, 32 cm	AAC 9.0 mm diameter	(0.305+0.277j)	3.9553912883053364e-06j	(0.999+0.001j)	(10.357+9.434j)	(-0+0j)	(0.999+0.001j)	132	69 9.8	124.8	-3	69 9.6	-1.4	6.7	5.49	TRUE	110	82.5	353.87	42.3	274.52	21.2
Tower Type B2	No bundling – 1 conductor	AAC 16.3 mm diameter	(0.186+0.406j)	2.7064494980165873e-06j	(0.999+0j)	(6.315+13.785j)	(-0+0j)	(0.999+0j)	132	69 9.8	127.9	-4.3	69 9.5	-1	6.7	3.35	TRUE	216	162	664.06	65.4	487.71	32.7

Tower Type A1	No bundling – 1 conductor	AAC 31.5 mm diameter	(0.05+0.341j)	3.22249029675 09506e-06j	(0.999+0j)	(1.691+11.577j)	(-0+0j)	(0.999+0j)	132	69 9.8	131	-3.5	69 9.5	-1.2	6.8	0.9	TRUE	495	371.25	1265.84	81.7	905.97	40.8
Tower Type A2	No bundling – 1 conductor	AAC 26.3 mm diameter	(0.071+0.365j)	3.00867297012 2985e-06j	(0.999+0j)	(2.426+12.4j)	(-0+0j)	(0.999+0j)	132	69 9.8	130.5	-3.8	69 9.5	-1.1	6.9	1.29	TRUE	405	303.75	1104.64	78.9	793.78	39.5
Tower Type B1	No bundling – 1 conductor	AAC 26.3 mm diameter	(0.071+0.357j)	3.07097604661 22096e-06j	(0.999+0j)	(2.426+12.148j)	(-0+0j)	(0.999+0j)	132	69 9.8	130.5	-3.7	69 9.5	-1.1	6.9	1.29	TRUE	405	303.75	1121.31	78.7	806.01	39.4
Tower Type B2	No bundling – 1 conductor	AAC 21.0 mm diameter	(0.112+0.39j)	2.81703573838 76282e-06j	(0.999+0j)	(3.804+13.244j)	(-0+0j)	(0.999+0j)	132	69 9.8	129.6	-4.1	69 9.5	-1	6.9	2.02	TRUE	299	224.25	904.89	74	655.11	37
Tower Type B2 – Double	No bundling – 1 conductor	AAC 9.0 mm diameter	(0.305+0.443j)	2.47837090371 08816e-06j	(0.999+0j)	(10.357+15.055j)	(-0+0j)	(0.999+0j)	132	69 9.8	125.1	-4.8	69 9.5	-0.9	6.9	5.49	TRUE	110	82.5	418.27	55.5	314.42	27.7
Tower Type C	No bundling – 1 conductor	AAC 26.3 mm diameter	(0.071+0.361j)	3.04070028744 60686e-06j	(0.999+0j)	(2.426+12.269j)	(-0+0j)	(0.999+0j)	132	69 9.8	130.5	-3.8	69 9.5	-1.1	6.9	1.29	TRUE	405	303.75	1113.24	78.8	800.09	39.4
Tower Type A1	Bundling spacer – 2 conductor, 24 cm	AAC 16.3 mm diameter	(0.093+0.268j)	4.09747327257 6863e-06j	(0.999+0j)	(3.157+9.105j)	(-0+0j)	(0.999+0j)	132	69 9.8	129.9	-2.8	69 9.6	-1.5	7	1.67	TRUE	216	162	1205.4	70.9	875.89	35.4
Tower Type A2	Bundling spacer – 2 conductor, 24 cm	AAC 9.0 mm diameter	(0.305+0.299j)	3.66597323261 33328e-06j	(0.999+0.001j)	(10.357+10.179j)	(-0+0j)	(0.999+0.001j)	132	69 9.8	124.9	-3.2	69 9.6	-1.3	7	5.49	TRUE	110	82.5	369.27	44.5	284.74	22.3
Tower Type B1	Bundling spacer – 2 conductor, 24 cm	AAC 9.0 mm diameter	(0.305+0.292j)	3.75889282846 01294e-06j	(0.999+0.001j)	(10.357+9.927j)	(-0+0j)	(0.999+0.001j)	132	69 9.8	124.9	-3.1	69 9.6	-1.3	7	5.49	TRUE	110	82.5	364.35	43.8	281.49	21.9
Tower Type B1 – Double	No bundling – 1 conductor	AAC 16.3 mm diameter	(0.093+0.387j)	2.83271689722 85187e-06j	(0.999+0j)	(3.157+13.17j)	(-0+0j)	(0.999+0j)	132	69 9.8	130	-4.1	69 9.5	-1	7	1.67	TRUE	216	162	976.29	76.5	704.09	38.3
Tower Type C	Bundling spacer – 2 conductor, 24 cm	AAC 9.0 mm diameter	(0.305+0.296j)	3.71363392456 81814e-06j	(0.999+0.001j)	(10.357+10.048j)	(-0+0j)	(0.999+0.001j)	132	69 9.8	124.9	-3.2	69 9.6	-1.3	7	5.49	TRUE	110	82.5	366.75	44.1	283.08	22.1
Tower Type A1	Bundling spacer – 2 conductor, 32 cm	AAC 16.3 mm diameter	(0.093+0.259j)	4.24055936227 3198e-06j	(0.999+0j)	(3.157+8.798j)	(-0+0j)	(0.999+0j)	132	69 9.8	129.9	-2.7	69 9.6	-1.5	7.1	1.67	TRUE	216	162	1224.4	70.3	890.4	35.1
Tower Type A2	Bundling spacer – 2 conductor, 32 cm	AAC 9.0 mm diameter	(0.305+0.29j)	3.78009002916 2843e-06j	(0.999+0.001j)	(10.357+9.872j)	(-0+0j)	(0.999+0.001j)	132	69 9.8	124.9	-3.1	69 9.6	-1.4	7.1	5.49	TRUE	110	82.5	363.22	43.6	280.75	21.8
Tower Type B1	Bundling spacer – 2 conductor, 32 cm	AAC 9.0 mm diameter	(0.305+0.283j)	3.87896259721 9783e-06j	(0.999+0.001j)	(10.357+9.62j)	(-0+0j)	(0.999+0.001j)	132	69 9.8	124.8	-3	69 9.6	-1.4	7.1	5.49	TRUE	110	82.5	357.95	42.9	277.25	21.4
Tower Type C	Bundling spacer – 2 conductor, 32 cm	AAC 9.0 mm diameter	(0.305+0.286j)	3.83078464597 7888e-06j	(0.999+0.001j)	(10.357+9.741j)	(-0+0j)	(0.999+0.001j)	132	69 9.8	124.8	-3.1	69 9.6	-1.4	7.1	5.49	TRUE	110	82.5	360.52	43.2	278.96	21.6
Tower Type B2	No bundling – 1 conductor	AAC 26.3 mm diameter	(0.071+0.375j)	2.92312903516 95497e-06j	(0.999+0j)	(2.426+12.763j)	(-0+0j)	(0.999+0j)	132	69 9.8	130.5	-3.9	69 9.5	-1.1	7.2	1.29	TRUE	405	303.75	1081.36	79.2	776.72	39.6
Tower Type A2	No bundling – 1 conductor	AAC 31.5 mm diameter	(0.05+0.353j)	3.10517070630 79695e-06j	(0.999+0j)	(1.691+12.015j)	(-0+0j)	(0.999+0j)	132	69 9.8	131	-3.7	69 9.5	-1.1	7.3	0.9	TRUE	495	371.25	1228.11	82	878.6	41
Tower Type B1	No bundling – 1 conductor	AAC 31.5 mm diameter	(0.05+0.346j)	3.17157849578 00177e-06j	(0.999+0j)	(1.691+11.763j)	(-0+0j)	(0.999+0j)	132	69 9.8	131	-3.6	69 9.5	-1.2	7.3	0.9	TRUE	495	371.25	1249.54	81.8	894.15	40.9
Tower Type C	No bundling – 1 conductor	AAC 31.5 mm diameter	(0.05+0.35j)	3.13929705756 9788e-06j	(0.999+0j)	(1.691+11.884j)	(-0+0j)	(0.999+0j)	132	69 9.8	131	-3.6	69 9.5	-1.1	7.3	0.9	TRUE	495	371.25	1239.15	81.9	886.61	41
Tower Type B2	Bundling spacer – 2 conductor, 24 cm	AAC 9.0 mm diameter	(0.305+0.31j)	3.53975313347 70054e-06j	(0.999+0.001j)	(10.357+10.542j)	(-0+0j)	(0.999+0.001j)	132	69 9.8	124.9	-3.3	69 9.5	-1.3	7.4	5.49	TRUE	110	82.5	375.88	45.5	289.07	22.8
Tower Type B1 – Double	No bundling – 1 conductor	AAC 21.0 mm diameter	(0.056+0.372j)	2.95409386185 74357e-06j	(0.999+0j)	(1.902+12.629j)	(-0+0j)	(0.999+0j)	132	69 9.8	130.9	-3.9	69 9.5	-1.1	7.4	1.01	TRUE	299	224.25	1152.97	81.4	825.52	40.7
Tower Type B2 – Double	No bundling – 1 conductor	AAC 16.3 mm diameter	(0.093+0.406j)	2.70644949801 65873e-06j	(0.999+0j)	(3.157+13.785j)	(-0+0j)	(0.999+0j)	132	69 9.8	130.1	-4.2	69 9.5	-1	7.4	1.67	TRUE	216	162	946.95	77.1	682.38	38.5
Tower Type A1	Bundling spacer – 3 conductor, 23 cm	AAC 9.0 mm diameter	(0.203+0.244j)	4.49740760513 4836e-06j	(0.999+0.001j)	(6.904+8.296j)	(-0+0j)	(0.999+0.001j)	132	69 9.8	127.2	-2.6	69 9.7	-1.6	7.5	3.66	TRUE	110	82.5	596.66	50.2	449.56	25.1
Tower Type A1	Bundling spacer – 2 conductor, 24 cm	AAC 21.0 mm diameter	(0.056+0.26j)	4.22296420408 1824e-06j	(0.999+0j)	(1.902+8.834j)	(-0+0j)	(0.999+0j)	132	69 9.8	130.7	-2.7	69 9.6	-1.5	7.5	1.01	TRUE	299	224.25	1511.46	77.8	1087.5	38.9
Tower Type A2	Bundling spacer – 2 conductor, 24 cm	AAC 16.3 mm diameter	(0.093+0.281j)	3.90965080643 7302e-06j	(0.999+0j)	(3.157+9.543j)	(-0+0j)	(0.999+0j)	132	69 9.8	129.9	-2.9	69 9.6	-1.4	7.5	1.67	TRUE	216	162	1178.46	71.7	855.4	35.8
Tower Type B1	Bundling spacer – 2 conductor, 24 cm	AAC 16.3 mm diameter	(0.093+0.273j)	4.01551204773 12335e-06j	(0.999+0j)	(3.157+9.291j)	(-0+0j)	(0.999+0j)	132	69 9.8	129.9	-2.9	69 9.6	-1.5	7.5	1.67	TRUE	216	162	1193.93	71.2	867.16	35.6

Tower Type B2	Bundling spacer – 2 conductor, 32 cm	AAC 9.0 mm diameter	(0.305+0.301j)	3.646033178574553e-06j	(0.999+0.001j)	(10.357+10.234j)	(-0+0j)	(0.999+0.001j)	132	69	9.8	124.9	-3.2	69	9.6	-1.3	7.5	5.49	TRUE	110	82.5	370.32	44.7	285.43	22.3
Tower Type C	Bundling spacer – 2 conductor, 24 cm	AAC 16.3 mm diameter	(0.093+0.277j)	3.963904982018061e-06j	(0.999+0j)	(3.157+9.412j)	(-0+0j)	(0.999+0j)	132	69	9.8	129.9	-2.9	69	9.6	-1.4	7.5	1.67	TRUE	216	162	1186.48	71.5	861.49	35.7
Tower Type A1	Bundling spacer – 2 conductor, 32 cm	AAC 21.0 mm diameter	(0.056+0.251j)	4.375111654726636e-06j	(0.999+0j)	(1.902+8.527j)	(-0+0j)	(0.999+0j)	132	69	9.8	130.7	-2.6	69	9.6	-1.6	7.6	1.01	TRUE	299	224.25	1549.15	77.4	1115.24	38.7
Tower Type A2	Bundling spacer – 2 conductor, 32 cm	AAC 16.3 mm diameter	(0.093+0.272j)	4.039711621790552e-06j	(0.999+0j)	(3.157+9.235j)	(-0+0j)	(0.999+0j)	132	69	9.8	129.9	-2.8	69	9.6	-1.5	7.6	1.67	TRUE	216	162	1197.36	71.1	869.77	35.6
Tower Type B1	Bundling spacer – 2 conductor, 32 cm	AAC 16.3 mm diameter	(0.093+0.264j)	4.152835201603012 5e-06j	(0.999+0j)	(3.157+8.984j)	(-0+0j)	(0.999+0j)	132	69	9.8	129.9	-2.8	69	9.6	-1.5	7.6	1.67	TRUE	216	162	1212.91	70.6	881.62	35.3
Tower Type B2	No bundling – 1 conductor	AAC 31.5 mm diameter	(0.05+0.364j)	3.014134457367631 4e-06j	(0.999+0j)	(1.691+12.377j)	(-0+0j)	(0.999+0j)	132	69	9.8	131	-3.8	69	9.5	-1.1	7.6	0.9	TRUE	495	371.25	1198.41	82.2	857.08	41.1
Tower Type C	Bundling spacer – 2 conductor, 32 cm	AAC 16.3 mm diameter	(0.093+0.268j)	4.097662295680747 5e-06j	(0.999+0j)	(3.157+9.105j)	(-0+0j)	(0.999+0j)	132	69	9.8	129.9	-2.8	69	9.6	-1.5	7.6	1.67	TRUE	216	162	1205.43	70.9	875.91	35.4
Tower Type A1	Bundling spacer – 3 conductor, 33 cm	AAC 9.0 mm diameter	(0.203+0.229j)	4.794515586144e-06j	(0.999+0.001j)	(6.904+7.783j)	(-0+0j)	(0.999+0.001j)	132	69	9.8	127.2	-2.4	69	9.7	-1.7	7.7	3.66	TRUE	110	82.5	581.78	48.4	439.84	24.2
Tower Type B2 – Double	No bundling – 1 conductor	AAC 21.0 mm diameter	(0.056+0.39j)	2.817035738387628 2e-06j	(0.999+0j)	(1.902+13.243j)	(-0+0j)	(0.999+0j)	132	69	9.8	130.9	-4.1	69	9.5	-1	7.8	1.01	TRUE	299	224.25	1109.46	81.8	793.93	40.9
Tower Type B1	Bundling spacer – 3 conductor, 23 cm	AAC 9.0 mm diameter	(0.203+0.249j)	4.398858292644292 5e-06j	(0.999+0.001j)	(6.904+8.482j)	(-0+0j)	(0.999+0.001j)	132	69	9.8	127.2	-2.6	69	9.6	-1.6	7.9	3.66	TRUE	110	82.5	601.23	50.9	452.49	25.4
Tower Type B2	Bundling spacer – 2 conductor, 24 cm	AAC 16.3 mm diameter	(0.093+0.291j)	3.766421101720277 3e-06j	(0.999+0j)	(3.157+9.905j)	(-0+0j)	(0.999+0j)	132	69	9.8	129.9	-3	69	9.6	-1.4	7.9	1.67	TRUE	216	162	1156.32	72.3	838.65	36.2
Tower Type B1 – Double	Bundling spacer – 2 conductor, 24 cm	AAC 9.0 mm diameter	(0.152+0.292j)	3.758892828460129 4e-06j	(0.999+0j)	(5.178+9.926j)	(-0+0j)	(0.999+0j)	132	69	9.8	128.5	-3.1	69	9.6	-1.4	7.9	2.75	TRUE	110	82.5	832.85	62.4	613.42	31.2
Tower Type A2	Bundling spacer – 3 conductor, 23 cm	AAC 9.0 mm diameter	(0.203+0.257j)	4.272138805808978 5e-06j	(0.999+0.001j)	(6.904+8.734j)	(-0+0j)	(0.999+0.001j)	132	69	9.8	127.2	-2.7	69	9.6	-1.5	8	3.66	TRUE	110	82.5	606.79	51.7	456.01	25.8
Tower Type A2	Bundling spacer – 2 conductor, 24 cm	AAC 21.0 mm diameter	(0.056+0.273j)	4.023740590288976e-06j	(0.999+0j)	(1.902+9.272j)	(-0+0j)	(0.999+0j)	132	69	9.8	130.7	-2.8	69	9.6	-1.5	8	1.01	TRUE	299	224.25	1460.42	78.4	1049.99	39.2
Tower Type B1	Bundling spacer – 2 conductor, 24 cm	AAC 21.0 mm diameter	(0.056+0.265j)	4.135959044669734e-06j	(0.999+0j)	(1.902+9.02j)	(-0+0j)	(0.999+0j)	132	69	9.8	130.7	-2.8	69	9.6	-1.5	8	1.01	TRUE	299	224.25	1489.41	78.1	1071.28	39
Tower Type B2	Bundling spacer – 2 conductor, 32 cm	AAC 16.3 mm diameter	(0.093+0.282j)	3.886980013919267 5e-06j	(0.999+0j)	(3.157+9.598j)	(-0+0j)	(0.999+0j)	132	69	9.8	129.9	-3	69	9.6	-1.4	8	1.67	TRUE	216	162	1175.05	71.8	852.82	35.9
Tower Type B1 – Double	Bundling spacer – 2 conductor, 32 cm	AAC 9.0 mm diameter	(0.152+0.283j)	3.878962597219783e-06j	(0.999+0j)	(5.178+9.618j)	(-0+0j)	(0.999+0j)	132	69	9.8	128.5	-3	69	9.6	-1.4	8	2.75	TRUE	110	82.5	836.17	61.7	616.51	30.9
Tower Type C	Bundling spacer – 3 conductor, 23 cm	AAC 9.0 mm diameter	(0.203+0.253j)	4.337003305287532e-06j	(0.999+0.001j)	(6.904+8.603j)	(-0+0j)	(0.999+0.001j)	132	69	9.8	127.2	-2.7	69	9.6	-1.6	8	3.66	TRUE	110	82.5	603.99	51.3	454.25	25.6
Tower Type C	Bundling spacer – 2 conductor, 24 cm	AAC 21.0 mm diameter	(0.056+0.269j)	4.081230692578939e-06j	(0.999+0j)	(1.902+9.141j)	(-0+0j)	(0.999+0j)	132	69	9.8	130.7	-2.8	69	9.6	-1.5	8	1.01	TRUE	299	224.25	1475.35	78.2	1060.95	39.1
Tower Type A2	Bundling spacer – 2 conductor, 32 cm	AAC 21.0 mm diameter	(0.056+0.264j)	4.161636786518278e-06j	(0.999+0j)	(1.902+8.965j)	(-0+0j)	(0.999+0j)	132	69	9.8	130.7	-2.7	69	9.6	-1.5	8.1	1.01	TRUE	299	224.25	1495.95	78	1076.1	39
Tower Type B1	Bundling spacer – 3 conductor, 33 cm	AAC 9.0 mm diameter	(0.203+0.234j)	4.682677340496768e-06j	(0.999+0.001j)	(6.904+7.968j)	(-0+0j)	(0.999+0.001j)	132	69	9.8	127.2	-2.5	69	9.7	-1.7	8.1	3.66	TRUE	110	82.5	587.55	49.1	443.63	24.5
Tower Type B1	Bundling spacer – 2 conductor, 32 cm	AAC 21.0 mm diameter	(0.056+0.256j)	4.281793480174353 6e-06j	(0.999+0j)	(1.902+8.713j)	(-0+0j)	(0.999+0j)	132	69	9.8	130.7	-2.7	69	9.6	-1.6	8.1	1.01	TRUE	299	224.25	1526.16	77.7	1098.32	38.8
Tower Type B1 – Double	No bundling – 1 conductor	AAC 26.3 mm diameter	(0.036+0.357j)	3.070976046612209 6e-06j	(0.999+0j)	(1.213+12.148j)	(-0+0j)	(0.999+0j)	132	69	9.8	131.3	-3.7	69	9.5	-1.1	8.1	0.64	TRUE	405	303.75	1279.7	84.3	912.47	42.1
Tower Type C	Bundling spacer – 2 conductor, 32 cm	AAC 21.0 mm diameter	(0.056+0.26j)	4.223164982970196 5e-06j	(0.999+0j)	(1.902+8.834j)	(-0+0j)	(0.999+0j)	132	69	9.8	130.7	-2.7	69	9.6	-1.5	8.1	1.01	TRUE	299	224.25	1511.51	77.8	1087.53	38.9
Tower Type A1	Bundling spacer – 3 conductor, 23 cm	AAC 16.3 mm diameter	(0.062+0.232j)	4.738978162261975e-06j	(0.999+0j)	(2.105+7.873j)	(-0+0j)	(0.999+0j)	132	69	9.8	130.6	-2.4	69	9.7	-1.7	8.2	1.12	TRUE	216	162	1574.51	75	1137.15	37.5
Tower Type A1	Bundling spacer – 2 conductor, 24 cm	AAC 26.3 mm diameter	(0.036+0.253j)	4.341058981694303e-06j	(0.999+0j)	(1.213+8.594j)	(-0+0j)	(0.999+0j)	132	69	9.8	131.2	-2.6	69	9.6	-1.6	8.2	0.64	TRUE	405	303.75	1718.3	82	1229.21	41

Tower Type A2	Bundling spacer – 3 conductor, 33 cm	AAC 9.0 mm diameter	(0.203+0.242j)	4.539344580389231e-06j	(0.999+0.001j)	(6.904+8.22j)	(-0+0j)	(0.999+0.001j)	132	69	9.8	127.2	-2.6	69	9.7	-1.6	8.2	3.66	TRUE	110	82.5	594.65	50	448.26	25
Tower Type B2 – Double	Bundling spacer – 2 conductor, 24 cm	AAC 9.0 mm diameter	(0.152+0.31j)	3.539753133477005 4e-06j	(0.999+0j)	(5.178+10.54j)	(-0+0j)	(0.999+0j)	132	69	9.8	128.5	-3.3	69	9.6	-1.3	8.2	2.75	TRUE	110	82.5	824.37	63.8	605.99	31.9
Tower Type C	Bundling spacer – 3 conductor, 33 cm	AAC 9.0 mm diameter	(0.203+0.238j)	4.612646489574854e-06j	(0.999+0.001j)	(6.904+8.089j)	(-0+0j)	(0.999+0.001j)	132	69	9.8	127.2	-2.5	69	9.7	-1.7	8.2	3.66	TRUE	110	82.5	591.06	49.5	445.93	24.8
Tower Type A1	Bundling spacer – 2 conductor, 32 cm	AAC 26.3 mm diameter	(0.036+0.244j)	4.501997144985102e-06j	(0.999+0j)	(1.213+8.287j)	(-0+0j)	(0.999+0j)	132	69	9.8	131.2	-2.5	69	9.7	-1.6	8.3	0.64	TRUE	405	303.75	1770.16	81.7	1266.81	40.8
Tower Type B2	Bundling spacer – 3 conductor, 23 cm	AAC 9.0 mm diameter	(0.203+0.268j)	4.101697355857075e-06j	(0.999+0j)	(6.904+9.097j)	(-0+0j)	(0.999+0j)	132	69	9.8	127.2	-2.8	69	9.6	-1.5	8.3	3.66	TRUE	110	82.5	613.6	52.8	460.22	26.4
Tower Type B2	Bundling spacer – 2 conductor, 24 cm	AAC 21.0 mm diameter	(0.056+0.283j)	3.872191594001406e-06j	(0.999+0j)	(1.902+9.635j)	(-0+0j)	(0.999+0j)	132	69	9.8	130.8	-2.9	69	9.6	-1.4	8.3	1.01	TRUE	299	224.25	1420.3	78.8	1020.57	39.4
Tower Type A1	Bundling spacer – 3 conductor, 33 cm	AAC 16.3 mm diameter	(0.062+0.216j)	5.070035355472591e-06j	(0.999+0j)	(2.105+7.358j)	(-0+0j)	(0.999+0j)	132	69	9.8	130.5	-2.3	69	9.7	-1.9	8.4	1.12	TRUE	216	162	1639.08	74	1185.29	37
Tower Type B2	Bundling spacer – 2 conductor, 32 cm	AAC 21.0 mm diameter	(0.056+0.274j)	3.999731415782102e-06j	(0.999+0j)	(1.902+9.327j)	(-0+0j)	(0.999+0j)	132	69	9.8	130.7	-2.9	69	9.6	-1.5	8.4	1.01	TRUE	299	224.25	1454.14	78.5	1045.38	39.2
Tower Type B2 – Double	Bundling spacer – 2 conductor, 32 cm	AAC 9.0 mm diameter	(0.152+0.301j)	3.646033178574553e-06j	(0.999+0j)	(5.178+10.233j)	(-0+0j)	(0.999+0j)	132	69	9.8	128.5	-3.2	69	9.6	-1.3	8.4	2.75	TRUE	110	82.5	828.89	63.2	609.89	31.6
Tower Type A1	Bundling spacer – 4 conductor, 26 cm	AAC 9.0 mm diameter	(0.152+0.213j)	5.158664593667276e-06j	(0.999+0j)	(5.178+7.233j)	(-0+0j)	(0.999+0j)	132	69	9.8	128.4	-2.2	69	9.8	-1.9	8.5	2.75	TRUE	110	82.5	826.44	54.4	615.77	27.2
Tower Type B2	Bundling spacer – 3 conductor, 33 cm	AAC 9.0 mm diameter	(0.203+0.252j)	4.347394433587209e-06j	(0.999+0.001j)	(6.904+8.583j)	(-0+0j)	(0.999+0.001j)	132	69	9.8	127.2	-2.7	69	9.6	-1.6	8.5	3.66	TRUE	110	82.5	603.53	51.2	453.96	25.6
Tower Type B2 – Double	No bundling – 1 conductor	AAC 26.3 mm diameter	(0.036+0.375j)	2.923129035169549 7e-06j	(0.999+0j)	(1.213+12.763j)	(-0+0j)	(0.999+0j)	132	69	9.8	131.4	-3.9	69	9.5	-1.1	8.5	0.64	TRUE	405	303.75	1225.27	84.6	873.32	42.3
Tower Type B1	Bundling spacer – 2 conductor, 24 cm	AAC 26.3 mm diameter	(0.036+0.258j)	4.249172540753887e-06j	(0.999+0j)	(1.213+8.78j)	(-0+0j)	(0.999+0j)	132	69	9.8	131.2	-2.7	69	9.6	-1.6	8.6	0.64	TRUE	405	303.75	1688.32	82.1	1207.48	41.1
Tower Type A2	Bundling spacer – 3 conductor, 23 cm	AAC 16.3 mm diameter	(0.062+0.244j)	4.489530698635078e-06j	(0.999+0j)	(2.105+8.31j)	(-0+0j)	(0.999+0j)	132	69	9.8	130.6	-2.5	69	9.7	-1.6	8.7	1.12	TRUE	216	162	1522.23	75.8	1098.32	37.9
Tower Type A2	Bundling spacer – 2 conductor, 24 cm	AAC 26.3 mm diameter	(0.036+0.266j)	4.130814401780984e-06j	(0.999+0j)	(1.213+9.031j)	(-0+0j)	(0.999+0j)	132	69	9.8	131.2	-2.8	69	9.6	-1.5	8.7	0.64	TRUE	405	303.75	1649.3	82.4	1179.22	41.2
Tower Type B1	Bundling spacer – 3 conductor, 23 cm	AAC 16.3 mm diameter	(0.062+0.237j)	4.629686343379485e-06j	(0.999+0j)	(2.105+8.058j)	(-0+0j)	(0.999+0j)	132	69	9.8	130.6	-2.5	69	9.7	-1.7	8.7	1.12	TRUE	216	162	1551.99	75.4	1120.41	37.7
Tower Type B1	Bundling spacer – 2 conductor, 32 cm	AAC 26.3 mm diameter	(0.036+0.249j)	4.403248801698379 4e-06j	(0.999+0j)	(1.213+8.473j)	(-0+0j)	(0.999+0j)	132	69	9.8	131.2	-2.6	69	9.7	-1.6	8.7	0.64	TRUE	405	303.75	1738.44	81.9	1243.81	40.9
Tower Type C	Bundling spacer – 3 conductor, 23 cm	AAC 16.3 mm diameter	(0.062+0.241j)	4.561219929670155e-06j	(0.999+0j)	(2.105+8.179j)	(-0+0j)	(0.999+0j)	132	69	9.8	130.6	-2.5	69	9.7	-1.7	8.7	1.12	TRUE	216	162	1537.58	75.6	1109.71	37.8
Tower Type C	Bundling spacer – 2 conductor, 24 cm	AAC 26.3 mm diameter	(0.036+0.262j)	4.191427941951168e-06j	(0.999+0j)	(1.213+8.901j)	(-0+0j)	(0.999+0j)	132	69	9.8	131.2	-2.7	69	9.6	-1.5	8.7	0.64	TRUE	405	303.75	1669.34	82.2	1193.73	41.1
Tower Type A2	Bundling spacer – 2 conductor, 32 cm	AAC 26.3 mm diameter	(0.036+0.257j)	4.276279881386 31e-06j	(0.999+0j)	(1.213+8.724j)	(-0+0j)	(0.999+0j)	132	69	9.8	131.2	-2.7	69	9.6	-1.6	8.8	0.64	TRUE	405	303.75	1697.19	82.1	1213.91	41
Tower Type C	Bundling spacer – 2 conductor, 32 cm	AAC 26.3 mm diameter	(0.036+0.253j)	4.341271147404662e-06j	(0.999+0j)	(1.213+8.594j)	(-0+0j)	(0.999+0j)	132	69	9.8	131.2	-2.6	69	9.6	-1.6	8.8	0.64	TRUE	405	303.75	1718.37	82	1229.26	41
Tower Type A1	Bundling spacer – 3 conductor, 23 cm	AAC 21.0 mm diameter	(0.037+0.226j)	4.850106164457482e-06j	(0.999+0j)	(1.268+7.692j)	(-0+0j)	(0.999+0j)	132	69	9.8	131.1	-2.3	69	9.7	-1.8	8.9	0.67	TRUE	299	224.25	1861.59	80.6	1334.14	40.3
Tower Type A2	Bundling spacer – 4 conductor, 26 cm	AAC 9.0 mm diameter	(0.152+0.226j)	4.864449831231781e-06j	(0.999+0j)	(5.178+7.67j)	(-0+0j)	(0.999+0j)	132	69	9.8	128.4	-2.4	69	9.7	-1.8	8.9	2.75	TRUE	110	82.5	834.59	56	620.4	28
Tower Type A2	Bundling spacer – 3 conductor, 33 cm	AAC 16.3 mm diameter	(0.062+0.229j)	4.785564609711747e-06j	(0.999+0j)	(2.105+7.796j)	(-0+0j)	(0.999+0j)	132	69	9.8	130.6	-2.4	69	9.7	-1.7	8.9	1.12	TRUE	216	162	1583.93	74.9	1144.16	37.4
Tower Type B1	Bundling spacer – 4 conductor, 26 cm	AAC 9.0 mm diameter	(0.152+0.218j)	5.029421686258565e-06j	(0.999+0j)	(5.178+7.419j)	(-0+0j)	(0.999+0j)	132	69	9.8	128.4	-2.3	69	9.7	-1.8	8.9	2.75	TRUE	110	82.5	830.36	55.1	618.06	27.5
Tower Type B1	Bundling spacer – 3 conductor, 33 cm	AAC 16.3 mm diameter	(0.062+0.222j)	4.945141495600 5e-06j	(0.999+0j)	(2.105+7.544j)	(-0+0j)	(0.999+0j)	132	69	9.8	130.5	-2.3	69	9.7	-1.8	8.9	1.12	TRUE	216	162	1615.36	74.4	1167.58	37.2

Tower Type B1 – Double	Bundling spacer – 2 conductor, 24 cm	AAC 16.3 mm diameter	(0.046+0.273j)	4.01551204773 12335e-06j	(0.999+0j)	(1.579+9.291j)	(-0+0j)	(0.999+0j)	132	69 9.8	131	-2.8	69 9.6	-1.5	8.9	0.84	TRUE	216	162	1529.58	80.4	1096.72	40.2
Tower Type B1 – Double	No bundling – 1 conductor	AAC 31.5 mm diameter	(0.025+0.346j)	3.17157849578 00177e-06j	(0.999+0j)	(0.845+11.763j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-3.6	69 9.5	-1.2	8.9	0.45	FALSE	495	371.25	1367.52	85.9	972.84	42.9
Tower Type C	Bundling spacer – 4 conductor, 26 cm	AAC 9.0 mm diameter	(0.152+0.222j)	4.94872487796 618e-06j	(0.999+0j)	(5.178+7.539j)	(-0+0j)	(0.999+0j)	132	69 9.8	128.4	-2.3	69 9.7	-1.8	8.9	2.75	TRUE	110	82.5	832.55	55.5	619.29	27.8
Tower Type C	Bundling spacer – 3 conductor, 33 cm	AAC 16.3 mm diameter	(0.062+0.225j)	4.86710558755 0069e-06j	(0.999+0j)	(2.105+7.665j)	(-0+0j)	(0.999+0j)	132	69 9.8	130.6	-2.3	69 9.7	-1.8	8.9	1.12	TRUE	216	162	1600.15	74.6	1156.24	37.3
Tower Type A1	Bundling spacer – 2 conductor, 24 cm	AAC 31.5 mm diameter	(0.025+0.247j)	4.44061452019 8643e-06j	(0.999+0j)	(0.845+8.401j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.5	-2.6	69 9.7	-1.6	9	0.45	FALSE	495	371.25	1850.11	84.3	1319.22	42.1
Tower Type B2	Bundling spacer – 2 conductor, 24 cm	AAC 26.3 mm diameter	(0.036+0.276j)	3.97125241796 1687e-06j	(0.999+0j)	(1.213+9.394j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.2	-2.9	69 9.6	-1.5	9	0.64	TRUE	405	303.75	1595.98	82.6	1140.64	41.3
Tower Type B1 – Double	Bundling spacer – 2 conductor, 32 cm	AAC 16.3 mm diameter	(0.046+0.264j)	4.15283520160 30125e-06j	(0.999+0j)	(1.579+8.984j)	(-0+0j)	(0.999+0j)	132	69 9.8	131	-2.7	69 9.6	-1.5	9	0.84	TRUE	216	162	1569.79	80	1126.04	40
Tower Type A1	Bundling spacer – 3 conductor, 33 cm	AAC 21.0 mm diameter	(0.037+0.211j)	5.19744083192 0063e-06j	(0.999+0j)	(1.268+7.178j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.1	-2.2	69 9.8	-1.9	9.1	0.67	TRUE	299	224.25	1964.16	80	1408.88	40
Tower Type A1	Bundling spacer – 2 conductor, 32 cm	AAC 31.5 mm diameter	(0.025+0.238j)	4.60916237181 5347e-06j	(0.999+0j)	(0.845+8.094j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.4	-2.5	69 9.7	-1.7	9.1	0.45	FALSE	495	371.25	1911.48	84	1363.39	42
Tower Type B2	Bundling spacer – 3 conductor, 23 cm	AAC 16.3 mm diameter	(0.062+0.255j)	4.30168311505 8902e-06j	(0.999+0j)	(2.105+8.673j)	(-0+0j)	(0.999+0j)	132	69 9.8	130.6	-2.7	69 9.6	-1.6	9.1	1.12	TRUE	216	162	1480.76	76.4	1067.6	38.2
Tower Type B2	Bundling spacer – 2 conductor, 32 cm	AAC 26.3 mm diameter	(0.036+0.267j)	4.10551445005 63375e-06j	(0.999+0j)	(1.213+9.087j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.2	-2.8	69 9.6	-1.5	9.1	0.64	TRUE	405	303.75	1640.9	82.4	1173.14	41.2
Tower Type B2 – Double	Bundling spacer – 2 conductor, 24 cm	AAC 16.3 mm diameter	(0.046+0.291j)	3.76642110172 02773e-06j	(0.999+0j)	(1.579+9.905j)	(-0+0j)	(0.999+0j)	132	69 9.8	131	-3	69 9.6	-1.4	9.2	0.84	TRUE	216	162	1454.64	80.9	1042.15	40.5
Tower Type B2	Bundling spacer – 4 conductor, 26 cm	AAC 9.0 mm diameter	(0.152+0.236j)	4.64468594071 9138e-06j	(0.999+0j)	(5.178+8.033j)	(-0+0j)	(0.999+0j)	132	69 9.8	128.4	-2.5	69 9.7	-1.7	9.3	2.75	TRUE	110	82.5	838.73	57.2	622.38	28.6
Tower Type B2	Bundling spacer – 3 conductor, 33 cm	AAC 16.3 mm diameter	(0.062+0.24j)	4.57271466629 4702e-06j	(0.999+0j)	(2.105+8.159j)	(-0+0j)	(0.999+0j)	132	69 9.8	130.6	-2.5	69 9.7	-1.7	9.3	1.12	TRUE	216	162	1540.02	75.5	1111.52	37.8
Tower Type B1 – Double	Bundling spacer – 3 conductor, 23 cm	AAC 9.0 mm diameter	(0.102+0.249j)	4.39885829264 42925e-06j	(0.999+0j)	(3.452+8.481j)	(-0+0j)	(0.999+0j)	132	69 9.8	129.6	-2.6	69 9.6	-1.6	9.3	1.83	TRUE	110	82.5	1176.82	67.9	858.69	33.9
Tower Type B2 – Double	Bundling spacer – 2 conductor, 32 cm	AAC 16.3 mm diameter	(0.046+0.282j)	3.88698001391 92675e-06j	(0.999+0j)	(1.579+9.598j)	(-0+0j)	(0.999+0j)	132	69 9.8	131	-2.9	69 9.6	-1.4	9.3	0.84	TRUE	216	162	1491.24	80.7	1068.78	40.3
Tower Type B2 – Double	No bundling – 1 conductor	AAC 31.5 mm diameter	(0.025+0.364j)	3.01413445736 76314e-06j	(0.999+0j)	(0.845+12.377j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-3.8	69 9.5	-1.1	9.3	0.45	FALSE	495	371.25	1305.16	86.1	928.2	43
Tower Type A1	Bundling spacer – 4 conductor, 26 cm	AAC 16.3 mm diameter	(0.046+0.203j)	5.39526095086 31095e-06j	(0.999+0j)	(1.579+6.915j)	(-0+0j)	(0.999+0j)	132	69 9.8	130.9	-2.1	69 9.8	-2	9.4	0.84	TRUE	216	162	1898.4	77.1	1366.97	38.6
Tower Type A2	Bundling spacer – 3 conductor, 23 cm	AAC 21.0 mm diameter	(0.037+0.239j)	4.58914466860 5896e-06j	(0.999+0j)	(1.268+8.129j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.2	-2.5	69 9.7	-1.7	9.4	0.67	TRUE	299	224.25	1781.87	81.1	1276.15	40.6
Tower Type B1	Bundling spacer – 3 conductor, 23 cm	AAC 21.0 mm diameter	(0.037+0.232j)	4.73569038509 1749e-06j	(0.999+0j)	(1.268+7.878j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.1	-2.4	69 9.7	-1.7	9.4	0.67	TRUE	299	224.25	1826.92	80.9	1308.91	40.4
Tower Type B1	Bundling spacer – 2 conductor, 24 cm	AAC 31.5 mm diameter	(0.025+0.253j)	4.34451185357 5704e-06j	(0.999+0j)	(0.845+8.587j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.5	-2.6	69 9.6	-1.6	9.4	0.45	FALSE	495	371.25	1814.83	84.4	1293.84	42.2
Tower Type C	Bundling spacer – 3 conductor, 23 cm	AAC 21.0 mm diameter	(0.037+0.235j)	4.66407703127 7323e-06j	(0.999+0j)	(1.268+7.999j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.1	-2.4	69 9.7	-1.7	9.4	0.67	TRUE	299	224.25	1805	81	1292.96	40.5
Tower Type A2	Bundling spacer – 2 conductor, 24 cm	AAC 31.5 mm diameter	(0.025+0.26j)	4.22086017093 3272e-06j	(0.999+0j)	(0.845+8.839j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.5	-2.7	69 9.6	-1.5	9.5	0.45	FALSE	495	371.25	1769.13	84.5	1260.97	42.3
Tower Type B1	Bundling spacer – 2 conductor, 32 cm	AAC 31.5 mm diameter	(0.025+0.244j)	4.50571089210 6696e-06j	(0.999+0j)	(0.845+8.28j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.5	-2.5	69 9.7	-1.7	9.5	0.45	FALSE	495	371.25	1873.89	84.2	1336.33	42.1
Tower Type B1 – Double	Bundling spacer – 3 conductor, 33 cm	AAC 9.0 mm diameter	(0.102+0.234j)	4.68267734049 6768e-06j	(0.999+0j)	(3.452+7.967j)	(-0+0j)	(0.999+0j)	132	69 9.8	129.6	-2.4	69 9.7	-1.7	9.5	1.83	TRUE	110	82.5	1201.17	66.6	877.89	33.3
Tower Type C	Bundling spacer – 2 conductor, 24 cm	AAC 31.5 mm diameter	(0.025+0.256j)	4.28416533683 6702e-06j	(0.999+0j)	(0.845+8.708j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.5	-2.7	69 9.6	-1.6	9.5	0.45	FALSE	495	371.25	1792.57	84.5	1277.83	42.2

Tower Type A2	Bundling spacer – 3 conductor, 33 cm	AAC 21.0 mm diameter	(0.037+0.224j)	4.89891436485 3833e-06j	(0.999+0j)	(1.268+7.615j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.1	-2.3	69 9.7	-1.8	9.6	0.67	TRUE	299	224.25	1876.25	80.5	1344.81	40.3
Tower Type A2	Bundling spacer – 2 conductor, 32 cm	AAC 31.5 mm diameter	(0.025+0.251j)	4.37285332025 686e-06j	(0.999+0j)	(0.845+8.532j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.5	-2.6	69 9.6	-1.6	9.6	0.45	FALSE	495	371.25	1825.25	84.3	1301.34	42.2
Tower Type B1	Bundling spacer – 3 conductor, 33 cm	AAC 21.0 mm diameter	(0.037+0.217j)	5.06627235833 1339e-06j	(0.999+0j)	(1.268+7.364j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.1	-2.2	69 9.7	-1.9	9.6	0.67	TRUE	299	224.25	1925.9	80.2	1380.98	40.1
Tower Type B2 – Double	Bundling spacer – 3 conductor, 23 cm	AAC 9.0 mm diameter	(0.102+0.268j)	4.10169735585 7075e-06j	(0.999+0j)	(3.452+9.096j)	(-0+0j)	(0.999+0j)	132	69 9.8	129.7	-2.8	69 9.6	-1.5	9.6	1.83	TRUE	110	82.5	1146.01	69.2	834.74	34.6
Tower Type C	Bundling spacer – 3 conductor, 33 cm	AAC 21.0 mm diameter	(0.037+0.22j)	4.98439830884 3734e-06j	(0.999+0j)	(1.268+7.485j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.1	-2.3	69 9.7	-1.8	9.6	0.67	TRUE	299	224.25	1901.73	80.4	1363.37	40.2
Tower Type C	Bundling spacer – 2 conductor, 32 cm	AAC 31.5 mm diameter	(0.025+0.247j)	4.44083652913 6301e-06j	(0.999+0j)	(0.845+8.401j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.5	-2.6	69 9.7	-1.6	9.6	0.45	FALSE	495	371.25	1850.19	84.3	1319.28	42.1
Tower Type B2	Bundling spacer – 3 conductor, 23 cm	AAC 21.0 mm diameter	(0.037+0.25j)	4.39305070838 7671e-06j	(0.999+0j)	(1.268+8.492j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.2	-2.6	69 9.7	-1.6	9.8	0.67	TRUE	299	224.25	1720.45	81.5	1231.53	40.8
Tower Type B2	Bundling spacer – 2 conductor, 24 cm	AAC 31.5 mm diameter	(0.025+0.271j)	4.05440608415 12455e-06j	(0.999+0j)	(0.845+9.202j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.5	-2.8	69 9.6	-1.5	9.8	0.45	FALSE	495	371.25	1707.06	84.8	1216.37	42.4
Tower Type B1 – Double	Bundling spacer – 2 conductor, 24 cm	AAC 21.0 mm diameter	(0.028+0.265j)	4.13595904466 9734e-06j	(0.999+0j)	(0.951+9.02j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.4	-2.7	69 9.6	-1.5	9.8	0.5	FALSE	299	224.25	1712.69	84	1221.72	42
Tower Type B2 – Double	Bundling spacer – 3 conductor, 33 cm	AAC 9.0 mm diameter	(0.102+0.252j)	4.34739443358 7209e-06j	(0.999+0j)	(3.452+8.582j)	(-0+0j)	(0.999+0j)	132	69 9.8	129.6	-2.6	69 9.6	-1.6	9.8	1.83	TRUE	110	82.5	1171.88	68.1	854.83	34
Tower Type A2	Bundling spacer – 4 conductor, 26 cm	AAC 16.3 mm diameter	(0.046+0.216j)	5.07427926100 99525e-06j	(0.999+0j)	(1.579+7.352j)	(-0+0j)	(0.999+0j)	132	69 9.8	130.9	-2.2	69 9.7	-1.9	9.9	0.84	TRUE	216	162	1819.51	77.9	1308.9	38.9
Tower Type B1	Bundling spacer – 4 conductor, 26 cm	AAC 16.3 mm diameter	(0.046+0.209j)	5.25405327521 5045e-06j	(0.999+0j)	(1.579+7.101j)	(-0+0j)	(0.999+0j)	132	69 9.8	130.9	-2.2	69 9.8	-1.9	9.9	0.84	TRUE	216	162	1864.21	77.5	1341.78	38.7
Tower Type B2	Bundling spacer – 2 conductor, 32 cm	AAC 31.5 mm diameter	(0.025+0.262j)	4.19444871884 8093e-06j	(0.999+0j)	(0.845+8.894j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.5	-2.7	69 9.6	-1.5	9.9	0.45	FALSE	495	371.25	1759.32	84.6	1253.92	42.3
Tower Type B1 – Double	Bundling spacer – 2 conductor, 32 cm	AAC 21.0 mm diameter	(0.028+0.256j)	4.28179348017 43536e-06j	(0.999+0j)	(0.951+8.713j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.4	-2.7	69 9.6	-1.6	9.9	0.5	FALSE	299	224.25	1765.06	83.8	1259.45	41.9
Tower Type C	Bundling spacer – 4 conductor, 26 cm	AAC 16.3 mm diameter	(0.046+0.212j)	5.16605015151 7751e-06j	(0.999+0j)	(1.579+7.222j)	(-0+0j)	(0.999+0j)	132	69 9.8	130.9	-2.2	69 9.8	-1.9	9.9	0.84	TRUE	216	162	1842.49	77.7	1325.8	38.8
Tower Type A1	Bundling spacer – 3 conductor, 23 cm	AAC 26.3 mm diameter	(0.024+0.222j)	4.95328021701 5424e-06j	(0.999+0j)	(0.809+7.532j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.5	-2.3	69 9.7	-1.8	10	0.43	FALSE	405	303.75	2047.19	83.9	1460.52	41.9
Tower Type B2	Bundling spacer – 3 conductor, 33 cm	AAC 21.0 mm diameter	(0.037+0.235j)	4.67609671690 05954e-06j	(0.999+0j)	(1.268+7.978j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.1	-2.4	69 9.7	-1.7	10	0.67	TRUE	299	224.25	1808.69	81	1295.64	40.5
Tower Type A1	Bundling spacer – 3 conductor, 33 cm	AAC 26.3 mm diameter	(0.024+0.206j)	5.31610216400 5732e-06j	(0.999+0j)	(0.809+7.018j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.4	-2.1	69 9.8	-1.9	10.2	0.43	FALSE	405	303.75	2176.17	83.4	1553.49	41.7
Tower Type B2	Bundling spacer – 4 conductor, 26 cm	AAC 16.3 mm diameter	(0.046+0.227j)	4.83561241121 5029e-06j	(0.999+0j)	(1.579+7.715j)	(-0+0j)	(0.999+0j)	132	69 9.8	130.9	-2.4	69 9.7	-1.8	10.2	0.84	TRUE	216	162	1758.16	78.4	1263.85	39.2
Tower Type B2 – Double	Bundling spacer – 2 conductor, 24 cm	AAC 21.0 mm diameter	(0.028+0.283j)	3.87219159400 1406e-06j	(0.999+0j)	(0.951+9.635j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.4	-2.9	69 9.6	-1.4	10.2	0.5	FALSE	299	224.25	1616.6	84.4	1152.55	42.2
Tower Type B2 – Double	Bundling spacer – 2 conductor, 32 cm	AAC 21.0 mm diameter	(0.028+0.274j)	3.99973141578 2102e-06j	(0.999+0j)	(0.951+9.327j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.4	-2.8	69 9.6	-1.5	10.3	0.5	FALSE	299	224.25	1663.28	84.2	1186.14	42.1
Tower Type A1	Bundling spacer – 4 conductor, 26 cm	AAC 21.0 mm diameter	(0.028+0.199j)	5.50292099422 56775e-06j	(0.999+0j)	(0.951+6.78j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.3	-2.1	69 9.8	-2	10.4	0.5	FALSE	299	224.25	2182.3	82	1560.94	41
Tower Type A2	Bundling spacer – 3 conductor, 23 cm	AAC 26.3 mm diameter	(0.024+0.234j)	4.68140918254 4531e-06j	(0.999+0j)	(0.809+7.969j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.5	-2.4	69 9.7	-1.7	10.4	0.43	FALSE	405	303.75	1948.68	84.2	1389.59	42.1
Tower Type B1	Bundling spacer – 3 conductor, 23 cm	AAC 26.3 mm diameter	(0.024+0.227j)	4.83400469048 72875e-06j	(0.999+0j)	(0.809+7.718j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.5	-2.4	69 9.7	-1.8	10.4	0.43	FALSE	405	303.75	2004.17	84	1429.54	42
Tower Type C	Bundling spacer – 3 conductor, 23 cm	AAC 26.3 mm diameter	(0.024+0.231j)	4.75941046205 9674e-06j	(0.999+0j)	(0.809+7.839j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.5	-2.4	69 9.7	-1.7	10.4	0.43	FALSE	405	303.75	1977.11	84.1	1410.05	42.1
Tower Type A2	Bundling spacer – 3 conductor, 33 cm	AAC 26.3 mm diameter	(0.024+0.219j)	5.00419795251 0292e-06j	(0.999+0j)	(0.809+7.455j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.5	-2.3	69 9.7	-1.8	10.6	0.43	FALSE	405	303.75	2065.47	83.8	1473.68	41.9

Tower Type B1	Bundling spacer – 3 conductor, 33 cm	AAC 26.3 mm diameter	(0.024+0.212j)	5.17895499943 7324e-06j	(0.999+0j)	(0.809+7.204j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.4	-2.2	69 9.7	-1.9	10.6	0.43	FALSE	405	303.75	2127.75	83.6	1518.58	41.8
Tower Type B1 – Double	Bundling spacer – 4 conductor, 26 cm	AAC 9.0 mm diameter	(0.076+0.218j)	5.02942168625 8565e-06j	(0.999+0j)	(2.589+7.418j)	(-0+0j)	(0.999+0j)	132	69 9.8	130.2	-2.3	69 9.7	-1.8	10.6	1.37	TRUE	110	82.5	1476.46	70.8	1072.49	35.4
Tower Type C	Bundling spacer – 3 conductor, 33 cm	AAC 26.3 mm diameter	(0.024+0.215j)	5.09342914838 3911e-06j	(0.999+0j)	(0.809+7.325j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.5	-2.2	69 9.7	-1.9	10.6	0.43	FALSE	405	303.75	2097.35	83.7	1496.66	41.9
Tower Type B1 – Double	Bundling spacer – 3 conductor, 23 cm	AAC 16.3 mm diameter	(0.031+0.237j)	4.62968634337 9485e-06j	(0.999+0j)	(1.052+8.058j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.3	-2.5	69 9.7	-1.7	10.7	0.56	FALSE	216	162	1857.95	82.6	1327.98	41.3
Tower Type A2	Bundling spacer – 4 conductor, 26 cm	AAC 21.0 mm diameter	(0.028+0.212j)	5.16939734601 39205e-06j	(0.999+0j)	(0.951+7.217j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.3	-2.2	69 9.8	-1.9	10.8	0.5	FALSE	299	224.25	2072.12	82.5	1481.16	41.2
Tower Type B1	Bundling spacer – 4 conductor, 26 cm	AAC 21.0 mm diameter	(0.028+0.205j)	5.35609829843 2733e-06j	(0.999+0j)	(0.951+6.965j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.3	-2.1	69 9.8	-2	10.8	0.5	FALSE	299	224.25	2134.15	82.2	1526.06	41.1
Tower Type B2	Bundling spacer – 3 conductor, 23 cm	AAC 26.3 mm diameter	(0.024+0.245j)	4.47752619426 2683e-06j	(0.999+0j)	(0.809+8.332j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.5	-2.5	69 9.7	-1.6	10.8	0.43	FALSE	405	303.75	1873.75	84.5	1335.69	42.2
Tower Type C	Bundling spacer – 4 conductor, 26 cm	AAC 21.0 mm diameter	(0.028+0.208j)	5.26467329975 3775e-06j	(0.999+0j)	(0.951+7.086j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.3	-2.2	69 9.8	-1.9	10.8	0.5	FALSE	299	224.25	2103.88	82.4	1504.15	41.2
Tower Type B1 – Double	Bundling spacer – 3 conductor, 33 cm	AAC 16.3 mm diameter	(0.031+0.222j)	4.94514149560 05e-06j	(0.999+0j)	(1.052+7.544j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.3	-2.3	69 9.7	-1.8	10.9	0.56	FALSE	216	162	1962.41	82.1	1403.6	41
Tower Type B2	Bundling spacer – 3 conductor, 33 cm	AAC 26.3 mm diameter	(0.024+0.23j)	4.77192719190 3771e-06j	(0.999+0j)	(0.809+7.818j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.5	-2.4	69 9.7	-1.7	11	0.43	FALSE	405	303.75	1981.66	84.1	1413.33	42
Tower Type B2 – Double	Bundling spacer – 4 conductor, 26 cm	AAC 9.0 mm diameter	(0.076+0.236j)	4.64468594071 9138e-06j	(0.999+0j)	(2.589+8.032j)	(-0+0j)	(0.999+0j)	132	69 9.8	130.2	-2.5	69 9.7	-1.7	11	1.37	TRUE	110	82.5	1420.35	72.1	1029.95	36.1
Tower Type B1 – Double	Bundling spacer – 2 conductor, 24 cm	AAC 26.3 mm diameter	(0.018+0.258j)	4.24917254075 3887e-06j	(0.999+0j)	(0.606+8.78j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-2.7	69 9.6	-1.6	11.1	0.32	FALSE	405	303.75	1838.69	86	1307.71	43
Tower Type B2 – Double	Bundling spacer – 3 conductor, 23 cm	AAC 16.3 mm diameter	(0.031+0.255j)	4.30168311505 8902e-06j	(0.999+0j)	(1.052+8.673j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.3	-2.6	69 9.6	-1.6	11.1	0.56	FALSE	216	162	1746.35	83.1	1247.31	41.5
Tower Type A1	Bundling spacer – 3 conductor, 23 cm	AAC 31.5 mm diameter	(0.017+0.218j)	5.03921947042 116e-06j	(0.999+0j)	(0.564+7.403j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-2.3	69 9.7	-1.8	11.2	0.3	FALSE	495	371.25	2162.91	85.6	1539.19	42.8
Tower Type B2	Bundling spacer – 4 conductor, 26 cm	AAC 21.0 mm diameter	(0.028+0.223j)	4.92191714150 1634e-06j	(0.999+0j)	(0.951+7.58j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.4	-2.3	69 9.7	-1.8	11.2	0.5	FALSE	299	224.25	1988.53	82.8	1420.72	41.4
Tower Type B1 – Double	Bundling spacer – 2 conductor, 32 cm	AAC 26.3 mm diameter	(0.018+0.249j)	4.40324880169 83794e-06j	(0.999+0j)	(0.606+8.473j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-2.6	69 9.7	-1.6	11.2	0.32	FALSE	405	303.75	1899.82	85.9	1351.47	43
Tower Type B2 – Double	Bundling spacer – 3 conductor, 33 cm	AAC 16.3 mm diameter	(0.031+0.24j)	4.57271466629 4702e-06j	(0.999+0j)	(1.052+8.159j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.3	-2.5	69 9.7	-1.7	11.3	0.56	FALSE	216	162	1838.78	82.6	1314.11	41.3
Tower Type A1	Bundling spacer – 3 conductor, 33 cm	AAC 31.5 mm diameter	(0.017+0.203j)	5.41521837669 2445e-06j	(0.999+0j)	(0.564+6.889j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-2.1	69 9.8	-2	11.4	0.3	FALSE	495	371.25	2308.94	85.3	1643.85	42.7
Tower Type B2 – Double	Bundling spacer – 2 conductor, 24 cm	AAC 26.3 mm diameter	(0.018+0.276j)	3.97125241796 1687e-06j	(0.999+0j)	(0.606+9.394j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.7	-2.9	69 9.6	-1.5	11.5	0.32	FALSE	405	303.75	1727.46	86.3	1228.14	43.2
Tower Type B1	Bundling spacer – 3 conductor, 23 cm	AAC 31.5 mm diameter	(0.017+0.223j)	4.91582074091 05975e-06j	(0.999+0j)	(0.564+7.589j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-2.3	69 9.7	-1.8	11.6	0.3	FALSE	495	371.25	2114.53	85.8	1504.53	42.9
Tower Type B2 – Double	Bundling spacer – 2 conductor, 32 cm	AAC 26.3 mm diameter	(0.018+0.267j)	4.10551445005 63375e-06j	(0.999+0j)	(0.606+9.087j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-2.8	69 9.6	-1.5	11.6	0.32	FALSE	405	303.75	1781.35	86.2	1266.68	43.1
Tower Type A1	Bundling spacer – 4 conductor, 26 cm	AAC 26.3 mm diameter	(0.018+0.196j)	5.60221910322 6575e-06j	(0.999+0j)	(0.606+6.659j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-2	69 9.8	-2.1	11.7	0.32	FALSE	405	303.75	2362.51	84.8	1683.25	42.4
Tower Type A2	Bundling spacer – 3 conductor, 23 cm	AAC 31.5 mm diameter	(0.017+0.231j)	4.75810039601 443e-06j	(0.999+0j)	(0.564+7.841j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-2.4	69 9.7	-1.7	11.7	0.3	FALSE	495	371.25	2052.35	85.9	1460	42.9
Tower Type C	Bundling spacer – 3 conductor, 23 cm	AAC 31.5 mm diameter	(0.017+0.227j)	4.83870025541 1803e-06j	(0.999+0j)	(0.564+7.71j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-2.3	69 9.7	-1.8	11.7	0.3	FALSE	495	371.25	2084.17	85.8	1482.79	42.9
Tower Type B1	Bundling spacer – 3 conductor, 33 cm	AAC 31.5 mm diameter	(0.017+0.208j)	5.27297786675 5299e-06j	(0.999+0j)	(0.564+7.075j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-2.2	69 9.8	-1.9	11.8	0.3	FALSE	495	371.25	2253.95	85.4	1604.42	42.7
Tower Type A2	Bundling spacer – 3 conductor, 33 cm	AAC 31.5 mm diameter	(0.017+0.216j)	5.09192877615 2022e-06j	(0.999+0j)	(0.564+7.327j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-2.2	69 9.7	-1.9	11.9	0.3	FALSE	495	371.25	2183.51	85.6	1553.94	42.8

Tower Type C	Bundling spacer – 3 conductor, 33 cm	AAC 31.5 mm diameter	(0.017+0.212j)	5.18434499110 7786e-06j	(0.999+0j)	(0.564+7.196j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-2.2	69 9.7	-1.9	11.9	0.3	FALSE	495	371.25	2219.53	85.5	1579.75	42.8
Tower Type B2	Bundling spacer – 3 conductor, 23 cm	AAC 31.5 mm diameter	(0.017+0.241j)	4.54763279835 6005e-06j	(0.999+0j)	(0.564+8.204j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-2.5	69 9.7	-1.7	12	0.3	FALSE	495	371.25	1968.81	86.1	1400.21	43
Tower Type B1 – Double	Bundling spacer – 3 conductor, 23 cm	AAC 21.0 mm diameter	(0.019+0.232j)	4.73569038509 1749e-06j	(0.999+0j)	(0.634+7.878j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-2.4	69 9.7	-1.7	12.1	0.34	FALSE	299	224.25	2021.98	85.4	1439.41	42.7
Tower Type A2	Bundling spacer – 4 conductor, 26 cm	AAC 26.3 mm diameter	(0.018+0.209j)	5.25692787319 5806e-06j	(0.999+0j)	(0.606+7.097j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-2.2	69 9.8	-1.9	12.2	0.32	FALSE	405	303.75	2231.64	85.1	1589.29	42.6
Tower Type B1	Bundling spacer – 4 conductor, 26 cm	AAC 26.3 mm diameter	(0.018+0.201j)	5.45012310775 3459e-06j	(0.999+0j)	(0.606+6.845j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-2.1	69 9.8	-2	12.2	0.32	FALSE	405	303.75	2305.1	84.9	1642.02	42.5
Tower Type B2	Bundling spacer – 3 conductor, 33 cm	AAC 31.5 mm diameter	(0.017+0.226j)	4.85163807301 1554e-06j	(0.999+0j)	(0.564+7.69j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-2.3	69 9.7	-1.8	12.2	0.3	FALSE	495	371.25	2089.27	85.8	1486.44	42.9
Tower Type C	Bundling spacer – 4 conductor, 26 cm	AAC 26.3 mm diameter	(0.018+0.205j)	5.35548841120 3889e-06j	(0.999+0j)	(0.606+6.966j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-2.1	69 9.8	-2	12.2	0.32	FALSE	405	303.75	2269.19	85	1616.24	42.5
Tower Type B1 – Double	Bundling spacer – 3 conductor, 33 cm	AAC 21.0 mm diameter	(0.019+0.217j)	5.06627235833 1339e-06j	(0.999+0j)	(0.634+7.364j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-2.2	69 9.7	-1.9	12.3	0.34	FALSE	299	224.25	2148.88	85.1	1530.44	42.5
Tower Type B2	Bundling spacer – 4 conductor, 26 cm	AAC 26.3 mm diameter	(0.018+0.219j)	5.00120312214 9354e-06j	(0.999+0j)	(0.606+7.46j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-2.3	69 9.7	-1.8	12.5	0.32	FALSE	405	303.75	2133.47	85.4	1518.88	42.7
Tower Type B2 – Double	Bundling spacer – 3 conductor, 23 cm	AAC 21.0 mm diameter	(0.019+0.25j)	4.39305070838 7671e-06j	(0.999+0j)	(0.634+8.492j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-2.6	69 9.7	-1.6	12.5	0.34	FALSE	299	224.25	1888.51	85.7	1343.76	42.9
Tower Type B1 – Double	Bundling spacer – 4 conductor, 26 cm	AAC 16.3 mm diameter	(0.023+0.209j)	5.25405327521 5045e-06j	(0.999+0j)	(0.789+7.101j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.5	-2.2	69 9.8	-1.9	12.6	0.42	FALSE	216	162	2161.57	83.7	1542.57	41.8
Tower Type B2 – Double	Bundling spacer – 3 conductor, 33 cm	AAC 21.0 mm diameter	(0.019+0.235j)	4.67609671690 05954e-06j	(0.999+0j)	(0.634+7.978j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.6	-2.4	69 9.7	-1.7	12.7	0.34	FALSE	299	224.25	1998.9	85.5	1422.87	42.7
Tower Type B1 – Double	Bundling spacer – 2 conductor, 24 cm	AAC 31.5 mm diameter	(0.012+0.253j)	4.34451185357 5704e-06j	(0.999+0j)	(0.423+8.587j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.8	-2.6	69 9.6	-1.6	12.8	0.22	FALSE	495	371.25	1923.61	87.2	1365.86	43.6
Tower Type B1 – Double	Bundling spacer – 2 conductor, 32 cm	AAC 31.5 mm diameter	(0.012+0.244j)	4.50571089210 6696e-06j	(0.999+0j)	(0.423+8.28j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.7	-2.5	69 9.7	-1.7	12.9	0.22	FALSE	495	371.25	1990.86	87.1	1413.83	43.5
Tower Type B2 – Double	Bundling spacer – 4 conductor, 26 cm	AAC 16.3 mm diameter	(0.023+0.227j)	4.83561241121 5029e-06j	(0.999+0j)	(0.789+7.715j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.5	-2.3	69 9.7	-1.8	13	0.42	FALSE	216	162	2010.9	84.2	1434.05	42.1
Tower Type B2 – Double	Bundling spacer – 2 conductor, 24 cm	AAC 31.5 mm diameter	(0.012+0.271j)	4.05440608415 12455e-06j	(0.999+0j)	(0.423+9.202j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.8	-2.8	69 9.6	-1.5	13.1	0.22	FALSE	495	371.25	1801.88	87.4	1279.08	43.7
Tower Type B2 – Double	Bundling spacer – 2 conductor, 32 cm	AAC 31.5 mm diameter	(0.012+0.262j)	4.19444871884 8093e-06j	(0.999+0j)	(0.423+8.894j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.8	-2.7	69 9.6	-1.5	13.2	0.22	FALSE	495	371.25	1860.76	87.3	1321.05	43.6
Tower Type A1	Bundling spacer – 4 conductor, 26 cm	AAC 31.5 mm diameter	(0.012+0.193j)	5.68445195646 9492e-06j	(0.999+0j)	(0.423+6.563j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.7	-2	69 9.8	-2.1	13.3	0.22	FALSE	495	371.25	2473.85	86.3	1758.76	43.2
Tower Type A2	Bundling spacer – 4 conductor, 26 cm	AAC 31.5 mm diameter	(0.012+0.206j)	5.32927086771 666e-06j	(0.999+0j)	(0.423+7j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.7	-2.1	69 9.8	-2	13.8	0.22	FALSE	495	371.25	2329.94	86.5	1655.9	43.3
Tower Type B1	Bundling spacer – 4 conductor, 26 cm	AAC 31.5 mm diameter	(0.012+0.199j)	5.52792045093 7468e-06j	(0.999+0j)	(0.423+6.749j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.7	-2.1	69 9.8	-2	13.8	0.22	FALSE	495	371.25	2410.6	86.4	1713.55	43.2
Tower Type C	Bundling spacer – 4 conductor, 26 cm	AAC 31.5 mm diameter	(0.012+0.202j)	5.43058888539 4342e-06j	(0.999+0j)	(0.423+6.87j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.7	-2.1	69 9.8	-2	13.8	0.22	FALSE	495	371.25	2371.13	86.5	1685.34	43.2
Tower Type B2	Bundling spacer – 4 conductor, 26 cm	AAC 31.5 mm diameter	(0.012+0.217j)	5.06663521322 2634e-06j	(0.999+0j)	(0.423+7.363j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.7	-2.2	69 9.7	-1.9	14.2	0.22	FALSE	495	371.25	2222.62	86.7	1579.24	43.4
Tower Type B1 – Double	Bundling spacer – 3 conductor, 23 cm	AAC 26.3 mm diameter	(0.012+0.227j)	4.83400469048 72875e-06j	(0.999+0j)	(0.404+7.718j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.7	-2.3	69 9.7	-1.8	14.2	0.21	FALSE	405	303.75	2132.74	87	1514.75	43.5
Tower Type B1 – Double	Bundling spacer – 3 conductor, 33 cm	AAC 26.3 mm diameter	(0.012+0.212j)	5.17895499943 7324e-06j	(0.999+0j)	(0.404+7.204j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.7	-2.2	69 9.8	-1.9	14.4	0.21	FALSE	405	303.75	2275.28	86.8	1616.49	43.4
Tower Type B1 – Double	Bundling spacer – 4 conductor, 26 cm	AAC 21.0 mm diameter	(0.014+0.205j)	5.35609829843 2733e-06j	(0.999+0j)	(0.476+6.965j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.7	-2.1	69 9.8	-2	14.5	0.25	FALSE	299	224.25	2320.38	86.1	1650.18	43
Tower Type B2 – Double	Bundling spacer – 3 conductor, 23 cm	AAC 26.3 mm diameter	(0.012+0.245j)	4.47752619426 2683e-06j	(0.999+0j)	(0.404+8.332j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.8	-2.5	69 9.7	-1.6	14.5	0.21	FALSE	405	303.75	1984.11	87.2	1408.74	43.6

Tower Type B2 – Double	Bundling spacer – 3 conductor, 33 cm	AAC 26.3 mm diameter	(0.012+0.23j)	4.77192719190 3771e-06j	(0.999+0j)	(0.404+7.818j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.7	-2.4	69 9.7	-1.8	14.7	0.21	FALSE	405	303.75	2106.95	87	1496.35	43.5
Tower Type B2 – Double	Bundling spacer – 4 conductor, 26 cm	AAC 21.0 mm diameter	(0.014+0.223j)	4.92191714150 1634e-06j	(0.999+0j)	(0.476+7.58j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.7	-2.3	69 9.7	-1.8	14.9	0.25	FALSE	299	224.25	2145.86	86.4	1525.38	43.2
Tower Type B1 – Double	Bundling spacer – 3 conductor, 23 cm	AAC 31.5 mm diameter	(0.008+0.223j)	4.91582074091 05975e-06j	(0.999+0j)	(0.282+7.589j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.8	-2.3	69 9.7	-1.8	16.6	0.15	FALSE	495	371.25	2206.38	87.9	1565.06	43.9
Tower Type B1 – Double	Bundling spacer – 3 conductor, 33 cm	AAC 31.5 mm diameter	(0.008+0.208j)	5.27297786675 5299e-06j	(0.999+0j)	(0.282+7.075j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.8	-2.2	69 9.8	-1.9	16.8	0.15	FALSE	495	371.25	2359.59	87.7	1674.12	43.9
Tower Type B2 – Double	Bundling spacer – 3 conductor, 23 cm	AAC 31.5 mm diameter	(0.008+0.241j)	4.54763279835 6005e-06j	(0.999+0j)	(0.282+8.204j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.8	-2.5	69 9.7	-1.7	17	0.15	FALSE	495	371.25	2047.47	88	1452	44
Tower Type B1 – Double	Bundling spacer – 4 conductor, 26 cm	AAC 26.3 mm diameter	(0.009+0.201j)	5.45012310775 3459e-06j	(0.999+0j)	(0.303+6.845j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.8	-2.1	69 9.8	-2	17.2	0.16	FALSE	405	303.75	2426.75	87.5	1722.41	43.7
Tower Type B2 – Double	Bundling spacer – 3 conductor, 33 cm	AAC 31.5 mm diameter	(0.008+0.226j)	4.85163807301 1554e-06j	(0.999+0j)	(0.282+7.69j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.8	-2.3	69 9.7	-1.8	17.2	0.15	FALSE	495	371.25	2178.75	87.9	1545.4	44
Tower Type B2 – Double	Bundling spacer – 4 conductor, 26 cm	AAC 26.3 mm diameter	(0.009+0.219j)	5.00120312214 9354e-06j	(0.999+0j)	(0.303+7.46j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.8	-2.3	69 9.7	-1.8	17.6	0.16	FALSE	405	303.75	2235.93	87.7	1586.49	43.8
Tower Type B1 – Double	Bundling spacer – 4 conductor, 26 cm	AAC 31.5 mm diameter	(0.006+0.199j)	5.52792045093 7468e-06j	(0.999+0j)	(0.211+6.749j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.9	-2.1	69 9.8	-2	20.4	0.11	FALSE	495	371.25	2497.03	88.2	1770.37	44.1
Tower Type B2 – Double	Bundling spacer – 4 conductor, 26 cm	AAC 31.5 mm diameter	(0.006+0.217j)	5.06663521322 2634e-06j	(0.999+0j)	(0.211+7.363j)	(-0+0j)	(0.999+0j)	132	69 9.8	131.9	-2.2	69 9.7	-1.9	20.8	0.11	FALSE	495	371.25	2295.28	88.4	1626.97	44.2