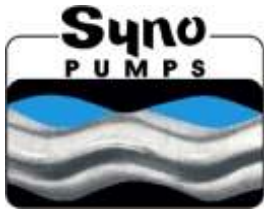


**Agricultural Products
(BOREHOLE PUMP)**

SYNOBOREHOLEPUMPMANUAL

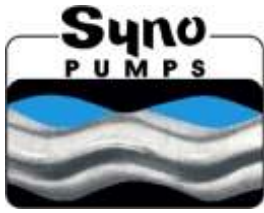


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INTRODUCTION

PUMPING PRINCIPLE

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SYNO Progressing Cavity Pumps -The progressing SYNO cavity pump principle is ideal for handling liquids that can be viscous, shear sensitive, 2 or 3 phase mixtures or when applications require, significant suction lift capabilities. The principle inherent in the pump design is ideally suited for both low to high flow applications.

The Heart of the SYNO bore hole pump is the rotor and stator. As the single helix rotor revolves eccentrically within the double helix of the stator, a continuous cavity is formed and progresses towards the discharge end of the pump as the rotor rotates.

The figures shown below describe the principle. As Metallic Rotor having single helical profile eccentrically turns inside a resilient Stator having double helical profile. Due to special profile of Rotor and Stator, a series of cavities are created 180 degrees apart. As the Rotor turns inside the stator, the cavities progresses from suction to discharge end.



MOTION 1



MOTION 2



MOTION 3

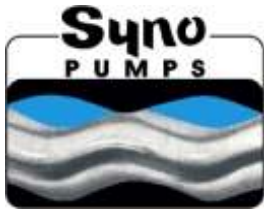


MOTION 4

Characteristics

- Positive Displacement :** Capacity is proportional to speed and is relatively insensitive to changes in pressure. The pumps are hence useful for duties where flow needs to be controlled.
- Self-Priming :** Can handle multiphase liquids.
- Non-Clogging :** Handles Viscous liquids or liquids with high solid content or large solids with ease.
- Simple Construction :** Simple to dismantle, assemble and maintain.

SYNO - to Suit Every Application



Agricultural Products

INTRODUCTION

**Description, Application
and Benefits**

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DESCRIPTION:

The Syno Borehole pump is the essence of simplicity in design. The simple positive displacement, Syno designed rotor and stator are immersed below draw-down level in the bore or well. The motor and drive head are located at ground level for easy inspection, maintenance and installation.

APPLICATION:

Syno is not just one pump, but a complete and versatile range designed to cover all deep-well borehole and "down the bank" installations. Syno borehole pumps will operate against total heads of 10 to 200 feet (3-70 meters). The pumps are suitable for all types of underground waters -whether sand or silt laden, brackish or corrosive. Stainless steel shafting and fiberglass column are available for brackish applications. Special purpose corrosive water pumps are available for special applications, contact Syno Pumps for details. Capacities range from 10,000 lph to 1,80,000 lph to suit bores from as small as 3" to 8" ID (76 to 203mm), in fact, all bores and wells. (refer performance curves Pg.19-20) Pump capacity can be matched to the yield of your bore to maximize the output simply by varying the speed of the pump.

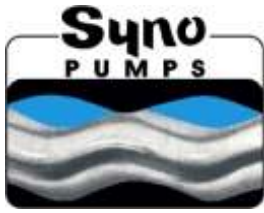


BOREHOLE HEADS

BENEFITS:

Simple, innovative design. Outstanding versatility - suits wide range of bore sizes and applications.

Superior performance - can pump high heads over long distances making optimum use of available bores with good water. Longer life - due to high abrasives handling capability and low speed which helps minimize abrasion. Alloy steel elements and shaft with fiberglass column ideal for corrosive waters. Little or no maintenance. Use petrol, diesels, or electric, or even a tractor can be used.

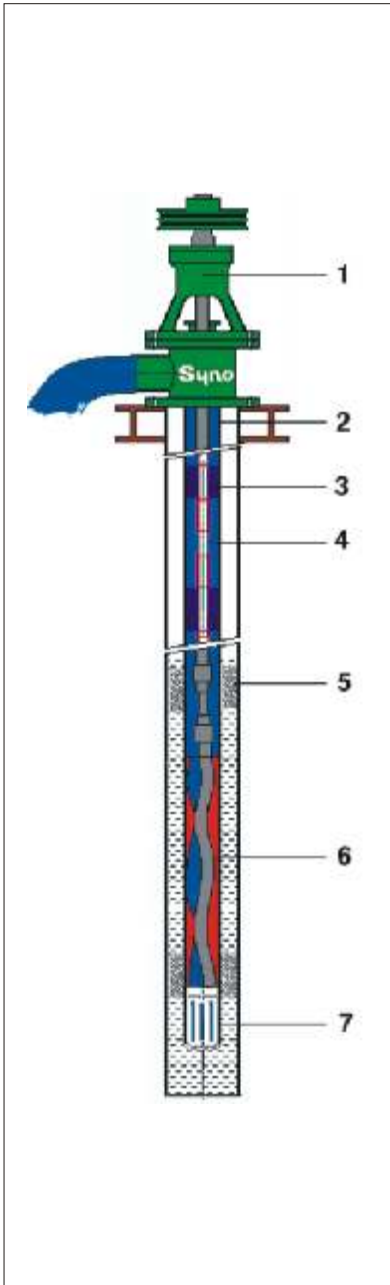


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FEATURES

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Seven Basic Assemblies



SEVEN BASIC ASSEMBLIES:

1. Combined discharge and drives head with radial and thrust bearings. Discharge heads are compact, robust and weather-proof. All feature grease lubricated pre-packed or sealed bearings. Two designs are available. Vertical shaft models for electric or quarter twist diesel drive and right angle or compact side mount diesel.

2. Column. Columns are available in 10-metre lengths manufactured from heavy duty galvanized/non galvanized pipe. Connection is by Syno's exclusive precision parallel threads producing a strong watertight joint.

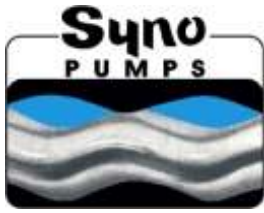
3. Bobbin or Spider bearings. Simple, efficient and above all, long-wearing, even under abrasive conditions. Short bobbin bearing shafts made of alloy steel run in bobbins to totally eliminate wear on the main drive shaft.

4. Drive shaft. Drive shaft is supplied in equivalent lengths with rolled threads for maximum torque transmission. You have the option of carbon steel or stainless steel shafting depending on the quality of the water.

5. Column stabilizers. A unique Syno development. Supplied to support the discharge column in relation to the bore casing, thus eliminating vibration and ensuring the discharge column is always accurately centered.

6. Syno's Rotor/Stator pumping element. Perfected after many years of Syno development and research.

7. Strainer with foot valve. Designed specifically to ensure efficient lubrication of the column to prevent leakage and loss of pipeline water with minimum restriction to the pump inlet.



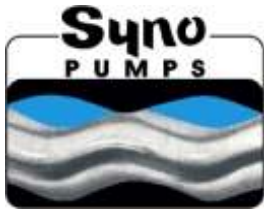
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OVERVIEW

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Features

Ordinary Column	Exclusive SYNO Heavy Duty Column
<p>Ordinary Column in medium weight pipe requires taper threads. These may seal well when new but vibration can cause water and corrosion to enter. If these few turns of thread give way, what happens to your pump ?</p>	<p>Syno Heavy Duty column is thick enough for parallel threads. We carefully machine the ends for a face to face connection. When you screw these faces together, you keep water out and many more threads are working for you.</p>



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SELECTION

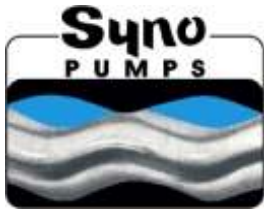
Selection Overview

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FACTORS TO REMEMBER DURING THE SELECTION PROCESS:

Whilst the information in this publication will allow you to select the correct size and type of pump element, column and shafting and drive head, you are advised to remember the following important points:

- 1.** When placing your order, confirm your requirements and full conditions of service with your Syno Pumps representative. This will ensure your calculations are correct, and the ancillary equipment you have selected, the pump and the pump speed, horsepower, etc., are matched to suit your actual conditions of service. This is particularly the case where you have unusual operating conditions, such as bore water containing high sand or silt concentrations, using low rated engines or when discharging through long lengths of piping and reticulation services.
- 2.** When operating the pump with a diesel or petrol engine, it is necessary to use a clutch between engine and pump. This serves two purposes, the first allowing the engine to obtain operating speed and sufficient torque to overcome the inertia of the pump unit in starting, and if the clutch is hand operated, allows you to service and test-run the engine without necessarily driving the pump at the same time.
- 3.** Equally the electric motor operation, it is essential that the starting equipment on 3 phase motors provide adequate starting torque requirements, or other reduced current starting, please advise your Syno Office for their recommendations, to ensure you have no trouble with your Syno installation.
- 4.** The Syno pump will handle silt laden and corrosive bore waters, but where the water is abrasive, you should contact Syno Office, who will give you advice on this aspect of bore pumping.
- 5.** The pump should always be installed in a vertical, straight bore, but of course there are many bores in India where alignment is not known, particularly below surface water level and where bending is common. Generally speaking, the Syno borehole pump can be installed in vertical holes with approximately half the diameter of the hole misalignment, per 100 feet in depth. They can also be installed on inclined riverbank installations providing proper column support is assured. But wherever these circumstances prevail, your Syno representative again should be consulted for our recommendation.
- 6.** Syno pumps are entirely manufactured in India and sold and serviced by the company's offices and authorized agents in many places.



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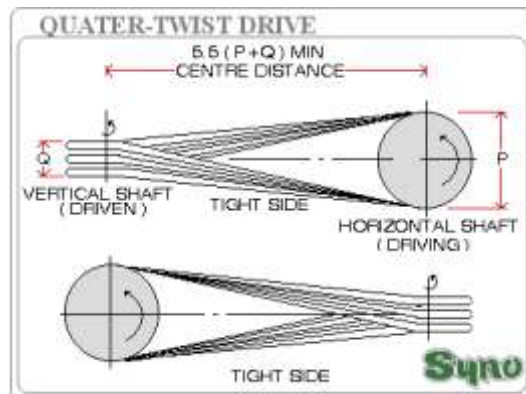
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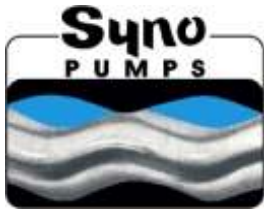
Selection Overview

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When using a quarter-twist drive please observe the following principles:

1. Suitable guarding must be installed to protect the operator from the belts and pulleys.
2. Drive ratio should not exceed 2.5:1.
3. The center distance between pulleys should not be less than 5.5 times a distance equaling the diameter of the larger pulley plus the width of the pulley $5.5 (P + Q)$.
4. Drive side must always be on the bottom.





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INSTALLATION

Introduction

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The Syno Water Pumping System represents a significant capital expenditure of quality, efficient equipment. Once the system is properly installed, and with minimal maintenance, you can expect a long and efficient trouble free service life. This booklet has been written to assist you with the installation of your system and to provide reference information, which may be both interesting and useful throughout the life of the system.

TOOLS REQUIRED

The Syno Borehole Water Pumping System is designed for easy installation with few specialized tools required, as follows:

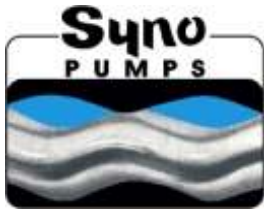
- firm standing tripod of suitable load capacity which gives at least 4 1/2 meters clear lift
- a safety winch or block and tackle. An adequate length of wire rope of sufficient load rating to take the weight of column and shafting with swiveling safety hook, sling or lifting cables
- two pairs of pipe wrenches - (914mm/36")
- two pairs of vice grips
- one hacksaw
- one set of imperial and metric Allen keys
- lifting tool & column clamp
- wire brush and file
- thread sealant for column - stag
- thread lubricant for shafting .
- basic set of ring and open spanners
- bucket and stop watch to measure flow

Weights of Columns and Shafting (Kg. per meter)		
NB	DRY	INC. WATER
1 1/4" (32mm)	4.5	6.5
1 1/2" (40 mm)	5.5	7
2" (50mm)	8	10
2 1/2" (65 mm)	10	14
3" (80 mm)	13	18
4" (100 mm)	18	26

Average safe working loads for wire rope in reasonable condition would be:

6mm (1/4") Dia.	600 kg per rope
10mm (3/8") Dia.	1500 kg per rope
12mm (1/2") Dia.	2500 kg per rope

Note: The maximum load a block and tackle may lift safely is the above figure x number of ropes attached to or going through the bottom sheaf.



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INSTALLATION

Overview

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OVERVIEW

Installing a borehole pump is not difficult provided you are well organized and that you have read these instructions before commencing the work. The following summary gives an overview of the installation procedure. Note that the preparatory work and pre-assembly steps are most important to achieve a smooth running job.

Summary of events:

- ☞ Checks prior to delivery of the system.
- ☞ Check alignment of bore.
- ☞ Pre-assembly of all the column and shafting.
- ☞ Lowering the pump element into the bore.
- ☞ Lowering the column and shafting into the bore
- ☞ Installing the pump head and driver.
- ☞ Preparation of the work site.
- ☞ Pre-assembly of all the drive shaft lengths.
- ☞ Installing the base plate.
- ☞ Finishing column and shafting installation
- ☞ Final actions

Each of the above steps will now be discussed in detail.

EQUIPMENT ITEMS :

What you should receive:

1. A Pump Element

Depending on the system duty (i.e. required flow and total head).

2. Drive and Discharge Head.

Depending on the application Drive and Discharge Head assembly is supplied bare shaft or fitted with electric motor or engine drive, driven by either a 1/4 twist belt drive assembly, a right angle drive.

3. Column and Shafting

There should be sufficient lengths of column and shafting to reach the level of pump setting in the bore. The Rising Main (column assembly) comprises For each length of column (3m/10ft) there is one length of drive shaft (3m/10ft) and one bobbin bearing shaft assembly. The column is made of heavy duty galvanized pipe, with parallel thread. Each pipe length is supplied with a pipe socket fitted on one end. The drive shaft is made from high tensile steel as standard (stainless steel optional).

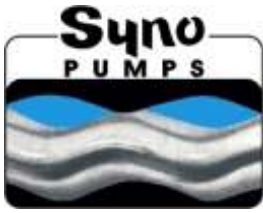
The Bobbin Assembly comprises:

- ☞ 1 bobbin bearing shaft of alloy steel (stainless steel optional).
- ☞ 2 coupling nuts of high tensile steel (stainless steel optional)
- ☞ 1 bobbin bearing (Natural G-1 rubber).
- ☞ 1 Bobbin Bearing & 1 Stabilizer.

4. Stabilizers

Natural rubber stabilizers are used in cased bores, one every second length of column.

In un-cased bores at least one stabilizer should be used per each length of column. Trimming and fitting column stabilizers. No trimming is needed as Syno delivers every size of stabilizer as required. However if needed, use a hacksaw or sharp knife to trim them so they fit snugly and centrally in the bore casing.



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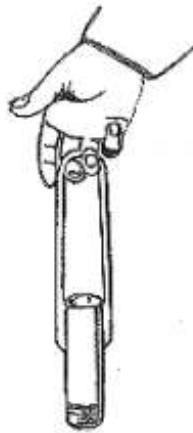
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EQUIPMENTS

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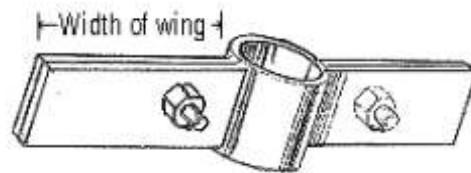
5. Lifting and Lowering Tool

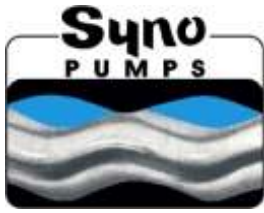
This tool screws into the column socket enabling the column to be safely lowered into the bore. The eye of the lifting tool is provided for the hook from the block and tackle on the tripod. A tri-pod can be supplied from Syno, on request, but three lengths of used pipe or similar can normally be used to construct a temporary tri-pod.



6. Column Clamp

This tool must be used whenever lowering or raising any equipment into the bore. It holds the column in position and must always be fitted below the column socket as a safety precaution.





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INSTALLATION

CHECKS

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CHECKS PRIOR TO DELIVERY OF THE SYSTEM

(1) Check to see if the bore is cased.

If it is not cased, more stabilizers on the column will need to be used. These will have to be ordered with the equipment.

(2) Measure the diameter of the bore casing.

Suitable stabilizers should be ordered or else trimming would be required to fit the bore casing size. If the casing is larger than normal or the pump is to be installed in a well, consult Syno to allow for the special requirements of this situation.

(3) Check the depth of the bore.

Method: Place a weighted object on end of a rope and lower into bore. When the rope goes slack the bottom of the bore has been reached. Measure the length of rope used to the point where the rope went slack.

(4) Check the water level.

Method: Use the weighted object on the end of a rope as before. Either listen for the splash or locate the wet mark on the rope after the weighted object reaches the bottom of the bore.

(5) Check the alignment of the bore.

Normally this should not be necessary to check since most bores if drilled properly will be straight. However if the bore is suspect, use the following method to determine if the bore is suitable for installing the pump.

Lower 3 column lengths, joined together (with a socket at the bottom end to avoid thread damage) but without stabilizers down the bore to the pump setting. You will need the bore depth of cable or rope to do this. If the column lengths reach the desired setting without any resistance then the pump can be installed. If the column lengths meet resistance or jam then the pump should not be installed. Consult your Syno dealer for advice. Failure to observe this recommendation may result in premature wears and possible damage of the pump and line shaft components.

(6) Determine the pump setting.

Normally the pump is positioned about 3m/10ft above the bottom of the bore or just above the screen. The pump setting depends on the normal draw down of the water level which is expected from a heavy pumping duty. The pump should be positioned to avoid dry running even under the worst possible conditions. If there is some doubt about the test results or the condition of the bore is uncertain, it is recommended that the bore be tested prior to determining the pump setting. This is achieved by bringing an engine or electric driven pump to the bore and pumping at a higher than required rate for at least 24 hours. The level of the water in the bore is then re-measured and the pump setting decided. Example - The standing water level may be 6m/20ft from the surface. When the bore is pumped for 24 hours at required flow rate, the draw down water level may hold at 12m/40ft. Therefore it would be safe to install the pump at below 12m/40 ft, say 14m/ 45 ft.

(7) Prepare the Plinth.(Base supporting column)

Drawings of the plinth size and construction for both electric and diesel drive bore hole pump types are shown on the following pages.

There are two ways of attaching the base plate of the pump to the concrete plinth.

(a) Place rag bolts into wet concrete immediately after pouring as per the drawing dimensions.

(b) After the concrete plinth has cured, holes may be drilled into the concrete used to hold down the base plate onto the plinth.



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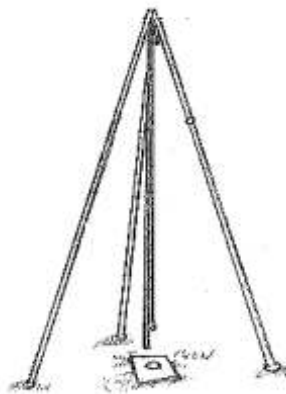
INSTALLATION

PRE ASSEMBLY

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PREPARATION OF THE WORK SITE-

Ensure the work area is clean and clear. Position the tripod with the apex centrally above the bore. Test the tripod carefully to ensure steadiness, firmness and rigidity. Ensure that the feet of the tripod are fixed or secured, so that they will not move during lifting.



PRE-ASSEMBLY OF THE DRIVE SHAFT LENGTHS

In a dirt free area, preferably on blocks of wood, assemble the drive shafting. Each assembly comprises 1 drive shafts and 1 bobbin bearing shafts, 2 coupling nuts and 1 bobbin bearings, in 3m/10ft lengths.

Steps-

(1) Take one long drive shaft and place in the working area. Do not grease inside of female threads, as build up between shaft ends will cause hydraulic effect.

(2) Assemble from right to left. Lubricate male shaft threads only with small amount of (Kopre kote antisieze) if available.

(3) Screw a coupling nut onto the left hand end leaving two threads exposed.

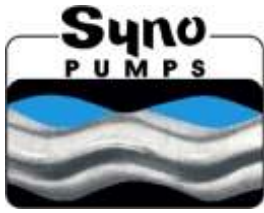
Note: Threads are left hand. Only use vice grips on long drive shaft and coupling nuts.

WARNING: Never use vice grips on the bobbin bearing shaft. The vice grips could score the bobbin shaft and as it rotates inside the captive bobbin bearing, the scoring could grab or cut the bobbin bearing.

(4) Screw the bobbin bearing shaft into coupling nut, after lubricating male thread only.

(5) Place the bobbin bearing on the bobbin bearing shaft arrow pointing left.

NOTE: Two threads are left exposed to ensure that the shafts on either side are screwed evenly into the coupling nuts. This will also ensure that mating shafts bottom out and lock against each other, allowing free travel of shafting inside the bobbin bearing. Continue assembling shafting until all the 3m/10 ft shafting assemblies are completed.



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PRE ASSEMBLY

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- (6) Screw on another coupling nut.
- (7) Place vice grips on the drive shaft and first coupling nut.
- (8) Tighten this sub assembly.
- (9) Screw second long drive shaft into left hand coupling nut leaving two threads exposed.
- (10) Place vice grips on second coupling nut and second drive shaft. Tighten. Screw on coupling nut leaving two threads exposed.
- (11) Screw in bobbin bearing shaft.
- (12) Place bobbin bearing on shaft.
- (13) Screw the fourth coupling nut down by hand leaving two threads exposed. This will be tightened when joining next shaft assembly.
- (14) Place vice grips on third coupling nut and second drive shaft. Tighten. The assembly is complete.

PRE-ASSEMBLY OF ALL THE COLUMN AND SHAFTING

The number of 3m/10 ft shafting assemblies prepared should match the number of 3m/10 ft columns provided for the bore setting.

NOTE: Each length of column section comes complete with a socket screwed to one end.

Steps-

- (1) **Line up the columns.**
- (2) Pick up a shafting assembly.
- (3) Fit the left hand end (end with the coupling nut on it) of the shafting into the male threaded end of the column.
- (4) Push the shafting assembly into the column leaving 150mm/6 inches of drive shafting protruding from the threaded end of the column.

Note: That the arrow on the bobbin bearing points towards the socket.

- (5) Fit stabilizers to the column. Stabilizers should be fitted to every third length of column. One on the first length of column and then every third length. It is recommended that a stabilizer is fitted to the first and last length of column in addition to the intermediate lengths.
- (6) If stabilizers may need to be trimmed to suit the bore casing diameter.

Remember to measure accurately.

"Measure twice and cut once."

Repeat for all the lengths of column.

NOTE: Installation of the pump can be achieved with the head base in position over the bore.



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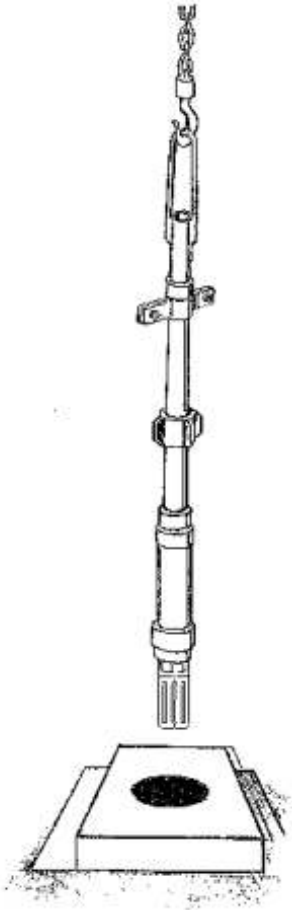
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LOWERING THE PUMP ELEMENT INTO THE BORE.

Steps-



(1) Screw the lifting tool onto the socket on the end of the pump barrel.

(2) Place the column clamp on the barrel of the pump below the socket.
Tighten the clamp.

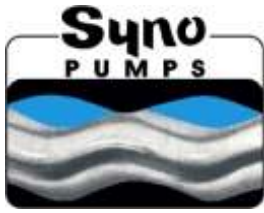
(3) Bring the hook from the block and tackle to the lifting tool and lift the pump above the bore ensuring that the pump is central to the borehole.

(4) Lower the element into the hole until the bore clamp rests on the base plate.

(5) Remove the eyehook and lifting piece.

(6) Unscrew the lifting tool from the element and screw it into the first length of column. The lifting tool will screw into the socket on the end of the next length of column. (The other end of the column is left with the thread exposed).

(7) Screw the long coupling onto the shaft protruding from the element. (The long coupling is supplied in element to column connection kit.



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INSTALLATION

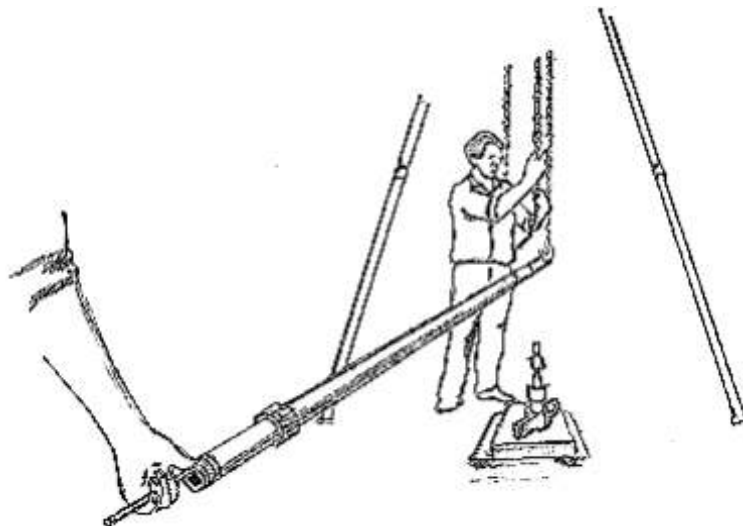
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LOWERING THE COLUMN AND SHAFTING INTO THE BORE.

Steps-

- (1) Lift the first column assembly above the bore. It may be necessary to hold the shafting to stop it from slipping out of the column.
- (2) Put anti-seize compound or grease on the drive shaft male thread. Use sparingly. If not, a cushion effect may occur preventing shafts from properly butting together.
There should be a male drive shaft protruding from the lower end of the column assembly and a long coupling female thread protruding from the pump element.
- (3) Pull down the shafting, and using two pairs of vice grips, screw the shafting into the long coupling.
- (4) Lower the column down to meet the socket on the end of the pump. Columns must butt together inside the socket.
- (5) Lift the whole pump and column assembly clear of the base frame, making sure that the block and tackle is taking the weight of the column, shafting and pump element. Remove the column clamp from the element and gently lower the assembly down the bore, leaving approximately 250mm (10 inches) of column exposed.





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INSTALLATION

INSTALLATION

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(6) Refit the column clamp below the upper most column socket and tighten the clamp to the column. Lower the pump and column until the clamp is resting on the base plate. Release the block and tackle.





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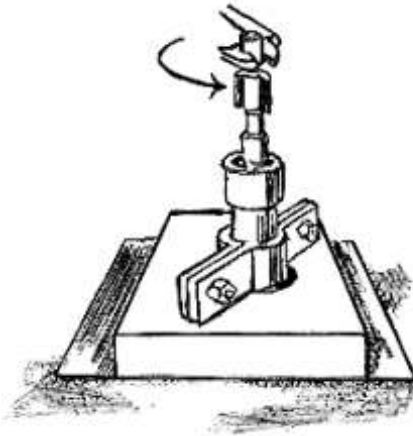
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INSTALLATION

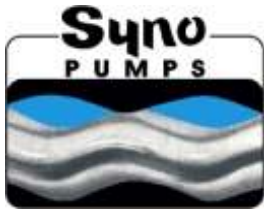
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WARNING: When screwing column down in a clockwise direction (column has right hand thread), as shafting is left hand or anti clockwise, shafting may unscrew.

(7) In case the shafting may have been loosened when the column was tightened, when the next length of column and shafting is being connected, take the vice grip and place it on the coupling nut protruding from the column and rotate it in an anti-clockwise direction. The shafting should then be properly tightened. Repeat the column and shafting installation procedure until all the lengths have been fitted.



NOTE: The threads are left-handed. Tighten, using one vice grip on the long coupling and one on the drive shaft.



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MAINTENANCE

Service Requirements

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PUMP MAINTENANCE AND SERVICE REQUIREMENTS

Because of its simplicity of design, and the fact that rotating underground parts and bearings are water and self-lubricated, the underground section of your installation should require little attention or replacement, unless you are pumping particularly corrosive or abrasive water.

NOTE: If the water is known to be corrosive (ie, it has a low pH value) a water analysis should be obtained to ensure that correct pump materials are selected for your installation. This will ensure a longer, maintenance free life.

1. Packed Glands

The gland should be inspected and adjusted regularly to provide the correct lubrication with a slight leakage. The gland packing should be replaced approximately every 5,000 hours, or sooner if the gland shows signs of excessive leakage. Grease gland bolts and nuts at each inspection.

2. Bearings

Bearings are rated for operation in excess of 10,000 hours. However wear will occur quickly if bearings are allowed to operate without lubrication or under dirty conditions, or if overloaded due to excessive belt tension.

3. Open Cage Bearings

Check every 5,000 hours. Wash thoroughly with solvent. Repack with high speed ball bearing grease. Sealed bearings require no attention.

4. Belt Tension

Belt tension should be checked during gland inspections. If belts need replacement, replace all belts with a matched set.

UNDERGROUND COMPONENTS

1. Pump Element

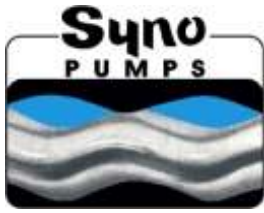
As the pumping element is water-lubricated, it should not require service. However if service or replacements become necessary, the work can be carried out on the site without special tools.

2. Column, Drive shaft, Bobbin Bearings

Need for replacement of any worn or defective units will be obvious from visual inspection, but as withdrawal of column and drive shaft assemblies, and the pumping elements, requires time and effort it is wise always to replace any items which are suspect

3. Pump Stator

The stator is natural rubber molded inside a metal tube, and should not be lubricated with any petroleum based products (i.e., hand cleaner, grease etc.).



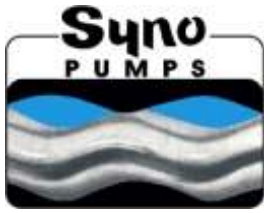
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Maintenance

Maintenance Period

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MAINTENANCE CHECKS	SERVICE PERIOD BASED ON 8HRS A DAY & 7 DAYS WEEK OPERATION	SERVICE PERIOD RUNNING HOURS
Check gland packing and retighten as required	4 months	1,000
Replace gland packing	20 months	5,000
Grease gland bolts and inspect pump	4 months	1,000
Inspect pulley and belt condition	4 months	1,000
Replace belts	12 months	3,000
Check pressure & flow	12 months	3,000
Grease the Bearings	4 months	1,000



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WARRANTY

Product Warranty

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WARRANTY

1. Pumps manufactured by Syno Pumps are covered by warranty for a period not exceeding twelve (12) months from installation.
2. Syno Pumps will make good by repair, or at their option, the replacement of faulty parts under warranty, providing always that:
 - (a) The equipment was correctly installed and properly used in accordance with Syno Installation and Operation Instruction and accepted codes of good engineering practice.
 - (b) The claim for goods under warranty arises solely from faulty design, material or workmanship.
 - (c) The repair is carried out in the Syno factory or by an authorized dealer or distributor appointed by Syno Pumps. Authorized agents must obtain written approval from Syno Pumps before completing any repairs under warranty.
 - (d) All freight costs to and from the factory or repair agent are to be paid by the purchaser³. In the case of equipment or components of the pump, which are not of Syno manufacture, but installed in or with the pump, the warranty is limited till then.
4. Syno Pumps warranty does not cover any of the following:
 - (a) Claims for third party liability of damage caused by failure of any of the company's products.
 - (b) Damage caused by abnormal operating conditions eg. Violence, storm cataclysm or any other force.
 - (c) Damage caused by the equipment being used for an application for which it is not recommended.
 - (d) Damage caused by sand or abrasive materials, corrosion due to acid waters, electrolytic action, liquid temperature beyond the recommended range, cavitations, improper supply voltage, use of non-approved control gear, inadequate cooling, or insufficient liquid to enable the pump to perform to specification.
5. The decision of Syno Pumps in relation to any claims or disputes over warranty is final.
6. The warranty is in lieu of all other warranties and conditions expressed or implied, written or oral, statutory or otherwise, which are hereby negated and excluded.

In case of claim please contact your Authorized Syno Dealer or contact Syno Pumps direct with details as completed in Delivery Record.