

Foundation Installation Instructions

Introduction



This is a Kijito with a 12ft Rotor on a 40ft tower and was installed for one of the Kenya Wildlife Services Anti Poaching Camps. The excess water went to the elephants!

BOBS HARRIES ENGINEERING LTD
THIKA, KENYA

FOUNDATION INSTALLATION INSTRUCTIONS

It is normally recommended the KIJITO Windpump manufacturers carries out the installation of the Windpump. However, in certain circumstances, this will be feasible and either the Windpump purchaser or a

recommended third party will have to carry out the installation. In either case it is essential that:-

The Windpump site is carefully selected and prepared.

The concrete foundations are correct and to the specification given on Drawing Nos. A-3-010-03, A-3-010-04, A-1-015 and A-1-016.

These points will be dealt with separately as follows:-

Site Selection and Preparation

The Windpump site will probably be predetermined by the water source. However as Windpumps will only operate in the wind, it is essential that there is not anything near the Windpump that might cause a windshield or create turbulence. Therefore the area surrounding the Windpump should be free from any building or trees above 3 metres high, preferably within a distance of at least 100 metres.

Kijito Windpumps come with a unique feature, in that all towers are hinged, so that the machine can be installed at ground level and then raised into position with a winch. So consideration has also to be given to the best direction for the Kijito to be laid back, and again in the opposite direction there must be room for the winching up operation. This means that adequate space has to be provided, in the direction that the Windpump will lay down, and for the winch anchor or heavy vehicle in the other direction. The space required obviously depends on the size of the Windpump and the height of the tower. Also sufficient area must be kept free to allow access of installation and well maintenance vehicles, especially for boreholes. The Windpump is raised or lowered with a winch and 'A' frame. Frame has been made by incorporating brackets on the foundation plates. (If a KIJITO Windpump owner intends to do his own well maintenance he will need to have his own 'A' frame). The drawing No. A-1-195 J gives manufacturing details of the 'A' frame.

The winch used to raise and lower the Windpump must have a minimum rating of at least 3 tonnes. Drawing No. A-1- 016 gives details of the winch anchor foundation and its sitting relative to the Windpump. The drawing shows an anchor suitable for 'Tirfor' type winch. If an alternative type of winch is used the anchor point will have to be modified to suit, but the foundation size and winch rating must remain the same.

It must be noted that although it is not absolutely necessary to provide a "permanent" anchor for the winch, if a vehicle is used it must be at least 3 tonnes with adequate winch attachment point.

Foundations

There are two basic types of Windpump installations:-

For boreholes or open wells of limited diameter, the foundations should be made in accordance with drawings Nos. A-010-03, A-3-010-04.

For large open wells the foundation should be made in accordance with drawing No. A-1-015.

Both types of foundations will be dealt with separately and are designed to support the Windpump in winds up to 40 m/sec, therefore the reinforced concrete oversite not only provides protection from erosion caused by water leakage but also is a

necessary part of the structure.

If the Windpump is sited in an area in which the wind never exceeds 30m/sec the oversite can be omitted. However protection against soil erosion around the windpump base should be considered.

Borehole and small open wells.

Procedure:

Place the assembled template A-3-014-01 centrally over the well or borehole.

Note: For borehole situations the template should locate on the borehole casing which usually protrudes above ground level. Accurate measurements at this stage are essential, to make sure that the foundations are centrally located around the borehole casing. Failure to do this will result in excessive pumprod and cylinder wear due to the resulting misalignment.

Mark the three foundation positions to dig 750 x 750 as shown on the drawings A-3-010-03 & 04.

Remove the template and dig the three holes 750 x 750 x 1200 - 2000 deep, depending on the soil conditions. Obviously the aim is to have the base of the foundations resting on rock or firmly compacted murram.

It is now advisable if a permanent winch anchor is required to mark out and dig the wind anchor foundation in accordance with drawing No A-1-016.

Mark the position for the correct oversite, dig out the required depth and provide shuttering as shown on the drawing.

The reinforcement mesh should now be cut to shape and positioned in the oversite at the correct height as shown.

NOTE: As the concrete forms part of the structure, in every windy areas the reinforcement mesh is essential.

Replace the template locating it on the borehole casing if necessary as described instep 1. It should now have the three foundation templates (A-3-147-01) bolted to it, from which the 12 foundation bolts will locate. It will be noted that two of these plates have the hinges on, on which the whole tower will be raised and lowered. So it is essential that these should be located in such a way as to allow room for the entire tower and rotor to be laid back during installation. Also of course there should be room on the opposite side to either install anchor (Drawing A-1-016) or park a heavy vehicle that can be used as a winch point.

Note: Some of our newer foundation templates already come with the foundation plates welded in position. After the concrete has cured this will be removed and the actual foundation plates that come with the tower assembly, will then be put in position.

Assembled twelve foundation bolts drawing No. A-2-148 (four in each foundation plate as shown), giving approximately 15mm of thread protrusion above the M24 nut. Allow the foundation bolts to hang through the reinforcement mesh in holes as shown.

The three foundation plates should now be leveled and fixed at required height. A 'bubble' spirit level should be used placing it in several positions around the template to ensure that the assembly is level - **this is most important.**

The concrete should now be prepared. It is recommended to thoroughly mix the quantities dry before adding water.

The quantity ratios should be :-

CEMENT 1 SAND 2 COARSE AGGREGATE 3

NOTE:

Care must be taken not only to achieve the correct quantity ratio of the materials but also the type and quality of materials is important:-

CEMENT:

The most common is Portland cement which is usually supplied in 50kgs bags. Preferably bags of cement should be used immediately as there will be a marked loss of strength if stored longer than four weeks.

SAND:

This can be natural from pit or river bed. It must be well graded through the sieve and should not contain excessive silt or clay particles.

COARSE AGGREGATE:

This may be gravel, crushed rock or stones of 10mm - 40mm approximate diameter. NOTE: "ALL IN" aggregate (normally called "BALLAST") can sometimes be purchased . This will be a mixture of both sand and coarse aggregate and therefore only require cement to complete the mixture.

The quantity ratio should be:- CEMENT 1 BALLAST 2

Water is added to the dry mix to produce a dense concrete of adequate workability. The quantity is very important factor and will influence the strength of the concrete. Generally the mix should not be too wet but have just enough water to enable good compaction. It will be best to mix several manageable batches rather than all the mix in one go.

The concrete mix can now be poured into the foundation holes, and must be continually "tampered down" to ensure good compaction.

IMPORTANT: Regularly check the level and position of the template as it can be easily be knocked out of position when pouring the concrete. Also ensure that the foundation bolts are hanging correctly in the holes.

After the foundations have been completed the oversite should be filled allowing the concrete to pour through the mesh which should be positioned at the med-depth as shown.

Finally ensure that the concrete is fully compacted beneath the foundation plates and smooth the oversite surface using a long wooden board.

The concrete foundations should now be left to cure for at least 7 days. It is advisable to protect the concrete from the sun to prevent the surface drying out too quickly and cracking. This can be done by covering the foundations with damp sacking. Water must be sprinkled over the sacking regularly to keep it damp for the first two days.

After curing the twelve M24 foundation nuts must be fully tightened : NOTE: A spanner approximately 400mm to 500mm long is necessary to adequately tighten these nuts.

Check once again that all the foundation plates are level by using a spirit level before unbolting and removing the template jigs. NOTE: If the foundation plates are significantly out of level, they will have to be packed. This must be done with steel sheet (NOT WOOD OR STONES).

The foundations are complete and the KIJITO Windpump can now be installed. For instructions and list of equipment, see the Installation Manual.

Large open wells:

Drawing No. A-1-015 shows foundation details for large open wells. This type installation will require a '1' beam to support the unhinged legs of the Windpump. The correct size of beam can be selected from TABLE A of the drawing.

Before installing the foundation the well should be prepared. Often the walls of open wells left unsupported, however it is recommended that the well lining rings are used to prevent the walls from collapsing or being eroded by heavy rain or water spillage. Well liners are relatively cheap and easy to make and manufacturing details are given on drawing No. A-2-017. Any gap between the well liners and the well wall must be filled with soil. The top most liner should protrude at least 100mm above ground level to provide support when laying the reinforcement concrete oversite. Also it is desirable to back fill the top liner with concrete to provide extra support for the foundations.

As described for borehole and small open installations, correct spacing of the foundation plates is essential to match the windpump bottom tower feet.

Again drawing Nos A-3-0120-04 & A-3-014-01 gives manufacturing details of jigs and shows them assembled with the three foundation plates and beam to form a

template which will ensure correct spacing and positioning of the foundations.

PROCEDURE:

Position the '1' beam assembled with the foundation template across the well. Ensure that the centreline of the tower will be adequate distance from the well wall as indicated on the drawing and two foundation plate incorporating the 'A' frame plates are in the correct position to enable the tower to be lowered.

Mark out four 750 x 750 foundation hole positions as shown on the drawing.

Remove the beam and template and dig four holes 750 x 750 x 1200 -2000 deep.

It is now advisable if a permanent winch anchor is required to mark out and dig the winch anchor foundation in accordance with drawing No A-1-106.

Mark the position of the concrete oversite then dig out to the required depth and provide shuttering as shown on the drawing. Shuttering will also be required for the two raised hinged foundation plates to bring them level with top of the beam as shown.

The reinforcement mesh should now be cut to shape and positioned in the oversite at the correct height as shown. NOTE: As the concrete oversite forms part of the structure, in very windy areas, the reinforcement mesh is essential.

Replace the beam and template in position as described in step 1.8.

Assemble sixteen foundation bolts drawing A-3-148-01 (four in each plate) giving approximately 15mm of thread protrusion above the M24 nut. Allow the foundation bolts to hang through the reinforcement mesh in the holes as shown.

The two raised foundation plates and the plates welded to the beam must be level and fixed at the required height. A 'bubble' spirit level should be used by placing it in several positions around the template and on the beam to ensure that the assembly is level. This has been described in procedure steps 10 to 16 of the foundations instruction for boreholes and small open wells.

It is advisable to build a small retaining wall around the well perimeter. This not only gives some protection against animals or humans falling down the well but also prevents rubbish and debris from contaminating the well. The wall can be built on the concrete oversite as shown.

The foundations are now complete and the KIJITO Windpump can be installed. For instructions and list of equipment needed see the Installation Manual.

ADDENDA

FORTY FOOT TOWERS:

Windpumps on forty foot towers are more difficult to put up, more difficult to service, and are not so easy to lay back when the borehole needs to be checked with drilling or cleaning rig. It is therefore our recommendation that 30' towers should be used whenever possible, however as mentioned before anything within 100 metres of Windpump, that can be removed, should be removed.

Having said that, the bigger Windpumps, especially 24ft and 26ft rotor machines should really have a 40ft tower unless the land around them is completely flat and clear obstacles.

If a 40ft tower is required, we can supply an extra ten foot section that simply bolts onto the bottom of the regular 30ft tower. This section has parallel sides so that it can also be used on a previously laid foundation for a 30ft tower. However it also incorporates three side braces coming out from each tower leg, bolted onto separate foundations situated 1000mms out from the main tower leg. (See drawing A-3-012-01 & A-3-012-02).

If a 40ft tower is replacing a previous 30ft tower (i.e. the previous foundations are already in situ) - then after laying down the Windpump and removing it to the side, dig the holes for three new foundations. These should be a minimum of 600mm square and 1000mm deep. The one foundation bolt provided should be bolted in position with the piece of angle iron that is part of the regular 30ft foundation template that has been made from the drawings in this handbook. Using a piece of cord care should be taken that the extra foundations bolts is on exactly the same radius from the centre of the foundations as the main tower leg.

If a 40ft tower is being installed initially then it is our recommendation that the three main foundation pillars be dug down deeper than for the regular 30ft tower. Depending on the subsoil this should be between 1500 and 2000mms.

For extra safety and hygiene during the future use of the windpump we also recommend that the plinth which is made of 250mm of reinforced concrete over the top of the foundation pillars be extended to cover the three extra foundations. It is possible for the ground round the windpump to become very wet during times of heavy rain, or careless use of water pumped by the machine, and the plinth and the recommended depths of holes for the foundation pillars will prevent any chance of the windpump being blown over during times of very high winds.

Black Cotton Soil

There are some soils or sandy areas that may require much more substantial foundations, as it is not possible to dig down to anything that is firm. The object then is to provide the windpump with a foundation that is like a raft, that will provide stability due to its lateral extensions. One method that we have used to do this can be seen in drawings A-3-012-4 & A-3-012-05.

If there is anything in this manual that you do not understand, or if you have a problem please contact us at:

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List of drawings used in Kijito Foundation Manual

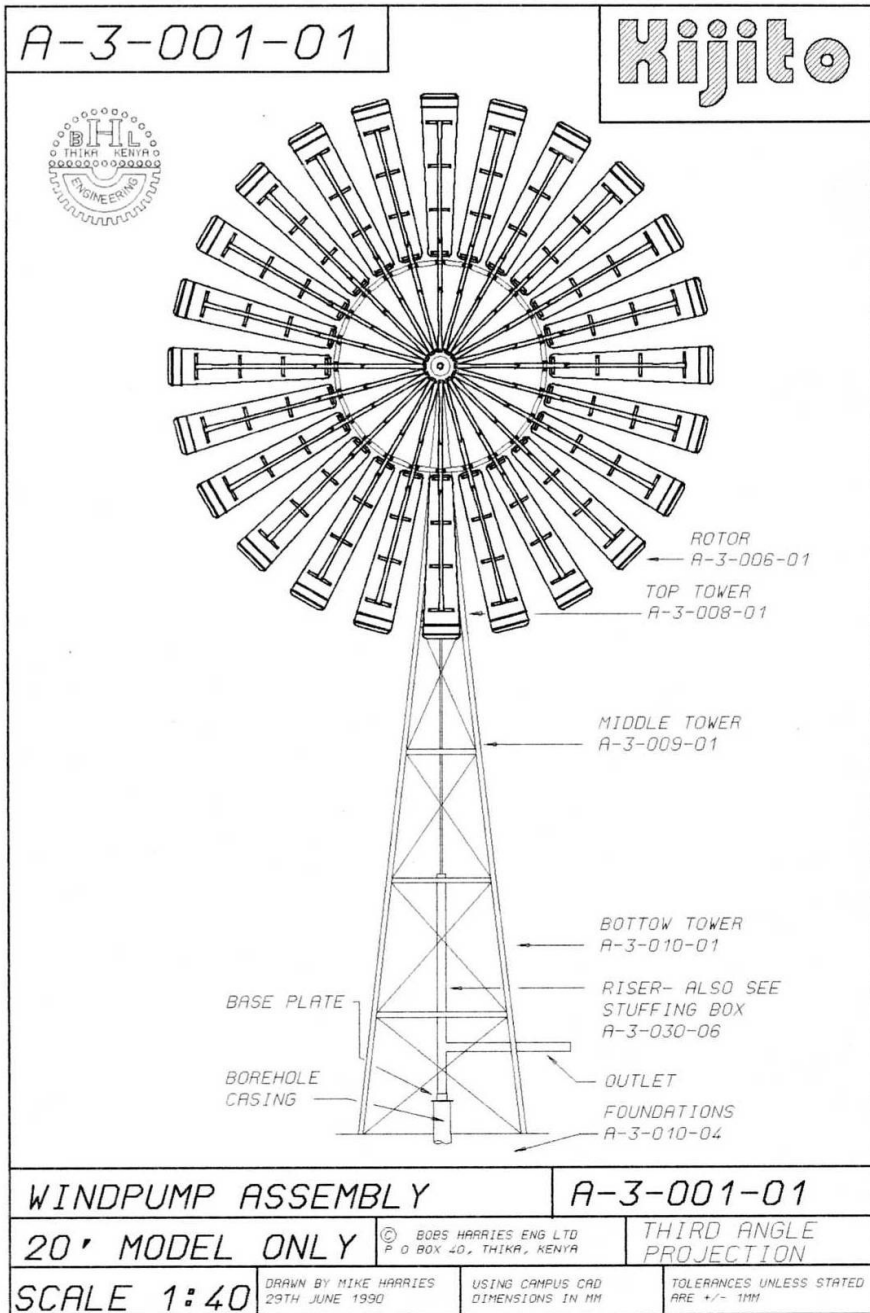
1.	A-3-001-01	Windpump Assembly 20' Model
2.	A-3-014-01	Foundation Template
3.	A-3-012-01	Ten Foot Tower Extension
4.	A-3-012-02	Foundations for 40' Tower
5.	A-3-148-01	Foundation Bolt
6.	A-3-147-01	Foundation Plate
7.	A-1-016	Large Well Foundation & Anchor
8.	A-1-015	Large Well Foundation – detail
9.	A-3-010-04	Borehole Foundations – 30' – side
10.	A-3-010-03	Borehole Foundations – 30' – plan
11.	A-3-012-04	Black Cotton Soil Foundations – plan
12.	A-3-012-05	Black Cotton Soil Foundations – side
13.	A-2-017	Well Lining Ring
14.	A-1-195J	"A" Frame Details



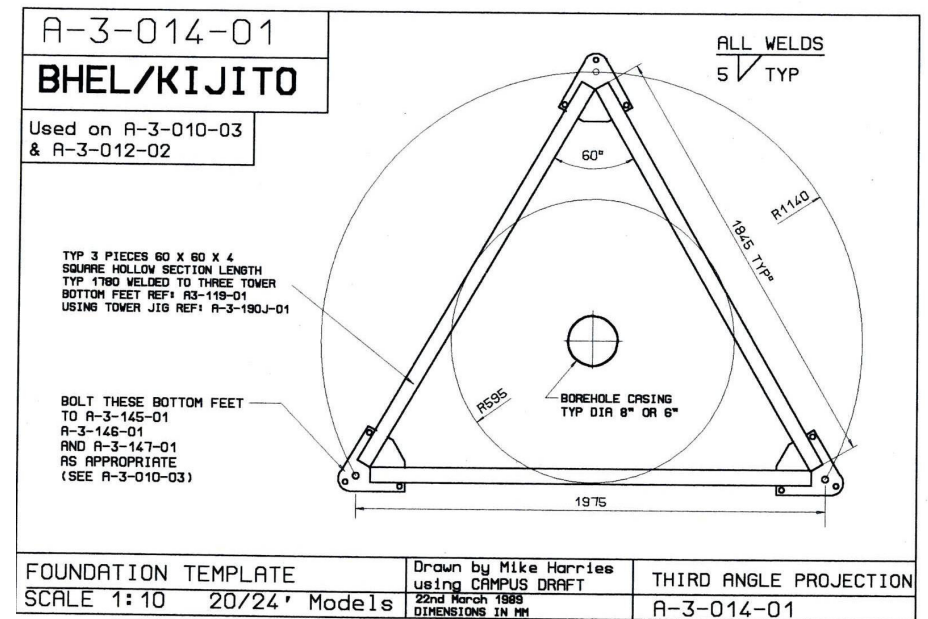
Foreman Paul Muiruri winches the last pipe down, before raising this 16ft Kijito up on its hinged tower



Foundation holes dug, prior to placing the jig over them to locate the Foundation Bolts. The tower jig can be seen in the back ground.



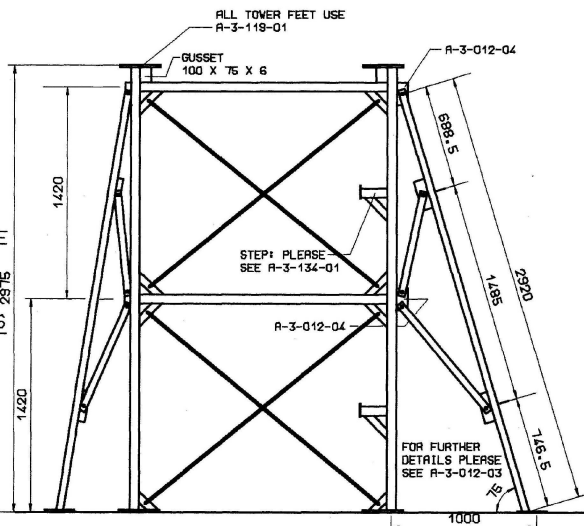
The Foundation jig with the tower footplates and the foundation bolts attached. As can be seen it is important to adjust the jig so it is centrally located around the borehole casing



BHEL/KIJITO

THE MAIN FOUNDATIONS FOR THIS TEN FOOT EXTENSION ARE DESIGNED TO USE THE SAME AS THE STANDARD 30' TOWER. THIS CAN FACILITATE RETROFITTING IF THIS SHOULD BECOME NECESSARY. 75

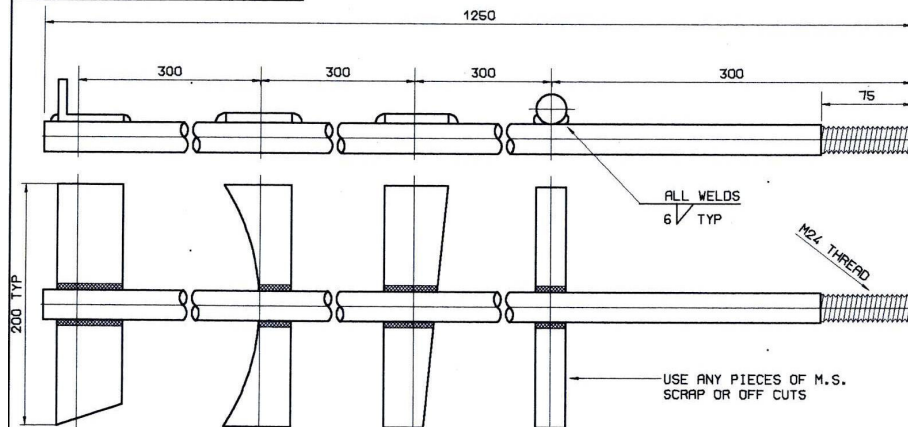
MAIN TOWER - 2" BLACK
PIPE CLASS "B" 62 O.D.
AND WALL 4 MM
SIDE STAYS - 1 1/2" BLACK
PIPE CLASS "B" 46 O.D. —
AND WALL 4 MM



A-3-012-01

MATERIAL SPECS:
HOT ROLLED M.S. BAR
25 DIA (1")

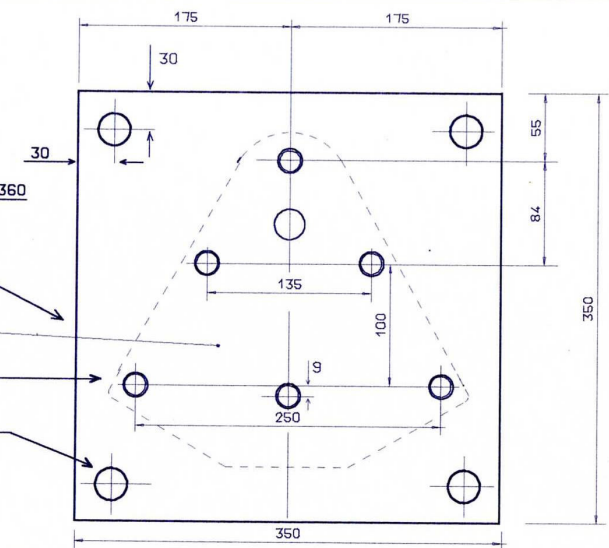
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A-3-148-01

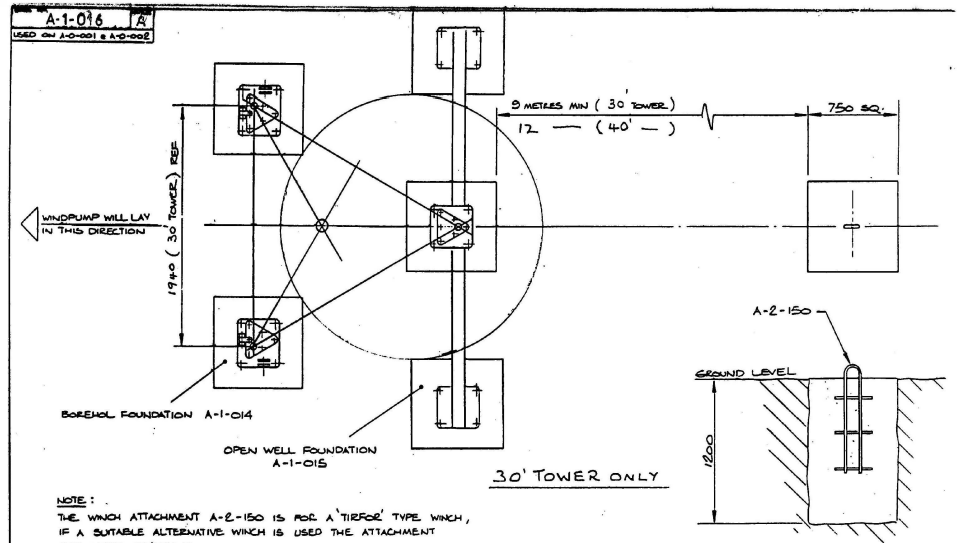
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USE CUTTING AND DRILLING
TEMPLATE NO A-3-210J-01





A-3-147-01

A-1-016
USED ON A-0-001 & A-0-002



NOTE:
THE WINCH ATTACHMENT A-2-150 IS FOR A 'TIRFOR' TYPE WINCH,
IF A SUITABLE ALTERNATIVE WINCH IS USED THE ATTACHMENT
MAY NEED MODIFYING

SEE ASSEMBLY INSTRUCTION SHEET NO 5

TITLE FOUNDATION INSTALLATION (WINDCH ANCHOR)		DESIGN NUMBER	 Right Windpump
INTERNAL SPEC		DATE MAR 76	
3" ANGLE PROJECTION		SCALE 1:10	APPROVED 
DISTANCE UNLESS NOTED - SEE DIMENSIONS IN DETAILS		CHECKED BY DIVISION	
			CRG. NO. A-1-016

