WESTERN POWER DISTRIBUTION

*Serving the Midlands, South West and Wales*

# Company Directive

## STANDARD TECHNIQUE: OH4T/4

## The Design of Single Circuit High Voltage Overhead Lines on Wood Poles at 11kV and 33kV


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**Implementation Date:** September 2016

**Approved by**

**Policy Manager**

**Date:** 21 September 2016

## Implementation Plan

### Introduction
This ST details the design and construction requirements when building single circuit 11 & 33kV wood pole lines.

### Main Changes
To improve overhead line resilience and mitigate the risks of cascade failure under severe ice and wind loadings, clause 3.13 and 3.14 have been introduced, this will limit failure to a small section of OH line and mitigate risks associated with failure over strategic crossings.

Section 4 introduces a requirement to only use materials approved by WPD and introduces Clauses 4.7 & 4.9 relating to the application of Helical Fittings and Bills of Materials (BoM's) respectively; BoM's have also been included against all relevant GA Drawing in appendix N.

To benefit from the introduction of Medium Stout class poles their windloading and strut loading capability has been updated in all relevant tables throughout the document.

Fig 6 GA for 'Tee Off' pole amended to clarify the requirements for all conductor sizes. Distance between top crossarm and tee off crossarm has also amended to ensure minimum clearances are maintained to allow work should the tee off be disconnected.

For clarity GA drawings for 'H' pole foundations have also been included.

### Impact of Changes
There will be very little impact to the business as for the most part the requirements for cascade failure are already being met by the natural design of process, however this change formalised the requirement to actively consider cascade failure as part of the planning and construction process.

The introduction of Table 4, bills of materials and foundation drawing help clarify requirements of build and will assist the business in the day to day planning and construction of new overhead lines.

### Implementation Actions
Team managers shall brief all relevant staff e.g. Linesmen, Planners, Surveyors, Technicians, and Wayleave Officers of these changes.

Planners / Surveyors shall implement these requirements when planning and surveying all new overhead lines schemes.

Overhead Trainers to update these requirements into their training material.

### Implementation Timetable.
This Standard Technique should be implemented as of 1st November 2016; however it should be noted the requirements to mitigate the risks of cascade failure are not retrospective to existing lines or planned work.

| Document Revision & Review Table | | |
|---|---|---|
| **Date** | **Comments** | **Author** |
| Sept 2016 | 1. Clause 2.4 amended with a requirement to design new and re-conductored lines wherever possible with a design temperature of 75$^{o}$C.<br>2. Introduction of clauses 3.13 Failure Containment and 3.14 Strategic Crossing Requirements.<br>3. Section 4 introduces a requirement to only use materials approved by WPD and inclusion of new clauses 4.7 Helical Fittings & 4.9 - Bill of Materials (BoM's).<br>4. Introduction of Medium Stout class poles in the 'Unstayed Pole Wind Span Limits' tables in Appendices A to K.<br>5. Appendix N inclusion / amendments include:-<br>• Table N2 Medium Stout Strut Loadings, other tables also amended to provide versatility on foundation blocks which can be used to obtain the desired strut loading capability. Subsequent tables renumbered.<br>• Fig 6 'Tee Off' Pole amended to clarify the requirements for all conductor sizes. Distance between top crossarm and tee off crossarm also amended to ensure minimum clearances are maintained to allow work should the tee off be disconnected.<br>• Bills of Materials (BOMs) included against GA drawings.<br>• GA drawings for 'H' pole foundations | Mike Chapman |
| Jan 2014 | 1. Introduction of Medium Stout class poles for use on 38mm HDC & 50AAAC in Normal Loading Environment. For further information on implementation refer to **Tool Box Briefing OHL01.14**<br>2. Reference to 'Hard Drawn Aluminium' replaced in favour of 'All Aluminium Conductor (AAC)' | Mike Chapman |
| Feb 2013 | 1. Section 4.6 - Allowance for the use of 11kV Polymeric Pin Insulators 50447.<br>2. Inclusion of Extra Stout Poles for conductors greater than 25mm HDC, in the unstayed pole wind span limits tables.<br>3. Inclusion of additional augured depths 2.4m up to 14m poles and 2.6m over 14m for all conductors in the unstayed pole wind span limits tables.<br>4. Inclusion of 11kV poly pins on relevant GA drawings.<br>5. Addition of kN tensions in sag and tension tables for all conductors.<br>6. Re-adjustment of page numbering | Mike Chapman |

**CONTENTS**

## 1. INTRODUCTION

1.1. This Standard Technique describes the design approach to be taken for WPD's single circuit overhead lines on wood poles at 11kV and 33kV.

1.2. This Standard Technique replaces ST:OH4D and ST:OH4G, covering both "light" and "heavy" construction designs in a single document, in line with ENA Technical Specification 43-40 Issue 2, and shall be used for all new, wood pole overhead lines, including diversions and refurbishments involving conductor replacement.

1.3. This Standard Technique covers a range of conductor sizes, both copper and aluminium alloy, which should be used as standard. Should an alternative size or type of conductor be required, the Overhead Line Engineer should be consulted.

1.4. Contained within the Appendices are a series of design tables, generated in accordance with the design requirements set out within the rest of this document, intended to allow an overhead line to be designed without recourse to any design software. As a result, a certain amount of conservatism is built in to these tables. Where a more precise design is required, an Excel-based ENATS 43-40 design package is available. A user guide to this software is included in ENATS 43-40.

## 2. CONDUCTORS

2.1. The standard conductors that may be used on 11kV poles dressed with "light" crossarms are:

| | |
|---|---|
| Hard Drawn Copper (HDC): | $25mm^2$ |

2.2. The standard conductors that may be used on 11kV and 33kV poles dressed with "heavy" crossarms are:

| | |
|---|---|
| Hard Drawn Copper (HDC): | $38mm^2$, $70mm^2$, $100mm^2$, $150mm^2$ |
| All Aluminium Alloy (AAAC): | $50mm^2$ "Hazel"*, $60mm^2$ "Pine"<br>$100mm^2$ "Oak", $150mm^2$ "Ash",<br>$175mm^2$ "Elm", $200mm^2$ "Poplar" |
| All Aluminium (AAC) | $300mm^2$ "Butterfly", $400mm^2$ "Centipede" |

* "Hazel" AAAC is **NOT** to be used within 5km of the coast, or where significant salt pollution is known to occur.

2.3. ACSR conductors shall not be used.

2.4. Lines shall be profiled for a minimum rated temperature of 55°C; however, in order to benefit from the additional current capability of conductors, wherever possible all new and re-conductored lines shall be designed to a rated temperature of 75°C.

2.5. The choice of conductor material (hard drawn copper v aluminium alloy) should take into account local conditions as well as relative costs. As a guide, the following table indicates the equivalences between the two materials:

| HDC SIZE ($mm^2$) | EQUIVALENT AAAC SIZE ($mm^2$) |
|---|---|
| 25 | n/a |
| 38 | 50 or 60 |
| 70 | 100 |
| 100 | 150 or 175 |
| 150 | 200 |

## 3. DESIGN REQUIREMENTS

### 3.1. Weather Loads:

Wind and ice loads shall be considered according to the environment in which the overhead line is to be constructed, and according to the cross-sectional area of the conductor.

For areas at altitudes up to and including 300m above sea level, the "*normal*" environment shall apply. For areas above 300m and up to 500m altitude above sea level, the "*severe*" environment shall apply. Where local knowledge indicates that areas below 300m are particularly exposed and/or subject to more onerous weather conditions, the "severe" environment should be applied. Where lines are to be built above 500m altitude, the Overhead Line Engineer shall be consulted.

For all conductors <u>other than</u> $25mm^2$ HDC, the weather loading parameters to be used shall be:

"*Normal*" environments: 380 $N/m^2$ wind pressure, 9.5mm radial ice
"*Severe*" environments: 570 $N/m^2$ wind pressure, 12.5mm radial ice

In both "*normal*" and "*severe*" environments, temperature shall be taken as -5.6°C, ice density shall be taken as $913kg/m^3$, and a factor of safety of 2.0 on the conductor shall apply as detailed in [3.2] below.

For $25mm^2$ HDC, a wind pressure of 760 $N/m^2$ may be used, with no ice loading, for both "*normal*" and "*severe*" environments. In this case, a factor of safety of 2.5 on the conductor shall apply as detailed in [3.2] below.

## 3.2. Safety Factors:

| Component | Safety Factor |
|---|---|
| Foundations (all poles) | 2.5 |
| Unstayed Pole (up to 1:10 downpull) | 2.5 |
| (up to 1:7.5 downpull) | 3.0 |
| (up to 1:5 downpull) | 3.5 |
| Stayed Pole | 2.5 |
| Stays and Stay Assemblies | 2.5 |
| Steelwork and Fasteners | 2.5 |
| Pin/Post Insulators | 2.5 |
| Tension Insulators | 3.0 (See Note) |
| Conductors Not Subject to Ice Loading | 2.5 (See Note) |
| Conductors Subject to Ice Loading | 2.0 (See Note) |

Note: The factors of safety relating to tension insulators and conductors are taken into account in determining the Maximum Working Tension (MWT) limits given for the conductors in the Appendices. Tension insulators are rated at 70kN maximum, giving an upper limit on MWT of 23.33kN (or 2379 kgf) for any conductor.

## 3.3. Basic Span and Equivalent Span Values:

The basic span (a standard, assumed equivalent span used for the calculation of sags and tensions) to be used will depend on the conductor and on the environment in which the line is built. Because a line's equivalent span affects its sag/tension behaviour, it is important that the basic span chosen for the purposes of calculation and the actual equivalent span are as close as practical.

When assessing the maximum loads imposed on structures by the conductors, it is important that the basic span used in calculations is no smaller than the actual equivalent span. Conversely, when assessing sags and clearances, it is important that the basic span is no larger than the equivalent span.

In order to ensure that the standardised design information detailed in the Appendices is safe, a maximum equivalent span has been used to derive the structure loading tables, and a minimum equivalent span has been used to derive the sag/tension tables. These maximum and minimum values are given as follows:

| Conductor | Recommended Equivalent Span Range (m) "*normal*" environment | "*severe*" environment |
|---|---|---|
| 25 & 38mm$^2$ HDC<br>50 & 60mm$^2$ AAAC | 90 - 110 | 70 - 90 |
| 70, 100 & 150mm$^2$ HDC<br>100, 150, 175 & 200mm$^2$ AAAC<br>300 & 400 mm$^2$ Aluminium | 110 - 130 | 90 - 110 |

Line sections (between section poles) should be designed to have an equivalent span within the range given above. This will ensure that when applying the information in the Appendices, poles are not inadvertently overloaded and nor will sags be greater than expected. Where there is a requirement to design a line with an equivalent span outside the above ranges, the advice of the Overhead Line Engineer should be sought.

Note that because the equivalent span is, in effect, similar to an average value of span length, individual span lengths can lie outside this range.

In order to calculate the equivalent span of a line section, the following equation applies:

Equivalent Span = $\sqrt{\frac{\sum L^3}{\sum L}}$ Where $L$ is Span Length.

(Take the sum of the cubes of the span lengths, then divide by the sum of the span lengths, then take the square root of the answer.)

### 3.4. Maximum Individual Span Length:

The maximum permissible length of any given individual span will be determined by either the clashing limit, or by the wind loading limit of any intermediate structures supporting the span.

Clashing Limit: This limit on span length, applicable to all spans of an overhead line, reduces the risk of inter-phase clashing during a storm event as a result of gusting wind and uneven icing of the conductors. The Appendices indicate the single span length limits for each of the standard conductors, which vary according to the crossarm phase spacing.

**Note that for 25mm$^2$ HDC, the "*normal*" altitude limit is <u>200m</u> for the purposes of determining clashing limit.**

Wind Load Limit: The critical load for an intermediate (unstayed) pole is the bending load resulting from the wind acting on both the pole itself and the attached conductors. The wind load limit for a given pole is therefore determined by the wind span (defined as half the sum of the adjacent span lengths), rather than the length of a particular span. For each standard conductor, the Appendices detail the wind span limits for single pole structures and their foundations.

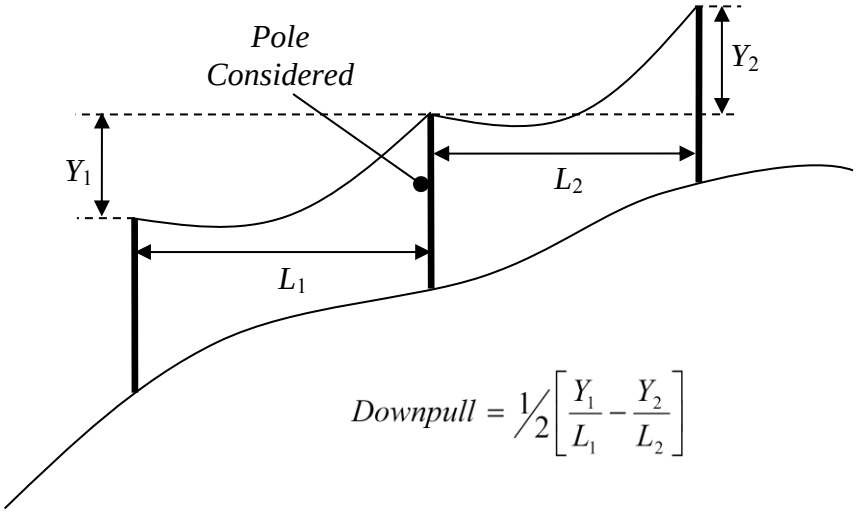
The wind load limit of an "H" pole intermediate structure is assumed to be double that for a single pole having the same number of kicking blocks. Note that the brace block connecting the two legs of an "H" pole is not considered as a kicking block and does not contribute to the wind load limit.

The use of a trussing set on an intermediate "H" pole structure may be assumed to be equivalent to fitting two kicking blocks to each leg of the structure.

The wind load limit on span length only applies to unstayed structures. Stayed structures are restricted by the clashing limit only. The capability of straight-line intermediate structures may therefore be enhanced by the addition of wind stays (see [3.7] below), in which case the strut loads are given by the "stayed structure" design tables where the angle of deviation is 0°.

## 3.5. Conductor Downpull / Uplift

For the purposes of this document, downpull at a particular pole is defined as half the sum of the adjacent gradients, as illustrated below. Note that downpull gradients are considered positive, and uplift gradients negative. In the example below, the gradient of span $L_2$ is therefore subtracted from the gradient of span $L_1$, as it is negative.



The resulting downpull value is therefore the equivalent symmetrical gradient each side of the pole that would give the same vertical loading. For the standard pole-top arrangements in Appendix L, the standard downpull limit is 1:10 (1/10). For some combinations of conductor system and pole top steelwork, this limit is reduced to 1:20, as indicated in the Appendices corresponding to the affected conductors.

Where a line profile indicates a support is below the -5.6 °C cold curve of the conductor (i.e. there is no "belly" in the conductor in one or both of the spans being supported), the pole is in an uplift condition and a section pole must be used.

### 3.6. Long Spans (e.g. Valley and River Crossings)

It is occasionally necessary for a single span to be significantly longer than the limits given in the Appendices, for example when crossing a valley or a river.

In these cases, the "Queen Mary" long span crossarm (ITEM 30399) with 10ft phase centres, and 10ft pole centres should be used. Previous experience with this structure type has shown that it is suitable for use on spans up to 450m length.

Such crossings should be section-section, with the crossarm perpendicular to the line direction, maximising inter-phase spacing. The structures should be designed to terminate the long span, with additional stays potentially being required if the adjacent spans approach at an angle. Further details are available from the Company Overhead Line Engineer.

### 3.7. Deviation Angles and Stay Requirements

Deviation angles may be limited either by the strength of pole-top components, or by stay assembly capabilities. The Appendices indicate the limitations of specific pole-top arrangements for each of the standard conductors, along with the associated capabilities of stay assemblies.

All poles supporting a deviation angle should be stayed, the angle of deviation being rounded up to the nearest 5° degrees for the purposes of strut load calculation and stay assembly requirement.

Where wind stays are used for intermediate or straight section poles, stays should be fitted on both sides of the structure. As these poles are stayed, the wind span limits given in the Appendices do not apply. Instead, strut loads for a 0° deviation angle need to be considered, and span lengths are restricted only by the clashing limit.

Stays shall have a minimum angle to the pole of 30°.

Appendix P contains charts to aid in the determination of stay positions and rakes.

### 3.8. Strut Loads in Stayed Pole Structures

The total strut load for any structure is dependent on the conductor system, deviation angle, and stay angle. Values for the standard conductors are given in the Appendices.

For single poles, the total structure load will be the same as the individual pole load, however for "H" poles the situation is a little more complicated. "H" pole structures utilising an even staying arrangement (both poles fitted with identical stay arrangements) will experience a 50/50 split of the total structure load in each pole. "H" pole structures with an uneven staying arrangement (3 stays) shall be assumed to experience a 60/40 split of the total structure load. As "H" pole structures must be constructed with a matched pair of poles, each pole of an unevenly stayed structure must be sized to take 60% of the total structure load. In other words, the total structure capability in this case needs to match 120% of the total structure load. Foundation capability for the structure is similarly affected, as described in [3.11] below.

## 3.9. Conductor Sags and Tensions

The design tension of a conductor is limited by either the Maximum Working Tension (MWT) limit under ice and wind loading, or by the Every Day Tension (EDT) limit at a nominal temperature of 5°C in the absence of any ice or wind.

Whilst the MWT limit ensures a conductor's safety factor is maintained under peak loading conditions, the EDT limit ensures that the occurrence of harmful levels of wind-induced vibration are minimised. The EDT limit is equal to 33% of the conductor's breaking load for copper conductors, and 20% for aluminium-based conductors.

Design sags and tensions are given in the Appendices, and have been calculated according to the ruling limit for each of the standard conductors, and for the basic span given by [3.3].

The conductor design parameters detailed in the Appendices, however, may not match the figures outlined above. Because the MWT limit can be affected by basic span, the EDT limits for some of the standard conductors have been given at -5.6°C, with a MWT limit quoted at the maximum permissible 2379 kgf in order to "force" the correct basis when used with standard OHL design software. This ensures that quoted erection tensions are consistent for the full range of line equivalent spans given in [3.3] above.

## 3.10. Conductor Creep and Erection Tensions

Over the life of a conductor, a certain amount of permanent elongation, or creep, will occur. This shall be compensated for by over-tensioning the conductor when erected. The amount of over-tension to be applied shall be equivalent to 10% at 15°C.

This over-tension has been incorporated into the erection sag and tension tables given in the Appendices.

## 3.11. Pole Foundations

For the purposes of designing the foundations for intermediate (unstayed) poles, soils are categorised either by their maximum rupturing capability (G), or by general description, taken from ENATS 43-40 Issue 1 (now superseded by issue 2) as follows:

| | |
|---|---|
| *Poor* | *Soft clay, clay loam, poorly compacted sand clays containing a large amount of silt and vegetable matter, and made ground.* |
| *(G = 230 KN/m$^2$/m)* | *Poor soils are normally wet and poorly drained.* |
| *Average* | *Compact fine sand, medium clay, compact, well drained sandy loam, loose coarse sand and gravel.* |
| *(G = 390 KN/m$^2$/m)* | *Average soils should drain sufficiently well that water does not stand on the surface.* |
| *Good* | *Compact, well graded sand and gravel, hard clay, well graded fine and course sand, decomposed granite rock and soil.* |
| *(G = 630 KN/m$^2$/m)* | *Good soils should be well drained and in locations where water will not stand.* |

Standard burial depths for poles shall be:

| | |
|---|---|
| Dug: | 1.8m for poles up to 14m length, 2.1m for longer poles. |
| Augured: | 2.4m for poles up to 14m length, 2.6m for longer poles<br>Or<br>2.8m for poles up to 14m length, 3.0m for longer poles. |

The burial depths above assume that the ground is fairly level, with a maximum gradient of 1:10. For steeper ground, up to 1:5 gradient, burial depths shall be increased by 300mm.

For unstayed structures, the Appendices give the wind span capabilities of the structure and foundation for various combinations of pole length, pole grade, soil category and number of kicking blocks installed on the pole.

For stayed structures, Appendix N gives the strut load capability for various combinations of pole length, pole grade, and number of blocks installed. Soil is assumed to be “average” for the purposes of assessing bearing capacity.

Note that for "H" poles, the total structure capabilities given in Appendix N assume a 50/50 load distribution between the two, individual poles. For unevenly-stayed structures, the total strut load given by the corresponding design tables must be multiplied by a factor of 1.2 prior to comparison with capability tables in Appendix N.

All single pole, stayed structures should preferably be installed in a standard pole pit, and fitted with at least a single kicking block in the top position (in order to minimise the risk of leaning in service). A second block in the bottom position may be required to extend the wind span, or to increase the strut loading capability.

Augured poles are acceptable for single pole, intermediate and stayed structures; however a kicking block will still need to be installed on a stayed pole to avoid the possibility of sinking due to the resulting strut loading limitation of the soil.

Stayed "H" pole structures may be installed with, or without, kicking blocks fitted to the individual legs, depending on the strut strength required as indicated in the appropriate design tables.

Where unstayed intermediate "H" poles are used, for example where extended wind spans are needed, it is recommended that at least a single kicking block is fitted to each leg. Alternatively, trussing tackle may be used to provide the appropriate rigidity of the structure. An intermediate "H" pole fitted with a trussing set may be considered as the equivalent of two, single pole intermediates fitted with two kicking blocks each for wind span capability assessment.

In very poor soils where standard foundations do not give the required strut loading capacity, "bog-shoe" foundations as per Figures F15 and F16 should be used.

## 3.12. Electrical Clearances

Lines shall be designed to the electrical clearances given by ST: OH1A. The suitability of the final line design shall be determined by the appropriate line profiling software in conjunction with survey data.

## 3.13. Failure Containment

To improve network resilience and mitigate risks associated with cascade failure due to severe ice and wind loadings or local environmental issues it is necessary to limit section lengths to no more than 10 spans in all areas.

As such each newly constructed line shall be constructed with failure containment supports adequate to arrest cascade failure, these shall be separated by not more than 10 spans.

The following list can be considered as failure containment supports

- Section Supports Figs 4, 9, 10, 11
- Terminal Supports Figs 5, 12, 13

Consideration should also be given to the strategic placement of isolatable plant & equipment such as ABSD's, reclosers, sectionalisers, fuses and links etc. on the basis of connected customers and lengths of overhead & underground network that would be affected in the eventuality of a failure.

### 3.14. Strategic Crossing Requirements

Where an overhead line will over sail what can be considered to be a strategic crossing e.g. roads managed by Highways England or Traffic Wales, railway crossings managed by Network Rail, navigable waterways etc. the following precautions shall be implemented so as to mitigate the adverse effects of a failure:-

- The relevant authority shall be contacted to finalise arrangements.
- A single span philosophy shall be adopted i.e. a failure containment support shall be installed either side of the crossing with the support stayed (Note: this can be a single semi slack Type 2 stay having a minimum stay angle of $30^{o}$)

## 4. MATERIALS

All materials used in the construction of Western Power Distributions overhead lines shall be supplied in accordance with the applicable Equipment Specifications or where this is not available by the relevant Energy Networks Association Technical Specification by suppliers who are currently approved by Western Power Distribution.

### 4.1. Wood Poles

Wood poles should meet the requirements of EE129 and be fabricated to the drawings given in the appendices:

| | |
|---|---|
| Figure F1 | Single Pole, Light or Heavy HV construction |
| Figure F2 | All H poles |
| Figure F14 | Single Pole, LV or Light HV construction (25 HDC only) |

The minimum pole grade to be used for all HV construction shall be Medium.

### 4.2. Conductors

Conductors shall meet the requirements of WPD specification EE85.

### 4.3. Steelwork

All steelwork, nuts, bolts, and washers shall meet the requirements of WPD specification EE60. Standard WPD drawings are given in ST: OH4P.

Where trussing sets are required, these are available from WPD's supplier of wood poles (indicated in E5).

### 4.4. Anti-Split Bolts

Anti-split bolts shall be fitted to all poles which have been pre-drilled for them.

## 4.5. Stay Assemblies

Stay strands and fittings shall meet the requirements of ST: OH4L.

## 4.6. Insulators

Insulators shall meet the requirements of WPD specifications EE58 and EE59. Standard insulator requirements are given below:

| | Structure | Insulators | ITEM |
|---|---|---|---|
| Normal Pollution | 11kV Intermediate | 11kV Porcelain Pin / Poly Pin | 30413 / 50447 |
| | 11kV "Light" Section / Terminal | "Single-Dish" 20kN Polymeric & Pig Tail | 39876 |
| | 11kV "Heavy" Section / Terminal | "Double-Dish" 70kN Ball-Socket Polymeric | 39875 |
| | 33kV Intermediate | 33kV Pin | 30415 |
| | 33kV Section / Terminal | "Triple-Dish" 70kN Ball-Socket Polymeric | 41848 |
| High Pollution e.g. Cornwall | 11kV Intermediate | 20kV Pin / Poly Pin | 35099* / 50447 |
| | 11kV Section / Terminal | "Double-Dish" 70kN Ball-Socket Polymeric | 39875 |
| | 33kV Intermediate | 33kV Post | 30422 |
| | 33kV Section / Terminal | 2-off "Double-Dish" 70kN Ball-Socket Polymeric | 39875 |

*35099 – The 20kV porcelain pin insulator has a 92mm neck size and as such will require an appropriate helical top tie / side tie fitting.

## 4.7. Helical Fittings

**4.7.1.** In environments where corrosion of bare aluminium based conductors under binds is known to be a problem, conductor grease shall be liberally applied between the bind and the conductor.

**4.7.2.** In highly corrosive environments, helicals formed from copper alloy wires (brass) should be used on copper based conductors.

**4.7.3.** Elastomeric pads shall be fitted between bare conductors and the insulators to prevent abrasion.

**4.7.4.** In locations where severe weather conditions are likely to be experienced and where length of span and direction of the line in relation to the prevailing wind may cause excessive conductor movement double top ties shall be used.

### 4.8. Anti-Climbing Measures, Signs, and Notices

These shall meet the requirements of ST: OH4M and ST: OH4N respectively.

### 4.9. Bill of Materials (BoM's)

Generic Bills of Materials are included in Appendix N following each the General Arrangement Figure. They are set up for standard construction however in areas of high pollution they should be read in conjunction with the table in clause 4.6.

**Note: If a conductor does not appear in a BoM against a specific Figure No. then it is not a permissible construction.**

These materials are correct at time of this update; a document containing the latest BoM's can be seen by following this link. (ST: OH4T BoM's)

## 5. STANDARD DESIGN TABLES

**Note:** the convention used for the tables in the Appendices is that all loads quoted incorporate the relevant safety factor; while all strengths are quoted "as is" (i.e. the value given is the actual failure load).

### 5.1. General Limitations

The tables included in the Appendices are intended to provide sufficient information to allow an overhead line to be designed and constructed to the requirements of this Standard Technique without the need to use any design software (other than for clearance profiling). In order to provide the information in a form sufficiently simple as to be practical, a necessarily conservative approach has been taken when generating the tables. The basis for the design tables in the Appendices is given in sections [5.2] to [5.7] below.

Where a more precise design is required, or where a deviation from the standard parameters given is required, an Excel-based spreadsheet package is available, along with a copy of ENATS 43-40 which contains the instructions for its use.

To access these documents click on the relevant link:

\\Excel_spreadsheet_4340_WPD_empirical.xls\\

\\ENATS_43-40.pdf\\

Note that the requirements of this Standard Technique supersede those of ENATS 43-40.

## 5.2. Conductor Design and Loading Parameters

The standard, physical properties of the conductors are given, along with design basis parameters. MWT and EDT values are taken as described in [3.9].

Note that 50mm$^2$ AAAC "Hazel" should be designed WITH ice load considered as part of the MWT basis, contrary to the exception made in ENATS 43-40.

## 5.3. Single Span Length (Clashing) Limits

Maximum single span lengths are given according to the clashing limit determined by the loading environment for each of the standard conductors. Note that for higher risk areas, these limits should be reduced as indicated in the relevant tables which, in turn, refer to the weather zone maps of Appendix O.

Phase spacing has been assumed to correspond to those applicable to the standard intermediate crossarm for the construction considered. Span lengths have been rounded to nearest 5m.

Where a line crosses a boundary between weather zones, the most onerous value shall be applied to the whole line.

## 5.4. Wind Span Limits (Unstayed Structure Design)

The maximum permissible wind spans for single poles, in metres, are given in these tables according to pole length, pole grade, and soil type. Burial depths are assumed to be standard. Note that these are not individual span length limits – the wind span for a given structure is defined as half the sum of the adjacent span lengths.

Note that the tables have been generated independently of any other limitations, such as clashing limit, with the result that indicated wind span limits may be far in excess of the clashing limit, which will then determine the final span length limit.

The limits for "H" poles are simply double those for the single pole arrangement of each leg of the "H". "H" poles utilising trussing sets may be assumed as equivalent to each leg being fitted with two kicking blocks.

In order to ensure conservatism, conductor height above pole top has been assumed as applicable to 33kV (360mm above pole top) in all cases.

## 5.5. Strut Load Limits and Capabilities

The stayed structure design tables give the strut loads imposed by each of the standard conductor systems at line deviation angles ranging from 0 – 60 degrees, and at downpull gradients up to 1:10. In addition, the maximum line deviation angles for the various possible stay arrangements are given. **It should also be noted that for**

**unevenly-stayed "H" poles, the total structure load must be multiplied by 1.2, as indicated in [3.8].**

The pole-top hamper weight was taken as the default in the ENATS 43-40 spreadsheets for "H" poles – the worst case. No additional pole-mounted equipment has been allowed for. Should additional equipment be present on the pole, its weight (multiplied by a factor of safety of 2.5) must be added to the final strut load prior to assessment against the capabilities given by Tables N1, N2, N3 & N4.

The final, total strut load can then be compared with tables N1, N2, N3 & N4, which indicate the overall capability of the various pole/foundation combinations.

## 5.6. Sag and Tension Tables

Sag and tension values are given for each of the standard conductors in both "*normal*" and "*severe*" environments.

Separate tables are given for design values, and for erection values, which have been derived including the over-tension required to compensate for long term creep. The design values are those that are to be used in order to determine clearances, and assume that the conductors have fully crept.

The values in the tables have been derived for the minimum recommended basic span for each combination of conductor and environment.

## 5.7. Pole-Top General Arrangements and Capabilities

General arrangement drawings for the standard range of pole top hampers are given in Appendix N. These drawings include a list of associated parts, along with their respective ITEM numbers.

In addition, structure capability tables are included in each Appendix associated with the standard conductors. Constraints relating to downpull, altitude, and loading environments are given in the tables.

## 25 $mm^2$ Hard Drawn Copper

* Conductor & Design Parameters
* Structure Suitability
* Stayed Pole Design Data
* Unstayed Pole Design Data
* Sags and Tensions

## 25mm$^2$ Hard Drawn Copper

### Conductor Parameters:

| | |
|---|---|
| Conductor Stranding (#strands / diameter(mm)) | 7/2.10 |
| Greased Conductor Weight (kg/m) | 0.217 |
| Cross Sectional Area of Conductor (mm²) | 24.2 |
| Conductor Overall Diameter (mm) | 6.30 |
| Coefficient of Linear Expansion (/Degree C) | 1.70E-05 |
| Modulus of Elasticity (kg/mm²) | 12,660 |
| Rated Breaking Strength of Conductor (kgf) | 924.9 |

### Design Loading Parameters: "Normal" & "Severe"

| | |
|---|---|
| Basic / Recommended Span (m) | 110 or 90 |
| Wind Pressure on Conductor (N/m²) | 760 |
| Radial Ice Thickness (mm) | 0.0 |
| Ice Density (kg/m³) | 913 |
| Absolute Maximum Working Tension (MWT) Limit (kgf) | 2,379.0 |
| Temperature at MWT Limit (Degrees C) | -5.6 |
| Maximum "Everyday" Tension (EDT) Limit (kgf) | 211.1 |
| Temperature at EDT Limit (Degrees C) | -5.6 |
| Maximum Conductor Tension (MCT) at -5.6 degC (kgf) | 370.0 |
| Maximum Conductor Weight (MCW) (kg/m) | 0.217 |
| Maximum Conductor Pressure (MCP) (kg/m) | 0.488 |
| Freezing Point Tension (FPT) (kgf) | 200.2 |

| Span Length Limits: | "Normal" | "Severe" |
|---|---|---|
| Maximum **Equivalent** Span | 110 | 90 |
| *Maximum **Single** Span (clashing limit)<br>(Standard light crossarm, 1.0m phase spacing) | 110 | 90 |

## 25mm$^2$ Hard Drawn Copper

### Pole-Top Steelwork Suitability

| Grade | Structure Configuration | | Drg. Ref | Max. Dev'n Normal | Max. Dev'n Severe | Max. D'pull. | Notes |
|---|---|---|---|---|---|---|---|
| Light | Single Pole | Single Arm Intermediate Pin Angle | F3 | 30º | 30º | 1:10 | |
| Light | Single Pole | Single Arm Straight Section Angle Section | F4 | 60º | 60º | 1:10 | |
| Light | Single Pole | Single Arm Termination | F5 | O.K. | O.K. | 1:10 | |

## 25mm$^2$ Hard Drawn Copper - All Loading Environments

### Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 370.0 |
| Wind Pressure (N/m²) | 760 |
| Maximum Conductor Weight (MCW) (kg/m) | 0.22 |
| Maximum Conductor Pressure (MCP) (kg/m) | 0.49 |
| Maximum Wind Span Length (m) | 110 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 2,774.9 |
| Transverse Load [Normal to Span] (kgf) | 402.8 |
| Vertical Load with Downpull (1:10) (kgf) | 1,559.8 |
| Pole Wind Loading (kgf) | 0.0 |

### Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|
| 0 | | 2,257 | 2,135 | 2,040 | 1,963 |
| 5 | | 2,676 | 2,480 | 2,328 | 2,204 |
| 10 | | 3,093 | 2,824 | 2,614 | 2,445 |
| 15 | | 3,506 | 3,165 | 2,899 | 2,684 |
| 20 | | 3,916 | 3,503 | 3,181 | 2,920 |
| 25 | | 4,321 | 3,837 | 3,460 | 3,154 |
| 30 | | 4,722 | 4,167 | 3,735 | 3,385 |
| 35 | | 5,116 | 4,492 | 4,006 | 3,613 |
| 40 | | 5,503 | 4,811 | 4,273 | 3,836 |
| 45 | | 5,883 | 5,124 | 4,534 | 4,056 |
| 50 | | 6,255 | 5,431 | 4,790 | 4,270 |
| 55 | | 6,617 | 5,730 | 5,040 | 4,480 |
| 60 | Terminal | 6,970 | 6,021 | 5,283 | 4,684 |

***NOTE: Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

### Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | 60 | 60 | 60 | 60 |
| 35 | Single | 60 | 60 | 60 | 60 |
| 40 | Pole | 60 | 60 | 60 | 60 |
| 45 | | 60 | 60 | 60 | 60 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

# 25mm² Hard Drawn Copper - All Loading Environments

## Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 760 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 0.49 |

## Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| Pole Length (m) and Grade | | Average / Poor Soil | | | | | Good / Average Soil | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | |
| | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 | M | 199 | 200 | 78 | 178 | 197 | 199 | 200 | 134 | 197 | 197 | 199 | 200 | 191 | 197 | 197 |
| 9 | M | 198 | 199 | 71 | 165 | 197 | 198 | 199 | 125 | 197 | 197 | 198 | 199 | 180 | 197 | 197 |
| 9.5 | M | 198 | 198 | 64 | 153 | 198 | 198 | 198 | 117 | 198 | 198 | 198 | 198 | 170 | 198 | 198 |
| 10 | M | 198 | 199 | 58 | 141 | 199 | 199 | 199 | 109 | 199 | 199 | 199 | 199 | 160 | 199 | 199 |
| 10.5 | M | 192 | 199 | 52 | 131 | 199 | 199 | 199 | 101 | 199 | 199 | 199 | 199 | 151 | 199 | 199 |
| 11 | M | 183 | 200 | 46 | 121 | 200 | 200 | 200 | 94 | 200 | 200 | 200 | 200 | 143 | 200 | 200 |
| 11.5 | M | 174 | 201 | 40 | 112 | 201 | 201 | 201 | 87 | 195 | 201 | 201 | 201 | 135 | 201 | 201 |
| 12 | M | 165 | 201 | 34 | 103 | 195 | 201 | 201 | 81 | 183 | 201 | 201 | 201 | 127 | 201 | 201 |
| 13 | M | 147 | 210 | 22 | 84 | 169 | 210 | 210 | 66 | 159 | 210 | 210 | 210 | 110 | 210 | 210 |
| 14 | M | 134 | 222 | 12 | 69 | 146 | 222 | 222 | 55 | 141 | 222 | 222 | 222 | 99 | 213 | 222 |
| 15 | M | 178 | 238 | 53 | 121 | 230 | 238 | 238 | 120 | 222 | 238 | 238 | 238 | 188 | 238 | 238 |
| 16 | M | 163 | 254 | 41 | 103 | 204 | 254 | 254 | 107 | 201 | 254 | 254 | 254 | 174 | 254 | 254 |
| 17 | M | 148 | 277 | 27 | 85 | 178 | 273 | 277 | 93 | 180 | 277 | 277 | 277 | 158 | 274 | 277 |
| 18 | M | 133 | 266 | 15 | 69 | 156 | 254 | 279 | 79 | 160 | 279 | 279 | 279 | 142 | 251 | 279 |
| 20 | M | 107 | 237 | no | 38 | 114 | 226 | 298 | 54 | 125 | 238 | 298 | 298 | 116 | 211 | 298 |
| 22 | M | 74 | 199 | no | 5 | 72 | 188 | 317 | 23 | 86 | 187 | 302 | 317 | 83 | 167 | 301 |
| | | | | | | | | | | | | | | | | |
| 10 | MS | 234 | 295 | 67 | 150 | 262 | 295 | 295 | 126 | 250 | 295 | 295 | 295 | 185 | 295 | 295 |
| 11 | MS | 208 | 295 | 51 | 126 | 227 | 295 | 295 | 107 | 219 | 295 | 295 | 295 | 163 | 295 | 295 |
| 12 | MS | 190 | 313 | 39 | 106 | 197 | 313 | 313 | 92 | 193 | 313 | 313 | 313 | 146 | 280 | 313 |
| 13 | MS | 168 | 315 | 25 | 86 | 169 | 290 | 316 | 76 | 167 | 292 | 316 | 316 | 126 | 249 | 316 |
| | | | | | | | | | | | | | | | | |
| 8.5 | S | 293 | 380 | 95 | 191 | 321 | 375 | 380 | 165 | 308 | 370 | 375 | 380 | 235 | 370 | 370 |
| 9 | S | 282 | 391 | 88 | 177 | 299 | 388 | 391 | 156 | 290 | 386 | 388 | 391 | 225 | 386 | 386 |
| 9.5 | S | 265 | 385 | 79 | 163 | 278 | 383 | 385 | 145 | 271 | 382 | 383 | 385 | 211 | 379 | 382 |
| 10 | S | 251 | 381 | 71 | 150 | 258 | 380 | 381 | 134 | 254 | 380 | 380 | 381 | 198 | 357 | 380 |
| 10.5 | S | 237 | 378 | 63 | 138 | 240 | 378 | 378 | 124 | 237 | 378 | 378 | 378 | 186 | 336 | 378 |
| 11 | S | 224 | 376 | 55 | 127 | 224 | 366 | 376 | 115 | 222 | 367 | 376 | 376 | 175 | 317 | 376 |
| 11.5 | S | 211 | 374 | 48 | 116 | 208 | 350 | 374 | 106 | 208 | 346 | 374 | 374 | 164 | 299 | 374 |
| 12 | S | 200 | 362 | 41 | 106 | 193 | 334 | 373 | 97 | 194 | 326 | 373 | 373 | 154 | 283 | 373 |
| 13 | S | 181 | 337 | 27 | 86 | 166 | 311 | 390 | 82 | 170 | 289 | 390 | 390 | 136 | 253 | 390 |
| 14 | S | 164 | 315 | 15 | 68 | 141 | 289 | 402 | 68 | 148 | 257 | 402 | 402 | 120 | 227 | 373 |
| 15 | S | 215 | 386 | 65 | 128 | 231 | 371 | 411 | 146 | 242 | 396 | 411 | 411 | 228 | 356 | 411 |
| 16 | S | 196 | 363 | 50 | 108 | 203 | 348 | 430 | 129 | 218 | 359 | 430 | 430 | 209 | 327 | 430 |
| 17 | S | 176 | 337 | 34 | 89 | 177 | 323 | 426 | 111 | 193 | 325 | 426 | 426 | 188 | 298 | 426 |
| 18 | S | 160 | 317 | 21 | 71 | 153 | 303 | 435 | 96 | 172 | 294 | 435 | 435 | 172 | 273 | 435 |
| 20 | S | 125 | 275 | no | 37 | 108 | 262 | 438 | 64 | 131 | 237 | 399 | 438 | 136 | 225 | 367 |
| 22 | S | 90 | 233 | no | 3 | 66 | 220 | 433 | 32 | 91 | 186 | 351 | 433 | 100 | 179 | 305 |

## 25mm$^2$ Hard Drawn Copper - "NORMAL" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** |
| -5.6 | 236.06 | 2.32 | 0.18 | 0.29 | 0.41 | 0.56 | 0.74 | 0.93 | 1.15 | 1.39 | - | - | - | - | - | - |
| -4 | 231.34 | 2.27 | 0.19 | 0.29 | 0.42 | 0.58 | 0.75 | 0.95 | 1.17 | 1.42 | - | - | - | - | - | - |
| 0 | 220.07 | 2.16 | 0.20 | 0.31 | 0.44 | 0.60 | 0.79 | 1.00 | 1.23 | 1.49 | - | - | - | - | - | - |
| 4 | 209.57 | 2.06 | 0.21 | 0.32 | 0.47 | 0.64 | 0.83 | 1.05 | 1.30 | 1.57 | - | - | - | - | - | - |
| 8 | 199.82 | 1.96 | 0.22 | 0.34 | 0.49 | 0.67 | 0.87 | 1.10 | 1.36 | 1.64 | - | - | - | - | - | - |
| 12 | 190.81 | 1.87 | 0.23 | 0.36 | 0.51 | 0.70 | 0.91 | 1.15 | 1.42 | 1.72 | - | - | - | - | - | - |
| 16 | 182.48 | 1.79 | 0.24 | 0.37 | 0.54 | 0.73 | 0.95 | 1.21 | 1.49 | 1.80 | - | - | - | - | - | - |
| 20 | 174.80 | 1.71 | 0.25 | 0.39 | 0.56 | 0.76 | 0.99 | 1.26 | 1.55 | 1.88 | - | - | - | - | - | - |
| 24 | 167.72 | 1.65 | 0.26 | 0.40 | 0.58 | 0.79 | 1.04 | 1.31 | 1.62 | 1.96 | - | - | - | - | - | - |
| 28 | 161.20 | 1.58 | 0.27 | 0.42 | 0.61 | 0.83 | 1.08 | 1.36 | 1.69 | 2.04 | - | - | - | - | - | - |
| 32 | 155.19 | 1.52 | 0.28 | 0.44 | 0.63 | 0.86 | 1.12 | 1.42 | 1.75 | 2.12 | - | - | - | - | - | - |
| 36 | 149.65 | 1.47 | 0.29 | 0.45 | 0.65 | 0.89 | 1.16 | 1.47 | 1.82 | 2.20 | - | - | - | - | - | - |

### DESIGN TABLE

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** |
| -5.6 | 211.10 | 2.07 | 0.21 | 0.32 | 0.46 | 0.63 | 0.82 | 1.04 | 1.29 | 1.56 | - | - | - | - | - | - |
| 0 | 197.51 | 1.94 | 0.22 | 0.34 | 0.50 | 0.67 | 0.88 | 1.11 | 1.38 | 1.66 | - | - | - | - | - | - |
| 30 | 145.77 | 1.43 | 0.30 | 0.47 | 0.67 | 0.91 | 1.19 | 1.51 | 1.86 | 2.25 | - | - | - | - | - | - |
| 50 | 124.88 | 1.23 | 0.35 | 0.54 | 0.78 | 1.07 | 1.39 | 1.76 | 2.18 | 2.63 | - | - | - | - | - | - |
| 55 | 120.73 | 1.18 | 0.36 | 0.56 | 0.81 | 1.10 | 1.44 | 1.82 | 2.25 | 2.72 | - | - | - | - | - | - |
| 60 | 116.91 | 1.15 | 0.37 | 0.58 | 0.84 | 1.14 | 1.49 | 1.88 | 2.32 | 2.81 | - | - | - | - | - | - |
| 65 | 113.39 | 1.11 | 0.38 | 0.60 | 0.86 | 1.17 | 1.53 | 1.94 | 2.40 | 2.90 | - | - | - | - | - | - |
| 70 | 110.13 | 1.08 | 0.39 | 0.62 | 0.89 | 1.21 | 1.58 | 2.00 | 2.47 | 2.98 | - | - | - | - | - | - |
| 75 | 107.11 | 1.05 | 0.41 | 0.63 | 0.91 | 1.24 | 1.62 | 2.05 | 2.54 | 3.07 | - | - | - | - | - | - |

## 25mm$^2$ Hard Drawn Copper - "SEVERE" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. (Deg.C) | Tension (kgf) | Tension (kN) | Sag (m) for Span Length (m) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** |
| -5.6 | 264.2 | 2.59 | 0.16 | 0.26 | 0.37 | 0.50 | 0.66 | 0.83 | - | - | - | - | - | - | - | - |
| -4 | 258.0 | 2.53 | 0.17 | 0.26 | 0.38 | 0.52 | 0.67 | 0.85 | - | - | - | - | - | - | - | - |
| 0 | 242.8 | 2.38 | 0.18 | 0.28 | 0.40 | 0.55 | 0.71 | 0.90 | - | - | - | - | - | - | - | - |
| 4 | 228.5 | 2.24 | 0.19 | 0.30 | 0.43 | 0.58 | 0.76 | 0.96 | - | - | - | - | - | - | - | - |
| 8 | 215.0 | 2.11 | 0.20 | 0.32 | 0.45 | 0.62 | 0.81 | 1.02 | - | - | - | - | - | - | - | - |
| 12 | 202.3 | 1.98 | 0.21 | 0.34 | 0.48 | 0.66 | 0.86 | 1.09 | - | - | - | - | - | - | - | - |
| 16 | 190.6 | 1.87 | 0.23 | 0.36 | 0.51 | 0.70 | 0.91 | 1.15 | - | - | - | - | - | - | - | - |
| 20 | 179.8 | 1.76 | 0.24 | 0.38 | 0.54 | 0.74 | 0.97 | 1.22 | - | - | - | - | - | - | - | - |
| 24 | 169.9 | 1.67 | 0.26 | 0.40 | 0.57 | 0.78 | 1.02 | 1.29 | - | - | - | - | - | - | - | - |
| 28 | 160.9 | 1.58 | 0.27 | 0.42 | 0.61 | 0.83 | 1.08 | 1.37 | - | - | - | - | - | - | - | - |
| 32 | 152.6 | 1.50 | 0.28 | 0.44 | 0.64 | 0.87 | 1.14 | 1.44 | - | - | - | - | - | - | - | - |
| 36 | 145.2 | 1.42 | 0.30 | 0.47 | 0.67 | 0.92 | 1.20 | 1.51 | - | - | - | - | - | - | - | - |

### DESIGN TABLE

| Temp. (Deg.C) | Tension (kgf) | Tension (kN) | Sag (m) for Span Length (m) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** |
| -5.6 | 239.3 | 2.35 | 0.18 | 0.28 | 0.41 | 0.56 | 0.73 | 0.92 | - | - | - | - | - | - | - | - |
| 0 | 219.7 | 2.16 | 0.20 | 0.31 | 0.44 | 0.60 | 0.79 | 1.00 | - | - | - | - | - | - | - | - |
| 30 | 144.2 | 1.41 | 0.30 | 0.47 | 0.68 | 0.92 | 1.20 | 1.52 | - | - | - | - | - | - | - | - |
| 50 | 116.3 | 1.14 | 0.37 | 0.58 | 0.84 | 1.14 | 1.49 | 1.89 | - | - | - | - | - | - | - | - |
| 55 | 111.1 | 1.09 | 0.39 | 0.61 | 0.88 | 1.20 | 1.56 | 1.98 | - | - | - | - | - | - | - | - |
| 60 | 106.4 | 1.04 | 0.41 | 0.64 | 0.92 | 1.25 | 1.63 | 2.06 | - | - | - | - | - | - | - | - |
| 65 | 102.2 | 1.00 | 0.42 | 0.66 | 0.96 | 1.30 | 1.70 | 2.15 | - | - | - | - | - | - | - | - |
| 70 | 98.4 | 0.97 | 0.44 | 0.69 | 0.99 | 1.35 | 1.76 | 2.23 | - | - | - | - | - | - | - | - |
| 75 | 94.9 | 0.93 | 0.46 | 0.71 | 1.03 | 1.40 | 1.83 | 2.31 | - | - | - | - | - | - | - | - |

## 38 $mm^2$ Hard Drawn Copper

* Conductor & Design Parameters
* Structure Suitability
* Stayed Pole Design Data
* Unstayed Pole Design Data
* Sags and Tensions

## 38mm$^2$ Hard Drawn Copper

### Conductor Parameters:

| | |
|---|---|
| Conductor Stranding (#strands / diameter(mm)) | 7/2.64 |
| Greased Conductor Weight (kg/m) | 0.343 |
| Cross Sectional Area of Conductor (mm²) | 38.3 |
| Conductor Overall Diameter (mm) | 7.92 |
| Coefficient of Linear Expansion (/Degree C) | 1.70E-05 |
| Modulus of Elasticity (kg/mm²) | 12,660 |
| Rated Breaking Strength of Conductor (kgf) | 1,491.8 |

| **Design Loading Parameters:** | **"Normal"** | **"Severe"** |
|---|---|---|
| Basic / Recommended Span (m) | 110 | 90 |
| Wind Pressure on Conductor (N/m²) | 380 | 570 |
| Radial Ice Thickness (mm) | 9.5 | 12.5 |
| Ice Density (kg/m³) | 913 | 913 |
| Absolute Maximum Working Tension (MWT) Limit (kgf) | 2,379.0 | 2,379.0 |
| Temperature at MWT Limit (Degrees C) | -5.6 | -5.6 |
| Maximum "Everyday" Tension (EDT) Limit (kgf) | 298.1 | 153.0 |
| Temperature at EDT Limit (Degrees C) | -5.6 | -5.6 |
| Maximum Conductor Tension (MCT) at -5.6 degC (kgf) | 745.9 | 745.9 |
| Maximum Conductor Weight (MCW) (kg/m) | 0.818 | 1.076 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.043 | 1.913 |
| Freezing Point Tension (FPT) (kgf) | 284.3 | 149.2 |

| **Span Length Limits:** | **"Normal"** | **"Severe"** |
|---|---|---|
| Maximum **Equivalent** Span | 110 | 90 |
| *Maximum **Single** Span (clashing limit)<br>(Standard heavy crossarm, 1.2m phase spacing) | 110 | 90 |
| *Maximum **Single** Span (clashing limit)<br>(H Pole, long span heavy crossarm, 2.0m phase spacing) | 140 | 110 |

**NOTE: Single span limits to be reduced by 10m where weather zone is worse than 2B at "normal" altitudes, or worse than 3C at "severe" altitudes. Weather zones are given in Appendix O**

## 38mm$^2$ Hard Drawn Copper

### Pole-Top Steelwork Suitability

| Grade | Structure Configuration | | Drg. Ref | Max. Dev'n Normal | Max. Dev'n Severe | Max. D'pull. | Notes |
|---|---|---|---|---|---|---|---|
| Light | Single Pole | Single Arm Intermediate / Pin Angle | F3 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Straight Section / Angle Section | F4 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Termination | F5 | Not Suitable | Not Suitable | Not Suitable | |
| Heavy | Single Pole | Single Arm Intermediate / Pin Angle | F7 | 22º | 18º | 1:10 | |
| Heavy | Single Pole | Double Arm Intermediate / Pin Angle | F8 | 22º | 18º | 1:10 | |
| Heavy | Single Pole | Double Arm Straight Section / Angle Section | F9 | 60º | 60º | 1:10 | |
| Heavy | "H" Pole | Double Arm Angle Section | F10 | 60º | 60º | 1:10 | Limits as per F8 if used as intermediate |
| Heavy | "H" Pole | Double Arm Section / Inter. For long spans | F11 | 60º (section) | 60º (section) | 1:10 | No deviation allowed if used as intermediate |
| Heavy | "H" Pole | Double Arm Termination | F12 | O.K. | O.K. | 1:10 | |
| Heavy | Single Pole | Double Arm Termination | F13 | O.K. | O.K. | 1:10 | |

## 38mm$^2$ Hard Drawn Copper - "NORMAL" Loading Environment

### Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 745.9 |
| Wind Pressure (N/m²) | 380 |
| Maximum Conductor Weight (MCW) (kg/m) | 0.82 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.04 |
| Maximum Wind Span Length (m) | 140 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 5,594.5 |
| Transverse Load [Normal to Span] (kgf) | 1,095.3 |
| Vertical Load with Downpull (1:10) (kgf) | 2,800.7 |
| Pole Wind Loading (kgf) | 224.5 |

### Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|
| 0 | | 5,087 | 4,686 | 4,374 | 4,120 |
| 5 | | 5,930 | 5,381 | 4,954 | 4,608 |
| 10 | | 6,769 | 6,072 | 5,531 | 5,092 |
| 15 | | 7,600 | 6,758 | 6,103 | 5,572 |
| 20 | | 8,423 | 7,437 | 6,669 | 6,047 |
| 25 | | 9,236 | 8,107 | 7,229 | 6,516 |
| 30 | | 10,038 | 8,768 | 7,780 | 6,979 |
| 35 | | 10,826 | 9,418 | 8,323 | 7,434 |
| 40 | | 11,601 | 10,057 | 8,855 | 7,881 |
| 45 | | 12,359 | 10,682 | 9,377 | 8,319 |
| 50 | | 13,099 | 11,292 | 9,887 | 8,747 |
| 55 | | 13,821 | 11,887 | 10,383 | 9,163 |
| 60 | Terminal | 14,522 | 12,466 | 10,866 | 9,568 |

***NOTE: Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

### Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | 20 | 55 | 40 | 60 |
| 35 | Single | 25 | 60 | 49 | 60 |
| 40 | Pole | 30 | 60 | 58 | 60 |
| 45 | | 35 | 60 | 60 | 60 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | | 60 | 60 | 60 | 60 | x | O.K. |
| 35 | "H" | 60 | 60 | 60 | 60 | O.K. | O.K. |
| 40 | Pole | 60 | 60 | 60 | 60 | O.K. | O.K. |
| 45 | | 60 | 60 | 60 | 60 | O.K. | O.K. |

## 38mm$^2$ Hard Drawn Copper - "SEVERE" Loading Environment

### Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 745.9 |
| Wind Pressure (N/m²) | 570 |
| Maximum Conductor Weight (MCW) (kg/m) | 1.08 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.91 |
| Maximum Wind Span Length (m) | 110 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 5,594.0 |
| Transverse Load [Normal to Span] (kgf) | 1,578.6 |
| Vertical Load with Downpull (1:10) (kgf) | 2,828.9 |
| Pole Wind Loading (kgf) | 336.8 |

### Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|
| 0 | | 6,146 | 5,564 | 5,112 | 4,744 |
| 5 | | 6,989 | 6,259 | 5,691 | 5,231 |
| 10 | | 7,825 | 6,948 | 6,267 | 5,713 |
| 15 | | 8,652 | 7,631 | 6,836 | 6,191 |
| 20 | | 9,470 | 8,305 | 7,398 | 6,663 |
| 25 | | 10,276 | 8,969 | 7,953 | 7,128 |
| 30 | | 11,069 | 9,623 | 8,498 | 7,586 |
| 35 | | 11,847 | 10,265 | 9,034 | 8,036 |
| 40 | | 12,609 | 10,893 | 9,558 | 8,476 |
| 45 | | 13,354 | 11,507 | 10,071 | 8,906 |
| 50 | | 14,080 | 12,106 | 10,570 | 9,325 |
| 55 | | 14,785 | 12,688 | 11,056 | 9,732 |
| 60 | Terminal | 15,469 | 13,251 | 11,526 | 10,127 |

***NOTE: Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

### Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | 14 | 48 | 34 | 60 |
| 35 | Single | 19 | 60 | 43 | 60 |
| 40 | Pole | 24 | 60 | 51 | 60 |
| 45 | | 29 | 60 | 59 | 60 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | | 60 | 60 | 60 | 60 | x | O.K. |
| 35 | "H" | 60 | 60 | 60 | 60 | x | O.K. |
| 40 | Pole | 60 | 60 | 60 | 60 | O.K. | O.K. |
| 45 | | 60 | 60 | 60 | 60 | O.K. | O.K. |

## 38mm² Hard Drawn Copper - "NORMAL" Loading Environment
## Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 380 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.04 |

### Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| | Average / Poor Soil | | | | | Good / Average Soil | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pole Length (m) and Grade | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | |
| | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 M | 83 | 84 | 44 | 82 | 82 | 83 | 84 | 71 | 82 | 82 | 83 | 84 | 82 | 82 | 82 |
| 9 M | 82 | 83 | 42 | 81 | 81 | 82 | 83 | 67 | 81 | 81 | 82 | 83 | 81 | 81 | 81 |
| 9.5 M | 82 | 82 | 39 | 81 | 81 | 82 | 82 | 64 | 81 | 81 | 82 | 82 | 81 | 81 | 81 |
| 10 M | 81 | 82 | 37 | 76 | 81 | 81 | 82 | 61 | 81 | 81 | 81 | 82 | 81 | 81 | 81 |
| 10.5 M | 81 | 81 | 35 | 72 | 81 | 81 | 81 | 58 | 81 | 81 | 81 | 81 | 81 | 81 | 81 |
| 11 M | 82 | 82 | 33 | 68 | 82 | 82 | 82 | 56 | 82 | 82 | 82 | 82 | 78 | 82 | 82 |
| 11.5 M | 82 | 82 | 31 | 65 | 82 | 82 | 82 | 53 | 82 | 82 | 82 | 82 | 75 | 82 | 82 |
| 12 M | 82 | 82 | 29 | 61 | 82 | 82 | 82 | 51 | 82 | 82 | 82 | 82 | 73 | 82 | 82 |
| 13 M | 83 | 84 | 25 | 55 | 84 | 84 | 84 | 46 | 84 | 84 | 84 | 84 | 67 | 84 | 84 |
| 14 M | 79 | 90 | 23 | 49 | 86 | 90 | 90 | 43 | 83 | 90 | 90 | 90 | 63 | 90 | 90 |
| 15 M | 97 | 97 | 44 | 75 | 97 | 97 | 97 | 75 | 97 | 97 | 97 | 97 | 97 | 97 | 97 |
| 16 M | 97 | 104 | 40 | 70 | 104 | 104 | 104 | 72 | 104 | 104 | 104 | 104 | 103 | 104 | 104 |
| 17 M | 93 | 113 | 37 | 64 | 107 | 113 | 113 | 67 | 108 | 113 | 113 | 113 | 98 | 113 | 113 |
| 18 M | 87 | 114 | 33 | 58 | 99 | 114 | 114 | 63 | 101 | 114 | 114 | 114 | 93 | 114 | 114 |
| 20 M | 80 | 124 | 27 | 49 | 84 | 124 | 124 | 56 | 89 | 124 | 124 | 124 | 85 | 124 | 124 |
| 22 M | 70 | 128 | 19 | 39 | 70 | 123 | 131 | 47 | 76 | 124 | 131 | 131 | 75 | 114 | 131 |
| | | | | | | | | | | | | | | | |
| 10 MS | 118 | 122 | 42 | 80 | 121 | 122 | 122 | 69 | 121 | 121 | 122 | 122 | 96 | 121 | 121 |
| 11 MS | 109 | 120 | 37 | 71 | 118 | 120 | 120 | 63 | 114 | 120 | 120 | 120 | 88 | 120 | 120 |
| 12 MS | 102 | 128 | 33 | 64 | 106 | 128 | 128 | 58 | 104 | 128 | 128 | 128 | 82 | 128 | 128 |
| 13 MS | 94 | 128 | 29 | 57 | 95 | 128 | 128 | 52 | 94 | 128 | 128 | 128 | 76 | 128 | 128 |
| | | | | | | | | | | | | | | | |
| 8.5 S | 147 | 166 | 55 | 99 | 160 | 164 | 166 | 87 | 154 | 161 | 164 | 166 | 120 | 161 | 161 |
| 9 S | 142 | 171 | 52 | 94 | 151 | 170 | 171 | 84 | 147 | 167 | 170 | 171 | 116 | 167 | 167 |
| 9.5 S | 135 | 167 | 49 | 88 | 142 | 167 | 167 | 80 | 139 | 165 | 167 | 167 | 111 | 165 | 165 |
| 10 S | 129 | 165 | 46 | 83 | 134 | 164 | 165 | 76 | 131 | 163 | 164 | 165 | 105 | 163 | 163 |
| 10.5 S | 124 | 162 | 43 | 78 | 126 | 162 | 163 | 72 | 125 | 162 | 162 | 163 | 101 | 162 | 162 |
| 11 S | 119 | 155 | 40 | 74 | 119 | 161 | 161 | 68 | 118 | 161 | 161 | 161 | 96 | 161 | 161 |
| 11.5 S | 114 | 149 | 38 | 70 | 113 | 160 | 160 | 65 | 113 | 160 | 160 | 160 | 92 | 156 | 160 |
| 12 S | 109 | 159 | 36 | 66 | 107 | 159 | 159 | 62 | 107 | 159 | 159 | 159 | 88 | 149 | 159 |
| 13 S | 103 | 166 | 31 | 59 | 96 | 163 | 166 | 57 | 98 | 154 | 166 | 166 | 82 | 137 | 166 |
| 14 S | 97 | 167 | 28 | 53 | 87 | 156 | 172 | 52 | 90 | 141 | 172 | 172 | 77 | 127 | 172 |
| 15 S | 123 | 177 | 53 | 83 | 131 | 177 | 177 | 91 | 136 | 177 | 177 | 177 | 130 | 177 | 177 |
| 16 S | 117 | 185 | 49 | 76 | 120 | 185 | 185 | 86 | 127 | 185 | 185 | 185 | 123 | 178 | 185 |
| 17 S | 109 | 183 | 44 | 69 | 110 | 178 | 183 | 80 | 118 | 180 | 183 | 183 | 116 | 167 | 183 |
| 18 S | 104 | 177 | 40 | 64 | 102 | 171 | 187 | 75 | 111 | 168 | 187 | 187 | 110 | 158 | 187 |
| 20 S | 93 | 163 | 32 | 52 | 86 | 157 | 189 | 65 | 96 | 146 | 189 | 189 | 99 | 141 | 189 |
| 22 S | 82 | 148 | 23 | 42 | 71 | 143 | 186 | 55 | 83 | 127 | 186 | 186 | 87 | 124 | 183 |

## 38mm² Hard Drawn Copper - "SEVERE" Loading Environment

### Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 570 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.91 |

### Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| Pole Length (m) and Grade | | Average / Poor Soil | | | | | | Good / Average Soil | | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | |
| | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 | M | 43 | 43 | 22 | 42 | 42 | | 43 | 43 | 36 | 42 | 42 | | 43 | 43 | 42 | 42 | 42 |
| 9 | M | 42 | 42 | 20 | 41 | 41 | | 42 | 42 | 34 | 41 | 41 | | 42 | 42 | 41 | 41 | 41 |
| 9.5 | M | 41 | 42 | 19 | 41 | 41 | | 41 | 42 | 32 | 41 | 41 | | 41 | 42 | 41 | 41 | 41 |
| 10 | M | 41 | 41 | 17 | 39 | 41 | | 41 | 41 | 30 | 41 | 41 | | 41 | 41 | 41 | 41 | 41 |
| 10.5 | M | 41 | 41 | 16 | 36 | 41 | | 41 | 41 | 29 | 41 | 41 | | 41 | 41 | 41 | 41 | 41 |
| 11 | M | 41 | 41 | 15 | 34 | 41 | | 41 | 41 | 27 | 41 | 41 | | 41 | 41 | 39 | 41 | 41 |
| 11.5 | M | 41 | 41 | 13 | 32 | 41 | | 41 | 41 | 25 | 41 | 41 | | 41 | 41 | 37 | 41 | 41 |
| 12 | M | 41 | 41 | 12 | 29 | 41 | | 41 | 41 | 24 | 41 | 41 | | 41 | 41 | 36 | 41 | 41 |
| 13 | M | 41 | 42 | 9 | 25 | 42 | | 42 | 42 | 21 | 42 | 42 | | 42 | 42 | 32 | 42 | 42 |
| 14 | M | 38 | 45 | 7 | 22 | 42 | | 45 | 45 | 18 | 40 | 45 | | 45 | 45 | 30 | 45 | 45 |
| 15 | M | 49 | 49 | 18 | 36 | 49 | | 49 | 49 | 36 | 49 | 49 | | 49 | 49 | 49 | 49 | 49 |
| 16 | M | 47 | 53 | 16 | 32 | 53 | | 53 | 53 | 33 | 53 | 53 | | 53 | 53 | 50 | 53 | 53 |
| 17 | M | 44 | 57 | 13 | 28 | 52 | | 57 | 57 | 30 | 52 | 57 | | 57 | 57 | 47 | 57 | 57 |
| 18 | M | 40 | 57 | 11 | 24 | 47 | | 57 | 57 | 27 | 48 | 57 | | 57 | 57 | 43 | 57 | 57 |
| 20 | M | 35 | 63 | 6 | 18 | 37 | | 63 | 63 | 22 | 40 | 63 | | 63 | 63 | 38 | 62 | 63 |
| 22 | M | 28 | 60 | 0 | 11 | 28 | | 57 | 66 | 16 | 32 | 57 | | 66 | 66 | 31 | 52 | 66 |
| | | | | | | | | | | | | | | | | | | |
| 10 | MS | 61 | 63 | 19 | 40 | 62 | | 63 | 63 | 34 | 62 | 62 | | 63 | 63 | 49 | 62 | 62 |
| 11 | MS | 56 | 62 | 16 | 35 | 60 | | 62 | 62 | 30 | 58 | 62 | | 62 | 62 | 44 | 62 | 62 |
| 12 | MS | 51 | 65 | 14 | 30 | 53 | | 65 | 65 | 27 | 52 | 65 | | 65 | 65 | 40 | 65 | 65 |
| 13 | MS | 47 | 65 | 11 | 26 | 47 | | 65 | 65 | 23 | 46 | 65 | | 65 | 65 | 36 | 65 | 65 |
| | | | | | | | | | | | | | | | | | | |
| 8.5 | S | 77 | 87 | 27 | 51 | 84 | | 86 | 87 | 45 | 81 | 84 | | 86 | 87 | 62 | 84 | 84 |
| 9 | S | 74 | 90 | 25 | 48 | 79 | | 89 | 90 | 43 | 77 | 88 | | 89 | 90 | 60 | 88 | 88 |
| 9.5 | S | 70 | 88 | 23 | 45 | 74 | | 87 | 88 | 40 | 72 | 86 | | 87 | 88 | 57 | 86 | 86 |
| 10 | S | 67 | 86 | 21 | 42 | 69 | | 86 | 86 | 37 | 68 | 85 | | 86 | 86 | 54 | 85 | 85 |
| 10.5 | S | 64 | 84 | 19 | 39 | 65 | | 84 | 85 | 35 | 64 | 84 | | 84 | 85 | 51 | 84 | 84 |
| 11 | S | 61 | 81 | 18 | 36 | 61 | | 83 | 83 | 33 | 60 | 83 | | 83 | 83 | 48 | 83 | 83 |
| 11.5 | S | 58 | 77 | 16 | 33 | 57 | | 83 | 83 | 31 | 57 | 83 | | 83 | 83 | 46 | 80 | 83 |
| 12 | S | 55 | 82 | 15 | 31 | 53 | | 82 | 82 | 29 | 54 | 82 | | 82 | 82 | 43 | 76 | 82 |
| 13 | S | 51 | 86 | 12 | 27 | 47 | | 84 | 86 | 26 | 48 | 79 | | 86 | 86 | 40 | 69 | 86 |
| 14 | S | 47 | 85 | 9 | 23 | 41 | | 79 | 89 | 23 | 43 | 71 | | 89 | 89 | 36 | 63 | 89 |
| 15 | S | 61 | 92 | 22 | 39 | 65 | | 92 | 92 | 43 | 68 | 92 | | 92 | 92 | 64 | 92 | 92 |
| 16 | S | 57 | 96 | 19 | 34 | 58 | | 95 | 96 | 40 | 62 | 96 | | 96 | 96 | 60 | 90 | 96 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | S | 52 | 93 | 16 | 30 | 52 | | 89 | 95 | 36 | 57 | 90 | | 95 | 95 | 55 | 83 | 95 |
| 18 | S | 49 | 88 | 13 | 26 | 47 | | 85 | 97 | 32 | 52 | 83 | | 97 | 97 | 52 | 78 | 97 |
| 20 | S | 41 | 79 | 7 | 19 | 37 | | 76 | 99 | 26 | 43 | 70 | | 99 | 99 | 44 | 67 | 99 |
| 22 | S | 33 | 70 | 1 | 11 | 27 | | 67 | 97 | 19 | 34 | 58 | | 97 | 97 | 36 | 56 | 89 |
| 9 | ES | 82 | 116 | 28 | 50 | 80 | | 116 | 116 | 47 | 80 | 116 | | 116 | 116 | 66 | 111 | 116 |
| 9.5 | ES | 77 | 113 | 26 | 47 | 75 | | 113 | 113 | 44 | 76 | 113 | | 113 | 113 | 63 | 104 | 113 |
| 10 | ES | 73 | 111 | 24 | 43 | 70 | | 111 | 111 | 41 | 71 | 111 | | 111 | 111 | 59 | 99 | 111 |
| 10.5 | ES | 70 | 109 | 22 | 40 | 66 | | 109 | 109 | 39 | 67 | 105 | | 109 | 109 | 56 | 93 | 109 |
| 11 | ES | 66 | 107 | 20 | 38 | 62 | | 106 | 107 | 36 | 63 | 99 | | 107 | 107 | 53 | 88 | 107 |
| 11.5 | ES | 64 | 110 | 18 | 35 | 58 | | 103 | 110 | 35 | 60 | 94 | | 110 | 110 | 51 | 85 | 110 |
| 12 | ES | 61 | 106 | 17 | 33 | 54 | | 99 | 108 | 33 | 57 | 89 | | 108 | 108 | 48 | 80 | 108 |
| 13 | ES | 56 | 100 | 14 | 28 | 48 | | 93 | 109 | 29 | 51 | 80 | | 109 | 109 | 44 | 73 | 109 |
| 14 | ES | 52 | 94 | 11 | 24 | 42 | | 87 | 112 | 25 | 45 | 72 | | 112 | 112 | 40 | 67 | 102 |
| 15 | ES | 66 | 110 | 25 | 40 | 66 | | 108 | 110 | 47 | 71 | 109 | | 110 | 110 | 69 | 101 | 110 |
| 16 | ES | 61 | 106 | 21 | 36 | 59 | | 103 | 111 | 43 | 65 | 100 | | 111 | 111 | 65 | 94 | 111 |
| 17 | ES | 57 | 101 | 18 | 32 | 53 | | 97 | 115 | 39 | 60 | 92 | | 115 | 115 | 61 | 88 | 115 |

## 38mm$^2$ Hard Drawn Copper - "NORMAL" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** |
| -5.6 | 334.7 | 3.28 | 0.21 | 0.32 | 0.46 | 0.63 | 0.82 | 1.04 | 1.28 | 1.55 | 1.85 | 2.17 | 2.51 | - | - | - |
| -4 | 328.3 | 3.22 | 0.21 | 0.33 | 0.47 | 0.64 | 0.84 | 1.06 | 1.31 | 1.58 | 1.88 | 2.21 | 2.56 | - | - | - |
| 0 | 313.1 | 3.07 | 0.22 | 0.34 | 0.49 | 0.67 | 0.88 | 1.11 | 1.37 | 1.66 | 1.97 | 2.32 | 2.69 | - | - | - |
| 4 | 299.1 | 2.93 | 0.23 | 0.36 | 0.52 | 0.70 | 0.92 | 1.16 | 1.44 | 1.74 | 2.07 | 2.43 | 2.81 | - | - | - |
| 8 | 286.1 | 2.81 | 0.24 | 0.38 | 0.54 | 0.74 | 0.96 | 1.22 | 1.50 | 1.82 | 2.16 | 2.54 | 2.94 | - | - | - |
| 12 | 274.2 | 2.69 | 0.25 | 0.39 | 0.56 | 0.77 | 1.00 | 1.27 | 1.57 | 1.89 | 2.26 | 2.65 | 3.07 | - | - | - |
| 16 | 263.1 | 2.58 | 0.26 | 0.41 | 0.59 | 0.80 | 1.04 | 1.32 | 1.63 | 1.97 | 2.35 | 2.76 | 3.20 | - | - | - |
| 20 | 253.0 | 2.48 | 0.27 | 0.42 | 0.61 | 0.83 | 1.09 | 1.37 | 1.70 | 2.05 | 2.44 | 2.87 | 3.33 | - | - | - |
| 24 | 243.6 | 2.39 | 0.28 | 0.44 | 0.63 | 0.86 | 1.13 | 1.43 | 1.76 | 2.13 | 2.54 | 2.98 | 3.45 | - | - | - |
| 28 | 235.0 | 2.31 | 0.29 | 0.46 | 0.66 | 0.90 | 1.17 | 1.48 | 1.83 | 2.21 | 2.63 | 3.09 | 3.58 | - | - | - |
| 32 | 227.0 | 2.23 | 0.30 | 0.47 | 0.68 | 0.93 | 1.21 | 1.53 | 1.89 | 2.29 | 2.72 | 3.20 | 3.71 | - | - | - |
| 36 | 219.6 | 2.15 | 0.31 | 0.49 | 0.70 | 0.96 | 1.25 | 1.58 | 1.95 | 2.37 | 2.81 | 3.30 | 3.83 | - | - | - |

### DESIGN TABLE

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** |
| -5.6 | 298.1 | 2.92 | 0.23 | 0.36 | 0.52 | 0.71 | 0.92 | 1.17 | 1.44 | 1.74 | 2.07 | 2.43 | 2.82 | - | - | - |
| 0 | 280.3 | 2.75 | 0.25 | 0.38 | 0.55 | 0.75 | 0.98 | 1.24 | 1.53 | 1.85 | 2.21 | 2.59 | 3.00 | - | - | - |
| 30 | 213.0 | 2.09 | 0.32 | 0.50 | 0.73 | 0.99 | 1.29 | 1.63 | 2.02 | 2.44 | 2.90 | 3.41 | 3.95 | - | - | - |
| 50 | 185.2 | 1.82 | 0.37 | 0.58 | 0.83 | 1.14 | 1.48 | 1.88 | 2.32 | 2.80 | 3.34 | 3.92 | 4.54 | - | - | - |
| 55 | 179.6 | 1.76 | 0.38 | 0.60 | 0.86 | 1.17 | 1.53 | 1.94 | 2.39 | 2.89 | 3.44 | 4.04 | 4.68 | - | - | - |
| 60 | 174.4 | 1.71 | 0.39 | 0.62 | 0.89 | 1.21 | 1.58 | 1.99 | 2.46 | 2.98 | 3.54 | 4.16 | 4.82 | - | - | - |
| 65 | 169.6 | 1.66 | 0.40 | 0.63 | 0.91 | 1.24 | 1.62 | 2.05 | 2.53 | 3.06 | 3.64 | 4.28 | 4.96 | - | - | - |
| 70 | 165.2 | 1.62 | 0.42 | 0.65 | 0.94 | 1.27 | 1.66 | 2.11 | 2.60 | 3.14 | 3.74 | 4.39 | 5.09 | - | - | - |
| 75 | 161.0 | 1.58 | 0.43 | 0.67 | 0.96 | 1.31 | 1.71 | 2.16 | 2.67 | 3.23 | 3.84 | 4.51 | 5.23 | - | - | - |

## 38mm$^2$ Hard Drawn Copper - "SEVERE" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** |
| -5.6 | 172.55 | 1.69 | 0.40 | 0.62 | 0.90 | 1.22 | 1.59 | 2.02 | 2.49 | 3.01 | - | - | - | - | - | - |
| -4 | 170.21 | 1.67 | 0.40 | 0.63 | 0.91 | 1.24 | 1.61 | 2.04 | 2.52 | 3.05 | - | - | - | - | - | - |
| 0 | 164.69 | 1.62 | 0.42 | 0.65 | 0.94 | 1.28 | 1.67 | 2.11 | 2.61 | 3.15 | - | - | - | - | - | - |
| 4 | 159.60 | 1.57 | 0.43 | 0.67 | 0.97 | 1.32 | 1.72 | 2.18 | 2.69 | 3.25 | - | - | - | - | - | - |
| 8 | 154.90 | 1.52 | 0.44 | 0.69 | 1.00 | 1.36 | 1.77 | 2.25 | 2.77 | 3.35 | - | - | - | - | - | - |
| 12 | 150.54 | 1.48 | 0.46 | 0.71 | 1.03 | 1.40 | 1.83 | 2.31 | 2.85 | 3.45 | - | - | - | - | - | - |
| 16 | 146.48 | 1.44 | 0.47 | 0.73 | 1.06 | 1.44 | 1.88 | 2.37 | 2.93 | 3.55 | - | - | - | - | - | - |
| 20 | 142.71 | 1.40 | 0.48 | 0.75 | 1.08 | 1.47 | 1.93 | 2.44 | 3.01 | 3.64 | - | - | - | - | - | - |
| 24 | 139.18 | 1.37 | 0.49 | 0.77 | 1.11 | 1.51 | 1.97 | 2.50 | 3.08 | 3.73 | - | - | - | - | - | - |
| 28 | 135.88 | 1.33 | 0.51 | 0.79 | 1.14 | 1.55 | 2.02 | 2.56 | 3.16 | 3.82 | - | - | - | - | - | - |
| 32 | 132.78 | 1.30 | 0.52 | 0.81 | 1.16 | 1.58 | 2.07 | 2.62 | 3.23 | 3.91 | - | - | - | - | - | - |
| 36 | 129.86 | 1.27 | 0.53 | 0.83 | 1.19 | 1.62 | 2.12 | 2.68 | 3.31 | 4.00 | - | - | - | - | - | - |

### DESIGN TABLE

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** |
| -5.6 | 153.00 | 1.50 | 0.45 | 0.70 | 1.01 | 1.37 | 1.80 | 2.27 | 2.81 | 3.40 | - | - | - | - | - | - |
| 0 | 147.17 | 1.44 | 0.47 | 0.73 | 1.05 | 1.43 | 1.87 | 2.36 | 2.92 | 3.53 | - | - | - | - | - | - |
| 30 | 123.71 | 1.21 | 0.56 | 0.87 | 1.25 | 1.70 | 2.22 | 2.81 | 3.47 | 4.20 | - | - | - | - | - | - |
| 50 | 112.85 | 1.11 | 0.61 | 0.95 | 1.37 | 1.86 | 2.43 | 3.08 | 3.80 | 4.60 | - | - | - | - | - | - |
| 55 | 110.53 | 1.08 | 0.62 | 0.97 | 1.40 | 1.90 | 2.49 | 3.15 | 3.88 | 4.70 | - | - | - | - | - | - |
| 60 | 108.34 | 1.06 | 0.63 | 0.99 | 1.43 | 1.94 | 2.54 | 3.21 | 3.96 | 4.80 | - | - | - | - | - | - |
| 65 | 106.27 | 1.04 | 0.65 | 1.01 | 1.45 | 1.98 | 2.59 | 3.27 | 4.04 | 4.89 | - | - | - | - | - | - |
| 70 | 104.31 | 1.02 | 0.66 | 1.03 | 1.48 | 2.02 | 2.63 | 3.33 | 4.12 | 4.98 | - | - | - | - | - | - |
| 75 | 102.45 | 1.00 | 0.67 | 1.05 | 1.51 | 2.05 | 2.68 | 3.39 | 4.19 | 5.07 | - | - | - | - | - | - |

# APPENDIX C

## 50 $mm^2$ Aluminium Alloy "Hazel"

* Conductor & Design Parameters
* Structure Suitability
* Stayed Pole Design Data
* Unstayed Pole Design Data
* Sags and Tensions

## 50mm$^2$ Aluminium Alloy "Hazel"

### Conductor Parameters:

| | |
|---|---|
| Conductor Stranding (#strands / diameter(mm)) | 7/3.30 |
| Greased Conductor Weight (kg/m) | 0.165 |
| Cross Sectional Area of Conductor (mm²) | 59.9 |
| Conductor Overall Diameter (mm) | 9.90 |
| Coefficient of Linear Expansion (/Degree C) | 2.30E-05 |
| Modulus of Elasticity (kg/mm²) | 6,000 |
| Rated Breaking Strength of Conductor (kgf) | 1,800.8 |

| Design Loading Parameters: | "Normal" | "Severe" |
|---|---|---|
| Basic / Recommended Span (m) | 110 | 90 |
| Wind Pressure on Conductor (N/m²) | 380 | 570 |
| Radial Ice Thickness (mm) | 9.5 | 12.5 |
| Ice Density (kg/m³) | 913 | 913 |
| Absolute Maximum Working Tension (MWT) Limit (kgf) | 2,379.0 | 2,379.0 |
| Temperature at MWT Limit (Degrees C) | -5.6 | -5.6 |
| Maximum "Everyday" Tension (EDT) Limit (kgf) | 360.2 | 215.9 |
| Temperature at EDT Limit (Degrees C) | 5.0 | -5.6 |
| Maximum Conductor Tension (MCT) at -5.6 degC (kgf) | 847.4 | 900.4 |
| Maximum Conductor Weight (MCW) (kg/m) | 0.694 | 0.968 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.120 | 2.029 |
| Freezing Point Tension (FPT) (kgf) | 395.0 | 190.2 |

| Span Length Limits: | "Normal" | "Severe" |
|---|---|---|
| Maximum **Equivalent** Span | 110 | 90 |
| *Maximum **Single** Span (clashing limit)<br>(Standard heavy crossarm, 1.2m phase spacing) | 115 | 90 |
| *Maximum **Single** Span (clashing limit)<br>(H Pole, long span heavy crossarm, 2.0m phase spacing) | 145 | 120 |

**NOTE: Single span limits to be reduced by 10m where weather zone is worse than 2B at "normal" altitudes, or worse than 3C at "severe" altitudes. Weather zones are given in Appendix O**

## 50mm$^2$ Aluminium Alloy "Hazel"

### Pole-Top Steelwork Suitability

| Grade | Structure Configuration | | Drg. Ref | Max. Dev'n Normal | Max. Dev'n Severe | Max. D'pull. | Notes |
|---|---|---|---|---|---|---|---|
| Light | Single Pole | Single Arm Intermediate / Pin Angle | F3 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Straight Section / Angle Section | F4 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Termination | F5 | Not Suitable | Not Suitable | Not Suitable | |
| Heavy | Single Pole | Single Arm Intermediate / Pin Angle | F7 | 18º | 14º | 1:10 | |
| Heavy | Single Pole | Double Arm Intermediate / Pin Angle | F8 | 18º | 14º | 1:10 | |
| Heavy | Single Pole | Double Arm Straight Section / Angle Section | F9 | 60º | 60º | 1:10 | |
| Heavy | "H" Pole | Double Arm Angle Section | F10 | 60º | 60º | 1:10 | Limits as per F8 if used as intermediate |
| Heavy | "H" Pole | Double Arm Section / Inter. For long spans | F11 | 60º (section) | 60º (section) | 1:10 | No deviation allowed if used as intermediate |
| Heavy | "H" Pole | Double Arm Termination | F12 | O.K. | O.K. | 1:10 | |
| Heavy | Single Pole | Double Arm Termination | F13 | O.K. | O.K. | 1:10 | |

## 50mm$^2$ Aluminium Alloy "Hazel" - "NORMAL" Loading Environment

### Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 847.4 |
| Wind Pressure (N/m²) | 380 |
| Maximum Conductor Weight (MCW) (kg/m) | 0.69 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.12 |
| Maximum Wind Span Length (m) | 145 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 6,355.2 |
| Transverse Load [Normal to Span] (kgf) | 1,217.8 |
| Vertical Load with Downpull (1:10) (kgf) | 2,847.7 |
| Pole Wind Loading (kgf) | 224.5 |

### Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|
| 0 | | 5,346 | 4,908 | 4,567 | 4,290 |
| 5 | | 6,304 | 5,698 | 5,226 | 4,843 |
| 10 | | 7,257 | 6,483 | 5,881 | 5,393 |
| 15 | | 8,201 | 7,262 | 6,531 | 5,939 |
| 20 | | 9,137 | 8,033 | 7,175 | 6,479 |
| 25 | | 10,061 | 8,795 | 7,811 | 7,012 |
| 30 | | 10,972 | 9,547 | 8,438 | 7,538 |
| 35 | | 11,868 | 10,286 | 9,055 | 8,056 |
| 40 | | 12,748 | 11,011 | 9,660 | 8,564 |
| 45 | | 13,610 | 11,722 | 10,253 | 9,061 |
| 50 | | 14,452 | 12,416 | 10,832 | 9,548 |
| 55 | | 15,273 | 13,093 | 11,397 | 10,022 |
| 60 | Terminal | 16,071 | 13,751 | 11,946 | 10,482 |

***NOTE: Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

### Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | 17 | 46 | 34 | 60 |
| 35 | Single | 21 | 57 | 41 | 60 |
| 40 | Pole | 25 | 60 | 49 | 60 |
| 45 | | 29 | 60 | 56 | 60 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | | 60 | 60 | 60 | 60 | x | O.K. |
| 35 | "H" | 60 | 60 | 60 | 60 | x | O.K. |
| 40 | Pole | 60 | 60 | 60 | 60 | O.K. | O.K. |
| 45 | | 60 | 60 | 60 | 60 | O.K. | O.K. |

## 50mm$^2$ Aluminium Alloy "Hazel" - "SEVERE" Loading Environment

### Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 900.4 |
| Wind Pressure (N/m²) | 570 |
| Maximum Conductor Weight (MCW) (kg/m) | 0.97 |
| Maximum Conductor Pressure (MCP) (kg/m) | 2.03 |
| Maximum Wind Span Length (m) | 120 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 6,753.1 |
| Transverse Load [Normal to Span] (kgf) | 1,825.7 |
| Vertical Load with Downpull (1:10) (kgf) | 3,043.8 |
| Pole Wind Loading (kgf) | 336.8 |

### Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|
| 0 | | 6,789 | 6,132 | 5,621 | 5,206 |
| 5 | | 7,807 | 6,971 | 6,321 | 5,794 |
| 10 | | 8,816 | 7,803 | 7,016 | 6,376 |
| 15 | | 9,816 | 8,628 | 7,703 | 6,954 |
| 20 | | 10,803 | 9,442 | 8,383 | 7,524 |
| 25 | | 11,778 | 10,245 | 9,053 | 8,086 |
| 30 | | 12,736 | 11,036 | 9,713 | 8,640 |
| 35 | | 13,677 | 11,812 | 10,360 | 9,183 |
| 40 | | 14,600 | 12,572 | 10,995 | 9,716 |
| 45 | | 15,501 | 13,315 | 11,615 | 10,236 |
| 50 | | 16,379 | 14,040 | 12,220 | 10,743 |
| 55 | | 17,234 | 14,744 | 12,807 | 11,236 |
| 60 | Terminal | 18,062 | 15,427 | 13,377 | 11,715 |

***NOTE: Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

### Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | 9 | 37 | 25 | 60 |
| 35 | Single | 14 | 47 | 32 | 60 |
| 40 | Pole | 18 | 56 | 39 | 60 |
| 45 | | 21 | 60 | 45 | 60 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | | 60 | 60 | 60 | 60 | x | O.K. |
| 35 | "H" | 60 | 60 | 60 | 60 | x | O.K. |
| 40 | Pole | 60 | 60 | 60 | 60 | x | O.K. |
| 45 | | 60 | 60 | 60 | 60 | O.K. | O.K. |

# 50mm² Aluminium Alloy "Hazel" - "NORMAL" Loading Environment

## Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 380 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.12 |

## Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| | | Average / Poor Soil | | | | | | Good / Average Soil | | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pole Length (m) and Grade | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | |
| | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 | M | 80 | 78 | 41 | 76 | 76 | | 80 | 78 | 66 | 76 | 76 | | 80 | 78 | 76 | 76 | 76 |
| 9 | M | 79 | 77 | 39 | 76 | 76 | | 79 | 77 | 63 | 76 | 76 | | 79 | 77 | 76 | 76 | 76 |
| 9.5 | M | 78 | 76 | 37 | 75 | 75 | | 78 | 76 | 60 | 75 | 75 | | 78 | 76 | 75 | 75 | 75 |
| 10 | M | 78 | 76 | 35 | 71 | 75 | | 78 | 76 | 57 | 75 | 75 | | 78 | 76 | 75 | 75 | 75 |
| 10.5 | M | 78 | 76 | 33 | 67 | 76 | | 78 | 76 | 54 | 76 | 76 | | 78 | 76 | 76 | 76 | 76 |
| 11 | M | 78 | 76 | 31 | 64 | 76 | | 78 | 76 | 52 | 76 | 76 | | 78 | 76 | 73 | 76 | 76 |
| 11.5 | M | 78 | 76 | 29 | 60 | 76 | | 78 | 76 | 50 | 76 | 76 | | 78 | 76 | 70 | 76 | 76 |
| 12 | M | 78 | 76 | 27 | 57 | 76 | | 78 | 76 | 47 | 76 | 76 | | 78 | 76 | 68 | 76 | 76 |
| 13 | M | 79 | 78 | 24 | 51 | 78 | | 80 | 78 | 43 | 78 | 78 | | 80 | 78 | 62 | 78 | 78 |
| 14 | M | 75 | 84 | 21 | 46 | 80 | | 86 | 84 | 40 | 77 | 84 | | 86 | 84 | 59 | 84 | 84 |
| 15 | M | 92 | 90 | 41 | 70 | 90 | | 92 | 90 | 70 | 90 | 90 | | 92 | 90 | 90 | 90 | 90 |
| 16 | M | 92 | 97 | 38 | 65 | 97 | | 99 | 97 | 67 | 97 | 97 | | 99 | 97 | 96 | 97 | 97 |
| 17 | M | 87 | 105 | 34 | 59 | 100 | | 107 | 105 | 63 | 101 | 105 | | 107 | 105 | 91 | 105 | 105 |
| 18 | M | 82 | 106 | 31 | 54 | 92 | | 108 | 106 | 58 | 94 | 106 | | 108 | 106 | 86 | 106 | 106 |
| 20 | M | 76 | 115 | 25 | 46 | 78 | | 118 | 115 | 52 | 83 | 115 | | 118 | 115 | 80 | 115 | 115 |
| 22 | M | 66 | 119 | 18 | 36 | 65 | | 116 | 122 | 44 | 71 | 115 | | 124 | 122 | 70 | 106 | 122 |
| | | | | | | | | | | | | | | | | | | |
| 10 | MS | 112 | 117 | 40 | 76 | 116 | | 116 | 117 | 66 | 116 | 116 | | 116 | 117 | 92 | 116 | 116 |
| 11 | MS | 103 | 115 | 35 | 68 | 112 | | 115 | 115 | 59 | 108 | 115 | | 115 | 115 | 84 | 115 | 115 |
| 12 | MS | 97 | 122 | 31 | 61 | 100 | | 122 | 122 | 55 | 98 | 122 | | 122 | 122 | 78 | 122 | 122 |
| 13 | MS | 89 | 122 | 27 | 54 | 90 | | 122 | 122 | 49 | 89 | 122 | | 122 | 122 | 72 | 122 | 122 |
| | | | | | | | | | | | | | | | | | | |
| 8.5 | S | 140 | 154 | 51 | 92 | 149 | | 158 | 154 | 81 | 144 | 150 | | 158 | 154 | 112 | 150 | 150 |
| 9 | S | 136 | 159 | 49 | 88 | 140 | | 163 | 159 | 78 | 137 | 156 | | 163 | 159 | 108 | 156 | 156 |
| 9.5 | S | 129 | 156 | 46 | 82 | 132 | | 159 | 156 | 74 | 129 | 154 | | 159 | 156 | 103 | 154 | 154 |
| 10 | S | 123 | 153 | 43 | 77 | 124 | | 157 | 153 | 70 | 122 | 152 | | 157 | 153 | 98 | 152 | 152 |
| 11 | S | 113 | 145 | 38 | 69 | 111 | | 153 | 150 | 64 | 110 | 150 | | 153 | 150 | 90 | 150 | 150 |
| 12 | S | 104 | 148 | 33 | 61 | 99 | | 151 | 148 | 58 | 100 | 148 | | 151 | 148 | 82 | 139 | 148 |
| 13 | S | 97 | 155 | 29 | 55 | 90 | | 155 | 155 | 53 | 91 | 143 | | 158 | 155 | 77 | 128 | 155 |
| 14 | S | 91 | 156 | 26 | 49 | 81 | | 147 | 160 | 49 | 84 | 131 | | 164 | 160 | 72 | 119 | 160 |
| 15 | S | 116 | 165 | 49 | 77 | 122 | | 169 | 165 | 85 | 127 | 165 | | 169 | 165 | 121 | 165 | 165 |
| 16 | S | 110 | 172 | 45 | 71 | 112 | | 176 | 172 | 80 | 118 | 172 | | 176 | 172 | 115 | 166 | 172 |
| 17 | S | 103 | 171 | 41 | 65 | 103 | | 168 | 171 | 74 | 110 | 167 | | 174 | 171 | 108 | 155 | 171 |
| 18 | S | 98 | 165 | 37 | 59 | 95 | | 162 | 174 | 70 | 103 | 156 | | 178 | 174 | 103 | 147 | 174 |
| 20 | S | 88 | 152 | 29 | 49 | 80 | | 148 | 176 | 61 | 90 | 136 | | 180 | 176 | 92 | 131 | 176 |
| 22 | S | 77 | 138 | 22 | 39 | 66 | | 134 | 173 | 51 | 77 | 118 | | 177 | 173 | 81 | 116 | 171 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | ES | 149 | 210 | 55 | 94 | 147 | | 210 | 210 | 88 | 147 | 210 | | 210 | 210 | 122 | 200 | 210 |
| 9.5 | ES | 141 | 205 | 51 | 88 | 138 | | 205 | 205 | 84 | 138 | 205 | | 205 | 205 | 116 | 189 | 205 |
| 10 | ES | 135 | 201 | 48 | 83 | 129 | | 201 | 201 | 79 | 131 | 201 | | 201 | 201 | 110 | 179 | 201 |
| 10.5 | ES | 128 | 198 | 45 | 78 | 122 | | 198 | 198 | 75 | 124 | 190 | | 198 | 198 | 105 | 170 | 198 |
| 11 | ES | 123 | 194 | 42 | 73 | 115 | | 192 | 194 | 71 | 117 | 180 | | 194 | 194 | 100 | 162 | 194 |
| 11.5 | ES | 120 | 199 | 40 | 70 | 109 | | 187 | 199 | 69 | 113 | 172 | | 199 | 199 | 97 | 155 | 199 |
| 12 | ES | 115 | 193 | 38 | 66 | 103 | | 180 | 196 | 65 | 107 | 163 | | 196 | 196 | 93 | 148 | 196 |
| 13 | ES | 107 | 182 | 34 | 59 | 93 | | 170 | 198 | 60 | 98 | 149 | | 198 | 198 | 86 | 137 | 198 |
| 14 | ES | 101 | 204 | 29 | 52 | 83 | | 161 | 204 | 55 | 89 | 136 | | 204 | 204 | 80 | 126 | 189 |
| 15 | ES | 125 | 199 | 54 | 82 | 126 | | 199 | 199 | 93 | 134 | 199 | | 199 | 199 | 132 | 187 | 199 |
| 16 | ES | 119 | 196 | 50 | 75 | 116 | | 190 | 201 | 88 | 126 | 186 | | 201 | 201 | 125 | 176 | 201 |
| 17 | ES | 112 | 188 | 45 | 69 | 106 | | 182 | 208 | 82 | 117 | 173 | | 208 | 208 | 119 | 166 | 208 |

## 50mm² Aluminium Alloy "Hazel" - "SEVERE" Loading Environment

### Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 570 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 2.03 |

### Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| | | Average / Poor Soil | | | | | | Good / Average Soil | | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pole Length (m) and Grade | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | |
| | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 | M | 42 | 41 | 20 | 39 | 39 | | 42 | 41 | 34 | 39 | 39 | | 42 | 41 | 39 | 39 | 39 |
| 9 | M | 41 | 40 | 19 | 39 | 39 | | 41 | 40 | 32 | 39 | 39 | | 41 | 40 | 39 | 39 | 39 |
| 9.5 | M | 40 | 39 | 18 | 38 | 38 | | 40 | 39 | 30 | 38 | 38 | | 40 | 39 | 38 | 38 | 38 |
| 10 | M | 40 | 39 | 16 | 36 | 38 | | 40 | 39 | 29 | 38 | 38 | | 40 | 39 | 38 | 38 | 38 |
| 10.5 | M | 39 | 39 | 15 | 34 | 38 | | 39 | 39 | 27 | 38 | 38 | | 39 | 39 | 38 | 38 | 38 |
| 11 | M | 40 | 39 | 14 | 32 | 39 | | 40 | 39 | 25 | 39 | 39 | | 40 | 39 | 37 | 39 | 39 |
| 11.5 | M | 40 | 39 | 13 | 30 | 39 | | 40 | 39 | 24 | 39 | 39 | | 40 | 39 | 35 | 39 | 39 |
| 12 | M | 40 | 39 | 11 | 28 | 39 | | 40 | 39 | 22 | 39 | 39 | | 40 | 39 | 34 | 39 | 39 |
| 13 | M | 39 | 39 | 9 | 24 | 39 | | 40 | 39 | 19 | 39 | 39 | | 40 | 39 | 30 | 39 | 39 |
| 14 | M | 37 | 43 | 7 | 21 | 39 | | 44 | 43 | 17 | 38 | 43 | | 44 | 43 | 28 | 43 | 43 |
| 15 | M | 47 | 46 | 17 | 34 | 46 | | 47 | 46 | 34 | 46 | 46 | | 47 | 46 | 46 | 46 | 46 |
| 16 | M | 45 | 50 | 15 | 30 | 50 | | 51 | 50 | 31 | 50 | 50 | | 51 | 50 | 47 | 50 | 50 |
| 17 | M | 42 | 54 | 12 | 26 | 49 | | 55 | 54 | 28 | 49 | 54 | | 55 | 54 | 44 | 54 | 54 |
| 18 | M | 39 | 54 | 10 | 23 | 44 | | 55 | 54 | 25 | 45 | 54 | | 55 | 54 | 41 | 54 | 54 |
| 20 | M | 34 | 59 | 6 | 17 | 35 | | 61 | 59 | 21 | 38 | 59 | | 61 | 59 | 36 | 58 | 59 |
| 22 | M | 27 | 57 | 0 | 10 | 26 | | 55 | 62 | 15 | 30 | 54 | | 64 | 62 | 29 | 49 | 62 |
| | | | | | | | | | | | | | | | | | | |
| 10 | MS | 58 | 60 | 18 | 38 | 59 | | 59 | 60 | 32 | 59 | 59 | | 59 | 60 | 46 | 59 | 59 |
| 11 | MS | 52 | 58 | 15 | 33 | 57 | | 58 | 58 | 29 | 55 | 58 | | 58 | 58 | 42 | 58 | 58 |
| 12 | MS | 48 | 62 | 13 | 29 | 50 | | 62 | 62 | 25 | 49 | 62 | | 62 | 62 | 38 | 62 | 62 |
| 13 | MS | 44 | 62 | 10 | 24 | 44 | | 62 | 62 | 22 | 44 | 62 | | 62 | 62 | 34 | 62 | 62 |
| | | | | | | | | | | | | | | | | | | |
| 8.5 | S | 75 | 82 | 25 | 48 | 79 | | 84 | 82 | 42 | 76 | 79 | | 84 | 82 | 59 | 79 | 79 |
| 9 | S | 72 | 85 | 24 | 45 | 74 | | 86 | 85 | 40 | 72 | 83 | | 86 | 85 | 57 | 83 | 83 |
| 9.5 | S | 68 | 83 | 22 | 42 | 70 | | 84 | 83 | 38 | 68 | 81 | | 84 | 83 | 53 | 81 | 81 |
| 10 | S | 64 | 81 | 20 | 39 | 65 | | 83 | 81 | 35 | 64 | 80 | | 83 | 81 | 51 | 80 | 80 |
| 10.5 | S | 61 | 80 | 18 | 36 | 61 | | 81 | 80 | 33 | 60 | 79 | | 81 | 80 | 48 | 79 | 79 |
| 11 | S | 58 | 76 | 17 | 34 | 57 | | 80 | 79 | 31 | 57 | 78 | | 80 | 79 | 45 | 78 | 78 |
| 11.5 | S | 55 | 73 | 15 | 32 | 54 | | 80 | 78 | 29 | 54 | 78 | | 80 | 78 | 43 | 76 | 78 |
| 12 | S | 53 | 78 | 14 | 29 | 50 | | 79 | 78 | 27 | 51 | 78 | | 79 | 78 | 41 | 72 | 78 |
| 13 | S | 49 | 81 | 11 | 25 | 44 | | 80 | 81 | 24 | 45 | 74 | | 83 | 81 | 37 | 65 | 81 |
| 14 | S | 45 | 81 | 9 | 22 | 39 | | 76 | 84 | 21 | 41 | 67 | | 86 | 84 | 34 | 60 | 84 |
| 15 | S | 58 | 87 | 21 | 36 | 61 | | 89 | 87 | 41 | 64 | 87 | | 89 | 87 | 60 | 87 | 87 |
| 16 | S | 54 | 91 | 18 | 32 | 55 | | 91 | 91 | 37 | 59 | 91 | | 93 | 91 | 57 | 85 | 91 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | S | 50 | 88 | 15 | 28 | 49 | | 85 | 90 | 34 | 53 | 85 | | 92 | 90 | 52 | 78 | 90 |
| 18 | S | 46 | 83 | 12 | 25 | 44 | | 81 | 92 | 31 | 49 | 78 | | 94 | 92 | 49 | 73 | 92 |
| 20 | S | 39 | 75 | 7 | 18 | 35 | | 72 | 93 | 24 | 40 | 66 | | 95 | 93 | 42 | 63 | 93 |
| 22 | S | 32 | 66 | 1 | 11 | 26 | | 63 | 91 | 18 | 32 | 55 | | 94 | 91 | 34 | 53 | 84 |
| 9 | ES | 79 | 113 | 27 | 48 | 78 | | 112 | 113 | 45 | 78 | 112 | | 112 | 113 | 64 | 107 | 112 |
| 9.5 | ES | 75 | 110 | 25 | 45 | 72 | | 110 | 110 | 43 | 73 | 110 | | 110 | 110 | 60 | 101 | 110 |
| 10 | ES | 71 | 108 | 23 | 42 | 68 | | 108 | 108 | 40 | 68 | 107 | | 108 | 108 | 57 | 95 | 108 |
| 10.5 | ES | 67 | 106 | 21 | 39 | 63 | | 106 | 106 | 37 | 64 | 101 | | 106 | 106 | 54 | 90 | 106 |
| 11 | ES | 64 | 104 | 19 | 36 | 59 | | 102 | 104 | 35 | 61 | 95 | | 104 | 104 | 51 | 85 | 104 |
| 11.5 | ES | 62 | 106 | 18 | 34 | 56 | | 99 | 107 | 33 | 58 | 90 | | 107 | 107 | 49 | 81 | 107 |
| 12 | ES | 59 | 102 | 16 | 31 | 52 | | 95 | 105 | 31 | 54 | 85 | | 105 | 105 | 46 | 77 | 105 |
| 13 | ES | 54 | 96 | 13 | 27 | 46 | | 89 | 106 | 28 | 49 | 77 | | 106 | 106 | 42 | 70 | 106 |
| 14 | ES | 50 | 90 | 10 | 23 | 40 | | 83 | 109 | 24 | 43 | 69 | | 109 | 109 | 38 | 64 | 98 |
| 15 | ES | 63 | 106 | 24 | 39 | 63 | | 103 | 106 | 45 | 68 | 104 | | 106 | 106 | 66 | 97 | 106 |
| 16 | ES | 59 | 102 | 20 | 34 | 57 | | 98 | 107 | 41 | 62 | 96 | | 107 | 107 | 62 | 90 | 107 |
| 17 | ES | 54 | 96 | 17 | 30 | 51 | | 93 | 111 | 37 | 57 | 88 | | 111 | 111 | 58 | 84 | 111 |

## 50mm$^2$ Aluminium Alloy "Hazel" - "NORMAL" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. (Deg.C) | Tension (kgf) | Tension (kN) | Sag (m) for Span Length (m) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** |
| -5.6 | 472.91 | 4.64 | 0.07 | 0.11 | 0.16 | 0.21 | 0.28 | 0.35 | 0.44 | 0.53 | 0.63 | 0.74 | 0.86 | 0.98 | - | - |
| -4 | 460.50 | 4.52 | 0.07 | 0.11 | 0.16 | 0.22 | 0.29 | 0.36 | 0.45 | 0.54 | 0.65 | 0.76 | 0.88 | 1.01 | - | - |
| 0 | 429.77 | 4.22 | 0.08 | 0.12 | 0.17 | 0.24 | 0.31 | 0.39 | 0.48 | 0.58 | 0.69 | 0.81 | 0.94 | 1.08 | - | - |
| 4 | 399.54 | 3.92 | 0.08 | 0.13 | 0.19 | 0.25 | 0.33 | 0.42 | 0.52 | 0.63 | 0.74 | 0.87 | 1.01 | 1.16 | - | - |
| 8 | 369.94 | 3.63 | 0.09 | 0.14 | 0.20 | 0.27 | 0.36 | 0.45 | 0.56 | 0.68 | 0.80 | 0.94 | 1.09 | 1.26 | - | - |
| 12 | 341.15 | 3.35 | 0.10 | 0.15 | 0.22 | 0.30 | 0.39 | 0.49 | 0.61 | 0.73 | 0.87 | 1.02 | 1.19 | 1.36 | - | - |
| 16 | 313.37 | 3.07 | 0.11 | 0.16 | 0.24 | 0.32 | 0.42 | 0.53 | 0.66 | 0.80 | 0.95 | 1.11 | 1.29 | 1.48 | - | - |
| 20 | 286.85 | 2.81 | 0.12 | 0.18 | 0.26 | 0.35 | 0.46 | 0.58 | 0.72 | 0.87 | 1.04 | 1.22 | 1.41 | 1.62 | - | - |
| 24 | 261.86 | 2.57 | 0.13 | 0.20 | 0.28 | 0.39 | 0.51 | 0.64 | 0.79 | 0.95 | 1.14 | 1.33 | 1.55 | 1.78 | - | - |
| 28 | 238.66 | 2.34 | 0.14 | 0.22 | 0.31 | 0.42 | 0.55 | 0.70 | 0.87 | 1.05 | 1.25 | 1.46 | 1.70 | 1.95 | - | - |
| 32 | 217.49 | 2.13 | 0.15 | 0.24 | 0.34 | 0.47 | 0.61 | 0.77 | 0.95 | 1.15 | 1.37 | 1.61 | 1.86 | 2.14 | - | - |
| 36 | 198.49 | 1.95 | 0.17 | 0.26 | 0.37 | 0.51 | 0.67 | 0.84 | 1.04 | 1.26 | 1.50 | 1.76 | 2.04 | 2.34 | - | - |

### DESIGN TABLE

| Temp. (Deg.C) | Tension (kgf) | Tension (kN) | Sag (m) for Span Length (m) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** |
| -5.6 | 439.36 | 4.31 | 0.08 | 0.12 | 0.17 | 0.23 | 0.30 | 0.38 | 0.47 | 0.57 | 0.68 | 0.79 | 0.92 | 1.06 | - | - |
| 0 | 396.96 | 3.89 | 0.08 | 0.13 | 0.19 | 0.26 | 0.33 | 0.42 | 0.52 | 0.63 | 0.75 | 0.88 | 1.02 | 1.17 | - | - |
| 30 | 206.09 | 2.02 | 0.16 | 0.25 | 0.36 | 0.49 | 0.64 | 0.81 | 1.00 | 1.21 | 1.44 | 1.69 | 1.97 | 2.26 | - | - |
| 50 | 137.67 | 1.35 | 0.24 | 0.38 | 0.54 | 0.74 | 0.96 | 1.22 | 1.50 | 1.82 | 2.16 | 2.54 | 2.94 | 3.38 | - | - |
| 55 | 126.99 | 1.25 | 0.26 | 0.41 | 0.59 | 0.80 | 1.04 | 1.32 | 1.63 | 1.97 | 2.34 | 2.75 | 3.19 | 3.66 | - | - |
| 60 | 118.04 | 1.16 | 0.28 | 0.44 | 0.63 | 0.86 | 1.12 | 1.42 | 1.75 | 2.12 | 2.52 | 2.96 | 3.43 | 3.94 | - | - |
| 65 | 110.46 | 1.08 | 0.30 | 0.47 | 0.67 | 0.92 | 1.20 | 1.52 | 1.87 | 2.26 | 2.69 | 3.16 | 3.67 | 4.21 | - | - |
| 70 | 103.99 | 1.02 | 0.32 | 0.50 | 0.72 | 0.97 | 1.27 | 1.61 | 1.99 | 2.40 | 2.86 | 3.36 | 3.89 | 4.47 | - | - |
| 75 | 98.41 | 0.97 | 0.34 | 0.52 | 0.76 | 1.03 | 1.34 | 1.70 | 2.10 | 2.54 | 3.02 | 3.55 | 4.12 | 4.72 | - | - |

## 50mm$^2$ Aluminium Alloy "Hazel" - "SEVERE" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 241.53 | 2.37 | 0.14 | 0.21 | 0.31 | 0.42 | 0.55 | 0.69 | 0.86 | 1.04 | 1.23 | - | - | - | - | - | - | - | - |
| -4 | 231.39 | 2.27 | 0.14 | 0.22 | 0.32 | 0.44 | 0.57 | 0.72 | 0.89 | 1.08 | 1.29 | - | - | - | - | - | - | - | - |
| 0 | 207.47 | 2.04 | 0.16 | 0.25 | 0.36 | 0.49 | 0.64 | 0.81 | 1.00 | 1.21 | 1.43 | - | - | - | - | - | - | - | - |
| 4 | 185.87 | 1.82 | 0.18 | 0.28 | 0.40 | 0.54 | 0.71 | 0.90 | 1.11 | 1.35 | 1.60 | - | - | - | - | - | - | - | - |
| 8 | 166.83 | 1.64 | 0.20 | 0.31 | 0.45 | 0.61 | 0.79 | 1.00 | 1.24 | 1.50 | 1.78 | - | - | - | - | - | - | - | - |
| 12 | 150.39 | 1.48 | 0.22 | 0.34 | 0.49 | 0.67 | 0.88 | 1.11 | 1.37 | 1.66 | 1.98 | - | - | - | - | - | - | - | - |
| 16 | 136.42 | 1.34 | 0.24 | 0.38 | 0.55 | 0.74 | 0.97 | 1.23 | 1.51 | 1.83 | 2.18 | - | - | - | - | - | - | - | - |
| 20 | 124.66 | 1.22 | 0.27 | 0.41 | 0.60 | 0.81 | 1.06 | 1.34 | 1.66 | 2.01 | 2.39 | - | - | - | - | - | - | - | - |
| 24 | 114.78 | 1.13 | 0.29 | 0.45 | 0.65 | 0.88 | 1.15 | 1.46 | 1.80 | 2.18 | 2.59 | - | - | - | - | - | - | - | - |
| 28 | 106.45 | 1.04 | 0.31 | 0.49 | 0.70 | 0.95 | 1.24 | 1.57 | 1.94 | 2.35 | 2.80 | - | - | - | - | - | - | - | - |
| 32 | 99.40 | 0.98 | 0.33 | 0.52 | 0.75 | 1.02 | 1.33 | 1.68 | 2.08 | 2.52 | 2.99 | - | - | - | - | - | - | - | - |
| 36 | 93.38 | 0.92 | 0.35 | 0.55 | 0.80 | 1.08 | 1.42 | 1.79 | 2.21 | 2.68 | 3.19 | - | - | - | - | - | - | - | - |

### DESIGN TABLE

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 215.90 | 2.12 | 0.15 | 0.24 | 0.34 | 0.47 | 0.61 | 0.78 | 0.96 | 1.16 | 1.38 | - | - | - | - | - | - | - | - |
| 0 | 185.12 | 1.82 | 0.18 | 0.28 | 0.40 | 0.55 | 0.71 | 0.90 | 1.12 | 1.35 | 1.61 | - | - | - | - | - | - | - | - |
| 30 | 96.05 | 0.94 | 0.34 | 0.54 | 0.77 | 1.05 | 1.38 | 1.74 | 2.15 | 2.60 | 3.10 | - | - | - | - | - | - | - | - |
| 50 | 74.52 | 0.73 | 0.44 | 0.69 | 1.00 | 1.36 | 1.77 | 2.25 | 2.77 | 3.36 | 3.99 | - | - | - | - | - | - | - | - |
| 55 | 70.91 | 0.70 | 0.47 | 0.73 | 1.05 | 1.43 | 1.87 | 2.36 | 2.91 | 3.53 | 4.20 | - | - | - | - | - | - | - | - |
| 60 | 67.74 | 0.66 | 0.49 | 0.76 | 1.10 | 1.49 | 1.95 | 2.47 | 3.05 | 3.69 | 4.39 | - | - | - | - | - | - | - | - |
| 65 | 64.94 | 0.64 | 0.51 | 0.80 | 1.15 | 1.56 | 2.04 | 2.58 | 3.18 | 3.85 | 4.58 | - | - | - | - | - | - | - | - |
| 70 | 62.44 | 0.61 | 0.53 | 0.83 | 1.19 | 1.62 | 2.12 | 2.68 | 3.31 | 4.00 | 4.77 | - | - | - | - | - | - | - | - |
| 75 | 60.20 | 0.59 | 0.55 | 0.86 | 1.24 | 1.68 | 2.20 | 2.78 | 3.43 | 4.15 | 4.94 | - | - | - | - | - | - | - | - |

# APPENDIX D

## 60 $mm^2$ Aluminium Alloy "Pine"

- Conductor & Design Parameters
- Structure Suitability
- Stayed Pole Design Data
- Unstayed Pole Design Data
- Sags and Tensions

## 60mm$^2$ Aluminium Alloy "Pine"

### Conductor Parameters:

| | |
|---|---|
| Conductor Stranding (#strands / diameter(mm)) | 7/3.61 |
| Greased Conductor Weight (kg/m) | 0.198 |
| Cross Sectional Area of Conductor (mm²) | 71.6 |
| Conductor Overall Diameter (mm) | 10.83 |
| Coefficient of Linear Expansion (/Degree C) | 2.30E-05 |
| Modulus of Elasticity (kg/mm²) | 6,000 |
| Rated Breaking Strength of Conductor (kgf) | 2,155.7 |

| **Design Loading Parameters:** | **"Normal"** | **"Severe"** |
|---|---|---|
| Basic / Recommended Span (m) | 110 | 90 |
| Wind Pressure on Conductor (N/m²) | 380 | 570 |
| Radial Ice Thickness (mm) | 9.5 | 12.5 |
| Ice Density (kg/m³) | 913 | 913 |
| Absolute Maximum Working Tension (MWT) Limit (kgf) | 1,077.8 | 2,379.0 |
| Temperature at MWT Limit (Degrees C) | -5.6 | -5.6 |
| Maximum "Everyday" Tension (EDT) Limit (kgf) | 431.1 | 229.8 |
| Temperature at EDT Limit (Degrees C) | 5.0 | -5.6 |
| Maximum Conductor Tension (MCT) at -5.6 degC (kgf) | 948.4 | 964.9 |
| Maximum Conductor Weight (MCW) (kg/m) | 0.752 | 1.034 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.156 | 2.083 |
| Freezing Point Tension (FPT) (kgf) | 472.9 | 203.7 |

| **Span Length Limits:** | **"Normal"** | **"Severe"** |
|---|---|---|
| Maximum **Equivalent** Span | 110 | 90 |
| *Maximum **Single** Span (clashing limit)<br>(Standard heavy crossarm, 1.2m phase spacing) | 115 | 95 |
| *Maximum **Single** Span (clashing limit)<br>(H Pole, long span heavy crossarm, 2.0m phase spacing) | 150 | 120 |

**NOTE: Single span limits to be reduced by 10m where weather zone is worse than 2B at "normal" altitudes, or worse than 3C at "severe" altitudes. Weather zones are given in Appendix O**

## 60mm$^2$ Aluminium Alloy "Pine"

### Pole-Top Steelwork Suitability

| Grade | Structure Configuration | | Drg. Ref | Max. Dev'n Normal | Max. Dev'n Severe | Max. D'pull. | Notes |
|---|---|---|---|---|---|---|---|
| Light | Single Pole | Single Arm Intermediate / Pin Angle | F3 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Straight Section / Angle Section | F4 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Termination | F5 | Not Suitable | Not Suitable | Not Suitable | |
| Heavy | Single Pole | Single Arm Intermediate / Pin Angle | F7 | 16º | 12º | 1:10 | |
| Heavy | Single Pole | Double Arm Intermediate / Pin Angle | F8 | 16º | 12º | 1:10 | |
| Heavy | Single Pole | Double Arm Straight Section / Angle Section | F9 | 60º | 60º | 1:10 | |
| Heavy | "H" Pole | Double Arm Angle Section | F10 | 60º | 60º | 1:10 | Limits as per F8 if used as intermediate |
| Heavy | "H" Pole | Double Arm Section / Inter. For long spans | F11 | 60º (section) | 60º (section) | 1:10 | No deviation allow ed if used as intermediate |
| Heavy | "H" Pole | Double Arm Termination | F12 | O.K. | O.K. | 1:10 | |
| Heavy | Single Pole | Double Arm Termination | F13 | O.K. | O.K. | 1:10 | |

## 60mm$^2$ Aluminium Alloy "Pine" - "NORMAL" Loading Environment

### Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 948.4 |
| Wind Pressure (N/m²) | 380 |
| Maximum Conductor Weight (MCW) (kg/m) | 0.75 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.16 |
| Maximum Wind Span Length (m) | 150 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 7,113.1 |
| Transverse Load [Normal to Span] (kgf) | 1,300.4 |
| Vertical Load with Downpull (1:10) (kgf) | 3,089.7 |
| Pole Wind Loading (kgf) | 224.5 |

### Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|
| 0 | | 5,731 | 5,268 | 4,907 | 4,615 |
| 5 | | 6,804 | 6,152 | 5,645 | 5,234 |
| 10 | | 7,870 | 7,031 | 6,379 | 5,850 |
| 15 | | 8,928 | 7,904 | 7,107 | 6,460 |
| 20 | | 9,976 | 8,767 | 7,828 | 7,065 |
| 25 | | 11,011 | 9,621 | 8,540 | 7,663 |
| 30 | | 12,032 | 10,463 | 9,242 | 8,252 |
| 35 | | 13,036 | 11,291 | 9,934 | 8,832 |
| 40 | | 14,023 | 12,104 | 10,612 | 9,402 |
| 45 | | 14,989 | 12,901 | 11,277 | 9,960 |
| 50 | | 15,933 | 13,680 | 11,927 | 10,505 |
| 55 | | 16,854 | 14,439 | 12,560 | 11,037 |
| 60 | Terminal | 17,749 | 15,177 | 13,176 | 11,554 |

***NOTE: Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

### Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | 14 | 40 | 29 | 60 |
| 35 | Single | 18 | 50 | 36 | 60 |
| 40 | Pole | 22 | 59 | 42 | 60 |
| 45 | | 25 | 60 | 48 | 60 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | | 60 | 60 | 60 | 60 | x | O.K. |
| 35 | "H" | 60 | 60 | 60 | 60 | x | O.K. |
| 40 | Pole | 60 | 60 | 60 | 60 | x | O.K. |
| 45 | | 60 | 60 | 60 | 60 | O.K. | O.K. |

## 60mm$^2$ Aluminium Alloy "Pine" - "SEVERE" Loading Environment

### Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 964.9 |
| Wind Pressure (N/m²) | 570 |
| Maximum Conductor Weight (MCW) (kg/m) | 1.03 |
| Maximum Conductor Pressure (MCP) (kg/m) | 2.08 |
| Maximum Wind Span Length (m) | 120 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 7,236.5 |
| Transverse Load [Normal to Span] (kgf) | 1,874.3 |
| Vertical Load with Downpull (1:10) (kgf) | 3,199.3 |
| Pole Wind Loading (kgf) | 336.8 |

### Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|
| 0 | | 7,029 | 6,357 | 5,834 | 5,410 |
| 5 | | 8,119 | 7,256 | 6,585 | 6,040 |
| 10 | | 9,202 | 8,148 | 7,329 | 6,665 |
| 15 | | 10,273 | 9,032 | 8,067 | 7,284 |
| 20 | | 11,333 | 9,906 | 8,796 | 7,895 |
| 25 | | 12,378 | 10,767 | 9,515 | 8,499 |
| 30 | | 13,407 | 11,616 | 10,222 | 9,092 |
| 35 | | 14,417 | 12,449 | 10,918 | 9,676 |
| 40 | | 15,407 | 13,265 | 11,599 | 10,247 |
| 45 | | 16,375 | 14,063 | 12,265 | 10,806 |
| 50 | | 17,319 | 14,842 | 12,915 | 11,351 |
| 55 | | 18,237 | 15,599 | 13,546 | 11,882 |
| 60 | Terminal | 19,128 | 16,333 | 14,159 | 12,396 |

***NOTE: Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

### Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | 8 | 34 | 23 | 60 |
| 35 | Single | 12 | 43 | 30 | 60 |
| 40 | Pole | 16 | 52 | 36 | 60 |
| 45 | | 19 | 60 | 42 | 60 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | | 60 | 60 | 60 | 60 | x | O.K. |
| 35 | "H" | 60 | 60 | 60 | 60 | x | O.K. |
| 40 | Pole | 60 | 60 | 60 | 60 | x | O.K. |
| 45 | | 60 | 60 | 60 | 60 | x | O.K. |

## 60mm² Aluminium Alloy "Pine" - "NORMAL" Loading Environment

### Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 380 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.16 |

### Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| | | Average / Poor Soil | | | | | | Good / Average Soil | | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pole Length (m) and Grade | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | |
| | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 | M | 75 | 76 | 40 | 74 | 74 | | 75 | 76 | 64 | 74 | 74 | | 75 | 76 | 74 | 74 | 74 |
| 9 | M | 74 | 75 | 38 | 73 | 73 | | 74 | 75 | 61 | 73 | 73 | | 74 | 75 | 73 | 73 | 73 |
| 9.5 | M | 74 | 74 | 35 | 73 | 73 | | 74 | 74 | 58 | 73 | 73 | | 74 | 74 | 73 | 73 | 73 |
| 10 | M | 73 | 74 | 33 | 69 | 73 | | 73 | 74 | 55 | 73 | 73 | | 73 | 74 | 73 | 73 | 73 |
| 10.5 | M | 73 | 73 | 32 | 65 | 73 | | 73 | 73 | 53 | 73 | 73 | | 73 | 73 | 73 | 73 | 73 |
| 11 | M | 74 | 74 | 30 | 62 | 74 | | 74 | 74 | 50 | 74 | 74 | | 74 | 74 | 71 | 74 | 74 |
| 11.5 | M | 74 | 74 | 28 | 58 | 74 | | 74 | 74 | 48 | 74 | 74 | | 74 | 74 | 68 | 74 | 74 |
| 12 | M | 74 | 74 | 26 | 55 | 74 | | 74 | 74 | 46 | 74 | 74 | | 74 | 74 | 65 | 74 | 74 |
| 13 | M | 75 | 76 | 23 | 49 | 76 | | 76 | 76 | 42 | 76 | 76 | | 76 | 76 | 60 | 76 | 76 |
| 14 | M | 72 | 81 | 20 | 44 | 77 | | 81 | 81 | 39 | 75 | 81 | | 81 | 81 | 57 | 81 | 81 |
| 15 | M | 88 | 88 | 39 | 68 | 88 | | 88 | 88 | 68 | 88 | 88 | | 88 | 88 | 88 | 88 | 88 |
| 16 | M | 88 | 94 | 36 | 63 | 94 | | 94 | 94 | 64 | 94 | 94 | | 94 | 94 | 93 | 94 | 94 |
| 17 | M | 84 | 102 | 33 | 58 | 97 | | 102 | 102 | 61 | 97 | 102 | | 102 | 102 | 89 | 102 | 102 |
| 18 | M | 79 | 103 | 30 | 53 | 89 | | 103 | 103 | 57 | 91 | 103 | | 103 | 103 | 84 | 103 | 103 |
| 20 | M | 72 | 112 | 24 | 44 | 76 | | 112 | 112 | 51 | 80 | 112 | | 112 | 112 | 77 | 112 | 112 |
| 22 | M | 63 | 116 | 17 | 35 | 63 | | 111 | 118 | 42 | 69 | 111 | | 118 | 118 | 68 | 103 | 118 |
| | | | | | | | | | | | | | | | | | | |
| 10 | MS | 107 | 110 | 38 | 72 | 109 | | 110 | 110 | 62 | 109 | 109 | | 110 | 110 | 87 | 109 | 109 |
| 11 | MS | 98 | 109 | 33 | 64 | 106 | | 109 | 109 | 57 | 103 | 109 | | 109 | 109 | 80 | 109 | 109 |
| 12 | MS | 92 | 115 | 30 | 58 | 95 | | 115 | 115 | 52 | 94 | 115 | | 115 | 115 | 74 | 115 | 115 |
| 13 | MS | 85 | 116 | 26 | 51 | 86 | | 116 | 116 | 47 | 85 | 116 | | 116 | 116 | 68 | 116 | 116 |
| | | | | | | | | | | | | | | | | | | |
| 8.5 | S | 132 | 150 | 49 | 90 | 144 | | 148 | 150 | 79 | 139 | 145 | | 148 | 150 | 108 | 145 | 145 |
| 9 | S | 128 | 154 | 47 | 85 | 136 | | 153 | 154 | 76 | 133 | 151 | | 153 | 154 | 105 | 151 | 151 |
| 9.5 | S | 122 | 151 | 44 | 80 | 128 | | 150 | 151 | 72 | 125 | 149 | | 150 | 151 | 100 | 149 | 149 |
| 10 | S | 117 | 149 | 41 | 75 | 120 | | 148 | 149 | 68 | 119 | 147 | | 148 | 149 | 95 | 147 | 147 |
| 10.5 | S | 112 | 146 | 39 | 71 | 114 | | 146 | 147 | 65 | 112 | 146 | | 146 | 147 | 91 | 146 | 146 |
| 11 | S | 107 | 140 | 36 | 67 | 107 | | 145 | 145 | 62 | 107 | 145 | | 145 | 145 | 87 | 145 | 145 |
| 11.5 | S | 103 | 135 | 34 | 63 | 102 | | 144 | 144 | 59 | 102 | 144 | | 144 | 144 | 83 | 140 | 144 |
| 12 | S | 99 | 143 | 32 | 59 | 96 | | 143 | 143 | 56 | 97 | 143 | | 143 | 143 | 80 | 134 | 143 |
| 13 | S | 93 | 150 | 28 | 53 | 87 | | 150 | 150 | 51 | 88 | 139 | | 150 | 150 | 74 | 124 | 150 |
| 14 | S | 87 | 151 | 25 | 48 | 78 | | 140 | 155 | 47 | 81 | 127 | | 155 | 155 | 70 | 115 | 155 |
| 15 | S | 111 | 160 | 48 | 75 | 118 | | 160 | 160 | 82 | 123 | 160 | | 160 | 160 | 117 | 160 | 160 |
| 16 | S | 105 | 167 | 44 | 69 | 108 | | 167 | 167 | 77 | 115 | 167 | | 167 | 167 | 111 | 161 | 167 |
| 17 | S | 99 | 165 | 39 | 62 | 100 | | 161 | 165 | 72 | 107 | 162 | | 165 | 165 | 104 | 151 | 165 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | S | 94 | 160 | 36 | 57 | 92 | | 155 | 169 | 68 | 100 | 151 | | 169 | 169 | 100 | 143 | 169 |
| 20 | S | 84 | 147 | 28 | 47 | 77 | | 142 | 171 | 59 | 87 | 132 | | 171 | 171 | 89 | 127 | 171 |
| 22 | S | 74 | 133 | 21 | 37 | 64 | | 129 | 168 | 50 | 75 | 115 | | 168 | 168 | 79 | 112 | 165 |

# 60mm² Aluminium Alloy "Pine" - "SEVERE" Loading Environment

## Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 570 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 2.08 |

## Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| Pole Length (m) and Grade | | Average / Poor Soil | | | | | Good / Average Soil | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | |
| | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 | M | 39 | 40 | 20 | 38 | 38 | 39 | 40 | 33 | 38 | 38 | 39 | 40 | 38 | 38 | 38 |
| 9 | M | 38 | 39 | 18 | 38 | 38 | 38 | 39 | 31 | 38 | 38 | 38 | 39 | 38 | 38 | 38 |
| 9.5 | M | 38 | 38 | 17 | 37 | 37 | 38 | 38 | 29 | 37 | 37 | 38 | 38 | 37 | 37 | 37 |
| 10 | M | 38 | 38 | 16 | 35 | 37 | 38 | 38 | 28 | 37 | 37 | 38 | 38 | 37 | 37 | 37 |
| 10.5 | M | 37 | 38 | 15 | 33 | 37 | 37 | 38 | 26 | 37 | 37 | 37 | 38 | 37 | 37 | 37 |
| 11 | M | 38 | 38 | 13 | 31 | 38 | 38 | 38 | 25 | 38 | 38 | 38 | 38 | 36 | 38 | 38 |
| 11.5 | M | 38 | 38 | 12 | 29 | 38 | 38 | 38 | 23 | 38 | 38 | 38 | 38 | 34 | 38 | 38 |
| 12 | M | 38 | 38 | 11 | 27 | 38 | 38 | 38 | 22 | 38 | 38 | 38 | 38 | 33 | 38 | 38 |
| 13 | M | 38 | 38 | 9 | 23 | 38 | 38 | 38 | 19 | 38 | 38 | 38 | 38 | 29 | 38 | 38 |
| 14 | M | 35 | 42 | 7 | 20 | 38 | 42 | 42 | 17 | 37 | 42 | 42 | 42 | 27 | 42 | 42 |
| 15 | M | 45 | 45 | 17 | 33 | 45 | 45 | 45 | 33 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| 16 | M | 43 | 48 | 15 | 29 | 48 | 48 | 48 | 30 | 48 | 48 | 48 | 48 | 46 | 48 | 48 |
| 17 | M | 40 | 52 | 12 | 26 | 47 | 52 | 52 | 27 | 48 | 52 | 52 | 52 | 43 | 52 | 52 |
| 18 | M | 37 | 53 | 10 | 22 | 43 | 53 | 53 | 25 | 44 | 53 | 53 | 53 | 40 | 53 | 53 |
| 20 | M | 32 | 58 | 5 | 16 | 34 | 58 | 58 | 20 | 37 | 58 | 58 | 58 | 35 | 57 | 58 |
| 22 | M | 26 | 55 | 0 | 10 | 26 | 53 | 61 | 14 | 29 | 53 | 61 | 61 | 28 | 48 | 61 |
| | | | | | | | | | | | | | | | | |
| 10 | MS | 56 | 58 | 18 | 37 | 57 | 58 | 58 | 31 | 57 | 57 | 58 | 58 | 45 | 57 | 57 |
| 11 | MS | 51 | 57 | 15 | 32 | 55 | 57 | 57 | 28 | 54 | 57 | 57 | 57 | 41 | 57 | 57 |
| 12 | MS | 47 | 60 | 12 | 28 | 49 | 60 | 60 | 25 | 48 | 60 | 60 | 60 | 37 | 60 | 60 |
| 13 | MS | 43 | 60 | 10 | 24 | 43 | 60 | 60 | 21 | 43 | 60 | 60 | 60 | 33 | 60 | 60 |
| | | | | | | | | | | | | | | | | |
| 8.5 | S | 71 | 80 | 24 | 47 | 77 | 79 | 80 | 41 | 74 | 77 | 79 | 80 | 57 | 77 | 77 |
| 9 | S | 68 | 82 | 23 | 44 | 72 | 82 | 82 | 39 | 71 | 80 | 82 | 82 | 55 | 80 | 80 |
| 9.5 | S | 65 | 80 | 21 | 41 | 68 | 80 | 80 | 37 | 66 | 79 | 80 | 80 | 52 | 79 | 79 |
| 10 | S | 61 | 79 | 20 | 38 | 63 | 79 | 79 | 34 | 62 | 78 | 79 | 79 | 49 | 78 | 78 |
| 10.5 | S | 58 | 78 | 18 | 35 | 59 | 77 | 78 | 32 | 59 | 77 | 77 | 78 | 47 | 77 | 77 |
| 11 | S | 56 | 74 | 16 | 33 | 56 | 76 | 77 | 30 | 55 | 76 | 76 | 77 | 44 | 76 | 76 |
| 11.5 | S | 53 | 71 | 15 | 31 | 52 | 76 | 76 | 28 | 52 | 76 | 76 | 76 | 42 | 74 | 76 |
| 12 | S | 50 | 76 | 13 | 29 | 49 | 76 | 76 | 27 | 49 | 76 | 76 | 76 | 40 | 70 | 76 |
| 13 | S | 47 | 79 | 11 | 25 | 43 | 77 | 79 | 24 | 44 | 72 | 79 | 79 | 36 | 64 | 79 |
| 14 | S | 43 | 78 | 8 | 21 | 38 | 73 | 82 | 21 | 40 | 65 | 82 | 82 | 33 | 58 | 82 |
| 15 | S | 56 | 85 | 21 | 36 | 60 | 85 | 85 | 40 | 62 | 85 | 85 | 85 | 59 | 85 | 85 |
| 16 | S | 52 | 88 | 18 | 31 | 54 | 88 | 88 | 36 | 57 | 88 | 88 | 88 | 55 | 83 | 88 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | S | 48 | 85 | 15 | 27 | 48 | | 82 | 87 | 33 | 52 | 83 | | 87 | 87 | 51 | 76 | 87 |
| 18 | S | 45 | 81 | 12 | 24 | 43 | | 78 | 90 | 30 | 48 | 76 | | 90 | 90 | 47 | 71 | 90 |
| 20 | S | 38 | 73 | 7 | 17 | 34 | | 70 | 91 | 24 | 39 | 64 | | 91 | 91 | 40 | 61 | 91 |
| 22 | S | 31 | 64 | 1 | 10 | 25 | | 61 | 89 | 17 | 31 | 53 | | 89 | 89 | 33 | 52 | 81 |
| | | | | | | | | | | | | | | | | | | |
| 9 | ES | 75 | 106 | 26 | 46 | 74 | | 106 | 106 | 43 | 74 | 106 | | 106 | 106 | 61 | 102 | 106 |
| 9.5 | ES | 71 | 104 | 24 | 43 | 69 | | 104 | 104 | 41 | 69 | 104 | | 104 | 104 | 57 | 96 | 104 |
| 10 | ES | 66 | 100 | 21 | 39 | 64 | | 99 | 100 | 37 | 64 | 97 | | 99 | 100 | 53 | 89 | 97 |
| 10.5 | ES | 63 | 103 | 19 | 37 | 60 | | 101 | 103 | 35 | 61 | 96 | | 102 | 103 | 51 | 85 | 101 |
| 11 | ES | 60 | 102 | 17 | 34 | 56 | | 96 | 102 | 33 | 57 | 90 | | 101 | 102 | 48 | 80 | 100 |
| 11.5 | ES | 58 | 101 | 16 | 32 | 53 | | 94 | 105 | 31 | 54 | 86 | | 104 | 105 | 46 | 77 | 104 |
| 12 | ES | 55 | 97 | 15 | 29 | 49 | | 90 | 103 | 29 | 51 | 81 | | 103 | 103 | 44 | 73 | 103 |
| 13 | ES | 51 | 91 | 12 | 25 | 43 | | 84 | 107 | 26 | 46 | 73 | | 107 | 107 | 40 | 66 | 102 |
| 14 | ES | 47 | 85 | 9 | 21 | 38 | | 79 | 110 | 22 | 41 | 65 | | 110 | 110 | 36 | 60 | 93 |
| 15 | ES | 59 | 102 | 22 | 36 | 60 | | 98 | 109 | 42 | 64 | 99 | | 109 | 109 | 63 | 92 | 109 |
| 16 | ES | 55 | 97 | 19 | 32 | 54 | | 93 | 112 | 39 | 59 | 91 | | 112 | 112 | 59 | 85 | 112 |
| 17 | ES | 53 | 94 | 16 | 29 | 48 | | 91 | 121 | 36 | 55 | 84 | | 121 | 121 | 56 | 81 | 120 |

## 60mm$^2$ Aluminium Alloy "Pine" - "NORMAL" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. (Deg.C) | Tension (kgf) | Tension (kN) | Sag (m) for Span Length (m) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** |
| -5.6 | 566.1 | 5.55 | 0.07 | 0.11 | 0.16 | 0.21 | 0.28 | 0.35 | 0.44 | 0.53 | 0.63 | 0.74 | 0.86 | 0.98 |
| -4 | 551.2 | 5.41 | 0.07 | 0.11 | 0.16 | 0.22 | 0.29 | 0.36 | 0.45 | 0.54 | 0.65 | 0.76 | 0.88 | 1.01 |
| 0 | 514.4 | 5.05 | 0.08 | 0.12 | 0.17 | 0.24 | 0.31 | 0.39 | 0.48 | 0.58 | 0.69 | 0.81 | 0.94 | 1.08 |
| 4 | 478.3 | 4.69 | 0.08 | 0.13 | 0.19 | 0.25 | 0.33 | 0.42 | 0.52 | 0.63 | 0.74 | 0.87 | 1.01 | 1.16 |
| 8 | 442.8 | 4.34 | 0.09 | 0.14 | 0.20 | 0.27 | 0.36 | 0.45 | 0.56 | 0.68 | 0.80 | 0.94 | 1.09 | 1.26 |
| 12 | 408.4 | 4.01 | 0.10 | 0.15 | 0.22 | 0.30 | 0.39 | 0.49 | 0.61 | 0.73 | 0.87 | 1.02 | 1.19 | 1.36 |
| 16 | 375.1 | 3.68 | 0.11 | 0.16 | 0.24 | 0.32 | 0.42 | 0.53 | 0.66 | 0.80 | 0.95 | 1.11 | 1.29 | 1.48 |
| 20 | 343.4 | 3.37 | 0.12 | 0.18 | 0.26 | 0.35 | 0.46 | 0.58 | 0.72 | 0.87 | 1.04 | 1.22 | 1.41 | 1.62 |
| 24 | 313.5 | 3.08 | 0.13 | 0.20 | 0.28 | 0.39 | 0.51 | 0.64 | 0.79 | 0.95 | 1.14 | 1.33 | 1.55 | 1.78 |
| 28 | 285.7 | 2.80 | 0.14 | 0.22 | 0.31 | 0.42 | 0.55 | 0.70 | 0.87 | 1.05 | 1.25 | 1.46 | 1.70 | 1.95 |
| 32 | 260.4 | 2.55 | 0.15 | 0.24 | 0.34 | 0.47 | 0.61 | 0.77 | 0.95 | 1.15 | 1.37 | 1.61 | 1.86 | 2.14 |
| 36 | 237.6 | 2.33 | 0.17 | 0.26 | 0.37 | 0.51 | 0.67 | 0.84 | 1.04 | 1.26 | 1.50 | 1.76 | 2.04 | 2.34 |

### DESIGN TABLE

| Temp. (Deg.C) | Tension (kgf) | Tension (kN) | Sag (m) for Span Length (m) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** |
| -5.6 | 525.9 | 5.16 | 0.08 | 0.12 | 0.17 | 0.23 | 0.30 | 0.38 | 0.47 | 0.57 | 0.68 | 0.79 | 0.92 | 1.06 |
| 0 | 475.2 | 4.66 | 0.08 | 0.13 | 0.19 | 0.26 | 0.33 | 0.42 | 0.52 | 0.63 | 0.75 | 0.88 | 1.02 | 1.17 |
| 30 | 246.7 | 2.42 | 0.16 | 0.25 | 0.36 | 0.49 | 0.64 | 0.81 | 1.00 | 1.21 | 1.44 | 1.69 | 1.97 | 2.26 |
| 50 | 164.8 | 1.62 | 0.24 | 0.38 | 0.54 | 0.74 | 0.96 | 1.22 | 1.50 | 1.82 | 2.16 | 2.54 | 2.94 | 3.38 |
| 55 | 152.0 | 1.49 | 0.26 | 0.41 | 0.59 | 0.80 | 1.04 | 1.32 | 1.63 | 1.97 | 2.34 | 2.75 | 3.19 | 3.66 |
| 60 | 141.3 | 1.39 | 0.28 | 0.44 | 0.63 | 0.86 | 1.12 | 1.42 | 1.75 | 2.12 | 2.52 | 2.96 | 3.43 | 3.94 |
| 65 | 132.2 | 1.30 | 0.30 | 0.47 | 0.67 | 0.92 | 1.20 | 1.52 | 1.87 | 2.26 | 2.69 | 3.16 | 3.67 | 4.21 |
| 70 | 124.5 | 1.22 | 0.32 | 0.50 | 0.72 | 0.97 | 1.27 | 1.61 | 1.99 | 2.40 | 2.86 | 3.36 | 3.89 | 4.47 |
| 75 | 117.8 | 1.16 | 0.34 | 0.52 | 0.76 | 1.03 | 1.34 | 1.70 | 2.10 | 2.54 | 3.02 | 3.55 | 4.12 | 4.72 |

## 60mm$^2$ Aluminium Alloy "Pine" - "SEVERE" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 465.70 | 4.57 | 0.09 | 0.13 | 0.19 | 0.26 | 0.34 | 0.43 | 0.53 | 0.64 | 0.77 | - | - | - | - | - | - | - | - |
| -4 | 451.00 | 4.42 | 0.09 | 0.14 | 0.20 | 0.27 | 0.35 | 0.44 | 0.55 | 0.66 | 0.79 | - | - | - | - | - | - | - | - |
| 0 | 414.50 | 4.07 | 0.10 | 0.15 | 0.21 | 0.29 | 0.38 | 0.48 | 0.60 | 0.72 | 0.86 | - | - | - | - | - | - | - | - |
| 4 | 379.00 | 3.72 | 0.10 | 0.16 | 0.24 | 0.32 | 0.42 | 0.53 | 0.65 | 0.79 | 0.94 | - | - | - | - | - | - | - | - |
| 8 | 344.50 | 3.38 | 0.11 | 0.18 | 0.26 | 0.35 | 0.46 | 0.58 | 0.72 | 0.87 | 1.03 | - | - | - | - | - | - | - | - |
| 12 | 311.40 | 3.05 | 0.13 | 0.20 | 0.29 | 0.39 | 0.51 | 0.64 | 0.79 | 0.96 | 1.14 | - | - | - | - | - | - | - | - |
| 16 | 280.20 | 2.75 | 0.14 | 0.22 | 0.32 | 0.43 | 0.57 | 0.72 | 0.88 | 1.07 | 1.27 | - | - | - | - | - | - | - | - |
| 20 | 251.30 | 2.47 | 0.16 | 0.25 | 0.35 | 0.48 | 0.63 | 0.80 | 0.98 | 1.19 | 1.42 | - | - | - | - | - | - | - | - |
| 24 | 225.20 | 2.21 | 0.18 | 0.27 | 0.40 | 0.54 | 0.70 | 0.89 | 1.10 | 1.33 | 1.58 | - | - | - | - | - | - | - | - |
| 28 | 202.10 | 1.98 | 0.20 | 0.31 | 0.44 | 0.60 | 0.78 | 0.99 | 1.22 | 1.48 | 1.76 | - | - | - | - | - | - | - | - |
| 32 | 182.10 | 1.79 | 0.22 | 0.34 | 0.49 | 0.67 | 0.87 | 1.10 | 1.36 | 1.64 | 1.96 | - | - | - | - | - | - | - | - |
| 36 | 165.10 | 1.62 | 0.24 | 0.37 | 0.54 | 0.73 | 0.96 | 1.21 | 1.50 | 1.81 | 2.16 | - | - | - | - | - | - | - | - |

### DESIGN TABLE

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 433.30 | 4.25 | 0.09 | 0.14 | 0.21 | 0.28 | 0.37 | 0.46 | 0.57 | 0.69 | 0.82 | - | - | - | - | - | - | - | - |
| 0 | 383.10 | 3.76 | 0.10 | 0.16 | 0.23 | 0.32 | 0.41 | 0.52 | 0.65 | 0.78 | 0.93 | - | - | - | - | - | - | - | - |
| 30 | 175.20 | 1.72 | 0.23 | 0.35 | 0.51 | 0.69 | 0.90 | 1.14 | 1.41 | 1.71 | 2.03 | - | - | - | - | - | - | - | - |
| 50 | 117.00 | 1.15 | 0.34 | 0.53 | 0.76 | 1.04 | 1.35 | 1.71 | 2.12 | 2.56 | 3.05 | - | - | - | - | - | - | - | - |
| 55 | 108.50 | 1.06 | 0.37 | 0.57 | 0.82 | 1.12 | 1.46 | 1.85 | 2.28 | 2.76 | 3.29 | - | - | - | - | - | - | - | - |
| 60 | 101.40 | 0.99 | 0.39 | 0.61 | 0.88 | 1.20 | 1.56 | 1.98 | 2.44 | 2.95 | 3.52 | - | - | - | - | - | - | - | - |
| 65 | 95.40 | 0.94 | 0.42 | 0.65 | 0.93 | 1.27 | 1.66 | 2.10 | 2.59 | 3.14 | 3.74 | - | - | - | - | - | - | - | - |
| 70 | 90.20 | 0.88 | 0.44 | 0.69 | 0.99 | 1.34 | 1.76 | 2.22 | 2.74 | 3.32 | 3.95 | - | - | - | - | - | - | - | - |
| 75 | 85.80 | 0.84 | 0.46 | 0.72 | 1.04 | 1.41 | 1.85 | 2.34 | 2.88 | 3.49 | 4.15 | - | - | - | - | - | - | - | - |

## 70 $mm^2$ Hard Drawn Copper

* Conductor & Design Parameters
* Structure Suitability
* Stayed Pole Design Data
* Unstayed Pole Design Data
* Sags and Tensions

## 70mm$^2$ Hard Drawn Copper

### Conductor Parameters:

| | |
|---|---|
| Conductor Stranding (#strands / diameter(mm)) | 7/3.55 |
| Greased Conductor Weight (kg/m) | 0.621 |
| Cross Sectional Area of Conductor (mm²) | 69.3 |
| Conductor Overall Diameter (mm) | 10.65 |
| Coefficient of Linear Expansion (/Degree C) | 1.70E-05 |
| Modulus of Elasticity (kg/mm²) | 12,660 |
| Rated Breaking Strength of Conductor (kgf) | 2,643.2 |

| **Design Loading Parameters:** | **"Normal"** | **"Severe"** |
|---|---|---|
| Basic / Recommended Span (m) | 130 | 110 |
| Wind Pressure on Conductor (N/m²) | 380 | 570 |
| Radial Ice Thickness (mm) | 9.5 | 12.5 |
| Ice Density (kg/m³) | 913 | 913 |
| Absolute Maximum Working Tension (MWT) Limit (kgf) | 2,379.0 | 2,379.0 |
| Temperature at MWT Limit (Degrees C) | -5.6 | -5.6 |
| Maximum "Everyday" Tension (EDT) Limit (kgf) | 771.2 | 470.9 |
| Temperature at EDT Limit (Degrees C) | -5.6 | -5.6 |
| Maximum Conductor Tension (MCT) at -5.6 degC (kgf) | 1,321.6 | 1,321.6 |
| Maximum Conductor Weight (MCW) (kg/m) | 1.170 | 1.451 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.149 | 2.072 |
| Freezing Point Tension (FPT) (kgf) | 731.9 | 452.2 |

| **Span Length Limits:** | **"Normal"** | **"Severe"** |
|---|---|---|
| Maximum **Equivalent** Span | 130 | 110 |
| *Maximum **Single** Span (clashing limit)<br>(Standard heavy crossarm, 1.2m phase spacing) | 130 | 110 |
| *Maximum **Single** Span (clashing limit)<br>(H Pole, long span heavy crossarm, 2.0m phase spacing) | 170 | 135 |

**NOTE: Single span limits to be reduced by 15m where weather zone is worse than 2B at "normal" altitudes, or worse than 3C at "severe" altitudes. Weather zones are given in Appendix O**

## 70mm$^2$ Hard Drawn Copper

### Pole-Top Steelwork Suitability

| Grade | Structure Configuration | | Drg. Ref | Max. Dev'n Normal | Max. Dev'n Severe | Max. D'pull. | Notes |
|---|---|---|---|---|---|---|---|
| Light | Single Pole | Single Arm Intermediate / Pin Angle | F3 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Straight Section / Angle Section | F4 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Termination | F5 | Not Suitable | Not Suitable | Not Suitable | |
| Heavy | Single Pole | Single Arm Intermediate / Pin Angle | F7 | 11º | 7º | 1:20 | Limited Dow npull |
| Heavy | Single Pole | Double Arm Intermediate / Pin Angle | F8 | 11º | 7º | 1:10 | |
| Heavy | Single Pole | Double Arm Straight Section / Angle Section | F9 | 60º | 60º | 1:10 | |
| Heavy | "H" Pole | Double Arm Angle Section | F10 | 60º | 60º | 1:10 | Limits as per F8 if used as intermediate |
| Heavy | "H" Pole | Double Arm Section / Inter. For long spans | F11 | 60º (section) | 60º (section) | 1:10 | No deviation allow ed if used as intermediate |
| Heavy | "H" Pole | Double Arm Termination | F12 | O.K. | O.K. | 1:10 | |
| Heavy | Single Pole | Double Arm Termination | F13 | O.K. | O.K. | 1:10 | |

## 70mm$^2$ Hard Drawn Copper - "NORMAL" Loading Environment

### Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 1,321.6 |
| Wind Pressure (N/m²) | 380 |
| Maximum Conductor Weight (MCW) (kg/m) | 1.17 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.15 |
| Maximum Wind Span Length (m) | 170 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 9,912.0 |
| Transverse Load [Normal to Span] (kgf) | 1,464.9 |
| Vertical Load with Downpull (1:10) (kgf) | 4,292.8 |
| Pole Wind Loading (kgf) | 224.5 |

### Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|
| 0 | | 7,219 | 6,706 | 6,306 | 5,982 |
| 5 | | 8,714 | 7,938 | 7,335 | 6,846 |
| 10 | | 10,202 | 9,165 | 8,359 | 7,704 |
| 15 | | 11,679 | 10,383 | 9,375 | 8,557 |
| 20 | | 13,143 | 11,590 | 10,382 | 9,402 |
| 25 | | 14,591 | 12,784 | 11,378 | 10,238 |
| 30 | | 16,019 | 13,962 | 12,361 | 11,063 |
| 35 | | 17,427 | 15,122 | 13,330 | 11,876 |
| 40 | | 18,810 | 16,263 | 14,281 | 12,674 |
| 45 | | 20,166 | 17,381 | 15,214 | 13,457 |
| 50 | | 21,492 | 18,475 | 16,127 | 14,223 |
| 55 | | 22,787 | 19,542 | 17,018 | 14,970 |
| 60 | Terminal | 24,047 | 20,581 | 17,885 | 15,698 |

***NOTE: Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

### Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | 9 | 27 | 20 | 50 |
| 35 | Single | 12 | 34 | 24 | 60 |
| 40 | Pole | 14 | 40 | 29 | 60 |
| 45 | | 17 | 45 | 33 | 60 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | | 47 | 60 | 60 | 60 | x | x |
| 35 | "H" | 58 | 60 | 60 | 60 | x | O.K. |
| 40 | Pole | 60 | 60 | 60 | 60 | x | O.K. |
| 45 | | 60 | 60 | 60 | 60 | x | O.K. |

# 70mm$^2$ Hard Drawn Copper - "SEVERE" Loading Environment

## Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 1,321.6 |
| Wind Pressure (N/m²) | 570 |
| Maximum Conductor Weight (MCW) (kg/m) | 1.45 |
| Maximum Conductor Pressure (MCP) (kg/m) | 2.07 |
| Maximum Wind Span Length (m) | 135 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 9,912.2 |
| Transverse Load [Normal to Span] (kgf) | 2,641.9 |
| Vertical Load with Downpull (1:10) (kgf) | 4,651.1 |
| Pole Wind Loading (kgf) | 336.8 |

## Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|
| 0 | | 8,487 | 7,747 | 7,172 | 6,705 |
| 5 | | 9,982 | 8,979 | 8,200 | 7,568 |
| 10 | | 11,466 | 10,204 | 9,221 | 8,425 |
| 15 | | 12,938 | 11,417 | 10,234 | 9,275 |
| 20 | | 14,395 | 12,618 | 11,236 | 10,115 |
| 25 | | 15,833 | 13,804 | 12,226 | 10,946 |
| 30 | | 17,250 | 14,973 | 13,201 | 11,764 |
| 35 | | 18,644 | 16,122 | 14,160 | 12,569 |
| 40 | | 20,012 | 17,250 | 15,101 | 13,359 |
| 45 | | 21,351 | 18,354 | 16,023 | 14,132 |
| 50 | | 22,658 | 19,432 | 16,922 | 14,886 |
| 55 | | 23,932 | 20,482 | 17,798 | 15,622 |
| 60 | Terminal | 25,169 | 21,502 | 18,650 | 16,336 |

***NOTE: Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

## Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | 5 | 23 | 15 | 45 |
| 35 | Single | 7 | 29 | 20 | 56 |
| 40 | Pole | 10 | 35 | 24 | 60 |
| 45 | | 13 | 41 | 28 | 60 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | | 42 | 60 | 60 | 60 | x | x |
| 35 | "H" | 53 | 60 | 60 | 60 | x | x |
| 40 | Pole | 60 | 60 | 60 | 60 | x | O.K. |
| 45 | | 60 | 60 | 60 | 60 | x | O.K. |

# 70mm² Hard Drawn Copper - "NORMAL" Loading Environment

## Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 380 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.15 |

## Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| Pole Length (m) and Grade | | Average / Poor Soil | | | | | Good / Average Soil | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | |
| | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 | M | 76 | 76 | 40 | 74 | 74 | 76 | 76 | 64 | 74 | 74 | 76 | 76 | 74 | 74 | 74 |
| 9 | M | 75 | 75 | 38 | 74 | 74 | 75 | 75 | 61 | 74 | 74 | 75 | 75 | 74 | 74 | 74 |
| 9.5 | M | 74 | 74 | 36 | 73 | 73 | 74 | 74 | 58 | 73 | 73 | 74 | 74 | 73 | 73 | 73 |
| 10 | M | 74 | 74 | 34 | 69 | 73 | 74 | 74 | 55 | 73 | 73 | 74 | 74 | 73 | 73 | 73 |
| 10.5 | M | 74 | 74 | 32 | 65 | 74 | 74 | 74 | 53 | 74 | 74 | 74 | 74 | 74 | 74 | 74 |
| 11 | M | 74 | 74 | 30 | 62 | 74 | 74 | 74 | 51 | 74 | 74 | 74 | 74 | 71 | 74 | 74 |
| 11.5 | M | 74 | 74 | 28 | 59 | 74 | 74 | 74 | 48 | 74 | 74 | 74 | 74 | 68 | 74 | 74 |
| 12 | M | 74 | 74 | 27 | 56 | 74 | 74 | 74 | 46 | 74 | 74 | 74 | 74 | 66 | 74 | 74 |
| 13 | M | 76 | 76 | 23 | 49 | 76 | 76 | 76 | 42 | 76 | 76 | 76 | 76 | 61 | 76 | 76 |
| 14 | M | 82 | 82 | 21 | 45 | 78 | 82 | 82 | 39 | 75 | 82 | 82 | 82 | 57 | 82 | 82 |
| 15 | M | 88 | 88 | 40 | 68 | 88 | 88 | 88 | 68 | 88 | 88 | 88 | 88 | 88 | 88 | 88 |
| 16 | M | 88 | 94 | 37 | 63 | 94 | 94 | 94 | 65 | 94 | 94 | 94 | 94 | 93 | 94 | 94 |
| 17 | M | 84 | 103 | 33 | 58 | 97 | 103 | 103 | 61 | 98 | 103 | 103 | 103 | 89 | 103 | 103 |
| 18 | M | 79 | 103 | 30 | 53 | 90 | 103 | 103 | 57 | 91 | 103 | 103 | 103 | 84 | 103 | 103 |
| 20 | M | 73 | 112 | 24 | 44 | 76 | 112 | 112 | 51 | 81 | 112 | 112 | 112 | 78 | 112 | 112 |
| 22 | M | 64 | 116 | 17 | 35 | 64 | 112 | 119 | 43 | 69 | 112 | 119 | 119 | 68 | 104 | 119 |
| | | | | | | | | | | | | | | | | |
| 10 | MS | 107 | 111 | 38 | 73 | 110 | 110 | 111 | 63 | 110 | 110 | 110 | 111 | 87 | 110 | 110 |
| 11 | MS | 99 | 109 | 34 | 65 | 107 | 109 | 109 | 57 | 103 | 109 | 109 | 109 | 80 | 109 | 109 |
| 12 | MS | 93 | 116 | 30 | 58 | 96 | 116 | 116 | 52 | 94 | 116 | 116 | 116 | 75 | 116 | 116 |
| 13 | MS | 86 | 117 | 26 | 52 | 86 | 117 | 117 | 47 | 86 | 117 | 117 | 117 | 69 | 117 | 117 |
| | | | | | | | | | | | | | | | | |
| 8.5 | S | 133 | 150 | 49 | 90 | 145 | 149 | 150 | 79 | 140 | 146 | 149 | 150 | 109 | 146 | 146 |
| 9 | S | 129 | 155 | 47 | 85 | 137 | 154 | 155 | 76 | 133 | 152 | 154 | 155 | 105 | 152 | 152 |
| 9.5 | S | 123 | 152 | 44 | 80 | 129 | 151 | 152 | 72 | 126 | 150 | 151 | 152 | 100 | 150 | 150 |
| 10 | S | 117 | 149 | 42 | 75 | 121 | 149 | 149 | 69 | 119 | 148 | 149 | 149 | 96 | 148 | 148 |
| 10.5 | S | 112 | 147 | 39 | 71 | 114 | 147 | 148 | 65 | 113 | 147 | 147 | 148 | 91 | 147 | 147 |
| 11 | S | 108 | 141 | 37 | 67 | 108 | 146 | 146 | 62 | 107 | 146 | 146 | 146 | 87 | 146 | 146 |
| 11.5 | S | 103 | 136 | 34 | 63 | 102 | 145 | 145 | 59 | 102 | 145 | 145 | 145 | 84 | 141 | 145 |
| 12 | S | 99 | 144 | 32 | 60 | 97 | 144 | 144 | 56 | 97 | 144 | 144 | 144 | 80 | 135 | 144 |
| 13 | S | 93 | 151 | 29 | 53 | 87 | 148 | 151 | 52 | 89 | 140 | 151 | 151 | 75 | 125 | 151 |
| 14 | S | 117 | 152 | 25 | 48 | 79 | 156 | 156 | 48 | 82 | 128 | 156 | 156 | 70 | 116 | 156 |
| 15 | S | 111 | 161 | 48 | 75 | 119 | 161 | 161 | 83 | 124 | 161 | 161 | 161 | 118 | 161 | 161 |
| 16 | S | 106 | 168 | 44 | 69 | 109 | 168 | 168 | 78 | 115 | 168 | 168 | 168 | 112 | 162 | 168 |
| 17 | S | 99 | 166 | 40 | 63 | 100 | 162 | 166 | 72 | 107 | 163 | 166 | 166 | 105 | 152 | 166 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | S | 95 | 161 | 36 | 58 | 92 | | 156 | 170 | 68 | 101 | 152 | | 170 | 170 | 100 | 143 | 170 |
| 20 | S | 84 | 148 | 29 | 47 | 78 | | 143 | 172 | 59 | 88 | 133 | | 172 | 172 | 90 | 128 | 172 |
| 22 | S | 74 | 134 | 21 | 38 | 64 | | 129 | 169 | 50 | 75 | 115 | | 169 | 169 | 79 | 113 | 166 |
| | | | | | | | | | | | | | | | | | | |
| 9 | ES | 142 | 198 | 52 | 89 | 140 | | 198 | 198 | 84 | 140 | 198 | | 198 | 198 | 116 | 190 | 198 |
| 9.5 | ES | 135 | 194 | 49 | 84 | 131 | | 194 | 194 | 80 | 132 | 194 | | 194 | 194 | 110 | 180 | 194 |
| 10 | ES | 125 | 188 | 44 | 77 | 122 | | 186 | 188 | 73 | 123 | 184 | | 186 | 188 | 102 | 168 | 184 |
| 10.5 | ES | 122 | 193 | 42 | 74 | 116 | | 190 | 193 | 71 | 117 | 181 | | 192 | 193 | 99 | 161 | 191 |
| 11 | ES | 116 | 192 | 39 | 69 | 109 | | 182 | 192 | 67 | 111 | 171 | | 191 | 192 | 94 | 153 | 189 |
| 11.5 | ES | 113 | 191 | 38 | 66 | 104 | | 178 | 198 | 65 | 107 | 164 | | 197 | 198 | 92 | 148 | 197 |
| 12 | ES | 109 | 184 | 35 | 62 | 98 | | 171 | 196 | 61 | 101 | 156 | | 196 | 196 | 88 | 141 | 196 |
| 13 | ES | 102 | 174 | 31 | 55 | 88 | | 162 | 202 | 56 | 93 | 142 | | 202 | 202 | 82 | 130 | 196 |
| 14 | ES | 127 | 165 | 27 | 49 | 79 | | 202 | 209 | 52 | 85 | 129 | | 209 | 209 | 76 | 120 | 180 |
| 15 | ES | 119 | 196 | 51 | 77 | 120 | | 190 | 206 | 88 | 128 | 191 | | 206 | 206 | 125 | 178 | 206 |
| 16 | ES | 113 | 188 | 47 | 71 | 110 | | 182 | 211 | 83 | 119 | 178 | | 211 | 211 | 119 | 168 | 211 |
| 17 | ES | 110 | 185 | 44 | 66 | 102 | | 179 | 228 | 80 | 114 | 167 | | 228 | 228 | 116 | 161 | 228 |

# 70mm² Hard Drawn Copper - "SEVERE" Loading Environment

## Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 570 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 2.07 |

## Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| | Average / Poor Soil | | | | | | Good / Average Soil | | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pole Length (m) and Grade | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | |
| | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 M | 39 | 40 | 20 | 38 | 38 | | 39 | 40 | 33 | 38 | 38 | | 39 | 40 | 38 | 38 | 38 |
| 9 M | 39 | 39 | 19 | 38 | 38 | | 39 | 39 | 31 | 38 | 38 | | 39 | 39 | 38 | 38 | 38 |
| 9.5 M | 38 | 38 | 17 | 38 | 38 | | 38 | 38 | 30 | 38 | 38 | | 38 | 38 | 38 | 38 | 38 |
| 10 M | 38 | 38 | 16 | 36 | 37 | | 38 | 38 | 28 | 37 | 37 | | 38 | 38 | 37 | 37 | 37 |
| 10.5 M | 38 | 38 | 15 | 33 | 38 | | 38 | 38 | 26 | 38 | 38 | | 38 | 38 | 38 | 38 | 38 |
| 11 M | 38 | 38 | 13 | 31 | 38 | | 38 | 38 | 25 | 38 | 38 | | 38 | 38 | 36 | 38 | 38 |
| 11.5 M | 38 | 38 | 12 | 29 | 38 | | 38 | 38 | 23 | 38 | 38 | | 38 | 38 | 35 | 38 | 38 |
| 12 M | 38 | 38 | 11 | 27 | 38 | | 38 | 38 | 22 | 38 | 38 | | 38 | 38 | 33 | 38 | 38 |
| 13 M | 38 | 39 | 9 | 23 | 39 | | 39 | 39 | 19 | 39 | 39 | | 39 | 39 | 29 | 39 | 39 |
| 14 M | 42 | 42 | 7 | 20 | 38 | | 42 | 42 | 17 | 37 | 42 | | 42 | 42 | 27 | 42 | 42 |
| 15 M | 45 | 45 | 17 | 33 | 45 | | 45 | 45 | 33 | 45 | 45 | | 45 | 45 | 45 | 45 | 45 |
| 16 M | 43 | 48 | 15 | 29 | 48 | | 48 | 48 | 30 | 48 | 48 | | 48 | 48 | 46 | 48 | 48 |
| 17 M | 41 | 53 | 12 | 26 | 48 | | 53 | 53 | 28 | 48 | 53 | | 53 | 53 | 43 | 53 | 53 |
| 18 M | 37 | 53 | 10 | 22 | 43 | | 53 | 53 | 25 | 44 | 53 | | 53 | 53 | 40 | 53 | 53 |
| 20 M | 32 | 58 | 5 | 17 | 34 | | 58 | 58 | 20 | 37 | 58 | | 58 | 58 | 35 | 57 | 58 |
| 22 M | 26 | 55 | 0 | 10 | 26 | | 53 | 61 | 14 | 29 | 53 | | 61 | 61 | 28 | 48 | 61 |
| | | | | | | | | | | | | | | | | | |
| 10 MS | 56 | 58 | 18 | 37 | 57 | | 58 | 58 | 32 | 57 | 57 | | 58 | 58 | 45 | 57 | 57 |
| 11 MS | 51 | 57 | 15 | 32 | 56 | | 57 | 57 | 28 | 54 | 57 | | 57 | 57 | 41 | 57 | 57 |
| 12 MS | 47 | 60 | 12 | 28 | 49 | | 60 | 60 | 25 | 48 | 60 | | 60 | 60 | 37 | 60 | 60 |
| 13 MS | 43 | 60 | 10 | 24 | 43 | | 60 | 60 | 22 | 43 | 60 | | 60 | 60 | 33 | 60 | 60 |
| | | | | | | | | | | | | | | | | | |
| 8.5 S | 71 | 81 | 25 | 47 | 78 | | 80 | 81 | 41 | 75 | 78 | | 80 | 81 | 58 | 78 | 78 |
| 9 S | 69 | 83 | 23 | 44 | 73 | | 82 | 83 | 39 | 71 | 81 | | 82 | 83 | 55 | 81 | 81 |
| 9.5 S | 65 | 81 | 21 | 41 | 68 | | 80 | 81 | 37 | 67 | 79 | | 80 | 81 | 52 | 79 | 79 |
| 10 S | 62 | 79 | 20 | 38 | 64 | | 79 | 79 | 35 | 63 | 78 | | 79 | 79 | 50 | 78 | 78 |
| 10.5 S | 59 | 78 | 18 | 36 | 60 | | 78 | 78 | 32 | 59 | 77 | | 78 | 78 | 47 | 77 | 77 |
| 11 S | 56 | 74 | 16 | 33 | 56 | | 77 | 77 | 30 | 56 | 77 | | 77 | 77 | 44 | 77 | 77 |
| 11.5 S | 53 | 71 | 15 | 31 | 53 | | 76 | 76 | 29 | 53 | 76 | | 76 | 76 | 42 | 74 | 76 |
| 12 S | 51 | 76 | 13 | 29 | 49 | | 76 | 76 | 27 | 50 | 76 | | 76 | 76 | 40 | 70 | 76 |
| 13 S | 47 | 79 | 11 | 25 | 43 | | 77 | 79 | 24 | 44 | 73 | | 79 | 79 | 36 | 64 | 79 |
| 14 S | 60 | 79 | 8 | 21 | 38 | | 82 | 82 | 21 | 40 | 65 | | 82 | 82 | 33 | 59 | 82 |
| 15 S | 56 | 85 | 21 | 36 | 60 | | 85 | 85 | 40 | 62 | 85 | | 85 | 85 | 59 | 85 | 85 |
| 16 S | 52 | 89 | 18 | 32 | 54 | | 88 | 89 | 37 | 57 | 89 | | 89 | 89 | 55 | 83 | 89 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | S | 48 | 86 | 15 | 28 | 48 | | 83 | 88 | 33 | 52 | 83 | | 88 | 88 | 51 | 77 | 88 |
| 18 | S | 45 | 82 | 12 | 24 | 43 | | 79 | 90 | 30 | 48 | 77 | | 90 | 90 | 48 | 72 | 90 |
| 20 | S | 38 | 73 | 7 | 17 | 34 | | 70 | 91 | 24 | 39 | 64 | | 91 | 91 | 41 | 62 | 91 |
| 22 | S | 31 | 64 | 1 | 10 | 25 | | 62 | 89 | 17 | 31 | 54 | | 89 | 89 | 34 | 52 | 82 |
| | | | | | | | | | | | | | | | | | | |
| 9 | ES | 75 | 107 | 26 | 46 | 74 | | 107 | 107 | 43 | 74 | 107 | | 107 | 107 | 61 | 102 | 107 |
| 9.5 | ES | 71 | 104 | 24 | 43 | 69 | | 104 | 104 | 41 | 70 | 104 | | 104 | 104 | 58 | 96 | 104 |
| 10 | ES | 66 | 101 | 21 | 39 | 64 | | 99 | 101 | 37 | 64 | 98 | | 99 | 101 | 53 | 89 | 98 |
| 10.5 | ES | 64 | 103 | 19 | 37 | 60 | | 101 | 103 | 35 | 61 | 96 | | 102 | 103 | 51 | 85 | 102 |
| 11 | ES | 60 | 102 | 18 | 34 | 56 | | 97 | 102 | 33 | 57 | 91 | | 101 | 102 | 48 | 81 | 100 |
| 11.5 | ES | 58 | 101 | 16 | 32 | 53 | | 94 | 105 | 31 | 54 | 86 | | 105 | 105 | 46 | 77 | 105 |
| 12 | ES | 56 | 97 | 15 | 29 | 49 | | 90 | 104 | 29 | 51 | 81 | | 104 | 104 | 44 | 73 | 104 |
| 13 | ES | 51 | 91 | 12 | 25 | 43 | | 85 | 107 | 26 | 46 | 73 | | 107 | 107 | 40 | 67 | 103 |
| 14 | ES | 47 | 86 | 9 | 21 | 38 | | 79 | 111 | 23 | 41 | 66 | | 111 | 111 | 36 | 60 | 94 |
| 15 | ES | 60 | 103 | 22 | 36 | 60 | | 99 | 109 | 42 | 64 | 100 | | 109 | 109 | 63 | 92 | 109 |
| 16 | ES | 56 | 97 | 19 | 32 | 54 | | 94 | 112 | 39 | 59 | 91 | | 112 | 112 | 59 | 86 | 112 |
| 17 | ES | 53 | 95 | 16 | 29 | 49 | | 91 | 122 | 37 | 55 | 85 | | 122 | 122 | 57 | 81 | 121 |

## 70mm$^2$ Hard Drawn Copper - "NORMAL" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** |
| -5.6 | 856.10 | 8.40 | 0.15 | 0.23 | 0.33 | 0.44 | 0.58 | 0.73 | 0.91 | 1.10 | 1.31 | 1.53 | 1.78 | 2.04 | 2.32 | 2.62 | - |
| -4 | 840.79 | 8.25 | 0.15 | 0.23 | 0.33 | 0.45 | 0.59 | 0.75 | 0.92 | 1.12 | 1.33 | 1.56 | 1.81 | 2.08 | 2.36 | 2.67 | - |
| 0 | 803.84 | 7.89 | 0.15 | 0.24 | 0.35 | 0.47 | 0.62 | 0.78 | 0.97 | 1.17 | 1.39 | 1.63 | 1.89 | 2.17 | 2.47 | 2.79 | - |
| 4 | 768.80 | 7.54 | 0.16 | 0.25 | 0.36 | 0.49 | 0.65 | 0.82 | 1.01 | 1.22 | 1.45 | 1.71 | 1.98 | 2.27 | 2.59 | 2.92 | - |
| 8 | 735.71 | 7.22 | 0.17 | 0.26 | 0.38 | 0.52 | 0.68 | 0.85 | 1.06 | 1.28 | 1.52 | 1.78 | 2.07 | 2.37 | 2.70 | 3.05 | - |
| 12 | 704.55 | 6.91 | 0.18 | 0.28 | 0.40 | 0.54 | 0.71 | 0.89 | 1.10 | 1.33 | 1.59 | 1.86 | 2.16 | 2.48 | 2.82 | 3.18 | - |
| 16 | 675.31 | 6.62 | 0.18 | 0.29 | 0.41 | 0.56 | 0.74 | 0.93 | 1.15 | 1.39 | 1.66 | 1.94 | 2.25 | 2.59 | 2.94 | 3.32 | - |
| 20 | 647.94 | 6.36 | 0.19 | 0.30 | 0.43 | 0.59 | 0.77 | 0.97 | 1.20 | 1.45 | 1.73 | 2.02 | 2.35 | 2.70 | 3.07 | 3.46 | - |
| 24 | 622.37 | 6.11 | 0.20 | 0.31 | 0.45 | 0.61 | 0.80 | 1.01 | 1.25 | 1.51 | 1.80 | 2.11 | 2.45 | 2.81 | 3.19 | 3.61 | - |
| 28 | 598.52 | 5.87 | 0.21 | 0.32 | 0.47 | 0.64 | 0.83 | 1.05 | 1.30 | 1.57 | 1.87 | 2.19 | 2.54 | 2.92 | 3.32 | 3.75 | - |
| 32 | 576.30 | 5.65 | 0.22 | 0.34 | 0.48 | 0.66 | 0.86 | 1.09 | 1.35 | 1.63 | 1.94 | 2.28 | 2.64 | 3.03 | 3.45 | 3.89 | - |
| 36 | 555.62 | 5.45 | 0.22 | 0.35 | 0.50 | 0.68 | 0.89 | 1.13 | 1.40 | 1.69 | 2.01 | 2.36 | 2.74 | 3.14 | 3.58 | 4.04 | - |

### DESIGN TABLE

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** |
| -5.6 | 771.20 | 7.57 | 0.16 | 0.25 | 0.36 | 0.49 | 0.64 | 0.82 | 1.01 | 1.22 | 1.45 | 1.70 | 1.97 | 2.27 | 2.58 | 2.91 | - |
| 0 | 725.22 | 7.11 | 0.17 | 0.27 | 0.39 | 0.52 | 0.69 | 0.87 | 1.07 | 1.30 | 1.54 | 1.81 | 2.10 | 2.41 | 2.74 | 3.09 | - |
| 30 | 539.54 | 5.29 | 0.23 | 0.36 | 0.52 | 0.71 | 0.92 | 1.17 | 1.44 | 1.74 | 2.07 | 2.43 | 2.82 | 3.24 | 3.68 | 4.16 | - |
| 50 | 460.33 | 4.52 | 0.27 | 0.42 | 0.61 | 0.83 | 1.08 | 1.37 | 1.69 | 2.04 | 2.43 | 2.85 | 3.31 | 3.79 | 4.32 | 4.87 | - |
| 55 | 444.43 | 4.36 | 0.28 | 0.44 | 0.63 | 0.86 | 1.12 | 1.41 | 1.75 | 2.11 | 2.52 | 2.95 | 3.42 | 3.93 | 4.47 | 5.05 | - |
| 60 | 429.77 | 4.22 | 0.29 | 0.45 | 0.65 | 0.89 | 1.16 | 1.46 | 1.81 | 2.19 | 2.60 | 3.05 | 3.54 | 4.06 | 4.62 | 5.22 | - |
| 65 | 416.24 | 4.08 | 0.30 | 0.47 | 0.67 | 0.91 | 1.19 | 1.51 | 1.87 | 2.26 | 2.69 | 3.15 | 3.66 | 4.20 | 4.77 | 5.39 | - |
| 70 | 403.72 | 3.96 | 0.31 | 0.48 | 0.69 | 0.94 | 1.23 | 1.56 | 1.92 | 2.33 | 2.77 | 3.25 | 3.77 | 4.33 | 4.92 | 5.56 | - |
| 75 | 392.10 | 3.85 | 0.32 | 0.50 | 0.71 | 0.97 | 1.27 | 1.60 | 1.98 | 2.40 | 2.85 | 3.35 | 3.88 | 4.46 | 5.07 | 5.72 | - |

## 70mm$^2$ Hard Drawn Copper - "SEVERE" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** |
| -5.6 | 530.25 | 5.20 | 0.23 | 0.37 | 0.53 | 0.72 | 0.94 | 1.19 | 1.46 | 1.77 | 2.11 | 2.47 | 2.87 | - | - | - |
| -4 | 520.98 | 5.11 | 0.24 | 0.37 | 0.54 | 0.73 | 0.95 | 1.21 | 1.49 | 1.80 | 2.15 | 2.52 | 2.92 | - | - | - |
| 0 | 499.08 | 4.90 | 0.25 | 0.39 | 0.56 | 0.76 | 1.00 | 1.26 | 1.56 | 1.88 | 2.24 | 2.63 | 3.05 | - | - | - |
| 4 | 478.89 | 4.70 | 0.26 | 0.41 | 0.58 | 0.79 | 1.04 | 1.31 | 1.62 | 1.96 | 2.33 | 2.74 | 3.18 | - | - | - |
| 8 | 460.30 | 4.52 | 0.27 | 0.42 | 0.61 | 0.83 | 1.08 | 1.37 | 1.69 | 2.04 | 2.43 | 2.85 | 3.31 | - | - | - |
| 12 | 443.16 | 4.35 | 0.28 | 0.44 | 0.63 | 0.86 | 1.12 | 1.42 | 1.75 | 2.12 | 2.52 | 2.96 | 3.43 | - | - | - |
| 16 | 427.34 | 4.19 | 0.29 | 0.45 | 0.65 | 0.89 | 1.16 | 1.47 | 1.82 | 2.20 | 2.62 | 3.07 | 3.56 | - | - | - |
| 20 | 412.74 | 4.05 | 0.30 | 0.47 | 0.68 | 0.92 | 1.20 | 1.52 | 1.88 | 2.28 | 2.71 | 3.18 | 3.69 | - | - | - |
| 24 | 399.23 | 3.92 | 0.31 | 0.49 | 0.70 | 0.95 | 1.24 | 1.58 | 1.94 | 2.35 | 2.80 | 3.29 | 3.81 | - | - | - |
| 28 | 386.71 | 3.79 | 0.32 | 0.50 | 0.72 | 0.98 | 1.28 | 1.63 | 2.01 | 2.43 | 2.89 | 3.39 | 3.93 | - | - | - |
| 32 | 375.10 | 3.68 | 0.33 | 0.52 | 0.75 | 1.01 | 1.32 | 1.68 | 2.07 | 2.50 | 2.98 | 3.50 | 4.06 | - | - | - |
| 36 | 364.29 | 3.57 | 0.34 | 0.53 | 0.77 | 1.04 | 1.36 | 1.73 | 2.13 | 2.58 | 3.07 | 3.60 | 4.18 | - | - | - |

### DESIGN TABLE

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** |
| -5.6 | 470.90 | 4.62 | 0.26 | 0.41 | 0.59 | 0.81 | 1.06 | 1.34 | 1.65 | 1.99 | 2.37 | 2.79 | 3.23 | - | - | - |
| 0 | 446.14 | 4.38 | 0.28 | 0.44 | 0.63 | 0.85 | 1.11 | 1.41 | 1.74 | 2.11 | 2.51 | 2.94 | 3.41 | - | - | - |
| 30 | 351.16 | 3.44 | 0.35 | 0.55 | 0.80 | 1.08 | 1.41 | 1.79 | 2.21 | 2.68 | 3.18 | 3.74 | 4.33 | - | - | - |
| 50 | 310.60 | 3.05 | 0.40 | 0.62 | 0.90 | 1.22 | 1.60 | 2.02 | 2.50 | 3.02 | 3.60 | 4.22 | 4.90 | - | - | - |
| 55 | 302.26 | 2.97 | 0.41 | 0.64 | 0.92 | 1.26 | 1.64 | 2.08 | 2.57 | 3.11 | 3.70 | 4.34 | 5.03 | - | - | - |
| 60 | 294.49 | 2.89 | 0.42 | 0.66 | 0.95 | 1.29 | 1.69 | 2.14 | 2.64 | 3.19 | 3.80 | 4.46 | 5.17 | - | - | - |
| 65 | 287.24 | 2.82 | 0.43 | 0.68 | 0.97 | 1.32 | 1.73 | 2.19 | 2.70 | 3.27 | 3.89 | 4.57 | 5.30 | - | - | - |
| 70 | 280.46 | 2.75 | 0.44 | 0.69 | 1.00 | 1.36 | 1.77 | 2.24 | 2.77 | 3.35 | 3.99 | 4.68 | 5.43 | - | - | - |
| 75 | 274.10 | 2.69 | 0.45 | 0.71 | 1.02 | 1.39 | 1.81 | 2.29 | 2.83 | 3.43 | 4.08 | 4.79 | 5.55 | - | - | - |

# APPENDIX F

## 100 $mm^2$ Aluminium Alloy "Oak"

- Conductor & Design Parameters
- Structure Suitability
- Stayed Pole Design Data
- Unstayed Pole Design Data
- Sags and Tensions

## 100mm$^2$ Aluminium Alloy "Oak"

### Conductor Parameters:

| | |
|---|---|
| Conductor Stranding (#strands / diameter(mm)) | 7/4.65 |
| Greased Conductor Weight (kg/m) | 0.328 |
| Cross Sectional Area of Conductor (mm²) | 118.9 |
| Conductor Overall Diameter (mm) | 13.95 |
| Coefficient of Linear Expansion (/Degree C) | 2.30E-05 |
| Modulus of Elasticity (kg/mm²) | 6,000 |
| Rated Breaking Strength of Conductor (kgf) | 3,576.1 |

| Design Loading Parameters: | "Normal" | "Severe" |
|---|---|---|
| Basic / Recommended Span (m) | 130 | 110 |
| Wind Pressure on Conductor (N/m²) | 380 | 570 |
| Radial Ice Thickness (mm) | 9.5 | 12.5 |
| Ice Density (kg/m³) | 913 | 913 |
| Absolute Maximum Working Tension (MWT) Limit (kgf) | 1,788.1 | 1,788.1 |
| Temperature at MWT Limit (Degrees C) | -5.6 | -5.6 |
| Maximum "Everyday" Tension (EDT) Limit (kgf) | 715.2 | 715.2 |
| Temperature at EDT Limit (Degrees C) | 5.0 | 5.0 |
| Maximum Conductor Tension (MCT) at -5.6 degC (kgf) | 1,421.3 | 1,677.0 |
| Maximum Conductor Weight (MCW) (kg/m) | 0.967 | 1.277 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.277 | 2.264 |
| Freezing Point Tension (FPT) (kgf) | 780.3 | 784.5 |

| Span Length Limits: | "Normal" | "Severe" |
|---|---|---|
| Maximum **Equivalent** Span | 130 | 110 |
| *Maximum **Single** Span (clashing limit)<br>(Standard heavy crossarm, 1.2m phase spacing) | 130 | 110 |
| *Maximum **Single** Span (clashing limit)<br>(H Pole, long span heavy crossarm, 2.0m phase spacing) | 170 | 145 |

**NOTE: Single span limits to be reduced by 15m where weather zone is worse than 2B at "normal" altitudes, or worse than 3C at "severe" altitudes. Weather zones are given in Appendix O**

## 100mm$^2$ Aluminium Alloy "Oak"

### Pole-Top Steelwork Suitability

| Grade | Structure Configuration | | Drg. Ref | Max. Dev'n Normal | Max. Dev'n Severe | Max. D'pull. | Notes |
|---|---|---|---|---|---|---|---|
| Light | Single Pole | Single Arm Intermediate / Pin Angle | F3 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Straight Section / Angle Section | F4 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Termination | F5 | Not Suitable | Not Suitable | Not Suitable | |
| Heavy | Single Pole | Single Arm Intermediate / Pin Angle | F7 | 9º | 5º | 1:20 | Limited Dow npull |
| Heavy | Single Pole | Double Arm Intermediate / Pin Angle | F8 | 9º | 5º | 1:10 | |
| Heavy | Single Pole | Double Arm Straight Section / Angle Section | F9 | 60º | 60º | 1:10 | |
| Heavy | "H" Pole | Double Arm Angle Section | F10 | 60º | 60º | 1:10 | Limits as per F8 if used as intermediate |
| Heavy | "H" Pole | Double Arm Section / Inter. For long spans | F11 | 60º (section) | 60º (section) | 1:10 | No deviation allow ed if used as intermediate |
| Heavy | "H" Pole | Double Arm Termination | F12 | O.K. | O.K. | 1:10 | |
| Heavy | Single Pole | Double Arm Termination | F13 | Not Suitable | Not Suitable | Not Suitable | |

## 100mm$^2$ Aluminium Alloy "Oak" - "NORMAL" Loading Environment

### Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 1,421.3 |
| Wind Pressure (N/m²) | 380 |
| Maximum Conductor Weight (MCW) (kg/m) | 0.97 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.28 |
| Maximum Wind Span Length (m) | 170 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 10,659.5 |
| Transverse Load [Normal to Span] (kgf) | 1,627.9 |
| Vertical Load with Downpull (1:10) (kgf) | 4,182.9 |
| Pole Wind Loading (kgf) | 224.5 |

### Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|
| 0 | | 7,391 | 6,828 | 6,391 | 6,035 |
| 5 | | 8,999 | 8,154 | 7,497 | 6,964 |
| 10 | | 10,599 | 9,473 | 8,598 | 7,887 |
| 15 | | 12,187 | 10,783 | 9,690 | 8,804 |
| 20 | | 13,761 | 12,080 | 10,773 | 9,713 |
| 25 | | 15,317 | 13,363 | 11,844 | 10,611 |
| 30 | | 16,852 | 14,629 | 12,900 | 11,498 |
| 35 | | 18,365 | 15,876 | 13,941 | 12,371 |
| 40 | | 19,851 | 17,102 | 14,963 | 13,229 |
| 45 | | 21,308 | 18,303 | 15,966 | 14,070 |
| 50 | | 22,733 | 19,478 | 16,946 | 14,893 |
| 55 | | 24,123 | 20,624 | 17,903 | 15,695 |
| 60 | Terminal | 25,476 | 21,740 | 18,834 | 16,477 |

***NOTE: Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

### Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | 7 | 24 | 17 | 45 |
| 35 | Single | 10 | 30 | 22 | 55 |
| 40 | Pole | 13 | 36 | 26 | 60 |
| 45 | | 15 | 41 | 29 | 60 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | | 43 | 60 | 60 | 60 | x | x |
| 35 | "H" | 52 | 60 | 60 | 60 | x | x |
| 40 | Pole | 60 | 60 | 60 | 60 | x | O.K. |
| 45 | | 60 | 60 | 60 | 60 | x | O.K. |

# 100mm$^2$ Aluminium Alloy "Oak" - "SEVERE" Loading Environment

## Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 1,677.0 |
| Wind Pressure (N/m²) | 570 |
| Maximum Conductor Weight (MCW) (kg/m) | 1.28 |
| Maximum Conductor Pressure (MCP) (kg/m) | 2.26 |
| Maximum Wind Span Length (m) | 145 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 12,577.9 |
| Transverse Load [Normal to Span] (kgf) | 2,462.0 |
| Vertical Load with Downpull (1:10) (kgf) | 4,719.7 |
| Pole Wind Loading (kgf) | 336.8 |

## Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|
| 0 | | 9,567 | 8,717 | 8,055 | 7,519 |
| 5 | | 11,464 | 10,281 | 9,360 | 8,613 |
| 10 | | 13,349 | 11,835 | 10,657 | 9,702 |
| 15 | | 15,218 | 13,376 | 11,943 | 10,781 |
| 20 | | 17,069 | 14,902 | 13,217 | 11,849 |
| 25 | | 18,897 | 16,409 | 14,474 | 12,905 |
| 30 | | 20,699 | 17,895 | 15,715 | 13,945 |
| 35 | | 22,472 | 19,357 | 16,934 | 14,969 |
| 40 | | 24,212 | 20,792 | 18,132 | 15,974 |
| 45 | | 25,917 | 22,198 | 19,305 | 16,958 |
| 50 | | 27,582 | 23,570 | 20,450 | 17,919 |
| 55 | | 29,204 | 24,908 | 21,567 | 18,856 |
| 60 | Terminal | 30,782 | 26,209 | 22,652 | 19,767 |

***NOTE: Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

## Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | 2 | 16 | 10 | 33 |
| 35 | Single | 4 | 21 | 14 | 41 |
| 40 | Pole | 6 | 25 | 17 | 49 |
| 45 | | 8 | 30 | 20 | 56 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | | 31 | 47 | 59 | 60 | x | x |
| 35 | "H" | 39 | 58 | 60 | 60 | x | x |
| 40 | Pole | 46 | 60 | 60 | 60 | x | x |
| 45 | | 53 | 60 | 60 | 60 | x | x |

# 100mm² Aluminium Alloy "Oak" - "NORMAL" Loading Environment

## Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 380 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.28 |

## Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| Pole Length (m) and Grade | | Average / Poor Soil | | | | | Good / Average Soil | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | |
| | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 | M | 68 | 68 | 36 | 67 | 67 | 68 | 68 | 58 | 67 | 67 | 68 | 68 | 67 | 67 | 67 |
| 9 | M | 67 | 68 | 34 | 66 | 66 | 67 | 68 | 55 | 66 | 66 | 67 | 68 | 66 | 66 | 66 |
| 9.5 | M | 67 | 67 | 32 | 66 | 66 | 67 | 67 | 52 | 66 | 66 | 67 | 67 | 66 | 66 | 66 |
| 10 | M | 66 | 67 | 30 | 62 | 66 | 66 | 67 | 50 | 66 | 66 | 66 | 67 | 66 | 66 | 66 |
| 10.5 | M | 66 | 66 | 29 | 59 | 66 | 66 | 66 | 48 | 66 | 66 | 66 | 66 | 66 | 66 | 66 |
| 11 | M | 67 | 67 | 27 | 56 | 67 | 67 | 67 | 45 | 67 | 67 | 67 | 67 | 64 | 67 | 67 |
| 11.5 | M | 67 | 67 | 25 | 53 | 67 | 67 | 67 | 43 | 67 | 67 | 67 | 67 | 62 | 67 | 67 |
| 12 | M | 67 | 67 | 24 | 50 | 67 | 67 | 67 | 42 | 67 | 67 | 67 | 67 | 59 | 67 | 67 |
| 13 | M | 68 | 69 | 21 | 44 | 69 | 69 | 69 | 38 | 69 | 69 | 69 | 69 | 54 | 69 | 69 |
| 14 | M | 74 | 74 | 18 | 40 | 70 | 74 | 74 | 35 | 68 | 74 | 74 | 74 | 52 | 74 | 74 |
| 15 | M | 79 | 79 | 36 | 62 | 79 | 79 | 79 | 61 | 79 | 79 | 79 | 79 | 79 | 79 | 79 |
| 16 | M | 79 | 85 | 33 | 57 | 85 | 85 | 85 | 58 | 85 | 85 | 85 | 85 | 84 | 85 | 85 |
| 17 | M | 76 | 92 | 30 | 52 | 88 | 92 | 92 | 55 | 88 | 92 | 92 | 92 | 80 | 92 | 92 |
| 18 | M | 71 | 93 | 27 | 48 | 81 | 93 | 93 | 51 | 82 | 93 | 93 | 93 | 76 | 93 | 93 |
| 20 | M | 66 | 101 | 22 | 40 | 69 | 101 | 101 | 46 | 73 | 101 | 101 | 101 | 70 | 101 | 101 |
| 22 | M | 57 | 105 | 15 | 31 | 57 | 101 | 107 | 38 | 62 | 101 | 107 | 107 | 61 | 93 | 107 |
| | | | | | | | | | | | | | | | | |
| 10 | MS | 96 | 100 | 34 | 65 | 99 | 99 | 100 | 56 | 99 | 99 | 99 | 100 | 79 | 99 | 99 |
| 11 | MS | 89 | 98 | 30 | 58 | 96 | 98 | 98 | 51 | 93 | 98 | 98 | 98 | 72 | 98 | 98 |
| 12 | MS | 83 | 104 | 27 | 52 | 86 | 104 | 104 | 47 | 85 | 104 | 104 | 104 | 67 | 104 | 104 |
| 13 | MS | 77 | 105 | 23 | 46 | 78 | 105 | 105 | 43 | 77 | 105 | 105 | 105 | 62 | 105 | 105 |
| | | | | | | | | | | | | | | | | |
| 8.5 | S | 120 | 135 | 44 | 81 | 131 | 134 | 135 | 71 | 126 | 131 | 134 | 135 | 98 | 131 | 131 |
| 9 | S | 116 | 139 | 43 | 77 | 123 | 138 | 139 | 69 | 120 | 137 | 138 | 139 | 95 | 137 | 137 |
| 9.5 | S | 111 | 137 | 40 | 72 | 116 | 136 | 137 | 65 | 113 | 135 | 136 | 137 | 90 | 135 | 135 |
| 10 | S | 106 | 134 | 37 | 68 | 109 | 134 | 134 | 62 | 107 | 133 | 134 | 134 | 86 | 133 | 133 |
| 10.5 | S | 101 | 132 | 35 | 64 | 103 | 132 | 133 | 59 | 102 | 132 | 132 | 133 | 82 | 132 | 132 |
| 11 | S | 97 | 127 | 33 | 60 | 97 | 131 | 131 | 56 | 97 | 131 | 131 | 131 | 79 | 131 | 131 |
| 11.5 | S | 93 | 122 | 31 | 57 | 92 | 130 | 130 | 53 | 92 | 130 | 130 | 130 | 75 | 127 | 130 |
| 12 | S | 89 | 130 | 29 | 54 | 87 | 130 | 130 | 50 | 88 | 130 | 130 | 130 | 72 | 121 | 130 |
| 13 | S | 84 | 136 | 26 | 48 | 79 | 133 | 136 | 46 | 80 | 126 | 136 | 136 | 67 | 112 | 136 |
| 14 | S | 105 | 136 | 23 | 43 | 71 | 141 | 141 | 43 | 74 | 115 | 141 | 141 | 63 | 104 | 141 |
| 15 | S | 100 | 145 | 43 | 68 | 107 | 145 | 145 | 74 | 111 | 145 | 145 | 145 | 106 | 145 | 145 |
| 16 | S | 95 | 151 | 40 | 62 | 98 | 151 | 151 | 70 | 104 | 151 | 151 | 151 | 101 | 146 | 151 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | S | 89 | 149 | 36 | 57 | 90 | | 145 | 149 | 65 | 96 | 147 | | 149 | 149 | 94 | 136 | 149 |
| 18 | S | 85 | 145 | 32 | 52 | 83 | | 140 | 153 | 61 | 90 | 137 | | 153 | 153 | 90 | 129 | 153 |
| 20 | S | 76 | 133 | 26 | 43 | 70 | | 128 | 154 | 53 | 79 | 119 | | 154 | 154 | 81 | 115 | 154 |
| 22 | S | 67 | 121 | 19 | 34 | 58 | | 116 | 152 | 45 | 68 | 104 | | 152 | 152 | 71 | 101 | 150 |
| | | | | | | | | | | | | | | | | | | |
| 9 | ES | 127 | 127 | 47 | 80 | 126 | | 178 | 178 | 76 | 126 | 178 | | 178 | 178 | 104 | 171 | 178 |
| 9.5 | ES | 121 | 121 | 44 | 75 | 118 | | 175 | 175 | 72 | 119 | 175 | | 175 | 175 | 99 | 162 | 175 |
| 10 | ES | 113 | 113 | 40 | 70 | 110 | | 167 | 167 | 66 | 110 | 166 | | 167 | 167 | 92 | 151 | 166 |
| 10.5 | ES | 110 | 110 | 38 | 66 | 104 | | 171 | 171 | 64 | 106 | 163 | | 173 | 173 | 89 | 145 | 172 |
| 11 | ES | 105 | 105 | 35 | 62 | 98 | | 164 | 164 | 60 | 100 | 154 | | 171 | 171 | 85 | 138 | 170 |
| 11.5 | ES | 102 | 102 | 34 | 59 | 93 | | 160 | 160 | 58 | 96 | 147 | | 178 | 178 | 82 | 133 | 177 |
| 12 | ES | 98 | 98 | 32 | 56 | 88 | | 154 | 154 | 55 | 91 | 140 | | 176 | 176 | 79 | 127 | 176 |
| 13 | ES | 92 | 92 | 28 | 50 | 79 | | 146 | 146 | 51 | 83 | 128 | | 181 | 181 | 73 | 117 | 176 |
| 14 | ES | 86 | 86 | 24 | 44 | 71 | | 138 | 138 | 46 | 76 | 116 | | 188 | 188 | 68 | 108 | 162 |
| 15 | ES | 107 | 107 | 46 | 70 | 108 | | 171 | 171 | 79 | 115 | 172 | | 186 | 186 | 113 | 160 | 186 |
| 16 | ES | 101 | 101 | 42 | 64 | 99 | | 164 | 164 | 75 | 107 | 160 | | 190 | 190 | 107 | 151 | 190 |
| 17 | ES | 99 | 99 | 40 | 60 | 92 | | 161 | 161 | 72 | 102 | 150 | | 205 | 205 | 105 | 145 | 205 |

## 100mm² Aluminium Alloy "Oak" - "SEVERE" Loading Environment

### Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 570 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 2.26 |

### Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| Pole Length (m) and Grade | | Average / Poor Soil | | | | | | Good / Average Soil | | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | |
| | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 | M | 36 | 36 | 18 | 35 | 35 | | 36 | 36 | 30 | 35 | 35 | | 36 | 36 | 35 | 35 | 35 |
| 9 | M | 35 | 36 | 17 | 35 | 35 | | 35 | 36 | 29 | 35 | 35 | | 35 | 36 | 35 | 35 | 35 |
| 9.5 | M | 35 | 35 | 16 | 34 | 34 | | 35 | 35 | 27 | 34 | 34 | | 35 | 35 | 34 | 34 | 34 |
| 10 | M | 35 | 35 | 14 | 32 | 34 | | 35 | 35 | 26 | 34 | 34 | | 35 | 35 | 34 | 34 | 34 |
| 10.5 | M | 34 | 34 | 13 | 30 | 34 | | 34 | 34 | 24 | 34 | 34 | | 34 | 34 | 34 | 34 | 34 |
| 11 | M | 35 | 35 | 12 | 28 | 35 | | 35 | 35 | 23 | 35 | 35 | | 35 | 35 | 33 | 35 | 35 |
| 11.5 | M | 35 | 35 | 11 | 27 | 35 | | 35 | 35 | 21 | 35 | 35 | | 35 | 35 | 32 | 35 | 35 |
| 12 | M | 35 | 35 | 10 | 25 | 35 | | 35 | 35 | 20 | 35 | 35 | | 35 | 35 | 30 | 35 | 35 |
| 13 | M | 35 | 35 | 8 | 21 | 35 | | 35 | 35 | 17 | 35 | 35 | | 35 | 35 | 27 | 35 | 35 |
| 14 | M | 38 | 38 | 6 | 18 | 35 | | 38 | 38 | 16 | 34 | 38 | | 38 | 38 | 25 | 38 | 38 |
| 15 | M | 41 | 41 | 15 | 30 | 41 | | 41 | 41 | 30 | 41 | 41 | | 41 | 41 | 41 | 41 | 41 |
| 16 | M | 40 | 44 | 13 | 27 | 44 | | 44 | 44 | 28 | 44 | 44 | | 44 | 44 | 42 | 44 | 44 |
| 17 | M | 37 | 48 | 11 | 24 | 44 | | 48 | 48 | 25 | 44 | 48 | | 48 | 48 | 39 | 48 | 48 |
| 18 | M | 34 | 48 | 9 | 21 | 39 | | 48 | 48 | 23 | 40 | 48 | | 48 | 48 | 36 | 48 | 48 |
| 20 | M | 30 | 53 | 5 | 15 | 31 | | 53 | 53 | 18 | 34 | 53 | | 53 | 53 | 32 | 52 | 53 |
| 22 | M | 24 | 51 | 0 | 9 | 24 | | 48 | 56 | 13 | 27 | 48 | | 56 | 56 | 26 | 44 | 56 |
| | | | | | | | | | | | | | | | | | | |
| 10 | MS | 52 | 53 | 16 | 34 | 53 | | 53 | 53 | 29 | 53 | 53 | | 53 | 53 | 41 | 53 | 53 |
| 11 | MS | 47 | 52 | 14 | 30 | 51 | | 52 | 52 | 26 | 49 | 52 | | 52 | 52 | 37 | 52 | 52 |
| 12 | MS | 43 | 55 | 11 | 26 | 45 | | 55 | 55 | 23 | 44 | 55 | | 55 | 55 | 34 | 55 | 55 |
| 13 | MS | 39 | 55 | 9 | 22 | 40 | | 55 | 55 | 20 | 39 | 55 | | 55 | 55 | 31 | 55 | 55 |
| | | | | | | | | | | | | | | | | | | |
| 8.5 | S | 65 | 74 | 22 | 43 | 71 | | 73 | 74 | 38 | 68 | 71 | | 73 | 74 | 53 | 71 | 71 |
| 9 | S | 63 | 76 | 21 | 40 | 67 | | 75 | 76 | 36 | 65 | 74 | | 75 | 76 | 51 | 74 | 74 |
| 9.5 | S | 60 | 74 | 19 | 38 | 62 | | 74 | 74 | 34 | 61 | 73 | | 74 | 74 | 48 | 73 | 73 |
| 10 | S | 56 | 73 | 18 | 35 | 58 | | 72 | 73 | 32 | 57 | 72 | | 72 | 73 | 45 | 72 | 72 |
| 10.5 | S | 54 | 71 | 16 | 33 | 55 | | 71 | 71 | 30 | 54 | 71 | | 71 | 71 | 43 | 71 | 71 |
| 11 | S | 51 | 68 | 15 | 30 | 51 | | 70 | 70 | 28 | 51 | 70 | | 70 | 70 | 41 | 70 | 70 |
| 11.5 | S | 49 | 65 | 14 | 28 | 48 | | 70 | 70 | 26 | 48 | 70 | | 70 | 70 | 39 | 68 | 70 |
| 12 | S | 46 | 69 | 12 | 26 | 45 | | 69 | 69 | 24 | 45 | 69 | | 69 | 69 | 37 | 64 | 69 |
| 13 | S | 43 | 73 | 10 | 23 | 40 | | 71 | 73 | 22 | 41 | 66 | | 73 | 73 | 33 | 59 | 73 |
| 14 | S | 55 | 72 | 8 | 19 | 35 | | 75 | 75 | 19 | 36 | 60 | | 75 | 75 | 30 | 54 | 75 |
| 15 | S | 51 | 78 | 19 | 33 | 55 | | 78 | 78 | 36 | 57 | 78 | | 78 | 78 | 54 | 78 | 78 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | S | 48 | 81 | 16 | 29 | 49 | | 80 | 81 | 33 | 52 | 81 | | 81 | 81 | 51 | 76 | 81 |
| 17 | S | 44 | 78 | 13 | 25 | 44 | | 75 | 80 | 30 | 48 | 76 | | 80 | 80 | 47 | 70 | 80 |
| 18 | S | 41 | 75 | 11 | 22 | 40 | | 72 | 82 | 27 | 44 | 70 | | 82 | 82 | 44 | 66 | 82 |
| 20 | S | 35 | 67 | 6 | 16 | 31 | | 64 | 83 | 22 | 36 | 59 | | 83 | 83 | 37 | 56 | 83 |
| 22 | S | 28 | 59 | 1 | 10 | 23 | | 56 | 82 | 16 | 29 | 49 | | 82 | 82 | 31 | 48 | 75 |
| | | | | | | | | | | | | | | | | | | |
| 9 | ES | 69 | 98 | 24 | 42 | 68 | | 98 | 98 | 40 | 68 | 98 | | 98 | 98 | 56 | 93 | 98 |
| 9.5 | ES | 65 | 95 | 22 | 39 | 63 | | 95 | 95 | 37 | 64 | 95 | | 95 | 95 | 53 | 88 | 95 |
| 10 | ES | 60 | 92 | 19 | 36 | 59 | | 91 | 92 | 34 | 59 | 90 | | 91 | 92 | 48 | 82 | 90 |
| 10.5 | ES | 58 | 94 | 18 | 34 | 55 | | 93 | 94 | 32 | 56 | 88 | | 94 | 94 | 47 | 78 | 93 |
| 11 | ES | 55 | 93 | 16 | 31 | 51 | | 88 | 93 | 30 | 52 | 83 | | 93 | 93 | 44 | 74 | 92 |
| 11.5 | ES | 53 | 93 | 15 | 29 | 48 | | 86 | 96 | 29 | 50 | 79 | | 96 | 96 | 42 | 71 | 96 |
| 12 | ES | 51 | 89 | 13 | 27 | 45 | | 83 | 95 | 27 | 47 | 74 | | 95 | 95 | 40 | 67 | 95 |
| 13 | ES | 47 | 84 | 11 | 23 | 40 | | 77 | 98 | 24 | 42 | 67 | | 98 | 98 | 36 | 61 | 94 |
| 14 | ES | 43 | 78 | 8 | 19 | 35 | | 72 | 101 | 21 | 37 | 60 | | 101 | 101 | 33 | 55 | 86 |
| 15 | ES | 54 | 94 | 20 | 33 | 55 | | 90 | 100 | 39 | 59 | 91 | | 100 | 100 | 58 | 84 | 100 |
| 16 | ES | 51 | 89 | 17 | 29 | 49 | | 86 | 103 | 35 | 54 | 84 | | 103 | 103 | 54 | 79 | 103 |
| 17 | ES | 49 | 87 | 15 | 26 | 44 | | 84 | 112 | 33 | 50 | 77 | | 112 | 112 | 52 | 74 | 111 |

## 100mm$^2$ Aluminium Alloy "Oak" - "NORMAL" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 935.85 | 9.18 | 0.07 | 0.11 | 0.16 | 0.21 | 0.28 | 0.36 | 0.44 | 0.53 | 0.63 | 0.74 | 0.86 | 0.99 | 1.12 | 1.27 | - | - | - |
| -4 | 911.95 | 8.95 | 0.07 | 0.11 | 0.16 | 0.22 | 0.29 | 0.36 | 0.45 | 0.54 | 0.65 | 0.76 | 0.88 | 1.01 | 1.15 | 1.30 | - | - | - |
| 0 | 853.00 | 8.37 | 0.08 | 0.12 | 0.17 | 0.24 | 0.31 | 0.39 | 0.48 | 0.58 | 0.69 | 0.81 | 0.94 | 1.08 | 1.23 | 1.39 | - | - | - |
| 4 | 795.38 | 7.80 | 0.08 | 0.13 | 0.19 | 0.25 | 0.33 | 0.42 | 0.52 | 0.62 | 0.74 | 0.87 | 1.01 | 1.16 | 1.32 | 1.49 | - | - | - |
| 8 | 739.39 | 7.25 | 0.09 | 0.14 | 0.20 | 0.27 | 0.36 | 0.45 | 0.56 | 0.67 | 0.80 | 0.94 | 1.09 | 1.25 | 1.42 | 1.60 | - | - | - |
| 12 | 685.38 | 6.72 | 0.10 | 0.15 | 0.22 | 0.29 | 0.38 | 0.49 | 0.60 | 0.72 | 0.86 | 1.01 | 1.17 | 1.35 | 1.53 | 1.73 | - | - | - |
| 16 | 633.76 | 6.22 | 0.10 | 0.16 | 0.23 | 0.32 | 0.41 | 0.52 | 0.65 | 0.78 | 0.93 | 1.09 | 1.27 | 1.46 | 1.66 | 1.87 | - | - | - |
| 20 | 584.92 | 5.74 | 0.11 | 0.18 | 0.25 | 0.34 | 0.45 | 0.57 | 0.70 | 0.85 | 1.01 | 1.19 | 1.38 | 1.58 | 1.80 | 2.03 | - | - | - |
| 24 | 539.29 | 5.29 | 0.12 | 0.19 | 0.27 | 0.37 | 0.49 | 0.62 | 0.76 | 0.92 | 1.10 | 1.29 | 1.49 | 1.71 | 1.95 | 2.20 | - | - | - |
| 28 | 497.20 | 4.88 | 0.13 | 0.21 | 0.30 | 0.40 | 0.53 | 0.67 | 0.83 | 1.00 | 1.19 | 1.39 | 1.62 | 1.86 | 2.11 | 2.39 | - | - | - |
| 32 | 458.87 | 4.50 | 0.14 | 0.22 | 0.32 | 0.44 | 0.57 | 0.72 | 0.89 | 1.08 | 1.29 | 1.51 | 1.75 | 2.01 | 2.29 | 2.58 | - | - | - |
| 36 | 424.38 | 4.16 | 0.15 | 0.24 | 0.35 | 0.47 | 0.62 | 0.78 | 0.97 | 1.17 | 1.39 | 1.63 | 1.90 | 2.18 | 2.48 | 2.79 | - | - | - |

### DESIGN TABLE

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 865.14 | 8.49 | 0.08 | 0.12 | 0.17 | 0.23 | 0.30 | 0.38 | 0.47 | 0.57 | 0.68 | 0.80 | 0.93 | 1.07 | 1.21 | 1.37 | - | - | - |
| 0 | 784.47 | 7.70 | 0.08 | 0.13 | 0.19 | 0.26 | 0.33 | 0.42 | 0.52 | 0.63 | 0.75 | 0.88 | 1.03 | 1.18 | 1.34 | 1.51 | - | - | - |
| 30 | 434.58 | 4.26 | 0.15 | 0.24 | 0.34 | 0.46 | 0.60 | 0.76 | 0.94 | 1.14 | 1.36 | 1.60 | 1.85 | 2.12 | 2.42 | 2.73 | - | - | - |
| 50 | 308.51 | 3.03 | 0.21 | 0.33 | 0.48 | 0.65 | 0.85 | 1.08 | 1.33 | 1.61 | 1.92 | 2.25 | 2.61 | 2.99 | 3.41 | 3.84 | - | - | - |
| 55 | 287.66 | 2.82 | 0.23 | 0.36 | 0.51 | 0.70 | 0.91 | 1.16 | 1.43 | 1.73 | 2.05 | 2.41 | 2.80 | 3.21 | 3.65 | 4.12 | - | - | - |
| 60 | 269.78 | 2.65 | 0.24 | 0.38 | 0.55 | 0.75 | 0.97 | 1.23 | 1.52 | 1.84 | 2.19 | 2.57 | 2.98 | 3.42 | 3.89 | 4.40 | - | - | - |
| 65 | 254.35 | 2.50 | 0.26 | 0.40 | 0.58 | 0.79 | 1.03 | 1.31 | 1.61 | 1.95 | 2.32 | 2.73 | 3.16 | 3.63 | 4.13 | 4.66 | - | - | - |
| 70 | 240.93 | 2.36 | 0.27 | 0.43 | 0.61 | 0.83 | 1.09 | 1.38 | 1.70 | 2.06 | 2.45 | 2.88 | 3.34 | 3.83 | 4.36 | 4.92 | - | - | - |
| 75 | 229.17 | 2.25 | 0.29 | 0.45 | 0.64 | 0.88 | 1.15 | 1.45 | 1.79 | 2.17 | 2.58 | 3.03 | 3.51 | 4.03 | 4.58 | 5.18 | - | - | - |

## 100mm$^2$ Aluminium Alloy "Oak" - "SEVERE" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 939.10 | 9.21 | 0.07 | 0.11 | 0.16 | 0.21 | 0.28 | 0.35 | 0.44 | 0.53 | 0.63 | 0.74 | 0.86 | 0.98 | - | - | - | - | - |
| -4 | 914.46 | 8.97 | 0.07 | 0.11 | 0.16 | 0.22 | 0.29 | 0.36 | 0.45 | 0.54 | 0.65 | 0.76 | 0.88 | 1.01 | - | - | - | - | - |
| 0 | 853.44 | 8.37 | 0.08 | 0.12 | 0.17 | 0.24 | 0.31 | 0.39 | 0.48 | 0.58 | 0.69 | 0.81 | 0.94 | 1.08 | - | - | - | - | - |
| 4 | 793.41 | 7.78 | 0.08 | 0.13 | 0.19 | 0.25 | 0.33 | 0.42 | 0.52 | 0.63 | 0.74 | 0.87 | 1.01 | 1.16 | - | - | - | - | - |
| 8 | 734.65 | 7.21 | 0.09 | 0.14 | 0.20 | 0.27 | 0.36 | 0.45 | 0.56 | 0.68 | 0.80 | 0.94 | 1.09 | 1.26 | - | - | - | - | - |
| 12 | 677.49 | 6.65 | 0.10 | 0.15 | 0.22 | 0.30 | 0.39 | 0.49 | 0.61 | 0.73 | 0.87 | 1.02 | 1.19 | 1.36 | - | - | - | - | - |
| 16 | 622.33 | 6.11 | 0.11 | 0.16 | 0.24 | 0.32 | 0.42 | 0.53 | 0.66 | 0.80 | 0.95 | 1.11 | 1.29 | 1.48 | - | - | - | - | - |
| 20 | 569.67 | 5.59 | 0.12 | 0.18 | 0.26 | 0.35 | 0.46 | 0.58 | 0.72 | 0.87 | 1.04 | 1.22 | 1.41 | 1.62 | - | - | - | - | - |
| 24 | 520.05 | 5.10 | 0.13 | 0.20 | 0.28 | 0.39 | 0.51 | 0.64 | 0.79 | 0.95 | 1.14 | 1.33 | 1.55 | 1.78 | - | - | - | - | - |
| 28 | 473.98 | 4.65 | 0.14 | 0.22 | 0.31 | 0.42 | 0.55 | 0.70 | 0.87 | 1.05 | 1.25 | 1.46 | 1.70 | 1.95 | - | - | - | - | - |
| 32 | 431.94 | 4.24 | 0.15 | 0.24 | 0.34 | 0.47 | 0.61 | 0.77 | 0.95 | 1.15 | 1.37 | 1.61 | 1.86 | 2.14 | - | - | - | - | - |
| 36 | 394.21 | 3.87 | 0.17 | 0.26 | 0.37 | 0.51 | 0.67 | 0.84 | 1.04 | 1.26 | 1.50 | 1.76 | 2.04 | 2.34 | - | - | - | - | - |

### DESIGN TABLE

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 872.48 | 8.56 | 0.08 | 0.12 | 0.17 | 0.23 | 0.30 | 0.38 | 0.47 | 0.57 | 0.68 | 0.79 | 0.92 | 1.06 | - | - | - | - | - |
| 0 | 788.29 | 7.73 | 0.08 | 0.13 | 0.19 | 0.26 | 0.33 | 0.42 | 0.52 | 0.63 | 0.75 | 0.88 | 1.02 | 1.17 | - | - | - | - | - |
| 30 | 409.29 | 4.02 | 0.16 | 0.25 | 0.36 | 0.49 | 0.64 | 0.81 | 1.00 | 1.21 | 1.44 | 1.69 | 1.97 | 2.26 | - | - | - | - | - |
| 50 | 273.41 | 2.68 | 0.24 | 0.38 | 0.54 | 0.74 | 0.96 | 1.22 | 1.50 | 1.82 | 2.16 | 2.54 | 2.94 | 3.38 | - | - | - | - | - |
| 55 | 252.21 | 2.47 | 0.26 | 0.41 | 0.59 | 0.80 | 1.04 | 1.32 | 1.63 | 1.97 | 2.34 | 2.75 | 3.19 | 3.66 | - | - | - | - | - |
| 60 | 234.42 | 2.30 | 0.28 | 0.44 | 0.63 | 0.86 | 1.12 | 1.42 | 1.75 | 2.12 | 2.52 | 2.96 | 3.43 | 3.94 | - | - | - | - | - |
| 65 | 219.38 | 2.15 | 0.30 | 0.47 | 0.67 | 0.92 | 1.20 | 1.52 | 1.87 | 2.26 | 2.69 | 3.16 | 3.67 | 4.21 | - | - | - | - | - |
| 70 | 206.53 | 2.03 | 0.32 | 0.50 | 0.72 | 0.97 | 1.27 | 1.61 | 1.99 | 2.40 | 2.86 | 3.36 | 3.89 | 4.47 | - | - | - | - | - |
| 75 | 195.45 | 1.92 | 0.34 | 0.52 | 0.76 | 1.03 | 1.34 | 1.70 | 2.10 | 2.54 | 3.02 | 3.55 | 4.12 | 4.72 | - | - | - | - | - |

## 100 $mm^2$ Hard Drawn Copper

* Conductor & Design Parameters
* Structure Suitability
* Stayed Pole Design Data
* Unstayed Pole Design Data
* Sags and Tensions

## 100mm$^2$ Hard Drawn Copper

### Conductor Parameters:

| | |
|---|---|
| Conductor Stranding (#strands / diameter(mm)) | 7/4.30 |
| Greased Conductor Weight (kg/m) | 0.911 |
| Cross Sectional Area of Conductor (mm²) | 101.7 |
| Conductor Overall Diameter (mm) | 12.90 |
| Coefficient of Linear Expansion (/Degree C) | 1.70E-05 |
| Modulus of Elasticity (kg/mm²) | 12,660 |
| Rated Breaking Strength of Conductor (kgf) | 3,724.8 |

| **Design Loading Parameters:** | **"Normal"** | **"Severe"** |
|---|---|---|
| Basic / Recommended Span (m) | 130 | 110 |
| Wind Pressure on Conductor (N/m²) | 380 | 570 |
| Radial Ice Thickness (mm) | 9.5 | 12.5 |
| Ice Density (kg/m³) | 913 | 913 |
| Absolute Maximum Working Tension (MWT) Limit (kgf) | 2,379.0 | 2,379.0 |
| Temperature at MWT Limit (Degrees C) | -5.6 | -5.6 |
| Maximum "Everyday" Tension (EDT) Limit (kgf) | 1,302.1 | 941.5 |
| Temperature at EDT Limit (Degrees C) | -5.6 | -5.6 |
| Maximum Conductor Tension (MCT) at -5.6 degC (kgf) | 1,862.4 | 1,862.4 |
| Maximum Conductor Weight (MCW) (kg/m) | 1.522 | 1.822 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.236 | 2.203 |
| Freezing Point Tension (FPT) (kgf) | 1,231.7 | 890.5 |

| **Span Length Limits:** | **"Normal"** | **"Severe"** |
|---|---|---|
| Maximum **Equivalent** Span | 130 | 110 |
| *Maximum **Single** Span (clashing limit)<br>(Standard heavy crossarm, 1.2m phase spacing) | 145 | 115 |
| *Maximum **Single** Span (clashing limit)<br>(H Pole, long span heavy crossarm, 2.0m phase spacing) | 190 | 150 |

**NOTE: Single span limits to be reduced by 20m where weather zone is worse than 2B at "normal" altitudes, or worse than 3C at "severe" altitudes. Weather zones are given in Appendix O**

## 100mm$^2$ Hard Drawn Copper

### Pole-Top Steelwork Suitability

| Grade | Structure Configuration | | Drg. Ref | Max. Dev'n Normal | Max. Dev'n Severe | Max. D'pull. | Notes |
|---|---|---|---|---|---|---|---|
| Light | Single Pole | Single Arm Intermediate / Pin Angle | F3 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Straight Section / Angle Section | F4 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Termination | F5 | Not Suitable | Not Suitable | Not Suitable | |
| Heavy | Single Pole | Single Arm Intermediate / Pin Angle | F7 | 2º | 1º | 1:20 | Limited Dow npull |
| Heavy | Single Pole | Double Arm Intermediate / Pin Angle | F8 | 7º | 4º | 1:10 | |
| Heavy | Single Pole | Double Arm Straight Section / Angle Section | F9 | 45º | 45º | 1:10 | |
| Heavy | "H" Pole | Double Arm Angle Section | F10 | 60º | 60º | 1:10 | Limits as per F8 if used as intermediate |
| Heavy | "H" Pole | Double Arm Section / Inter. For long spans | F11 | 60º (section) | 60º (section) | 1:10 | No deviation allow ed if used as intermediate |
| Heavy | "H" Pole | Double Arm Termination | F12 | O.K. | O.K. | 1:10 | |
| Heavy | Single Pole | Double Arm Termination | F13 | Not Suitable | Not Suitable | Not Suitable | |

## 100mm$^2$ Hard Drawn Copper - "NORMAL" Loading Environment

### Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 1,862.4 |
| Wind Pressure (N/m²) | 380 |
| Maximum Conductor Weight (MCW) (kg/m) | 1.52 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.24 |
| Maximum Wind Span Length (m) | 190 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 13,968.0 |
| Transverse Load [Normal to Span] (kgf) | 1,761.4 |
| Vertical Load with Downpull (1:10) (kgf) | 5,776.3 |
| Pole Wind Loading (kgf) | 224.5 |

### Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|
| 0 | 9,216 | 8,613 | 8,143 | 7,762 |
| 5 | 11,324 | 10,350 | 9,593 | 8,979 |
| 10 | 13,422 | 12,080 | 11,037 | 10,190 |
| 15 | 15,506 | 13,799 | 12,471 | 11,394 |
| 20 | 17,572 | 15,502 | 13,892 | 12,587 |
| 25 | 19,617 | 17,188 | 15,299 | 13,767 |
| 30 | 21,636 | 18,853 | 16,688 | 14,933 |
| 35 | 23,625 | 20,493 | 18,057 | 16,081 |
| 40 | 25,581 | 22,106 | 19,403 | 17,211 |
| 45 | 27,501 | 23,689 | 20,724 | 18,319 |
| 50 | 29,379 | 25,238 | 22,017 | 19,403 |
| 55 | 31,214 | 26,751 | 23,279 | 20,463 |
| 60 | 33,001 | 28,224 | 24,508 | 21,494 |

***NOTE: Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

### Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | Single Pole | 5 | 18 | 13 | 33 |
| 35 | | 7 | 22 | 16 | 40 |
| 40 | | 9 | 26 | 19 | 47 |
| 45 | | 11 | 30 | 21 | 53 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | "H" Pole | 31 | 45 | 56 | 60 | x | x |
| 35 | | 38 | 55 | 60 | 60 | x | x |
| 40 | | 44 | 60 | 60 | 60 | x | x |
| 45 | | 51 | 60 | 60 | 60 | x | x |

## 100mm$^2$ Hard Drawn Copper - "SEVERE" Loading Environment

### Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 1,862.4 |
| Wind Pressure (N/m²) | 570 |
| Maximum Conductor Weight (MCW) (kg/m) | 1.82 |
| Maximum Conductor Pressure (MCP) (kg/m) | 2.20 |
| Maximum Wind Span Length (m) | 150 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 13,968.1 |
| Transverse Load [Normal to Span] (kgf) | 2,478.3 |
| Vertical Load with Downpull (1:10) (kgf) | 5,657.7 |
| Pole Wind Loading (kgf) | 336.8 |

### Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|
| 0 | 10,533 | 9,678 | 9,013 | 8,473 |
| 5 | 12,640 | 11,415 | 10,462 | 9,689 |
| 10 | 14,734 | 13,142 | 11,903 | 10,898 |
| 15 | 16,813 | 14,855 | 13,333 | 12,098 |
| 20 | 18,871 | 16,552 | 14,749 | 13,286 |
| 25 | 20,905 | 18,229 | 16,148 | 14,460 |
| 30 | 22,911 | 19,883 | 17,529 | 15,619 |
| 35 | 24,885 | 21,511 | 18,887 | 16,759 |
| 40 | 26,824 | 23,110 | 20,221 | 17,878 |
| 45 | 28,724 | 24,676 | 21,528 | 18,975 |
| 50 | 30,580 | 26,208 | 22,806 | 20,047 |
| 55 | 32,391 | 27,700 | 24,052 | 21,092 |
| 60 | 34,152 | 29,152 | 25,263 | 22,109 |

***NOTE: Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

### Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | 2 | 14 | 9 | 29 |
| 35 | Single | 4 | 19 | 12 | 36 |
| 40 | Pole | 5 | 23 | 15 | 43 |
| 45 | | 7 | 27 | 18 | 50 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | | 28 | 41 | 52 | 60 | x | x |
| 35 | "H" | 34 | 51 | 60 | 60 | x | x |
| 40 | Pole | 41 | 60 | 60 | 60 | x | x |
| 45 | | 47 | 60 | 60 | 60 | x | x |

# 100mm² Hard Drawn Copper - "NORMAL" Loading Environment

## Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 380 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.24 |

## Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| Pole Length (m) and Grade | | Average / Poor Soil | | | | | Good / Average Soil | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | |
| | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 | M | 70 | 71 | 37 | 69 | 69 | 70 | 71 | 60 | 69 | 69 | 70 | 71 | 69 | 69 | 69 |
| 9 | M | 69 | 70 | 35 | 68 | 68 | 69 | 70 | 57 | 68 | 68 | 69 | 70 | 68 | 68 | 68 |
| 9.5 | M | 69 | 69 | 33 | 68 | 68 | 69 | 69 | 54 | 68 | 68 | 69 | 69 | 68 | 68 | 68 |
| 10 | M | 69 | 69 | 31 | 64 | 68 | 69 | 69 | 52 | 68 | 68 | 69 | 69 | 68 | 68 | 68 |
| 10.5 | M | 68 | 69 | 29 | 61 | 68 | 68 | 69 | 49 | 68 | 68 | 68 | 69 | 68 | 68 | 68 |
| 11 | M | 69 | 69 | 28 | 58 | 69 | 69 | 69 | 47 | 69 | 69 | 69 | 69 | 66 | 69 | 69 |
| 11.5 | M | 69 | 69 | 26 | 54 | 69 | 69 | 69 | 45 | 69 | 69 | 69 | 69 | 64 | 69 | 69 |
| 12 | M | 69 | 69 | 25 | 52 | 69 | 69 | 69 | 43 | 69 | 69 | 69 | 69 | 61 | 69 | 69 |
| 13 | M | 70 | 71 | 21 | 46 | 71 | 71 | 71 | 39 | 71 | 71 | 71 | 71 | 56 | 71 | 71 |
| 14 | M | 67 | 76 | 19 | 42 | 72 | 76 | 76 | 36 | 70 | 76 | 76 | 76 | 53 | 76 | 76 |
| 15 | M | 82 | 82 | 37 | 64 | 82 | 82 | 82 | 64 | 82 | 82 | 82 | 82 | 82 | 82 | 82 |
| 16 | M | 82 | 88 | 34 | 59 | 88 | 88 | 88 | 60 | 88 | 88 | 88 | 88 | 87 | 88 | 88 |
| 17 | M | 78 | 95 | 31 | 54 | 91 | 95 | 95 | 57 | 91 | 95 | 95 | 95 | 83 | 95 | 95 |
| 18 | M | 74 | 96 | 28 | 49 | 83 | 96 | 96 | 53 | 85 | 96 | 96 | 96 | 78 | 96 | 96 |
| 20 | M | 68 | 104 | 23 | 41 | 71 | 104 | 104 | 47 | 75 | 104 | 104 | 104 | 72 | 104 | 104 |
| 22 | M | 59 | 108 | 16 | 33 | 59 | 104 | 110 | 40 | 64 | 104 | 110 | 110 | 63 | 96 | 110 |
| | | | | | | | | | | | | | | | | |
| 10 | MS | 100 | 103 | 35 | 68 | 102 | 103 | 103 | 58 | 102 | 102 | 103 | 103 | 81 | 102 | 102 |
| 11 | MS | 91 | 102 | 31 | 60 | 99 | 102 | 102 | 53 | 96 | 102 | 102 | 102 | 74 | 102 | 102 |
| 12 | MS | 86 | 108 | 28 | 54 | 89 | 108 | 108 | 49 | 88 | 108 | 108 | 108 | 69 | 108 | 108 |
| 13 | MS | 80 | 108 | 24 | 48 | 80 | 108 | 108 | 44 | 80 | 108 | 108 | 108 | 64 | 108 | 108 |
| | | | | | | | | | | | | | | | | |
| 8.5 | S | 124 | 140 | 46 | 84 | 135 | 139 | 140 | 74 | 130 | 136 | 139 | 140 | 101 | 136 | 136 |
| 9 | S | 120 | 144 | 44 | 79 | 127 | 143 | 144 | 71 | 124 | 141 | 143 | 144 | 98 | 141 | 141 |
| 9.5 | S | 114 | 141 | 41 | 74 | 120 | 140 | 141 | 67 | 117 | 139 | 140 | 141 | 93 | 139 | 139 |
| 10 | S | 109 | 139 | 39 | 70 | 113 | 138 | 139 | 64 | 111 | 137 | 138 | 139 | 89 | 137 | 137 |
| 10.5 | S | 104 | 136 | 36 | 66 | 106 | 137 | 137 | 61 | 105 | 136 | 137 | 137 | 85 | 136 | 136 |
| 11 | S | 100 | 131 | 34 | 62 | 100 | 135 | 136 | 58 | 100 | 135 | 135 | 136 | 81 | 135 | 135 |
| 11.5 | S | 96 | 126 | 32 | 59 | 95 | 135 | 135 | 55 | 95 | 135 | 135 | 135 | 78 | 131 | 135 |
| 12 | S | 92 | 134 | 30 | 55 | 90 | 134 | 134 | 52 | 90 | 134 | 134 | 134 | 74 | 125 | 134 |
| 13 | S | 87 | 140 | 26 | 50 | 81 | 138 | 140 | 48 | 83 | 130 | 140 | 140 | 69 | 116 | 140 |
| 14 | S | 82 | 141 | 23 | 45 | 73 | 131 | 145 | 44 | 76 | 119 | 145 | 145 | 65 | 107 | 145 |
| 15 | S | 104 | 149 | 45 | 70 | 110 | 149 | 149 | 77 | 115 | 149 | 149 | 149 | 109 | 149 | 149 |
| 16 | S | 98 | 156 | 41 | 64 | 101 | 156 | 156 | 72 | 107 | 156 | 156 | 156 | 104 | 150 | 156 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | S | 92 | 154 | 37 | 58 | 93 | | 150 | 154 | 67 | 100 | 152 | | 154 | 154 | 98 | 141 | 154 |
| 18 | S | 88 | 150 | 33 | 54 | 86 | | 145 | 158 | 63 | 93 | 142 | | 158 | 158 | 93 | 133 | 158 |
| 20 | S | 78 | 137 | 27 | 44 | 72 | | 133 | 160 | 55 | 81 | 123 | | 160 | 160 | 84 | 119 | 160 |
| 22 | S | 69 | 125 | 19 | 35 | 60 | | 120 | 157 | 47 | 70 | 107 | | 157 | 157 | 74 | 105 | 155 |
| | | | | | | | | | | | | | | | | | | |
| 9 | ES | 132 | 184 | 49 | 83 | 130 | | 184 | 184 | 78 | 130 | 184 | | 184 | 184 | 108 | 177 | 184 |
| 9.5 | ES | 125 | 180 | 46 | 78 | 122 | | 180 | 180 | 74 | 123 | 180 | | 180 | 180 | 102 | 167 | 180 |
| 10 | ES | 117 | 175 | 41 | 72 | 114 | | 173 | 175 | 68 | 114 | 171 | | 173 | 175 | 95 | 156 | 171 |
| 10.5 | ES | 113 | 180 | 39 | 68 | 108 | | 176 | 180 | 66 | 109 | 168 | | 179 | 180 | 92 | 150 | 178 |
| 11 | ES | 108 | 178 | 37 | 64 | 101 | | 169 | 178 | 62 | 103 | 159 | | 177 | 178 | 88 | 143 | 176 |
| 11.5 | ES | 105 | 177 | 35 | 61 | 96 | | 165 | 184 | 60 | 99 | 152 | | 183 | 184 | 85 | 137 | 183 |
| 12 | ES | 101 | 171 | 33 | 57 | 91 | | 159 | 182 | 57 | 94 | 145 | | 182 | 182 | 81 | 131 | 182 |
| 13 | ES | 95 | 162 | 29 | 51 | 82 | | 151 | 187 | 52 | 86 | 132 | | 187 | 187 | 76 | 121 | 182 |
| 14 | ES | 89 | 153 | 25 | 46 | 73 | | 143 | 194 | 48 | 79 | 120 | | 194 | 194 | 71 | 112 | 167 |
| 15 | ES | 111 | 182 | 47 | 72 | 111 | | 176 | 192 | 82 | 119 | 178 | | 192 | 192 | 117 | 166 | 192 |
| 16 | ES | 105 | 175 | 43 | 66 | 102 | | 169 | 196 | 77 | 111 | 165 | | 196 | 196 | 111 | 156 | 196 |
| 17 | ES | 102 | 172 | 41 | 62 | 95 | | 166 | 212 | 75 | 106 | 155 | | 212 | 212 | 108 | 149 | 212 |

# 100mm² Hard Drawn Copper - "SEVERE" Loading Environment

## Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 570 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 2.20 |

## Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| | Average / Poor Soil | | | | | Good / Average Soil | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pole Length (m) and Grade | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | |
| | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 M | 37 | 37 | 19 | 36 | 36 | 37 | 37 | 31 | 36 | 36 | 37 | 37 | 36 | 36 | 36 |
| 9 M | 36 | 37 | 17 | 36 | 36 | 36 | 37 | 30 | 36 | 36 | 36 | 37 | 36 | 36 | 36 |
| 9.5 M | 36 | 36 | 16 | 35 | 35 | 36 | 36 | 28 | 35 | 35 | 36 | 36 | 35 | 35 | 35 |
| 10 M | 36 | 36 | 15 | 33 | 35 | 36 | 36 | 26 | 35 | 35 | 36 | 36 | 35 | 35 | 35 |
| 10.5 M | 35 | 35 | 14 | 31 | 35 | 35 | 35 | 25 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| 11 M | 36 | 36 | 13 | 29 | 36 | 36 | 36 | 23 | 36 | 36 | 36 | 36 | 34 | 36 | 36 |
| 11.5 M | 36 | 36 | 11 | 27 | 36 | 36 | 36 | 22 | 36 | 36 | 36 | 36 | 32 | 36 | 36 |
| 12 M | 36 | 36 | 10 | 26 | 36 | 36 | 36 | 21 | 36 | 36 | 36 | 36 | 31 | 36 | 36 |
| 13 M | 36 | 36 | 8 | 22 | 36 | 36 | 36 | 18 | 36 | 36 | 36 | 36 | 28 | 36 | 36 |
| 14 M | 33 | 39 | 6 | 19 | 36 | 39 | 39 | 16 | 35 | 39 | 39 | 39 | 26 | 39 | 39 |
| 15 M | 42 | 42 | 16 | 31 | 42 | 42 | 42 | 31 | 42 | 42 | 42 | 42 | 42 | 42 | 42 |
| 16 M | 41 | 46 | 14 | 28 | 46 | 46 | 46 | 28 | 46 | 46 | 46 | 46 | 43 | 46 | 46 |
| 17 M | 38 | 49 | 11 | 24 | 45 | 49 | 49 | 26 | 45 | 49 | 49 | 49 | 40 | 49 | 49 |
| 18 M | 35 | 50 | 9 | 21 | 40 | 50 | 50 | 23 | 41 | 50 | 50 | 50 | 37 | 50 | 50 |
| 20 M | 31 | 55 | 5 | 16 | 32 | 55 | 55 | 19 | 35 | 55 | 55 | 55 | 33 | 54 | 55 |
| 22 M | 25 | 52 | 0 | 9 | 24 | 50 | 57 | 13 | 27 | 50 | 57 | 57 | 27 | 45 | 57 |
| | | | | | | | | | | | | | | | |
| 10 MS | 53 | 55 | 17 | 35 | 54 | 54 | 55 | 30 | 54 | 54 | 54 | 55 | 43 | 54 | 54 |
| 11 MS | 48 | 54 | 14 | 30 | 52 | 54 | 54 | 26 | 50 | 53 | 54 | 54 | 38 | 53 | 53 |
| 12 MS | 44 | 57 | 12 | 26 | 46 | 57 | 57 | 23 | 45 | 57 | 57 | 57 | 35 | 57 | 57 |
| 13 MS | 40 | 57 | 9 | 23 | 41 | 57 | 57 | 20 | 40 | 57 | 57 | 57 | 31 | 57 | 57 |
| | | | | | | | | | | | | | | | |
| 8.5 S | 67 | 76 | 23 | 44 | 73 | 75 | 76 | 39 | 70 | 73 | 75 | 76 | 54 | 73 | 73 |
| 9 S | 65 | 78 | 22 | 42 | 68 | 77 | 78 | 37 | 67 | 76 | 77 | 78 | 52 | 76 | 76 |
| 9.5 S | 61 | 76 | 20 | 39 | 64 | 76 | 76 | 35 | 63 | 75 | 76 | 76 | 49 | 75 | 75 |
| 10 S | 58 | 75 | 18 | 36 | 60 | 74 | 75 | 32 | 59 | 73 | 74 | 75 | 47 | 73 | 73 |
| 10.5 S | 55 | 73 | 17 | 34 | 56 | 73 | 73 | 30 | 55 | 73 | 73 | 73 | 44 | 73 | 73 |
| 11 S | 53 | 70 | 15 | 31 | 53 | 72 | 72 | 29 | 52 | 72 | 72 | 72 | 42 | 72 | 72 |
| 11.5 S | 50 | 67 | 14 | 29 | 49 | 72 | 72 | 27 | 49 | 72 | 72 | 72 | 40 | 70 | 72 |
| 12 S | 48 | 71 | 13 | 27 | 46 | 71 | 71 | 25 | 47 | 71 | 71 | 71 | 38 | 66 | 71 |
| 13 S | 44 | 75 | 10 | 23 | 41 | 73 | 75 | 22 | 42 | 68 | 75 | 75 | 34 | 60 | 75 |
| 14 S | 41 | 74 | 8 | 20 | 36 | 69 | 78 | 20 | 37 | 62 | 78 | 78 | 31 | 55 | 78 |
| 15 S | 53 | 80 | 19 | 34 | 56 | 80 | 80 | 38 | 59 | 80 | 80 | 80 | 56 | 80 | 80 |
| 16 S | 49 | 83 | 17 | 30 | 51 | 83 | 83 | 34 | 54 | 83 | 83 | 83 | 52 | 78 | 83 |
| 17 S | 45 | 81 | 14 | 26 | 45 | 78 | 83 | 31 | 49 | 78 | 83 | 83 | 48 | 72 | 83 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | S | 42 | 77 | 11 | 23 | 41 | | 74 | 85 | 28 | 45 | 72 | | 85 | 85 | 45 | 67 | 85 |
| 20 | S | 36 | 69 | 6 | 16 | 32 | | 66 | 86 | 22 | 37 | 61 | | 86 | 86 | 38 | 58 | 86 |
| 22 | S | 29 | 61 | 1 | 10 | 24 | | 58 | 84 | 16 | 29 | 50 | | 84 | 84 | 31 | 49 | 77 |
| | | | | | | | | | | | | | | | | | | |
| 9 | ES | 71 | 100 | 24 | 44 | 70 | | 100 | 100 | 41 | 70 | 100 | | 100 | 100 | 57 | 96 | 100 |
| 9.5 | ES | 67 | 98 | 22 | 41 | 65 | | 98 | 98 | 38 | 66 | 98 | | 98 | 98 | 54 | 91 | 98 |
| 10 | ES | 62 | 95 | 20 | 37 | 60 | | 93 | 95 | 35 | 60 | 92 | | 93 | 95 | 50 | 84 | 92 |
| 10.5 | ES | 60 | 97 | 18 | 35 | 57 | | 95 | 97 | 33 | 57 | 90 | | 96 | 97 | 48 | 80 | 96 |
| 11 | ES | 57 | 96 | 16 | 32 | 53 | | 91 | 96 | 31 | 54 | 85 | | 95 | 96 | 45 | 76 | 94 |
| 11.5 | ES | 55 | 95 | 15 | 30 | 50 | | 89 | 99 | 29 | 51 | 81 | | 99 | 99 | 43 | 73 | 98 |
| 12 | ES | 52 | 92 | 14 | 28 | 46 | | 85 | 98 | 27 | 48 | 77 | | 98 | 98 | 41 | 69 | 98 |
| 13 | ES | 48 | 86 | 11 | 24 | 41 | | 80 | 101 | 24 | 43 | 69 | | 101 | 101 | 37 | 63 | 97 |
| 14 | ES | 44 | 81 | 8 | 20 | 36 | | 75 | 104 | 21 | 38 | 62 | | 104 | 104 | 34 | 57 | 88 |
| 15 | ES | 56 | 96 | 20 | 34 | 56 | | 93 | 103 | 40 | 60 | 94 | | 103 | 103 | 59 | 87 | 103 |
| 16 | ES | 52 | 91 | 18 | 30 | 51 | | 88 | 106 | 36 | 56 | 86 | | 106 | 106 | 55 | 81 | 106 |
| 17 | ES | 50 | 89 | 15 | 27 | 46 | | 86 | 115 | 34 | 52 | 80 | | 115 | 115 | 53 | 76 | 114 |

## 100mm$^2$ Hard Drawn Copper - "NORMAL" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 1436.24 | 14.09 | 0.13 | 0.20 | 0.29 | 0.39 | 0.51 | 0.64 | 0.79 | 0.96 | 1.14 | 1.34 | 1.55 | 1.78 | 2.03 | 2.29 | 2.57 | 2.86 | - |
| -4 | 1410.76 | 13.84 | 0.13 | 0.20 | 0.29 | 0.40 | 0.52 | 0.65 | 0.81 | 0.98 | 1.16 | 1.36 | 1.58 | 1.82 | 2.07 | 2.33 | 2.62 | 2.91 | - |
| 0 | 1348.72 | 13.23 | 0.14 | 0.21 | 0.30 | 0.41 | 0.54 | 0.68 | 0.84 | 1.02 | 1.22 | 1.43 | 1.66 | 1.90 | 2.16 | 2.44 | 2.74 | 3.05 | - |
| 4 | 1289.19 | 12.65 | 0.14 | 0.22 | 0.32 | 0.43 | 0.57 | 0.72 | 0.88 | 1.07 | 1.27 | 1.49 | 1.73 | 1.99 | 2.26 | 2.55 | 2.86 | 3.19 | - |
| 8 | 1232.30 | 12.09 | 0.15 | 0.23 | 0.33 | 0.45 | 0.59 | 0.75 | 0.92 | 1.12 | 1.33 | 1.56 | 1.81 | 2.08 | 2.37 | 2.67 | 2.99 | 3.34 | - |
| 12 | 1178.15 | 11.56 | 0.15 | 0.24 | 0.35 | 0.47 | 0.62 | 0.78 | 0.97 | 1.17 | 1.39 | 1.63 | 1.89 | 2.18 | 2.47 | 2.79 | 3.13 | 3.49 | - |
| 16 | 1126.81 | 11.05 | 0.16 | 0.25 | 0.36 | 0.50 | 0.65 | 0.82 | 1.01 | 1.22 | 1.46 | 1.71 | 1.98 | 2.27 | 2.59 | 2.92 | 3.28 | 3.65 | - |
| 20 | 1078.32 | 10.58 | 0.17 | 0.26 | 0.38 | 0.52 | 0.68 | 0.86 | 1.06 | 1.28 | 1.52 | 1.79 | 2.07 | 2.38 | 2.70 | 3.05 | 3.42 | 3.81 | - |
| 24 | 1032.67 | 10.13 | 0.18 | 0.28 | 0.40 | 0.54 | 0.71 | 0.89 | 1.10 | 1.33 | 1.59 | 1.86 | 2.16 | 2.48 | 2.82 | 3.19 | 3.57 | 3.98 | - |
| 28 | 989.83 | 9.71 | 0.18 | 0.29 | 0.41 | 0.56 | 0.74 | 0.93 | 1.15 | 1.39 | 1.66 | 1.94 | 2.26 | 2.59 | 2.95 | 3.33 | 3.73 | 4.15 | - |
| 32 | 949.73 | 9.32 | 0.19 | 0.30 | 0.43 | 0.59 | 0.77 | 0.97 | 1.20 | 1.45 | 1.73 | 2.03 | 2.35 | 2.70 | 3.07 | 3.47 | 3.89 | 4.33 | - |
| 36 | 912.27 | 8.95 | 0.20 | 0.31 | 0.45 | 0.61 | 0.80 | 1.01 | 1.25 | 1.51 | 1.80 | 2.11 | 2.45 | 2.81 | 3.20 | 3.61 | 4.05 | 4.51 | - |

### DESIGN TABLE

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 1302.10 | 12.77 | 0.14 | 0.22 | 0.31 | 0.43 | 0.56 | 0.71 | 0.87 | 1.06 | 1.26 | 1.48 | 1.71 | 1.97 | 2.24 | 2.53 | 2.83 | 3.16 | - |
| 0 | 1222.38 | 11.99 | 0.15 | 0.23 | 0.34 | 0.46 | 0.60 | 0.75 | 0.93 | 1.13 | 1.34 | 1.57 | 1.83 | 2.10 | 2.39 | 2.69 | 3.02 | 3.36 | - |
| 30 | 888.27 | 8.71 | 0.21 | 0.32 | 0.46 | 0.63 | 0.82 | 1.04 | 1.28 | 1.55 | 1.85 | 2.17 | 2.51 | 2.89 | 3.28 | 3.71 | 4.15 | 4.63 | - |
| 50 | 743.22 | 7.29 | 0.25 | 0.38 | 0.55 | 0.75 | 0.98 | 1.24 | 1.53 | 1.85 | 2.21 | 2.59 | 3.00 | 3.45 | 3.92 | 4.43 | 4.97 | 5.53 | - |
| 55 | 714.32 | 7.01 | 0.26 | 0.40 | 0.57 | 0.78 | 1.02 | 1.29 | 1.59 | 1.93 | 2.30 | 2.69 | 3.13 | 3.59 | 4.08 | 4.61 | 5.17 | 5.76 | - |
| 60 | 687.83 | 6.75 | 0.26 | 0.41 | 0.60 | 0.81 | 1.06 | 1.34 | 1.66 | 2.00 | 2.38 | 2.80 | 3.25 | 3.73 | 4.24 | 4.79 | 5.37 | 5.98 | - |
| 65 | 663.50 | 6.51 | 0.27 | 0.43 | 0.62 | 0.84 | 1.10 | 1.39 | 1.72 | 2.08 | 2.47 | 2.90 | 3.36 | 3.86 | 4.39 | 4.96 | 5.56 | 6.20 | - |
| 70 | 641.10 | 6.29 | 0.28 | 0.44 | 0.64 | 0.87 | 1.14 | 1.44 | 1.78 | 2.15 | 2.56 | 3.00 | 3.48 | 4.00 | 4.55 | 5.13 | 5.76 | 6.41 | - |
| 75 | 620.44 | 6.09 | 0.29 | 0.46 | 0.66 | 0.90 | 1.17 | 1.49 | 1.84 | 2.22 | 2.64 | 3.10 | 3.60 | 4.13 | 4.70 | 5.31 | 5.95 | 6.63 | - |

## 100mm$^2$ Hard Drawn Copper - "SEVERE" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. (Deg.C) | Tension (kgf) | Tension (kN) | Sag (m) for Span Length (m) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** |
| -5.6 | 1049.92 | 10.30 | 0.17 | 0.27 | 0.39 | 0.53 | 0.69 | 0.88 | 1.08 | 1.31 | 1.56 | 1.83 | 2.13 | 2.44 |
| -4 | 1028.61 | 10.09 | 0.18 | 0.28 | 0.40 | 0.54 | 0.71 | 0.90 | 1.11 | 1.34 | 1.59 | 1.87 | 2.17 | 2.49 |
| 0 | 977.60 | 9.59 | 0.19 | 0.29 | 0.42 | 0.57 | 0.75 | 0.94 | 1.17 | 1.41 | 1.68 | 1.97 | 2.28 | 2.62 |
| 4 | 929.84 | 9.12 | 0.20 | 0.31 | 0.44 | 0.60 | 0.78 | 0.99 | 1.22 | 1.48 | 1.76 | 2.07 | 2.40 | 2.76 |
| 8 | 885.33 | 8.69 | 0.21 | 0.32 | 0.46 | 0.63 | 0.82 | 1.04 | 1.29 | 1.56 | 1.85 | 2.17 | 2.52 | 2.89 |
| 12 | 843.99 | 8.28 | 0.22 | 0.34 | 0.49 | 0.66 | 0.86 | 1.09 | 1.35 | 1.63 | 1.94 | 2.28 | 2.65 | 3.04 |
| 16 | 805.72 | 7.90 | 0.23 | 0.35 | 0.51 | 0.69 | 0.90 | 1.15 | 1.41 | 1.71 | 2.04 | 2.39 | 2.77 | 3.18 |
| 20 | 770.36 | 7.56 | 0.24 | 0.37 | 0.53 | 0.72 | 0.95 | 1.20 | 1.48 | 1.79 | 2.13 | 2.50 | 2.90 | 3.33 |
| 24 | 737.76 | 7.24 | 0.25 | 0.39 | 0.56 | 0.76 | 0.99 | 1.25 | 1.54 | 1.87 | 2.22 | 2.61 | 3.03 | 3.47 |
| 28 | 707.71 | 6.94 | 0.26 | 0.40 | 0.58 | 0.79 | 1.03 | 1.30 | 1.61 | 1.95 | 2.32 | 2.72 | 3.15 | 3.62 |
| 32 | 680.02 | 6.67 | 0.27 | 0.42 | 0.60 | 0.82 | 1.07 | 1.36 | 1.67 | 2.03 | 2.41 | 2.83 | 3.28 | 3.77 |
| 36 | 654.50 | 6.42 | 0.28 | 0.44 | 0.63 | 0.85 | 1.11 | 1.41 | 1.74 | 2.11 | 2.51 | 2.94 | 3.41 | 3.92 |

### DESIGN TABLE

| Temp. (Deg.C) | Tension (kgf) | Tension (kN) | Sag (m) for Span Length (m) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** |
| -5.6 | 941.50 | 9.24 | 0.19 | 0.30 | 0.44 | 0.59 | 0.77 | 0.98 | 1.21 | 1.46 | 1.74 | 2.04 | 2.37 | 2.72 |
| 0 | 878.95 | 8.62 | 0.21 | 0.32 | 0.47 | 0.63 | 0.83 | 1.05 | 1.30 | 1.57 | 1.87 | 2.19 | 2.54 | 2.92 |
| 30 | 639.00 | 6.27 | 0.29 | 0.45 | 0.64 | 0.87 | 1.14 | 1.44 | 1.78 | 2.16 | 2.57 | 3.01 | 3.49 | 4.01 |
| 50 | 542.70 | 5.32 | 0.34 | 0.52 | 0.76 | 1.03 | 1.34 | 1.70 | 2.10 | 2.54 | 3.02 | 3.55 | 4.11 | 4.72 |
| 55 | 523.71 | 5.14 | 0.35 | 0.54 | 0.78 | 1.07 | 1.39 | 1.76 | 2.17 | 2.63 | 3.13 | 3.68 | 4.26 | 4.89 |
| 60 | 506.30 | 4.97 | 0.36 | 0.56 | 0.81 | 1.10 | 1.44 | 1.82 | 2.25 | 2.72 | 3.24 | 3.80 | 4.41 | 5.06 |
| 65 | 490.29 | 4.81 | 0.37 | 0.58 | 0.84 | 1.14 | 1.49 | 1.88 | 2.32 | 2.81 | 3.35 | 3.93 | 4.55 | 5.23 |
| 70 | 475.52 | 4.66 | 0.38 | 0.60 | 0.86 | 1.17 | 1.53 | 1.94 | 2.40 | 2.90 | 3.45 | 4.05 | 4.69 | 5.39 |
| 75 | 461.86 | 4.53 | 0.39 | 0.62 | 0.89 | 1.21 | 1.58 | 2.00 | 2.47 | 2.98 | 3.55 | 4.17 | 4.83 | 5.55 |

# APPENDIX H

## 150 mm$^2$ Aluminium Alloy "Ash"

- Conductor & Design Parameters
- Structure Suitability
- Stayed Pole Design Data
- Unstayed Pole Design Data
- Sags and Tensions

## 150mm$^2$ Aluminium Alloy "Ash"

### Conductor Parameters:

| | |
|---|---|
| Conductor Stranding (#strands / diameter(mm)) | 19/3.48 |
| Greased Conductor Weight (kg/m) | 0.519 |
| Cross Sectional Area of Conductor (mm²) | 180.7 |
| Conductor Overall Diameter (mm) | 17.40 |
| Coefficient of Linear Expansion (/Degree C) | 2.30E-05 |
| Modulus of Elasticity (kg/mm²) | 5,700 |
| Rated Breaking Strength of Conductor (kgf) | 5,436.1 |

| **Design Loading Parameters:** | **"Normal"** | **"Severe"** |
|---|---|---|
| Basic / Recommended Span (m) | 130 | 110 |
| Wind Pressure on Conductor (N/m²) | 380 | 570 |
| Radial Ice Thickness (mm) | 9.5 | 12.5 |
| Ice Density (kg/m³) | 913 | 913 |
| Absolute Maximum Working Tension (MWT) Limit (kgf) | 2,379.0 | 2,379.0 |
| Temperature at MWT Limit (Degrees C) | -5.6 | -5.6 |
| Maximum "Everyday" Tension (EDT) Limit (kgf) | 1,087.2 | 1,087.2 |
| Temperature at EDT Limit (Degrees C) | 5.0 | 5.0 |
| Maximum Conductor Tension (MCT) at -5.6 degC (kgf) | 1,893.0 | 2,169.5 |
| Maximum Conductor Weight (MCW) (kg/m) | 1.252 | 1.591 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.410 | 2.464 |
| Freezing Point Tension (FPT) (kgf) | 1,180.6 | 1,186.7 |

| **Span Length Limits:** | **"Normal"** | **"Severe"** |
|---|---|---|
| Maximum **Equivalent** Span | 130 | 110 |
| *Maximum **Single** Span (clashing limit)<br>(Standard heavy crossarm, 1.2m phase spacing) | 135 | 115 |
| *Maximum **Single** Span (clashing limit)<br>(H Pole, long span heavy crossarm, 2.0m phase spacing) | 175 | 150 |

**NOTE: Single span limits to be reduced by 15m where weather zone is worse than 2B at "normal" altitudes, or worse than 3C at "severe" altitudes. Weather zones are given in Appendix O**

## 150mm$^2$ Aluminium Alloy "Ash"

### Pole-Top Steelwork Suitability

| Grade | Structure Configuration | | Drg. Ref | Max. Dev'n Normal | Max. Dev'n Severe | Max. D'pull. | Notes |
|---|---|---|---|---|---|---|---|
| Light | Single Pole | Single Arm Intermediate / Pin Angle | F3 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Straight Section / Angle Section | F4 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Termination | F5 | Not Suitable | Not Suitable | Not Suitable | |
| Heavy | Single Pole | Single Arm Intermediate / Pin Angle | F7 | 4º | Not Suitable | 1:20 | Limited Dow npull |
| Heavy | Single Pole | Double Arm Intermediate / Pin Angle | F8 | 6º | 3º | 1:10 | |
| Heavy | Single Pole | Double Arm Straight Section / Angle Section | F9 | 45º | 45º | 1:10 | |
| Heavy | "H" Pole | Double Arm Angle Section | F10 | 60º | 60º | 1:10 | Limits as per F8 if used as intermediate |
| Heavy | "H" Pole | Double Arm Section / Inter. For long spans | F11 | 60º (section) | 60º (section) | 1:10 | No deviation allow ed if used as intermediate |
| Heavy | "H" Pole | Double Arm Termination | F12 | O.K. | O.K. | 1:10 | |
| Heavy | Single Pole | Double Arm Termination | F13 | Not Suitable | Not Suitable | Not Suitable | |

# 150mm$^2$ Aluminium Alloy "Ash" - "NORMAL" Loading Environment

## Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 1,893.0 |
| Wind Pressure (N/m²) | 380 |
| Maximum Conductor Weight (MCW) (kg/m) | 1.25 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.41 |
| Maximum Wind Span Length (m) | 175 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 14,197.8 |
| Transverse Load [Normal to Span] (kgf) | 1,851.2 |
| Vertical Load with Downpull (1:10) (kgf) | 5,296.9 |
| Pole Wind Loading (kgf) | 224.5 |

## Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|
| 0 | | 8,892 | 8,261 | 7,771 | 7,373 |
| 5 | | 11,034 | 10,028 | 9,245 | 8,609 |
| 10 | | 13,167 | 11,786 | 10,712 | 9,840 |
| 15 | | 15,284 | 13,532 | 12,169 | 11,063 |
| 20 | | 17,384 | 15,263 | 13,614 | 12,275 |
| 25 | | 19,461 | 16,976 | 15,043 | 13,475 |
| 30 | | 21,512 | 18,667 | 16,454 | 14,659 |
| 35 | | 23,533 | 20,334 | 17,845 | 15,826 |
| 40 | | 25,520 | 21,972 | 19,212 | 16,973 |
| 45 | | 27,469 | 23,579 | 20,553 | 18,098 |
| 50 | | 29,377 | 25,152 | 21,866 | 19,200 |
| 55 | | 31,240 | 26,688 | 23,147 | 20,275 |
| 60 | Terminal | 33,054 | 28,184 | 24,395 | 21,322 |

***NOTE: Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

## Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | 5 | 17 | 12 | 32 |
| 35 | Single | 6 | 21 | 15 | 39 |
| 40 | Pole | 8 | 25 | 18 | 46 |
| 45 | | 10 | 29 | 21 | 52 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | | 31 | 44 | 55 | 60 | x | x |
| 35 | "H" | 37 | 53 | 60 | 60 | x | x |
| 40 | Pole | 43 | 60 | 60 | 60 | x | x |
| 45 | | 49 | 60 | 60 | 60 | x | x |

# 150mm$^2$ Aluminium Alloy "Ash" - "SEVERE" Loading Environment

## Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 2,169.5 |
| Wind Pressure (N/m²) | 570 |
| Maximum Conductor Weight (MCW) (kg/m) | 1.59 |
| Maximum Conductor Pressure (MCP) (kg/m) | 2.46 |
| Maximum Wind Span Length (m) | 150 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 16,271.2 |
| Transverse Load [Normal to Span] (kgf) | 2,772.5 |
| Vertical Load with Downpull (1:10) (kgf) | 5,856.2 |
| Pole Wind Loading (kgf) | 336.8 |

## Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|
| 0 | | 11,242 | 10,297 | 9,562 | 8,965 |
| 5 | | 13,696 | 12,320 | 11,250 | 10,382 |
| 10 | | 16,136 | 14,332 | 12,929 | 11,791 |
| 15 | | 18,558 | 16,329 | 14,596 | 13,189 |
| 20 | | 20,956 | 18,307 | 16,246 | 14,574 |
| 25 | | 23,327 | 20,262 | 17,877 | 15,943 |
| 30 | | 25,666 | 22,190 | 19,487 | 17,294 |
| 35 | | 27,969 | 24,089 | 21,071 | 18,623 |
| 40 | | 30,230 | 25,953 | 22,627 | 19,928 |
| 45 | | 32,446 | 27,781 | 24,152 | 21,208 |
| 50 | | 34,613 | 29,567 | 25,642 | 22,459 |
| 55 | | 36,726 | 31,309 | 27,096 | 23,679 |
| 60 | Terminal | 38,781 | 33,004 | 28,510 | 24,865 |

***NOTE: Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

## Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | no | 11 | 7 | 24 |
| 35 | Single | 2 | 15 | 9 | 30 |
| 40 | Pole | 4 | 18 | 12 | 35 |
| 45 | | 5 | 22 | 14 | 41 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | | 23 | 34 | 43 | 60 | x | x |
| 35 | "H" | 28 | 42 | 52 | 60 | x | x |
| 40 | Pole | 33 | 49 | 60 | 60 | x | x |
| 45 | | 38 | 57 | 60 | 60 | x | x |

# 150mm² Aluminium Alloy "Ash" - "NORMAL" Loading Environment

## Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 380 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.41 |

## Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| | | Average / Poor Soil | | | | | | Good / Average Soil | | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pole Length (m) and Grade | | Auger (m) | | Standard Burial, # Kicking Blocks | | | | Auger (m) | | Standard Burial, # Kicking Blocks | | | | Auger (m) | | Standard Burial, # Kicking Blocks | | |
| | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 | M | 61 | 62 | 33 | 60 | 60 | | 61 | 62 | 52 | 60 | 60 | | 61 | 62 | 60 | 60 | 60 |
| 9 | M | 61 | 61 | 31 | 60 | 60 | | 61 | 61 | 50 | 60 | 60 | | 61 | 61 | 60 | 60 | 60 |
| 9.5 | M | 60 | 61 | 29 | 60 | 60 | | 60 | 61 | 47 | 60 | 60 | | 60 | 61 | 60 | 60 | 60 |
| 10 | M | 60 | 60 | 27 | 56 | 60 | | 60 | 60 | 45 | 60 | 60 | | 60 | 60 | 60 | 60 | 60 |
| 10.5 | M | 60 | 60 | 26 | 53 | 60 | | 60 | 60 | 43 | 60 | 60 | | 60 | 60 | 60 | 60 | 60 |
| 11 | M | 60 | 60 | 24 | 50 | 60 | | 60 | 60 | 41 | 60 | 60 | | 60 | 60 | 58 | 60 | 60 |
| 11.5 | M | 60 | 60 | 23 | 48 | 60 | | 60 | 60 | 39 | 60 | 60 | | 60 | 60 | 56 | 60 | 60 |
| 12 | M | 61 | 61 | 22 | 45 | 61 | | 61 | 61 | 38 | 61 | 61 | | 61 | 61 | 54 | 61 | 61 |
| 13 | M | 61 | 62 | 19 | 40 | 62 | | 62 | 62 | 34 | 62 | 62 | | 62 | 62 | 49 | 62 | 62 |
| 14 | M | 67 | 67 | 17 | 36 | 63 | | 67 | 67 | 32 | 61 | 67 | | 67 | 67 | 47 | 67 | 67 |
| 15 | M | 72 | 72 | 32 | 56 | 72 | | 72 | 72 | 56 | 72 | 72 | | 72 | 72 | 72 | 72 | 72 |
| 16 | M | 72 | 77 | 30 | 51 | 77 | | 77 | 77 | 53 | 77 | 77 | | 77 | 77 | 76 | 77 | 77 |
| 17 | M | 68 | 84 | 27 | 47 | 79 | | 84 | 84 | 50 | 80 | 84 | | 84 | 84 | 72 | 84 | 84 |
| 18 | M | 65 | 84 | 24 | 43 | 73 | | 84 | 84 | 46 | 74 | 84 | | 84 | 84 | 68 | 84 | 84 |
| 20 | M | 59 | 91 | 20 | 36 | 62 | | 91 | 91 | 41 | 66 | 91 | | 91 | 91 | 63 | 91 | 91 |
| 22 | M | 52 | 95 | 14 | 28 | 52 | | 91 | 97 | 35 | 56 | 91 | | 97 | 97 | 55 | 84 | 97 |
| | | | | | | | | | | | | | | | | | | |
| 10 | MS | 87 | 90 | 31 | 59 | 89 | | 90 | 90 | 51 | 89 | 89 | | 90 | 90 | 71 | 89 | 89 |
| 11 | MS | 80 | 90 | 27 | 52 | 87 | | 89 | 90 | 46 | 84 | 89 | | 89 | 90 | 65 | 89 | 89 |
| 12 | MS | 75 | 94 | 24 | 47 | 78 | | 94 | 94 | 43 | 77 | 94 | | 94 | 94 | 61 | 94 | 94 |
| 13 | MS | 70 | 95 | 21 | 42 | 70 | | 95 | 95 | 38 | 70 | 95 | | 95 | 95 | 56 | 95 | 95 |
| | | | | | | | | | | | | | | | | | | |
| 8.5 | S | 108 | 122 | 40 | 73 | 118 | | 121 | 122 | 64 | 114 | 119 | | 121 | 122 | 89 | 119 | 119 |
| 9 | S | 105 | 126 | 38 | 69 | 111 | | 125 | 126 | 62 | 109 | 124 | | 125 | 126 | 86 | 124 | 124 |
| 9.5 | S | 100 | 124 | 36 | 65 | 105 | | 123 | 124 | 59 | 103 | 122 | | 123 | 124 | 82 | 122 | 122 |
| 10 | S | 96 | 122 | 34 | 61 | 99 | | 121 | 122 | 56 | 97 | 120 | | 121 | 122 | 78 | 120 | 120 |
| 10.5 | S | 91 | 120 | 32 | 58 | 93 | | 120 | 120 | 53 | 92 | 119 | | 120 | 120 | 74 | 119 | 119 |
| 11 | S | 88 | 115 | 30 | 54 | 88 | | 119 | 119 | 50 | 87 | 119 | | 119 | 119 | 71 | 119 | 119 |
| 11.5 | S | 84 | 110 | 28 | 51 | 83 | | 118 | 118 | 48 | 83 | 118 | | 118 | 118 | 68 | 115 | 118 |
| 12 | S | 81 | 117 | 26 | 49 | 79 | | 117 | 117 | 46 | 79 | 117 | | 117 | 117 | 65 | 110 | 117 |
| 13 | S | 76 | 123 | 23 | 43 | 71 | | 121 | 123 | 42 | 72 | 114 | | 123 | 123 | 61 | 101 | 123 |
| 14 | S | 95 | 123 | 20 | 39 | 64 | | 127 | 127 | 39 | 66 | 104 | | 127 | 127 | 57 | 94 | 127 |
| 15 | S | 91 | 131 | 39 | 61 | 97 | | 131 | 131 | 67 | 101 | 131 | | 131 | 131 | 96 | 131 | 131 |
| 16 | S | 86 | 136 | 36 | 56 | 89 | | 136 | 136 | 63 | 94 | 136 | | 136 | 136 | 91 | 132 | 136 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | S | 81 | 135 | 32 | 51 | 81 | | 132 | 135 | 59 | 87 | 133 | | 135 | 135 | 85 | 123 | 135 |
| 18 | S | 77 | 131 | 29 | 47 | 75 | | 127 | 138 | 55 | 82 | 124 | | 138 | 138 | 82 | 117 | 138 |
| 20 | S | 69 | 120 | 23 | 39 | 63 | | 116 | 140 | 48 | 71 | 108 | | 140 | 140 | 73 | 104 | 140 |
| 22 | S | 60 | 109 | 17 | 31 | 52 | | 105 | 138 | 41 | 61 | 94 | | 138 | 138 | 64 | 92 | 135 |
| | | | | | | | | | | | | | | | | | | |
| 9 | ES | 115 | 161 | 43 | 73 | 114 | | 161 | 161 | 69 | 114 | 161 | | 161 | 161 | 94 | 155 | 161 |
| 9.5 | ES | 110 | 158 | 40 | 68 | 107 | | 158 | 158 | 65 | 107 | 158 | | 158 | 158 | 90 | 146 | 158 |
| 10 | ES | 102 | 153 | 36 | 63 | 100 | | 151 | 153 | 60 | 100 | 150 | | 151 | 153 | 83 | 137 | 150 |
| 10.5 | ES | 99 | 157 | 34 | 60 | 94 | | 154 | 157 | 58 | 96 | 147 | | 156 | 157 | 81 | 131 | 156 |
| 11 | ES | 95 | 156 | 32 | 56 | 89 | | 148 | 156 | 54 | 91 | 140 | | 155 | 156 | 77 | 125 | 154 |
| 11.5 | ES | 92 | 155 | 31 | 53 | 84 | | 145 | 161 | 53 | 87 | 133 | | 161 | 161 | 75 | 120 | 160 |
| 12 | ES | 88 | 150 | 29 | 50 | 80 | | 139 | 160 | 50 | 82 | 127 | | 159 | 160 | 71 | 115 | 159 |
| 13 | ES | 83 | 142 | 25 | 45 | 72 | | 132 | 164 | 46 | 75 | 115 | | 164 | 164 | 66 | 106 | 159 |
| 14 | ES | 78 | 134 | 22 | 40 | 64 | | 125 | 170 | 42 | 69 | 105 | | 170 | 170 | 62 | 98 | 146 |
| 15 | ES | 97 | 160 | 41 | 63 | 97 | | 155 | 168 | 72 | 104 | 156 | | 168 | 168 | 102 | 145 | 168 |
| 16 | ES | 92 | 153 | 38 | 58 | 90 | | 148 | 172 | 67 | 97 | 145 | | 172 | 172 | 97 | 137 | 172 |
| 17 | ES | 90 | 151 | 36 | 54 | 83 | | 146 | 186 | 65 | 92 | 136 | | 186 | 186 | 95 | 131 | 186 |

# 150mm² Aluminium Alloy "Ash" - "SEVERE" Loading Environment

## Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 570 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 2.46 |

## Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| | | Average / Poor Soil | | | | | | Good / Average Soil | | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pole Length (m) and Grade | | Auger (m) | | Standard Burial, # Kicking Blocks | | | | Auger (m) | | Standard Burial, # Kicking Blocks | | | | Auger (m) | | Standard Burial, # Kicking Blocks | | |
| | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 | M | 33 | 33 | 17 | 32 | 32 | | 33 | 33 | 28 | 32 | 32 | | 33 | 33 | 32 | 32 | 32 |
| 9 | M | 32 | 33 | 15 | 32 | 32 | | 32 | 33 | 26 | 32 | 32 | | 32 | 33 | 32 | 32 | 32 |
| 9.5 | M | 32 | 32 | 14 | 31 | 31 | | 32 | 32 | 25 | 31 | 31 | | 32 | 32 | 31 | 31 | 31 |
| 10 | M | 32 | 32 | 13 | 30 | 31 | | 32 | 32 | 23 | 31 | 31 | | 32 | 32 | 31 | 31 | 31 |
| 10.5 | M | 32 | 32 | 12 | 28 | 32 | | 32 | 32 | 22 | 32 | 32 | | 32 | 32 | 32 | 32 | 32 |
| 11 | M | 32 | 32 | 11 | 26 | 32 | | 32 | 32 | 21 | 32 | 32 | | 32 | 32 | 30 | 32 | 32 |
| 11.5 | M | 32 | 32 | 10 | 24 | 32 | | 32 | 32 | 20 | 32 | 32 | | 32 | 32 | 29 | 32 | 32 |
| 12 | M | 32 | 32 | 9 | 23 | 32 | | 32 | 32 | 18 | 32 | 32 | | 32 | 32 | 28 | 32 | 32 |
| 13 | M | 32 | 32 | 7 | 20 | 32 | | 32 | 32 | 16 | 32 | 32 | | 32 | 32 | 25 | 32 | 32 |
| 14 | M | 35 | 35 | 6 | 17 | 32 | | 35 | 35 | 14 | 31 | 35 | | 35 | 35 | 23 | 35 | 35 |
| 15 | M | 38 | 38 | 14 | 28 | 38 | | 38 | 38 | 28 | 38 | 38 | | 38 | 38 | 38 | 38 | 38 |
| 16 | M | 36 | 41 | 12 | 25 | 41 | | 41 | 41 | 25 | 41 | 41 | | 41 | 41 | 39 | 41 | 41 |
| 17 | M | 34 | 44 | 10 | 22 | 40 | | 44 | 44 | 23 | 40 | 44 | | 44 | 44 | 36 | 44 | 44 |
| 18 | M | 31 | 45 | 8 | 19 | 36 | | 45 | 45 | 21 | 37 | 45 | | 45 | 45 | 33 | 45 | 45 |
| 20 | M | 27 | 49 | 4 | 14 | 29 | | 49 | 49 | 17 | 31 | 49 | | 49 | 49 | 29 | 48 | 49 |
| 22 | M | 22 | 46 | 0 | 8 | 22 | | 44 | 51 | 12 | 24 | 44 | | 51 | 51 | 24 | 40 | 51 |
| | | | | | | | | | | | | | | | | | | |
| 10 | MS | 47 | 49 | 15 | 31 | 48 | | 49 | 49 | 26 | 48 | 48 | | 49 | 49 | 38 | 48 | 48 |
| 11 | MS | 43 | 48 | 12 | 27 | 47 | | 48 | 48 | 23 | 45 | 48 | | 48 | 48 | 34 | 48 | 48 |
| 12 | MS | 40 | 51 | 10 | 23 | 41 | | 51 | 51 | 21 | 40 | 51 | | 51 | 51 | 31 | 51 | 51 |
| 13 | MS | 36 | 51 | 8 | 20 | 36 | | 51 | 51 | 18 | 36 | 51 | | 51 | 51 | 28 | 51 | 51 |
| | | | | | | | | | | | | | | | | | | |
| 8.5 | S | 60 | 68 | 21 | 40 | 65 | | 67 | 68 | 34 | 63 | 65 | | 67 | 68 | 48 | 65 | 65 |
| 9 | S | 58 | 69 | 19 | 37 | 61 | | 69 | 69 | 33 | 60 | 68 | | 69 | 69 | 47 | 68 | 68 |
| 9.5 | S | 55 | 68 | 18 | 35 | 57 | | 68 | 68 | 31 | 56 | 67 | | 68 | 68 | 44 | 67 | 67 |
| 10 | S | 52 | 67 | 16 | 32 | 53 | | 66 | 67 | 29 | 53 | 66 | | 66 | 67 | 42 | 66 | 66 |
| 10.5 | S | 49 | 65 | 15 | 30 | 50 | | 65 | 66 | 27 | 50 | 65 | | 65 | 66 | 39 | 65 | 65 |
| 11 | S | 47 | 63 | 14 | 28 | 47 | | 64 | 65 | 26 | 47 | 64 | | 64 | 65 | 37 | 64 | 64 |
| 11.5 | S | 45 | 60 | 12 | 26 | 44 | | 64 | 64 | 24 | 44 | 64 | | 64 | 64 | 35 | 62 | 64 |
| 12 | S | 43 | 64 | 11 | 24 | 41 | | 64 | 64 | 22 | 42 | 64 | | 64 | 64 | 34 | 59 | 64 |
| 13 | S | 39 | 67 | 9 | 21 | 36 | | 65 | 67 | 20 | 37 | 61 | | 67 | 67 | 31 | 54 | 67 |
| 14 | S | 50 | 66 | 7 | 18 | 32 | | 69 | 69 | 17 | 33 | 55 | | 69 | 69 | 28 | 49 | 69 |
| 15 | S | 47 | 71 | 17 | 30 | 50 | | 71 | 71 | 33 | 52 | 71 | | 71 | 71 | 50 | 71 | 71 |
| 16 | S | 44 | 74 | 15 | 26 | 45 | | 74 | 74 | 31 | 48 | 74 | | 74 | 74 | 46 | 70 | 74 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | S | 40 | 72 | 12 | 23 | 41 | | 69 | 74 | 28 | 44 | 70 | | 74 | 74 | 43 | 64 | 74 |
| 18 | S | 38 | 69 | 10 | 20 | 36 | | 66 | 76 | 25 | 40 | 64 | | 76 | 76 | 40 | 60 | 76 |
| 20 | S | 32 | 61 | 6 | 14 | 28 | | 59 | 76 | 20 | 33 | 54 | | 76 | 76 | 34 | 52 | 76 |
| 22 | S | 26 | 54 | 1 | 9 | 21 | | 52 | 75 | 15 | 26 | 45 | | 75 | 75 | 28 | 44 | 69 |
| | | | | | | | | | | | | | | | | | | |
| 9 | ES | 63 | 90 | 22 | 39 | 62 | | 90 | 90 | 36 | 62 | 90 | | 90 | 90 | 51 | 86 | 90 |
| 9.5 | ES | 60 | 88 | 20 | 36 | 58 | | 88 | 88 | 34 | 59 | 88 | | 88 | 88 | 48 | 81 | 88 |
| 10 | ES | 55 | 84 | 17 | 33 | 54 | | 83 | 84 | 31 | 54 | 82 | | 83 | 84 | 44 | 75 | 82 |
| 10.5 | ES | 53 | 87 | 16 | 31 | 51 | | 85 | 87 | 29 | 51 | 81 | | 86 | 87 | 43 | 72 | 85 |
| 11 | ES | 51 | 86 | 15 | 28 | 47 | | 81 | 86 | 27 | 48 | 76 | | 85 | 86 | 40 | 68 | 84 |
| 11.5 | ES | 49 | 85 | 14 | 27 | 44 | | 79 | 89 | 26 | 46 | 72 | | 88 | 89 | 39 | 65 | 88 |
| 12 | ES | 47 | 82 | 12 | 25 | 41 | | 76 | 87 | 24 | 43 | 68 | | 87 | 87 | 37 | 62 | 87 |
| 13 | ES | 43 | 77 | 10 | 21 | 36 | | 71 | 90 | 22 | 39 | 61 | | 90 | 90 | 33 | 56 | 87 |
| 14 | ES | 39 | 72 | 7 | 18 | 32 | | 67 | 93 | 19 | 34 | 55 | | 93 | 93 | 30 | 51 | 79 |
| 15 | ES | 50 | 86 | 18 | 31 | 50 | | 83 | 92 | 36 | 54 | 84 | | 92 | 92 | 53 | 77 | 92 |
| 16 | ES | 47 | 82 | 16 | 27 | 45 | | 79 | 94 | 33 | 50 | 77 | | 94 | 94 | 49 | 72 | 94 |
| 17 | ES | 45 | 80 | 14 | 24 | 41 | | 77 | 102 | 31 | 46 | 71 | | 102 | 102 | 47 | 68 | 101 |

## 150mm$^2$ Aluminium Alloy "Ash" - "NORMAL" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** |
| -5.6 | 1410.43 | 13.84 | 0.07 | 0.11 | 0.17 | 0.23 | 0.29 | 0.37 | 0.46 | 0.56 | 0.66 | 0.78 | 0.90 | 1.03 | 1.18 | 1.33 | 1.49 | - |
| -4 | 1376.07 | 13.50 | 0.08 | 0.12 | 0.17 | 0.23 | 0.30 | 0.38 | 0.47 | 0.57 | 0.68 | 0.80 | 0.92 | 1.06 | 1.21 | 1.36 | 1.53 | - |
| 0 | 1291.32 | 12.67 | 0.08 | 0.13 | 0.18 | 0.25 | 0.32 | 0.41 | 0.50 | 0.61 | 0.72 | 0.85 | 0.98 | 1.13 | 1.29 | 1.45 | 1.63 | - |
| 4 | 1208.45 | 11.85 | 0.09 | 0.13 | 0.19 | 0.26 | 0.34 | 0.43 | 0.54 | 0.65 | 0.77 | 0.91 | 1.05 | 1.21 | 1.37 | 1.55 | 1.74 | - |
| 8 | 1127.85 | 11.06 | 0.09 | 0.14 | 0.21 | 0.28 | 0.37 | 0.47 | 0.58 | 0.70 | 0.83 | 0.97 | 1.13 | 1.29 | 1.47 | 1.66 | 1.86 | - |
| 12 | 1049.99 | 10.30 | 0.10 | 0.15 | 0.22 | 0.30 | 0.40 | 0.50 | 0.62 | 0.75 | 0.89 | 1.04 | 1.21 | 1.39 | 1.58 | 1.79 | 2.00 | - |
| 16 | 975.37 | 9.57 | 0.11 | 0.17 | 0.24 | 0.33 | 0.43 | 0.54 | 0.67 | 0.80 | 0.96 | 1.12 | 1.30 | 1.50 | 1.70 | 1.92 | 2.15 | - |
| 20 | 904.53 | 8.87 | 0.11 | 0.18 | 0.26 | 0.35 | 0.46 | 0.58 | 0.72 | 0.87 | 1.03 | 1.21 | 1.41 | 1.61 | 1.84 | 2.07 | 2.32 | - |
| 24 | 837.98 | 8.22 | 0.12 | 0.19 | 0.28 | 0.38 | 0.50 | 0.63 | 0.77 | 0.94 | 1.11 | 1.31 | 1.52 | 1.74 | 1.98 | 2.24 | 2.51 | - |
| 28 | 776.19 | 7.61 | 0.13 | 0.21 | 0.30 | 0.41 | 0.53 | 0.68 | 0.84 | 1.01 | 1.20 | 1.41 | 1.64 | 1.88 | 2.14 | 2.42 | 2.71 | - |
| 32 | 719.46 | 7.06 | 0.14 | 0.23 | 0.32 | 0.44 | 0.58 | 0.73 | 0.90 | 1.09 | 1.30 | 1.52 | 1.77 | 2.03 | 2.31 | 2.61 | 2.92 | - |
| 36 | 667.96 | 6.55 | 0.16 | 0.24 | 0.35 | 0.48 | 0.62 | 0.79 | 0.97 | 1.17 | 1.40 | 1.64 | 1.90 | 2.18 | 2.49 | 2.81 | 3.15 | - |

### DESIGN TABLE

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** |
| -5.6 | 1302.49 | 12.78 | 0.08 | 0.12 | 0.18 | 0.24 | 0.32 | 0.40 | 0.50 | 0.60 | 0.72 | 0.84 | 0.98 | 1.12 | 1.27 | 1.44 | 1.61 | - |
| 0 | 1186.68 | 11.64 | 0.09 | 0.14 | 0.20 | 0.27 | 0.35 | 0.44 | 0.55 | 0.66 | 0.79 | 0.92 | 1.07 | 1.23 | 1.40 | 1.58 | 1.77 | - |
| 30 | 679.49 | 6.67 | 0.15 | 0.24 | 0.34 | 0.47 | 0.61 | 0.77 | 0.95 | 1.16 | 1.37 | 1.61 | 1.87 | 2.15 | 2.44 | 2.76 | 3.09 | - |
| 50 | 488.58 | 4.79 | 0.21 | 0.33 | 0.48 | 0.65 | 0.85 | 1.08 | 1.33 | 1.61 | 1.91 | 2.24 | 2.60 | 2.99 | 3.40 | 3.84 | 4.30 | - |
| 55 | 456.21 | 4.48 | 0.23 | 0.36 | 0.51 | 0.70 | 0.91 | 1.15 | 1.42 | 1.72 | 2.05 | 2.40 | 2.79 | 3.20 | 3.64 | 4.11 | 4.61 | - |
| 60 | 428.27 | 4.20 | 0.24 | 0.38 | 0.55 | 0.74 | 0.97 | 1.23 | 1.51 | 1.83 | 2.18 | 2.56 | 2.97 | 3.41 | 3.88 | 4.38 | 4.91 | - |
| 65 | 404.03 | 3.96 | 0.26 | 0.40 | 0.58 | 0.79 | 1.03 | 1.30 | 1.61 | 1.94 | 2.31 | 2.71 | 3.15 | 3.61 | 4.11 | 4.64 | 5.20 | - |
| 70 | 382.87 | 3.76 | 0.27 | 0.42 | 0.61 | 0.83 | 1.08 | 1.37 | 1.69 | 2.05 | 2.44 | 2.86 | 3.32 | 3.81 | 4.34 | 4.90 | 5.49 | - |
| 75 | 364.28 | 3.57 | 0.28 | 0.45 | 0.64 | 0.87 | 1.14 | 1.44 | 1.78 | 2.15 | 2.56 | 3.01 | 3.49 | 4.01 | 4.56 | 5.15 | 5.77 | - |

## 150mm$^2$ Aluminium Alloy "Ash" - "SEVERE" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** |
| -5.6 | 1415.37 | 13.88 | 0.07 | 0.11 | 0.16 | 0.22 | 0.29 | 0.37 | 0.46 | 0.55 | 0.66 | 0.77 | 0.90 | 1.03 | - | - |
| -4 | 1379.90 | 13.54 | 0.08 | 0.12 | 0.17 | 0.23 | 0.30 | 0.38 | 0.47 | 0.57 | 0.68 | 0.79 | 0.92 | 1.06 | - | - |
| 0 | 1292.04 | 12.67 | 0.08 | 0.13 | 0.18 | 0.25 | 0.32 | 0.41 | 0.50 | 0.61 | 0.72 | 0.85 | 0.98 | 1.13 | - | - |
| 4 | 1205.60 | 11.83 | 0.09 | 0.13 | 0.19 | 0.26 | 0.34 | 0.44 | 0.54 | 0.65 | 0.77 | 0.91 | 1.05 | 1.21 | - | - |
| 8 | 1120.93 | 11.00 | 0.09 | 0.14 | 0.21 | 0.28 | 0.37 | 0.47 | 0.58 | 0.70 | 0.83 | 0.98 | 1.13 | 1.30 | - | - |
| 12 | 1038.47 | 10.19 | 0.10 | 0.16 | 0.22 | 0.31 | 0.40 | 0.51 | 0.62 | 0.76 | 0.90 | 1.06 | 1.22 | 1.41 | - | - |
| 16 | 958.74 | 9.41 | 0.11 | 0.17 | 0.24 | 0.33 | 0.43 | 0.55 | 0.68 | 0.82 | 0.97 | 1.14 | 1.33 | 1.52 | - | - |
| 20 | 882.36 | 8.66 | 0.12 | 0.18 | 0.26 | 0.36 | 0.47 | 0.60 | 0.74 | 0.89 | 1.06 | 1.24 | 1.44 | 1.65 | - | - |
| 24 | 810.03 | 7.95 | 0.13 | 0.20 | 0.29 | 0.39 | 0.51 | 0.65 | 0.80 | 0.97 | 1.15 | 1.35 | 1.57 | 1.80 | - | - |
| 28 | 742.42 | 7.28 | 0.14 | 0.22 | 0.31 | 0.43 | 0.56 | 0.71 | 0.87 | 1.06 | 1.26 | 1.48 | 1.71 | 1.97 | - | - |
| 32 | 680.17 | 6.67 | 0.15 | 0.24 | 0.34 | 0.47 | 0.61 | 0.77 | 0.95 | 1.15 | 1.37 | 1.61 | 1.87 | 2.15 | - | - |
| 36 | 623.70 | 6.12 | 0.17 | 0.26 | 0.37 | 0.51 | 0.67 | 0.84 | 1.04 | 1.26 | 1.50 | 1.76 | 2.04 | 2.34 | - | - |

### DESIGN TABLE

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** |
| -5.6 | 1313.43 | 12.88 | 0.08 | 0.12 | 0.18 | 0.24 | 0.32 | 0.40 | 0.49 | 0.60 | 0.71 | 0.83 | 0.97 | 1.11 | - | - |
| 0 | 1192.33 | 11.70 | 0.09 | 0.14 | 0.20 | 0.27 | 0.35 | 0.44 | 0.54 | 0.66 | 0.78 | 0.92 | 1.07 | 1.22 | - | - |
| 30 | 642.49 | 6.30 | 0.16 | 0.25 | 0.36 | 0.49 | 0.65 | 0.82 | 1.01 | 1.22 | 1.45 | 1.71 | 1.98 | 2.27 | - | - |
| 50 | 435.48 | 4.27 | 0.24 | 0.37 | 0.54 | 0.73 | 0.95 | 1.21 | 1.49 | 1.80 | 2.14 | 2.52 | 2.92 | 3.35 | - | - |
| 55 | 402.17 | 3.95 | 0.26 | 0.40 | 0.58 | 0.79 | 1.03 | 1.31 | 1.61 | 1.95 | 2.32 | 2.73 | 3.16 | 3.63 | - | - |
| 60 | 374.04 | 3.67 | 0.28 | 0.43 | 0.62 | 0.85 | 1.11 | 1.40 | 1.73 | 2.10 | 2.50 | 2.93 | 3.40 | 3.90 | - | - |
| 65 | 350.12 | 3.43 | 0.30 | 0.46 | 0.67 | 0.91 | 1.19 | 1.50 | 1.85 | 2.24 | 2.67 | 3.13 | 3.63 | 4.17 | - | - |
| 70 | 329.62 | 3.23 | 0.31 | 0.49 | 0.71 | 0.96 | 1.26 | 1.59 | 1.97 | 2.38 | 2.83 | 3.33 | 3.86 | 4.43 | - | - |
| 75 | 311.89 | 3.06 | 0.33 | 0.52 | 0.75 | 1.02 | 1.33 | 1.68 | 2.08 | 2.52 | 2.99 | 3.51 | 4.08 | 4.68 | - | - |

## 150 $mm^2$ Hard Drawn Copper

* Conductor & Design Parameters
* Structure Suitability
* Stayed Pole Design Data
* Unstayed Pole Design Data
* Sags and Tensions

## 150mm$^2$ Hard Drawn Copper

### Conductor Parameters:

| | |
|---|---|
| Conductor Stranding (#strands / diameter(mm)) | 19/3.20 |
| Greased Conductor Weight (kg/m) | 1.377 |
| Cross Sectional Area of Conductor (mm²) | 152.8 |
| Conductor Overall Diameter (mm) | 16.00 |
| Coefficient of Linear Expansion (/Degree C) | 1.70E-05 |
| Modulus of Elasticity (kg/mm²) | 12,660 |
| Rated Breaking Strength of Conductor (kgf) | 5,702.3 |

| Design Loading Parameters: | "Normal" | "Severe" |
|---|---|---|
| Basic / Recommended Span (m) | 130 | 110 |
| Wind Pressure on Conductor (N/m²) | 380 | 570 |
| Radial Ice Thickness (mm) | 9.5 | 12.5 |
| Ice Density (kg/m³) | 913 | 913 |
| Absolute Maximum Working Tension (MWT) Limit (kgf) | 2,379.0 | 2,379.0 |
| Temperature at MWT Limit (Degrees C) | -5.6 | -5.6 |
| Maximum "Everyday" Tension (EDT) Limit (kgf) | 1,748.2 | 1,379.9 |
| Temperature at EDT Limit (Degrees C) | -5.6 | -5.6 |
| Maximum Conductor Tension (MCT) at -5.6 degC (kgf) | 2,379.0 | 2,379.0 |
| Maximum Conductor Weight (MCW) (kg/m) | 2.072 | 2.399 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.356 | 2.383 |
| Freezing Point Tension (FPT) (kgf) | 1,658.2 | 1,307.0 |

| Span Length Limits: | "Normal" | "Severe" |
|---|---|---|
| Maximum **Equivalent** Span | 130 | 110 |
| *Maximum **Single** Span (clashing limit)<br>(Standard heavy crossarm, 1.2m phase spacing) | 150 | 120 |
| *Maximum **Single** Span (clashing limit)<br>(H Pole, long span heavy crossarm, 2.0m phase spacing) | 200 | 155 |

**NOTE: Single span limits to be reduced by 20m where weather zone is worse than 2B at "normal" altitudes, or worse than 3C at "severe" altitudes. Weather zones are given in Appendix O**

## 150mm$^2$ Hard Drawn Copper

### Pole-Top Steelwork Suitability

| Grade | Structure Configuration | | Drg. Ref | Max. Dev'n Normal | Max. Dev'n Severe | Max. D'pull. | Notes |
|---|---|---|---|---|---|---|---|
| Light | Single Pole | Single Arm Intermediate / Pin Angle | F3 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Straight Section / Angle Section | F4 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Termination | F5 | Not Suitable | Not Suitable | Not Suitable | |
| Heavy | Single Pole | Single Arm Intermediate / Pin Angle | F7 | Not Suitable | Not Suitable | Not Suitable | |
| Heavy | Single Pole | Double Arm Intermediate / Pin Angle | F8 | 4º | 2º | 1:10 | |
| Heavy | Single Pole | Double Arm Straight Section / Angle Section | F9 | 45º | 45º | 1:10 | |
| Heavy | "H" Pole | Double Arm Angle Section | F10 | 60º | 60º | 1:10 | Limits as per F8 if used as intermediate |
| Heavy | "H" Pole | Double Arm Section / Inter. For long spans | F11 | 60º (section) | 60º (section) | 1:10 | No deviation allowed if used as intermediate |
| Heavy | "H" Pole | Double Arm Termination | F12 | O.K. | O.K. | 1:10 | |
| Heavy | Single Pole | Double Arm Termination | F13 | Not Suitable | Not Suitable | Not Suitable | |

# 150mm$^2$ Hard Drawn Copper - "NORMAL" Loading Environment

## Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 2,379.0 |
| Wind Pressure (N/m²) | 380 |
| Maximum Conductor Weight (MCW) (kg/m) | 2.07 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.36 |
| Maximum Wind Span Length (m) | 200 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 17,842.3 |
| Transverse Load [Normal to Span] (kgf) | 2,034.3 |
| Vertical Load with Downpull (1:10) (kgf) | 7,486.8 |
| Pole Wind Loading (kgf) | 224.5 |

## Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|
| 0 | | 11,399 | 10,713 | 10,179 | 9,746 |
| 5 | | 14,092 | 12,933 | 12,032 | 11,300 |
| 10 | | 16,773 | 15,143 | 13,876 | 12,848 |
| 15 | | 19,437 | 17,340 | 15,709 | 14,386 |
| 20 | | 22,079 | 19,518 | 17,527 | 15,911 |
| 25 | | 24,693 | 21,674 | 19,326 | 17,421 |
| 30 | | 27,276 | 23,804 | 21,103 | 18,912 |
| 35 | | 29,822 | 25,903 | 22,855 | 20,382 |
| 40 | | 32,326 | 27,968 | 24,578 | 21,828 |
| 45 | | 34,784 | 29,994 | 26,269 | 23,247 |
| 50 | | 37,190 | 31,978 | 27,924 | 24,636 |
| 55 | | 39,541 | 33,917 | 29,542 | 25,993 |
| 60 | Terminal | 41,831 | 35,805 | 31,118 | 27,315 |

***NOTE: Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

## Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | 3 | 13 | 9 | 25 |
| 35 | Single | 4 | 16 | 11 | 30 |
| 40 | Pole | 6 | 19 | 14 | 35 |
| 45 | | 7 | 22 | 16 | 40 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | | 23 | 34 | 42 | 59 | x | x |
| 35 | "H" | 28 | 41 | 50 | 60 | x | x |
| 40 | Pole | 33 | 48 | 58 | 60 | x | x |
| 45 | | 38 | 54 | 60 | 60 | x | x |

## 150mm$^2$ Hard Drawn Copper - "SEVERE" Loading Environment

### Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 2,379.0 |
| Wind Pressure (N/m²) | 570 |
| Maximum Conductor Weight (MCW) (kg/m) | 2.40 |
| Maximum Conductor Pressure (MCP) (kg/m) | 2.38 |
| Maximum Wind Span Length (m) | 155 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 17,842.5 |
| Transverse Load [Normal to Span] (kgf) | 2,770.3 |
| Vertical Load with Downpull (1:10) (kgf) | 7,167.7 |
| Pole Wind Loading (kgf) | 336.8 |

### Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|
| 0 | | 12,549 | 11,605 | 10,871 | 10,275 |
| 5 | | 15,241 | 13,824 | 12,723 | 11,829 |
| 10 | | 17,918 | 16,032 | 14,565 | 13,374 |
| 15 | | 20,576 | 18,223 | 16,393 | 14,909 |
| 20 | | 23,209 | 20,395 | 18,205 | 16,429 |
| 25 | | 25,813 | 22,542 | 19,997 | 17,933 |
| 30 | | 28,383 | 24,661 | 21,765 | 19,416 |
| 35 | | 30,913 | 26,747 | 23,506 | 20,877 |
| 40 | | 33,400 | 28,797 | 25,217 | 22,313 |
| 45 | | 35,837 | 30,807 | 26,894 | 23,720 |
| 50 | | 38,221 | 32,773 | 28,534 | 25,096 |
| 55 | | 40,547 | 34,690 | 30,135 | 26,439 |
| 60 | Terminal | 42,811 | 36,557 | 31,692 | 27,746 |

***NOTE: Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

### Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | #N/A | 10 | 6 | 22 |
| 35 | Single | 2 | 13 | 9 | 27 |
| 40 | Pole | 3 | 17 | 11 | 32 |
| 45 | | 5 | 20 | 13 | 37 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | | 20 | 31 | 39 | 56 | x | x |
| 35 | "H" | 25 | 38 | 47 | 60 | x | x |
| 40 | Pole | 30 | 45 | 55 | 60 | x | x |
| 45 | | 35 | 51 | 60 | 60 | x | x |

# 150mm² Hard Drawn Copper - "NORMAL" Loading Environment

## Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 380 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.36 |

## Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| Pole Length (m) and Grade | | Average / Poor Soil | | | | | Good / Average Soil | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | |
| | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 | M | 64 | 64 | 34 | 63 | 63 | 64 | 64 | 54 | 63 | 63 | 64 | 64 | 63 | 63 | 63 |
| 9 | M | 63 | 64 | 32 | 62 | 62 | 63 | 64 | 52 | 62 | 62 | 63 | 64 | 62 | 62 | 62 |
| 9.5 | M | 63 | 63 | 30 | 62 | 62 | 63 | 63 | 49 | 62 | 62 | 63 | 63 | 62 | 62 | 62 |
| 10 | M | 62 | 63 | 28 | 59 | 62 | 62 | 63 | 47 | 62 | 62 | 62 | 63 | 62 | 62 | 62 |
| 10.5 | M | 62 | 62 | 27 | 55 | 62 | 62 | 62 | 45 | 62 | 62 | 62 | 62 | 62 | 62 | 62 |
| 11 | M | 63 | 63 | 25 | 52 | 63 | 63 | 63 | 43 | 63 | 63 | 63 | 63 | 60 | 63 | 63 |
| 11.5 | M | 63 | 63 | 24 | 50 | 63 | 63 | 63 | 41 | 63 | 63 | 63 | 63 | 58 | 63 | 63 |
| 12 | M | 63 | 63 | 22 | 47 | 63 | 63 | 63 | 39 | 63 | 63 | 63 | 63 | 56 | 63 | 63 |
| 13 | M | 64 | 65 | 19 | 42 | 65 | 65 | 65 | 35 | 65 | 65 | 65 | 65 | 51 | 65 | 65 |
| 14 | M | 61 | 69 | 17 | 38 | 66 | 69 | 69 | 33 | 64 | 69 | 69 | 69 | 49 | 69 | 69 |
| 15 | M | 75 | 75 | 33 | 58 | 75 | 75 | 75 | 58 | 75 | 75 | 75 | 75 | 75 | 75 | 75 |
| 16 | M | 75 | 80 | 31 | 53 | 80 | 80 | 80 | 55 | 80 | 80 | 80 | 80 | 79 | 80 | 80 |
| 17 | M | 71 | 87 | 28 | 49 | 82 | 87 | 87 | 52 | 83 | 87 | 87 | 87 | 75 | 87 | 87 |
| 18 | M | 67 | 88 | 25 | 45 | 76 | 88 | 88 | 48 | 77 | 88 | 88 | 88 | 71 | 88 | 88 |
| 20 | M | 62 | 95 | 21 | 38 | 65 | 95 | 95 | 43 | 68 | 95 | 95 | 95 | 66 | 95 | 95 |
| 22 | M | 54 | 98 | 15 | 30 | 54 | 95 | 100 | 36 | 59 | 95 | 100 | 100 | 58 | 88 | 100 |
| 10 | MS | 91 | 94 | 32 | 61 | 93 | 93 | 94 | 53 | 93 | 93 | 93 | 94 | 74 | 93 | 93 |
| 11 | MS | 83 | 93 | 28 | 55 | 90 | 93 | 93 | 48 | 87 | 93 | 93 | 93 | 68 | 93 | 93 |
| 12 | MS | 78 | 98 | 25 | 49 | 81 | 98 | 98 | 44 | 80 | 98 | 98 | 98 | 63 | 98 | 98 |
| 13 | MS | 72 | 99 | 22 | 44 | 73 | 99 | 99 | 40 | 73 | 99 | 99 | 99 | 58 | 99 | 99 |
| 8.5 | S | 113 | 127 | 42 | 76 | 123 | 126 | 127 | 67 | 119 | 124 | 126 | 127 | 92 | 124 | 124 |
| 9 | S | 109 | 131 | 40 | 72 | 116 | 130 | 131 | 65 | 113 | 129 | 130 | 131 | 89 | 129 | 129 |
| 9.5 | S | 104 | 129 | 38 | 68 | 109 | 128 | 129 | 61 | 107 | 127 | 128 | 129 | 85 | 127 | 127 |
| 10 | S | 99 | 126 | 35 | 64 | 103 | 126 | 126 | 58 | 101 | 125 | 126 | 126 | 81 | 125 | 125 |
| 10.5 | S | 95 | 124 | 33 | 60 | 97 | 125 | 125 | 55 | 96 | 124 | 125 | 125 | 77 | 124 | 124 |
| 11 | S | 91 | 119 | 31 | 57 | 92 | 123 | 124 | 52 | 91 | 123 | 123 | 124 | 74 | 123 | 123 |
| 11.5 | S | 87 | 115 | 29 | 53 | 87 | 123 | 123 | 50 | 87 | 123 | 123 | 123 | 71 | 120 | 123 |
| 12 | S | 84 | 122 | 27 | 50 | 82 | 122 | 122 | 48 | 82 | 122 | 122 | 122 | 68 | 114 | 122 |
| 13 | S | 79 | 128 | 24 | 45 | 74 | 125 | 128 | 44 | 75 | 118 | 128 | 128 | 63 | 105 | 128 |
| 14 | S | 74 | 128 | 21 | 41 | 67 | 120 | 132 | 40 | 69 | 108 | 132 | 132 | 59 | 98 | 132 |
| 15 | S | 94 | 136 | 41 | 64 | 100 | 136 | 136 | 70 | 105 | 136 | 136 | 136 | 100 | 136 | 136 |
| 16 | S | 90 | 142 | 37 | 58 | 92 | 142 | 142 | 66 | 98 | 142 | 142 | 142 | 95 | 137 | 142 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | S | 84 | 141 | 34 | 53 | 85 | | 137 | 141 | 61 | 91 | 138 | | 141 | 141 | 89 | 128 | 141 |
| 18 | S | 80 | 136 | 30 | 49 | 78 | | 132 | 144 | 58 | 85 | 129 | | 144 | 144 | 85 | 121 | 144 |
| 20 | S | 71 | 125 | 24 | 40 | 66 | | 121 | 145 | 50 | 74 | 112 | | 145 | 145 | 76 | 108 | 145 |
| 22 | S | 63 | 114 | 18 | 32 | 55 | | 110 | 143 | 42 | 64 | 98 | | 143 | 143 | 67 | 95 | 141 |
| | | | | | | | | | | | | | | | | | | |
| 9 | ES | 120 | 168 | 44 | 76 | 118 | | 168 | 168 | 71 | 118 | 168 | | 168 | 168 | 98 | 161 | 168 |
| 9.5 | ES | 114 | 164 | 42 | 71 | 111 | | 164 | 164 | 67 | 112 | 164 | | 164 | 164 | 93 | 152 | 164 |
| 10 | ES | 106 | 159 | 38 | 66 | 104 | | 158 | 159 | 62 | 104 | 156 | | 158 | 159 | 86 | 142 | 156 |
| 10.5 | ES | 103 | 164 | 36 | 62 | 98 | | 161 | 164 | 60 | 99 | 153 | | 163 | 164 | 84 | 137 | 162 |
| 11 | ES | 99 | 162 | 33 | 58 | 92 | | 154 | 162 | 57 | 94 | 145 | | 161 | 162 | 80 | 130 | 160 |
| 11.5 | ES | 96 | 162 | 32 | 56 | 88 | | 151 | 168 | 55 | 90 | 138 | | 167 | 168 | 78 | 125 | 167 |
| 12 | ES | 92 | 156 | 30 | 52 | 83 | | 145 | 166 | 52 | 86 | 132 | | 166 | 166 | 74 | 119 | 166 |
| 13 | ES | 86 | 147 | 26 | 47 | 75 | | 137 | 171 | 48 | 78 | 120 | | 171 | 171 | 69 | 110 | 166 |
| 14 | ES | 81 | 140 | 23 | 42 | 67 | | 130 | 177 | 44 | 72 | 110 | | 177 | 177 | 64 | 102 | 152 |
| 15 | ES | 101 | 166 | 43 | 66 | 101 | | 161 | 175 | 75 | 108 | 162 | | 175 | 175 | 106 | 151 | 175 |
| 16 | ES | 96 | 159 | 40 | 60 | 93 | | 154 | 179 | 70 | 101 | 151 | | 179 | 179 | 101 | 142 | 179 |
| 17 | ES | 93 | 157 | 37 | 56 | 86 | | 151 | 193 | 68 | 96 | 141 | | 193 | 193 | 99 | 136 | 193 |

# 150mm² Hard Drawn Copper - "SEVERE" Loading Environment

## Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 570 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 2.38 |

## Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| Pole Length (m) and Grade | | Average / Poor Soil | | | | | Good / Average Soil | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | |
| | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 | M | 34 | 34 | 17 | 33 | 33 | 34 | 34 | 29 | 33 | 33 | 34 | 34 | 33 | 33 | 33 |
| 9 | M | 34 | 34 | 16 | 33 | 33 | 34 | 34 | 27 | 33 | 33 | 34 | 34 | 33 | 33 | 33 |
| 9.5 | M | 33 | 33 | 15 | 33 | 33 | 33 | 33 | 26 | 33 | 33 | 33 | 33 | 33 | 33 | 33 |
| 10 | M | 33 | 33 | 14 | 31 | 33 | 33 | 33 | 24 | 33 | 33 | 33 | 33 | 33 | 33 | 33 |
| 10.5 | M | 33 | 33 | 13 | 29 | 33 | 33 | 33 | 23 | 33 | 33 | 33 | 33 | 33 | 33 | 33 |
| 11 | M | 33 | 33 | 12 | 27 | 33 | 33 | 33 | 22 | 33 | 33 | 33 | 33 | 31 | 33 | 33 |
| 11.5 | M | 33 | 33 | 11 | 25 | 33 | 33 | 33 | 20 | 33 | 33 | 33 | 33 | 30 | 33 | 33 |
| 12 | M | 33 | 33 | 10 | 24 | 33 | 33 | 33 | 19 | 33 | 33 | 33 | 33 | 29 | 33 | 33 |
| 13 | M | 33 | 33 | 7 | 20 | 33 | 33 | 33 | 17 | 33 | 33 | 33 | 33 | 26 | 33 | 33 |
| 14 | M | 31 | 36 | 6 | 18 | 33 | 36 | 36 | 15 | 32 | 36 | 36 | 36 | 24 | 36 | 36 |
| 15 | M | 39 | 39 | 15 | 29 | 39 | 39 | 39 | 28 | 39 | 39 | 39 | 39 | 39 | 39 | 39 |
| 16 | M | 38 | 42 | 13 | 25 | 42 | 42 | 42 | 26 | 42 | 42 | 42 | 42 | 40 | 42 | 42 |
| 17 | M | 35 | 46 | 10 | 22 | 41 | 46 | 46 | 24 | 42 | 46 | 46 | 46 | 37 | 46 | 46 |
| 18 | M | 32 | 46 | 8 | 19 | 37 | 46 | 46 | 21 | 38 | 46 | 46 | 46 | 35 | 46 | 46 |
| 20 | M | 28 | 51 | 5 | 14 | 30 | 51 | 51 | 17 | 32 | 51 | 51 | 51 | 30 | 50 | 51 |
| 22 | M | 23 | 48 | 0 | 9 | 22 | 46 | 53 | 12 | 25 | 46 | 53 | 53 | 25 | 42 | 53 |
| | | | | | | | | | | | | | | | | |
| 10 | MS | 49 | 51 | 16 | 32 | 50 | 50 | 51 | 27 | 50 | 50 | 50 | 51 | 39 | 50 | 50 |
| 11 | MS | 44 | 50 | 13 | 28 | 48 | 49 | 50 | 24 | 47 | 49 | 49 | 50 | 35 | 49 | 49 |
| 12 | MS | 41 | 52 | 11 | 24 | 43 | 52 | 52 | 22 | 42 | 52 | 52 | 52 | 32 | 52 | 52 |
| 13 | MS | 37 | 52 | 8 | 21 | 38 | 52 | 52 | 19 | 37 | 52 | 52 | 52 | 29 | 52 | 52 |
| | | | | | | | | | | | | | | | | |
| 8.5 | S | 62 | 70 | 21 | 41 | 68 | 69 | 70 | 36 | 65 | 68 | 69 | 70 | 50 | 68 | 68 |
| 9 | S | 60 | 72 | 20 | 38 | 63 | 71 | 72 | 34 | 62 | 70 | 71 | 72 | 48 | 70 | 70 |
| 9.5 | S | 57 | 70 | 18 | 36 | 59 | 70 | 70 | 32 | 58 | 69 | 70 | 70 | 45 | 69 | 69 |
| 10 | S | 54 | 69 | 17 | 33 | 55 | 69 | 69 | 30 | 54 | 68 | 69 | 69 | 43 | 68 | 68 |
| 10.5 | S | 51 | 68 | 16 | 31 | 52 | 68 | 68 | 28 | 51 | 67 | 68 | 68 | 41 | 67 | 67 |
| 11 | S | 49 | 65 | 14 | 29 | 49 | 67 | 67 | 26 | 48 | 67 | 67 | 67 | 39 | 67 | 67 |
| 11.5 | S | 46 | 62 | 13 | 27 | 46 | 66 | 66 | 25 | 46 | 66 | 66 | 66 | 37 | 64 | 66 |
| 12 | S | 44 | 66 | 12 | 25 | 43 | 66 | 66 | 23 | 43 | 66 | 66 | 66 | 35 | 61 | 66 |
| 13 | S | 41 | 69 | 9 | 21 | 38 | 67 | 69 | 21 | 39 | 63 | 69 | 69 | 32 | 56 | 69 |
| 14 | S | 38 | 68 | 7 | 18 | 33 | 63 | 72 | 18 | 35 | 57 | 72 | 72 | 29 | 51 | 72 |
| 15 | S | 49 | 74 | 18 | 31 | 52 | 74 | 74 | 35 | 54 | 74 | 74 | 74 | 51 | 74 | 74 |
| 16 | S | 45 | 77 | 15 | 27 | 47 | 76 | 77 | 32 | 50 | 77 | 77 | 77 | 48 | 72 | 77 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | S | 42 | 74 | 13 | 24 | 42 | | 72 | 76 | 29 | 45 | 72 | | 76 | 76 | 44 | 67 | 76 |
| 18 | S | 39 | 71 | 10 | 21 | 38 | | 68 | 78 | 26 | 42 | 67 | | 78 | 78 | 41 | 62 | 78 |
| 20 | S | 33 | 64 | 6 | 15 | 29 | | 61 | 79 | 21 | 34 | 56 | | 79 | 79 | 35 | 53 | 79 |
| 22 | S | 27 | 56 | 1 | 9 | 22 | | 53 | 78 | 15 | 27 | 46 | | 78 | 78 | 29 | 45 | 71 |
| | | | | | | | | | | | | | | | | | | |
| 9 | ES | 66 | 93 | 22 | 40 | 64 | | 93 | 93 | 38 | 65 | 93 | | 93 | 93 | 53 | 89 | 93 |
| 9.5 | ES | 62 | 91 | 21 | 37 | 60 | | 91 | 91 | 35 | 61 | 91 | | 91 | 91 | 50 | 84 | 91 |
| 10 | ES | 57 | 87 | 18 | 34 | 56 | | 86 | 87 | 32 | 56 | 85 | | 86 | 87 | 46 | 78 | 85 |
| 10.5 | ES | 55 | 90 | 17 | 32 | 52 | | 88 | 90 | 31 | 53 | 84 | | 89 | 90 | 44 | 74 | 88 |
| 11 | ES | 52 | 89 | 15 | 29 | 49 | | 84 | 89 | 28 | 50 | 79 | | 88 | 89 | 42 | 70 | 87 |
| 11.5 | ES | 51 | 88 | 14 | 28 | 46 | | 82 | 92 | 27 | 47 | 75 | | 91 | 92 | 40 | 67 | 91 |
| 12 | ES | 48 | 85 | 13 | 26 | 43 | | 78 | 90 | 25 | 45 | 71 | | 90 | 90 | 38 | 64 | 90 |
| 13 | ES | 44 | 79 | 10 | 22 | 38 | | 74 | 93 | 22 | 40 | 64 | | 93 | 93 | 35 | 58 | 89 |
| 14 | ES | 41 | 74 | 8 | 18 | 33 | | 69 | 96 | 20 | 35 | 57 | | 96 | 96 | 31 | 53 | 81 |
| 15 | ES | 52 | 89 | 19 | 32 | 52 | | 86 | 95 | 37 | 56 | 87 | | 95 | 95 | 55 | 80 | 95 |
| 16 | ES | 48 | 85 | 16 | 28 | 47 | | 81 | 98 | 34 | 51 | 79 | | 98 | 98 | 51 | 75 | 98 |
| 17 | ES | 46 | 82 | 14 | 25 | 42 | | 79 | 106 | 32 | 48 | 74 | | 106 | 106 | 49 | 71 | 105 |

## 150mm$^2$ Hard Drawn Copper - "NORMAL" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 1938.5 | 19.0 | 0.14 | 0.22 | 0.32 | 0.44 | 0.57 | 0.72 | 0.89 | 1.07 | 1.28 | 1.50 | 1.74 | 2.00 | 2.27 | 2.57 | 2.88 | 3.21 | 3.55 |
| -4 | 1903.9 | 18.7 | 0.14 | 0.23 | 0.33 | 0.44 | 0.58 | 0.73 | 0.90 | 1.09 | 1.30 | 1.53 | 1.77 | 2.03 | 2.31 | 2.61 | 2.93 | 3.26 | 3.62 |
| 0 | 1820.3 | 17.9 | 0.15 | 0.24 | 0.34 | 0.46 | 0.61 | 0.77 | 0.95 | 1.14 | 1.36 | 1.60 | 1.85 | 2.13 | 2.42 | 2.73 | 3.06 | 3.41 | 3.78 |
| 4 | 1740.8 | 17.1 | 0.16 | 0.25 | 0.36 | 0.48 | 0.63 | 0.80 | 0.99 | 1.20 | 1.42 | 1.67 | 1.94 | 2.22 | 2.53 | 2.86 | 3.20 | 3.57 | 3.95 |
| 8 | 1665.6 | 16.3 | 0.17 | 0.26 | 0.37 | 0.51 | 0.66 | 0.84 | 1.03 | 1.25 | 1.49 | 1.75 | 2.03 | 2.33 | 2.65 | 2.99 | 3.35 | 3.73 | 4.13 |
| 12 | 1594.7 | 15.6 | 0.17 | 0.27 | 0.39 | 0.53 | 0.69 | 0.87 | 1.08 | 1.31 | 1.55 | 1.82 | 2.12 | 2.43 | 2.76 | 3.12 | 3.50 | 3.90 | 4.32 |
| 16 | 1528.0 | 15.0 | 0.18 | 0.28 | 0.41 | 0.55 | 0.72 | 0.91 | 1.13 | 1.36 | 1.62 | 1.90 | 2.21 | 2.53 | 2.88 | 3.26 | 3.65 | 4.07 | 4.51 |
| 20 | 1465.5 | 14.4 | 0.19 | 0.29 | 0.42 | 0.58 | 0.75 | 0.95 | 1.17 | 1.42 | 1.69 | 1.98 | 2.30 | 2.64 | 3.01 | 3.39 | 3.81 | 4.24 | 4.70 |
| 24 | 1407.0 | 13.8 | 0.20 | 0.31 | 0.44 | 0.60 | 0.78 | 0.99 | 1.22 | 1.48 | 1.76 | 2.07 | 2.40 | 2.75 | 3.13 | 3.54 | 3.96 | 4.42 | 4.89 |
| 28 | 1352.4 | 13.3 | 0.20 | 0.32 | 0.46 | 0.62 | 0.81 | 1.03 | 1.27 | 1.54 | 1.83 | 2.15 | 2.49 | 2.86 | 3.26 | 3.68 | 4.12 | 4.59 | 5.09 |
| 32 | 1301.5 | 12.8 | 0.21 | 0.33 | 0.48 | 0.65 | 0.85 | 1.07 | 1.32 | 1.60 | 1.90 | 2.24 | 2.59 | 2.98 | 3.39 | 3.82 | 4.28 | 4.77 | 5.29 |
| 36 | 1254.1 | 12.3 | 0.22 | 0.34 | 0.49 | 0.67 | 0.88 | 1.11 | 1.37 | 1.66 | 1.98 | 2.32 | 2.69 | 3.09 | 3.51 | 3.97 | 4.45 | 4.95 | 5.49 |

### DESIGN TABLE

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 1748.2 | 17.1 | 0.16 | 0.25 | 0.35 | 0.48 | 0.63 | 0.80 | 0.98 | 1.19 | 1.42 | 1.66 | 1.93 | 2.22 | 2.52 | 2.85 | 3.19 | 3.55 | 3.94 |
| 0 | 1643.5 | 16.1 | 0.17 | 0.26 | 0.38 | 0.51 | 0.67 | 0.85 | 1.05 | 1.27 | 1.51 | 1.77 | 2.05 | 2.36 | 2.68 | 3.03 | 3.39 | 3.78 | 4.19 |
| 30 | 1218.3 | 12.0 | 0.23 | 0.35 | 0.51 | 0.69 | 0.90 | 1.14 | 1.41 | 1.71 | 2.03 | 2.39 | 2.77 | 3.18 | 3.62 | 4.08 | 4.58 | 5.10 | 5.65 |
| 50 | 1036.4 | 10.2 | 0.27 | 0.42 | 0.60 | 0.81 | 1.06 | 1.35 | 1.66 | 2.01 | 2.39 | 2.81 | 3.26 | 3.74 | 4.25 | 4.80 | 5.38 | 6.00 | 6.64 |
| 55 | 999.9 | 9.8 | 0.28 | 0.43 | 0.62 | 0.84 | 1.10 | 1.39 | 1.72 | 2.08 | 2.48 | 2.91 | 3.37 | 3.87 | 4.41 | 4.97 | 5.58 | 6.21 | 6.89 |
| 60 | 966.3 | 9.5 | 0.29 | 0.45 | 0.64 | 0.87 | 1.14 | 1.44 | 1.78 | 2.16 | 2.57 | 3.01 | 3.49 | 4.01 | 4.56 | 5.15 | 5.77 | 6.43 | 7.13 |
| 65 | 935.3 | 9.2 | 0.29 | 0.46 | 0.66 | 0.90 | 1.18 | 1.49 | 1.84 | 2.23 | 2.65 | 3.11 | 3.61 | 4.14 | 4.71 | 5.32 | 5.96 | 6.64 | 7.36 |
| 70 | 906.6 | 8.9 | 0.30 | 0.47 | 0.68 | 0.93 | 1.22 | 1.54 | 1.90 | 2.30 | 2.73 | 3.21 | 3.72 | 4.27 | 4.86 | 5.49 | 6.15 | 6.85 | 7.59 |
| 75 | 880.1 | 8.6 | 0.31 | 0.49 | 0.70 | 0.96 | 1.25 | 1.58 | 1.96 | 2.37 | 2.82 | 3.31 | 3.83 | 4.40 | 5.01 | 5.65 | 6.34 | 7.06 | 7.82 |

## 150mm$^2$ Hard Drawn Copper - "SEVERE" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. (Deg.C) | Tension (kgf) | Tension (kN) | Sag (m) for Span Length (m) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** |
| -5.6 | 1540.7 | 15.1 | 0.18 | 0.28 | 0.40 | 0.55 | 0.71 | 0.90 | 1.12 | 1.35 | 1.61 | 1.89 | 2.19 | 2.51 | 2.86 |
| -4 | 1509.8 | 14.8 | 0.18 | 0.29 | 0.41 | 0.56 | 0.73 | 0.92 | 1.14 | 1.38 | 1.64 | 1.93 | 2.23 | 2.57 | 2.92 |
| 0 | 1435.7 | 14.1 | 0.19 | 0.30 | 0.43 | 0.59 | 0.77 | 0.97 | 1.20 | 1.45 | 1.73 | 2.03 | 2.35 | 2.70 | 3.07 |
| 4 | 1366.5 | 13.4 | 0.20 | 0.31 | 0.45 | 0.62 | 0.81 | 1.02 | 1.26 | 1.52 | 1.81 | 2.13 | 2.47 | 2.83 | 3.22 |
| 8 | 1302.1 | 12.8 | 0.21 | 0.33 | 0.48 | 0.65 | 0.85 | 1.07 | 1.32 | 1.60 | 1.90 | 2.23 | 2.59 | 2.97 | 3.38 |
| 12 | 1242.4 | 12.2 | 0.22 | 0.35 | 0.50 | 0.68 | 0.89 | 1.12 | 1.39 | 1.68 | 1.99 | 2.34 | 2.72 | 3.12 | 3.55 |
| 16 | 1187.2 | 11.6 | 0.23 | 0.36 | 0.52 | 0.71 | 0.93 | 1.17 | 1.45 | 1.75 | 2.09 | 2.45 | 2.84 | 3.26 | 3.71 |
| 20 | 1136.2 | 11.1 | 0.24 | 0.38 | 0.55 | 0.74 | 0.97 | 1.23 | 1.51 | 1.83 | 2.18 | 2.56 | 2.97 | 3.41 | 3.88 |
| 24 | 1089.2 | 10.7 | 0.25 | 0.40 | 0.57 | 0.77 | 1.01 | 1.28 | 1.58 | 1.91 | 2.28 | 2.67 | 3.10 | 3.56 | 4.05 |
| 28 | 1045.9 | 10.3 | 0.26 | 0.41 | 0.59 | 0.81 | 1.05 | 1.33 | 1.65 | 1.99 | 2.37 | 2.78 | 3.23 | 3.70 | 4.21 |
| 32 | 1006.0 | 9.9 | 0.27 | 0.43 | 0.62 | 0.84 | 1.10 | 1.39 | 1.71 | 2.07 | 2.46 | 2.89 | 3.35 | 3.85 | 4.38 |
| 36 | 969.2 | 9.5 | 0.28 | 0.44 | 0.64 | 0.87 | 1.14 | 1.44 | 1.78 | 2.15 | 2.56 | 3.00 | 3.48 | 4.00 | 4.55 |

### DESIGN TABLE

| Temp. (Deg.C) | Tension (kgf) | Tension (kN) | Sag (m) for Span Length (m) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** |
| -5.6 | 1379.9 | 13.5 | 0.20 | 0.31 | 0.45 | 0.61 | 0.80 | 1.01 | 1.25 | 1.51 | 1.80 | 2.11 | 2.44 | 2.81 | 3.19 |
| 0 | 1289.8 | 12.7 | 0.21 | 0.33 | 0.48 | 0.65 | 0.85 | 1.08 | 1.33 | 1.61 | 1.92 | 2.26 | 2.62 | 3.00 | 3.42 |
| 30 | 945.1 | 9.3 | 0.29 | 0.46 | 0.66 | 0.89 | 1.17 | 1.48 | 1.82 | 2.20 | 2.62 | 3.08 | 3.57 | 4.10 | 4.66 |
| 50 | 806.2 | 7.9 | 0.34 | 0.53 | 0.77 | 1.05 | 1.37 | 1.73 | 2.14 | 2.58 | 3.07 | 3.61 | 4.18 | 4.80 | 5.47 |
| 55 | 778.7 | 7.6 | 0.35 | 0.55 | 0.80 | 1.08 | 1.41 | 1.79 | 2.21 | 2.67 | 3.18 | 3.74 | 4.33 | 4.97 | 5.66 |
| 60 | 753.4 | 7.4 | 0.37 | 0.57 | 0.82 | 1.12 | 1.46 | 1.85 | 2.28 | 2.76 | 3.29 | 3.86 | 4.48 | 5.14 | 5.85 |
| 65 | 730.1 | 7.2 | 0.38 | 0.59 | 0.85 | 1.16 | 1.51 | 1.91 | 2.36 | 2.85 | 3.39 | 3.98 | 4.62 | 5.30 | 6.04 |
| 70 | 708.7 | 7.0 | 0.39 | 0.61 | 0.87 | 1.19 | 1.55 | 1.97 | 2.43 | 2.94 | 3.50 | 4.10 | 4.76 | 5.47 | 6.22 |
| 75 | 688.8 | 6.8 | 0.40 | 0.62 | 0.90 | 1.22 | 1.60 | 2.02 | 2.50 | 3.02 | 3.60 | 4.22 | 4.90 | 5.62 | 6.40 |

## 175 mm$^2$ Aluminium Alloy "Elm"

* Conductor & Design Parameters
* Structure Suitability
* Stayed Pole Design Data
* Unstayed Pole Design Data
* Sags and Tensions

## 175mm$^2$ Aluminium Alloy "Elm"

### Conductor Parameters:

| | |
|---|---|
| Conductor Stranding (#strands / diameter(mm)) | 19/3.76 |
| Greased Conductor Weight (kg/m) | 0.606 |
| Cross Sectional Area of Conductor (mm²) | 211.0 |
| Conductor Overall Diameter (mm) | 18.80 |
| Coefficient of Linear Expansion (/Degree C) | 2.30E-05 |
| Modulus of Elasticity (kg/mm²) | 5,700 |
| Rated Breaking Strength of Conductor (kgf) | 6,346.7 |

| Design Loading Parameters: | "Normal" | "Severe" |
|---|---|---|
| Basic / Recommended Span (m) | 130 | 110 |
| Wind Pressure on Conductor (N/m²) | 380 | 570 |
| Radial Ice Thickness (mm) | 9.5 | 12.5 |
| Ice Density (kg/m³) | 913 | 913 |
| Absolute Maximum Working Tension (MWT) Limit (kgf) | 2,379.0 | 2,379.0 |
| Temperature at MWT Limit (Degrees C) | -5.6 | -5.6 |
| Maximum "Everyday" Tension (EDT) Limit (kgf) | 1,269.3 | 1,468.1 |
| Temperature at EDT Limit (Degrees C) | 5.0 | -5.6 |
| Maximum Conductor Tension (MCT) at -5.6 degC (kgf) | 2,126.5 | 2,379.0 |
| Maximum Conductor Weight (MCW) (kg/m) | 1.377 | 1.728 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.465 | 2.546 |
| Freezing Point Tension (FPT) (kgf) | 1,378.3 | 1,334.8 |

| Span Length Limits: | "Normal" | "Severe" |
|---|---|---|
| Maximum **Equivalent** Span | 130 | 110 |
| *Maximum **Single** Span (clashing limit)<br>(Standard heavy crossarm, 1.2m phase spacing) | 140 | 120 |
| *Maximum **Single** Span (clashing limit)<br>(H Pole, long span heavy crossarm, 2.0m phase spacing) | 180 | 155 |

**NOTE: Single span limits to be reduced by 20m where weather zone is worse than 2B at "normal" altitudes, or worse than 3C at "severe" altitudes. Weather zones are given in Appendix O**

## 175mm$^2$ Aluminium Alloy "Elm"

### Pole-Top Steelwork Suitability

| Grade | Structure Configuration | | Drg. Ref | Max. Dev'n Normal | Max. Dev'n Severe | Max. D'pull. | Notes |
|---|---|---|---|---|---|---|---|
| Light | Single Pole | Single Arm Intermediate / Pin Angle | F3 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Straight Section / Angle Section | F4 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Termination | F5 | Not Suitable | Not Suitable | Not Suitable | |
| Heavy | Single Pole | Single Arm Intermediate / Pin Angle | F7 | 1º | Not Suitable | 1:20 | Limited Dow npull |
| Heavy | Single Pole | Double Arm Intermediate / Pin Angle | F8 | 5º | 2º | 1:10 | |
| Heavy | Single Pole | Double Arm Straight Section / Angle Section | F9 | 45º | 45º | 1:10 | |
| Heavy | "H" Pole | Double Arm Angle Section | F10 | 60º | 60º | 1:10 | Limits as per F8 if used as intermediate |
| Heavy | "H" Pole | Double Arm Section / Inter. For long spans | F11 | 60º (section) | 60º (section) | 1:10 | No deviation allow ed if used as intermediate |
| Heavy | "H" Pole | Double Arm Termination | F12 | O.K. | O.K. | 1:10 | |
| Heavy | Single Pole | Double Arm Termination | F13 | Not Suitable | Not Suitable | Not Suitable | |

# 175mm$^2$ Aluminium Alloy "Elm" - "NORMAL" Loading Environment

## Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 2,126.5 |
| Wind Pressure (N/m²) | 380 |
| Maximum Conductor Weight (MCW) (kg/m) | 1.38 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.46 |
| Maximum Wind Span Length (m) | 180 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 15,948.4 |
| Transverse Load [Normal to Span] (kgf) | 1,977.4 |
| Vertical Load with Downpull (1:10) (kgf) | 5,861.0 |
| Pole Wind Loading (kgf) | 224.5 |

## Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|
| 0 | | 9,675 | 9,006 | 8,485 | 8,063 |
| 5 | | 12,081 | 10,990 | 10,141 | 9,452 |
| 10 | | 14,477 | 12,965 | 11,789 | 10,835 |
| 15 | | 16,857 | 14,927 | 13,427 | 12,209 |
| 20 | | 19,216 | 16,873 | 15,050 | 13,572 |
| 25 | | 21,551 | 18,798 | 16,657 | 14,920 |
| 30 | | 23,857 | 20,700 | 18,243 | 16,251 |
| 35 | | 26,129 | 22,573 | 19,807 | 17,563 |
| 40 | | 28,364 | 24,416 | 21,344 | 18,853 |
| 45 | | 30,556 | 26,223 | 22,853 | 20,119 |
| 50 | | 32,702 | 27,993 | 24,329 | 21,358 |
| 55 | | 34,798 | 29,721 | 25,771 | 22,568 |
| 60 | Terminal | 36,839 | 31,404 | 27,176 | 23,746 |

***NOTE: Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

## Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | 4 | 15 | 10 | 28 |
| 35 | Single | 5 | 18 | 13 | 34 |
| 40 | Pole | 7 | 22 | 15 | 40 |
| 45 | | 8 | 25 | 18 | 45 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | | 27 | 38 | 47 | 60 | x | x |
| 35 | "H" | 32 | 46 | 57 | 60 | x | x |
| 40 | Pole | 38 | 54 | 60 | 60 | x | x |
| 45 | | 43 | 60 | 60 | 60 | x | x |

# 175mm$^2$ Aluminium Alloy "Elm" - "SEVERE" Loading Environment

## Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 2,379.0 |
| Wind Pressure (N/m²) | 570 |
| Maximum Conductor Weight (MCW) (kg/m) | 1.73 |
| Maximum Conductor Pressure (MCP) (kg/m) | 2.55 |
| Maximum Wind Span Length (m) | 155 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 17,842.5 |
| Transverse Load [Normal to Span] (kgf) | 2,959.5 |
| Vertical Load with Downpull (1:10) (kgf) | 6,387.9 |
| Pole Wind Loading (kgf) | 336.8 |

## Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|
| 0 | | 12,097 | 11,096 | 10,316 | 9,684 |
| 5 | | 14,788 | 13,315 | 12,168 | 11,238 |
| 10 | | 17,465 | 15,521 | 14,009 | 12,783 |
| 15 | | 20,121 | 17,711 | 15,837 | 14,317 |
| 20 | | 22,752 | 19,881 | 17,648 | 15,836 |
| 25 | | 25,354 | 22,026 | 19,437 | 17,338 |
| 30 | | 27,920 | 24,142 | 21,203 | 18,819 |
| 35 | | 30,446 | 26,225 | 22,941 | 20,278 |
| 40 | | 32,928 | 28,271 | 24,649 | 21,711 |
| 45 | | 35,360 | 30,277 | 26,323 | 23,115 |
| 50 | | 37,738 | 32,238 | 27,959 | 24,488 |
| 55 | | 40,058 | 34,150 | 29,555 | 25,827 |
| 60 | Terminal | 42,315 | 36,011 | 31,108 | 27,130 |

***NOTE: Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

## Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | no | 10 | 5 | 21 |
| 35 | Single | 1 | 13 | 8 | 26 |
| 40 | Pole | 3 | 16 | 10 | 32 |
| 45 | | 4 | 19 | 12 | 36 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | | 20 | 30 | 38 | 56 | x | x |
| 35 | "H" | 25 | 37 | 47 | 60 | x | x |
| 40 | Pole | 30 | 44 | 55 | 60 | x | x |
| 45 | | 34 | 50 | 60 | 60 | x | x |

# 175mm² Aluminium Alloy "Elm" - "NORMAL" Loading Environment

## Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 380 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.47 |

## Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| | | Average / Poor Soil | | | | | | Good / Average Soil | | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pole Length (m) | | Auger | | Standard Burial, # Kicking Blocks | | | | Auger | | Standard Burial, # Kicking Blocks | | | | Auger | | Standard Burial, # Kicking Blocks | | |
| and Grade | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 | M | 59 | 60 | 31 | 58 | 58 | | 59 | 60 | 50 | 58 | 58 | | 59 | 60 | 58 | 58 | 58 |
| 9 | M | 58 | 59 | 30 | 58 | 58 | | 58 | 59 | 48 | 58 | 58 | | 58 | 59 | 58 | 58 | 58 |
| 9.5 | M | 58 | 58 | 28 | 57 | 57 | | 58 | 58 | 46 | 57 | 57 | | 58 | 58 | 57 | 57 | 57 |
| 10 | M | 58 | 58 | 26 | 54 | 57 | | 58 | 58 | 43 | 57 | 57 | | 58 | 58 | 57 | 57 | 57 |
| 10.5 | M | 58 | 58 | 25 | 51 | 58 | | 58 | 58 | 41 | 58 | 58 | | 58 | 58 | 58 | 58 | 58 |
| 11 | M | 58 | 58 | 23 | 48 | 58 | | 58 | 58 | 40 | 58 | 58 | | 58 | 58 | 56 | 58 | 58 |
| 11.5 | M | 58 | 58 | 22 | 46 | 58 | | 58 | 58 | 38 | 58 | 58 | | 58 | 58 | 54 | 58 | 58 |
| 12 | M | 58 | 58 | 21 | 43 | 58 | | 58 | 58 | 36 | 58 | 58 | | 58 | 58 | 52 | 58 | 58 |
| 13 | M | 59 | 60 | 18 | 39 | 60 | | 60 | 60 | 33 | 60 | 60 | | 60 | 60 | 47 | 60 | 60 |
| 14 | M | 64 | 64 | 16 | 35 | 61 | | 64 | 64 | 30 | 59 | 64 | | 64 | 64 | 45 | 64 | 64 |
| 15 | M | 69 | 69 | 31 | 54 | 69 | | 69 | 69 | 54 | 69 | 69 | | 69 | 69 | 69 | 69 | 69 |
| 16 | M | 69 | 74 | 29 | 49 | 74 | | 74 | 74 | 51 | 74 | 74 | | 74 | 74 | 73 | 74 | 74 |
| 17 | M | 66 | 80 | 26 | 45 | 76 | | 80 | 80 | 48 | 77 | 80 | | 80 | 80 | 70 | 80 | 80 |
| 18 | M | 62 | 81 | 23 | 41 | 70 | | 81 | 81 | 45 | 72 | 81 | | 81 | 81 | 66 | 81 | 81 |
| 20 | M | 57 | 88 | 19 | 35 | 60 | | 88 | 88 | 40 | 63 | 88 | | 88 | 88 | 61 | 88 | 88 |
| 22 | M | 50 | 91 | 13 | 27 | 50 | | 88 | 93 | 33 | 54 | 88 | | 93 | 93 | 53 | 81 | 93 |
| | | | | | | | | | | | | | | | | | | |
| 10 | MS | 84 | 87 | 30 | 57 | 86 | | 87 | 87 | 49 | 86 | 86 | | 87 | 87 | 68 | 86 | 86 |
| 11 | MS | 77 | 86 | 26 | 51 | 84 | | 86 | 86 | 44 | 81 | 86 | | 86 | 86 | 63 | 86 | 86 |
| 12 | MS | 72 | 91 | 23 | 45 | 75 | | 91 | 91 | 41 | 74 | 91 | | 91 | 91 | 58 | 91 | 91 |
| 13 | MS | 67 | 91 | 20 | 40 | 68 | | 91 | 91 | 37 | 67 | 91 | | 91 | 91 | 54 | 91 | 91 |
| | | | | | | | | | | | | | | | | | | |
| 8.5 | S | 104 | 118 | 39 | 71 | 114 | | 117 | 118 | 62 | 110 | 114 | | 117 | 118 | 85 | 114 | 114 |
| 9 | S | 101 | 121 | 37 | 67 | 107 | | 121 | 121 | 60 | 104 | 119 | | 121 | 121 | 83 | 119 | 119 |
| 9.5 | S | 96 | 119 | 35 | 63 | 101 | | 118 | 119 | 57 | 99 | 117 | | 118 | 119 | 79 | 117 | 117 |
| 10 | S | 92 | 117 | 33 | 59 | 95 | | 117 | 117 | 54 | 93 | 116 | | 117 | 117 | 75 | 116 | 116 |
| 10.5 | S | 88 | 115 | 31 | 56 | 90 | | 115 | 116 | 51 | 89 | 115 | | 115 | 116 | 72 | 115 | 115 |
| 11 | S | 84 | 111 | 29 | 52 | 85 | | 114 | 114 | 49 | 84 | 114 | | 114 | 114 | 68 | 114 | 114 |
| 11.5 | S | 81 | 106 | 27 | 49 | 80 | | 114 | 114 | 46 | 80 | 114 | | 114 | 114 | 65 | 111 | 114 |
| 12 | S | 78 | 113 | 25 | 47 | 76 | | 113 | 113 | 44 | 76 | 113 | | 113 | 113 | 63 | 106 | 113 |
| 13 | S | 73 | 118 | 22 | 42 | 68 | | 116 | 118 | 40 | 70 | 110 | | 118 | 118 | 59 | 98 | 118 |
| 14 | S | 92 | 119 | 20 | 37 | 62 | | 122 | 122 | 37 | 64 | 100 | | 122 | 122 | 55 | 91 | 122 |
| 15 | S | 87 | 126 | 38 | 59 | 93 | | 126 | 126 | 65 | 97 | 126 | | 126 | 126 | 92 | 126 | 126 |
| 16 | S | 83 | 131 | 34 | 54 | 85 | | 131 | 131 | 61 | 90 | 131 | | 131 | 131 | 88 | 127 | 131 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | S | 78 | 130 | 31 | 49 | 78 | | 127 | 130 | 57 | 84 | 128 | | 130 | 130 | 82 | 119 | 130 |
| 18 | S | 74 | 126 | 28 | 45 | 72 | | 122 | 133 | 53 | 79 | 119 | | 133 | 133 | 79 | 112 | 133 |
| 20 | S | 66 | 116 | 22 | 37 | 61 | | 112 | 135 | 46 | 69 | 104 | | 135 | 135 | 70 | 100 | 135 |
| 22 | S | 58 | 105 | 16 | 29 | 50 | | 101 | 132 | 39 | 59 | 90 | | 132 | 132 | 62 | 88 | 130 |
| | | | | | | | | | | | | | | | | | | |
| 9 | ES | 111 | 155 | 41 | 70 | 109 | | 155 | 155 | 66 | 109 | 155 | | 155 | 155 | 91 | 149 | 155 |
| 9.5 | ES | 106 | 152 | 38 | 66 | 103 | | 152 | 152 | 62 | 103 | 152 | | 152 | 152 | 86 | 141 | 152 |
| 10 | ES | 98 | 147 | 35 | 61 | 96 | | 146 | 147 | 57 | 96 | 144 | | 146 | 147 | 80 | 132 | 144 |
| 10.5 | ES | 95 | 152 | 33 | 58 | 91 | | 149 | 152 | 55 | 92 | 142 | | 151 | 152 | 78 | 126 | 150 |
| 11 | ES | 91 | 150 | 31 | 54 | 86 | | 143 | 150 | 52 | 87 | 134 | | 149 | 150 | 74 | 120 | 148 |
| 11.5 | ES | 89 | 150 | 29 | 51 | 81 | | 139 | 155 | 51 | 84 | 128 | | 155 | 155 | 72 | 116 | 154 |
| 12 | ES | 85 | 144 | 28 | 48 | 77 | | 134 | 154 | 48 | 79 | 122 | | 153 | 154 | 69 | 110 | 153 |
| 13 | ES | 80 | 136 | 24 | 43 | 69 | | 127 | 158 | 44 | 73 | 111 | | 158 | 158 | 64 | 102 | 153 |
| 14 | ES | 75 | 129 | 21 | 38 | 62 | | 120 | 164 | 40 | 66 | 101 | | 164 | 164 | 59 | 94 | 141 |
| 15 | ES | 93 | 154 | 40 | 61 | 94 | | 149 | 162 | 69 | 100 | 150 | | 162 | 162 | 98 | 140 | 162 |
| 16 | ES | 88 | 147 | 37 | 56 | 86 | | 142 | 166 | 65 | 94 | 139 | | 166 | 166 | 93 | 132 | 166 |
| 17 | ES | 86 | 145 | 34 | 52 | 80 | | 140 | 179 | 63 | 89 | 131 | | 179 | 179 | 91 | 126 | 179 |

# 175mm² Aluminium Alloy "Elm" - "SEVERE" Loading Environment

## Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,05 4 |
| Wind Pressure (N/m²) | 570 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 2.55 |

## Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| | | Average / Poor Soil | | | | | | Good / Average Soil | | | | | | Good Soil | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pole Length (m) | | Auger | | Standard Burial, # Kicking Blocks | | | | Auger | | Standard Burial, # Kicking Blocks | | | | Auger | | Standard Burial, # Kicking Blocks | | | |
| and Grade | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | |
| 8.5 | M | 32 | 32 | 16 | 31 | 31 | | 32 | 32 | 27 | 31 | 31 | | 32 | 32 | 31 | 31 | 31 | |
| 9 | M | 31 | 32 | 15 | 31 | 31 | | 31 | 32 | 25 | 31 | 31 | | 31 | 32 | 31 | 31 | 31 | |
| 9.5 | M | 31 | 31 | 14 | 30 | 30 | | 31 | 31 | 24 | 30 | 30 | | 31 | 31 | 30 | 30 | 30 | |
| 10 | M | 31 | 31 | 13 | 29 | 30 | | 31 | 31 | 23 | 30 | 30 | | 31 | 31 | 30 | 30 | 30 | |
| 10.5 | M | 31 | 31 | 12 | 27 | 31 | | 31 | 31 | 21 | 31 | 31 | | 31 | 31 | 31 | 31 | 31 | |
| 11 | M | 31 | 31 | 11 | 25 | 31 | | 31 | 31 | 20 | 31 | 31 | | 31 | 31 | 29 | 31 | 31 | |
| 11.5 | M | 31 | 31 | 10 | 24 | 31 | | 31 | 31 | 19 | 31 | 31 | | 31 | 31 | 28 | 31 | 31 | |
| 12 | M | 31 | 31 | 9 | 22 | 31 | | 31 | 31 | 18 | 31 | 31 | | 31 | 31 | 27 | 31 | 31 | |
| 13 | M | 31 | 31 | 7 | 19 | 31 | | 31 | 31 | 15 | 31 | 31 | | 31 | 31 | 24 | 31 | 31 | |
| 14 | M | 34 | 34 | 5 | 16 | 31 | | 34 | 34 | 14 | 30 | 34 | | 34 | 34 | 22 | 34 | 34 | |
| 15 | M | 37 | 37 | 14 | 27 | 37 | | 37 | 37 | 27 | 37 | 37 | | 37 | 37 | 37 | 37 | 37 | |
| 16 | M | 35 | 39 | 12 | 24 | 39 | | 39 | 39 | 25 | 39 | 39 | | 39 | 39 | 37 | 39 | 39 | |
| 17 | M | 33 | 43 | 10 | 21 | 39 | | 43 | 43 | 22 | 39 | 43 | | 43 | 43 | 35 | 43 | 43 | |
| 18 | M | 30 | 43 | 8 | 18 | 35 | | 43 | 43 | 20 | 36 | 43 | | 43 | 43 | 32 | 43 | 43 | |
| 20 | M | 26 | 47 | 4 | 13 | 28 | | 47 | 47 | 16 | 30 | 47 | | 47 | 47 | 28 | 46 | 47 | |
| 22 | M | 21 | 45 | 0 | 8 | 21 | | 43 | 50 | 12 | 24 | 43 | | 50 | 50 | 23 | 39 | 50 | |
| | | | | | | | | | | | | | | | | | | | |
| 10 | MS | 46 | 47 | 15 | 30 | 47 | | 47 | 47 | 26 | 47 | 47 | | 47 | 47 | 37 | 47 | 47 | |
| 11 | MS | 41 | 47 | 12 | 26 | 45 | | 46 | 47 | 23 | 44 | 46 | | 46 | 47 | 33 | 46 | 46 | |
| 12 | MS | 38 | 49 | 10 | 23 | 40 | | 49 | 49 | 20 | 39 | 49 | | 49 | 49 | 30 | 49 | 49 | |
| 13 | MS | 35 | 49 | 8 | 19 | 35 | | 49 | 49 | 17 | 35 | 49 | | 49 | 49 | 27 | 49 | 49 | |
| | | | | | | | | | | | | | | | | | | | |
| 8.5 | S | 58 | 65 | 20 | 38 | 63 | | 65 | 65 | 33 | 61 | 63 | | 65 | 65 | 47 | 63 | 63 | |
| 9 | S | 56 | 67 | 19 | 36 | 59 | | 67 | 67 | 32 | 58 | 66 | | 67 | 67 | 45 | 66 | 66 | |
| 9.5 | S | 53 | 66 | 17 | 33 | 55 | | 65 | 66 | 30 | 54 | 65 | | 65 | 66 | 43 | 65 | 65 | |
| 10 | S | 50 | 64 | 16 | 31 | 52 | | 64 | 64 | 28 | 51 | 64 | | 64 | 64 | 40 | 64 | 64 | |
| 10.5 | S | 48 | 63 | 15 | 29 | 49 | | 63 | 63 | 26 | 48 | 63 | | 63 | 63 | 38 | 63 | 63 | |
| 11 | S | 45 | 61 | 13 | 27 | 46 | | 62 | 63 | 25 | 45 | 62 | | 62 | 63 | 36 | 62 | 62 | |
| 11.5 | S | 43 | 58 | 12 | 25 | 43 | | 62 | 62 | 23 | 43 | 62 | | 62 | 62 | 34 | 60 | 62 | |
| 12 | S | 41 | 62 | 11 | 23 | 40 | | 62 | 62 | 22 | 40 | 62 | | 62 | 62 | 32 | 57 | 62 | |
| 13 | S | 38 | 65 | 9 | 20 | 35 | | 63 | 65 | 19 | 36 | 59 | | 65 | 65 | 30 | 52 | 65 | |
| 14 | S | 49 | 64 | 7 | 17 | 31 | | 67 | 67 | 17 | 32 | 53 | | 67 | 67 | 27 | 48 | 67 | |
| 15 | S | 45 | 69 | 17 | 29 | 49 | | 69 | 69 | 32 | 51 | 69 | | 69 | 69 | 48 | 69 | 69 | |
| 16 | S | 42 | 72 | 14 | 26 | 44 | | 72 | 72 | 30 | 47 | 72 | | 72 | 72 | 45 | 67 | 72 | |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | S | 39 | 70 | 12 | 22 | 39 | | 67 | 71 | 27 | 42 | 68 | | 71 | 71 | 41 | 62 | 71 |
| 18 | S | 36 | 66 | 10 | 20 | 35 | | 64 | 73 | 24 | 39 | 62 | | 73 | 73 | 39 | 58 | 73 |
| 20 | S | 31 | 59 | 5 | 14 | 28 | | 57 | 74 | 19 | 32 | 52 | | 74 | 74 | 33 | 50 | 74 |
| 22 | S | 25 | 52 | 1 | 8 | 21 | | 50 | 73 | 14 | 25 | 43 | | 73 | 73 | 27 | 42 | 66 |
| | | | | | | | | | | | | | | | | | | |
| 9 | ES | 61 | 87 | 21 | 38 | 60 | | 87 | 87 | 35 | 60 | 87 | | 87 | 87 | 50 | 83 | 87 |
| 9.5 | ES | 58 | 85 | 19 | 35 | 56 | | 85 | 85 | 33 | 57 | 85 | | 85 | 85 | 47 | 78 | 85 |
| 10 | ES | 54 | 82 | 17 | 32 | 52 | | 81 | 82 | 30 | 52 | 80 | | 81 | 82 | 43 | 73 | 80 |
| 10.5 | ES | 52 | 84 | 16 | 30 | 49 | | 82 | 84 | 29 | 50 | 78 | | 83 | 84 | 41 | 69 | 83 |
| 11 | ES | 49 | 83 | 14 | 28 | 46 | | 79 | 83 | 27 | 47 | 74 | | 82 | 83 | 39 | 66 | 82 |
| 11.5 | ES | 47 | 82 | 13 | 26 | 43 | | 77 | 86 | 25 | 44 | 70 | | 85 | 86 | 38 | 63 | 85 |
| 12 | ES | 45 | 79 | 12 | 24 | 40 | | 73 | 85 | 24 | 42 | 66 | | 84 | 85 | 36 | 60 | 84 |
| 13 | ES | 42 | 74 | 10 | 20 | 35 | | 69 | 87 | 21 | 37 | 59 | | 87 | 87 | 32 | 54 | 84 |
| 14 | ES | 38 | 70 | 7 | 17 | 31 | | 64 | 90 | 18 | 33 | 53 | | 90 | 90 | 29 | 49 | 76 |
| 15 | ES | 48 | 83 | 18 | 30 | 49 | | 80 | 89 | 34 | 52 | 81 | | 89 | 89 | 51 | 75 | 89 |
| 16 | ES | 45 | 79 | 15 | 26 | 44 | | 76 | 91 | 31 | 48 | 74 | | 91 | 91 | 48 | 70 | 91 |
| 17 | ES | 43 | 77 | 13 | 23 | 39 | | 74 | 99 | 30 | 45 | 69 | | 99 | 99 | 46 | 66 | 98 |

## 175mm$^2$ Aluminium Alloy "Elm" - "NORMAL" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. (Deg.C) | Tension (kgf) | Tension (kN) | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** |
| -5.6 | 1646.67 | 16.15 | 0.07 | 0.11 | 0.17 | 0.23 | 0.29 | 0.37 | 0.46 | 0.56 | 0.66 | 0.78 | 0.90 | 1.03 | 1.18 | 1.33 | 1.49 | - |
| -4 | 1606.56 | 15.76 | 0.08 | 0.12 | 0.17 | 0.23 | 0.30 | 0.38 | 0.47 | 0.57 | 0.68 | 0.80 | 0.92 | 1.06 | 1.21 | 1.36 | 1.53 | - |
| 0 | 1507.62 | 14.79 | 0.08 | 0.13 | 0.18 | 0.25 | 0.32 | 0.41 | 0.50 | 0.61 | 0.72 | 0.85 | 0.98 | 1.13 | 1.29 | 1.45 | 1.63 | - |
| 4 | 1410.87 | 13.84 | 0.09 | 0.13 | 0.19 | 0.26 | 0.34 | 0.43 | 0.54 | 0.65 | 0.77 | 0.91 | 1.05 | 1.21 | 1.37 | 1.55 | 1.74 | - |
| 8 | 1316.78 | 12.92 | 0.09 | 0.14 | 0.21 | 0.28 | 0.37 | 0.47 | 0.58 | 0.70 | 0.83 | 0.97 | 1.13 | 1.29 | 1.47 | 1.66 | 1.86 | - |
| 12 | 1225.89 | 12.03 | 0.10 | 0.15 | 0.22 | 0.30 | 0.40 | 0.50 | 0.62 | 0.75 | 0.89 | 1.04 | 1.21 | 1.39 | 1.58 | 1.79 | 2.00 | - |
| 16 | 1138.77 | 11.17 | 0.11 | 0.17 | 0.24 | 0.33 | 0.43 | 0.54 | 0.66 | 0.80 | 0.96 | 1.12 | 1.30 | 1.50 | 1.70 | 1.92 | 2.15 | - |
| 20 | 1056.07 | 10.36 | 0.11 | 0.18 | 0.26 | 0.35 | 0.46 | 0.58 | 0.72 | 0.87 | 1.03 | 1.21 | 1.41 | 1.61 | 1.84 | 2.07 | 2.32 | - |
| 24 | 978.38 | 9.60 | 0.12 | 0.19 | 0.28 | 0.38 | 0.50 | 0.63 | 0.77 | 0.94 | 1.11 | 1.31 | 1.52 | 1.74 | 1.98 | 2.24 | 2.51 | - |
| 28 | 906.23 | 8.89 | 0.13 | 0.21 | 0.30 | 0.41 | 0.53 | 0.68 | 0.84 | 1.01 | 1.20 | 1.41 | 1.64 | 1.88 | 2.14 | 2.41 | 2.71 | - |
| 32 | 840.01 | 8.24 | 0.14 | 0.23 | 0.32 | 0.44 | 0.58 | 0.73 | 0.90 | 1.09 | 1.30 | 1.52 | 1.77 | 2.03 | 2.31 | 2.61 | 2.92 | - |
| 36 | 779.88 | 7.65 | 0.16 | 0.24 | 0.35 | 0.48 | 0.62 | 0.79 | 0.97 | 1.17 | 1.40 | 1.64 | 1.90 | 2.18 | 2.49 | 2.81 | 3.15 | - |

### DESIGN TABLE

| Temp. (Deg.C) | Tension (kgf) | Tension (kN) | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** |
| -5.6 | 1520.64 | 14.92 | 0.08 | 0.12 | 0.18 | 0.24 | 0.32 | 0.40 | 0.50 | 0.60 | 0.72 | 0.84 | 0.98 | 1.12 | 1.27 | 1.44 | 1.61 | - |
| 0 | 1385.46 | 13.59 | 0.09 | 0.14 | 0.20 | 0.27 | 0.35 | 0.44 | 0.55 | 0.66 | 0.79 | 0.92 | 1.07 | 1.23 | 1.40 | 1.58 | 1.77 | - |
| 30 | 793.33 | 7.78 | 0.15 | 0.24 | 0.34 | 0.47 | 0.61 | 0.77 | 0.95 | 1.16 | 1.37 | 1.61 | 1.87 | 2.15 | 2.44 | 2.76 | 3.09 | - |
| 50 | 570.44 | 5.60 | 0.21 | 0.33 | 0.48 | 0.65 | 0.85 | 1.08 | 1.33 | 1.61 | 1.91 | 2.24 | 2.60 | 2.99 | 3.40 | 3.84 | 4.30 | - |
| 55 | 532.64 | 5.23 | 0.23 | 0.36 | 0.51 | 0.70 | 0.91 | 1.15 | 1.42 | 1.72 | 2.05 | 2.40 | 2.79 | 3.20 | 3.64 | 4.11 | 4.61 | - |
| 60 | 500.02 | 4.91 | 0.24 | 0.38 | 0.55 | 0.74 | 0.97 | 1.23 | 1.51 | 1.83 | 2.18 | 2.56 | 2.97 | 3.41 | 3.88 | 4.38 | 4.91 | - |
| 65 | 471.72 | 4.63 | 0.26 | 0.40 | 0.58 | 0.79 | 1.03 | 1.30 | 1.61 | 1.94 | 2.31 | 2.71 | 3.15 | 3.61 | 4.11 | 4.64 | 5.20 | - |
| 70 | 447.02 | 4.39 | 0.27 | 0.42 | 0.61 | 0.83 | 1.08 | 1.37 | 1.69 | 2.05 | 2.44 | 2.86 | 3.32 | 3.81 | 4.34 | 4.90 | 5.49 | - |
| 75 | 425.31 | 4.17 | 0.28 | 0.45 | 0.64 | 0.87 | 1.14 | 1.44 | 1.78 | 2.15 | 2.56 | 3.01 | 3.49 | 4.01 | 4.56 | 5.15 | 5.77 | - |

## 175mm$^2$ Aluminium Alloy "Elm" - "SEVERE" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** |
| -5.6 | 1583.46 | 15.53 | 0.08 | 0.12 | 0.17 | 0.23 | 0.31 | 0.39 | 0.48 | 0.58 | 0.69 | 0.81 | 0.94 | 1.08 | 1.22 | - |
| -4 | 1542.41 | 15.13 | 0.08 | 0.12 | 0.18 | 0.24 | 0.31 | 0.40 | 0.49 | 0.59 | 0.71 | 0.83 | 0.96 | 1.10 | 1.26 | - |
| 0 | 1440.91 | 14.14 | 0.08 | 0.13 | 0.19 | 0.26 | 0.34 | 0.43 | 0.53 | 0.64 | 0.76 | 0.89 | 1.03 | 1.18 | 1.35 | - |
| 4 | 1341.33 | 13.16 | 0.09 | 0.14 | 0.20 | 0.28 | 0.36 | 0.46 | 0.56 | 0.68 | 0.81 | 0.95 | 1.11 | 1.27 | 1.45 | - |
| 8 | 1244.14 | 12.20 | 0.10 | 0.15 | 0.22 | 0.30 | 0.39 | 0.49 | 0.61 | 0.74 | 0.88 | 1.03 | 1.19 | 1.37 | 1.56 | - |
| 12 | 1149.92 | 11.28 | 0.11 | 0.16 | 0.24 | 0.32 | 0.42 | 0.53 | 0.66 | 0.80 | 0.95 | 1.11 | 1.29 | 1.48 | 1.69 | - |
| 16 | 1059.37 | 10.39 | 0.11 | 0.18 | 0.26 | 0.35 | 0.46 | 0.58 | 0.71 | 0.86 | 1.03 | 1.21 | 1.40 | 1.61 | 1.83 | - |
| 20 | 973.26 | 9.55 | 0.12 | 0.19 | 0.28 | 0.38 | 0.50 | 0.63 | 0.78 | 0.94 | 1.12 | 1.31 | 1.53 | 1.75 | 1.99 | - |
| 24 | 892.41 | 8.75 | 0.14 | 0.21 | 0.31 | 0.42 | 0.54 | 0.69 | 0.85 | 1.03 | 1.22 | 1.43 | 1.66 | 1.91 | 2.17 | - |
| 28 | 817.58 | 8.02 | 0.15 | 0.23 | 0.33 | 0.45 | 0.59 | 0.75 | 0.93 | 1.12 | 1.33 | 1.57 | 1.82 | 2.08 | 2.37 | - |
| 32 | 749.37 | 7.35 | 0.16 | 0.25 | 0.36 | 0.50 | 0.65 | 0.82 | 1.01 | 1.22 | 1.46 | 1.71 | 1.98 | 2.27 | 2.59 | - |
| 36 | 688.09 | 6.75 | 0.18 | 0.28 | 0.40 | 0.54 | 0.70 | 0.89 | 1.10 | 1.33 | 1.58 | 1.86 | 2.16 | 2.48 | 2.82 | - |

### DESIGN TABLE

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** |
| -5.6 | 1468.10 | 14.40 | 0.08 | 0.13 | 0.19 | 0.25 | 0.33 | 0.42 | 0.52 | 0.62 | 0.74 | 0.87 | 1.01 | 1.16 | 1.32 | - |
| 0 | 1328.50 | 13.03 | 0.09 | 0.14 | 0.21 | 0.28 | 0.36 | 0.46 | 0.57 | 0.69 | 0.82 | 0.96 | 1.12 | 1.28 | 1.46 | - |
| 30 | 709.92 | 6.96 | 0.17 | 0.27 | 0.38 | 0.52 | 0.68 | 0.86 | 1.07 | 1.29 | 1.54 | 1.80 | 2.09 | 2.40 | 2.73 | - |
| 50 | 487.63 | 4.78 | 0.25 | 0.39 | 0.56 | 0.76 | 0.99 | 1.26 | 1.55 | 1.88 | 2.24 | 2.62 | 3.04 | 3.49 | 3.98 | - |
| 55 | 452.00 | 4.43 | 0.27 | 0.42 | 0.60 | 0.82 | 1.07 | 1.36 | 1.68 | 2.03 | 2.41 | 2.83 | 3.28 | 3.77 | 4.29 | - |
| 60 | 421.81 | 4.14 | 0.29 | 0.45 | 0.65 | 0.88 | 1.15 | 1.45 | 1.80 | 2.17 | 2.59 | 3.03 | 3.52 | 4.04 | 4.60 | - |
| 65 | 396.04 | 3.89 | 0.31 | 0.48 | 0.69 | 0.94 | 1.22 | 1.55 | 1.91 | 2.31 | 2.75 | 3.23 | 3.75 | 4.30 | 4.90 | - |
| 70 | 373.84 | 3.67 | 0.32 | 0.51 | 0.73 | 0.99 | 1.30 | 1.64 | 2.03 | 2.45 | 2.92 | 3.42 | 3.97 | 4.56 | 5.19 | - |
| 75 | 354.57 | 3.48 | 0.34 | 0.53 | 0.77 | 1.05 | 1.37 | 1.73 | 2.14 | 2.58 | 3.08 | 3.61 | 4.19 | 4.81 | 5.47 | - |

# APPENDIX K

## 200 mm$^2$ Aluminium Alloy "Poplar"

- Conductor & Design Parameters
- Structure Suitability
- Stayed Pole Design Data
- Unstayed Pole Design Data
- Sags and Tensions

## 200mm$^2$ Aluminium Alloy "Poplar"

| Conductor Parameters: | |
|---|---|
| Conductor Stranding (#strands / diameter(mm)) | 37/2.87 |
| Greased Conductor Weight (kg/m) | 0.689 |
| Cross Sectional Area of Conductor (mm²) | 239.4 |
| Conductor Overall Diameter (mm) | 20.09 |
| Coefficient of Linear Expansion (/Degree C) | 2.30E-05 |
| Modulus of Elasticity (kg/mm²) | 5,700 |
| Rated Breaking Strength of Conductor (kgf) | 7,200.0 |

| Design Loading Parameters: | "Normal" | "Severe" |
|---|---|---|
| Basic / Recommended Span (m) | 130 | 110 |
| Wind Pressure on Conductor (N/m²) | 380 | 570 |
| Radial Ice Thickness (mm) | 9.5 | 12.5 |
| Ice Density (kg/m³) | 913 | 913 |
| Absolute Maximum Working Tension (MWT) Limit (kgf) | 2,379.0 | 2,379.0 |
| Temperature at MWT Limit (Degrees C) | -5.6 | -5.6 |
| Maximum "Everyday" Tension (EDT) Limit (kgf) | 1,440.0 | 1,314.4 |
| Temperature at EDT Limit (Degrees C) | 5.0 | -5.6 |
| Maximum Conductor Tension (MCT) at -5.6 degC (kgf) | 2,344.6 | 2,379.3 |
| Maximum Conductor Weight (MCW) (kg/m) | 1.495 | 1.857 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.515 | 2.621 |
| Freezing Point Tension (FPT) (kgf) | 1,563.6 | 1,183.0 |

| Span Length Limits: | "Normal" | "Severe" |
|---|---|---|
| Maximum **Equivalent** Span | 130 | 110 |
| *Maximum **Single** Span (clashing limit) (Standard heavy crossarm, 1.2m phase spacing) | 140 | 120 |
| *Maximum **Single** Span (clashing limit) (H Pole, long span heavy crossarm, 2.0m phase spacing) | 180 | 160 |

**NOTE: Single span limits to be reduced by 20m where weather zone is worse than 2B at "normal" altitudes, or worse than 3C at "severe" altitudes. Weather zones are given in Appendix O**

## 200mm$^2$ Aluminium Alloy "Poplar"

### Pole-Top Steelwork Suitability

| Grade | Structure Configuration | | Drg. Ref | Max. Dev'n Normal | Max. Dev'n Severe | Max. D'pull. | Notes |
|---|---|---|---|---|---|---|---|
| Light | Single Pole | Single Arm Intermediate / Pin Angle | F3 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Straight Section / Angle Section | F4 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Termination | F5 | Not Suitable | Not Suitable | Not Suitable | |
| Heavy | Single Pole | Single Arm Intermediate / Pin Angle | F7 | Not Suitable | Not Suitable | Not Suitable | |
| Heavy | Single Pole | Double Arm Intermediate / Pin Angle | F8 | 4º | 2º | 1:10 | |
| Heavy | Single Pole | Double Arm Straight Section / Angle Section | F9 | 36º | 32º | 1:10 | |
| Heavy | "H" Pole | Double Arm Angle Section | F10 | 60º | 60º | 1:10 | Limits as per F8 if used as intermediate |
| Heavy | "H" Pole | Double Arm Section / Inter. For long spans | F11 | 60º (section) | 60º (section) | 1:10 | No deviation allowed if used as intermediate |
| Heavy | "H" Pole | Double Arm Termination | F12 | O.K. | O.K. | 1:10 | |
| Heavy | Single Pole | Double Arm Termination | F13 | Not Suitable | Not Suitable | Not Suitable | |

## 200mm$^2$ Aluminium Alloy "Poplar" - "NORMAL" Loading Environment

### Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 2,344.6 |
| Wind Pressure (N/m²) | 380 |
| Maximum Conductor Weight (MCW) (kg/m) | 1.50 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.52 |
| Maximum Wind Span Length (m) | 180 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 17,584.6 |
| Transverse Load [Normal to Span] (kgf) | 2,044.9 |
| Vertical Load with Downpull (1:10) (kgf) | 6,346.4 |
| Pole Wind Loading (kgf) | 224.5 |

### Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|
| 0 | | 10,277 | 9,587 | 9,051 | 8,616 |
| 5 | | 12,931 | 11,776 | 10,877 | 10,148 |
| 10 | | 15,573 | 13,954 | 12,695 | 11,673 |
| 15 | | 18,198 | 16,118 | 14,501 | 13,189 |
| 20 | | 20,801 | 18,265 | 16,292 | 14,692 |
| 25 | | 23,378 | 20,389 | 18,065 | 16,179 |
| 30 | | 25,922 | 22,488 | 19,816 | 17,649 |
| 35 | | 28,431 | 24,556 | 21,542 | 19,097 |
| 40 | | 30,898 | 26,590 | 23,239 | 20,521 |
| 45 | | 33,319 | 28,586 | 24,905 | 21,919 |
| 50 | | 35,689 | 30,541 | 26,536 | 23,287 |
| 55 | | 38,004 | 32,450 | 28,129 | 24,624 |
| 60 | Terminal | 40,260 | 34,310 | 29,681 | 25,926 |

***NOTE: For H pole structure the load identified in each cell would be distributed evenly across each pole. However Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

### Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | 3 | 13 | 9 | 25 |
| 35 | Single | 4 | 16 | 11 | 30 |
| 40 | Pole | 6 | 20 | 14 | 35 |
| 45 | | 7 | 23 | 16 | 40 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | | 24 | 34 | 42 | 60 | x | x |
| 35 | "H" | 29 | 42 | 51 | 60 | x | x |
| 40 | Pole | 34 | 48 | 59 | 60 | x | x |
| 45 | | 38 | 55 | 60 | 60 | x | x |

# 200mm$^2$ Aluminium Alloy "Poplar" - "SEVERE" Loading Environment

## Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 2,379.0 |
| Wind Pressure (N/m²) | 570 |
| Maximum Conductor Weight (MCW) (kg/m) | 1.86 |
| Maximum Conductor Pressure (MCP) (kg/m) | 2.62 |
| Maximum Wind Span Length (m) | 160 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 17,845.0 |
| Transverse Load [Normal to Span] (kgf) | 3,145.0 |
| Vertical Load with Downpull (1:10) (kgf) | 6,608.5 |
| Pole Wind Loading (kgf) | 336.8 |

## Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|
| 0 | | 12,159 | 11,161 | 10,384 | 9,754 |
| 5 | | 14,851 | 13,380 | 12,236 | 11,308 |
| 10 | | 17,528 | 15,587 | 14,078 | 12,854 |
| 15 | | 20,184 | 17,778 | 15,906 | 14,388 |
| 20 | | 22,816 | 19,948 | 17,717 | 15,907 |
| 25 | | 25,418 | 22,093 | 19,507 | 17,409 |
| 30 | | 27,985 | 24,210 | 21,273 | 18,891 |
| 35 | | 30,512 | 26,293 | 23,012 | 20,350 |
| 40 | | 32,994 | 28,340 | 24,720 | 21,783 |
| 45 | | 35,427 | 30,346 | 26,394 | 23,188 |
| 50 | | 37,806 | 32,308 | 28,031 | 24,561 |
| 55 | | 40,126 | 34,221 | 29,627 | 25,901 |
| 60 | Terminal | 42,384 | 36,082 | 31,181 | 27,204 |

***NOTE: For H pole structure the load identified in each cell would be distributed evenly across each pole. However Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

## Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | no | 10 | 6 | 21 |
| 35 | Single | 1 | 13 | 8 | 27 |
| 40 | Pole | 3 | 16 | 10 | 32 |
| 45 | | 4 | 19 | 12 | 36 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | | 20 | 30 | 38 | 56 | x | x |
| 35 | "H" | 25 | 37 | 47 | 60 | x | x |
| 40 | Pole | 30 | 44 | 55 | 60 | x | x |
| 45 | | 34 | 51 | 60 | 60 | x | x |

# 200mm² Aluminium Alloy "Poplar" - "NORMAL" Loading Environment

## Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 380 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.52 |

## Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| Pole Length (m) and Grade | | Average / Poor Soil | | | | | Good / Average Soil | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | |
| | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 | M | 57 | 58 | 30 | 56 | 56 | 57 | 58 | 49 | 56 | 56 | 57 | 58 | 56 | 56 | 56 |
| 9 | M | 57 | 57 | 29 | 56 | 56 | 57 | 57 | 46 | 56 | 56 | 57 | 57 | 56 | 56 | 56 |
| 9.5 | M | 56 | 57 | 27 | 55 | 55 | 56 | 57 | 44 | 55 | 55 | 56 | 57 | 55 | 55 | 55 |
| 10 | M | 56 | 56 | 25 | 52 | 56 | 56 | 56 | 42 | 56 | 56 | 56 | 56 | 56 | 56 | 56 |
| 10.5 | M | 56 | 56 | 24 | 50 | 56 | 56 | 56 | 40 | 56 | 56 | 56 | 56 | 56 | 56 | 56 |
| 11 | M | 56 | 56 | 23 | 47 | 56 | 56 | 56 | 38 | 56 | 56 | 56 | 56 | 54 | 56 | 56 |
| 11.5 | M | 56 | 56 | 21 | 44 | 56 | 56 | 56 | 37 | 56 | 56 | 56 | 56 | 52 | 56 | 56 |
| 12 | M | 56 | 56 | 20 | 42 | 56 | 56 | 56 | 35 | 56 | 56 | 56 | 56 | 50 | 56 | 56 |
| 13 | M | 57 | 58 | 17 | 37 | 58 | 58 | 58 | 32 | 58 | 58 | 58 | 58 | 46 | 58 | 58 |
| 14 | M | 54 | 62 | 32 | 56 | 62 | 62 | 62 | 54 | 62 | 62 | 62 | 62 | 62 | 62 | 62 |
| 15 | M | 67 | 67 | 30 | 52 | 67 | 67 | 67 | 52 | 67 | 67 | 67 | 67 | 67 | 67 | 67 |
| 16 | M | 67 | 72 | 28 | 48 | 72 | 72 | 72 | 49 | 72 | 72 | 72 | 72 | 71 | 72 | 72 |
| 17 | M | 64 | 78 | 25 | 44 | 74 | 78 | 78 | 46 | 74 | 78 | 78 | 78 | 67 | 78 | 78 |
| 18 | M | 60 | 78 | 23 | 40 | 68 | 78 | 78 | 43 | 69 | 78 | 78 | 78 | 64 | 78 | 78 |
| 20 | M | 55 | 85 | 18 | 34 | 58 | 85 | 85 | 39 | 61 | 85 | 85 | 85 | 59 | 85 | 85 |
| 22 | M | 48 | 88 | 13 | 26 | 48 | 85 | 90 | 32 | 52 | 85 | 90 | 90 | 52 | 79 | 90 |
| 10 | MS | 81 | 84 | 29 | 55 | 83 | 84 | 84 | 47 | 83 | 83 | 84 | 84 | 66 | 83 | 83 |
| 11 | MS | 75 | 83 | 25 | 49 | 81 | 83 | 83 | 43 | 78 | 83 | 83 | 83 | 60 | 83 | 83 |
| 12 | MS | 70 | 88 | 23 | 44 | 73 | 88 | 88 | 40 | 71 | 88 | 88 | 88 | 57 | 88 | 88 |
| 13 | MS | 65 | 88 | 20 | 39 | 65 | 88 | 88 | 36 | 65 | 88 | 88 | 88 | 52 | 88 | 88 |
| 8.5 | S | 101 | 115 | 37 | 68 | 110 | 113 | 115 | 60 | 106 | 111 | 113 | 115 | 82 | 111 | 111 |
| 9 | S | 98 | 118 | 36 | 65 | 104 | 117 | 118 | 58 | 101 | 115 | 117 | 118 | 80 | 115 | 115 |
| 9.5 | S | 93 | 116 | 34 | 61 | 97 | 115 | 116 | 55 | 95 | 113 | 115 | 116 | 76 | 113 | 113 |
| 10 | S | 89 | 114 | 31 | 57 | 92 | 113 | 114 | 52 | 90 | 112 | 113 | 114 | 72 | 112 | 112 |
| 10.5 | S | 85 | 112 | 30 | 54 | 87 | 112 | 112 | 49 | 86 | 111 | 112 | 112 | 69 | 111 | 111 |
| 11 | S | 81 | 111 | 28 | 51 | 82 | 110 | 111 | 47 | 81 | 110 | 110 | 111 | 66 | 110 | 110 |
| 11.5 | S | 78 | 110 | 26 | 48 | 78 | 110 | 110 | 45 | 77 | 110 | 110 | 110 | 63 | 107 | 110 |
| 12 | S | 75 | 109 | 24 | 45 | 73 | 109 | 109 | 42 | 74 | 109 | 109 | 109 | 61 | 102 | 109 |
| 13 | S | 71 | 114 | 22 | 40 | 66 | 112 | 114 | 39 | 67 | 106 | 114 | 114 | 57 | 94 | 114 |
| 14 | S | 66 | 115 | 39 | 62 | 98 | 107 | 118 | 66 | 100 | 118 | 118 | 118 | 94 | 118 | 118 |
| 15 | S | 84 | 122 | 36 | 57 | 90 | 122 | 122 | 63 | 94 | 122 | 122 | 122 | 89 | 122 | 122 |
| 16 | S | 80 | 127 | 33 | 52 | 83 | 127 | 127 | 59 | 87 | 127 | 127 | 127 | 85 | 123 | 127 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | S | 75 | 126 | 30 | 48 | 76 | | 122 | 126 | 55 | 81 | 124 | | 126 | 126 | 80 | 115 | 126 |
| 18 | S | 72 | 122 | 27 | 44 | 70 | | 118 | 129 | 52 | 76 | 115 | | 129 | 129 | 76 | 109 | 129 |
| 20 | S | 64 | 112 | 22 | 36 | 59 | | 108 | 130 | 45 | 66 | 101 | | 130 | 130 | 68 | 97 | 130 |
| 22 | S | 56 | 102 | 16 | 28 | 49 | | 98 | 128 | 38 | 57 | 87 | | 128 | 128 | 60 | 85 | 126 |
| | | | | | | | | | | | | | | | | | | |
| 9 | ES | 107 | 150 | 40 | 68 | 106 | | 150 | 150 | 64 | 106 | 150 | | 150 | 150 | 88 | 144 | 150 |
| 9.5 | ES | 102 | 147 | 37 | 64 | 99 | | 147 | 147 | 60 | 100 | 147 | | 147 | 147 | 84 | 136 | 147 |
| 10 | ES | 95 | 142 | 34 | 59 | 93 | | 141 | 142 | 55 | 93 | 139 | | 141 | 142 | 77 | 127 | 139 |
| 10.5 | ES | 92 | 147 | 32 | 56 | 88 | | 144 | 147 | 54 | 89 | 137 | | 146 | 147 | 75 | 122 | 145 |
| 11 | ES | 88 | 145 | 30 | 52 | 83 | | 138 | 145 | 51 | 84 | 130 | | 144 | 145 | 71 | 116 | 143 |
| 11.5 | ES | 86 | 145 | 28 | 50 | 78 | | 135 | 150 | 49 | 81 | 124 | | 150 | 150 | 69 | 112 | 149 |
| 12 | ES | 82 | 139 | 27 | 47 | 74 | | 130 | 149 | 46 | 77 | 118 | | 148 | 149 | 66 | 107 | 148 |
| 13 | ES | 77 | 132 | 24 | 42 | 67 | | 123 | 153 | 43 | 70 | 107 | | 153 | 153 | 62 | 99 | 148 |
| 14 | ES | 72 | 125 | 20 | 37 | 60 | | 116 | 158 | 39 | 64 | 98 | | 158 | 158 | 58 | 91 | 136 |
| 15 | ES | 90 | 149 | 39 | 59 | 91 | | 144 | 156 | 67 | 97 | 145 | | 156 | 156 | 95 | 135 | 156 |
| 16 | ES | 85 | 142 | 35 | 54 | 83 | | 138 | 160 | 63 | 90 | 135 | | 160 | 160 | 90 | 127 | 160 |
| 17 | ES | 83 | 140 | 33 | 50 | 77 | | 136 | 173 | 61 | 86 | 127 | | 173 | 173 | 88 | 122 | 173 |

# 200mm² Aluminium Alloy "Poplar" - "SEVERE" Loading Environment

## Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 570 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 2.62 |

## Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| Pole Length (m) and Grade | | Average / Poor Soil | | | | | Good / Average Soil | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | |
| | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 | M | 31 | 32 | 16 | 30 | 30 | 31 | 32 | 26 | 30 | 30 | 31 | 32 | 30 | 30 | 30 |
| 9 | M | 30 | 31 | 15 | 30 | 30 | 30 | 31 | 25 | 30 | 30 | 30 | 31 | 30 | 30 | 30 |
| 9.5 | M | 30 | 30 | 13 | 30 | 30 | 30 | 30 | 23 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| 10 | M | 30 | 30 | 12 | 28 | 30 | 30 | 30 | 22 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| 10.5 | M | 30 | 30 | 11 | 26 | 30 | 30 | 30 | 21 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| 11 | M | 30 | 30 | 10 | 24 | 30 | 30 | 30 | 20 | 30 | 30 | 30 | 30 | 29 | 30 | 30 |
| 11.5 | M | 30 | 30 | 10 | 23 | 30 | 30 | 30 | 18 | 30 | 30 | 30 | 30 | 27 | 30 | 30 |
| 12 | M | 30 | 30 | 9 | 21 | 30 | 30 | 30 | 17 | 30 | 30 | 30 | 30 | 26 | 30 | 30 |
| 13 | M | 30 | 30 | 7 | 18 | 30 | 30 | 30 | 15 | 30 | 30 | 30 | 30 | 23 | 30 | 30 |
| 14 | M | 28 | 33 | 5 | 16 | 30 | 33 | 33 | 13 | 29 | 33 | 33 | 33 | 21 | 33 | 33 |
| 15 | M | 36 | 36 | 13 | 26 | 36 | 36 | 36 | 26 | 36 | 36 | 36 | 36 | 36 | 36 | 36 |
| 16 | M | 34 | 38 | 11 | 23 | 38 | 38 | 38 | 24 | 38 | 38 | 38 | 38 | 36 | 38 | 38 |
| 17 | M | 32 | 41 | 9 | 20 | 38 | 41 | 41 | 22 | 38 | 41 | 41 | 41 | 34 | 41 | 41 |
| 18 | M | 29 | 42 | 8 | 18 | 34 | 42 | 42 | 19 | 35 | 42 | 42 | 42 | 31 | 42 | 42 |
| 20 | M | 26 | 46 | 4 | 13 | 27 | 46 | 46 | 16 | 29 | 46 | 46 | 46 | 27 | 45 | 46 |
| 22 | M | 21 | 44 | 0 | 8 | 20 | 42 | 48 | 11 | 23 | 42 | 48 | 48 | 22 | 38 | 48 |
| | | | | | | | | | | | | | | | | |
| 10 | MS | 44 | 46 | 14 | 29 | 45 | 46 | 46 | 25 | 45 | 45 | 46 | 46 | 36 | 45 | 45 |
| 11 | MS | 40 | 45 | 12 | 25 | 44 | 45 | 45 | 22 | 42 | 45 | 45 | 45 | 32 | 45 | 45 |
| 12 | MS | 37 | 48 | 10 | 22 | 39 | 48 | 48 | 20 | 38 | 48 | 48 | 48 | 29 | 48 | 48 |
| 13 | MS | 34 | 48 | 8 | 19 | 34 | 48 | 48 | 17 | 34 | 48 | 48 | 48 | 26 | 48 | 48 |
| | | | | | | | | | | | | | | | | |
| 8.5 | S | 56 | 64 | 19 | 37 | 61 | 63 | 64 | 32 | 59 | 61 | 63 | 64 | 45 | 61 | 61 |
| 9 | S | 54 | 66 | 18 | 35 | 57 | 65 | 66 | 31 | 56 | 64 | 65 | 66 | 44 | 64 | 64 |
| 9.5 | S | 51 | 64 | 17 | 32 | 54 | 63 | 64 | 29 | 53 | 63 | 63 | 64 | 41 | 63 | 63 |
| 10 | S | 49 | 63 | 15 | 30 | 50 | 62 | 63 | 27 | 49 | 62 | 62 | 63 | 39 | 62 | 62 |
| 10.5 | S | 46 | 62 | 14 | 28 | 47 | 61 | 62 | 26 | 47 | 61 | 61 | 62 | 37 | 61 | 61 |
| 11 | S | 44 | 61 | 13 | 26 | 44 | 61 | 61 | 24 | 44 | 61 | 61 | 61 | 35 | 61 | 61 |
| 11.5 | S | 42 | 60 | 12 | 24 | 41 | 60 | 60 | 22 | 41 | 60 | 60 | 60 | 33 | 58 | 60 |
| 12 | S | 40 | 60 | 11 | 23 | 39 | 60 | 60 | 21 | 39 | 60 | 60 | 60 | 32 | 56 | 60 |
| 13 | S | 37 | 63 | 8 | 19 | 34 | 61 | 63 | 19 | 35 | 57 | 63 | 63 | 29 | 51 | 63 |
| 14 | S | 34 | 62 | 7 | 17 | 30 | 58 | 65 | 16 | 31 | 52 | 65 | 65 | 26 | 46 | 65 |
| 15 | S | 44 | 67 | 16 | 28 | 47 | 67 | 67 | 31 | 49 | 67 | 67 | 67 | 47 | 67 | 67 |
| 16 | S | 41 | 70 | 14 | 25 | 42 | 69 | 70 | 29 | 45 | 70 | 70 | 70 | 44 | 66 | 70 |
| 17 | S | 38 | 68 | 12 | 22 | 38 | 65 | 69 | 26 | 41 | 66 | 69 | 69 | 40 | 61 | 69 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | S | 35 | 64 | 9 | 19 | 34 | | 62 | 71 | 24 | 38 | 60 | | 71 | 71 | 38 | 57 | 71 |
| 20 | S | 30 | 58 | 5 | 13 | 27 | | 55 | 72 | 19 | 31 | 51 | | 72 | 72 | 32 | 49 | 72 |
| 22 | S | 24 | 51 | 1 | 8 | 20 | | 49 | 71 | 14 | 25 | 42 | | 71 | 71 | 26 | 41 | 65 |
| | | | | | | | | | | | | | | | | | | |
| 9 | ES | 60 | 84 | 20 | 37 | 59 | | 84 | 84 | 34 | 59 | 84 | | 84 | 84 | 48 | 81 | 84 |
| 9.5 | ES | 56 | 82 | 19 | 34 | 55 | | 82 | 82 | 32 | 55 | 82 | | 82 | 82 | 46 | 76 | 82 |
| 10 | ES | 52 | 79 | 16 | 31 | 51 | | 78 | 79 | 29 | 51 | 77 | | 78 | 79 | 42 | 71 | 77 |
| 10.5 | ES | 50 | 82 | 15 | 29 | 47 | | 80 | 82 | 28 | 48 | 76 | | 81 | 82 | 40 | 67 | 80 |
| 11 | ES | 48 | 81 | 14 | 27 | 44 | | 76 | 81 | 26 | 45 | 72 | | 80 | 81 | 38 | 64 | 79 |
| 11.5 | ES | 46 | 80 | 13 | 25 | 42 | | 74 | 83 | 25 | 43 | 68 | | 83 | 83 | 36 | 61 | 83 |
| 12 | ES | 44 | 77 | 11 | 23 | 39 | | 71 | 82 | 23 | 40 | 64 | | 82 | 82 | 34 | 58 | 82 |
| 13 | ES | 40 | 72 | 9 | 20 | 34 | | 67 | 85 | 20 | 36 | 58 | | 85 | 85 | 31 | 53 | 81 |
| 14 | ES | 37 | 68 | 7 | 17 | 30 | | 63 | 88 | 18 | 32 | 52 | | 88 | 88 | 28 | 48 | 74 |
| 15 | ES | 47 | 81 | 17 | 29 | 47 | | 78 | 86 | 33 | 51 | 79 | | 86 | 86 | 50 | 73 | 86 |
| 16 | ES | 44 | 77 | 15 | 25 | 42 | | 74 | 89 | 31 | 47 | 72 | | 89 | 89 | 46 | 68 | 89 |
| 17 | ES | 42 | 75 | 13 | 23 | 38 | | 72 | 96 | 29 | 43 | 67 | | 96 | 96 | 45 | 64 | 95 |

## 200mm$^2$ Aluminium Alloy "Poplar" - "NORMAL" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 1868.10 | 18.33 | 0.07 | 0.12 | 0.17 | 0.23 | 0.30 | 0.37 | 0.46 | 0.56 | 0.66 | 0.78 | 0.90 | 1.04 | 1.18 | 1.33 | 1.49 | - | - |
| -4 | 1822.60 | 17.88 | 0.08 | 0.12 | 0.17 | 0.23 | 0.30 | 0.38 | 0.47 | 0.57 | 0.68 | 0.80 | 0.93 | 1.06 | 1.21 | 1.37 | 1.53 | - | - |
| 0 | 1710.40 | 16.78 | 0.08 | 0.13 | 0.18 | 0.25 | 0.32 | 0.41 | 0.50 | 0.61 | 0.73 | 0.85 | 0.99 | 1.13 | 1.29 | 1.46 | 1.63 | - | - |
| 4 | 1600.70 | 15.70 | 0.09 | 0.13 | 0.19 | 0.26 | 0.34 | 0.44 | 0.54 | 0.65 | 0.77 | 0.91 | 1.05 | 1.21 | 1.38 | 1.55 | 1.74 | - | - |
| 8 | 1494.00 | 14.66 | 0.09 | 0.14 | 0.21 | 0.28 | 0.37 | 0.47 | 0.58 | 0.70 | 0.83 | 0.97 | 1.13 | 1.30 | 1.48 | 1.67 | 1.87 | - | - |
| 12 | 1390.90 | 13.64 | 0.10 | 0.15 | 0.22 | 0.30 | 0.40 | 0.50 | 0.62 | 0.75 | 0.89 | 1.05 | 1.21 | 1.39 | 1.59 | 1.79 | 2.01 | - | - |
| 16 | 1292.20 | 12.68 | 0.11 | 0.17 | 0.24 | 0.33 | 0.43 | 0.54 | 0.67 | 0.81 | 0.96 | 1.13 | 1.31 | 1.50 | 1.71 | 1.93 | 2.16 | - | - |
| 20 | 1198.40 | 11.76 | 0.11 | 0.18 | 0.26 | 0.35 | 0.46 | 0.58 | 0.72 | 0.87 | 1.03 | 1.21 | 1.41 | 1.62 | 1.84 | 2.08 | 2.33 | - | - |
| 24 | 1110.40 | 10.89 | 0.12 | 0.19 | 0.28 | 0.38 | 0.50 | 0.63 | 0.78 | 0.94 | 1.12 | 1.31 | 1.52 | 1.75 | 1.99 | 2.24 | 2.51 | - | - |
| 28 | 1028.60 | 10.09 | 0.13 | 0.21 | 0.30 | 0.41 | 0.54 | 0.68 | 0.84 | 1.01 | 1.21 | 1.42 | 1.64 | 1.88 | 2.14 | 2.42 | 2.71 | - | - |
| 32 | 953.60 | 9.35 | 0.14 | 0.23 | 0.33 | 0.44 | 0.58 | 0.73 | 0.90 | 1.09 | 1.30 | 1.53 | 1.77 | 2.03 | 2.31 | 2.61 | 2.93 | - | - |
| 36 | 885.40 | 8.69 | 0.16 | 0.24 | 0.35 | 0.48 | 0.62 | 0.79 | 0.97 | 1.18 | 1.40 | 1.64 | 1.91 | 2.19 | 2.49 | 2.81 | 3.15 | - | - |

### DESIGN TABLE

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 1725.00 | 16.92 | 0.08 | 0.12 | 0.18 | 0.24 | 0.32 | 0.40 | 0.50 | 0.60 | 0.72 | 0.84 | 0.98 | 1.12 | 1.28 | 1.44 | 1.62 | - | - |
| 0 | 1571.70 | 15.42 | 0.09 | 0.14 | 0.20 | 0.27 | 0.35 | 0.44 | 0.55 | 0.66 | 0.79 | 0.93 | 1.07 | 1.23 | 1.40 | 1.58 | 1.78 | - | - |
| 30 | 900.60 | 8.83 | 0.15 | 0.24 | 0.34 | 0.47 | 0.61 | 0.77 | 0.96 | 1.16 | 1.38 | 1.62 | 1.87 | 2.15 | 2.45 | 2.76 | 3.10 | - | - |
| 50 | 648.00 | 6.36 | 0.21 | 0.33 | 0.48 | 0.65 | 0.85 | 1.08 | 1.33 | 1.61 | 1.91 | 2.25 | 2.61 | 2.99 | 3.40 | 3.84 | 4.31 | - | - |
| 55 | 605.10 | 5.94 | 0.23 | 0.36 | 0.51 | 0.70 | 0.91 | 1.15 | 1.42 | 1.72 | 2.05 | 2.41 | 2.79 | 3.20 | 3.64 | 4.11 | 4.61 | - | - |
| 60 | 568.10 | 5.57 | 0.24 | 0.38 | 0.55 | 0.74 | 0.97 | 1.23 | 1.52 | 1.83 | 2.18 | 2.56 | 2.97 | 3.41 | 3.88 | 4.38 | 4.91 | - | - |
| 65 | 536.00 | 5.26 | 0.26 | 0.40 | 0.58 | 0.79 | 1.03 | 1.30 | 1.61 | 1.94 | 2.31 | 2.72 | 3.15 | 3.62 | 4.11 | 4.64 | 5.21 | - | - |
| 70 | 508.00 | 4.98 | 0.27 | 0.42 | 0.61 | 0.83 | 1.09 | 1.37 | 1.70 | 2.05 | 2.44 | 2.87 | 3.32 | 3.81 | 4.34 | 4.90 | 5.49 | - | - |
| 75 | 483.40 | 4.74 | 0.29 | 0.45 | 0.64 | 0.87 | 1.14 | 1.44 | 1.78 | 2.16 | 2.57 | 3.01 | 3.49 | 4.01 | 4.56 | 5.15 | 5.77 | - | - |

## 200mm$^2$ Aluminium Alloy "Poplar" - "SEVERE" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 1432.10 | 14.05 | 0.10 | 0.15 | 0.22 | 0.29 | 0.38 | 0.49 | 0.60 | 0.73 | 0.87 | 1.02 | 1.18 | 1.35 | - | - | - | - | - |
| -4 | 1388.60 | 13.62 | 0.10 | 0.16 | 0.22 | 0.30 | 0.40 | 0.50 | 0.62 | 0.75 | 0.89 | 1.05 | 1.22 | 1.40 | - | - | - | - | - |
| 0 | 1282.60 | 12.58 | 0.11 | 0.17 | 0.24 | 0.33 | 0.43 | 0.54 | 0.67 | 0.81 | 0.97 | 1.13 | 1.32 | 1.51 | - | - | - | - | - |
| 4 | 1180.90 | 11.58 | 0.12 | 0.18 | 0.26 | 0.36 | 0.47 | 0.59 | 0.73 | 0.88 | 1.05 | 1.23 | 1.43 | 1.64 | - | - | - | - | - |
| 8 | 1084.50 | 10.64 | 0.13 | 0.20 | 0.29 | 0.39 | 0.51 | 0.64 | 0.79 | 0.96 | 1.14 | 1.34 | 1.56 | 1.79 | - | - | - | - | - |
| 12 | 994.20 | 9.75 | 0.14 | 0.22 | 0.31 | 0.42 | 0.55 | 0.70 | 0.87 | 1.05 | 1.25 | 1.46 | 1.70 | 1.95 | - | - | - | - | - |
| 16 | 911.00 | 8.94 | 0.15 | 0.24 | 0.34 | 0.46 | 0.61 | 0.77 | 0.95 | 1.14 | 1.36 | 1.60 | 1.85 | 2.13 | - | - | - | - | - |
| 20 | 835.30 | 8.19 | 0.16 | 0.26 | 0.37 | 0.51 | 0.66 | 0.84 | 1.03 | 1.25 | 1.48 | 1.74 | 2.02 | 2.32 | - | - | - | - | - |
| 24 | 767.60 | 7.53 | 0.18 | 0.28 | 0.40 | 0.55 | 0.72 | 0.91 | 1.12 | 1.36 | 1.62 | 1.90 | 2.20 | 2.52 | - | - | - | - | - |
| 28 | 707.60 | 6.94 | 0.19 | 0.30 | 0.44 | 0.60 | 0.78 | 0.99 | 1.22 | 1.47 | 1.75 | 2.06 | 2.39 | 2.74 | - | - | - | - | - |
| 32 | 655.00 | 6.43 | 0.21 | 0.33 | 0.47 | 0.64 | 0.84 | 1.07 | 1.31 | 1.59 | 1.89 | 2.22 | 2.58 | 2.96 | - | - | - | - | - |
| 36 | 609.10 | 5.98 | 0.23 | 0.35 | 0.51 | 0.69 | 0.90 | 1.15 | 1.41 | 1.71 | 2.04 | 2.39 | 2.77 | 3.18 | - | - | - | - | - |

### DESIGN TABLE

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 1314.40 | 12.89 | 0.10 | 0.16 | 0.24 | 0.32 | 0.42 | 0.53 | 0.66 | 0.79 | 0.94 | 1.11 | 1.28 | 1.47 | - | - | - | - | - |
| 0 | 1171.40 | 11.49 | 0.12 | 0.18 | 0.26 | 0.36 | 0.47 | 0.60 | 0.74 | 0.89 | 1.06 | 1.24 | 1.44 | 1.65 | - | - | - | - | - |
| 30 | 626.90 | 6.15 | 0.22 | 0.34 | 0.49 | 0.67 | 0.88 | 1.11 | 1.37 | 1.66 | 1.98 | 2.32 | 2.69 | 3.09 | - | - | - | - | - |
| 50 | 462.90 | 4.54 | 0.30 | 0.47 | 0.67 | 0.91 | 1.19 | 1.51 | 1.86 | 2.25 | 2.68 | 3.14 | 3.65 | 4.19 | - | - | - | - | - |
| 55 | 436.00 | 4.28 | 0.32 | 0.49 | 0.71 | 0.97 | 1.26 | 1.60 | 1.98 | 2.39 | 2.84 | 3.34 | 3.87 | 4.44 | - | - | - | - | - |
| 60 | 412.70 | 4.05 | 0.33 | 0.52 | 0.75 | 1.02 | 1.34 | 1.69 | 2.09 | 2.53 | 3.01 | 3.53 | 4.09 | 4.70 | - | - | - | - | - |
| 65 | 392.30 | 3.85 | 0.35 | 0.55 | 0.79 | 1.08 | 1.40 | 1.78 | 2.20 | 2.66 | 3.16 | 3.71 | 4.30 | 4.94 | - | - | - | - | - |
| 70 | 374.40 | 3.67 | 0.37 | 0.58 | 0.83 | 1.13 | 1.47 | 1.86 | 2.30 | 2.78 | 3.31 | 3.89 | 4.51 | 5.18 | - | - | - | - | - |
| 75 | 358.60 | 3.52 | 0.38 | 0.60 | 0.86 | 1.18 | 1.54 | 1.95 | 2.40 | 2.91 | 3.46 | 4.06 | 4.71 | 5.40 | - | - | - | - | - |

## 300 $mm^2$ All Aluminium Conductor (AAC) "Butterfly"

- Conductor & Design Parameters
- Structure Suitability
- Stayed Pole Design Data
- Unstayed Pole Design Data
- Sags and Tensions

## 300mm$^2$ All Aluminium Conductor (AAC) "Butterfly"

### Conductor Parameters:

| | |
|---|---|
| Conductor Stranding (#strands / diameter(mm)) | 19/4.65 |
| Greased Conductor Weight (kg/m) | 0.919 |
| Cross Sectional Area of Conductor (mm²) | 322.7 |
| Conductor Overall Diameter (mm) | 23.30 |
| Coefficient of Linear Expansion (/Degree C) | 2.30E-05 |
| Modulus of Elasticity (kg/mm²) | 5,700 |
| Rated Breaking Strength of Conductor (kgf) | 4,966.0 |

| **Design Loading Parameters:** | **"Normal"** | **"Severe"** |
|---|---|---|
| Basic / Recommended Span (m) | 130 | 110 |
| Wind Pressure on Conductor (N/m²) | 380 | 570 |
| Radial Ice Thickness (mm) | 9.5 | 12.5 |
| Ice Density (kg/m³) | 913 | 913 |
| Absolute Maximum Working Tension (MWT) Limit (kgf) | 2,379.0 | 2,379.0 |
| Temperature at MWT Limit (Degrees C) | -5.6 | -5.6 |
| Maximum "Everyday" Tension (EDT) Limit (kgf) | 993.2 | 1,030.4 |
| Temperature at EDT Limit (Degrees C) | 5.0 | -5.6 |
| Maximum Conductor Tension (MCT) at -5.6 degC (kgf) | 2,095.1 | 2,379.0 |
| Maximum Conductor Weight (MCW) (kg/m) | 1.813 | 2.203 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.639 | 2.807 |
| Freezing Point Tension (FPT) (kgf) | 1,063.3 | 940.8 |

| **Span Length Limits:** | **"Normal"** | **"Severe"** |
|---|---|---|
| Maximum **Equivalent** Span | 130 | 110 |
| *Maximum **Single** Span (clashing limit)<br>(Standard heavy crossarm, 1.2m phase spacing) | 130 | 115 |
| *Maximum **Single** Span (clashing limit)<br>(H Pole, long span heavy crossarm, 2.0m phase spacing) | 170 | 150 |

**NOTE: Single span limits to be reduced by 15m where weather zone is worse than 2B at "normal" altitudes, or worse than 3C at "severe" altitudes. Weather zones are given in Appendix O**

# 300mm$^2$ All Aluminium Conductor (AAC) "Butterfly"

## Pole-Top Steelwork Suitability

| Grade | Structure Configuration | | Drg. Ref | Max. Dev'n Normal | Max. Dev'n Severe | Max. D'pull. | Notes |
|---|---|---|---|---|---|---|---|
| Light | Single Pole | Single Arm Intermediate / Pin Angle | F3 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Straight Section / Angle Section | F4 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Termination | F5 | Not Suitable | Not Suitable | Not Suitable | |
| Heavy | Single Pole | Single Arm Intermediate / Pin Angle | F7 | Not Suitable | Not Suitable | Not Suitable | |
| Heavy | Single Pole | Double Arm Intermediate / Pin Angle | F8 | 5º | 2º | 1:10 | |
| Heavy | Single Pole | Double Arm Straight Section / Angle Section | F9 | 44º | 30º | 1:10 | |
| Heavy | "H" Pole | Double Arm Angle Section | F10 | 60º | 60º | 1:10 | Limits as per F8 if used as intermediate |
| Heavy | "H" Pole | Double Arm Section / Inter. For long spans | F11 | 60º (section) | 60º (section) | 1:10 | No deviation allowed if used as intermediate |
| Heavy | "H" Pole | Double Arm Termination | F12 | O.K. | O.K. | 1:10 | |
| Heavy | Single Pole | Double Arm Termination | F13 | Not Suitable | Not Suitable | Not Suitable | |

# 300mm$^2$ All Aluminium Conductor (AAC) "Butterfly" - "NORMAL" Environment

## Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 2,095.1 |
| Wind Pressure (N/m²) | 380 |
| Maximum Conductor Weight (MCW) (kg/m) | 1.81 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.64 |
| Maximum Wind Span Length (m) | 170 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 15,713.3 |
| Transverse Load [Normal to Span] (kgf) | 2,089.8 |
| Vertical Load with Downpull (1:10) (kgf) | 6,266.6 |
| Pole Wind Loading (kgf) | 224.5 |

## Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|
| 0 | | 10,275 | 9,572 | 9,025 | 8,581 |
| 5 | | 12,646 | 11,527 | 10,656 | 9,950 |
| 10 | | 15,006 | 13,472 | 12,280 | 11,312 |
| 15 | | 17,349 | 15,405 | 13,892 | 12,665 |
| 20 | | 19,672 | 17,320 | 15,491 | 14,006 |
| 25 | | 21,971 | 19,215 | 17,072 | 15,333 |
| 30 | | 24,240 | 21,087 | 18,633 | 16,644 |
| 35 | | 26,476 | 22,930 | 20,172 | 17,934 |
| 40 | | 28,674 | 24,742 | 21,684 | 19,204 |
| 45 | | 30,830 | 26,520 | 23,168 | 20,448 |
| 50 | | 32,940 | 28,260 | 24,620 | 21,667 |
| 55 | | 35,000 | 29,959 | 26,037 | 22,856 |
| 60 | Terminal | 37,007 | 31,613 | 27,418 | 24,014 |

***NOTE: Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

## Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | 3 | 15 | 10 | 28 |
| 35 | Single | 5 | 18 | 13 | 34 |
| 40 | Pole | 7 | 22 | 15 | 40 |
| 45 | | 8 | 25 | 18 | 45 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | | 27 | 39 | 48 | 60 | x | x |
| 35 | "H" | 32 | 47 | 58 | 60 | x | x |
| 40 | Pole | 38 | 55 | 60 | 60 | x | x |
| 45 | | 43 | 60 | 60 | 60 | x | x |

# 300mm$^2$ All Aluminium Conductor (AAC) "Butterfly" - "SEVERE" Environment

## Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 2,379.0 |
| Wind Pressure (N/m²) | 570 |
| Maximum Conductor Weight (MCW) (kg/m) | 2.20 |
| Maximum Conductor Pressure (MCP) (kg/m) | 2.81 |
| Maximum Wind Span Length (m) | 150 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 17,842.5 |
| Transverse Load [Normal to Span] (kgf) | 3,158.3 |
| Vertical Load with Downpull (1:10) (kgf) | 6,857.0 |
| Pole Wind Loading (kgf) | 336.8 |

## Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|
| 0 | | 12,911 | 11,848 | 11,022 | 10,352 |
| 5 | | 15,601 | 14,067 | 12,874 | 11,906 |
| 10 | | 18,277 | 16,273 | 14,714 | 13,450 |
| 15 | | 20,931 | 18,462 | 16,541 | 14,983 |
| 20 | | 23,560 | 20,630 | 18,350 | 16,501 |
| 25 | | 26,159 | 22,772 | 20,138 | 18,001 |
| 30 | | 28,721 | 24,885 | 21,901 | 19,480 |
| 35 | | 31,244 | 26,965 | 23,636 | 20,937 |
| 40 | | 33,720 | 29,007 | 25,341 | 22,367 |
| 45 | | 36,147 | 31,008 | 27,010 | 23,768 |
| 50 | | 38,519 | 32,964 | 28,643 | 25,137 |
| 55 | | 40,832 | 34,871 | 30,234 | 26,473 |
| 60 | Terminal | 43,082 | 36,726 | 31,782 | 27,771 |

***NOTE: Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

## Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | no | 9 | 5 | 21 |
| 35 | Single | no | 12 | 7 | 26 |
| 40 | Pole | 2 | 15 | 10 | 31 |
| 45 | | 3 | 18 | 12 | 36 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | | 19 | 30 | 37 | 55 | x | x |
| 35 | "H" | 24 | 37 | 46 | 60 | x | x |
| 40 | Pole | 29 | 43 | 54 | 60 | x | x |
| 45 | | 33 | 50 | 60 | 60 | x | x |

# 300mm$^2$ All Aluminium Conductor (AAC) "Butterfly" - "NORMAL" Environment

## Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 380 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.64 |

## Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| | | Average / Poor Soil | | | | | | Good / Average Soil | | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pole Length (m) and Grade | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | |
| | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 | S | 93 | 106 | 35 | 63 | 102 | | 104 | 106 | 55 | 98 | 102 | | 104 | 106 | 76 | 102 | 102 |
| 9 | S | 90 | 109 | 33 | 60 | 96 | | 108 | 109 | 53 | 93 | 106 | | 108 | 109 | 74 | 106 | 106 |
| 9.5 | S | 86 | 107 | 31 | 56 | 90 | | 106 | 107 | 51 | 88 | 105 | | 106 | 107 | 70 | 105 | 105 |
| 10 | S | 82 | 105 | 29 | 53 | 85 | | 104 | 105 | 48 | 83 | 104 | | 104 | 105 | 67 | 104 | 104 |
| 10.5 | S | 79 | 104 | 27 | 50 | 80 | | 103 | 104 | 46 | 79 | 103 | | 103 | 104 | 64 | 103 | 103 |
| 11 | S | 75 | 102 | 26 | 47 | 76 | | 102 | 102 | 43 | 75 | 102 | | 102 | 102 | 61 | 102 | 102 |
| 11.5 | S | 72 | 101 | 24 | 44 | 72 | | 101 | 101 | 41 | 72 | 101 | | 101 | 101 | 58 | 99 | 101 |
| 12 | S | 69 | 101 | 22 | 42 | 68 | | 101 | 101 | 39 | 68 | 101 | | 101 | 101 | 56 | 94 | 101 |
| 13 | S | 65 | 106 | 20 | 37 | 61 | | 104 | 106 | 36 | 62 | 98 | | 106 | 106 | 52 | 87 | 106 |
| 14 | S | 61 | 106 | 18 | 33 | 55 | | 99 | 109 | 33 | 57 | 90 | | 109 | 109 | 49 | 81 | 109 |
| 15 | S | 78 | 112 | 34 | 53 | 83 | | 112 | 112 | 58 | 86 | 112 | | 112 | 112 | 82 | 112 | 112 |
| 16 | S | 74 | 117 | 31 | 48 | 76 | | 117 | 117 | 54 | 81 | 117 | | 117 | 117 | 78 | 113 | 117 |
| 17 | S | 69 | 116 | 28 | 44 | 70 | | 113 | 116 | 51 | 75 | 114 | | 116 | 116 | 73 | 106 | 116 |
| 18 | S | 66 | 113 | 25 | 40 | 65 | | 109 | 119 | 48 | 70 | 107 | | 119 | 119 | 70 | 100 | 119 |
| 20 | S | 59 | 103 | 20 | 33 | 54 | | 100 | 120 | 41 | 61 | 93 | | 120 | 120 | 63 | 89 | 120 |
| 22 | S | 52 | 94 | 15 | 26 | 45 | | 91 | 118 | 35 | 53 | 81 | | 118 | 118 | 55 | 79 | 116 |
| | | | | | | | | | | | | | | | | | | |
| 8.5 | ES | 104 | 142 | 39 | 67 | 104 | | 142 | 142 | 62 | 104 | 142 | | 142 | 142 | 86 | 141 | 142 |
| 9 | ES | 99 | 139 | 37 | 63 | 98 | | 139 | 139 | 59 | 98 | 139 | | 139 | 139 | 81 | 133 | 139 |
| 9.5 | ES | 94 | 136 | 34 | 59 | 92 | | 136 | 136 | 56 | 92 | 136 | | 136 | 136 | 77 | 126 | 136 |
| 10 | ES | 88 | 132 | 31 | 54 | 86 | | 130 | 132 | 51 | 86 | 129 | | 130 | 132 | 71 | 118 | 129 |
| 10.5 | ES | 85 | 135 | 30 | 51 | 81 | | 133 | 135 | 49 | 82 | 127 | | 135 | 135 | 69 | 113 | 134 |
| 11 | ES | 81 | 134 | 28 | 48 | 76 | | 127 | 134 | 47 | 78 | 120 | | 133 | 134 | 66 | 107 | 132 |
| 11.5 | ES | 79 | 134 | 26 | 46 | 72 | | 125 | 139 | 45 | 75 | 114 | | 138 | 139 | 64 | 103 | 138 |
| 12 | ES | 76 | 129 | 25 | 43 | 69 | | 120 | 137 | 43 | 71 | 109 | | 137 | 137 | 61 | 99 | 137 |
| 13 | ES | 71 | 122 | 22 | 39 | 62 | | 113 | 141 | 39 | 65 | 99 | | 141 | 141 | 57 | 91 | 137 |
| 14 | ES | 67 | 115 | 19 | 34 | 55 | | 107 | 146 | 36 | 59 | 91 | | 146 | 146 | 53 | 84 | 126 |
| 15 | ES | 83 | 137 | 36 | 54 | 84 | | 133 | 144 | 62 | 89 | 134 | | 144 | 144 | 88 | 125 | 144 |
| 16 | ES | 79 | 132 | 33 | 50 | 77 | | 127 | 148 | 58 | 84 | 125 | | 148 | 148 | 83 | 117 | 148 |
| 17 | ES | 77 | 129 | 31 | 46 | 71 | | 125 | 160 | 56 | 79 | 117 | | 160 | 160 | 81 | 113 | 160 |
| 18 | ES | 70 | 120 | 27 | 41 | 65 | | 116 | 149 | 50 | 72 | 108 | | 149 | 149 | 74 | 104 | 149 |
| 20 | ES | 62 | 108 | 20 | 33 | 54 | | 104 | 146 | 43 | 62 | 93 | | 146 | 146 | 65 | 91 | 133 |
| 22 | ES | 56 | 101 | 16 | 27 | 45 | | 98 | 154 | 38 | 55 | 82 | | 140 | 154 | 60 | 82 | 118 |

# 300mm² All Aluminium Conductor (AAC) "Butterfly" - "SEVERE" Environment

## Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 570 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 2.81 |

## Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| Pole Length (m) and Grade | | Average / Poor Soil | | | | | Good / Average Soil | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | |
| | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 | S | 52 | 60 | 18 | 35 | 57 | 59 | 60 | 30 | 55 | 57 | 59 | 60 | 42 | 57 | 57 |
| 9 | S | 51 | 61 | 17 | 33 | 54 | 61 | 61 | 29 | 52 | 60 | 61 | 61 | 41 | 60 | 60 |
| 9.5 | S | 48 | 60 | 16 | 30 | 50 | 59 | 60 | 27 | 49 | 58 | 59 | 60 | 39 | 58 | 58 |
| 10 | S | 45 | 59 | 14 | 28 | 47 | 58 | 59 | 25 | 46 | 58 | 58 | 59 | 36 | 58 | 58 |
| 10.5 | S | 43 | 58 | 13 | 26 | 44 | 57 | 58 | 24 | 43 | 57 | 57 | 58 | 34 | 57 | 57 |
| 11 | S | 41 | 57 | 12 | 24 | 41 | 57 | 57 | 22 | 41 | 57 | 57 | 57 | 33 | 57 | 57 |
| 11.5 | S | 39 | 56 | 11 | 23 | 39 | 56 | 56 | 21 | 39 | 56 | 56 | 56 | 31 | 55 | 56 |
| 12 | S | 37 | 56 | 10 | 21 | 36 | 56 | 56 | 20 | 36 | 56 | 56 | 56 | 29 | 52 | 56 |
| 13 | S | 34 | 59 | 8 | 18 | 32 | 57 | 59 | 17 | 33 | 53 | 59 | 59 | 27 | 47 | 59 |
| 14 | S | 32 | 58 | 6 | 15 | 28 | 54 | 61 | 15 | 29 | 48 | 61 | 61 | 24 | 43 | 61 |
| 15 | S | 41 | 63 | 15 | 26 | 44 | 63 | 63 | 29 | 46 | 63 | 63 | 63 | 44 | 63 | 63 |
| 16 | S | 38 | 65 | 13 | 23 | 40 | 65 | 65 | 27 | 42 | 65 | 65 | 65 | 41 | 61 | 65 |
| 17 | S | 35 | 63 | 11 | 20 | 36 | 61 | 65 | 24 | 38 | 61 | 65 | 65 | 38 | 57 | 65 |
| 18 | S | 33 | 60 | 9 | 18 | 32 | 58 | 66 | 22 | 35 | 56 | 66 | 66 | 35 | 53 | 66 |
| 20 | S | 28 | 54 | 5 | 13 | 25 | 52 | 67 | 17 | 29 | 47 | 67 | 67 | 30 | 45 | 67 |
| 22 | S | 23 | 47 | 1 | 8 | 19 | 45 | 66 | 13 | 23 | 39 | 66 | 66 | 25 | 38 | 60 |
| | | | | | | | | | | | | | | | | |
| 8.5 | ES | 59 | 81 | 21 | 37 | 59 | 81 | 81 | 34 | 58 | 81 | 81 | 81 | 48 | 80 | 81 |
| 9 | ES | 56 | 79 | 19 | 34 | 55 | 79 | 79 | 32 | 55 | 79 | 79 | 79 | 45 | 75 | 79 |
| 9.5 | ES | 53 | 77 | 17 | 32 | 51 | 77 | 77 | 30 | 51 | 77 | 77 | 77 | 42 | 71 | 77 |
| 10 | ES | 49 | 74 | 15 | 29 | 47 | 73 | 74 | 27 | 47 | 72 | 73 | 74 | 39 | 66 | 72 |
| 10.5 | ES | 47 | 76 | 14 | 27 | 44 | 75 | 76 | 26 | 45 | 71 | 76 | 76 | 37 | 63 | 75 |
| 11 | ES | 44 | 75 | 13 | 25 | 41 | 71 | 75 | 24 | 42 | 67 | 75 | 75 | 35 | 59 | 74 |
| 11.5 | ES | 43 | 75 | 12 | 23 | 39 | 69 | 78 | 23 | 40 | 63 | 77 | 78 | 34 | 57 | 77 |
| 12 | ES | 41 | 72 | 11 | 22 | 36 | 67 | 77 | 21 | 38 | 60 | 76 | 77 | 32 | 54 | 76 |
| 13 | ES | 38 | 67 | 9 | 18 | 32 | 62 | 79 | 19 | 34 | 54 | 79 | 79 | 29 | 49 | 76 |
| 14 | ES | 35 | 63 | 6 | 16 | 28 | 58 | 82 | 16 | 30 | 48 | 82 | 82 | 26 | 45 | 69 |
| 15 | ES | 44 | 76 | 16 | 27 | 44 | 73 | 81 | 31 | 47 | 73 | 81 | 81 | 46 | 68 | 81 |
| 16 | ES | 41 | 72 | 14 | 24 | 40 | 69 | 83 | 29 | 43 | 67 | 83 | 83 | 43 | 63 | 83 |
| 17 | ES | 39 | 70 | 12 | 21 | 36 | 67 | 90 | 27 | 40 | 62 | 90 | 90 | 42 | 60 | 89 |
| 18 | ES | 35 | 64 | 9 | 18 | 32 | 61 | 84 | 23 | 36 | 57 | 84 | 84 | 37 | 54 | 82 |
| 20 | ES | 29 | 56 | 5 | 12 | 24 | 54 | 82 | 18 | 29 | 47 | 79 | 82 | 31 | 46 | 70 |
| 22 | ES | 24 | 51 | 1 | 7 | 18 | 49 | 87 | 14 | 23 | 39 | 73 | 87 | 26 | 40 | 61 |

## 300mm$^2$ All Aluminium Conductor (AAC) "Butterfly" - "NORMAL" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 1349.74 | 13.24 | 0.14 | 0.21 | 0.31 | 0.42 | 0.54 | 0.69 | 0.85 | 1.03 | 1.23 | 1.44 | 1.67 | 1.91 | 2.18 | 2.46 | - | - | - |
| -4 | 1309.13 | 12.84 | 0.14 | 0.22 | 0.32 | 0.43 | 0.56 | 0.71 | 0.88 | 1.06 | 1.26 | 1.48 | 1.72 | 1.97 | 2.25 | 2.54 | - | - | - |
| 0 | 1214.18 | 11.91 | 0.15 | 0.24 | 0.34 | 0.46 | 0.61 | 0.77 | 0.95 | 1.14 | 1.36 | 1.60 | 1.85 | 2.13 | 2.42 | 2.73 | - | - | - |
| 4 | 1128.59 | 11.07 | 0.16 | 0.25 | 0.37 | 0.50 | 0.65 | 0.82 | 1.02 | 1.23 | 1.47 | 1.72 | 2.00 | 2.29 | 2.61 | 2.94 | - | - | - |
| 8 | 1052.07 | 10.32 | 0.17 | 0.27 | 0.39 | 0.54 | 0.70 | 0.88 | 1.09 | 1.32 | 1.57 | 1.85 | 2.14 | 2.46 | 2.80 | 3.16 | - | - | - |
| 12 | 984.05 | 9.65 | 0.19 | 0.29 | 0.42 | 0.57 | 0.75 | 0.95 | 1.17 | 1.41 | 1.68 | 1.97 | 2.29 | 2.63 | 2.99 | 3.37 | - | - | - |
| 16 | 923.79 | 9.06 | 0.20 | 0.31 | 0.45 | 0.61 | 0.80 | 1.01 | 1.24 | 1.50 | 1.79 | 2.10 | 2.44 | 2.80 | 3.18 | 3.59 | - | - | - |
| 20 | 870.46 | 8.54 | 0.21 | 0.33 | 0.48 | 0.65 | 0.84 | 1.07 | 1.32 | 1.60 | 1.90 | 2.23 | 2.59 | 2.97 | 3.38 | 3.81 | - | - | - |
| 24 | 823.23 | 8.08 | 0.22 | 0.35 | 0.50 | 0.68 | 0.89 | 1.13 | 1.40 | 1.69 | 2.01 | 2.36 | 2.74 | 3.14 | 3.57 | 4.03 | - | - | - |
| 28 | 781.32 | 7.66 | 0.24 | 0.37 | 0.53 | 0.72 | 0.94 | 1.19 | 1.47 | 1.78 | 2.12 | 2.48 | 2.88 | 3.31 | 3.76 | 4.25 | - | - | - |
| 32 | 744.01 | 7.30 | 0.25 | 0.39 | 0.56 | 0.76 | 0.99 | 1.25 | 1.54 | 1.87 | 2.22 | 2.61 | 3.03 | 3.47 | 3.95 | 4.46 | - | - | - |
| 36 | 710.67 | 6.97 | 0.26 | 0.40 | 0.58 | 0.79 | 1.03 | 1.31 | 1.62 | 1.96 | 2.33 | 2.73 | 3.17 | 3.64 | 4.14 | 4.67 | - | - | - |

### DESIGN TABLE

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 1195.59 | 11.73 | 0.15 | 0.24 | 0.35 | 0.47 | 0.61 | 0.78 | 0.96 | 1.16 | 1.38 | 1.62 | 1.88 | 2.16 | 2.46 | 2.78 | - | - | - |
| 0 | 1081.00 | 10.60 | 0.17 | 0.27 | 0.38 | 0.52 | 0.68 | 0.86 | 1.06 | 1.29 | 1.53 | 1.80 | 2.08 | 2.39 | 2.72 | 3.07 | - | - | - |
| 30 | 707.27 | 6.94 | 0.26 | 0.41 | 0.58 | 0.80 | 1.04 | 1.32 | 1.62 | 1.97 | 2.34 | 2.74 | 3.18 | 3.65 | 4.16 | 4.69 | - | - | - |
| 50 | 584.89 | 5.74 | 0.31 | 0.49 | 0.71 | 0.96 | 1.26 | 1.59 | 1.96 | 2.38 | 2.83 | 3.32 | 3.85 | 4.42 | 5.03 | 5.68 | - | - | - |
| 55 | 562.17 | 5.51 | 0.33 | 0.51 | 0.74 | 1.00 | 1.31 | 1.66 | 2.04 | 2.47 | 2.94 | 3.45 | 4.01 | 4.60 | 5.23 | 5.91 | - | - | - |
| 60 | 541.68 | 5.31 | 0.34 | 0.53 | 0.76 | 1.04 | 1.36 | 1.72 | 2.12 | 2.57 | 3.05 | 3.58 | 4.16 | 4.77 | 5.43 | 6.13 | - | - | - |
| 65 | 523.10 | 5.13 | 0.35 | 0.55 | 0.79 | 1.08 | 1.41 | 1.78 | 2.20 | 2.66 | 3.16 | 3.71 | 4.30 | 4.94 | 5.62 | 6.35 | - | - | - |
| 70 | 506.18 | 4.97 | 0.36 | 0.57 | 0.82 | 1.11 | 1.45 | 1.84 | 2.27 | 2.75 | 3.27 | 3.84 | 4.45 | 5.11 | 5.81 | 6.56 | - | - | - |
| 75 | 490.69 | 4.81 | 0.37 | 0.59 | 0.84 | 1.15 | 1.50 | 1.90 | 2.34 | 2.83 | 3.37 | 3.96 | 4.59 | 5.27 | 5.99 | 6.77 | - | - | - |

## 300mm$^2$ All Aluminium Conductor (AAC) "Butterfly" - "SEVERE" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 1170.97 | 11.49 | 0.16 | 0.25 | 0.35 | 0.48 | 0.63 | 0.79 | 0.98 | 1.19 | 1.41 | 1.66 | 1.92 | 2.21 | - | - | - | - | - |
| -4 | 1130.87 | 11.09 | 0.16 | 0.25 | 0.37 | 0.50 | 0.65 | 0.82 | 1.02 | 1.23 | 1.46 | 1.72 | 1.99 | 2.29 | - | - | - | - | - |
| 0 | 1038.15 | 10.18 | 0.18 | 0.28 | 0.40 | 0.54 | 0.71 | 0.90 | 1.11 | 1.34 | 1.59 | 1.87 | 2.17 | 2.49 | - | - | - | - | - |
| 4 | 956.06 | 9.38 | 0.19 | 0.30 | 0.43 | 0.59 | 0.77 | 0.97 | 1.20 | 1.45 | 1.73 | 2.03 | 2.36 | 2.70 | - | - | - | - | - |
| 8 | 884.06 | 8.67 | 0.21 | 0.32 | 0.47 | 0.64 | 0.83 | 1.05 | 1.30 | 1.57 | 1.87 | 2.20 | 2.55 | 2.92 | - | - | - | - | - |
| 12 | 821.29 | 8.06 | 0.22 | 0.35 | 0.50 | 0.69 | 0.90 | 1.13 | 1.40 | 1.69 | 2.01 | 2.36 | 2.74 | 3.15 | - | - | - | - | - |
| 16 | 766.70 | 7.52 | 0.24 | 0.37 | 0.54 | 0.73 | 0.96 | 1.21 | 1.50 | 1.81 | 2.16 | 2.53 | 2.94 | 3.37 | - | - | - | - | - |
| 20 | 719.20 | 7.06 | 0.26 | 0.40 | 0.58 | 0.78 | 1.02 | 1.29 | 1.60 | 1.93 | 2.30 | 2.70 | 3.13 | 3.59 | - | - | - | - | - |
| 24 | 677.75 | 6.65 | 0.27 | 0.42 | 0.61 | 0.83 | 1.08 | 1.37 | 1.69 | 2.05 | 2.44 | 2.86 | 3.32 | 3.81 | - | - | - | - | - |
| 28 | 641.43 | 6.29 | 0.29 | 0.45 | 0.64 | 0.88 | 1.15 | 1.45 | 1.79 | 2.17 | 2.58 | 3.03 | 3.51 | 4.03 | - | - | - | - | - |
| 32 | 609.45 | 5.98 | 0.30 | 0.47 | 0.68 | 0.92 | 1.21 | 1.53 | 1.88 | 2.28 | 2.71 | 3.19 | 3.69 | 4.24 | - | - | - | - | - |
| 36 | 581.14 | 5.70 | 0.32 | 0.49 | 0.71 | 0.97 | 1.27 | 1.60 | 1.98 | 2.39 | 2.85 | 3.34 | 3.87 | 4.45 | - | - | - | - | - |

### DESIGN TABLE

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 1030.40 | 10.11 | 0.18 | 0.28 | 0.40 | 0.55 | 0.71 | 0.90 | 1.11 | 1.35 | 1.61 | 1.88 | 2.19 | 2.51 | - | - | - | - | - |
| 0 | 919.62 | 9.02 | 0.20 | 0.31 | 0.45 | 0.61 | 0.80 | 1.01 | 1.25 | 1.51 | 1.80 | 2.11 | 2.45 | 2.81 | - | - | - | - | - |
| 30 | 581.42 | 5.70 | 0.32 | 0.49 | 0.71 | 0.97 | 1.26 | 1.60 | 1.98 | 2.39 | 2.85 | 3.34 | 3.87 | 4.45 | - | - | - | - | - |
| 50 | 478.10 | 4.69 | 0.38 | 0.60 | 0.86 | 1.18 | 1.54 | 1.95 | 2.40 | 2.91 | 3.46 | 4.06 | 4.71 | 5.41 | - | - | - | - | - |
| 55 | 459.21 | 4.50 | 0.40 | 0.63 | 0.90 | 1.23 | 1.60 | 2.03 | 2.50 | 3.03 | 3.60 | 4.23 | 4.90 | 5.63 | - | - | - | - | - |
| 60 | 442.23 | 4.34 | 0.42 | 0.65 | 0.94 | 1.27 | 1.66 | 2.10 | 2.60 | 3.14 | 3.74 | 4.39 | 5.09 | 5.84 | - | - | - | - | - |
| 65 | 426.89 | 4.19 | 0.43 | 0.67 | 0.97 | 1.32 | 1.72 | 2.18 | 2.69 | 3.26 | 3.88 | 4.55 | 5.27 | 6.05 | - | - | - | - | - |
| 70 | 412.94 | 4.05 | 0.45 | 0.70 | 1.00 | 1.36 | 1.78 | 2.25 | 2.78 | 3.37 | 4.01 | 4.70 | 5.45 | 6.26 | - | - | - | - | - |
| 75 | 400.21 | 3.93 | 0.46 | 0.72 | 1.03 | 1.41 | 1.84 | 2.33 | 2.87 | 3.47 | 4.13 | 4.85 | 5.63 | 6.46 | - | - | - | - | - |

## 400 $mm^2$ All Aluminium Conductor (AAC) "Centipede"

- Conductor & Design Parameters
- Structure Suitability
- Stayed Pole Design Data
- Unstayed Pole Design Data
- Sags and Tensions

# 400mm$^2$ All Aluminium Conductor (AAC) "Centipede"

## Conductor Parameters:

| | |
|---|---|
| Conductor Stranding (#strands / diameter(mm)) | 37/3.78 |
| Greased Conductor Weight (kg/m) | 1.198 |
| Cross Sectional Area of Conductor (mm²) | 415.2 |
| Conductor Overall Diameter (mm) | 26.46 |
| Coefficient of Linear Expansion (/Degree C) | 2.30E-05 |
| Modulus of Elasticity (kg/mm²) | 5,700 |
| Rated Breaking Strength of Conductor (kgf) | 6,434.0 |

| **Design Loading Parameters:** | **"Normal"** | **"Severe"** |
|---|---|---|
| Basic / Recommended Span (m) | 130 | 110 |
| Wind Pressure on Conductor (N/m²) | 380 | 570 |
| Radial Ice Thickness (mm) | 9.5 | 12.5 |
| Ice Density (kg/m³) | 913 | 913 |
| Absolute Maximum Working Tension (MWT) Limit (kgf) | 2,379.0 | 2,379.0 |
| Temperature at MWT Limit (Degrees C) | -5.6 | -5.6 |
| Maximum "Everyday" Tension (EDT) Limit (kgf) | 1,360.9 | 954.4 |
| Temperature at EDT Limit (Degrees C) | -5.6 | -5.6 |
| Maximum Conductor Tension (MCT) at -5.6 degC (kgf) | 2,379.0 | 2,379.0 |
| Maximum Conductor Weight (MCW) (kg/m) | 2.179 | 2.596 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.763 | 2.993 |
| Freezing Point Tension (FPT) (kgf) | 1,262.2 | 896.2 |

| **Span Length Limits:** | **"Normal"** | **"Severe"** |
|---|---|---|
| Maximum **Equivalent** Span | 130 | 110 |
| *Maximum **Single** Span (clashing limit)<br>(Standard heavy crossarm, 1.2m phase spacing) | 130 | 110 |
| *Maximum **Single** Span (clashing limit)<br>(H Pole, long span heavy crossarm, 2.0m phase spacing) | 165 | 140 |

**NOTE: Single span limits to be reduced by 15m where weather zone is worse than 2B at "normal" altitudes, or worse than 3C at "severe" altitudes. Weather zones are given in Appendix O**

## 400mm$^2$ All Aluminium Conductor (AAC) "Centipede"

### Pole-Top Steelwork Suitability

| Grade | Structure Configuration | | Drg. Ref | Max. Dev'n Normal | Max. Dev'n Severe | Max. D'pull. | Notes |
|---|---|---|---|---|---|---|---|
| Light | Single Pole | Single Arm Intermediate / Pin Angle | F3 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Straight Section / Angle Section | F4 | Not Suitable | Not Suitable | Not Suitable | |
| Light | Single Pole | Single Arm Termination | F5 | Not Suitable | Not Suitable | Not Suitable | |
| Heavy | Single Pole | Single Arm Intermediate / Pin Angle | F7 | Not Suitable | Not Suitable | Not Suitable | |
| Heavy | Single Pole | Double Arm Intermediate / Pin Angle | F8 | 4º | 1º | 1:10 | |
| Heavy | Single Pole | Double Arm Straight Section / Angle Section | F9 | 34º | 30º | 1:10 | |
| Heavy | "H" Pole | Double Arm Angle Section | F10 | 60º | 60º | 1:10 | Limits as per F8 if used as intermediate |
| Heavy | "H" Pole | Double Arm Section / Inter. For long spans | F11 | 60º (section) | 60º (section) | 1:10 | No deviation allowed if used as intermediate |
| Heavy | "H" Pole | Double Arm Termination | F12 | O.K. | O.K. | 1:10 | |
| Heavy | Single Pole | Double Arm Termination | F13 | Not Suitable | Not Suitable | Not Suitable | |

# 400mm$^2$ All Aluminium Conductor (AAC) "Centipede" - NORMAL Environment

## Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 2,379.0 |
| Wind Pressure (N/m²) | 380 |
| Maximum Conductor Weight (MCW) (kg/m) | 2.18 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.76 |
| Maximum Wind Span Length (m) | 165 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 17,842.5 |
| Transverse Load [Normal to Span] (kgf) | 2,181.8 |
| Vertical Load with Downpull (1:10) (kgf) | 7,075.5 |
| Pole Wind Loading (kgf) | 224.5 |

## Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|
| 0 | | 11,243 | 10,512 | 9,943 | 9,482 |
| 5 | | 13,936 | 12,732 | 11,796 | 11,036 |
| 10 | | 16,616 | 14,942 | 13,640 | 12,584 |
| 15 | | 19,279 | 17,138 | 15,472 | 14,121 |
| 20 | | 21,919 | 19,315 | 17,289 | 15,645 |
| 25 | | 24,532 | 21,469 | 19,086 | 17,154 |
| 30 | | 27,112 | 23,596 | 20,862 | 18,644 |
| 35 | | 29,655 | 25,693 | 22,611 | 20,112 |
| 40 | | 32,155 | 27,755 | 24,332 | 21,555 |
| 45 | | 34,609 | 29,778 | 26,020 | 22,972 |
| 50 | | 37,011 | 31,758 | 27,673 | 24,359 |
| 55 | | 39,356 | 33,692 | 29,287 | 25,713 |
| 60 | Terminal | 41,641 | 35,576 | 30,859 | 27,032 |

***NOTE: Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

## Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | 2 | 12 | 8 | 24 |
| 35 | Single | 4 | 16 | 11 | 29 |
| 40 | Pole | 5 | 19 | 13 | 34 |
| 45 | | 7 | 22 | 15 | 39 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | | 23 | 33 | 41 | 59 | x | x |
| 35 | "H" | 28 | 40 | 50 | 60 | x | x |
| 40 | Pole | 33 | 47 | 58 | 60 | x | x |
| 45 | | 37 | 54 | 60 | 60 | x | x |

# 400mm$^2$ All Aluminium Conductor (AAC) "Centipede" - "SEVERE" Environment

## Stayed Pole Design Parameters:

| | |
|---|---|
| Maximum Conductor Tension (MCT) (kgf) | 2,379.0 |
| Wind Pressure (N/m²) | 570 |
| Maximum Conductor Weight (MCW) (kg/m) | 2.60 |
| Maximum Conductor Pressure (MCP) (kg/m) | 2.99 |
| Maximum Wind Span Length (m) | 140 |
| Number of Conductors | 3 |
| Longitudinal Load in Conductors (kgf) | 17,842.5 |
| Transverse Load [Normal to Span] (kgf) | 3,143.0 |
| Vertical Load with Downpull (1:10) (kgf) | 7,105.2 |
| Pole Wind Loading (kgf) | 336.8 |

## Total Strut Load for Structure (kgf), maximum 1:10 downpull:

| Line Angle | | Stay Angle 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|
| 0 | | 13,132 | 12,075 | 11,252 | 10,585 |
| 5 | | 15,823 | 14,294 | 13,104 | 12,139 |
| 10 | | 18,499 | 16,500 | 14,945 | 13,683 |
| 15 | | 21,153 | 18,689 | 16,771 | 15,216 |
| 20 | | 23,783 | 20,856 | 18,580 | 16,734 |
| 25 | | 26,381 | 22,999 | 20,368 | 18,234 |
| 30 | | 28,944 | 25,112 | 22,132 | 19,714 |
| 35 | | 31,467 | 27,192 | 23,867 | 21,170 |
| 40 | | 33,944 | 29,235 | 25,572 | 22,600 |
| 45 | | 36,371 | 31,236 | 27,242 | 24,002 |
| 50 | | 38,744 | 33,192 | 28,874 | 25,372 |
| 55 | | 41,057 | 35,100 | 30,466 | 26,707 |
| 60 | Terminal | 43,307 | 36,955 | 32,014 | 28,006 |

***NOTE: Multiply indicated value by 1.2 where an unevenly stayed "H" pole is to be used (i.e. three stays, rather than 4).**

## Maximum Line Deviation Angle for Stay Arrangement:

| Stay Angle | | Grade 1150 1 7/3.25 | 2 7/3.25 | 1 7/4.00 | 2 7/4.00 |
|---|---|---|---|---|---|
| 30 | | no | 9 | 5 | 21 |
| 35 | Single | 1 | 12 | 7 | 26 |
| 40 | Pole | 2 | 15 | 10 | 31 |
| 45 | | 3 | 18 | 12 | 36 |

**NOTE: A terminal is equivalent to a 60 degree deviation angle.**

| Stay Angle | | Grade 1150 3 7/3.25 | 4 7/3.25 | 3 7/4.00 | 4 7/4.00 | Grade 1150 Terminal Single per Limb 7/3.25 | 7/4.00 |
|---|---|---|---|---|---|---|---|
| 30 | | 19 | 30 | 38 | 55 | x | x |
| 35 | "H" | 24 | 37 | 46 | 60 | x | x |
| 40 | Pole | 29 | 43 | 54 | 60 | x | x |
| 45 | | 34 | 50 | 60 | 60 | x | x |

# 400mm² All Aluminium Conductor (AAC) "Centipede" - NORMAL Environment

## Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 380 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 1.76 |

## Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| | | Average / Poor Soil | | | | | | Good / Average Soil | | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pole Length (m) and Grade | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | |
| | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 | S | 87 | 99 | 32 | 59 | 95 | | 97 | 99 | 51 | 91 | 95 | | 97 | 99 | 71 | 95 | 95 |
| 9 | S | 84 | 101 | 31 | 55 | 89 | | 100 | 101 | 50 | 87 | 99 | | 100 | 101 | 69 | 99 | 99 |
| 9.5 | S | 80 | 99 | 29 | 52 | 84 | | 98 | 99 | 47 | 82 | 97 | | 98 | 99 | 65 | 97 | 97 |
| 10 | S | 76 | 98 | 27 | 49 | 79 | | 97 | 98 | 45 | 78 | 96 | | 97 | 98 | 62 | 96 | 96 |
| 10.5 | S | 73 | 96 | 25 | 46 | 74 | | 96 | 96 | 42 | 74 | 95 | | 96 | 96 | 59 | 95 | 95 |
| 11 | S | 70 | 95 | 24 | 43 | 70 | | 95 | 95 | 40 | 70 | 95 | | 95 | 95 | 57 | 95 | 95 |
| 11.5 | S | 67 | 94 | 22 | 41 | 67 | | 94 | 94 | 38 | 66 | 94 | | 94 | 94 | 54 | 92 | 94 |
| 12 | S | 65 | 94 | 21 | 39 | 63 | | 94 | 94 | 36 | 63 | 94 | | 94 | 94 | 52 | 88 | 94 |
| 13 | S | 61 | 98 | 18 | 35 | 57 | | 96 | 98 | 33 | 58 | 91 | | 98 | 98 | 49 | 81 | 98 |
| 14 | S | 57 | 99 | 16 | 31 | 51 | | 92 | 102 | 31 | 53 | 83 | | 102 | 102 | 45 | 75 | 102 |
| 15 | S | 73 | 105 | 31 | 49 | 77 | | 105 | 105 | 54 | 80 | 105 | | 105 | 105 | 76 | 105 | 105 |
| 16 | S | 69 | 109 | 29 | 45 | 71 | | 109 | 109 | 51 | 75 | 109 | | 109 | 109 | 73 | 105 | 109 |
| 17 | S | 65 | 108 | 26 | 41 | 65 | | 105 | 108 | 47 | 70 | 106 | | 108 | 108 | 68 | 99 | 108 |
| 18 | S | 62 | 105 | 23 | 37 | 60 | | 101 | 111 | 44 | 65 | 99 | | 111 | 111 | 65 | 93 | 111 |
| 20 | S | 55 | 96 | 18 | 31 | 50 | | 93 | 112 | 38 | 57 | 86 | | 112 | 112 | 58 | 83 | 112 |
| 22 | S | 48 | 87 | 13 | 24 | 42 | | 84 | 110 | 32 | 49 | 75 | | 110 | 110 | 51 | 73 | 108 |
| | | | | | | | | | | | | | | | | | | |
| 8.5 | ES | 97 | 132 | 36 | 62 | 97 | | 132 | 132 | 58 | 97 | 132 | | 132 | 132 | 80 | 131 | 132 |
| 9 | ES | 92 | 129 | 34 | 58 | 91 | | 129 | 129 | 55 | 91 | 129 | | 129 | 129 | 75 | 124 | 129 |
| 9.5 | ES | 88 | 126 | 32 | 55 | 85 | | 126 | 126 | 52 | 86 | 126 | | 126 | 126 | 72 | 117 | 126 |
| 10 | ES | 82 | 122 | 29 | 50 | 80 | | 121 | 122 | 48 | 80 | 120 | | 121 | 122 | 66 | 109 | 120 |
| 10.5 | ES | 79 | 126 | 27 | 48 | 75 | | 124 | 126 | 46 | 76 | 118 | | 125 | 126 | 64 | 105 | 124 |
| 11 | ES | 76 | 125 | 26 | 45 | 71 | | 118 | 125 | 43 | 72 | 112 | | 124 | 125 | 61 | 100 | 123 |
| 11.5 | ES | 74 | 124 | 24 | 43 | 67 | | 116 | 129 | 42 | 69 | 106 | | 129 | 129 | 60 | 96 | 128 |
| 12 | ES | 71 | 120 | 23 | 40 | 64 | | 112 | 128 | 40 | 66 | 101 | | 127 | 128 | 57 | 92 | 127 |
| 13 | ES | 66 | 113 | 20 | 36 | 57 | | 106 | 131 | 37 | 60 | 92 | | 131 | 131 | 53 | 85 | 127 |
| 14 | ES | 62 | 107 | 18 | 32 | 51 | | 100 | 136 | 33 | 55 | 84 | | 136 | 136 | 49 | 78 | 117 |
| 15 | ES | 77 | 128 | 33 | 50 | 78 | | 124 | 134 | 57 | 83 | 125 | | 134 | 134 | 82 | 116 | 134 |
| 16 | ES | 73 | 122 | 30 | 46 | 72 | | 118 | 137 | 54 | 78 | 116 | | 138 | 137 | 77 | 109 | 137 |
| 17 | ES | 72 | 120 | 28 | 43 | 66 | | 117 | 149 | 52 | 74 | 109 | | 149 | 149 | 76 | 105 | 149 |
| 18 | ES | 65 | 111 | 25 | 38 | 60 | | 108 | 139 | 47 | 67 | 100 | | 139 | 139 | 69 | 96 | 139 |
| 20 | ES | 57 | 100 | 19 | 31 | 50 | | 97 | 136 | 40 | 58 | 87 | | 136 | 136 | 61 | 85 | 123 |
| 22 | ES | 52 | 94 | 14 | 25 | 42 | | 91 | 144 | 35 | 51 | 76 | | 130 | 144 | 55 | 76 | 110 |

# 400mm² All Aluminium Conductor (AAC) "Centipede" - SEVERE Environment

## Unstayed Pole Design Parameters

| | |
|---|---|
| Design Fibre Stress of Pole and Blocks (N/mm²) | 53.3 |
| Design Average Modulus of Elasticity (N/mm²) | 10,054 |
| Wind Pressure (N/m²) | 380 |
| Number of Conductors | 3 |
| Maximum Conductor Pressure (MCP) (kg/m) | 2.99 |

## Unstayed Pole Wind Span Limits (m), Single Pole, 11kV or 33kV

| | | Average / Poor Soil | | | | | | Good / Average Soil | | | | | | Good Soil | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pole Length (m) and Grade | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | | | Auger Depth (m) | | Standard Burial, # Kicking Blocks | | |
| | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 | | 2.4 2.6 | 2.8 3 | 0 | 1 | 2 |
| 8.5 | S | 49 | 56 | 17 | 33 | 54 | | 55 | 56 | 28 | 52 | 54 | | 55 | 56 | 17 | 28 | 40 |
| 9 | S | 47 | 58 | 16 | 30 | 50 | | 57 | 58 | 27 | 49 | 56 | | 57 | 58 | 16 | 27 | 38 |
| 9.5 | S | 45 | 56 | 15 | 28 | 47 | | 56 | 56 | 25 | 46 | 55 | | 56 | 56 | 15 | 25 | 36 |
| 10 | S | 43 | 55 | 13 | 26 | 44 | | 55 | 55 | 24 | 43 | 54 | | 55 | 55 | 13 | 24 | 34 |
| 10.5 | S | 41 | 54 | 12 | 25 | 41 | | 54 | 54 | 22 | 41 | 53 | | 54 | 54 | 12 | 22 | 32 |
| 11 | S | 39 | 53 | 11 | 23 | 39 | | 53 | 53 | 21 | 38 | 53 | | 53 | 53 | 11 | 21 | 31 |
| 11.5 | S | 37 | 53 | 10 | 21 | 36 | | 53 | 53 | 20 | 36 | 53 | | 53 | 53 | 10 | 20 | 29 |
| 12 | S | 35 | 52 | 9 | 20 | 34 | | 52 | 52 | 18 | 34 | 52 | | 52 | 52 | 9 | 18 | 28 |
| 13 | S | 32 | 55 | 7 | 17 | 30 | | 53 | 55 | 16 | 31 | 50 | | 55 | 55 | 7 | 16 | 25 |
| 14 | S | 30 | 54 | 6 | 14 | 26 | | 50 | 57 | 14 | 27 | 45 | | 57 | 57 | 6 | 14 | 23 |
| 15 | S | 39 | 59 | 14 | 25 | 41 | | 59 | 59 | 27 | 43 | 59 | | 59 | 59 | 14 | 27 | 41 |
| 16 | S | 36 | 61 | 12 | 22 | 37 | | 61 | 61 | 25 | 40 | 61 | | 61 | 61 | 12 | 25 | 38 |
| 17 | S | 33 | 59 | 10 | 19 | 33 | | 57 | 61 | 23 | 36 | 57 | | 61 | 61 | 10 | 23 | 35 |
| 18 | S | 31 | 56 | 8 | 17 | 30 | | 54 | 62 | 21 | 33 | 53 | | 62 | 62 | 8 | 21 | 33 |
| 20 | S | 26 | 50 | 4 | 12 | 23 | | 48 | 63 | 16 | 27 | 45 | | 63 | 63 | 4 | 16 | 28 |
| 22 | S | 21 | 44 | 1 | 7 | 17 | | 42 | 62 | 12 | 21 | 37 | | 62 | 62 | 1 | 12 | 23 |
| | | | | | | | | | | | | | | | | | | |
| 8.5 | ES | 55 | 76 | 19 | 34 | 55 | | 76 | 76 | 32 | 55 | 76 | | 76 | 76 | 19 | 32 | 45 |
| 9 | ES | 52 | 74 | 18 | 32 | 51 | | 74 | 74 | 30 | 51 | 74 | | 74 | 74 | 18 | 30 | 42 |
| 9.5 | ES | 49 | 72 | 16 | 30 | 48 | | 72 | 72 | 28 | 48 | 72 | | 72 | 72 | 16 | 28 | 40 |
| 10 | ES | 46 | 69 | 14 | 27 | 44 | | 69 | 69 | 25 | 44 | 68 | | 69 | 69 | 14 | 25 | 36 |
| 10.5 | ES | 44 | 71 | 13 | 25 | 42 | | 70 | 71 | 24 | 42 | 67 | | 71 | 71 | 13 | 24 | 35 |
| 11 | ES | 42 | 71 | 12 | 23 | 39 | | 67 | 71 | 23 | 40 | 63 | | 70 | 71 | 12 | 23 | 33 |
| 11.5 | ES | 40 | 70 | 11 | 22 | 36 | | 65 | 73 | 21 | 38 | 59 | | 72 | 73 | 11 | 21 | 32 |
| 12 | ES | 38 | 67 | 10 | 20 | 34 | | 62 | 72 | 20 | 35 | 56 | | 72 | 72 | 10 | 20 | 30 |
| 13 | ES | 35 | 63 | 8 | 17 | 30 | | 58 | 74 | 18 | 32 | 51 | | 74 | 74 | 8 | 18 | 27 |
| 14 | ES | 32 | 59 | 6 | 15 | 26 | | 55 | 77 | 15 | 28 | 45 | | 77 | 77 | 6 | 15 | 25 |
| 15 | ES | 41 | 71 | 15 | 25 | 41 | | 68 | 76 | 29 | 44 | 69 | | 76 | 76 | 15 | 29 | 43 |
| 16 | ES | 38 | 67 | 13 | 22 | 37 | | 65 | 78 | 27 | 41 | 63 | | 78 | 78 | 13 | 27 | 41 |
| 17 | ES | 37 | 66 | 11 | 20 | 33 | | 63 | 84 | 25 | 38 | 58 | | 84 | 84 | 11 | 25 | 39 |
| 18 | ES | 33 | 60 | 9 | 17 | 30 | | 58 | 78 | 22 | 34 | 53 | | 78 | 78 | 9 | 22 | 35 |
| 20 | ES | 27 | 53 | 4 | 11 | 23 | | 50 | 77 | 17 | 27 | 44 | | 74 | 77 | 4 | 17 | 29 |
| 22 | ES | 23 | 48 | 1 | 7 | 17 | | 46 | 81 | 13 | 22 | 37 | | 69 | 81 | 1 | 13 | 25 |

## 400mm$^2$ All Aluminium Conductor (AAC) "Centipede" - "NORMAL" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 1546.47 | 15.17 | 0.15 | 0.24 | 0.35 | 0.47 | 0.62 | 0.78 | 0.97 | 1.17 | 1.39 | 1.64 | 1.90 | 2.18 | 2.48 | 2.80 | - | - | - |
| -4 | 1502.20 | 14.74 | 0.16 | 0.25 | 0.36 | 0.49 | 0.64 | 0.81 | 1.00 | 1.21 | 1.44 | 1.68 | 1.95 | 2.24 | 2.55 | 2.88 | - | - | - |
| 0 | 1399.69 | 13.73 | 0.17 | 0.27 | 0.39 | 0.52 | 0.68 | 0.87 | 1.07 | 1.29 | 1.54 | 1.81 | 2.10 | 2.41 | 2.74 | 3.09 | - | - | - |
| 4 | 1308.32 | 12.83 | 0.18 | 0.29 | 0.41 | 0.56 | 0.73 | 0.93 | 1.14 | 1.38 | 1.65 | 1.93 | 2.24 | 2.58 | 2.93 | 3.31 | - | - | - |
| 8 | 1227.20 | 12.04 | 0.20 | 0.31 | 0.44 | 0.60 | 0.78 | 0.99 | 1.22 | 1.48 | 1.76 | 2.06 | 2.39 | 2.75 | 3.12 | 3.53 | - | - | - |
| 12 | 1155.34 | 11.33 | 0.21 | 0.32 | 0.47 | 0.64 | 0.83 | 1.05 | 1.30 | 1.57 | 1.87 | 2.19 | 2.54 | 2.92 | 3.32 | 3.75 | - | - | - |
| 16 | 1091.65 | 10.71 | 0.22 | 0.34 | 0.49 | 0.67 | 0.88 | 1.11 | 1.37 | 1.66 | 1.98 | 2.32 | 2.69 | 3.09 | 3.51 | 3.96 | - | - | - |
| 20 | 1035.13 | 10.15 | 0.23 | 0.36 | 0.52 | 0.71 | 0.93 | 1.17 | 1.45 | 1.75 | 2.08 | 2.44 | 2.84 | 3.26 | 3.70 | 4.18 | - | - | - |
| 24 | 984.83 | 9.66 | 0.24 | 0.38 | 0.55 | 0.75 | 0.97 | 1.23 | 1.52 | 1.84 | 2.19 | 2.57 | 2.98 | 3.42 | 3.89 | 4.39 | - | - | - |
| 28 | 939.91 | 9.22 | 0.25 | 0.40 | 0.57 | 0.78 | 1.02 | 1.29 | 1.59 | 1.93 | 2.29 | 2.69 | 3.12 | 3.58 | 4.08 | 4.60 | - | - | - |
| 32 | 899.63 | 8.83 | 0.27 | 0.42 | 0.60 | 0.82 | 1.07 | 1.35 | 1.66 | 2.01 | 2.40 | 2.81 | 3.26 | 3.75 | 4.26 | 4.81 | - | - | - |
| 36 | 863.37 | 8.47 | 0.28 | 0.43 | 0.62 | 0.85 | 1.11 | 1.40 | 1.73 | 2.10 | 2.50 | 2.93 | 3.40 | 3.90 | 4.44 | 5.01 | - | - | - |

### DESIGN TABLE

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 1360.90 | 13.35 | 0.18 | 0.28 | 0.40 | 0.54 | 0.70 | 0.89 | 1.10 | 1.33 | 1.58 | 1.86 | 2.16 | 2.48 | 2.82 | 3.18 | - | - | - |
| 0 | 1241.85 | 12.18 | 0.19 | 0.30 | 0.43 | 0.59 | 0.77 | 0.98 | 1.21 | 1.46 | 1.74 | 2.04 | 2.36 | 2.71 | 3.09 | 3.48 | - | - | - |
| 30 | 852.85 | 8.37 | 0.28 | 0.44 | 0.63 | 0.86 | 1.12 | 1.42 | 1.76 | 2.12 | 2.53 | 2.97 | 3.44 | 3.95 | 4.50 | 5.07 | - | - | - |
| 50 | 719.33 | 7.06 | 0.33 | 0.52 | 0.75 | 1.02 | 1.33 | 1.69 | 2.08 | 2.52 | 3.00 | 3.52 | 4.08 | 4.68 | 5.33 | 6.02 | - | - | - |
| 55 | 693.92 | 6.81 | 0.35 | 0.54 | 0.78 | 1.06 | 1.38 | 1.75 | 2.16 | 2.61 | 3.11 | 3.65 | 4.23 | 4.86 | 5.52 | 6.24 | - | - | - |
| 60 | 670.83 | 6.58 | 0.36 | 0.56 | 0.80 | 1.09 | 1.43 | 1.81 | 2.23 | 2.70 | 3.21 | 3.77 | 4.38 | 5.02 | 5.71 | 6.45 | - | - | - |
| 65 | 649.74 | 6.37 | 0.37 | 0.58 | 0.83 | 1.13 | 1.48 | 1.87 | 2.30 | 2.79 | 3.32 | 3.90 | 4.52 | 5.19 | 5.90 | 6.66 | - | - | - |
| 70 | 630.39 | 6.18 | 0.38 | 0.59 | 0.86 | 1.16 | 1.52 | 1.92 | 2.38 | 2.87 | 3.42 | 4.01 | 4.66 | 5.34 | 6.08 | 6.87 | - | - | - |
| 75 | 612.57 | 6.01 | 0.39 | 0.61 | 0.88 | 1.20 | 1.56 | 1.98 | 2.44 | 2.96 | 3.52 | 4.13 | 4.79 | 5.50 | 6.26 | 7.06 | - | - | - |

## 400mm$^2$ All Aluminium Conductor (AAC) "Centipede" - "SEVERE" Loading Environment

### ERECTION TABLE (10% Overtension at 15ºC)

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 1096.41 | 10.76 | 0.22 | 0.34 | 0.49 | 0.67 | 0.87 | 1.11 | 1.37 | 1.65 | 1.97 | 2.31 | 2.68 | - | - | - | - | - | - |
| -4 | 1065.48 | 10.45 | 0.22 | 0.35 | 0.51 | 0.69 | 0.90 | 1.14 | 1.41 | 1.70 | 2.02 | 2.38 | 2.75 | - | - | - | - | - | - |
| 0 | 995.26 | 9.76 | 0.24 | 0.38 | 0.54 | 0.74 | 0.96 | 1.22 | 1.50 | 1.82 | 2.17 | 2.54 | 2.95 | - | - | - | - | - | - |
| 4 | 934.09 | 9.16 | 0.26 | 0.40 | 0.58 | 0.79 | 1.03 | 1.30 | 1.60 | 1.94 | 2.31 | 2.71 | 3.14 | - | - | - | - | - | - |
| 8 | 880.65 | 8.64 | 0.27 | 0.43 | 0.61 | 0.83 | 1.09 | 1.38 | 1.70 | 2.06 | 2.45 | 2.87 | 3.33 | - | - | - | - | - | - |
| 12 | 833.78 | 8.18 | 0.29 | 0.45 | 0.65 | 0.88 | 1.15 | 1.45 | 1.80 | 2.17 | 2.59 | 3.04 | 3.52 | - | - | - | - | - | - |
| 16 | 792.46 | 7.77 | 0.30 | 0.47 | 0.68 | 0.93 | 1.21 | 1.53 | 1.89 | 2.29 | 2.72 | 3.19 | 3.70 | - | - | - | - | - | - |
| 20 | 755.85 | 7.41 | 0.32 | 0.50 | 0.71 | 0.97 | 1.27 | 1.60 | 1.98 | 2.40 | 2.85 | 3.35 | 3.88 | - | - | - | - | - | - |
| 24 | 723.23 | 7.09 | 0.33 | 0.52 | 0.75 | 1.01 | 1.33 | 1.68 | 2.07 | 2.51 | 2.98 | 3.50 | 4.06 | - | - | - | - | - | - |
| 28 | 694.00 | 6.81 | 0.35 | 0.54 | 0.78 | 1.06 | 1.38 | 1.75 | 2.16 | 2.61 | 3.11 | 3.65 | 4.23 | - | - | - | - | - | - |
| 32 | 667.67 | 6.55 | 0.36 | 0.56 | 0.81 | 1.10 | 1.44 | 1.82 | 2.24 | 2.71 | 3.23 | 3.79 | 4.40 | - | - | - | - | - | - |
| 36 | 643.84 | 6.32 | 0.37 | 0.58 | 0.84 | 1.14 | 1.49 | 1.88 | 2.33 | 2.81 | 3.35 | 3.93 | 4.56 | - | - | - | - | - | - |

### DESIGN TABLE

| Temp. | Tension | Tension | Sag (m) for Span Length (m) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Deg.C) | (kgf) | (kN) | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **140** | **150** | **160** | **170** | **180** | **190** | **200** |
| -5.6 | 954.40 | 9.36 | 0.25 | 0.39 | 0.56 | 0.77 | 1.00 | 1.27 | 1.57 | 1.90 | 2.26 | 2.65 | 3.08 | - | - | - | - | - | - |
| 0 | 878.03 | 8.61 | 0.27 | 0.43 | 0.61 | 0.84 | 1.09 | 1.38 | 1.71 | 2.06 | 2.46 | 2.88 | 3.34 | - | - | - | - | - | - |
| 30 | 631.61 | 6.20 | 0.38 | 0.59 | 0.85 | 1.16 | 1.52 | 1.92 | 2.37 | 2.87 | 3.41 | 4.01 | 4.65 | - | - | - | - | - | - |
| 50 | 543.94 | 5.34 | 0.44 | 0.69 | 0.99 | 1.35 | 1.76 | 2.23 | 2.75 | 3.33 | 3.96 | 4.65 | 5.40 | - | - | - | - | - | - |
| 55 | 526.87 | 5.17 | 0.45 | 0.71 | 1.02 | 1.39 | 1.82 | 2.30 | 2.84 | 3.44 | 4.09 | 4.80 | 5.57 | - | - | - | - | - | - |
| 60 | 511.23 | 5.02 | 0.47 | 0.73 | 1.05 | 1.44 | 1.87 | 2.37 | 2.93 | 3.54 | 4.22 | 4.95 | 5.74 | - | - | - | - | - | - |
| 65 | 496.84 | 4.87 | 0.48 | 0.75 | 1.09 | 1.48 | 1.93 | 2.44 | 3.01 | 3.65 | 4.34 | 5.09 | 5.91 | - | - | - | - | - | - |
| 70 | 483.55 | 4.74 | 0.50 | 0.77 | 1.11 | 1.52 | 1.98 | 2.51 | 3.10 | 3.75 | 4.46 | 5.23 | 6.07 | - | - | - | - | - | - |
| 75 | 471.22 | 4.62 | 0.51 | 0.79 | 1.14 | 1.56 | 2.03 | 2.57 | 3.18 | 3.85 | 4.58 | 5.37 | 6.23 | - | - | - | - | - | - |

**APPENDIX N**

## SUPPORT TYPES, DUTIES & GENERAL ARRANGEMENT DRAWINGS

Tables N1, N2, N3, N4 Wood Pole and Foundation Strut Load Capabilities

Figures F1, F2 and F14 Wood Pole Fabrication Drawings

General Arrangement Drawings:

Figure F3 Single Pole, Single Arm (Light), Intermediate / Pin Angle

Figure F4 Single Pole, Single Arm (Light), Straight or Angle Section

Figure F5 Single Pole, Single Arm (Light), Terminal

Figure F6 Single Pole, Light Construction Tee-Off

Figure F7 Single Pole, Single Arm (Heavy), Intermediate / Pin Angle

Figure F8 Single Pole, Double Arm (Heavy), Intermediate / Pin Angle

Figure F9 Single Pole, Double Arm (Heavy), Straight or Angle Section

Figure F10 "H" Pole, Double Arm (Heavy), Angle Section

Figure F11 "H" Pole, Double Arm (Heavy), Occasional Long Span

Figure F12 "H" Pole, Double Arm (Heavy), Terminal

Figure F13 Single Pole, Double Arm (Heavy), Terminal

Figure F15 Bog Shoe for Poor Soils (Medium Poles)

Figure F16 Bog Shoe for Poor Soils (Stout Poles)

| Length (m) | Grade | Top Diameter (mm) | Diameter 1.5m From Butt (mm) | Planting Depth (mm) | Single Pole & Foundation Strut Strength (kgf) With 1 Block | With 2 Blocks | "H" Pole & Foundation Strut Strength (kgf) with brace block only | with 1 block fitted to each leg | with 2 blocks fitted to each leg | with brace block and 1 block fitted to each leg | with brace block and 2 blocks fitted to each leg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **8.5** | **MEDIUM** | 150 | 215 | 1800 | 7,909 | 8,122 | 13,085 | 13,085 | 16,244 | 16,244 | 16,244 |
| **9** | **MEDIUM** | 150 | 220 | 1800 | 7,308 | 7,308 | 13,246 | 13,246 | 14,615 | 14,615 | 14,615 |
| **9.5** | **MEDIUM** | 150 | 225 | 1800 | 6,638 | 6,638 | 13,276 | 13,276 | 13,276 | 13,276 | 13,276 |
| **10** | **MEDIUM** | 150 | 230 | 1800 | 6,077 | 6,077 | 12,155 | 12,155 | 12,155 | 12,155 | 12,155 |
| **10.5** | **MEDIUM** | 150 | 235 | 1800 | 5,605 | 5,605 | 11,210 | 11,210 | 11,210 | 11,210 | 11,210 |
| **11** | **MEDIUM** | 150 | 240 | 1800 | 5,201 | 5,201 | 10,401 | 10,401 | 10,401 | 10,401 | 10,401 |
| **11.5** | **MEDIUM** | 150 | 245 | 1800 | 4,853 | 4,853 | 9,705 | 9,705 | 9,705 | 9,705 | 9,705 |
| **12** | **MEDIUM** | 150 | 250 | 1800 | 4,550 | 4,550 | 9,101 | 9,101 | 9,101 | 9,101 | 9,101 |
| **13** | **MEDIUM** | 160 | 260 | 1800 | 4,642 | 4,642 | 9,284 | 9,284 | 9,284 | 9,284 | 9,284 |
| **14** | **MEDIUM** | 160 | 275 | 1800 | 4,338 | 4,338 | 8,676 | 8,676 | 8,676 | 8,676 | 8,676 |
| **15** | **MEDIUM** | 165 | 290 | 2100 | 4,488 | 4,488 | 8,976 | 8,976 | 8,976 | 8,976 | 8,976 |
| **16** | **MEDIUM** | 170 | 305 | 2100 | 4,525 | 4,525 | 9,050 | 9,050 | 9,050 | 9,050 | 9,050 |
| **17** | **MEDIUM** | 180 | 320 | 2100 | 4,857 | 4,857 | 9,715 | 9,715 | 9,715 | 9,715 | 9,715 |
| **18** | **MEDIUM** | 180 | 330 | 2100 | 4,521 | 4,521 | 9,043 | 9,043 | 9,043 | 9,043 | 9,043 |
| **20** | **MEDIUM** | 180 | 360 | 2100 | 4,232 | 4,232 | 8,464 | 8,464 | 8,464 | 8,464 | 8,464 |
| **22** | **MEDIUM** | 190 | 380 | 2100 | 4,244 | 4,244 | 8,488 | 8,488 | 8,488 | 8,488 | 8,488 |

**Table N1**

**Strut Load Capability of Poles & Foundations - MEDIUM Poles**

**Minimum Pole Top Dimensions to BS1990, Average Soil (429 kN/m$^2$ bearing capacity)**

| Length (m) | Grade | Top Diameter (mm) | Diameter 1.5m From Butt (mm) | Planting Depth (mm) | Single Pole & Foundation Strut Strength (kgf) With 1 Block | With 2 Blocks | "H" Pole & Foundation Strut Strength (kgf) with brace block only | with 1 block fitted to each leg | with 2 blocks fitted to each leg | with brace block and 1 block fitted to each leg | with brace block and 2 blocks fitted to each leg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **10** | **MED STOUT** | 170 | 260 | 1800 | 8,524 | 9,980 | 14,313 | 14,313 | 19,959 | 19,959 | 19,959 |
| **11** | **MED STOUT** | 175 | 270 | 1800 | 8,699 | 9,007 | 14,665 | 14,665 | 18,014 | 18,014 | 18,014 |
| **12** | **MED STOUT** | 180 | 285 | 1800 | 8,569 | 8,569 | 15,268 | 15,268 | 17,139 | 17,139 | 17,139 |
| **13** | **MED STOUT** | 185 | 295 | 1800 | 8,009 | 8,009 | 15,659 | 15,659 | 16,019 | 16,019 | 16,019 |

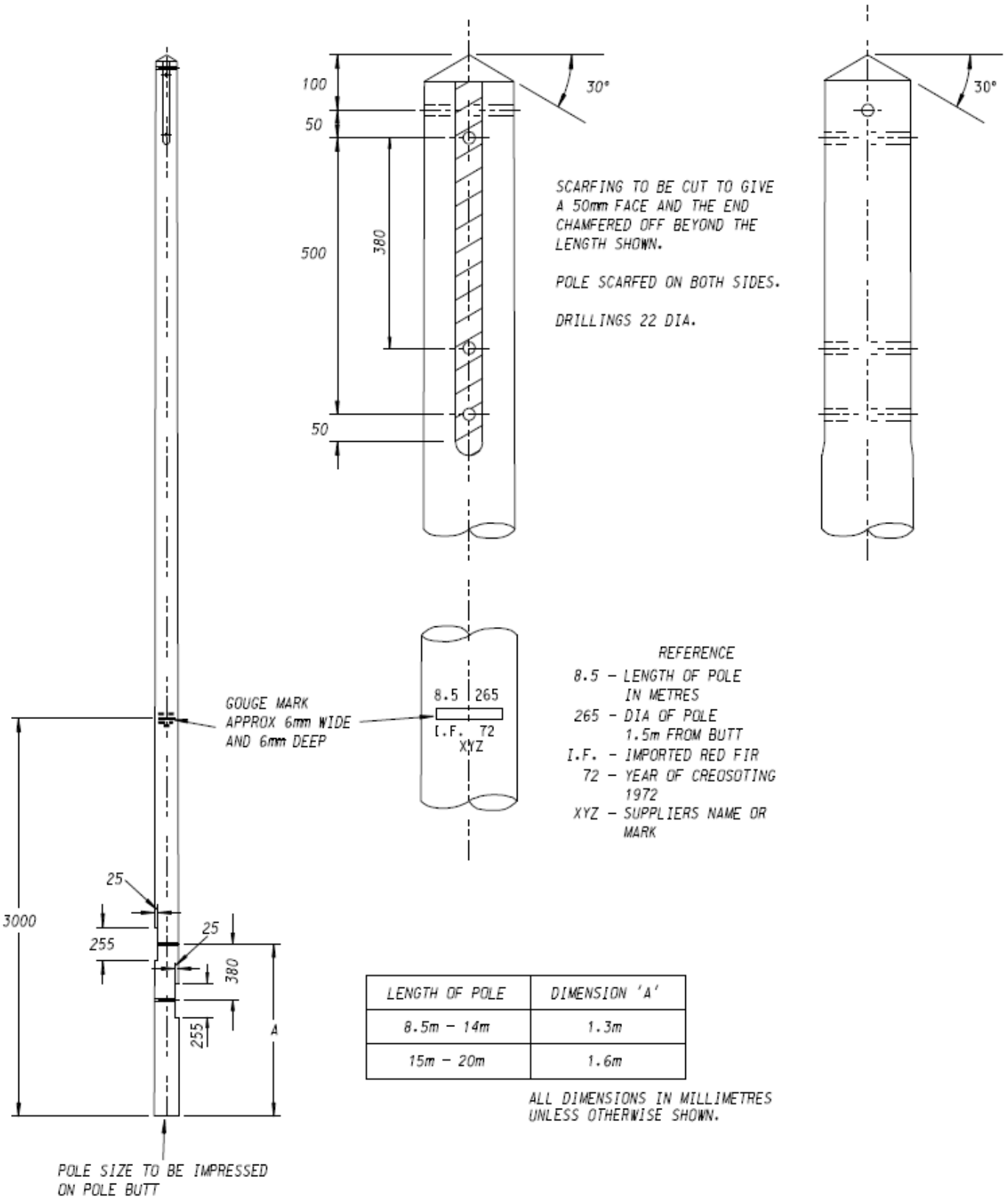
## Table N2
## Strut Load Capability of Poles & Foundations - Medium - Stout Poles
## Average Soil (429 kN/m$^2$ bearing capacity)

| Length (m) | Grade | Top Diameter (mm) | Diameter 1.5m From Butt (mm) | Planting Depth (mm) | Single Pole & Foundation Strut Strength (kgf) | | "H" Pole & Foundation Strut Strength (kgf) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | with 1 Block | with 2 Blocks | with brace block only | with 1 block fitted to each leg | with 2 blocks fitted to each leg | with brace block and 1 block fitted to each leg | with brace block and 2 blocks fitted to each leg |
| **8.5** | **STOUT** | 190 | 265 | 1800 | 8,223 | 15,332 | 13,712 | 13,712 | 27,929 | 27,929 | 39,831 |
| **9** | **STOUT** | 190 | 275 | 1800 | 8,438 | 15,547 | 14,142 | 14,142 | 28,360 | 28,360 | 36,736 |
| **9.5** | **STOUT** | 190 | 280 | 1800 | 8,537 | 15,646 | 14,340 | 14,340 | 28,557 | 28,557 | 33,092 |
| **10** | **STOUT** | 190 | 285 | 1800 | 8,637 | 15,030 | 14,541 | 14,541 | 28,758 | 28,758 | 30,061 |
| **10.5** | **STOUT** | 190 | 290 | 1800 | 8,740 | 13,750 | 14,746 | 14,746 | 27,501 | 27,501 | 27,501 |
| **11** | **STOUT** | 190 | 295 | 1800 | 8,844 | 12,662 | 14,954 | 14,954 | 25,325 | 25,325 | 25,325 |
| **11.5** | **STOUT** | 190 | 300 | 1800 | 8,950 | 11,725 | 15,167 | 15,167 | 23,450 | 23,450 | 23,450 |
| **12** | **STOUT** | 190 | 305 | 1800 | 9,058 | 10,915 | 15,383 | 15,383 | 21,830 | 21,830 | 21,830 |
| **13** | **STOUT** | 195 | 320 | 1800 | 9,395 | 10,432 | 16,055 | 16,055 | 20,864 | 20,864 | 20,864 |
| **14** | **STOUT** | 195 | 335 | 1800 | 9,561 | 9,561 | 16,788 | 16,788 | 19,122 | 19,122 | 19,122 |
| **15** | **STOUT** | 195 | 350 | 2100 | 9,113 | 9,113 | 17,550 | 17,550 | 18,226 | 18,226 | 18,226 |
| **16** | **STOUT** | 200 | 365 | 2100 | 8,957 | 8,957 | 17,915 | 17,915 | 17,915 | 17,915 | 17,915 |
| **17** | **STOUT** | 200 | 375 | 2100 | 8,209 | 8,209 | 16,418 | 16,418 | 16,418 | 16,418 | 16,418 |
| **18** | **STOUT** | 200 | 390 | 2100 | 7,783 | 7,783 | 15,566 | 15,566 | 15,566 | 15,566 | 15,566 |
| **20** | **STOUT** | 200 | 415 | 2100 | 6,953 | 6,953 | 13,906 | 13,906 | 13,906 | 13,906 | 13,906 |
| **22** | **STOUT** | 200 | 435 | 2100 | 6,194 | 6,194 | 12,389 | 12,389 | 12,389 | 12,389 | 12,389 |

## Table N3
## Strut Load Capability of Poles & Foundations - STOUT Poles
## Minimum Pole Top Dimensions to BS1990, Average Soil (429 kN/m$^2$ bearing capacity)

| Length (m) | Grade | Top Diameter (mm) | Diameter 1.5m From Butt (mm) | Planting Depth (mm) | Single Pole & Foundation Strut Strength (kgf) With 1 Block | With 2 Blocks | "H" Pole & Foundation Strut Strength (kgf) with brace block only | with 1 block fitted to each leg | with 2 blocks fitted to each leg | with brace block and 1 block fitted to each leg | with brace block and 2 blocks fitted to each leg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **9** | **Ex STOUT** | 190 | 300 | 1800 | 9,071 | 16,180 | 15,408 | 15,408 | 29,625 | 29,625 | 43,108 |
| **9.5** | **Ex STOUT** | 190 | 305 | 1800 | 9,173 | 16,281 | 15,611 | 15,611 | 29,829 | 29,829 | 38,760 |
| **10** | **Ex STOUT** | 210 | 305 | 1800 | 9,277 | 16,386 | 15,820 | 15,820 | 30,037 | 30,037 | 35,145 |
| **10.5** | **Ex STOUT** | 210 | 315 | 1800 | 9,384 | 16,050 | 16,033 | 16,033 | 30,251 | 30,251 | 32,099 |
| **11** | **Ex STOUT** | 215 | 320 | 1800 | 9,493 | 14,756 | 16,251 | 16,251 | 29,512 | 29,512 | 29,512 |
| **11.5** | **Ex STOUT** | 215 | 330 | 1800 | 9,742 | 14,053 | 16,749 | 16,749 | 28,106 | 28,106 | 28,106 |
| **12** | **Ex STOUT** | 215 | 335 | 1800 | 9,856 | 13,058 | 16,978 | 16,978 | 26,117 | 26,117 | 26,117 |
| **13** | **Ex STOUT** | 215 | 350 | 1800 | 10,234 | 11,761 | 17,735 | 17,735 | 23,523 | 23,523 | 23,523 |
| **14** | **Ex STOUT** | 220 | 365 | 1800 | 10,612 | 11,313 | 18,490 | 18,490 | 23,277 | 23,277 | 23,277 |
| **15** | **Ex STOUT** | 220 | 375 | 2100 | 10,433 | 10,433 | 19,005 | 19,005 | 20,865 | 20,865 | 20,865 |
| **16** | **Ex STOUT** | 220 | 390 | 2100 | 9,709 | 9,709 | 19,418 | 19,418 | 19,418 | 19,418 | 19,418 |
| **17** | **Ex STOUT** | 220 | 415 | 2100 | 9,576 | 9,576 | 19,153 | 19,153 | 19,153 | 19,153 | 19,153 |

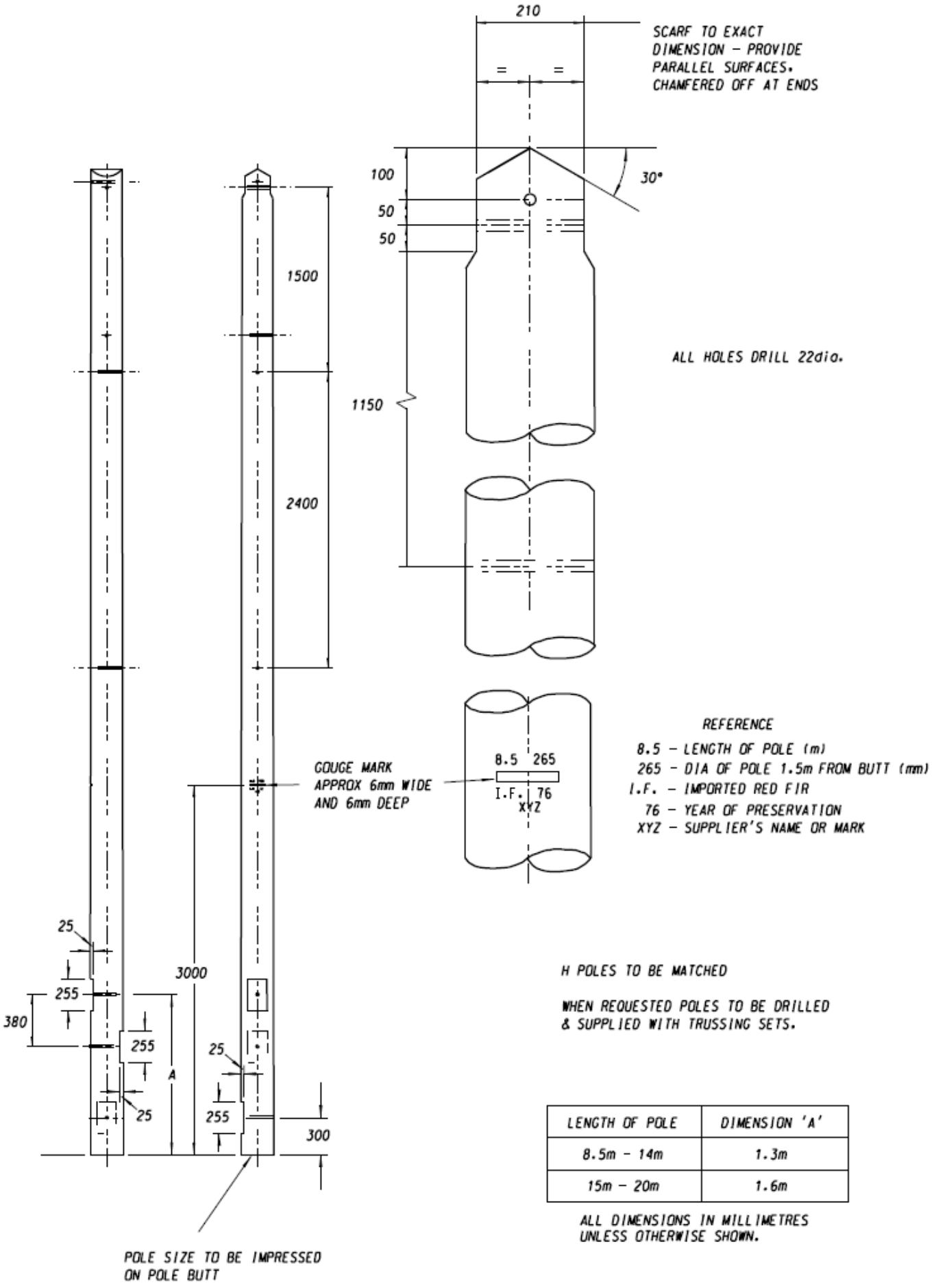
## Table N4
## Strut Load Capability of Poles & Foundations - Ex STOUT Poles
## Minimum Pole Top Dimensions to ENATS 43-88 Issue 5, Average Soil (429 kN/m$^2$ bearing capacity)




| LENGTH OF POLE | DIMENSION 'A' |
|---|---|
| 8.5m – 14m | 1.3m |
| 15m – 20m | 1.6m |

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE SHOWN.

**Fig 1 Single Pole Drilling, Scarfing and Marking**




| LENGTH OF POLE | DIMENSION 'A' |
|---|---|
| 8.5m – 14m | 1.3m |
| 15m – 20m | 1.6m |

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE SHOWN.

**Fig 2 'H' Pole Drilling, Scarfing and Marking**

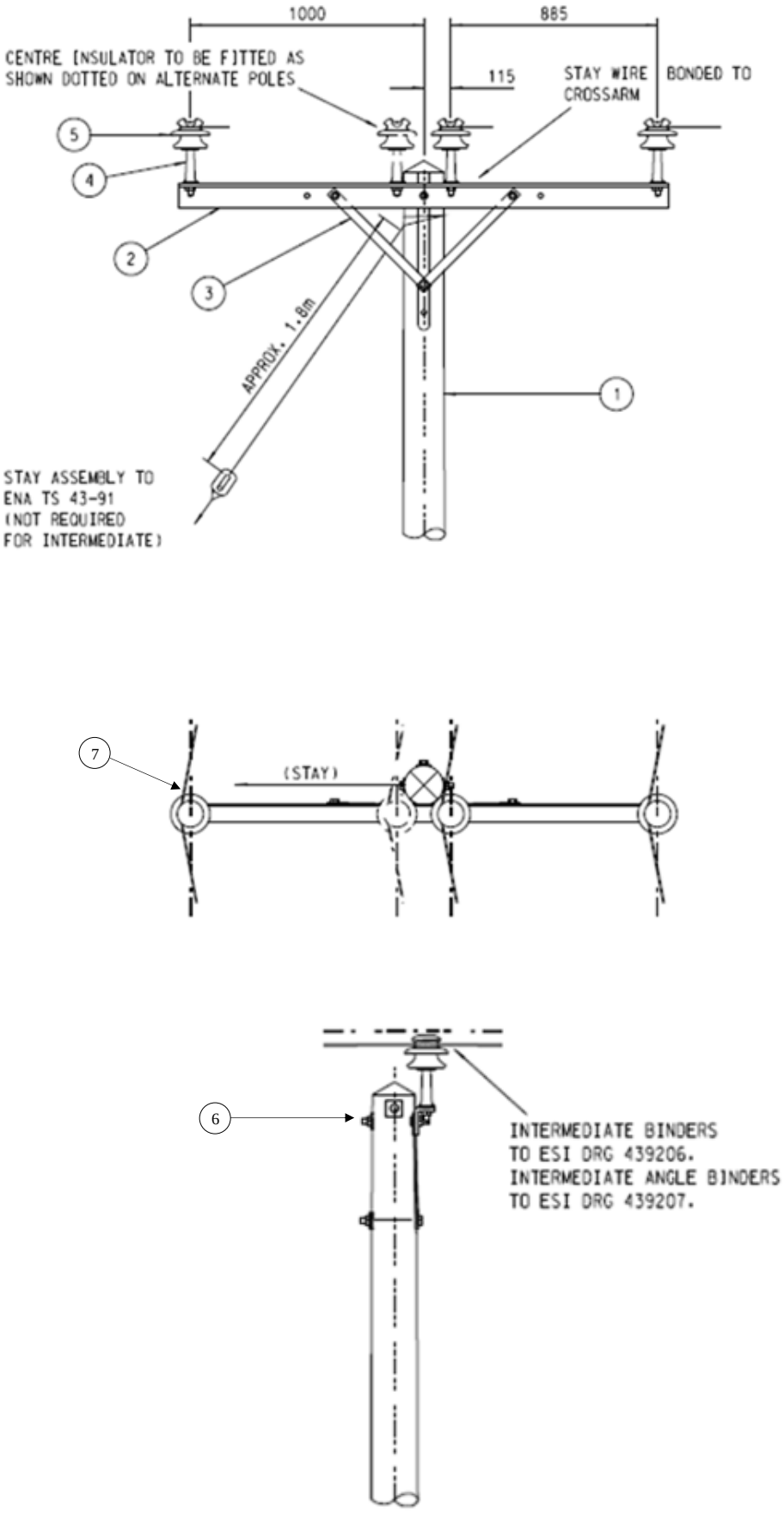



**Fig 3 General Assembly – Intermediate / Pin Angle Pole for 25mm$^2$ HDC**

## Fig 3 - 11kV Intermediate / Pin Angle - Single Crossarm
## Bill of Materials

(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 25 HDC |
|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirements See Fig 1 | 1 |
| 2 | Light Intermediate Crossarm – 2.1m | 30389 | | 1 |
| 3 | Tie Strap | 30467 | | 2 |
| 4 | Insulator Pin | 30441 | | 3 |
| 5 | 11kV Pin Insulator | 30413 or 50447 | | 3 |
| 7 | Bolt, M20x220mm c/w nut (for medium poles) | 30122 | | 3 |
| | Bolt, M20x40mm c/w nut | 30115 | | 2 |
| | Washer, M20, square, curved | 30522 | | 4 |
| | Washer, M20, square, flat | 30523 | | 4 |
| 8 | Helical insulator single top tie, 25 HDC<br>or<br>Helical insulator side tie, 25 HDC | 30633<br>or<br>30634 | | 3 |
| Additional items (not shown) that may be needed to complete the structure | | | | |
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | Not required for augured foundations | 1 or 2 |
| | Bolt, M20x530mm c/w nut (Medium pole) | 30127 | | 1 or 2 |
| | Washer, M20, square, curved | 30522 | | 1 or 2 |
| | Washer, M20, square, flat | 30523 | | 1 or 2 |
| - | Stay materials as per ST:OH4L & ST:OH4T | | Based on line & stay angle and conductor | A/R |
| - | Safety sign as per STOH4N | | License Area specific see | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R |
| - | Additional notices as per STOH4N | | Location specific | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R |

**If a conductor does not appear then it is not permitted with this GA**

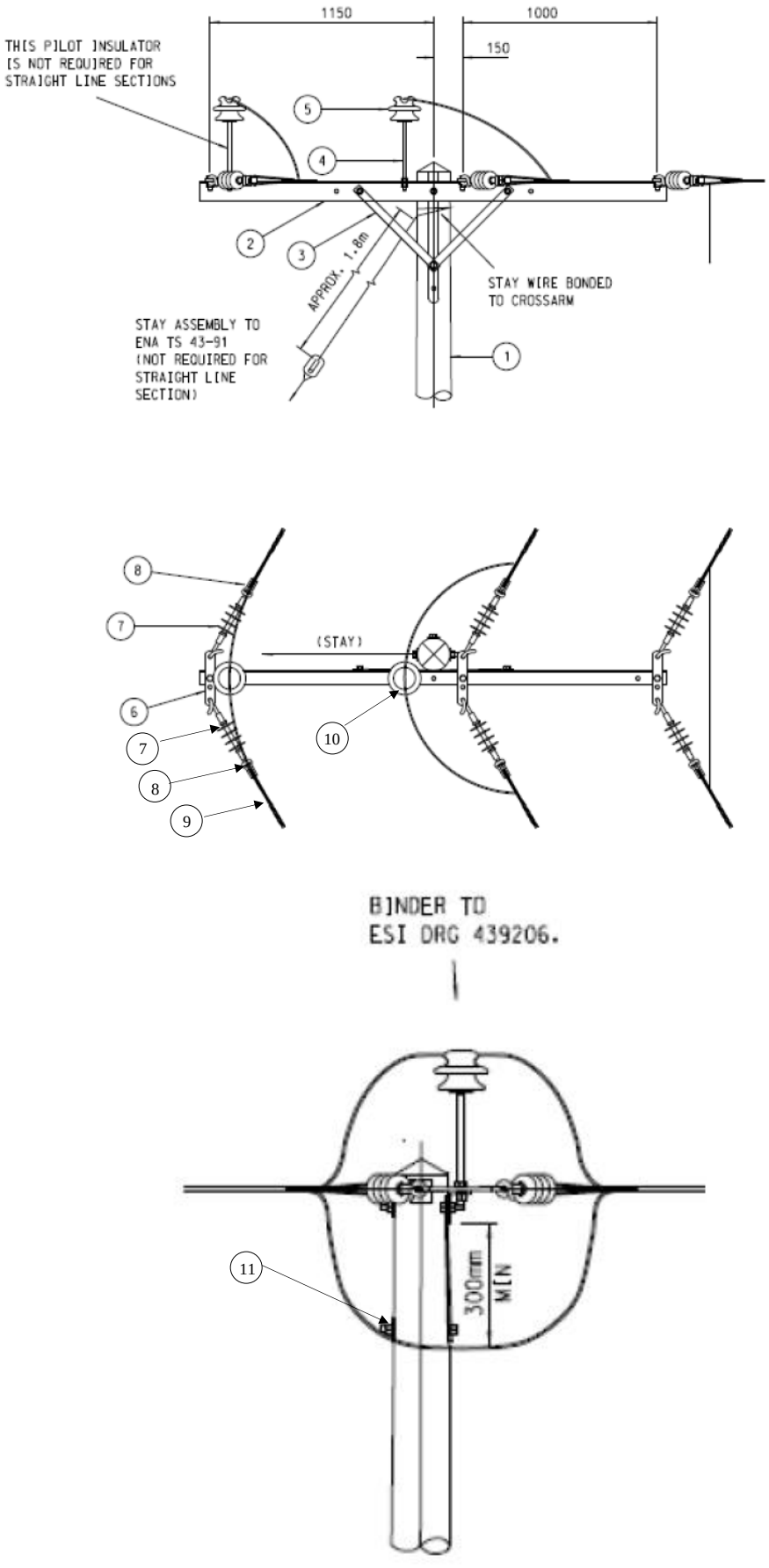



**Fig 4 General Assembly – Straight Line Section Angle for 25mm$^2$ HDC**

| Fig. F4 - Single Pole 11kV Section - Section Angle<br>Bill of Materials<br>(Materials should be read in conjunction with the limiting factors of Pole Top Suitability) | | | | |
|---|---|---|---|---|
| Fig Item No | Item description | Item Code | Comment | 25 HDC |
| 1 | Wood Pole | Various | Based on Requirements See Fig 1 | 1 |
| 2 | Light Section Crossarm – 2.4m | 30390 | | 1 |
| 3 | Tie Strap | 30467 | | 2 |
| 4 | Pilot Insulator Pin | 30444 | | 1 or 2 |
| 5 | Insulator assembly, 11kV | 30413 or 50447 | | 1 or 2 |
| 6 | Section Strap | 30468 | | 3 |
| 7 | 11kv single disk Pigtail / Ball Composite Insulator | 39876 | | 6 |
| 8 | Socket Thimble | 30440 | | 6 |
| 9 | Dead End Grip, 25 HDC | 30174 | | 6 |
| 10 | Helical insulator side tie, 25 HDC | 30634 | | 1 or 2 |
| 11 | Bolt, M20x220mm c/w nut (for medium poles) | 30122 | | 3 |
| | **or** | | | |
| | Bolt, M20x260mm c/w nut (for stout poles) | 30123 | | |
| | Bolt, M20x40mm c/w nut | 30115 | | 5 |
| | Washer, M20, square, curved | 30522 | | 4 |
| | Washer, M20, square, flat | 30523 | | 5 |
| Additional items (not shown) that may be needed to complete the structure | | | | |
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | A/R | 1 or 2 |
| | Bolt, M20x530mm c/w nut (Medium pole)<br>Bolt, M20x750mm c/w nut (Stout Pole) | 30127<br>36943 | | 1 or 2 |
| | Washer, M20, square, curved | 30522 | | 1 or 2 |
| | Washer, M20, square, flat | 30523 | | 1 or 2 |
| - | 25Cu Non Tension Connector | 30255 | | A/R |
| - | Stay materials as per ST:OH4L & ST:OH4T | | A/R | A/R |
| - | Safety sign as per STOH4N | | License Area specific | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R |
| - | Additional notices as required as per STOH4N | | Location specific | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R |

**If a conductor does not appear then it is not permitted with this GA**

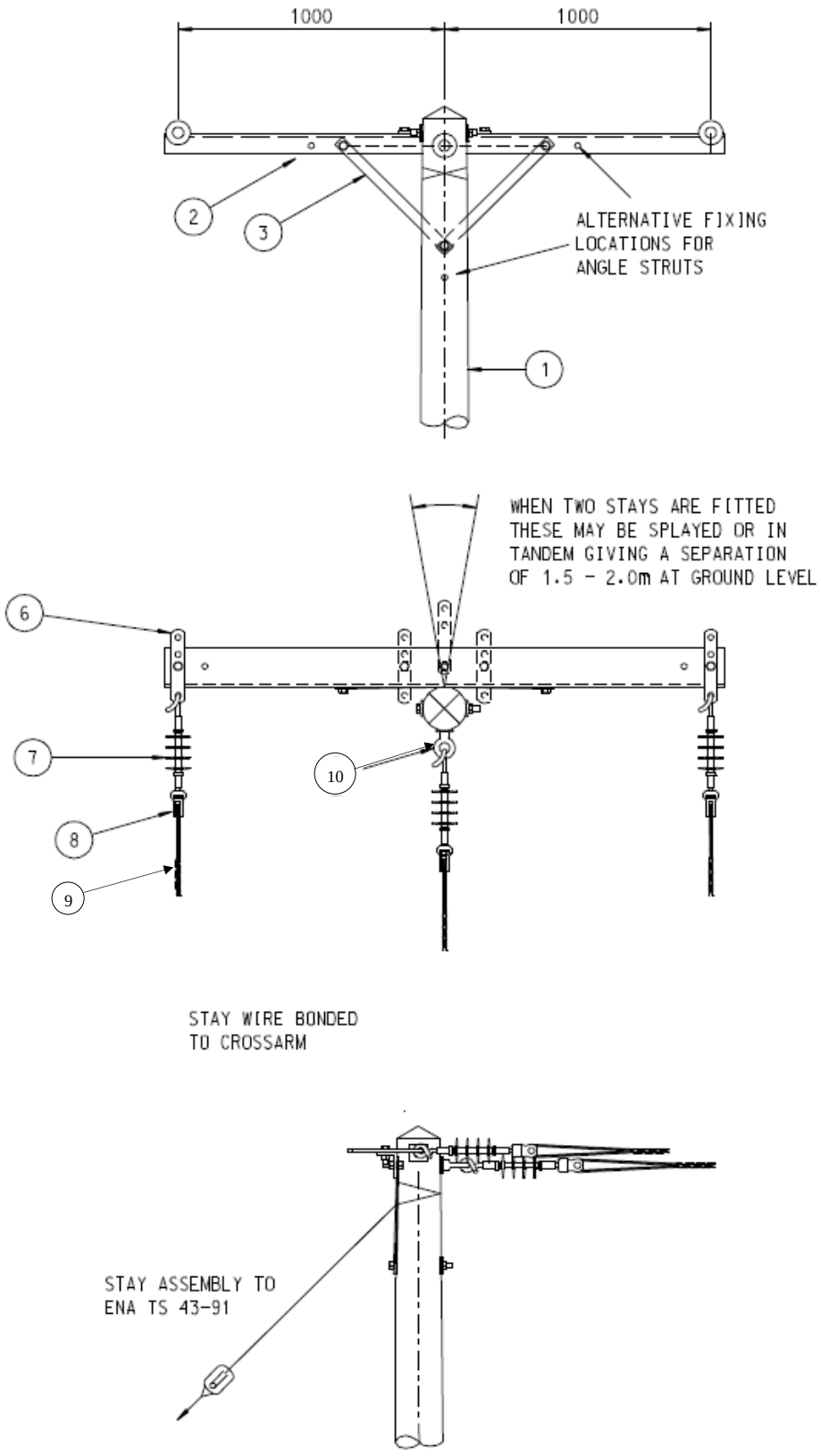



**Fig 5 General Assembly – Terminal Pole for 25mm$^2$ HDC**

## Fig 5 - Single Pole 11kV Terminal
## Bill of Materials

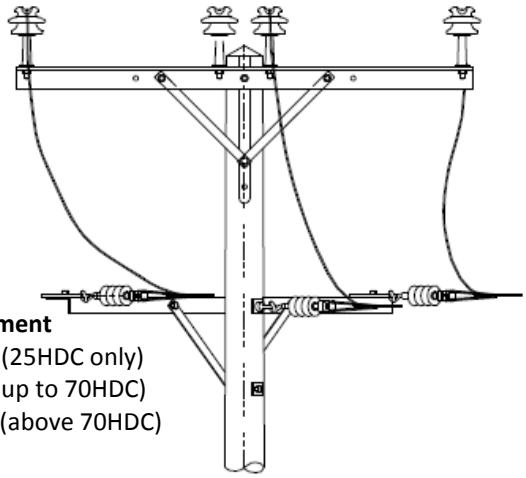
(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 25 HDC |
|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirements See Fig 1 | 1 |
| 2 | Light Terminal Crossarm – 2.1m | 30391 | | 1 |
| 3 | Tie Strap | 30467 | | 2 |
| 6 | Section Strap | 30468 | | 3 |
| 7 | 11kv single disk Pigtail / Ball Composite Insulator | 39876 | | 6 |
| 8 | Socket Thimble | 30440 | | 6 |
| 9 | Dead End Grip, 25 HDC | 30174 | | 6 |
| 10 | Bolt, M20x220mm c/w nut (for medium poles) | 30122 | | 2 |
| | **or** | | | |
| | Bolt, M20x260mm c/w nut (for stout poles) | 30123 | | |
| | Eyebolt M20 x 200mm (for medium poles) | 30130 | | 1 |
| | or | | | |
| | Eyebolt M20 x 300mm (for stout poles) | 30130 | | |
| | Bolt, M20x40mm c/w nut | 30115 | | 5 |
| | Washer, M20, square, curved | 30522 | | 4 |
| | Washer, M20, square, flat | 30523 | | 5 |
| Additional items (not shown) that may be needed to complete the structure | | | | |
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | A/R | 1 or 2 |
| | Bolt, M20x530mm c/w nut (Medium pole)<br>Bolt, M20x750mm c/w nut (Stout Pole) | 30127<br>36943 | | 1 or 2 |
| | Washer, M20, square, curved | 30522 | | 1 or 2 |
| | Washer, M20, square, flat | 30523 | | 1 or 2 |
| - | 25Cu Non Tension Connector | 30255 | | A/R |
| - | Stay materials as per ST:OH4L & ST:OH4T | | A/R | A/R |
| - | Safety sign as per STOH4N | | License Area specific | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R |
| - | Additional notices as required as per STOH4N | | Location specific | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R |

**If a conductor does not appear then it is not permitted with this GA**

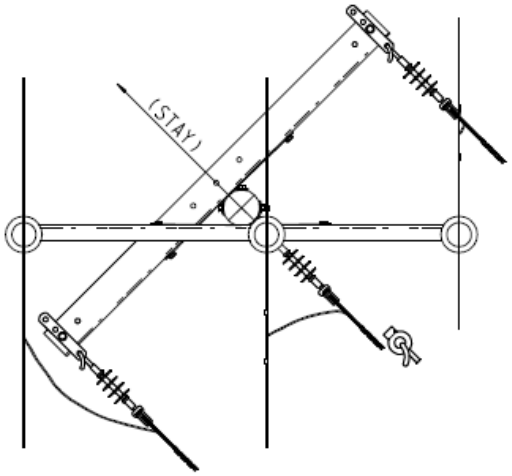
**Intermediate or Section Pole Top Arrangement**

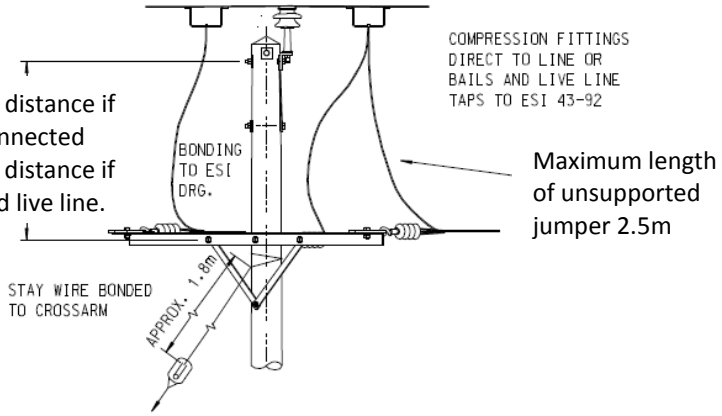
See Fig 3 – Intermediate pole 25HDC only (illustrated)
See Fig 4 – Section pole (25HDC only)
See Fig 7 or 8 – Intermediate Pole (all conductors)
See Fig 9 – Section Pole (all conductors)



**Tee Off Arrangement**

See Fig 5 – Terminal Pole (25HDC only)
See Fig 13 Terminal Pole (up to 70HDC)
See Fig 12 Terminal H Pole (above 70HDC)




1.2m min distance if solidly connected
2.2m min distance if connected live line.

Maximum length of unsupported jumper 2.5m

Notes: -
1. All materials as per the relevant Fig No.
2. Additional round washer and lock nuts required for bonding stay strand to pole top bolts.

## Fig 6 General Assembly – Tee Off Pole

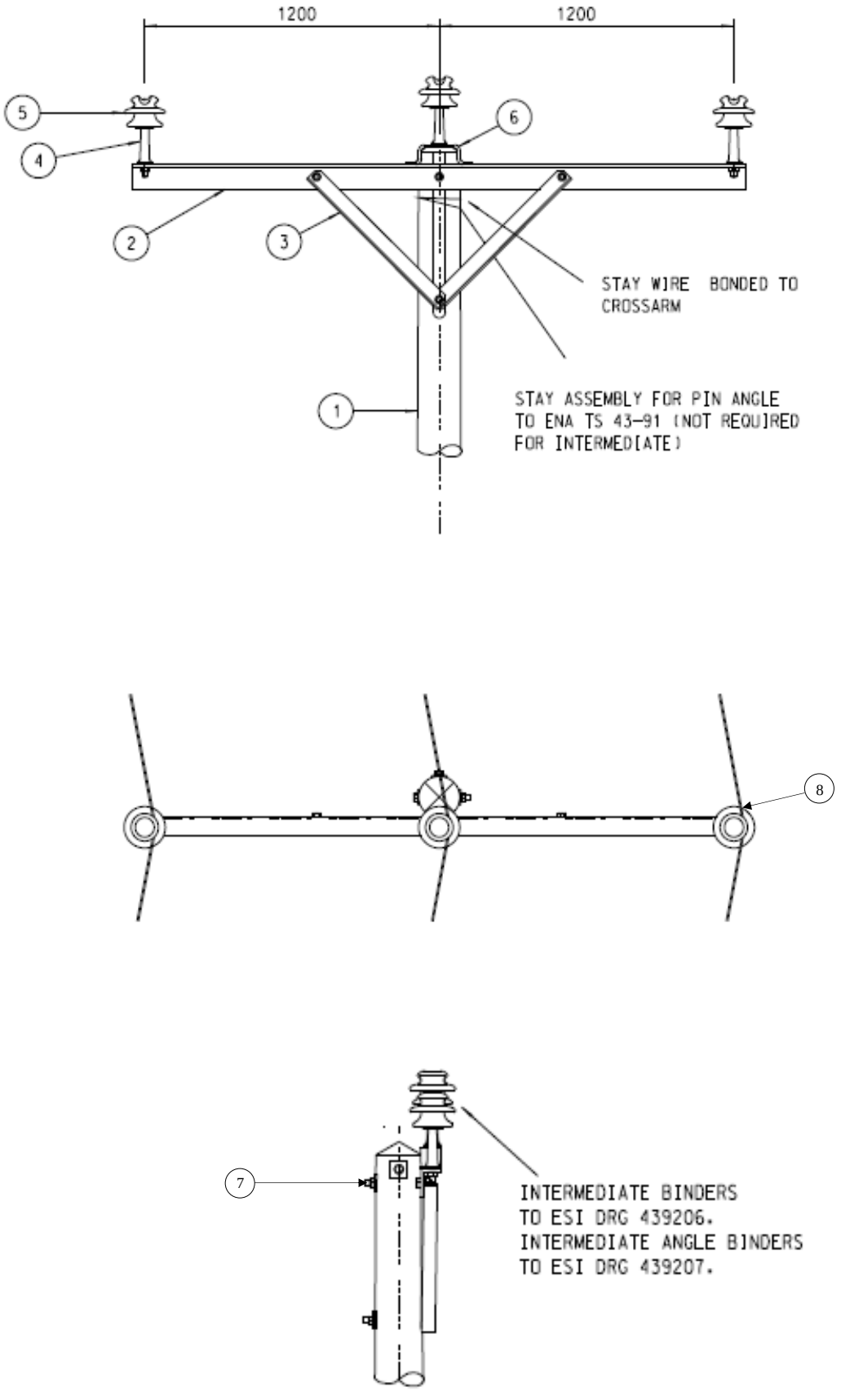



**Fig 7 General Assembly – Intermediate or Pin Angle**
**(Single member Crossarm)**

## Fig 7 - 11kV Intermediate - Single Crossarm
## Bill of Materials

(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 38 HDC | 70 HDC | 100 HDC | 50 AAAC | 60 AAAC | 100 AAAC | 150 AAAC |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirements See Fig 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | Heavy Intermediate Crossarm - 1.2m spacing's | 30401 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3 | Crossarm strut | 30473 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 4 | Insulator Pin | 30441 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 5 | 11kV Pin Insulator | 30413 or 50447 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 6 | Insulator bracket, | 30145 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 7 | Bolt, M20x260mm c/w nut (Med Pole) | 30123 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | **or** | | | | | | | | | |
| | Bolt, M20x300mm c/w nut (St or Ex St Pole) | 30124 | | | | | | | | |
| | Bolt, M20x60mm c/w nut | 30116 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Washer, M20, square, curved | 30522 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Washer, M20, square, flat | 30523 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 8 | Helical insulator tie, double, 38 HDC | 50505 | | 3 | | | | | | |
| | Helical insulator tie, double, 70 HDC | 30673 | | | 3 | | | | | |
| | Helical insulator tie, double, 100 HDC | 30675 | | | | 3 | | | | |
| | Helical insulator tie, double, 50 AAAC | 37370 | | | | | 3 | | | |
| | Helical insulator tie, double, 60 AAAC | NS | | | | | | 3 | | |
| | Helical insulator tie, double, 100 AAAC | 42953 | | | | | | | 3 | |
| | Helical insulator tie, double, 150 AAAC | 43238 | | | | | | | | 3 |
| **Additional items (not shown) that may be needed to complete the structure** | | | | | | | | | | |
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | Not required for augured foundations | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Bolt, M20x530mm c/w nut (Medium pole) Bolt, M20x750mm c/w nut (Stout Pole) | 30127 36943 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Washer, M20, square, curved | 30522 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Washer, M20, square, flat | 30523 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| - | Safety sign as per STOH4N | | License Area specific | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Additional notices as required as per STOH4N | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R |

**If a conductor does not appear then it is not permitted with this GA**

## Fig 7 - 33 kV Intermediate - Single Crossarm
## Bill of Materials

(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 70 HDC | 100 HDC | 100 AAAC | 150 AAAC | 175 AAAC |
|---|---|---|---|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirement See Fig 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | Heavy Intermediate Crossarm - 1.2m spacing's | 30401 | | 1 | 1 | 1 | 1 | 1 |
| 3 | Crossarm strut | 30473 | | 2 | 2 | 2 | 2 | 2 |
| 4 | Insulator Pin | 30442 | not req. if post insulators used | 3 | 3 | 3 | 3 | 3 |
| 5 | Insulator assembly, 33kV | 30415 or 30422 | Porcelain Pin or Porcelain Post | 3 | 3 | 3 | 3 | 3 |
| 6 | Insulator bracket, | 30145 | | 1 | 1 | 1 | 1 | 1 |
| 7 | Bolt, M20x300mm c/w nut (for stout or extra stout poles) | 30124 | | 3 | 3 | 3 | 3 | 3 |
| | Bolt, M20x60mm c/w nut | 30116 | | 4 | 4 | 4 | 4 | 4 |
| | Washer, M20, square, curved | 30522 | | 4 | 4 | 4 | 4 | 4 |
| | Washer, M20, round, flat | 30517 | | 4 | 4 | 4 | 4 | 4 |
| 8 | Helical insulator tie, double, 70 HDC | 30669 | | 3 | | | | |
| | Helical insulator tie, double, 100 HDC | 30665 | | | 3 | | | |
| | Helical insulator tie, double, 100 AAAC | 37366 | | | | 3 | | |
| | Helical insulator tie, double, 150 AAAC | 37039 | | | | | 3 | |
| | Helical insulator tie, double, 175 AAAC | 37039 | | | | | | 3 |
| **Additional items (not shown) that may be needed to complete the structure** | | | | | | | | |
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | Not required for augured foundations | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Bolt, M20x750mm c/w nut (Stout Pole) | 36943 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Washer, M20, square, curved | 30522 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Washer, M20, square, flat | 30523 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| - | Safety sign as per STOH4N | | License Area specific | 2 | 2 | 2 | 2 | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R | A/R | A/R | A/R | A/R |
| - | Additional notices as per STOH4N | | Location specific | A/R | A/R | A/R | A/R | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R | A/R | A/R | A/R | A/R |

**If a conductor does not appear then it is not permitted with this GA**

## Fig 7 - 11kV Pin Angle - Single Crossarm
## Bill of Materials

(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 38 HDC | 70 HDC | 100 HDC | 50 AAAC | 60 AAAC | 100 AAAC | 150 AAAC |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirements See Fig 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | Heavy Intermediate Crossarm - 1.2m spacing's | 30401 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3 | Crossarm strut | 30473 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 4 | Insulator Pin | 30441 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 5 | Insulator assembly, 11kV | 30413 or 50447 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 6 | Insulator bracket, | 30145 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 7 | Bolt, M20x260mm c/w nut (for medium poles) | 30123 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | **or** | | | | | | | | | |
| | Bolt, M20x300mm c/w nut (for stout or extra stout poles) | 30124 | | | | | | | | |
| | Bolt, M20x60mm c/w nut | 30116 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Washer, M20, square, curved | 30522 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Washer, M20, round, flat | 30517 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 8 | Helical insulator side tie, 38 HDC | 30646 | | 3 | | | | | | |
| | Helical insulator side tie, 70 HDC | 30674 | | | 3 | | | | | |
| | Helical insulator side tie, 100 HDC | 30676 | | | | 3 | | | | |
| | Helical insulator side tie, 50 AAAC | 37053 | | | | | 3 | | | |
| | Helical insulator side tie, 60 AAAC | not stocked | | | | | | 3 | | |
| | Helical insulator side tie, 100 AAAC | 50471 | | | | | | | 3 | |
| | Helical insulator side tie, 150 AAAC | 43240 | | | | | | | | 3 |
| Additional items (not shown) that may be needed to complete the structure | | | | | | | | | | |
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Bolt, M20x530mm c/w nut (Medium pole) Bolt, M20x750mm c/w nut (Stout Pole) | 30127 36943 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Washer, M20, square, curved | 30522 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Washer, M20, square, flat | 30523 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| - | Stay materials as per ST:OH4L & ST:OH4T | | Based on line & stay angle and conductor | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Safety sign as per ST:OH4N | | License Area specific see | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Additional notices as per ST:OH4N | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | ACDs as per ST:OH4M | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R |

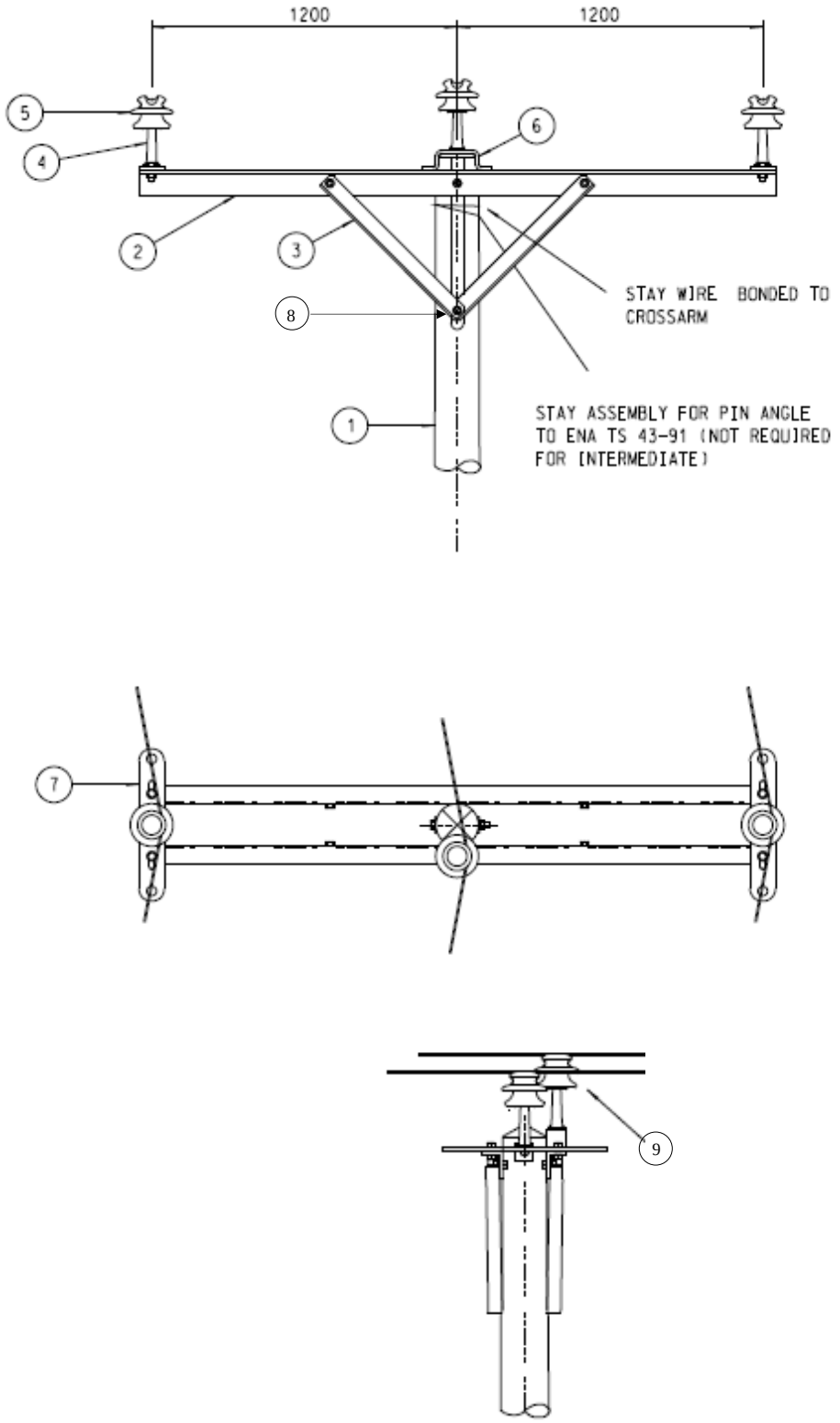
**If a conductor does not appear then it is not permitted with this GA**

## Fig 7 - 33kV Pin Angle - Single Crossarm
## Bill of Materials

(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 70 HDC | 100 HDC | 100 AAAC | 150AAAC | 175AAAC |
|---|---|---|---|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirements See Fig 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | Heavy Intermediate Crossarm - 1.2m spacing's | 30401 | | 1 | 1 | 1 | 1 | 1 |
| 3 | Crossarm strut | 30473 | | 2 | 2 | 2 | 2 | 2 |
| 4 | Insulator Pin | 30442 | not req. if post insulators used | 3 | 3 | 3 | 3 | 3 |
| 5 | Insulator assembly, 33kV | 30415 or 30422 | Porcelain Pin or Porcelain Post | 3 | 3 | 3 | 3 | 3 |
| 6 | Insulator bracket, | 30145 | | 1 | 1 | 1 | 1 | 1 |
| 7 | Bolt, M20x300mm c/w nut (for stout or extra stout poles) | 30124 | | 3 | 3 | 3 | 3 | 3 |
| | Bolt, M20x60mm c/w nut | 30116 | | 4 | 4 | 4 | 4 | 4 |
| | Washer, M20, square, curved | 30522 | | 4 | 4 | 4 | 4 | 4 |
| | Washer, M20, square, flat | 30523 | | 4 | 4 | 4 | 4 | 4 |
| 8 | Helical insulator side tie, 70 HDC | 30670 | | 3 | | | | |
| | Helical insulator side tie, 100 HDC | 30666 | | | 3 | | | |
| | Helical insulator side tie, 100 AAAC | 41830 | | | | 3 | | |
| | Helical insulator side tie, 150 AAAC | 41831 | | | | | 3 | |
| | Helical insulator side tie, 175 AAAC | 41831 | | | | | | 3 |
| Additional items (not shown) that may be needed to complete the structure | | | | | | | | |
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Bolt, M20x750mm c/w nut (Stout Pole) | 36943 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Washer, M20, square, curved | 30522 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Washer, M20, square, flat | 30523 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| - | Stay materials as per ST:OH4L & ST:OH4T | | Based on line & stay angle and conductor | A/R | A/R | A/R | A/R | A/R |
| - | Safety sign as per STOH4N | | License Area specific see | 2 | 2 | 2 | 2 | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R | A/R | A/R | A/R | A/R |
| - | Additional notices as per STOH4N | | Location specific | A/R | A/R | A/R | A/R | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R | A/R | A/R | A/R | A/R |

**If a conductor does not appear then it is not permitted with this GA**




Notes:-

1. All Bolts 60mm long with the exception of the pole bolts.
2. Pin Angle-(i) * Anti-Split bolt with two square curved washers to be fitted.
   (ii) Additional round washers and locknuts required for bonding stay strand to pole top bolts.
3. Where pole top diameter is too large for standard section strap, use Shops 47120.

**Fig 8 General Assembly – Intermediate or Pin Angle (Double member Crossarm)**

## Fig 8 - 11kV Intermediate - Double Crossarm
## Bill of Materials

(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 38 HDC | 70 HDC | 100 HDC | 50 AAAC | 60 AAAC | 100 AAAC | 150 AAAC | 175 AAAC | 200 AAAC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirements See Fig 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | Heavy Intermediate Crossarm - 1.2m spacing's | 30401 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | Crossarm strut | 30473 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 4 | Insulator Pin | 30441 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 5 | Insulator assembly, 11kV | 30413 or 50447 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 6 | Insulator bracket, | 30145 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 7 | Section Strap | 30469 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x260mm c/w nut (medium Pole) | 30123 | | | | | | | | | | |
| | **or** | | | | | | | | | | | |
| | Bolt, M20x300mm c/w nut (St or Ex St Pole) | 30124 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Bolt, M20x60mm c/w nut | 30116 | | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | Washer, M20, square, curved | 30522 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 8 | Washer, M20, square, flat | 30523 | | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | Helical insulator tie, double, 38 HDC | 50505 | | 3 | | | | | | | | |
| | Helical insulator tie, double, 70 HDC | 30673 | | | 3 | | | | | | | |
| | Helical insulator tie, double, 100 HDC | 30675 | | | | 3 | | | | | | |
| | Helical insulator tie, double, 50 AAAC | 37370 | | | | | 3 | | | | | |
| | Helical insulator tie, double, 60 AAAC | not stocked | | | | | | 3 | | | | |
| | Helical insulator tie, double, 100 AAAC | 42953 | | | | | | | 3 | | | |
| | Helical insulator tie, double, 150 AAAC | 43238 | | | | | | | | 3 | | |
| | Helical insulator tie, double, 175 AAAC | 43238 | | | | | | | | | 3 | |
| 9 | Helical insulator tie, double, 200 AAAC | 50501 | | | | | | | | | | 3 |
| **Additional items (not shown) that may be needed to complete the structure** | | | | | | | | | | | | |
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | Not required for augured foundations | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Bolt, M20x530mm c/w nut (Med pole) Bolt, M20x750mm c/w nut (St Pole) | 30127 36943 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Washer, M20, square, curved | 30522 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Washer, M20, square, flat | 30523 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| - | Safety sign as per STOH4N | | License Area specific | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Additional notices as per STOH4N | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |

**If a conductor does not appear then it is not permitted with this GA**

## Fig 8 - 33 kV Intermediate - Double Crossarm
## Bill of Materials

(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 70 HDC | 100 HDC | 150 HDC | 100 AAAC | 150 AAAC | 175 AAAC | 200 AAAC | 300 AAC | 400 AAC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Wood Pole | A/R | Based on Requirement See Fig 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | Heavy Intermediate Crossarm - 1.2m spacing's | 30401 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | Crossarm strut | 30473 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 4 | Insulator Pin | 30442 | not req. if post insulators used | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 5 | Insulator assembly, 33kV | 30415 or 30422 | Porcelain Pin or Porcelain Post | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 6 | Insulator bracket, | 30145 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 7 | Section Strap | 30469 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Bolt, M20x300mm c/w nut (for stout or extra stout poles) | 30124 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Bolt, M20x60mm c/w nut | 30116 | | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | Washer, M20, square, curved | 30522 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Washer, M20, square, flat | 30523 | | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 9 | Helical insulator tie, double, 70 HDC | 30669 | | 3 | | | | | | | | |
| | Helical insulator tie, double, 100 HDC | 30665 | | | 3 | | | | | | | |
| | Helical insulator tie, double, 150 HDC | 30667 | | | | 3 | | | | | | |
| | Helical insulator tie, double, 100 AAAC | 37366 | | | | | 3 | | | | | |
| | Helical insulator tie, double, 150 AAAC | 37039 | | | | | | 3 | | | | |
| | Helical insulator tie, double, 175 AAAC | 37039 | | | | | | | 3 | | | |
| | Helical insulator tie, double, 200 AAAC | 50516 | | | | | | | | 3 | | |
| | Helical insulator tie, double, 300 AAC | 60024 | | | | | | | | | 3 | |
| | Helical insulator tie, double, 400 AAC | not stocked | | | | | | | | | | 3 |
| Additional items (not shown) that may be needed to complete the structure | | | | | | | | | | | | |
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | Not required for augured foundations | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Bolt, M20x750mm c/w nut (Stout Pole) | 36943 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Washer, M20, square, curved | 30522 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Washer, M20, square, flat | 30523 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| - | Safety sign as per STOH4N | | License Area specific see | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Additional notices as per STOH4N | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |

**If a conductor does not appear then it is not permitted with this GA**

## Fig 8 - 11kV Single Pole Pin Angle - Double Crossarm
## Bill of Materials

(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 38 HDC | 70 HDC | 100 HDC | 50 AAAC | 60 AAAC | 100 AAAC | 150 AAAC | 175 AAAC | 200 AAAC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirements See Fig 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | Heavy Intermediate Crossarm - 1.2m spacing's | 30402 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | Crossarm strut | 30473 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 4 | Insulator Pin | 30441 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 x 30442 |
| 5 | Insulator assembly, 11kV | 30413 or 50447 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 x 30415 |
| 6 | Insulator Bracket | 30145 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 7 | Section Strap | 30469 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 8 | Bolt, M20x260mm c/w nut (for medium poles) | 30123 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | **or** | | | | | | | | | | | |
| | Bolt, M20x300mm c/w nut (for stout or extra stout poles) | 30124 | | | | | | | | | | |
| | Bolt, M20x60mm c/w nut | 30116 | | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | Washer, M20, square, curved | 30522 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Washer, M20, square, flat | 30523 | | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 9 | Helical insulator side tie, 38 HDC | 30646 | | 3 | | | | | | | | |
| | Helical insulator side tie, 70 HDC | 30674 | | | 3 | | | | | | | |
| | Helical insulator side tie, 100 HDC | 30676 | | | | 3 | | | | | | |
| | Helical insulator side tie, 50 AAAC | 37053 | | | | | 3 | | | | | |
| | Helical insulator side tie, 60 AAAC | not stocked | | | | | | 3 | | | | |
| | Helical insulator side tie, 100 AAAC | 50471 | | | | | | | 3 | | | |
| | Helical insulator side tie, 150 AAAC | 43240 | | | | | | | | 3 | | |
| | Helical insulator side tie, 175 AAAC | 43240 | | | | | | | | | 3 | |
| | Helical insulator side tie, 200 AAAC | 51041 | | | | | | | | | | 3 |
| Additional items (not shown) that may be needed to complete the structure | | | | | | | | | | | | |
| Foundations as per Tables in ST:OH4T | Type 2 Kicking Block | 30091 | Not required for augured foundations | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Bolt, M20x530mm c/w nut (Medium) Bolt, M20x750mm c/w nut (Stout) | 30127 36943 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Washer, M20, square, curved | 30522 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Washer, M20, square, flat | 30523 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| - | Stay materials as per ST:OH4L & ST:OH4T | | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Safety sign as per STOH4N | | License Area specific see | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Additional notices as per STOH4N | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R. |
| - | ACDs as per STOH4M | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |

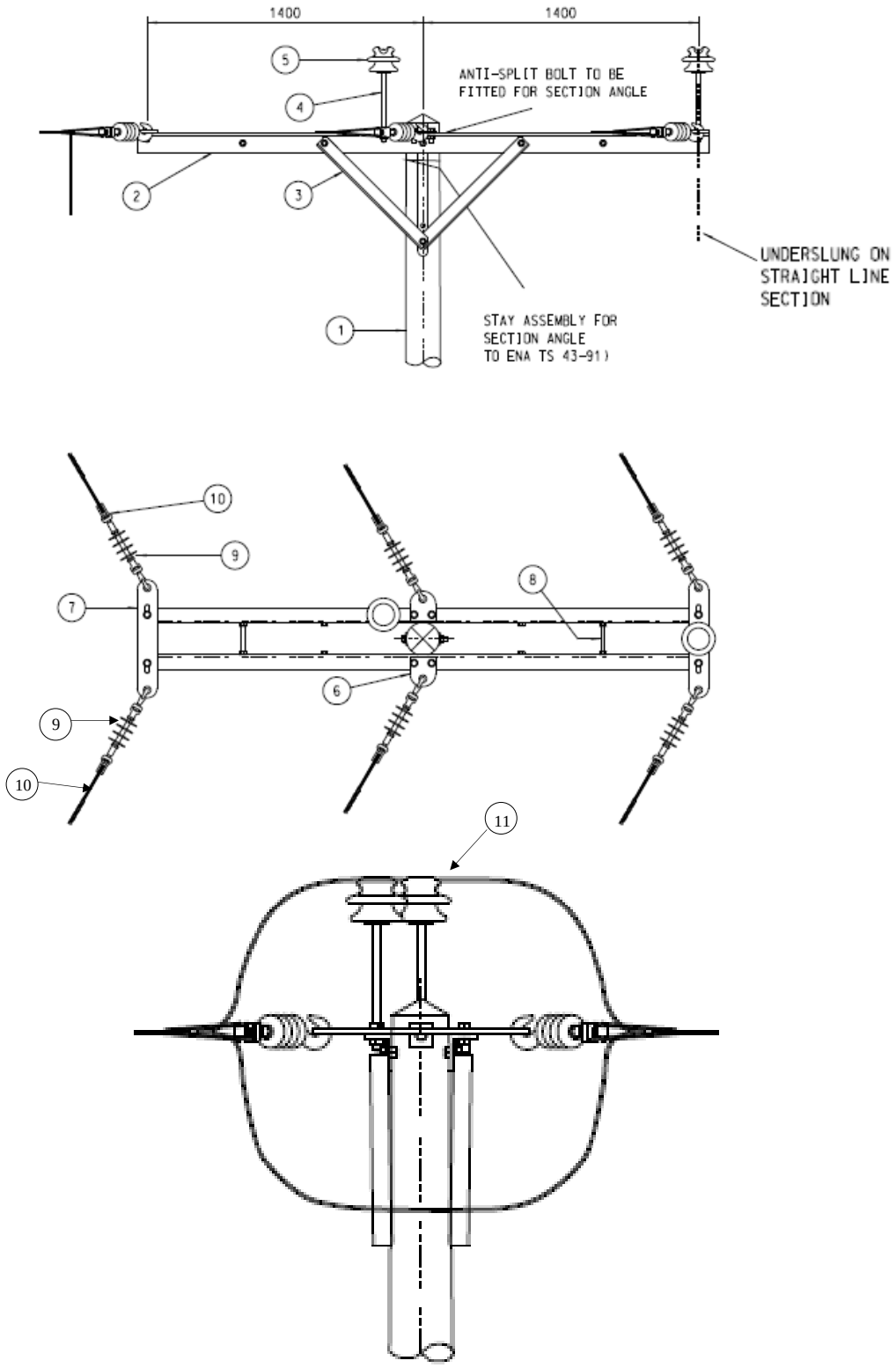
**If a conductor does not appear then it is not permitted with this GA**

## Fig 8 - 33kV Single Pole Pin Angle - Double Crossarm
## Bill of Materials

(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 70 HDC | 100 HDC | 150 HDC | 100 AAAC | 150 AAAC | 175 AAAC | 200 AAAC | 300 AAC | 400 AAC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirements See Fig 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | Heavy Intermediate Crossarm - 1.2m spacing's | 30401 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | Crossarm strut | 30473 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 4 | Insulator Pin | 30442 | not req. if post insulators used | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 5 | Insulator assembly, 33kV | 30415 or 30422 | Porcelain Pin or Porcelain Post | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 6 | Insulator Bracket | 30145 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 7 | Section Strap | 30469 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x300mm c/w nut (for stout or extra stout poles) | 30124 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Bolt, M20x60mm c/w nut | 30116 | | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | Washer, M20, square, curved | 30522 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Washer, M20, square, flat | 30523 | | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 9 | Helical insulator side tie, 70 HDC | 30670 | | 3 | | | | | | | | |
| | Helical insulator side tie, 100 HDC | 30666 | | | 3 | | | | | | | |
| | Helical insulator side tie, 150 HDC | 30668 | | | | 3 | | | | | | |
| | Helical insulator side tie, 100 AAAC | 41830 | | | | | 3 | | | | | |
| | Helical insulator side tie, 150 AAAC | 41831 | | | | | | 3 | | | | |
| | Helical insulator side tie, 175 AAAC | 41831 | | | | | | | 3 | | | |
| | Helical insulator side tie, 200 AAAC | 51041 | | | | | | | | 3 | | |
| | Helical insulator side tie, 300 AAC | 50485 | | | | | | | | | 3 | |
| | Helical insulator side tie, 400 AAC | not stocked | | | | | | | | | | 3 |
| Additional items (not shown) that may be needed to complete the structure | | | | | | | | | | | | |
| Foundations as per Tables in ST:OH4T | Type 2 Kicking Block | 30091 | A/R | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Bolt, M20x750mm c/w nut (Stout Pole) | 36943 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Washer, M20, square, curved | 30522 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Washer, M20, square, flat | 30523 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| - | Stay materials as per ST:OH4L & ST:OH4T | | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Safety sign as per STOH4N | | License Area specific see | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Additional notices as per STOH4N | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |

**If a conductor does not appear then it is not permitted with this GA**




Notes:-

1. All Bolts 60mm long with the exception of the pole bolts.
2. Section Angle-(i) * Anti-Split bolt with two square curved washers to be fitted.
   (ii) Additional round washers and locknuts required for bonding stay strand to pole top bolts.
3. Where pole top diameter is too large for standard section strap, use Shops 47120.

**Fig 9 General Assembly – Single pole Straight Line Section or Section Angle**

## Fig 9 - Single Pole 11kV Section - Section Angle

### Bill of Materials

(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig item No | Item description | Item Code | Comment | 38 HDC | 70 HDC | 100 HDC | 50 AAAC | 60 AAAC | 100 AAAC | 150 AAAC | 175 AAAC | 200 AAAC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirement See Fig 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | Heavy Section Crossarm - 1.4m spacing's | 30402 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | Crossarm strut | 30473 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 4 | Pilot Insulator Pin | 30444 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 x 30442 |
| 5 | Insulator assembly, 11kV | 50447 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 x 30415 |
| 6 | Terminal Strap | 30471 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 7 | Section Strap | 30469 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 8 | Bolt, M20x260mm c/w nut (for medium poles) **or** Bolt, M20x300mm c/w nut (for stout or extra stout poles) | 30123<br>30124 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Tie Rod | 30559 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x60mm c/w nut | 30116 | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | Washer, M20, square, curved | 30522 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Washer, M20, square, flat | 30523 | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 9 | 11kv Ball / Socket Tension Insulator (70kN) Composite Insulator | 39875 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | Ball Hook | 30435 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | Socket Thimble | 30445 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 10 | Dead End Grip, 38 HDC | 30179 | | 6 | | | | | | | | |
| | Dead End Grip, 70 HDC | 30181 | | | 6 | | | | | | | |
| | Dead End Grip, 100 HDC | 30184 | | | | 6 | | | | | | |
| | Dead End Grip, 50 AAAC | 30187 | | | | | 6 | | | | | |
| | Dead End Grip, 60 AAAC | not stocked | | | | | | 6 | | | | |
| | Dead End Grip, 100 AAAC | 30188 | | | | | | | 6 | | | |
| | Dead End Grip, 150 AAAC | 37367 | | | | | | | | 6 | | |
| | Dead End Grip, 175 AAAC | 43236 | | | | | | | | | 6 | |
| | Dead End Grip, 200 AAAC | 43236 | | | | | | | | | | 6 |
| 11 | Helical insulator side tie, 38 HDC | 30646 | | 1 or 2 | | | | | | | | |
| | Helical insulator side tie, 70 HDC | 30674 | | | 1 or 2 | | | | | | | |
| | Helical insulator side tie, 100 HDC | 30676 | | | | 1 or 2 | | | | | | |
| | Helical insulator side tie, 50 AAAC | 37053 | | | | | 1 or 2 | | | | | |
| | Helical insulator side tie, 60 AAAC | no stocked | | | | | | 1 or 2 | | | | |
| | Helical insulator side tie, 100 AAAC | 50471 | | | | | | | 1 or 2 | | | |
| | Helical insulator side tie, 150 AAAC | 43240 | | | | | | | | 1 or 2 | | |
| | Helical insulator side tie, 175 AAAC | 43240 | | | | | | | | | 1 or 2 | |
| | Helical insulator side tie, 200 AAAC | 51041 | | | | | | | | | | 1 or 2 |
| Additional items (not shown) that may be needed to complete the structure | | | | | | | | | | | | |
| Foundations as per Conduct | Type 2 Kicking Block | 30091 | A/R | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Bolt, M20x530mm c/w nut (Med) Bolt, M20x750mm c/w nut (Stout) | 30127 36943 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| or Tables in STOH4T | Washer, M20, square, curved | 30522 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Washer, M20, square, flat | 30523 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| - | Non tension Joints | | | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Stay materials as per ST:OH4L & ST:OH4T | | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Safety sign as per STOH4N | | License Area specific see | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Additional notices as per STOH4N | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |

**If a conductor does not appear then it is not permitted with this GA**

## Fig 9 - 33kV Single Pole Section - Section Angle

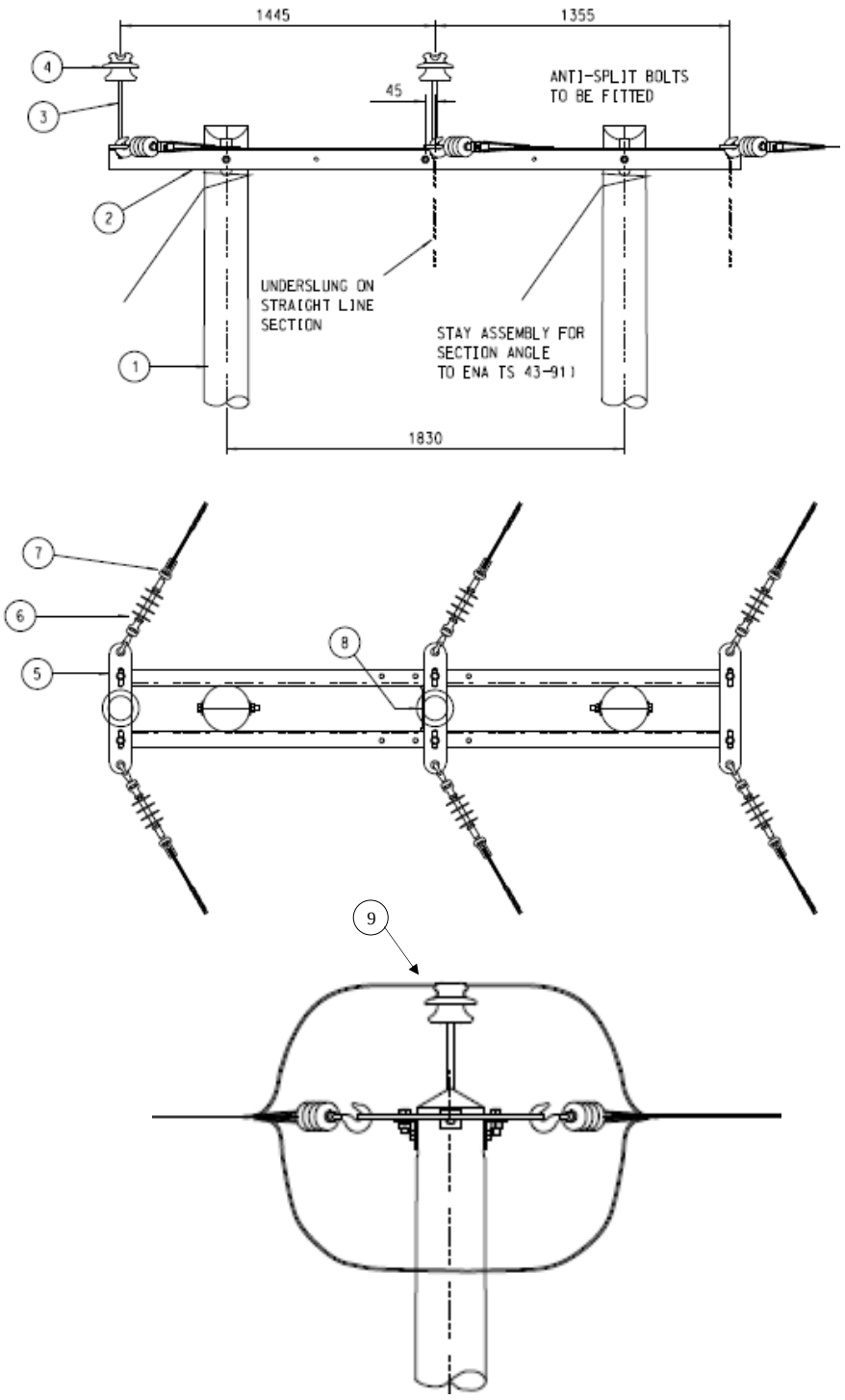
### Bill of Materials

(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 70 HDC | 100 HDC | 150 HDC | 100 AAAC | 150 AAAC | 175 AAAC | 200 AAAC | 300 AAC | 400 AAC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirements See Fig 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | Heavy Section Crossarm - 1.4m spacing's | 30402 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | Crossarm strut | 30473 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 4 | Insulator Pin | 30442 | only req. if pin insulator used | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| 5 | Insulator assembly, 33kV | 30415 or 30422 | Porcelain Pin or Porcelain Post | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| 6 | Terminal Strap | 30471 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 7 | Section Strap | 30469 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 8 | Bolt, M20x260mm c/w nut (for medium poles)<br>**Or**<br>Bolt, M20x300mm c/w nut (for stout or extra stout poles) | 30123<br>or<br>30124 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Tie Rod | 30559 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x60mm c/w nut | 30116 | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | Washer, M20, square, curved | 30522 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Washer, M20, square, flat | 30523 | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 9 | 33kv Ball / Socket Tension Insulator (70kN) Composite Insulator | 41848 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | Ball Hook | 30435 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | Socket Thimble | 30445 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 x 30437 | 6 |
| 10 | Dead End Grip, 70 HDC | 30181 | | 6 | | | | | | | | |
| | Dead End Grip, 100 HDC | 30184 | | | 6 | | | | | | | |
| | Dead End Grip, 150 HDC | 30186 | | | | 6 | | | | | | |
| | Dead End Grip, 100 AAAC | 30188 | | | | | 6 | | | | | |
| | Dead End Grip, 150 AAAC | 37367 | | | | | | 6 | | | | |
| | Dead End Grip, 175 AAAC | 43236 | | | | | | | 6 | | | |
| | Dead End Grip, 200 AAAC | 43236 | | | | | | | | 6 | | |
| | Dead End Compression , 300 AAC | 43560 or 50593 | | | | | | | | | 6 | |
| | Dead End Compression, 400 AAC | not stocked | | | | | | | | | | 6 |
| 11 | Helical insulator side tie, 70 HDC | 30670 | | 1 or 2 | | | | | | | | |
| | Helical insulator side tie, 100 HDC | 30666 | | | 1 or 2 | | | | | | | |
| | Helical insulator side tie, 150 HDC | 30668 | | | | 1 or 2 | | | | | | |
| | Helical insulator side tie, 100 AAAC | 41830 | | | | | 1 or 2 | | | | | |
| | Helical insulator side tie, 150 AAAC | 41831 | | | | | | 1 or 2 | | | | |
| | Helical insulator side tie, 175 AAAC | 41831 | | | | | | | 1 or 2 | | | |
| | Helical insulator side tie, 200 AAAC | 51041 | | | | | | | | 1 or 2 | | |
| | Helical insulator side tie, 300 AAC | 50485 | | | | | | | | | 1 or 2 | |
| | Helical insulator side tie, 400 AAC | not stocked | | | | | | | | | | 1 or 2 |

| Additional items (not shown) that may be needed to complete the structure | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | A/R | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Bolt, M20x530mm c/w nut (Medium)<br>Bolt, M20x750mm c/w nut (Stout) | 30127<br>36943 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Washer, M20, square, curved | 30522 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Washer, M20, square, flat | 30523 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Stay materials as per ST:OH4L & ST:OH4T | | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Safety sign as per STOH4N | | License Area specific see | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | As Required | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Additional notices as required as per STOH4N | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |

**If a conductor does not appear then it is not permitted with this GA**




Notes:-

1. All Bolts 60mm long with the exception of the pole bolts.
2. Section Angle-(i) * Anti-Split bolt with two square curved washers to be fitted.
   (ii) Additional round washers and locknuts required for bonding stay strand to pole top bolts.
3. Where pole top diameter is too large for standard section strap, use Shops 47120.

**Fig 10 General Assembly – 'H' Pole Section Angle up to 60°, Pin Angle or Intermediate**

## Fig 10 - 'H' Pole 11kV Section - Section Angle up to 60°
## Bill of Materials
## (Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 38 HDC | 70 HDC | 100 HDC | 50 AAAC | 60 AAAC | 100 AAAC | 150 AAAC | 175 AAAC | 200 AAAC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirement See Fig 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 2 | Heavy Section Crossarm - 1.4m spacing's | 30402 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | Pilot Insulator Pin | 30444 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 x 30442 |
| 4 | Insulator assembly, 11kV | 50447 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 x 30415 |
| 5 | Section Strap | 30469 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 6 | 11kv Ball / Socket Tension Insulator (70kN) Composite Insulator | 39875 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | Ball Hook | 30435 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | Socket Thimble | 30445 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 7 | Dead End Grip, 38 HDC | 30179 | | 6 | | | | | | | | |
| | Dead End Grip, 70 HDC | 30181 | | | 6 | | | | | | | |
| | Dead End Grip, 100 HDC | 30184 | | | | 6 | | | | | | |
| | Dead End Grip, 50 AAAC | 30187 | | | | | 6 | | | | | |
| | Dead End Grip, 60mm AAAC | not stocked | | | | | | 6 | | | | |
| | Dead End Grip, 100 AAAC | 30188 | | | | | | | 6 | | | |
| | Dead End Grip, 150 AAAC | 37367 | | | | | | | | 6 | | |
| | Dead End Grip, 175 AAAC | 43236 | | | | | | | | | 6 | |
| | Dead End Grip, 200 AAAC | 43236 | | | | | | | | | | 6 |
| 8 | Bolt, M20x260mm c/w nut (Med) **or** Bolt, M20x300mm c/w nut (St or Ex St) | 30123 30124 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Tie Rod | 30559 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Bolt, M20x60mm c/w nut | 30116 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | Washer, M20, square, curved | 30522 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Washer, M20, square, flat | 30523 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 9 | Helical insulator side tie, 38 HDC | 30646 | | 1 or 2 | | | | | | | | |
| | Helical insulator side tie, 70 HDC | 30674 | | | 1 or 2 | | | | | | | |
| | Helical insulator side tie, 100mm HDC | 30676 | | | | 1 or 2 | | | | | | |
| | Helical insulator side tie, 50 AAAC | 37053 | | | | | 1 or 2 | | | | | |
| | Helical insulator side tie, 60 AAAC | not stocked | | | | | | 1 or 2 | | | | |
| | Helical insulator side tie, 100 AAAC | 50471 | | | | | | | 1 or 2 | | | |
| | Helical insulator side tie, 150 AAAC | 43240 | | | | | | | | 1 or 2 | | |
| | Helical insulator side tie, 175 AAAC | 43240 | | | | | | | | | 1 or 2 | |
| | Helical insulator side tie, 200 AAAC | 51041 | | | | | | | | | | 1 or 2 |
| Additional items (not shown) that may be needed to complete the structure | | | | | | | | | | | | |
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | A/R | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Bolt, M20x530mm c/w nut (Medium pole) Bolt, M20x750mm c/w nut (Stout Pole) | 30127 36943 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, curved | 30522 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, flat and / or Brace Block Type 1, 2600mm long (1830mm centres) | 30523 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | | | | | | | | | | | | |
| | | 30093 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Steel Foundation Brace 1830mm H ENATS 439558 | 50552 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x530mm c/w nut | 30127 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x60mm c/w nut | 30116 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Washer, M20, square, curved | 30522 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Washer, M20, square, flat | 30523 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Washer, M20, round, flat | 30517 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| - | No tension Joints | | | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Stay materials as per ST:OH4L & ST:OH4T | | Based on line & stay angle and conductor | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Safety sign as per STOH4N | | License Area specific see | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Additional notices as per STOH4N | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |

**If a conductor does not appear then it is not permitted with this GA**

## Fig 10 - 33kV 'H' Pole Section - Section Angle up to 60

## Bill of Materials

(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 70 HDC | 100 HDC | 150 HDC | 100 AAAC | 150 AAAC | 175 AAAC | 200 AAAC | 300 AAC | 400 AAC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirements See Fig 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 2 | Heavy Section Crossarm - 1.4m spacing's | 30402 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | Insulator Pin | 30444 | only req. if pin insulator used | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| 4 | Insulator assembly, 33kV | 30415 or 30422 | Porcelain Pin or Porcelain Post | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| 5 | Section Strap | 30469 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 6 | 33kv Ball / Socket Tension Insulator (70kN) Composite Insulator | 41848 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | Ball Hook | 30435 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | Socket Thimble | 30445 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 or 6 x 30437 | 6 |
| 7 | Dead End Grip, 70 HDC | 30181 | | 6 | | | | | | | | |
| | Dead End Grip, 100 HDC | 30184 | | | 6 | | | | | | | |
| | Dead End Grip, 150 HDC | 30186 | | | | 6 | | | | | | |
| | Dead End Grip, 100 AAAC | 30188 | | | | | 6 | | | | | |
| | Dead End Grip, 150 AAAC | 37367 | | | | | | 6 | | | | |
| | Dead End Grip, 175 AAAC | 43236 | | | | | | | 6 | | | |
| | Dead End Grip, 200 AAAC | 43236 | | | | | | | | 6 | | |
| | Dead End Compression , 300 AAC | 43560 or 50593 | | | | | | | | | 6 | |
| | Dead End Compression, 400 AAC | not stocked | | | | | | | | | | 6 |
| 8 | Bolt, M20x260mm c/w nut (medium pole) **or** Bolt, M20x300mm c/w nut (stout or Ex St.) | 30123 or 30124 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Tie Rod | 30559 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x60mm c/w nut | 30116 | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | Washer, M20, square, curved | 30522 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Washer, M20, square, flat | 30523 | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 9 | Helical insulator side tie, 70 HDC | 30670 | | 1 or 2 | | | | | | | | |
| | Helical insulator side tie, 100 HDC | 30666 | | | 1 or 2 | | | | | | | |
| | Helical insulator side tie, 150 HDC | 30668 | | | | 1 or 2 | | | | | | |
| | Helical insulator side tie, 100 AAAC | 41830 | | | | | 1 or 2 | | | | | |
| | Helical insulator side tie, 150 AAAC | 41831 | | | | | | 1 or 2 | | | | |
| | Helical insulator side tie, 175 AAAC | 41831 | | | | | | | 1 or 2 | | | |
| | Helical insulator side tie, 200 AAAC | 51041 | | | | | | | | 1 or 2 | | |
| | Helical insulator side tie, 300 AAC | 50485 | | | | | | | | | 1 or 2 | |
| | Helical insulator side tie, 400 AAC | not stocked | | | | | | | | | | 1 or 2 |
| Additional items (not shown) that may be needed to complete the structure | | | | | | | | | | | | |
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | A/R | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Bolt, M20x530mm c/w nut (Medium pole) Bolt, M20x750mm c/w nut (Stout Pole) | 30127 36943 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, curved | 30522 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, flat | 30523 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | and / or | | | | | | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Brace Block Type 1, 2600mm long (1830mm centres) | 30093 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Steel Foundation Brace 1830mm H ENATS 439558 | 50552 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x530mm c/w nut | 30127 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x60mm c/w nut | 30116 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Washer, M20, square, curved | 30522 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Washer, M20, square, flat | 30523 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Washer, M20, round, flat | 30517 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| - | Stay materials as per ST:OH4L & ST:OH4T | | Based on line & stay angle and conductor | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Safety sign as per STOH4N | | License Area specific see | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Additional notices as per STOH4N | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |

**If a conductor does not appear then it is not permitted with this GA**

## Fig 10 - 'H' Pole 11kV Intermediate
## Bill of Materials

(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 38 HDC | 70 HDC | 100 HDC | 50 AAAC | 60 AAAC | 100 AAAC | 150 AAAC | 175 AAAC | 200mm AAAC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirements See Fig 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 2 | Heavy Section Crossarm - 1.4m spacing's | 30402 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | Insulator Pin | 30441 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 4 | Insulator assembly, 11kV | 50447 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 5 | Section Strap | 30469 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 8 | Bolt, M20x260mm c/w nut (medium pole) **or** Bolt, M20x300mm c/w nut (Stout or Ex St) | 30123<br>30124 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Tie Rod | 30559 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Bolt, M20x60mm c/w nut | 30116 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | Washer, M20, square, curved | 30522 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Washer, M20, square, flat | 30523 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 9 | Helical insulator tie, double, 38 HDC | 50505 | | 3 | | | | | | | | |
| | Helical insulator tie, double, 70 HDC | 30673 | | | 3 | | | | | | | |
| | Helical insulator tie, double, 100 HDC | 30675 | | | | 3 | | | | | | |
| | Helical insulator tie, double, 50 AAAC | 37370 | | | | | 3 | | | | | |
| | Helical insulator tie, double, 60 AAAC | not stocked | | | | | | 3 | | | | |
| | Helical insulator tie, double, 100 AAAC | 42953 | | | | | | | 3 | | | |
| | Helical insulator tie, double, 150 AAAC | 43238 | | | | | | | | 3 | | |
| | Helical insulator tie, double, 175m AAAC | 43238 | | | | | | | | | 3 | |
| | Helical insulator tie, double, 200 AAAC | 50501 | | | | | | | | | | 3 |
| Additional items (not shown) that may be needed to complete the structure | | | | | | | | | | | | |
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | A/R | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Bolt, M20x530mm c/w nut (Medium pole) Bolt, M20x750mm c/w nut (Stout Pole) | 30127 36943 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, curved | 30522 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, flat and / or | 30523 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Brace Block Type 1, 2600mm long (1830mm centres) | 30093 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Steel Foundation Brace 1830mm H ENATS 439558 | 50552 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x530mm c/w nut | 30127 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x60mm c/w nut | 30116 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Washer, M20, square, curved | 30522 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Washer, M20, square, flat | 30523 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Washer, M20, round, flat | 30517 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| - | Stay materials as per ST:OH4L & ST:OH4T | | Based on line & stay angle and conductor | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| - | Safety sign as per STOH4N | | License Area specific see | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Additional notices as per STOH4N | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |

**If a conductor does not appear then it is not permitted with this GA**

## Fig 10 - 33kV 'H' Pole Intermediate
## Bill of Materials

(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 70 HDC | 100 HDC | 150 HDC | 100 AAAC | 150 AAAC | 175 AAAC | 200 AAAC | 300 AAC | 400 AAC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirements See Fig 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 2 | Heavy Section Crossarm - 1.4m spacing's | 30402 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | Insulator Pin | 30442 | only req. if pin insulator used | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| 4 | Insulator assembly, 33kV | 30415 or 30422 | Porcelain Pin or Porcelain Post | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| 5 | Section Strap | 30469 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 6 | Bolt, M20x260mm c/w nut (medium pole) **or** Bolt, M20x300mm c/w nut (St. or Ex St.) | 30123 or 30124 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Tie Rod | 30559 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x60mm c/w nut | 30116 | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | Washer, M20, square, curved | 30522 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Washer, M20, square, flat | 30523 | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 7 | Helical insulator tie, double, 70 HDC | 30669 | | 3 | | | | | | | | |
| | Helical insulator tie, double, 100 HDC | 30665 | | | 3 | | | | | | | |
| | Helical insulator tie, double, 150 HDC | 30667 | | | | 3 | | | | | | |
| | Helical insulator tie, double, 100 AAAC | 37366 | | | | | 3 | | | | | |
| | Helical insulator tie, double, 150 AAAC | 37039 | | | | | | 3 | | | | |
| | Helical insulator tie, double, 175 AAAC | 37039 | | | | | | | 3 | | | |
| | Helical insulator tie, double, 200 AAAC | 50516 | | | | | | | | 3 | | |
| | Helical insulator tie, double, 300 AAC | 60024 | | | | | | | | | 3 | |
| | Helical insulator tie, double, 400 AAC | not stocked | | | | | | | | | | 3 |
| Additional items (not shown) that may be needed to complete the structure | | | | | | | | | | | | |
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | A/R | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Bolt, M20x530mm c/w nut (Medium pole) Bolt, M20x750mm c/w nut (Stout Pole) | 30127 36943 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, curved | 30522 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, flat and / or Brace Block Type 1, 2600mm long (1830mm centres) | 30523 30093 | | 2 or 4 1 | 2 or 4 1 | 2 or 4 1 | 2 or 4 1 | 2 or 4 1 | 2 or 4 1 | 2 or 4 1 | 2 or 4 1 | 2 or 4 1 |
| | Steel Foundation Brace 1830mm H ENATS 439558 | not stocked | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x530mm c/w nut | 30127 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x60mm c/w nut | 30116 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Washer, M20, square, curved | 30522 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Washer, M20, square, flat | 30523 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Washer, M20, round, flat | 30517 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| - | Stay materials as per ST:OH4L & ST:OH4T | | Based on line & stay angle and conductor | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Safety sign as per STOH4N | | License Area specific see | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Additional notices as required as per STOH4N | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |

**If a conductor does not appear then it is not permitted with this GA**

## Fig 10 - 'H' Pole 11kV Pin Angle
## Bill of Materials

(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 38 HDC | 70 HDC | 100 HDC | 50 AAAC | 60 AAAC | 100 AAAC | 150 AAAC | 175 AAAC | 200 AAAC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirements See Fig 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 2 | Heavy Section Crossarm - 1.4m spacing's | 30402 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | Insulator Pin | 30441 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 x 30442 |
| 4 | Insulator assembly, 11kV | 50447 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 x 30415 |
| 5 | Section Strap | 30469 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 7 | Bolt, M20x260mm c/w nut (med poles)<br>**or**<br>Bolt, M20x300mm c/w nut (St or Ex St ) | 30123<br><br>30124 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Tie Rod | 30559 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Bolt, M20x60mm c/w nut | 30116 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | Washer, M20, square, curved | 30522 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Washer, M20, square, flat | 30523 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 8 | Helical insulator side tie, 38 HDC | 30646 | | 3 | | | | | | | | |
| | Helical insulator side tie, 70 HDC | 30674 | | | 3 | | | | | | | |
| | Helical insulator side tie, 100 HDC | 30676 | | | | 3 | | | | | | |
| | Helical insulator side tie, 50 AAAC | 37053 | | | | | 3 | | | | | |
| | Helical insulator side tie, 60 AAAC | not stocked | | | | | | 3 | | | | |
| | Helical insulator side tie, 100 AAAC | 50471 | | | | | | | 3 | | | |
| | Helical insulator side tie, 150 AAAC | 43240 | | | | | | | | 3 | | |
| | Helical insulator side tie, 175 AAAC | 43240 | | | | | | | | | 3 | |
| | Helical insulator side tie, 200 AAAC | 51041 | | | | | | | | | | 3 |
| Additional items (not shown) that may be needed to complete the structure | | | | | | | | | | | | |
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | A/R | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Bolt, M20x530mm c/w nut (Med pole)<br>Bolt, M20x750mm c/w nut (St Pole) | 30127<br>36943 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, curved | 30522 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, flat<br>and / or | 30523 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Brace Block Type 1, 2600mm long (1830mm centres) | 30093 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Steel Foundation Brace 1830mm H ENATS 439558 | 50552 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x530mm c/w nut | 30127 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x60mm c/w nut | 30116 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Washer, M20, square, curved | 30522 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Washer, M20, square, flat | 30523 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Washer, M20, round, flat | 30517 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| - | Stay materials as per ST:OH4L & ST:OH4T | | Based on line & stay angle and conductor | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Safety sign as per STOH4N | | License Area specific see | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Additional notices as per STOH4N | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |

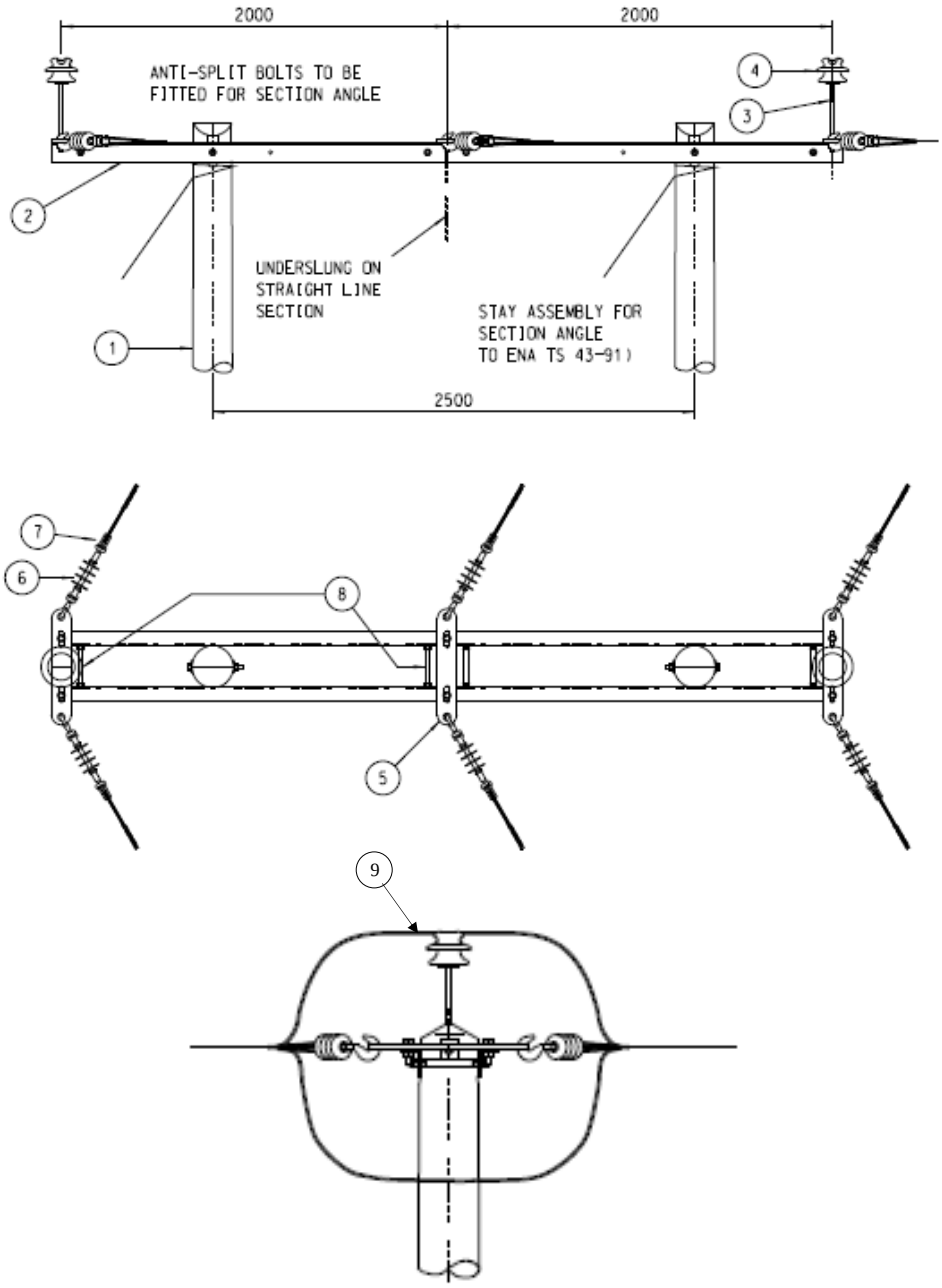
**If a conductor does not appear then it is not permitted with this GA**

## Fig 10 - 33kV 'H' Pole Pin Angle
## Bill of Materials

(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 70 HDC | 100 HDC | 150 HDC | 100 AAAC | 150 AAAC | 175 AAAC | 200 AAAC | 300 AAC | 400 AAC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirements See Fig 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 2 | Heavy Section Crossarm - 1.4m spacing's | 30402 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | Insulator Pin | 30442 | only req. if pin insulator used | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| 4 | Insulator assembly, 33kV | 30415 or 30422 | Porcelain Pin or Porcelain Post | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| 5 | Section Strap | 30469 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 6 | Bolt, M20x260mm c/w nut (Med poles) **or** Bolt, M20x300mm c/w nut (St or Ex St ) | 30123 or 30124 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Tie Rod | 30559 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x60mm c/w nut | 30116 | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | Washer, M20, square, curved | 30522 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Washer, M20, square, flat | 30523 | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 7 | Helical insulator side tie, 70 HDC | 30670 | | 3 | | | | | | | | |
| | Helical insulator side tie, 100 HDC | 30666 | | | 3 | | | | | | | |
| | Helical insulator side tie, 150 HDC | 30668 | | | | 3 | | | | | | |
| | Helical insulator side tie, 100 AAAC | 41830 | | | | | 3 | | | | | |
| | Helical insulator side tie, 150 AAAC | 41831 | | | | | | 3 | | | | |
| | Helical insulator side tie, 175 AAAC | 41831 | | | | | | | 3 | | | |
| | Helical insulator side tie, 200 AAAC | 51041 | | | | | | | | 3 | | |
| | Helical insulator side tie, 300 AAC | 50485 | | | | | | | | | 3 | |
| | Helical insulator side tie, 400 AAC | not stocked | | | | | | | | | | 3 |
| Additional items (not shown) that may be needed to complete the structure | | | | | | | | | | | | |
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | A/R | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Bolt, M20x530mm c/w nut (Med pole) Bolt, M20x750mm c/w nut (St Pole) | 30127 36943 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, curved | 30522 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, flat and / or | 30523 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Brace Block Type 1, 2600mm long (1830mm centres) | 30093 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Steel Foundation Brace 1830mm H ENATS 439558 | not stocked | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x530mm c/w nut | 30127 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x60mm c/w nut | 30116 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Washer, M20, square, curved | 30522 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Washer, M20, square, flat | 30523 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Washer, M20, round, flat | 30517 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| - | Stay materials as per ST:OH4L & ST:OH4T | | Based on line & stay angle and conductor | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Safety sign as per STOH4N | | License Area specific see | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Additional notices as per STOH4N | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |

**If a conductor does not appear then it is not permitted with this GA**




Notes:-

1. All Bolts 60mm long with the exception of the pole bolts.
2. Section Angle-(i) * Anti-Split bolt with two square curved washers to be fitted.
   (ii) Additional round washers and locknuts required for bonding stay strand to pole top bolts.
3. Where pole top diameter is too large for standard section strap. use Shops 47120.

**Fig 11 General Assembly – 'H' Pole Straight Line Section, Section Angle up to 60° or Intermediate for Occasional Long Span**

## Fig 11 - 'H' Pole 11kV Section - Section Angle up to 60 for Occasional Long Span

### Bill of Materials

(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 38 HDC | 70 HDC | 100 HDC | 50 AAAC | 60 AAAC | 100 AAAC | 150 AAAC | 175 AAAC | 200 AAAC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirements See Fig 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 2 | Heavy Crossarm - 2m spacing's | 30403 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | Pilot Insulator Pin | 30444 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 x 30442 |
| 4 | Insulator assembly, 11kV | 50447 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 x 30415 |
| 5 | Section Strap | 30469 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 6 | 11kv Ball / Socket Tension Insulator (70kN) Composite Insulator | 39875 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | Ball Hook | 30435 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | Socket Thimble | 30445 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 7 | Dead End Grip, 38 HDC | 30179 | | 6 | | | | | | | | |
| | Dead End Grip, 70 HDC | 30181 | | | 6 | | | | | | | |
| | Dead End Grip, 100 HDC | 30184 | | | | 6 | | | | | | |
| | Dead End Grip, 50 AAAC | 30187 | | | | | 6 | | | | | |
| | Dead End Grip, 60 AAAC | not stocked | | | | | | 6 | | | | |
| | Dead End Grip, 100 AAAC | 30188 | | | | | | | 6 | | | |
| | Dead End Grip, 150 AAAC | 37367 | | | | | | | | 6 | | |
| | Dead End Grip, 175 AAAC | 43236 | | | | | | | | | 6 | |
| | Dead End Grip, 200 AAAC | 43236 | | | | | | | | | | 6 |
| 8 | Bolt, M20x260mm c/w nut (Med poles) **or** Bolt, M20x300mm c/w nut (St or Ex St ) | 30123 30124 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Tie Rod | 30559 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Bolt, M20x60mm c/w nut | 30116 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | Washer, M20, square, curved | 30522 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Washer, M20, square, flat | 30523 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 9 | Helical insulator side tie, 38 HDC | 30646 | | 1 or 2 | | | | | | | | |
| | Helical insulator side tie, 70 HDC | 30674 | | | 1 or 2 | | | | | | | |
| | Helical insulator side tie, 100 HDC | 30676 | | | | 1 or 2 | | | | | | |
| | Helical insulator side tie, 50 AAAC | 37053 | | | | | 1 or 2 | | | | | |
| | Helical insulator side tie, 60 AAAC | not stocked | | | | | | 1 or 2 | | | | |
| | Helical insulator side tie, 100 AAAC | 50471 | | | | | | | 1 or 2 | | | |
| | Helical insulator side tie, 150 AAAC | 43240 | | | | | | | | 1 or 2 | | |
| | Helical insulator side tie, 175 AAAC | 43240 | | | | | | | | | 1 or 2 | |
| | Helical insulator side tie, 200 AAAC | 51041 | | | | | | | | | | 1 or 2 |
| Additional items (not shown) that may be needed to complete the structure | | | | | | | | | | | | |
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | A/R | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Bolt, M20x530mm c/w nut (Med) Bolt, M20x750mm c/w nut (St) | 30127 36943 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, curved | 30522 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, flat and / or | 30523 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Brace Block Type 2, 3000mm long (2500mm centres) | 30094 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Steel Foundation Brace 2500mm H ENATS 439559 | not stocked | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x530mm c/w nut | 30127 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x60mm c/w nut | 30116 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Washer, M20, square, curved | 30522 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Washer, M20, square, flat | 30523 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Washer, M20, round, flat | 30517 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| - | Foundations as per STOH4T | | Based on line angle and conductor | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | No tension Joints | | | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Stay materials as per ST:OH4L & ST:OH4T | | Based on line & stay angle and conductor | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Safety sign as per STOH4N | | License Area specific see | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Additional notices as required as per STOH4N | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |

**If a conductor does not appear then it is not permitted with this GA**

## Fig 11 - 33kV 'H' Pole Section - Section Angle up to 60 for Occasional Long Span

### Bill of Materials

(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 70 HDC | 100 HDC | 150 HDC | 100 AAAC | 150 AAAC | 175 AAAC | 200 AAAC | 300 AAC | 400 AAC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirements See Fig 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 2 | Heavy Crossarm - 2m spacing's | 30403 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | Insulator Pin | 30444 | Only req. if pin insulator used | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| 4 | Insulator assembly, 33kV | 30415 or 30422 | Porcelain Pin or Porcelain Post | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| 5 | Section Strap | 30469 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 6 | 33kv Ball / Socket Tension Insulator (70kN) Composite Insulator | 41848 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | Ball Hook | 30435 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | Socket Thimble | 30445 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 or 6 x 30437 | 6 |
| 7 | Dead End Grip, 70 HDC | 30181 | | 6 | | | | | | | | |
| | Dead End Grip, 100 HDC | 30184 | | | 6 | | | | | | | |
| | Dead End Grip, 150 HDC | 30186 | | | | 6 | | | | | | |
| | Dead End Grip, 100 AAAC | 30188 | | | | | 6 | | | | | |
| | Dead End Grip, 150 AAAC | 37367 | | | | | | 6 | | | | |
| | Dead End Grip, 175 AAAC | 43236 | | | | | | | 6 | | | |
| | Dead End Grip, 200 AAAC | 43236 | | | | | | | | 6 | | |
| | Dead End Compression , 300mm AAC | 43560 or 50593 | | | | | | | | | 6 | |
| | Dead End Compression, 400mm AAC | not stocked | | | | | | | | | | 6 |
| 8 | Bolt, M20x260mm c/w nut (Med ) **or** Bolt, M20x300mm c/w nut (St or Ex St) | 30123 or 30124 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Tie Rod | 30559 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Bolt, M20x60mm c/w nut | 30116 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | Washer, M20, square, curved | 30522 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Washer, M20, square, flat | 30523 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 9 | Helical insulator side tie, 70 HDC | 30670 | | 1 or 2 | | | | | | | | |
| | Helical insulator side tie, 100 HDC | 30666 | | | 1 or 2 | | | | | | | |
| | Helical insulator side tie, 150 HDC | 30668 | | | | 1 or 2 | | | | | | |
| | Helical insulator side tie, 100 AAAC | 41830 | | | | | 1 or 2 | | | | | |
| | Helical insulator side tie, 150 AAAC | 41831 | | | | | | 1 or 2 | | | | |
| | Helical insulator side tie, 175 AAAC | 41831 | | | | | | | 1 or 2 | | | |
| | Helical insulator side tie, 200 AAAC | 51041 | | | | | | | | 1 or 2 | | |
| | Helical insulator side tie, 300 AAC | 50485 | | | | | | | | | 1 or 2 | |
| | Helical insulator side tie, 400 AAC | not stocked | | | | | | | | | | 1 or 2 |
| Additional items (not shown) that may be needed to complete the structure | | | | | | | | | | | | |
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | A/R | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Bolt, M20x530mm c/w nut (Med pole) Bolt, M20x750mm c/w nut (St Pole) | 30127 36943 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, curved | 30522 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, flat and / or | 30523 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Brace Block Type 2, 3000mm long (2500mm centres) | 30094 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Steel Foundation Brace 2500mm H ENATS 439559 | not stocked | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x530mm c/w nut | 30127 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x60mm c/w nut | 30116 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Washer, M20, square, curved | 30522 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Washer, M20, square, flat | 30523 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Washer, M20, round, flat | 30517 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| - | No tension Joints | | | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Stay materials as per ST:OH4L & ST:OH4T | | Based on line & stay angle and conductor | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Safety sign as per STOH4N | | License Area specific see | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Additional notices as per STOH4N | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |

**If a conductor does not appear then it is not permitted with this GA**

## Fig 11 - 'H' Pole 11kV Intermediate Occasional Long Span
## Bill of Materials

(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 38 HDC | 70 HDC | 100 HDC | 50 AAAC | 60 AAAC | 100 AAAC | 150 AAAC | 175 AAAC | 200 AAAC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirements See Fig 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 2 | Heavy Crossarm - 2m spacing's | 30403 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | Insulator Pin | 30441 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 x 30442 |
| 4 | Insulator assembly, 11kV | 50447 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 x 30415 |
| 5 | Section Strap | 30469 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 8 | Bolt, M20x260mm c/w nut (med pole)<br>**or**<br>Bolt, M20x300mm c/w nut (St or Ex St pole) | 30123<br><br>30124 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Tie Rod | 30559 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Bolt, M20x60mm c/w nut | 30116 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | Washer, M20, square, curved | 30522 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Washer, M20, square, flat | 30523 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 9 | Helical insulator tie, double, 38 HDC | 50505 | | 3 | | | | | | | | |
| | Helical insulator tie, double, 70 HDC | 30673 | | | 3 | | | | | | | |
| | Helical insulator tie, double, 100 HDC | 30675 | | | | 3 | | | | | | |
| | Helical insulator tie, double, 50 AAAC | 37370 | | | | | 3 | | | | | |
| | Helical insulator tie, double, 60 AAAC | not stocked | | | | | | 3 | | | | |
| | Helical insulator tie, double, 100 AAAC | 42953 | | | | | | | 3 | | | |
| | Helical insulator tie, double, 150 AAAC | 43238 | | | | | | | | 3 | | |
| | Helical insulator tie, double, 175 AAAC | 43238 | | | | | | | | | 3 | |
| | Helical insulator tie, double, 200 AAAC | 50501 | | | | | | | | | | 3 |
| Additional items (not shown) that may be needed to complete the structure | | | | | | | | | | | | |
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | A/R | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Bolt, M20x530 c/w nut (Med pole)<br>Bolt, M20x750 c/w nut (St Pole) | 30127<br>36943 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, curved | 30522 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, flat<br>and / or<br>Brace Block Type 2, 3000mm long (2500mm centres) | 30523<br><br>30094 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | | | | | | | | | | | | |
| | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Steel Foundation Brace 2500mm H ENATS 439559 | not stocked | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x530mm c/w nut | 30127 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x60mm c/w nut | 30116 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Washer, M20, square, curved | 30522 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Washer, M20, square, flat | 30523 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Washer, M20, round, flat | 30517 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| - | Stay materials as per ST:OH4L & ST:OH4T | | Based on line & stay angle and conductor | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Safety sign as per STOH4N | | License Area specific see | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Additional notices as per STOH4N | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |

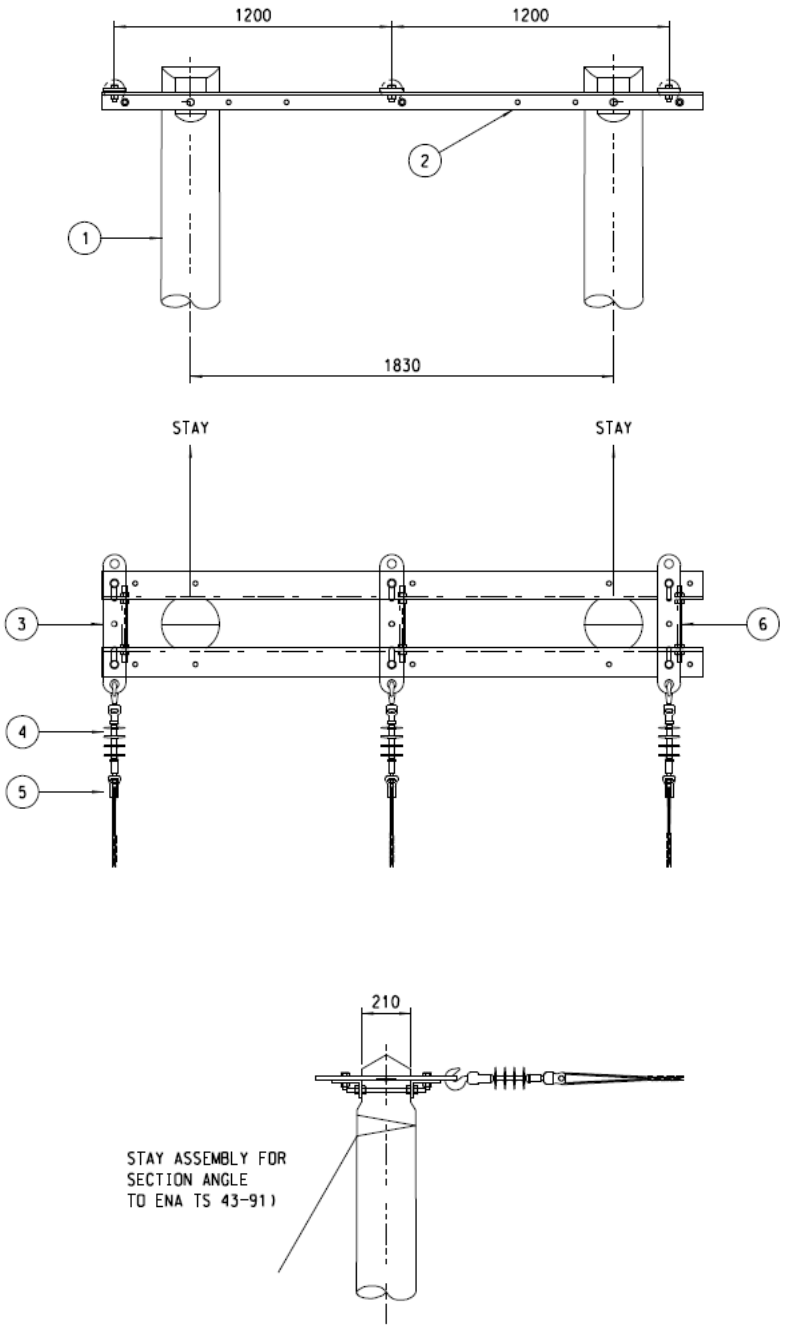
**If a conductor does not appear then it is not permitted with this GA**

## Fig 11 - 33kV 'H' Pole Intermediate Occasional Long Span
## Bill of Materials

(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 70 HDC | 100 HDC | 150 HDC | 100 AAAC | 150 AAAC | 175 AAAC | 200 AAAC | 300 AAC | 400 AAC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirements See Fig 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 2 | Heavy Crossarm - 2m spacing's | 30403 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | Insulator Pin | 30442 | only req. if pin insulator used | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| 4 | Insulator assembly, 33kV | 30415 or 30422 | Porcelain Pin or Porcelain Post | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| 5 | Section Strap | 30469 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 6 | Bolt, M20x260mm c/w nut (Med pole) **or** Bolt, M20x300mm c/w nut (St or Ex St Pole) | 30123 or 30124 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Tie Rod | 30559 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x60mm c/w nut | 30116 | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | Washer, M20, square, curved | 30522 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Washer, M20, square, flat | 30523 | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 7 | Helical insulator tie, double, 70 HDC | 30669 | | 3 | | | | | | | | |
| | Helical insulator tie, double, 100 HDC | 30665 | | | 3 | | | | | | | |
| | Helical insulator tie, double, 150 HDC | 30667 | | | | 3 | | | | | | |
| | Helical insulator tie, double, 100 AAAC | 37366 | | | | | 3 | | | | | |
| | Helical insulator tie, double, 150 AAAC | 37039 | | | | | | 3 | | | | |
| | Helical insulator tie, double, 175 AAAC | 37039 | | | | | | | 3 | | | |
| | Helical insulator tie, double, 200 AAAC | 50516 | | | | | | | | 3 | | |
| | Helical insulator tie, double, 300 AAC | 60024 | | | | | | | | | 3 | |
| | Helical insulator tie, double, 400 AAC | not stocked | | | | | | | | | | 3 |
| Additional items (not shown) that may be needed to complete the structure | | | | | | | | | | | | |
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | A/R | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Bolt, M20x530mm c/w nut (Medium pole) Bolt, M20x750mm c/w nut (Stout Pole) | 30127 36943 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, curved | 30522 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, flat | 30523 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | and / or | | | | | | | | | | | |
| | Brace Block Type 2, 3000mm long (2500mm centres) | 30094 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Steel Foundation Brace 2500mm H ENATS 439559 | not stocked | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x530mm c/w nut | 30127 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x60mm c/w nut | 30116 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Washer, M20, square, curved | 30522 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Washer, M20, square, flat | 30523 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Washer, M20, round, flat | 30517 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| - | Stay materials as per ST:OH4L & ST:OH4T | | Based on line & stay angle and conductor | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Safety sign as per STOH4N | | License Area specific see | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Additional notices as per STOH4N | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |

**If a conductor does not appear then it is not permitted with this GA**




Notes:-

1. All Bolts 60mm long with the exception of the pole bolts.
2. Additional round washers and locknuts required for bonding stay strand to pole top bolts.
3. Where pole top diameter is too large for standard section strap. use Shaps 47120.

**Fig 12 General Assembly – 'H' Pole Terminal**

## Fig 12 - 'H' Pole 11kV Terminal
## Bill of Materials

(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 38 HDC | 70 HDC | 100 HDC | 50 AAAC | 60 AAAC | 100 AAAC | 150 AAAC | 175 AAAC | 200 AAAC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirements See Fig 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 2 | Heavy Terminal Crossarm - 1.2m spacing's | 30404 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | Section Strap | 30469 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 4 | 11kv Ball / Socket Tension Insulator (70kN) Composite Insulator | 39875 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Ball Hook | 30435 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Socket Thimble | 30445 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 5 | Dead End Grip, 38 HDC | 30179 | | 3 | | | | | | | | |
| | Dead End Grip, 70 HDC | 30181 | | | 3 | | | | | | | |
| | Dead End Grip, 100 HDC | 30184 | | | | 3 | | | | | | |
| | Dead End Grip, 50 AAAC | 30187 | | | | | 3 | | | | | |
| | Dead End Grip, 60 AAAC | not stocked | | | | | | 3 | | | | |
| | Dead End Grip, 100 AAAC | 30188 | | | | | | | 3 | | | |
| | Dead End Grip, 150 AAAC | 37367 | | | | | | | | 3 | | |
| | Dead End Grip, 175 AAAC | 43236 | | | | | | | | | 3 | |
| | Dead End Grip, 200 AAAC | 43236 | | | | | | | | | | 3 |
| 6 | Bolt, M20x260mm c/w nut (Med) **or** Bolt, M20x300mm c/w nut (St or Ex St) | 30123 30124 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Tie Rod | 30559 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Bolt, M20x60mm c/w nut | 30116 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | Washer, M20, square, curved | 30522 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Washer, M20, square, flat | 30523 | | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Additional items (not shown) that may be needed to complete the structure | | | | | | | | | | | | |
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | A/R | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Bolt, M20x530mm c/w nut (Med Pole) Bolt, M20x750mm c/w nut (St Pole) | 30127 36943 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, curved | 30522 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, flat | 30523 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | and / or | | | | | | | | | | | |
| | Brace Block Type 1, 2600mm long (1830mm centres) | 30093 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Steel Foundation Brace 1830mm H ENATS 439558 | not stocked | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x530mm c/w nut | 30127 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x60mm c/w nut | 30116 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Washer, M20, square, curved | 30522 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Washer, M20, square, flat | 30523 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Washer, M20, round, flat | 30517 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| - | No tension Joints | | | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Stay materials as per ST:OH4L & ST:OH4T | | Based on line & stay angle and conductor | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Safety sign as per STOH4N | | License Area specific see | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Additional notices as per STOH4N | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |

**If a conductor does not appear then it is not permitted with this GA**

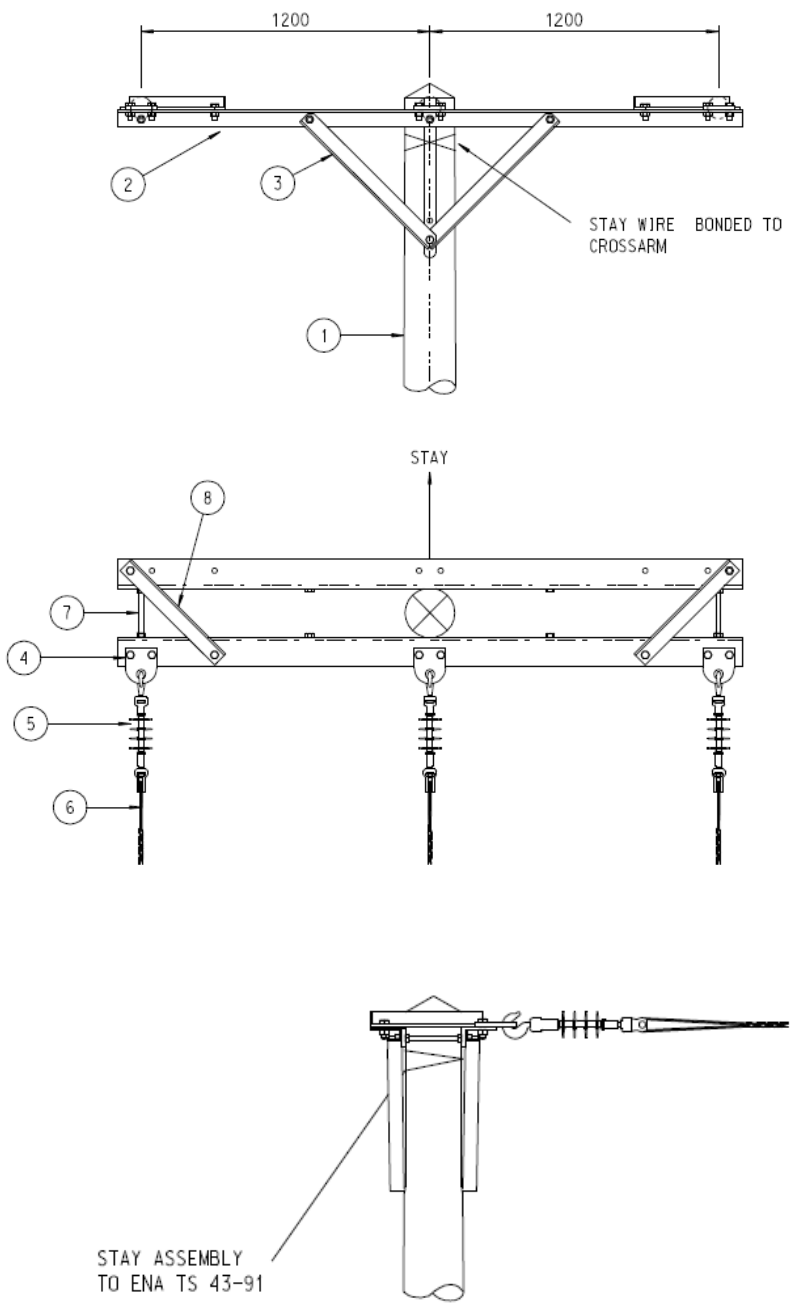
## Fig 12 - 33kV 'H' Terminal
## Bill of Materials

(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 70 HDC | 100 HDC | 150 HDC | 100 AAAC | 150 AAAC | 175 AAAC | 200 AAAC | 300 AAC | 400 AAC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirements See Fig 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 2 | Heavy Terminal Crossarm - 1.2m spacing's | 30404 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | Section Strap | 30469 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 4 | 33kv Ball / Socket Tension Insulator (70kN) Composite Insulator | 41848 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Ball Hook | 30435 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Socket Thimble | 30445 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 or 3 x 30437 | 3 |
| 5 | Dead End Grip, 70 HDC | 30181 | | 3 | | | | | | | | |
| | Dead End Grip, 100 HDC | 30184 | | | 3 | | | | | | | |
| | Dead End Grip, 150 HDC | 30186 | | | | 3 | | | | | | |
| | Dead End Grip, 100 AAAC | 30188 | | | | | 3 | | | | | |
| | Dead End Grip, 150 AAAC | 37367 | | | | | | 3 | | | | |
| | Dead End Grip, 175 AAAC | 43236 | | | | | | | 3 | | | |
| | Dead End Grip, 200mm AAAC | 43236 | | | | | | | | 3 | | |
| | Dead End Compression , 300 AAC | 43560 or 50593 | | | | | | | | | 3 | |
| | Dead End Compression, 400 AAC | not stocked | | | | | | | | | | 3 |
| 6 | Bolt, M20x260mm c/w nut (Med Pole) **or** Bolt, M20x300mm c/w nut (St or Ex St Pole) | 30123 or 30124 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Tie Rod | 30559 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Bolt, M20x60mm c/w nut | 30116 | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | Washer, M20, square, curved | 30522 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Washer, M20, square, flat | 30523 | | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Additional items (not shown) that may be needed to complete the structure | | | | | | | | | | | | |
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | A/R | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Bolt, M20x530mm c/w nut (Med pole) Bolt, M20x750mm c/w nut (St Pole) | 30127 36943 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, curved | 30522 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Washer, M20, square, flat and / or | 30523 | | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 | 2 or 4 |
| | Brace Block Type 1, 2600mm long (1830mm centres) | 30093 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Steel Foundation Brace 1830mm H ENATS 439558 | not stocked | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x530mm c/w nut | 30127 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Bolt, M20x60mm c/w nut | 30116 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Washer, M20, square, curved | 30522 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Washer, M20, square, flat | 30523 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Washer, M20, round, flat | 30517 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| - | No tension Joints | | | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Stay materials as per ST:OH4L & ST:OH4T | | Based on line & stay angle and conductor | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | Safety sign as per STOH4N | | License Area specific see | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| - | Additional notices as required as per STOH4N | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R | A/R |

**If a conductor does not appear then it is not permitted with this GA**




Notes:-
1. All Bolts 60mm long with the exception of the pole bolts.
2. Additional round washers and locknuts required for bonding stay strand to pole top bolts.

**Fig 13 General Assembly – Single Pole Terminal**

## Fig 13 - Single Pole 11kV Terminal
## Bill of Materials

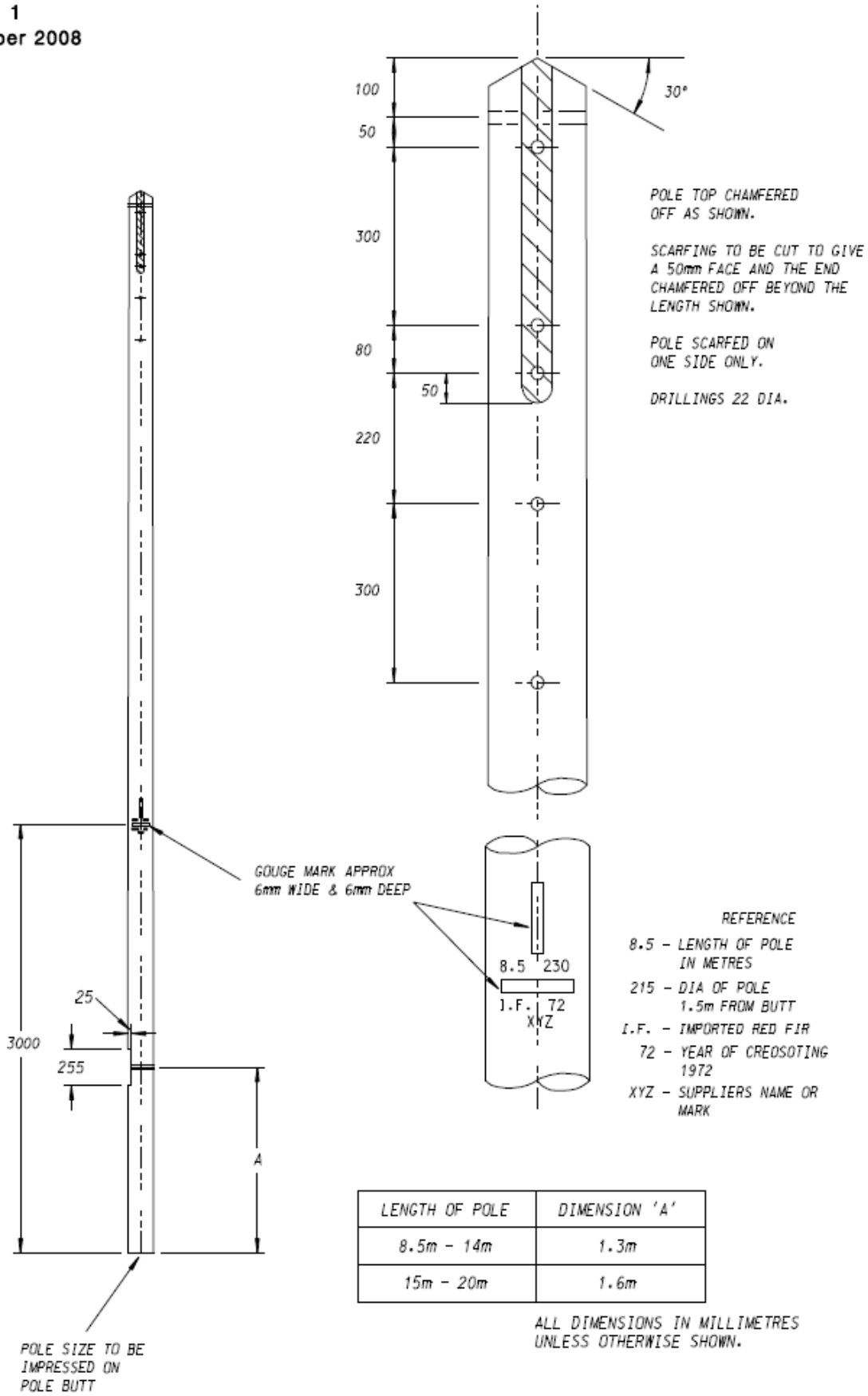
(Materials should be read in conjunction with the limiting factors of Pole Top Suitability)

| Fig Item No | Item description | Item Code | Comment | 38 HDC | 70 HDC | 50 AAAC | 60 AAAC |
|---|---|---|---|---|---|---|---|
| 1 | Wood Pole | Various | Based on Requirements See Fig 1 | 1 | 1 | 1 | 1 |
| 2 | Heavy Terminal Crossarm - 1.2m spacing's | 30404 | | 2 | 2 | 2 | 2 |
| 3 | Crossarm strut | 30473 | | 4 | 4 | 4 | 4 |
| 4 | Terminal Strap | 30471 | | 3 | 3 | 3 | 3 |
| 5 | 11kv Ball / Socket Tension Insulator (70kN) Composite Insulator | 39875 | | 3 | 3 | 3 | 3 |
| | Ball Hook | 30435 | | 3 | 3 | 3 | 3 |
| | Socket Thimble | 30445 | | 3 | 3 | 3 | 3 |
| 6 | Dead End Grip, 38 HDC | 30179 | | 3 | | | |
| | Dead End Grip, 70 HDC | 30181 | | | 3 | | |
| | Dead End Grip, 50 AAAC | 30187 | | | | 3 | |
| | Dead End Grip, 60 AAAC | not stocked | | | | | 3 |
| 7 | Bolt, M20x260mm c/w nut (Med Pole) **or** Bolt, M20x300mm c/w nut (St or Ex St Pole) | 30123 30124 | | 3 | 3 | 3 | 3 |
| | Tie Rod | 30559 | | 2 | 2 | 2 | 2 |
| | Bolt, M20x60mm c/w nut | 30116 | | 14 | 14 | 14 | 14 |
| | Washer, M20, square, curved | 30522 | | 2 | 2 | 2 | 2 |
| | Washer, M20, square, flat | 30523 | | 15 | 15 | 15 | 15 |
| 8 | Crossarm Brace | 30161 | | 2 | 2 | 2 | 2 |
| Additional items (not shown) that may be needed to complete the structure | | | | | | | |
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | A/R | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Bolt, M20x750mm c/w nut (St Pole) | 36943 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Washer, M20, square, curved | 30522 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| | Washer, M20, square, flat | 30523 | | 1 or 2 | 1 or 2 | 1 or 2 | 1 or 2 |
| - | No tension Joints | | | A/R | A/R | A/R | A/R |
| - | Stay materials as per ST:OH4L & ST:OH4T | | Based on line & stay angle and conductor | A/R | A/R | A/R | A/R |
| - | Safety sign as per STOH4N | | License Area specific see | 2 | 2 | 2 | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R | A/R | A/R | A/R |
| - | Additional notices as per STOH4N | | Location specific | A/R | A/R | A/R | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R | A/R | A/R | A/R |

**If a conductor does not appear then it is not permitted with this GA**

| Fig 13 - 33kV Single Pole Terminal<br>Bill of Materials<br>(Materials should be read in conjunction with the limiting factors of Pole Top Suitability) | | | | |
|---|---|---|---|---|
| Fig Item No | Item description | Shops Code | Comment | 70 HDC |
| 1 | Wood Pole | Various | Based on Requirements See Fig 1 | 1 |
| 2 | Heavy Terminal Crossarm - 1.2m spacing's | 30404 | | 2 |
| 3 | Crossarm strut | 30473 | | 4 |
| 4 | Terminal Strap | 30471 | | 2 |
| 5 | 33kv Ball / Socket Tension Insulator (70kN) Composite Insulator | 41848 | | 3 |
| | Ball Hook | 30435 | | 3 |
| | Socket Thimble | 30445 | | 3 |
| 6 | Dead End Grip, 70 HDC | 30181 | | 3 |
| 7 | Bolt, M20x300mm c/w nut (St or Ex St Pole) | 30124 | | |
| | Tie Rod | 30559 | | 2 |
| | Bolt, M20x60mm c/w nut | 30116 | | 14 |
| | Washer, M20, square, curved | 30522 | | 2 |
| | Washer, M20, square, flat | 30523 | | 15 |
| 8 | Crossarm Brace | 30670 | | 2 |
| Additional items (not shown) that may be needed to complete the structure | | | | |
| Foundations as per Conductor Tables in STOH4T | Type 2 Kicking Block | 30091 | A/R | 1 or 2 |
| | Bolt, M20x750mm c/w nut (St Pole) | 36943 | | 1 or 2 |
| | Washer, M20, square, curved | 30522 | | 1 or 2 |
| | Washer, M20, square, flat | 30523 | | 1 or 2 |
| - | Stay materials as per ST:OH4L & ST:OH4T | | Based on line & stay angle and conductor | As Required |
| - | Safety sign as per STOH4N | | License Area specific see | 2 |
| - | Number plate c/w fixing nails as per STOH4N | | Pole specific | A/R |
| - | Additional notices as per STOH4N | | Location specific | A/R |
| - | ACDs as per STOH4M | | Location specific | A/R |

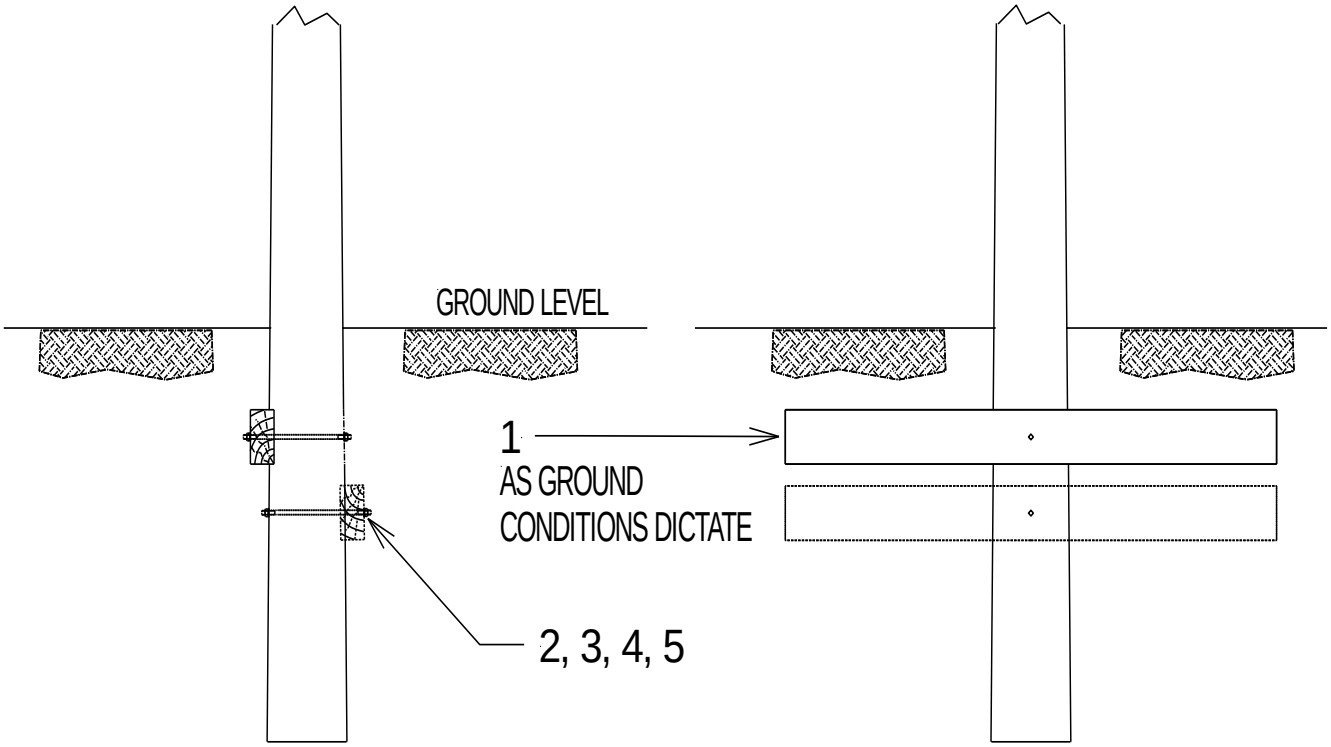
**If a conductor does not appear then it is not permitted with this GA**




| LENGTH OF POLE | DIMENSION 'A' |
|---|---|
| 8.5m - 14m | 1.3m |
| 15m - 20m | 1.6m |

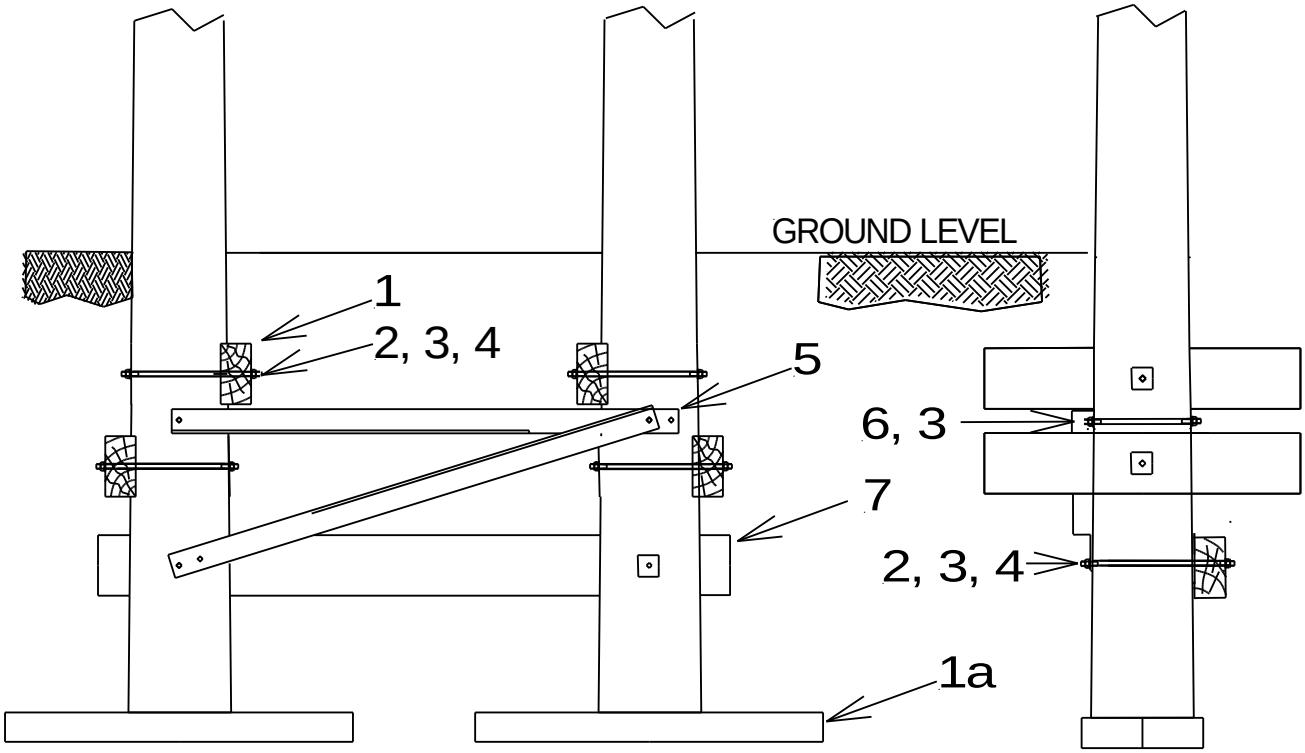
ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE SHOWN.

Fig. 14 SINGLE POLE DRILLING AND MARKING
**(For LV Lines to ESI 43-30, LV ABC to ESI 43-12 & 11kV Light Construction))**



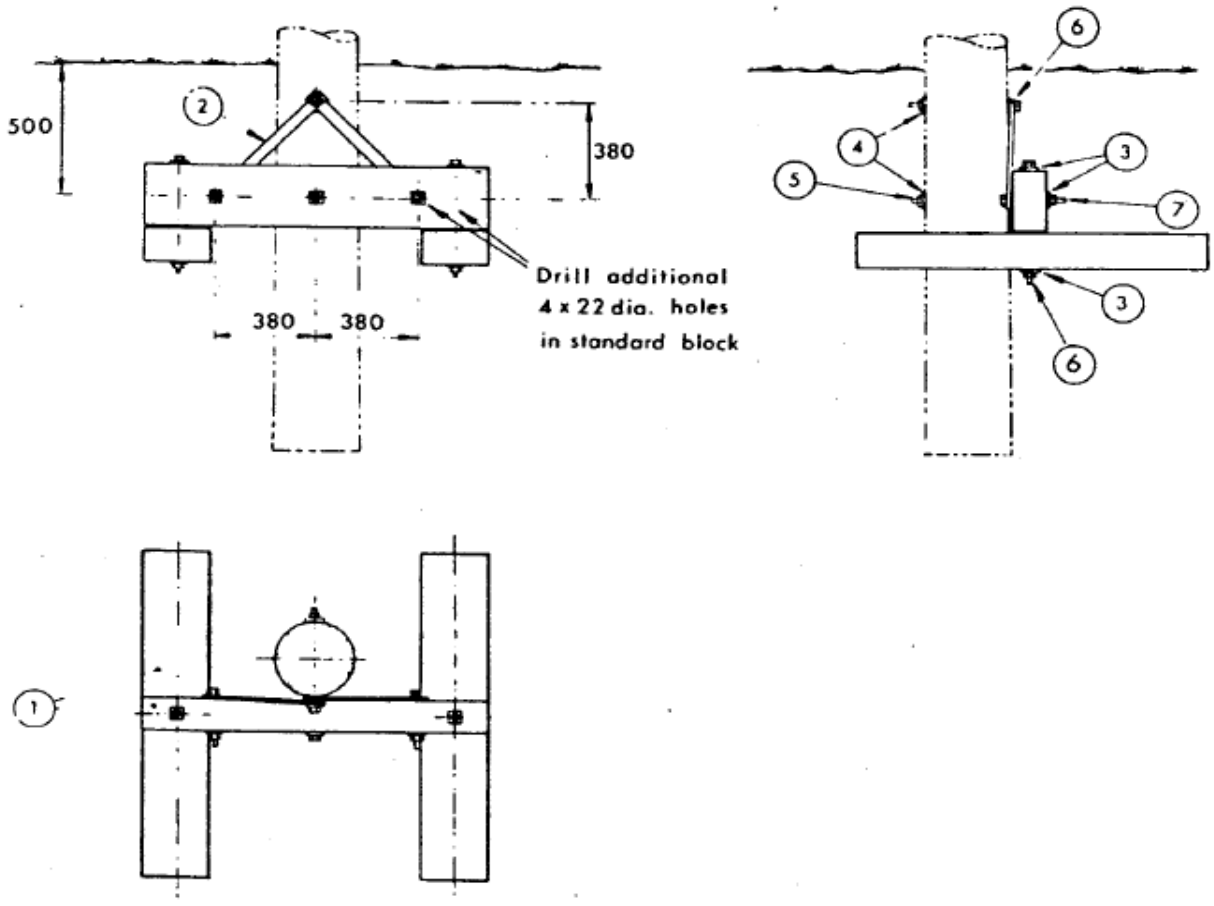

| Item No | Description | Quantity | Item Code |
|---|---|---|---|
| 1* | Wood stay/kicking block Type 2, 1300mm x 250mm x 125mm | 1 or 2 | 30091 |
| 2 | Bolt, M20x750mm c/w nut | 1 or 2 | 36943 |
| 3 | Washer, M20, square, curved | 1 or 2 | 30522 |
| 4 | Washer, M20, square, flat | 1 or 2 | 30523 |

## Figure 15 Single Pole Foundations



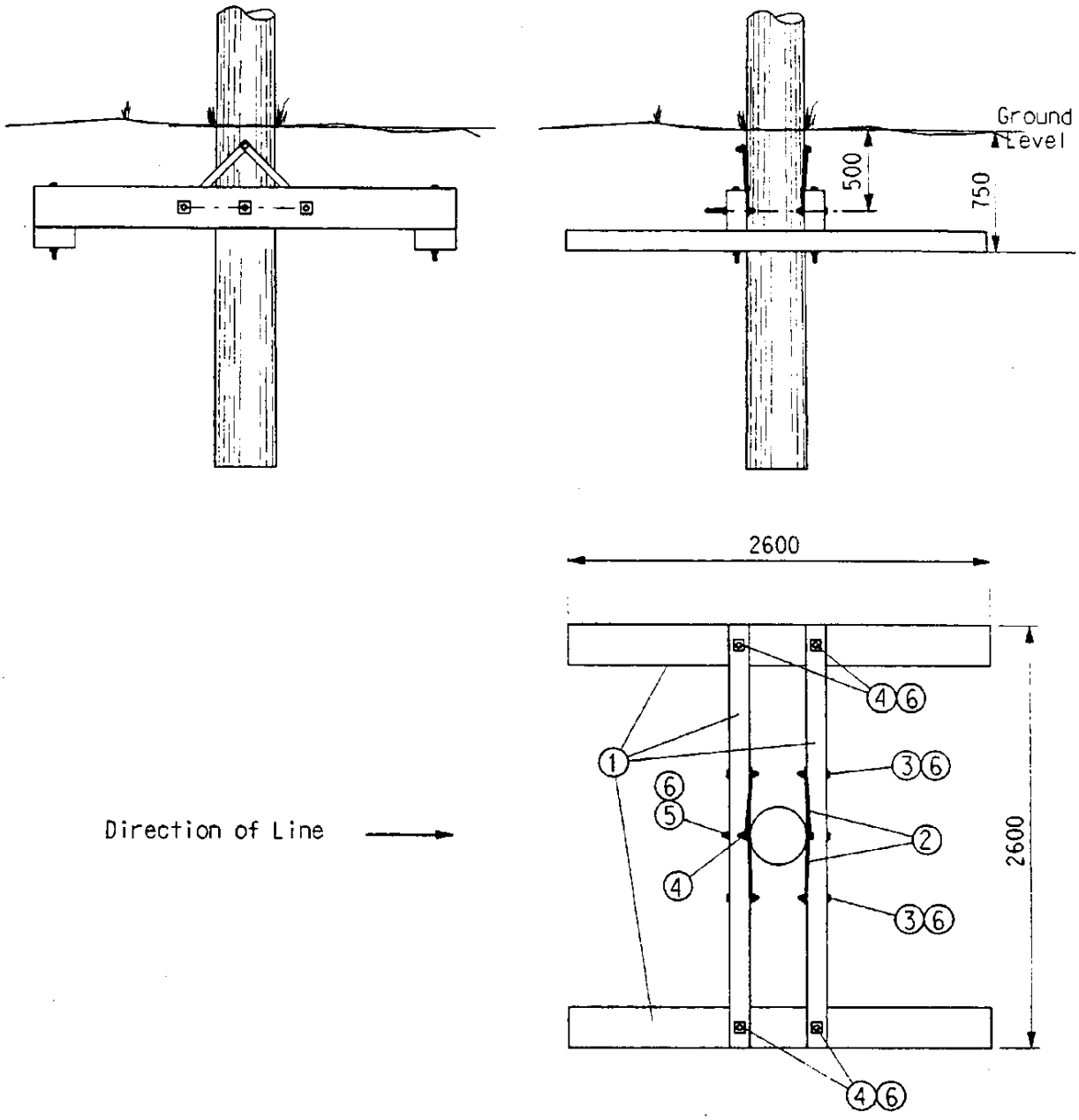

| Item No | Description | Quantity | Item Code |
|---|---|---|---|
| 1* | Wood stay/kicking block Type 2, 1300mm x 250mm x 125mm | 4 | 30091 |
| 1a * | Additional type 1 blocks (as above) laid end to end to provide a firm footing where required (i.e. ground unsuitable otherwise). | A/R | 30092 |
| 2 | Bolt & Nut M20 X 750 | 4 | 30122 |
| 3 | Square Curved Washer M20 | 7 | 30522 |
| 4 | Square Flat Washer M20 | 6 | 30533 |
| 5 | Steel foundation brace (1830mm centres)<br>Or<br>Steel foundation brace (2500mm centres) | 2 | 50552<br><br>60112 |
| 6 | Bolt, M20x530mm c/w nut | 2 | 30127 |
| 7 ** | Wood brace, length 2600mm (1830mm centres)<br>or<br>Wood brace, length 3000mm (2500mm centres) | 1 | 30093<br><br>30094 |
| Note<br>* As ground conditions dictate.<br>** Select as appropriate. (Only the long span arrangement has centres 2500mm apart) | | | |

## Figure 16 'H' Pole Foundations




| Item No | Description | Quantity | Item Code |
|---|---|---|---|
| 1 | Wood stay/kicking block Type 2, 1300mm x 250mm x 125mm | 3 | 30091 |
| 2* | Crossarm Tie Strap | 2 | 30467 |
| 3 | Square Flat Washer M20 | 7 | 30523 |
| 4 | Square Curved Washer M20 | 2 | 30522 |
| 5 | Bolt & Nut M20 X 530 | 1 | 30127 |
| 6 | Bolt & Nut M20 X 450 | 3 | 30126 |
| 7 | Bolt & Nut M20 X 750 | 2 | 30122 |
| *Note: Use 4 for conductors greater than 25mm HDC | | | |

## Fig 17 Bog Shoe for Poor Soils (Medium Poles)




| Item No | Description | Quantity | Material No |
|---|---|---|---|
| 1 | Brace Block (Type 1) | 4 | 30093 |
| 2* | Crossarm Tie Strap | 8 | 30467 |
| 3 | Bolt & Nut M20 X 180 | 4 | 30120 |
| 4 | Bolt & Nut M20 X 450 | 5 | 30126 |
| 5 | Bolt & Nut M20 X 750 | 1 | 36943 |
| 6 | Square Flat Washer for M20 | 14 | 30523 |
| *Note: Straps (item 2) are doubled - Use 8 in Total | | | |

## Fig 18 Bog Shoe for Poor Soils (Stout & Ex Stout Poles)

**APPENDIX O**

## CLASHING RISK WEATHER ZONES

Figures O1 to O5 Weather Zone Maps

⟶ INCREASING SEVERITY

A B C D E ICE CO-ORDINATES
1 2 3 4 5 WIND CO-ORDINATES

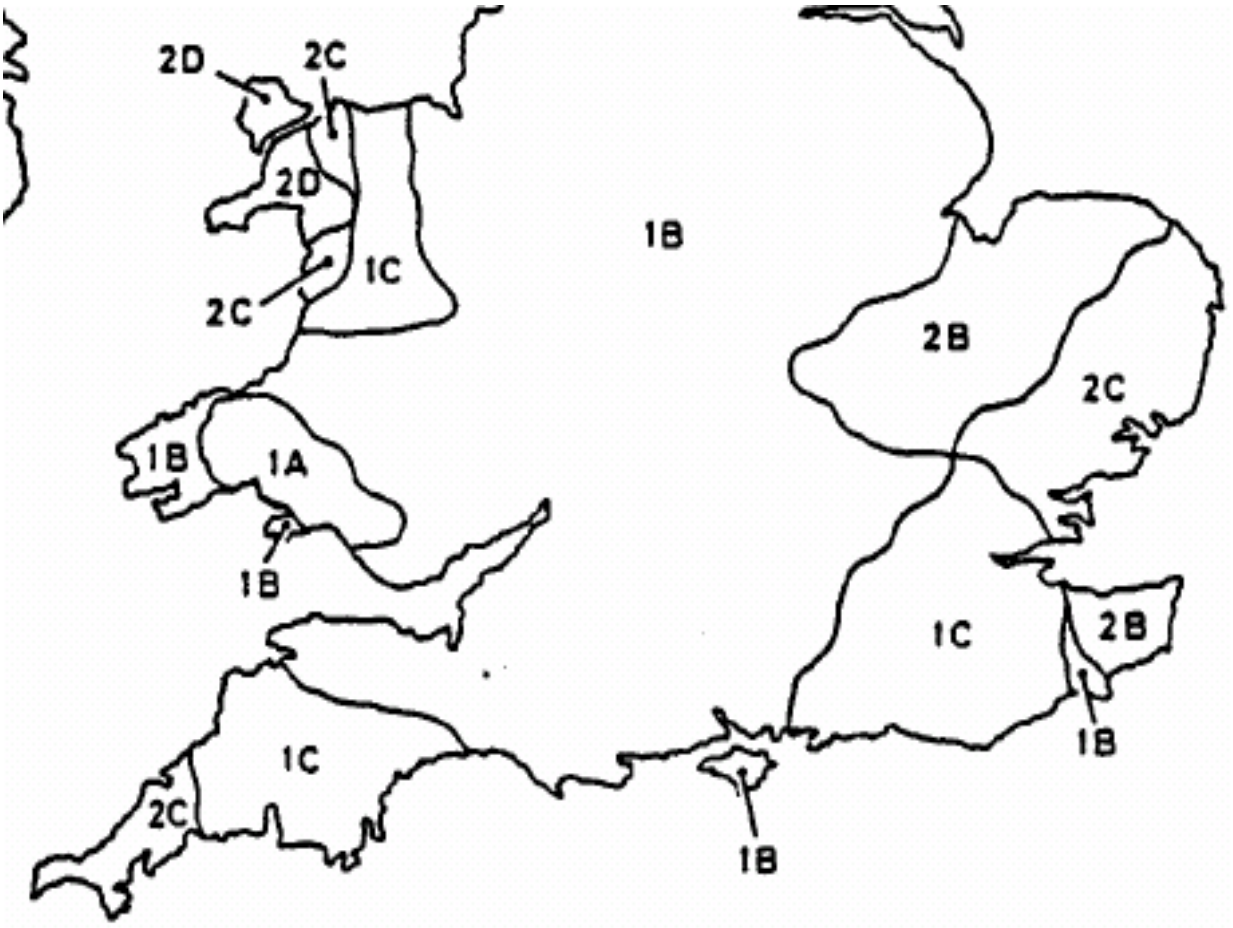



**Figure O1.**
**Weather Zones for Site Altitudes of 0m to 100m above Sea Level**

→ INCREASING SEVERITY

A B C D E ICE CO-ORDINATES
1 2 3 4 5 WIND CO-ORDINATES

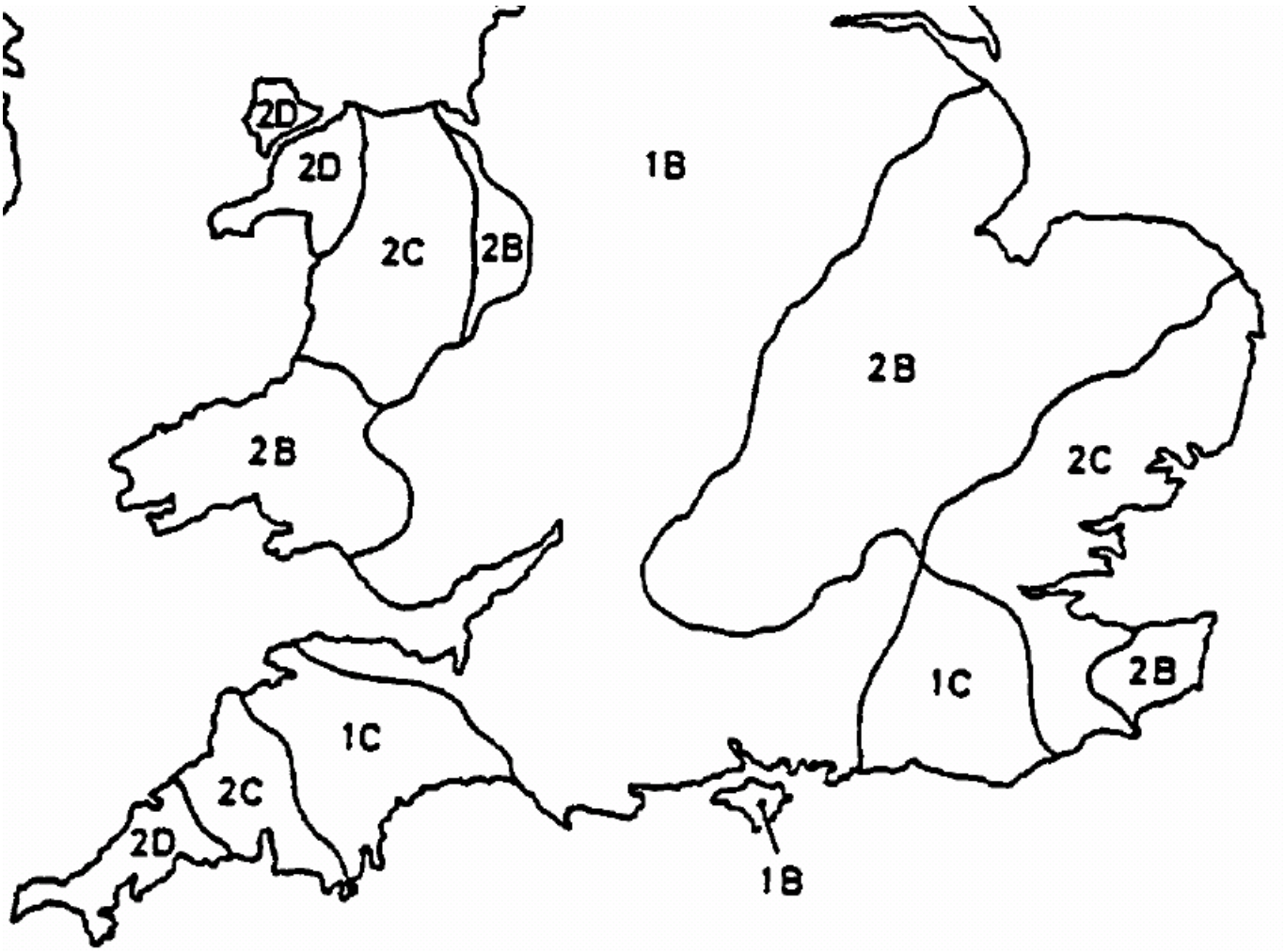



**Figure O2.**
**Weather Zones for Site Altitudes of 100m to 200m above Sea Level**

INCREASING SEVERITY

A B C D E ICE CO-ORDINATES
1 2 3 4 5 WIND CO-ORDINATES

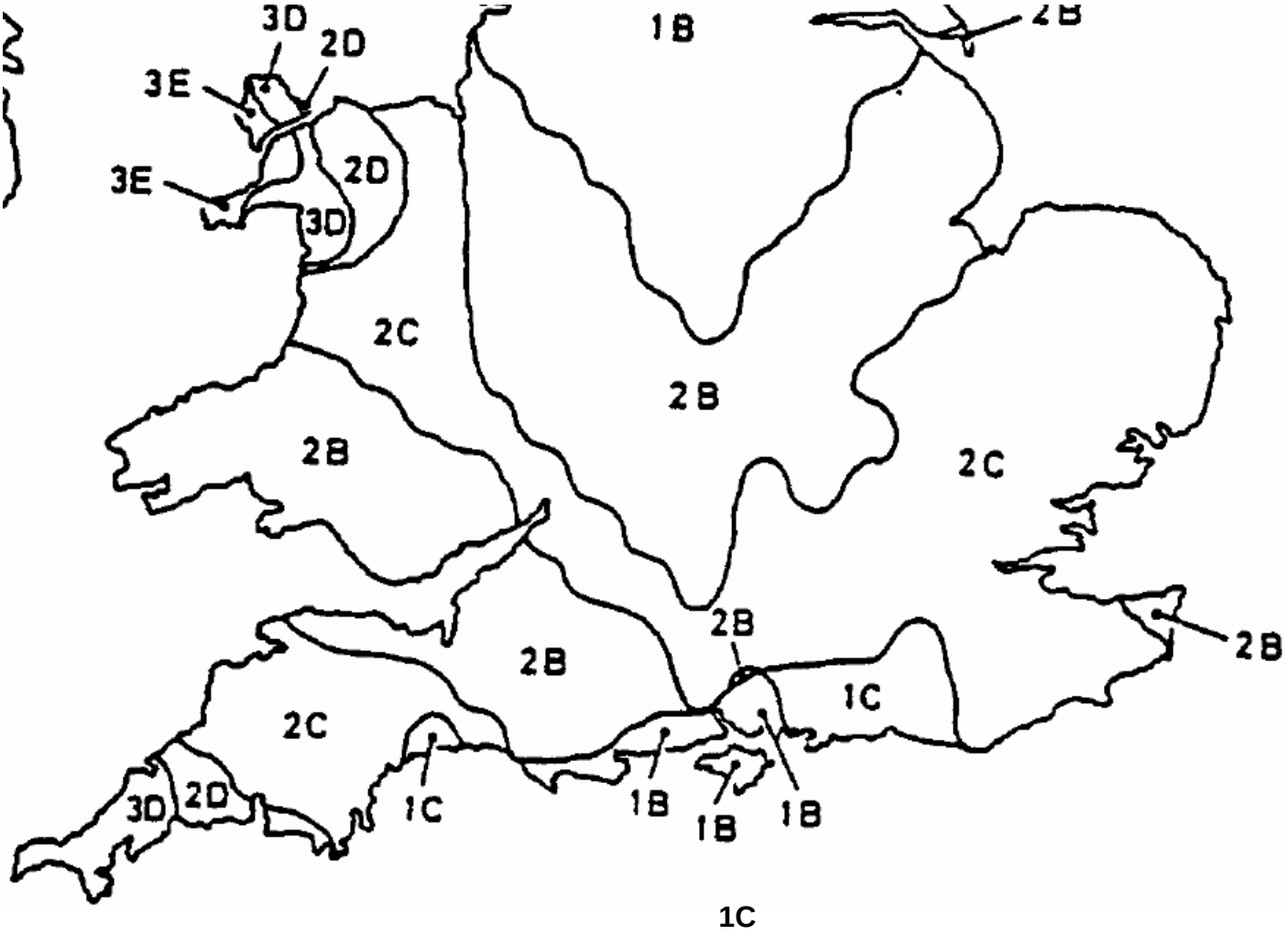



**Figure O3.**
**Weather Zones for Site Altitudes of 200m to 300m above Sea Level**

→ INCREASING SEVERITY

A B C D E ICE CO-ORDINATES
1 2 3 4 5 WIND CO-ORDINATES

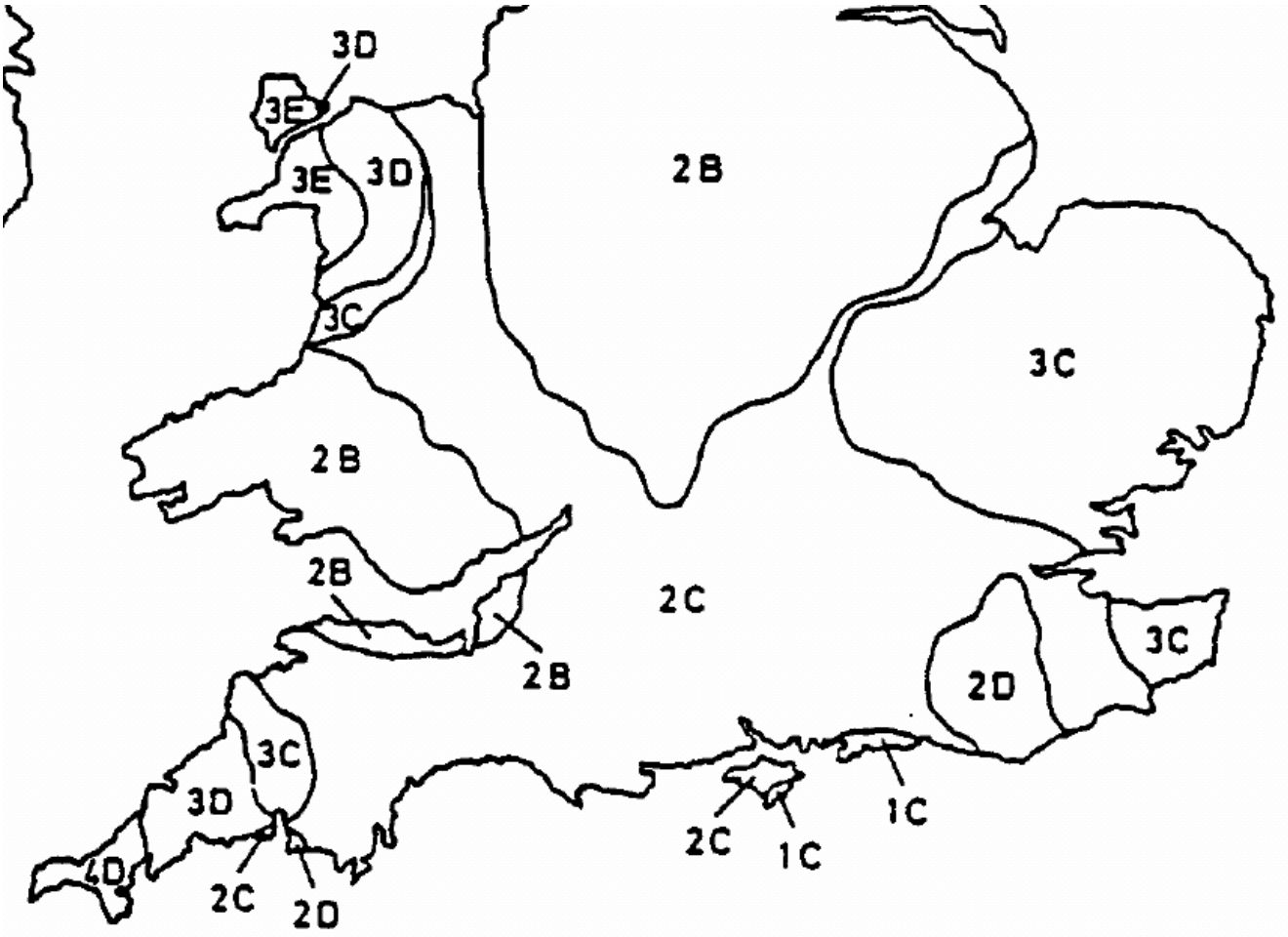



**Figure O4.**
**Weather Zones for Site Altitudes of 300m to 400m above Sea Level**

→ INCREASING SEVERITY

A B C D E ICE CO-ORDINATES
1 2 3 4 5 WIND CO-ORDINATES

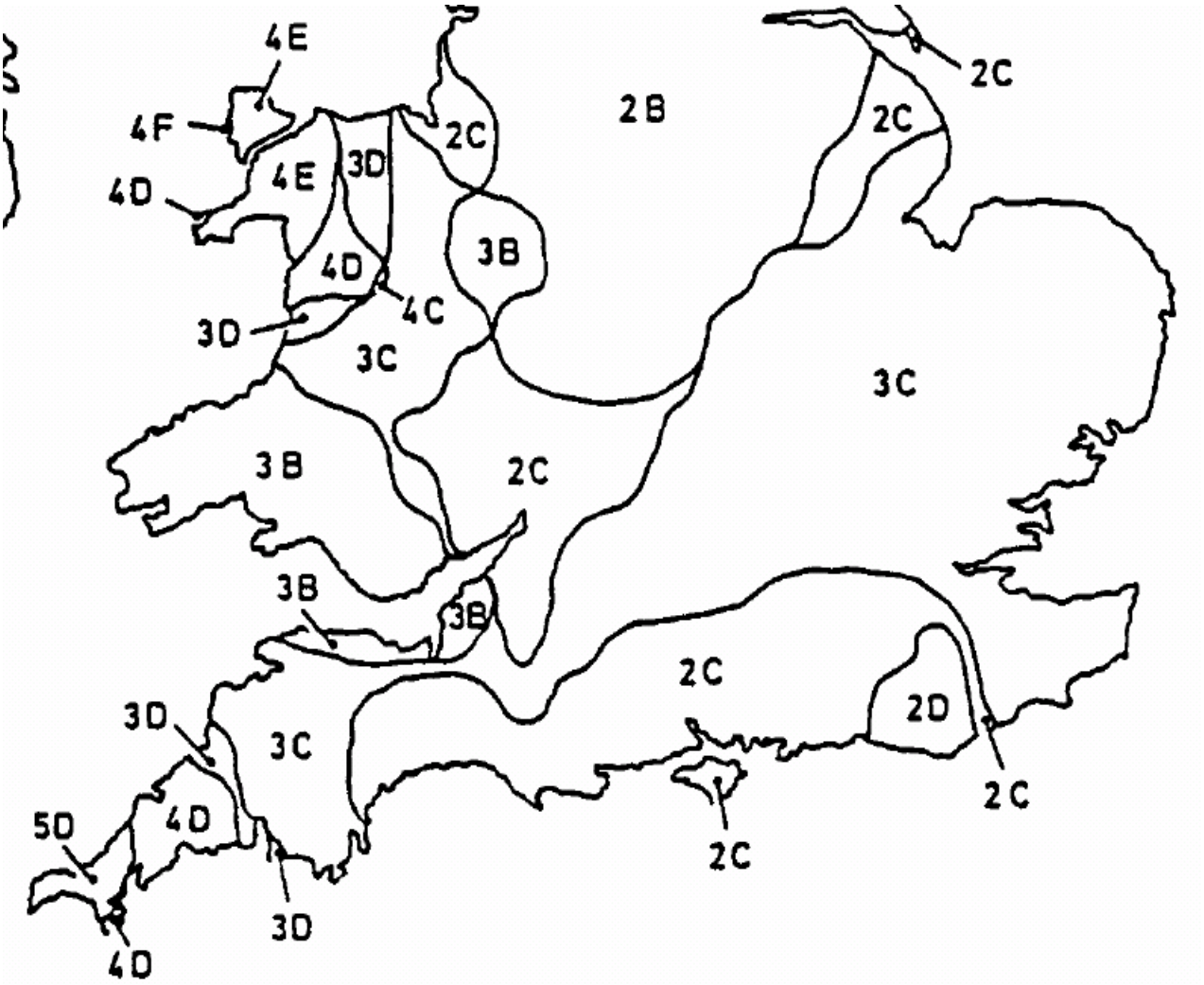
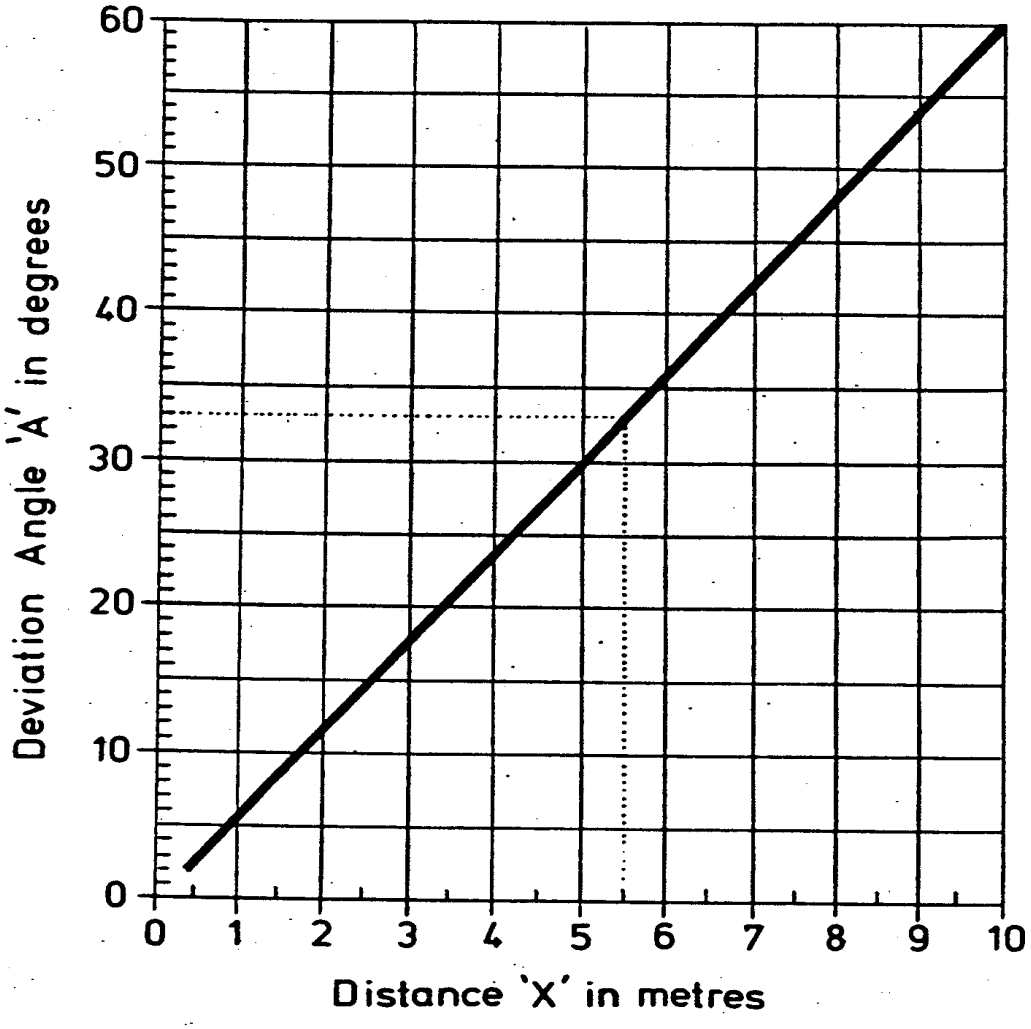



**Figure O5.**
**Weather Zones for Site Altitudes of 400m to 500m above Sea Level**



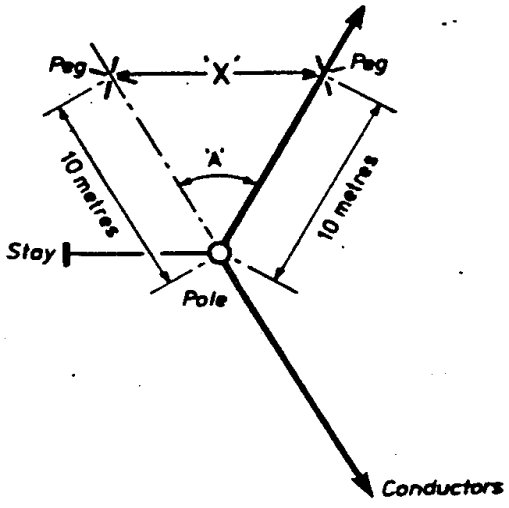

**To Determine the Angle of Deviation**

1. **Measure 10m from the pole in the direction of the line under the centre phase and mark the position with a peg.**

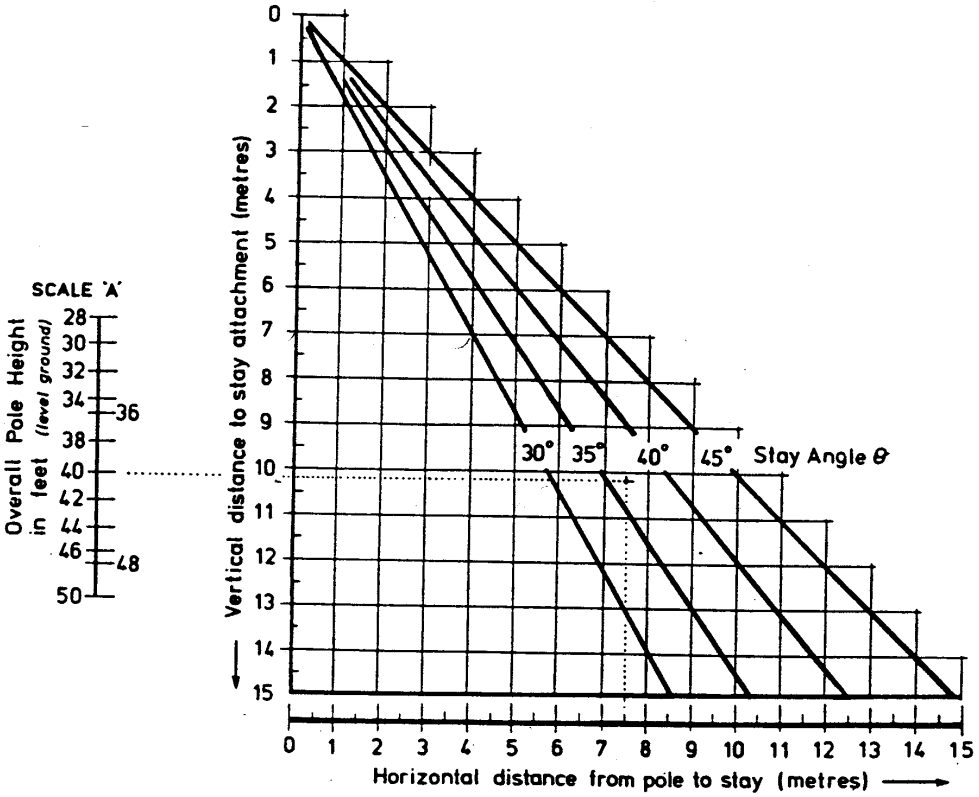
2. **Measure 10m from the pole in line with the adjacent span and mark the position with a peg.**

3. **Measure the distance 'X' between the pegs.**

4. **Using the above graph, read off the corresponding angle of deviation 'A'**

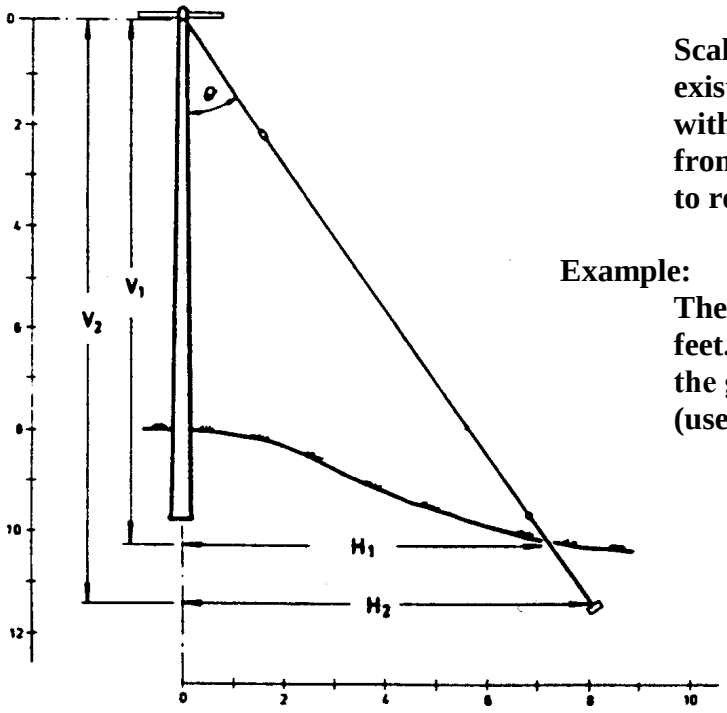



**Example**
**Distance 'X' measures 5.5m**
**From graph, Angle of deviation = 33°**




**Notes:-** **Use dimensions V1 & H1 for stay spread at ground level and V2 & H2 for stay spread at block position.**

**Scale A can be used to determine stay angles for existing 11kV Light supports on level ground with pole top make-off. Take horizontal line from pole height (Scale A) and from stay spread to read stay angle.**




**Example:**

**The pole height (indicated at gouge mark) 40 feet. Distance from pole to where the stay enters the ground 7.5m. Then the stay angle (θ) is 35° (use lowermost value).**

**APPENDIX Q**

## SUPERSEDED DOCUMENTATION

This document supersedes ST: OH4T/3 dated February 2014 which should be withdrawn.

**APPENDIX R**

## ASSOCIATED DOCUMENTS

| | |
|---|---|
| ENATS 43-40 | Specification for Single Circuit Overhead Lines on Wood Poles for use at High Voltage up to and including 33kV |
| ENATS 43-88 | Selection and Treatment of Wood Poles and Associated Timber for Overhead Lines |
| EE85 | Specification for Bare and PVC Covered Overhead Line Conductor |
| EE60 | Steelwork, Nuts, Bolts and Washers for use on the Overhead Line Network |
| ST:OH4P | Steelwork for Overhead Lines |
| ST:OH4L | Stay Strands and Fittings for Overhead Lines |
| EE58 | Specification for Overhead Line Insulators |
| EE59 | Specification for Composite Insulators |
| ST:OH4M | Anti-Climbing Devices for HV Lines Up to and Including 132kV |
| ST:OH4N | Notices for Overhead Lines |
| ST:OH1A | Overhead Line Clearances to Ground and Objects for Reasons of Safety |

**APPENDIX S**

## DOCUMENT REVISONS

This Standard Technique brings together the requirements previously set out in ST: OH4D and ST: OH4G, while clarifying and expanding on a range of design issues such as those relating to foundations and pole size selection. In addition, design information is now presented for lines to be constructed in “severe” loading environments.

Basic span values have been amended to better reflect typical HV overhead lines. Sag and loading tables have been re-generated using these new values. Whilst this has resulted in noticeable differences when compared to values presented in ST: OH4D and ST: OH4G, the new figures represent a more consistent design approach and ensure compliance with ENATS 43-40.

Further, the opportunity has been taken to align conductor physical parameters used with national standards, and design tables detailing strut loads, wind loads, and structure capabilities are now presented in a consistent format.

In addition to the standard, hard-drawn copper conductors currently used, a range of aluminium alloy conductors has been added. This will permit substantial reductions in the costs of heavy construction lines in particular, whilst retaining performance.

Finally, the minimum profiling temperature has been increased from 50°C to 55°C to ensure that newly constructed and refurbished overhead lines are resilient to the most likely impacts of climate change over their intended service life.

Use of the revised design tables will result in some increased costs resulting from the occasional need for deeper foundations or stronger and/or taller poles in some instances, but these costs will be minor. The use of aluminium alloy conductors would provide the opportunity for substantial cost reductions – at current prices, aluminium alloy conductors are less than half the cost of copper conductors having the same current-

carrying capacity, with only minor differences in structure requirements. Costs associated with the procurement and use of a wider range of ties, joints and connectors would also be minor.

Revision ST: OH4T/1 provides additions and clarifications necessary to enable implementation in the Midlands, as well as clarifying that "light" construction is now defined as lines built with 25mm$^2$ Hard Drawn Copper only.

Revisions to ST: OH4T/2 provide for:-
Allowance for the use of 11kV Polymeric Pin Insulators 50447 should allow for safer handling and greater Network reliability. The Inclusion of Extra Stout Poles for conductors greater than 25mm HDC, in the unstayed pole wind span limits tables allows for single extra stout poles to be used in places H poles would have been needed, this should reduce construction costs. Additional augured depths of 2.8 & 3m are not always required to achieve maximum wind loading for a given pole therefore additional augured depths 2.4m up to 14m poles and 2.6m over 14m for all conductors in the unstayed pole wind span limits tables has been included, this should reduce installation costs. Some staff have dynamometers that read in kN therefore to assist teams and the need to purchase Dynamometers which read in kgf, kN tensions in sag and tension tables for all conductors have been added.

Revisions to STOH4T/3provide for:-
The use of Medium Stout Poles for 38mm HDC & 50AAAC conductors at single pole intermediate positions in Normal Loading Environments. For further information on implementation refer to Tool Box Briefing OHL01.14

Revisions to ST: OH4T provide for: -
To improve over head line resilience against cascade failure under severe ice and wind loadings clause 3.13 Failure Containment and 3.14 Strategic Crossing have been introduced so as to mitigate the risks of such a failure.

Clause 4.8 Bill of Materials introduced which includes a link to a live bill of materials spreadsheet

Introduction of Medium Stout class poles to the 'Unstayed Pole Wind Span Limits' in Appendices A to K.

Introduction in / amendment of Appendix N:-

- Table N2 Medium Stout Strut Loadings, other tables also amended to provide versatility on foundation blocks which can be used to obtain the desired strut loading capability.
- Fig 6 'Tee Off' Pole amended to clarify the requirements for all conductor sizes. Distance between top crossarm and tee off crossarm also amended to ensure minimum clearances are maintained to allow work should the tee off be disconnected.
- Bills of Materials (BOMs) included against GA drawings
- GA drawings for 'H' pole foundations

**APPENDIX T**

**KEY WORDS**

Overhead Line, Wood Pole, Design, Heavy Construction, Light Construction