

Horizontal Hydraulic Pole Assembly & Installation

For Base Plate Mounted Utility Poles

1.0 Purpose

The purpose of this technical instruction is to detail those actions necessary to ensure that steel power pole sections are joined, assembled and installed in compliance with the applicable design standards.

2.0 Scope

This procedure applies to the joining/assembly and installation of base plate mounted steel utility poles. Methods of horizontal pole assembly are detailed.

3.0 Procedure Details

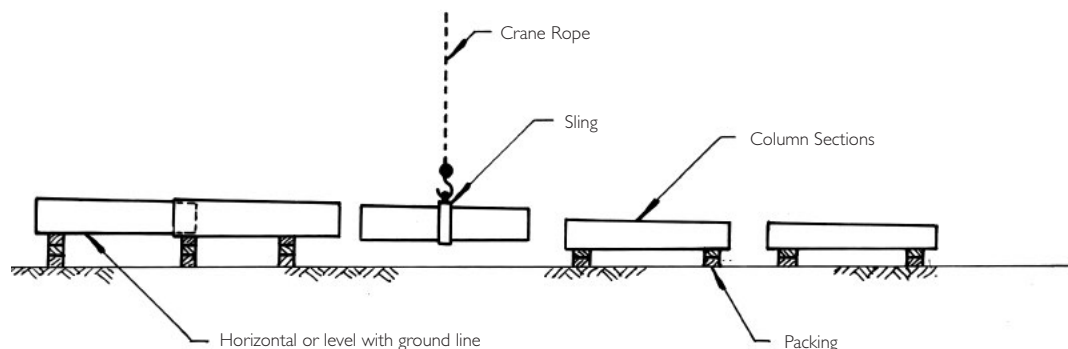
Preparation of Pole Foundations

- 3.1 The pole foundation, supplied by others, must be designed and constructed in accordance with the applicable standards to ensure that the pole foundation is appropriate to the pole design parameters.
- 3.2 Assemble the foundation bolts and templates into a cage using the nuts and washers supplied in accordance with the relevant drawing.
- 3.3 Before pouring the foundation it is recommended that the steel templates be used to ensure that the bolts are correctly centred and vertical. For poles requiring to be back raked, the foundation bolt cage may be back-raked the required amount. Alternatively if the foundation bolt cage is installed vertically then the back-rake adjustment can be taken up in adjusting the nut heights beneath the base plate (discussed in detail in Clause 3.17). The longer full threaded portion of the bolts should protrude the required distance above the finished concrete level (as shown on the relevant foundation bolt assembly drawing) and should be coated with grease and protected by a cap.

Horizontal Pole Assembly

- 3.4 Each site should determine, document and train its personnel in safe work methods relevant to the site and to the pole assembly and installation.
- 3.5 Arrange the base section onto the packing and level so that the jacking lugs on either side of the section are horizontal and so that the underside of the pole section will be horizontal. The packing height should be such to enable the pole sections and base to be well clear of the ground (refer figure 1). Make sure that the column base section is wedged to prevent rotation.

Figure 1.



- 3.6 Before lifting the base section check that the design slip distance and minimum slip distance is marked near the top of the section (these should already be marked with red lines at these locations). If these are not marked refer to the relevant pole drawing for the minimum and design slip distances and mark them on the section. If all slip lengths achieved are being recorded then mark an additional line 300mm past the design slip distance for a reference mark. Check that the packing is a minimum of 300mm clear of the slip joint length shown on the drawings to allow for any horizontal movement of the pole section during assembly.
- 3.7 Sling the next section for assembly at its centre of gravity and engage the sections as far as easily possible, making sure that perfect alignment of the pole sections are maintained. Rotate the section being slung as necessary to maintain perfect alignment of the corner fold lines. Pole sections must be aligned both horizontally, when viewed from the side, and must also at the same time be in a straight line when viewed from the end of the section. The crane used to engage the next section can be used to hold the section in perfect alignment while the jacking is carried out.
- 3.8 Misalignment of the sections for any reason may lead to jamming, which will prevent good telescoping of the joint and may be difficult to rectify.
- 3.9 Pole sections and climbing rung clips, if applicable, must be aligned along the length of the pole in accordance with the relevant pole drawings.
- 3.10 It is recommended that the jacking process be commenced at the base section slip joint. Attach suitable jacking blocks to the jacking studs and then attach hydraulic cylinders of suitable compressive capacity (refer to figures 2 & 3 below and the Bill of Materials at the end of this document).

Figure 2.

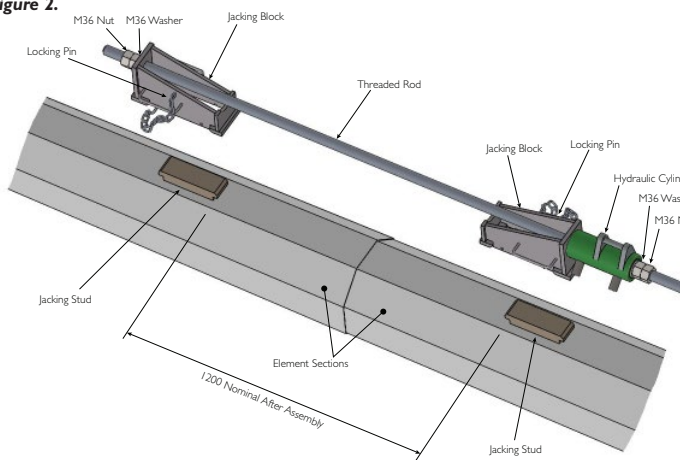
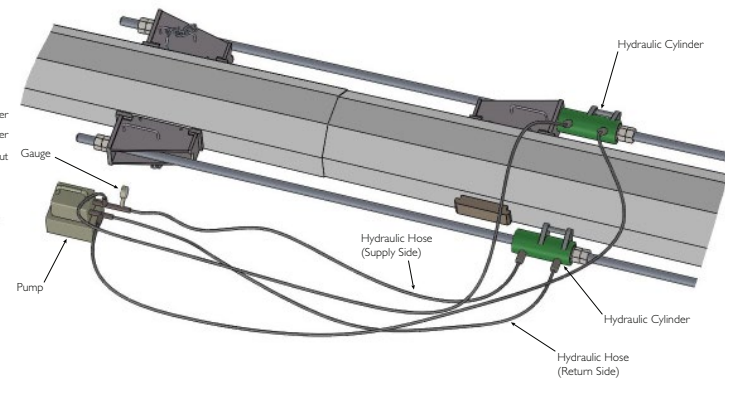


Figure 3.



- 3.11 All jacking equipment including the hydraulic hoses should be routinely checked for damage and replaced as necessary, prior to jacking commencing. The personnel operating the equipment should stand to the side of the equipment and not in direct line with the threaded rods. As an additional safety consideration in the unlikely event of a hose separating during operation, the middle portion of the hydraulic hoses may be covered with a blanket or heavy sheet.
- 3.12 Under strict supervision, operate the hydraulic Cylinders in coordination to ensure that telescoping of the sections proceeds evenly about the pole axis. INGAL EPS hydraulic cylinders will automatically apply approximately the same force to each side of the joint. If you are using INGAL EPS purchased hydraulic jacking equipment please carefully read all operating instructions on and attached to the unit before using the equipment.
- 3.13 Apply jacking pressure/force as described in 3.11 until at least the minimum jacking force is applied (see the relevant pole drawings for the minimum and maximum jacking forces). Check that the design slip distance shown on the relevant drawing has been achieved under application of the minimum jacking force. If so, no further jacking is required. If the design slip distance has not been reached continue to apply force up to the maximum jacking force until the design slip distance is achieved. Check that at least the minimum slip distance has been reached. Contact INGAL EPS if the final slip distance is less than the minimum shown on the relevant pole drawing. A minimum constructed overlap of less than 1.5 x the inside diameter of the female section may be allowed as per AS/NZS 7000 Appendix K CL K9.

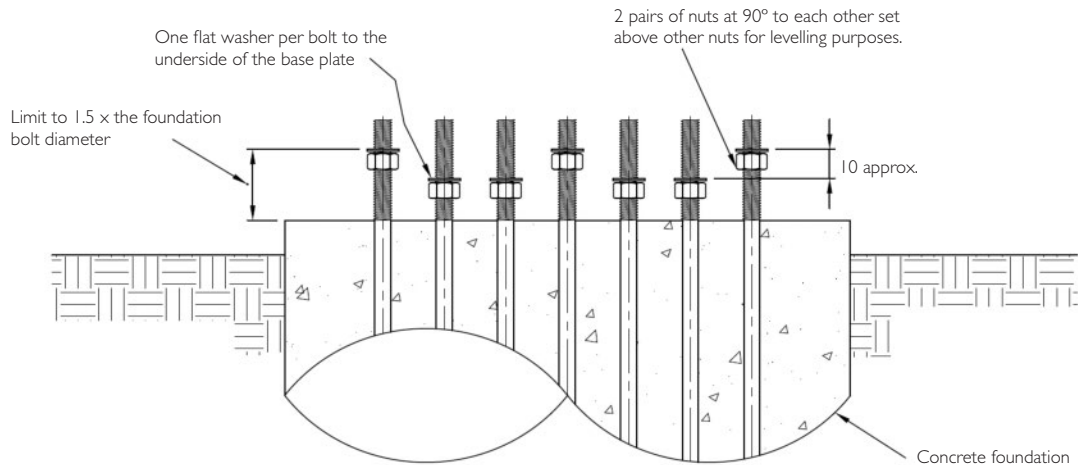
A suggested pole slipping record (hydraulic) sheet is shown at the end of this document.

- 3.14 If INGAL EPS purchased jacking equipment is being used, the **total** applied jacking force in kN can be read directly from the gauge on the unit.
- 3.15 Before removing the crane sling, pack up the newly assembled section to the required level ensuring that the packing is at least 300mm clear of the next joint to be made. Proceed in the manner described above until all of the slip joints of the pole have been jacked together.

Pole Installation

- 3.16** Safety considerations should be reviewed prior to any pole lift.
- 3.17** After the concrete has sufficiently cured, remove the top template leaving the bottom anchor bolt nuts and washers in position. These will reside under the pole base plate.
- 3.18** Identify and mark two pairs of nuts at 90 degrees to each other to be used for adjusting the plumbing of the pole. Lower all nuts to the concrete level and so that they are not noticeably higher than the two pairs of nuts to be used for plumbing the pole.
- 3.19** Now adjust the height of the two pairs of nuts to be used for plumbing the pole so that they are approximately 10mm higher than the remainder and level with each other. These four nuts will provide a means of obtaining vertical plumbing of the pole (refer figure 4). Limit the space between the top of concrete and the four raised nuts to a maximum of $1.5 \times$ foundation bolt diameter. If the pole is required to be back-raked on installation and the foundation bolt cage has not been offset for this purpose, allow the height of one of these pair of nuts to be adjusted to achieve the desired back-rake. The other pair of nuts at 90 degrees will also need to be adjusted by half of the first back-rake adjustment.

Figure 4.



- 3.20** Before lifting the pole, ensure the pole orientation is correct with respect to any cross arms and direction of the power line. If necessary, rotate the pole on the packing prior to lifting to facilitate the orientation.
- 3.21** Prior to any installation or lifting of poles, an appropriate installation/lift plan should be prepared and agreed on in accordance with project specification requirements and any applicable regulations. All lifting tackle and equipment must be checked for its capacity and adequacy for the mass of pole being lifted.
- 3.22** Safety considerations should be reviewed prior to any pole lift. Some common considerations include measures such as not standing directly under any lifting point or load carrying device, keeping fingers clear of the base plate as it is installed on foundation anchor bolts and also routinely checking for damage on the lifting tackle and equipment. Each site should determine, document and train its personnel in safe work methods relevant to the site and to the pole assembly and installation.
- 3.23** Accessories provided with the poles such as cross arms, may be fitted to the poles in accordance with the relevant drawings before installation, if deemed appropriate. All connections bolts for pole accessories should be snug tightened unless noted otherwise.
- 3.24** For **gantries** consisting of two or more poles and a horizontal cross beam/s, if the pole section connections are via bolted flanges then snug tighten the connection bolts as per Clause 3.30 to fully assemble the pole. The assembled poles can be erected following the remainder of the procedure. The cross beam/s can then be installed between the erected poles.
- 3.25** For some taller and heavier poles (the size being at the discretion of the lifting specialist), the lift plan might include the use a small mobile crane (B) to 'tail in' the base end of the assembled pole as the main crane (A) is lifting. This will avoid the base dragging on the ground and will help maintain control of the base until the pole is held vertical by the main lifting crane (see figure 5).
- 3.26** Centre the lifting crane (A) as shown in figure 5. Attach a sling formed into a cradle arrangement (see figure 6) at approximately two thirds of the pole height from the base. Attach shackles to the lifting sling and fix them to the oblong link. Attach a lifting sling around the oblong link and to the hook of the crane. Attach a wire rope, chain or hand winch of suitable weight holding capacity between the base plate lifting lugs and oblong link. Use appropriate shackles as required. The wire rope or chain should be made relatively taut prior to commencing to lift the assembled pole (refer figure 6). The purpose of the above arrangement is to largely prevent the sling from sliding up the pole as the head of the pole is lifted, while also transferring the lifting force back to the pole base. All lifting tackle must be checked for its capacity and adequacy for the mass of pole being lifted.
- 3.27** Figure 6 shows the sling around the pole as not choked and the method described ensures that the safety wire rope or chain will be taut and will prevent any pole sections separating in the unlikely event that a pole section has not been correctly jacked together. A correctly jacked section will not separate on lifting, however it is recommended to always have this safety measure in place.

- 3.28** Alternatively, a choked sling arrangement can be used. If this arrangement is used as a safety measure, it is very important that the pole sections again are restrained from potentially separating by keeping the wire rope/chain, between the base and the oblong lifting link or uppermost pole section taut. For poles provided with uplift restraints these can be fitted to all of the slip joints of the pole prior to lifting. For those poles without uplift restraints suitable weight holding capacity chains or wire ropes can be secured around and under the jacking studs at the top and bottom sides of each slip joint. Alternatively suitable chains or wire rope can be attached to two lifting lugs at the pole base and be secured above the top section slip joint around the cross arm through vang plates or be secured around and under the uppermost jacking studs.
- 3.29** Following the above, the pole may now be lifted onto the foundation bolts. Keep well clear of the base of the pole while it is being lifted and placed onto the foundation bolts.
- 3.30** With the pole now resting on the levelling nuts on the foundation, place washers and nuts on all bolt threads.
- 3.31** Tighten down the four adjusting top nuts only and check the alignment of the pole. Readjust the four levelling nuts under the base plate if necessary.
- 3.32** Now tighten all nuts to snug tight in a diametrically opposite sequence, tightening the nuts to the top side of the base plate and then the corresponding nuts under the base plate in a similar sequence. An approximation only of the assembly torque to achieve the snug tight condition is as follows:
- M20 = 143Nm or 106lbft
 - M24 = 248Nm or 183lbft
 - M30 = 491Nm or 362lbft.
 - M36 = 864Nm or 637lbft.
 - M39 = 1115Nm or 820lbft.
 - M42 = 1378Nm or 1020lbft.
 - M45 = 1700Nm or 1254lbft.
 - M48 = 2064Nm or 1520lbft.
 - M56 = 2950Nm or 2176lbft.
 - M64 = 3984Nm or 2938lbft.
 - M68 = 4833Nm or 3565lbft.
- 3.33** Recheck tensions commencing with the bolts first tightened to ensure all bolts have similar final tensions. If lock nuts have been supplied these can then be threaded on and snug tightened in a similar sequence to the first ring of top nuts.
- 3.34** Release the load from lifting crane (A) and remove the lifting tackle and wire safety rope/s or chain/s.
- 3.35** If grouting beneath the base plate is specified, fill the space between the base plate and the concrete foundation with a non-shrink grout (50MPa minimum). The grout must be at least in contact with the full underside of the base flange.

Figure 5.

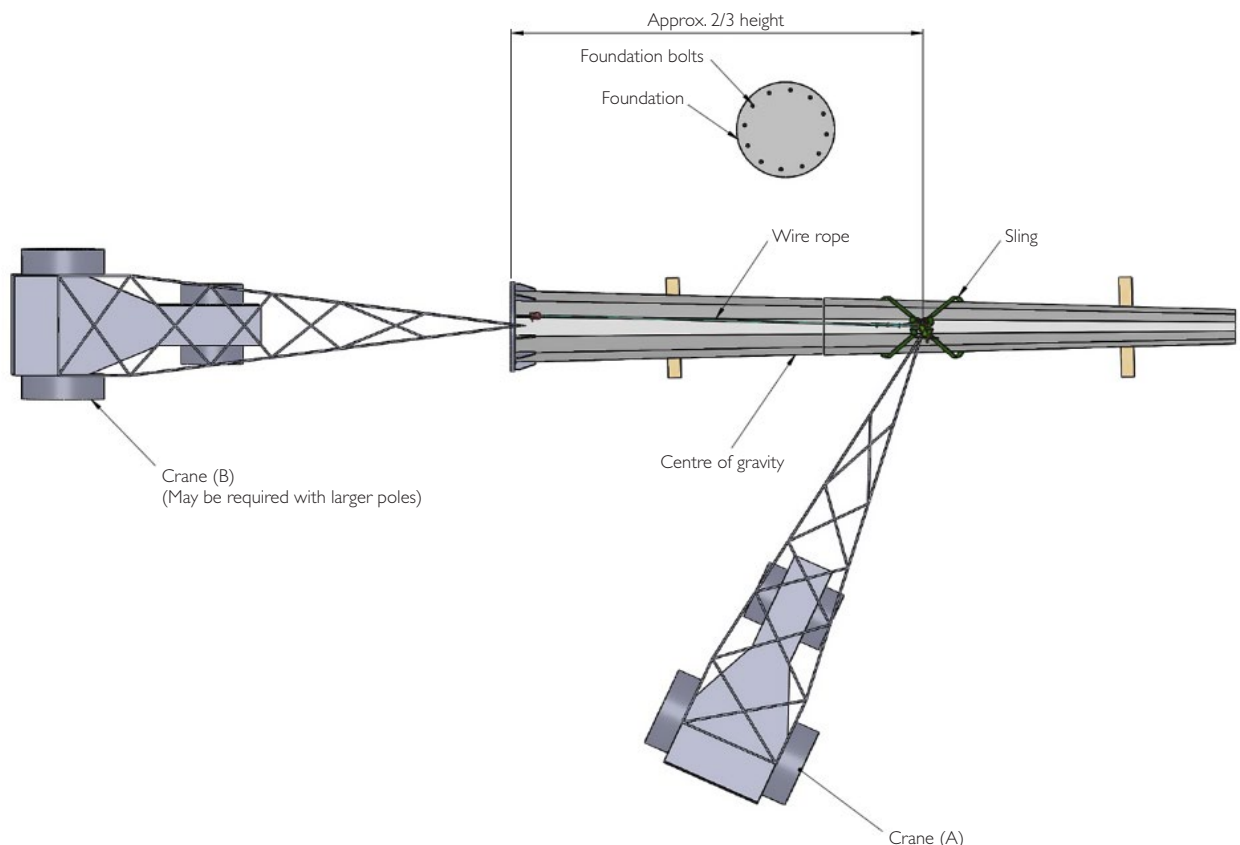
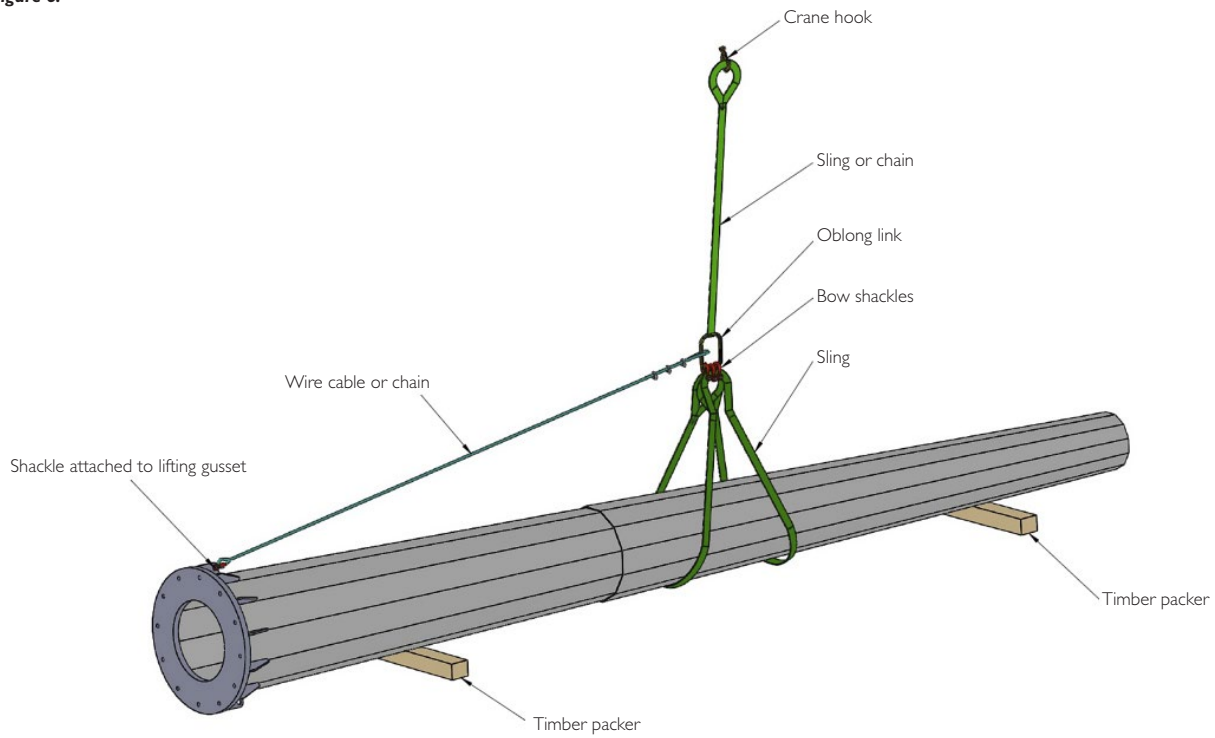


Figure 6.



A 30 minute video showing a previous assembly and installation of a 34.0m pole is available on the INGAL EPS website, www.ingaleps.com.au under the utility section.

4.0 Bill of Materials (Refer Drawing No. GA5663)

Description	Qty
1 Hydraulic Cylinder, Simplex RACD3010 30T Aluminium 10" Stroke Double Acting Cylinder	2
2 Pump, Simplex Electric G1241	1
3 Calibrated Gauge, Wika Pressure Oblique/Force 550kN	1
4 Calibrated Gauge Report, NATA	1
5 Hydraulic Hoses, 700 Bar 3/8" 5.0m Long	4
6 Tee, Fittings & Gauge Adapter for Pump	1
7 Jacking Blocks, Drawing No. AD7887*	4
8 Threaded Rod, 3.0m M36 Grade 8.8, Drawing No. AD7894*	2
9 Nut, M36 Grade 8 to ASI 252, Drawing No. AD7894*	8
10 Washer, M36 Grade 8 washers to ASI 252, Drawing No. AD7894*	4

***Note:** All Hot Dip Galvanised



Record of Pole Slipping (Hydraulic)

Company:

Project:

Asset Owner:

Ingaleps Pole No.:

Pole Location Reference:

Joint	Minimum Slip (mm)	Design Slip (mm)	Maximum Slip (mm)	Minimum Force (kN)	Maximum Force (kN)	Actual Slip (mm)	Actual Force (kN)
1-2							
2-3							
3-4							
4-5							
5-6							
6-7							

Comments:

Name:

Signature:

Date:

