# AXCLIGHT® H

## SUSPENDED CABLE FOR OVERHEAD LINES INSTALLATION INSTRUCTIONS

Nexans

# AXCLIGHT® H

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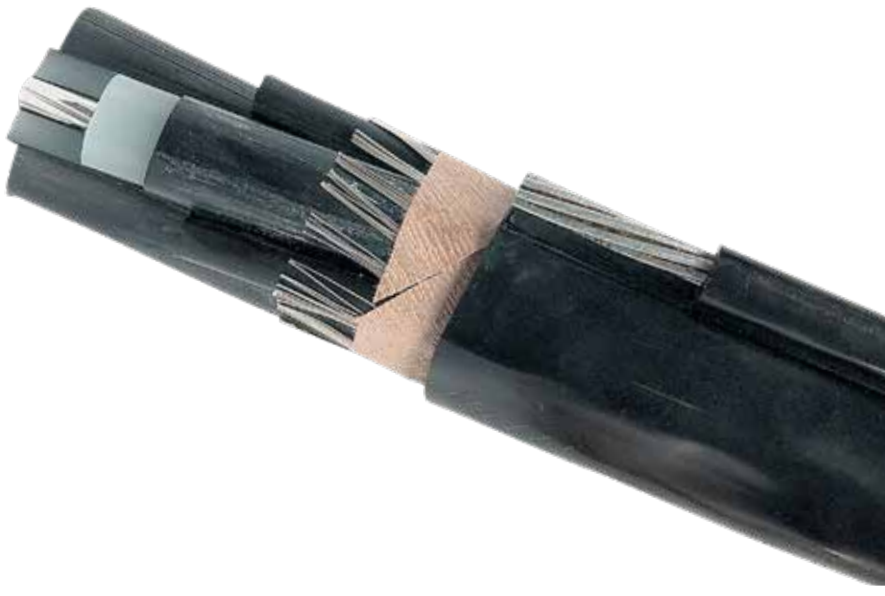
# RELIABLE AND COST EFFECTIVE

**Approximately 80% of customer downtime is the result of faults in the 12–24 kV distribution network. The best way to improve reliability of supply is to move cables underground.**

However, for projects in difficult terrain where it would be expensive and time consuming to lay cables underground, Axclight-H offers significant benefits. Launched in 1999, Axclight-H has shown itself to be extremely reliable, coping well with several major storms. For a lower investment cost than conversion to BLL, you can replace the overhead line with our Axclight-H cable.

Its strong supporting line and other structural features mean that the Axclight-H can be used to create systems with low operating, maintenance and repair costs. Other benefits include narrower line clearance widths, the ability also to run low voltage lines and telecommunication lines, and low sensitivity to lightning surges. Axclight-H can be used over land and water.

Axclight-H is available for 12-24 kV with cross-sections of 50 and 95 $mm^2$ Al. All cables have a supporting line of Fe 140, 25 $mm^2$. The line breaking load is 33.9 kN.



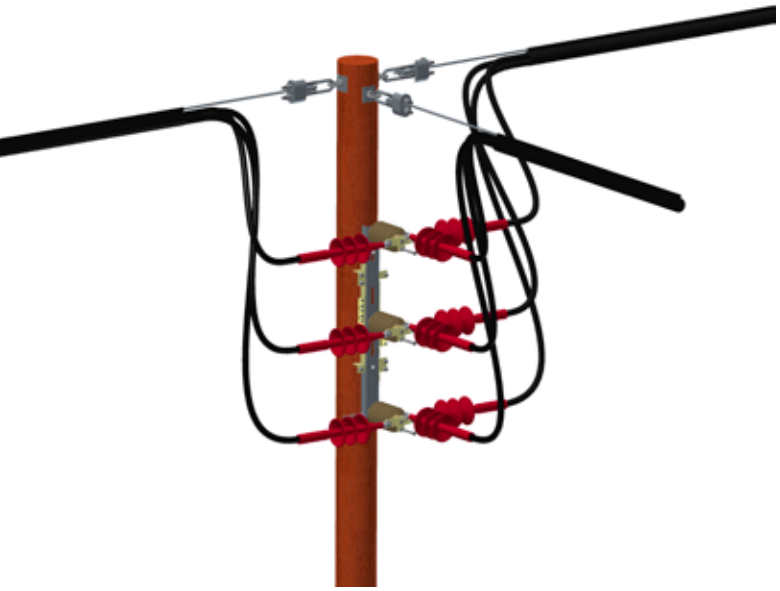
# TECHNICAL DESCRIPTION

## MECHANICAL DIMENSIONING

Dimensioning in accordance with the EBR standard K28 relating to suspended cable systems 0.4–24 kV.

## TENSIONING AND SPAN

The cable is tensioned in accordance with configuration tables. The tension is calculated so that the sag corresponds to 2% of the span at 0 °C and under the weight of the cable (except for 3x95, 24 kV, which is tensioned to 2.5% of the span). The longest normal span is assumed to be 110 m. If a longer normal span is required, a separation calculation must be carried out. The limitation is that the mechanical stress must not exceed 55% of the breaking load of the supporting line at 0 °C ice, without wind.



## INSTALLATION HEIGHT

Cables must be installed 6 m above ground in built-up areas and when crossing public roads.

In other areas, the height is 4.5 m above ground in accordance with ELSÄK-FS 2008:1.

## SUSPENSION DEVICES AND TENSIONERS

The recommended suspension device is Ensto SO 220 and wedge bolts are recommended as tensioners minimize.

## SPLICING AND SPLITTING

Splices between poles can be carried out with the supporting line relieving the cable sections of mechanical load. The best solution is to splice the supporting line with two tensioners.

Quicktap is the easiest way to split lines.

## STAYS

In order to minimise the risk of exposing the installer to two potentials in the pole, you are recommended to fit stay insulators. However, this is not a requirement.

# SUSPENSION

Breaking links should be used to reduce the risk of damage to the equipment. Breaking links are designed to fail before mechanical damage occurs to cables, suspension devices and poles.

The breaking load should be between 13 and 15 kN (breaking links must not be used on poles in crossings).

In poles in straight lines or small angles < 30° use spacing hooks (EBR 172).

For angles between 30° and 60° use double yokes SOT 73.

For tension relief and angles > 60° tension relief bracket 1 is recommended.

Angles less than 30 degrees.

Angles between 30 and 60 degrees.

Angles greater than 60 degrees.

## EARTHING

The cable screen and supporting line must be connected to earth at all terminations.

Earthing points must be provided for all applications in overhead line systems with protected details, transformer stations, circuit breakers or transitions from overhead line to cable. The earthing point is provided at the same pole if field conditions are acceptable.

It is not possible to use the supporting line as an earth connection from an earthing point along the line to the protected object, which means that a separate line must be installed as the earth connection.

When Axclight-H is used as an earth cable to a substation, the supporting line must be connected to the earth bar.

When splicing Axclight-H and Axclight-TT, the supporting line is left outside the splice and is insulated to the same electrical level as the sheath.

## WORKPLACE EARTH

A workplace earth is provided at the connections of the cable. The earth must also include the supporting line.

Alternatively, the work can be carried out as "work involving electricity" as defined in the applicable ESA Arbete instructions.

## CROSSINGS

According to Elsäkerhetsverket (Swedish National Electrical Safety Board) Directive: 30-99-0459, crossings over public roads using Axclight-H must be carried out in accordance with Issue 2 of SS 436 02 80.

## MATERIAL KITS

The material kits used in the structures are detailed in the type sheets in EBR publication K28. Contact your wholesaler for product information and pricing.

## LINE CLEARANCE WIDTH

The minimum clearance width for woodland is 2 m.

## PULLING

To avoid damaging the sheath, drag-free pulling is recommended.

Cable trailers are used for 12 kV, cross-section 50 $mm^2$ and for ALUS with gauge 76 mm. For other cross-sections, the "Snille" line trailer is used. Observe the minimum permitted bending radius of the cable, using double trailers for angles greater than 30°.

Axclight-H may be pulled to long lengths, but the length should not exceed 1500 m if the section includes many large angles or if the line is cut. Long cable lengths are heavy to pull and difficult to adjust when fitting.

## OVERVOLTAGE PROTECTION

Nonlinear resistance arresters are fitted when the cable joins with overhead line.

Nonlinear resistance arresters are also recommended for safety devices and circuit breakers if the cable length is between 50–250 m.

## TEMPLATES

Suitable marking templates are given in tables in the calculation program, EBR K28.

# INTEGRATION

Integration is carried out in accordance with the applicable assembly instructions issued by Svensk Energi in collaboration with Telia, Trafikverket (Swedish Transport Administration) and the Kommunförbundet (Swedish Association of Local Authorities). See also the high current regulations §B103 section 1 and SS 436 01 12 ”Integration of overhead lines for high current and low current. Mechanical dimensioning”.

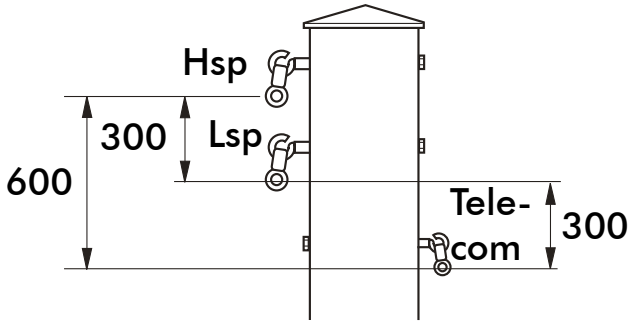
Pole-mounted substation.

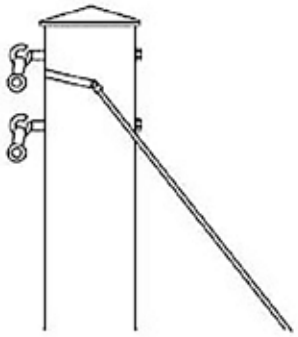
Suspension with breaking link.

# REQUIRED SPACING

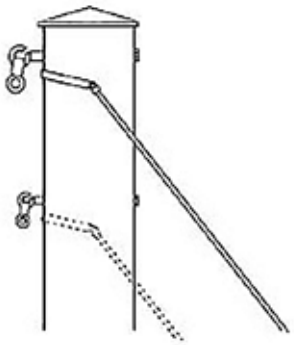
Take account of any differences in the sag of the various cables.

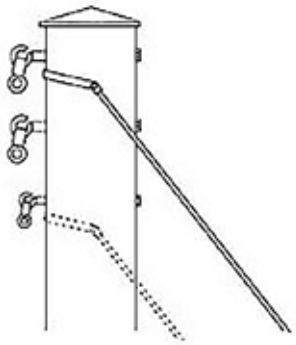
The diagram on the left shows the minimum required distances between pole fixings.



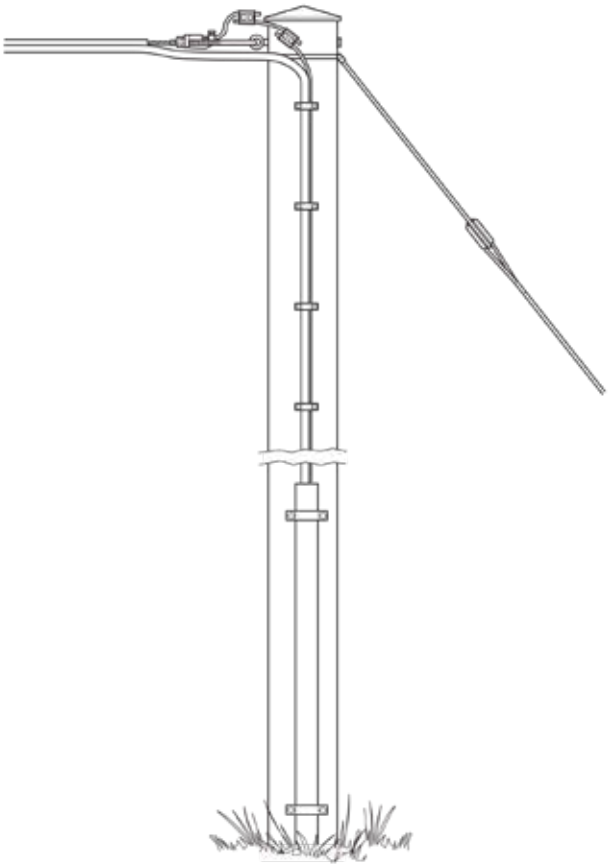
Extra stay not usually required.



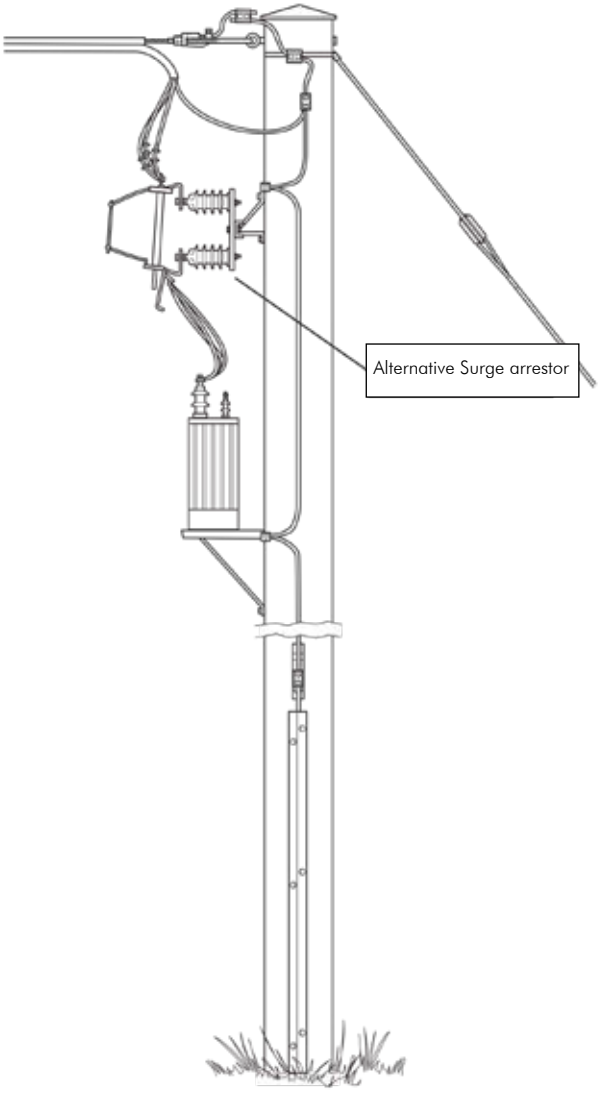


Extra stay recommended when integrating with low current cable.

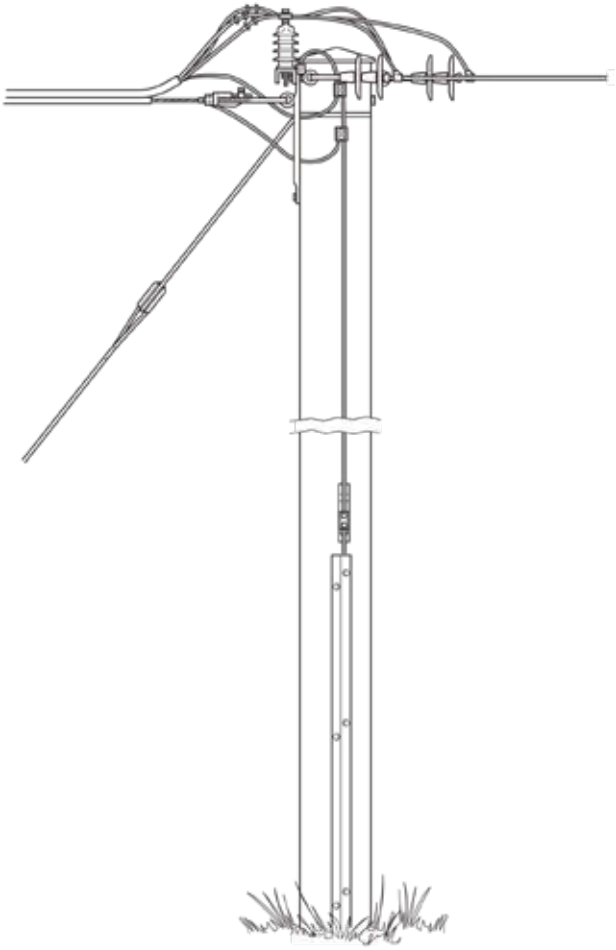
# INSTALLATION EXAMPLE



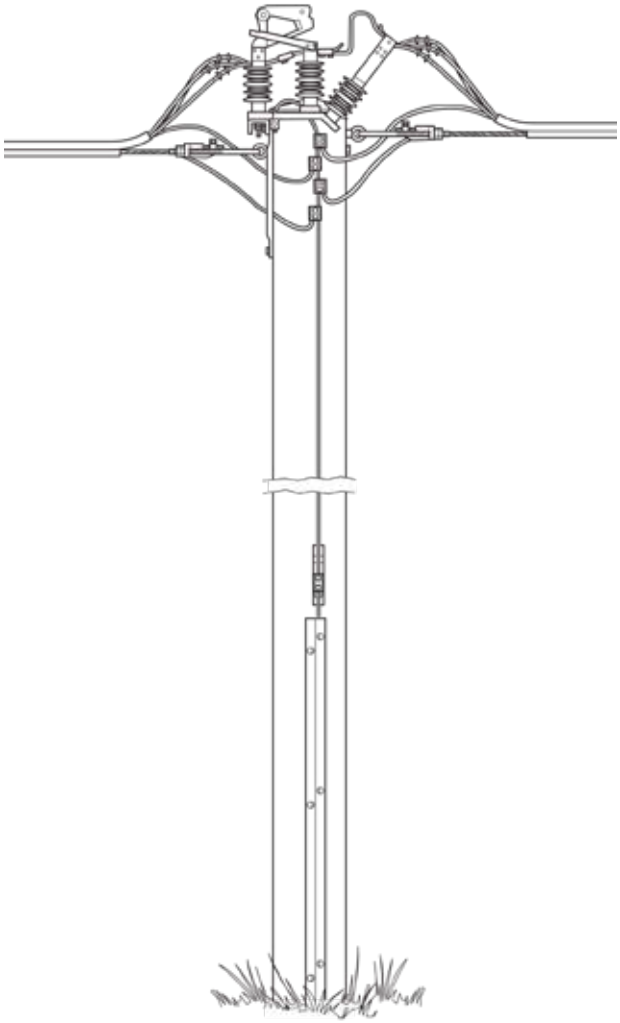
Terminating pole HKÄ 12 and HKÄ 22




Transformer station T1



Transition from overhead line to cable



Disconnectors

# GENERAL DATA

## AXCLIGHT®-H 12 KV

| Name | Axclight-H 3x50 Al | Axclight-H 3x95 Al |
|---|---|---|
| Conductor diameter mm | 8,0 | 11,3 |
| Screen cross-section $mm^2$ | 16 | 16 |
| Insulating wall mm | 3,4 | 3,4 |
| Diam. over semic. mm | 17,4 | 20,7 |
| External diameter mm | 44 | 51 |
| Height mm | 58 | 66 |
| Net weight kg/m | 1,85 | 2,50 |
| Cross-section of steel line $mm^2$ | 24,7 | 24,7 |
| Load capacity, A 90 °C conductor temp. in air 25 °C | 160 | 230 |
| Load capacity, A 90 °C conductor temp. in air 50 °C | 120 | 172 |
| Load capacity, A 90 °C conductor temp. in ground 15 °C | 170 | 240 |
| Conductor resistance Ω/km | 0,641 | 0,320 |
| Inductance mH/km | 0,35 | 0,32 |
| Capacitance μF/km | 0,24 | 0,32 |
| Max short circuit current 1 sec, kA 90 °C - 250 °C | 4,90 | 9,24 |
| Cap. of earth current A/km | 1,31 | 1,74 |
| E. modulus of supporting line, MPa | 180000 | 180000 |
| Stretch | 11*10-6/°C | 11*10-6/°C |
| Min breaking load, kN | 33,9 | 33,9 |
| Max permitted load, kN,55% | 18,6 | 18,6 |

# AXCLIGHT®-H 24 KV

| Name | Axclight-H 3x50 Al | Axclight-H 3x95 Al |
|---|---|---|
| Conductor diameter mm | 8,0 | 11,3 |
| Screen cross-section $mm^2$ | 16 | 16 |
| Insulating wall mm | 5,5 | 5,5 |
| Diam. over semic. mm | 21,6 | 24,9 |
| External diameter mm | 54 | 61 |
| Height mm | 68 | 76 |
| Net weight kg/m | 2,35 | 3,05 |
| Cross-section of steel line $mm^2$ | 24,7 | 24,7 |
| Load capacity, A 90 °C conductor temp. in air 25 °C | 160 | 230 |
| Load capacity, A 90 °C conductor temp. in air 50 °C | 120 | 172 |
| Load capacity, A 90 °C conductor temp. in ground 15 °C | 170 | 240 |
| Conductor resistance Ω/km | 0,641 | 0,320 |
| Inductance mH/km | 0,40 | 0,36 |
| Capacitance μF/km | 0,17 | 0,22 |
| Max short circuit current 1 sec, kA 90 °C - 250 °C | 4,90 | 9,24 |
| Cap. of earth current A/km | 1,85 | 2,39 |
| E. modulus of supporting line, MPa | 180000 | 180000 |
| Stretch | 11*10-6/°C | 11*10-6/°C |
| Min breaking load, kN | 33,9 | 33,9 |
| Max permitted load, kN,55% | 18,6 | 18,6 |

# AXCLIGHT®-H 3X50/16 12 KV

| Load case | Normalspan | 70 m | 80 m | 90 m |
|---|---|---|---|---|
| 0 °C no wind | Tensile force N | 8093 | 9250 | 10406 |
| | Sag m | 1,40 | 1,60 | 1,80 |
| | Template no | 1142 | 1000 | 888 |
| -50 °C no wind | Tensile force N | 9366 | 10588 | 11801 |
| | Sag m | 1,21 | 1,40 | 1,59 |
| | Template no | 987 | 874 | 785 |
| 0 °C ice, no wind | Tensile force N | 12303 | 13795 | 15260 |
| | Sag m | 1,92 | 2,23 | 2,55 |
| | Template no | 1567 | 1393 | 1259 |
| After permanent stretching and shrinkage | | | | |
| 0 °C ice, no wind | Tensile force N | 12303 | 13795 | 15260 |
| | Sag m | 1,92 | 2,23 | 2,55 |
| | Template no | 1567 | 1393 | 1259 |
| +65 °C no wind | Tensile force N | 6830 | 7867 | 8915 |
| | Sag m | 1,66 | 1,88 | 2,10 |
| | Template no | 1355 | 1174 | 1037 |

# NORMAL SPAN = 70 M

| Line temp | Tensile force | Sag in m with span of: | | | | |
|---|---|---|---|---|---|---|
| 0 ° | N | 50 m | 60 m | 70 m | 80 m | 90 m |
| 20 | 7661 | 0,75 | 1,09 | 1,48 | 1,93 | 2,44 |
| 10 | 7872 | 0,73 | 1,06 | 1,44 | 1,88 | 2,38 |
| 0 | 8093 | 0,71 | 1,03 | 1,40 | 1,83 | 2,31 |
| -10 | 8325 | 0,69 | 1,00 | 1,36 | 1,78 | 2,25 |
| -20 | 8567 | 0,67 | 0,97 | 1,32 | 1,73 | 2,19 |

Sag corresponds to 2% of normal span.

# AXCLIGHT®-H 3X50/16 24 KV

| Load case | Normalspan | 70 m | 80 m | 90 m |
|---|---|---|---|---|
| 0 °C no wind | Tensile force N | 10281 | 11750 | 13218 |
| | Sag m | 1,40 | 1,60 | 1,80 |
| | Template no | 1142 | 1000 | 888 |
| -50 °C no wind | Tensile force N | 11669 | 13218 | 14756 |
| | Sag m | 1,23 | 1,42 | 1,61 |
| | Template no | 1004 | 887 | 795 |
| 0 °C ice, no wind | Tensile force N | 14150 | 15914 | 17652 |
| | Sag m | 1,88 | 2,19 | 2,50 |
| | Template no | 1534 | 1368 | 1234 |
| After permanent stretching and shrinkage | | | | |
| 0 °C ice, no wind | Tensile force N | 14150 | 15914 | 17652 |
| | Sag m | 1,88 | 2,19 | 2,50 |
| | Template no | 1534 | 1368 | 1234 |
| +65 °C no wind | Tensile force N | 8801 | 10156 | 11525 |
| | Sag m | 1,64 | 1,85 | 2,06 |
| | Template no | 1338 | 1156 | 1017 |

# NORMAL SPAN = 70 M

| Line temp | Tensile force | Sag in m with span of: | | | | |
|---|---|---|---|---|---|---|
| 0 ° | N | 50 m | 60 m | 70 m | 80 m | 90 m |
| 20 | 9787 | 0,75 | 1,08 | 1,47 | 1,92 | 2,43 |
| 10 | 10029 | 0,73 | 1,05 | 1,44 | 1,87 | 2,37 |
| 0 | 10281 | 0,71 | 1,03 | 1,40 | 1,83 | 2,31 |
| -10 | 10541 | 0,70 | 1,00 | 1,37 | 1,78 | 2,26 |
| -20 | 10811 | 0,68 | 0,98 | 1,33 | 1,74 | 2,20 |

Sag corresponds to 2% of normal span.

# AXCLIGHT®-H 3X95/16 12 KV

| Load case | Normalspan | 70 m | 80 m | 90 m |
|---|---|---|---|---|
| 0 °C no wind | Tensile force N | 10937 | 12500 | 14062 |
| | Sag m | 1,40 | 1,60 | 1,80 |
| | Template no | 1142 | 1000 | 888 |
| -50 °C no wind | Tensile force N | 12381 | 14000 | 15611 |
| | Sag m | 1,24 | 1,43 | 1,62 |
| | Template no | 1012 | 893 | 800 |
| 0 °C ice, no wind | Tensile force N | 14732 | 16560 | 18362 |
| | Sag m | 1,87 | 2,17 | 2,48 |
| | Template no | 1526 | 1356 | 1224 |
| After permanent stretching and shrinkage | | | | |
| 0 °C ice, no wind | Tensile force N | 14732 | 16560 | 18362 |
| | Sag m | 1,87 | 2,17 | 2,48 |
| | Template no | 1526 | 1356 | 1224 |
| +65 °C no wind | Tensile force N | 9417 | 10851 | 12299 |
| | Sag m | 1,63 | 1,84 | 2,06 |
| | Template no | 1330 | 1150 | 1017 |

# NORMAL SPAN = 70 M

| Line temp | Tensile force | Sag in m with span of: | | | | |
|---|---|---|---|---|---|---|
| 0 ° | N | 50 m | 60 m | 70 m | 80 m | 90 m |
| 20 | 10428 | 0,75 | 1,08 | 1,47 | 1,92 | 2,43 |
| 10 | 10678 | 0,73 | 1,05 | 1,43 | 1,87 | 2,37 |
| 0 | 10937 | 0,71 | 1,03 | 1,40 | 1,83 | 2,31 |
| -10 | 11205 | 0,69 | 1,00 | 1,37 | 1,78 | 2,26 |
| -20 | 11482 | 0,68 | 0,98 | 1,33 | 1,74 | 2,20 |

Sag corresponds to 2% of normal span.

# AXCLIGHT®-H 3X95/16 24 KV

| Load case | Normalspan | 70 m | 80 m | 90 m |
|---|---|---|---|---|
| 0 °C no wind | Tensile force N | 10675 | 12200 | 13725 |
| | Sag m | 1,75 | 2,00 | 2,25 |
| | Template no | 1428 | 1249 | 1111 |
| -50 °C no wind | Tensile force N | 11794 | 13395 | 14988 |
| | Sag m | 1,58 | 1,82 | 2,06 |
| | Template no | 1289 | 1137 | 1017 |
| 0 °C ice, no wind | Tensile force N | 14429 | 16266 | 18077 |
| | Sag m | 2,14 | 2,48 | 2,83 |
| | Template no | 1746 | 1549 | 1397 |
| After permanent stretching and shrinkage | | | | |
| 0 °C ice, no wind | Tensile force N | 14429 | 16266 | 18077 |
| | Sag m | 2,14 | 2,48 | 2,83 |
| | Template no | 1746 | 1549 | 1397 |
| +65 °C no wind | Tensile force N | 9475 | 10891 | 12318 |
| | Sag m | 1,97 | 2,24 | 2,51 |
| | Template no | 1608 | 1400 | 1239 |

# NORMAL SPAN = 70 M

| Line temp | Tensile force | Sag in m with span of: | | | | |
|---|---|---|---|---|---|---|
| 0 ° | N | 50 m | 60 m | 70 m | 80 m | 90 m |
| 20 | 10276 | 0,93 | 1,34 | 1,82 | 2,37 | 3,00 |
| 10 | 10472 | 0,91 | 1,31 | 1,78 | 2,33 | 2,95 |
| 0 | 10675 | 0,89 | 1,29 | 1,75 | 2,29 | 2,89 |
| -10 | 10884 | 0,88 | 1,26 | 1,72 | 2,24 | 2,84 |
| -20 | 11100 | 0,86 | 1,24 | 1,68 | 2,20 | 2,78 |

Sag corresponds to 2,5 % of normal span.

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