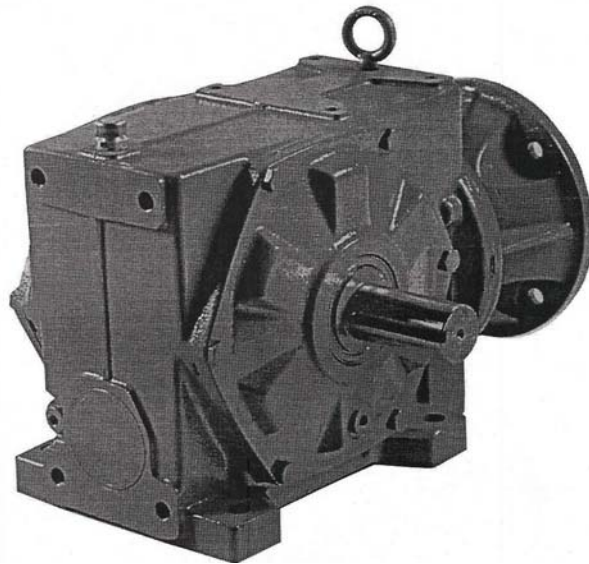
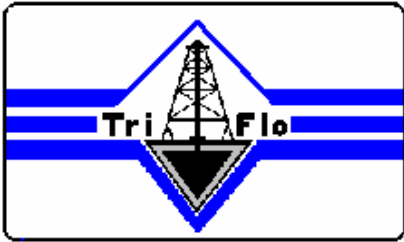


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Service & Operating Manual

Mud Agitator





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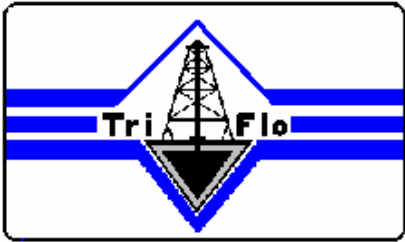
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MUD AGITATOR

TRI-FLO INTERNATIONAL introduces the TFI-FLO MUD AGITATOR, a new, more compact unit that incorporates high efficiency, light weight, minimal maintenance and the high torque capabilities required for maintaining a drilling / workover fluid of uniform consistency throughout the surface mud system.

Powered by either a 1445 RPM/50 HZ or 1750 RPM/60 HZ explosion-proof electric motor, the TRI-FLO MUD AGITATOR takes advantage of the high efficiency (94%) gear reducer to rotate the impeller at 73 RPM or 88 RPM, depending on the input power. The resulting flow pattern maintains an optimum turnover rate, keeping the mud system evenly dispersed at all times. Designed to operate efficiently under the most severe operating conditions, the TRI-FLO MUD AGITATOR is available in all horsepower and impeller types and sizes required meeting the customers needs.

The gear reducer utilizes a helical spiral bevel gear reduction system that produces a highly efficient, quiet operation. Due to the minimal power loss in the reducer, fewer horsepower is required at the input shaft in order to deliver the needed torque. The gearbox is a cast iron, one piece, lightweight, compact unit requiring a minimum of maintenance. A breather plug is provided to prevent surging of the lubricant, thereby maintaining a consistent temperature within the gearbox. Both the input and output shafts are constructed of alloy steel and the gears themselves meet AGMA Class 10 quality.



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AGITATOR SELECTION

Agitators were originally employed to supplement mud guns in keeping the mud from gelling. Maintaining a consistent blend of the mud components was not considered until mid of late 70's. Since then serious investigations of agitator design have been performed by numerous manufacturers of mud processing equipment, resulting in a better understanding of the function and complexity of mud agitators.

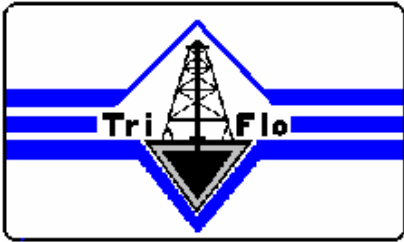
Several factors must be considered in the selection of an agitator in order for it to perform effectively:

Tank dimensions, width, length, and depth where compartmentalized compartment dimensions.

Ratio of impeller diameter to tank width. For optimum performance this ratio should be in the range of +/-0.3.

Mud Weight. The maximum anticipated mud weight; if unknown use a weight of 20 PPG.

Rig Power. The voltage and frequency (HZ) to be supplied to the agitators.



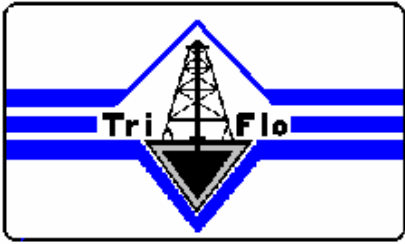
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SIZING

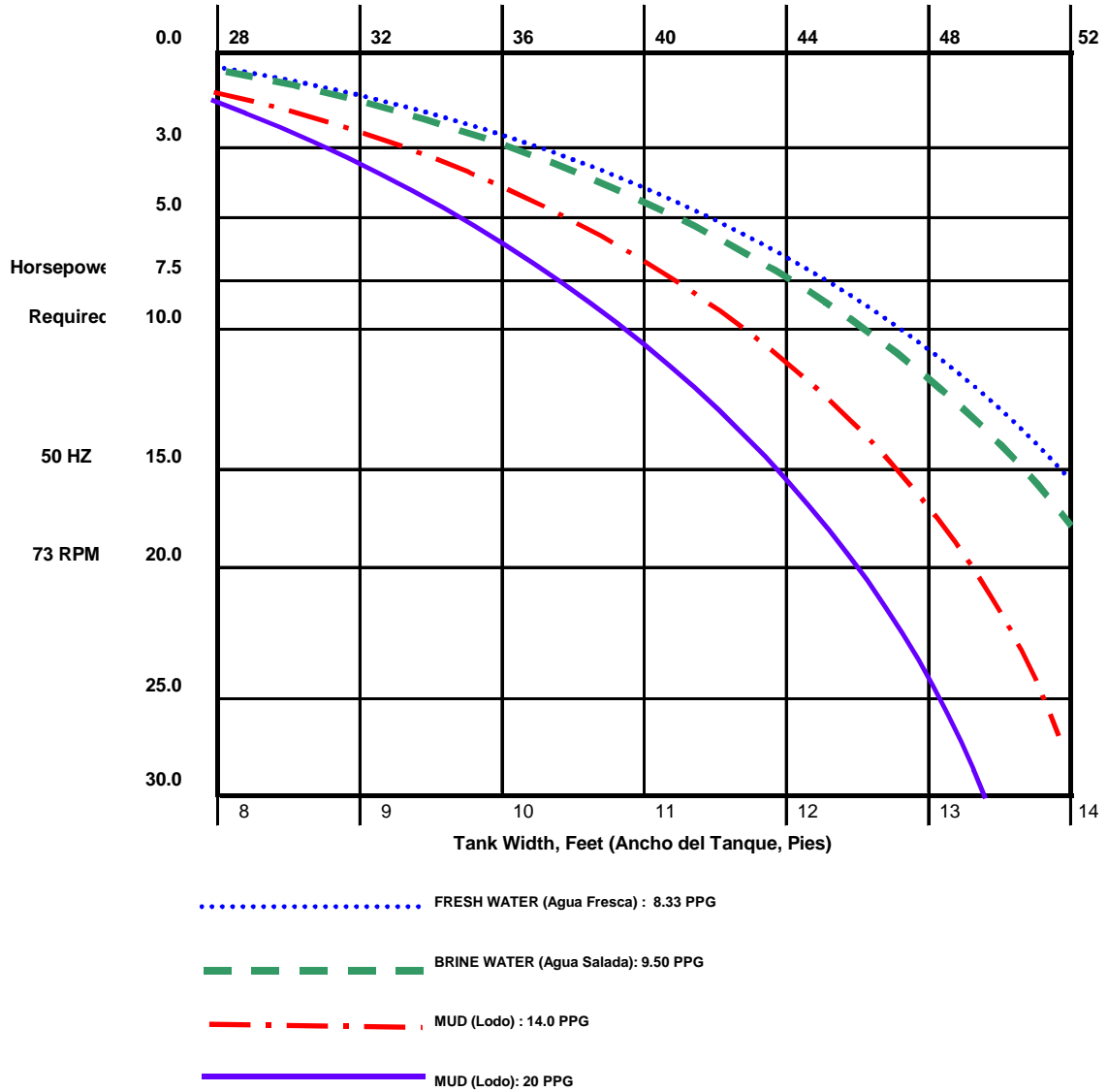
Sizing of agitators is performed by using "squares". If your tank is 8 feet wide, you should use 8 ft. x 8 ft. squares in your calculation: if it is 12 feet wide, use 12 ft. x 12 ft. squares. If your tank or compartment length is not an even multiple of the tank width, use the closest dimension to a square as possible. Example: an 8 ft. x 30 ft. tank would produce four 8 X 7.5 ft. squares. The tank width is always used in the determination of the impeller diameter to tank width ratio. The charts illustrated have been calculated for both 50 HZ and 60 HZ input power, producing 73 RPM and 88 RPM respectively. A D/W RATIO of 0.3 was used in plotting the curves for fresh water, brine water, 14 PPG and 20 PPG mud.

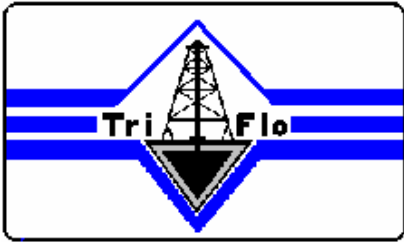
To determine the horsepower required, select your tank width at the bottom of the chart and read up to find your impeller diameter. Locate the curve that represents the heaviest mud weight to be used. Follow the vertical impeller Diameter line to the curve representing the mud weight and read horizontally to the left to determine your horsepower requirement. In every case, use the higher horsepower indicated by the intersection of the Mud Weight curve and the vertical Impeller Diameter.



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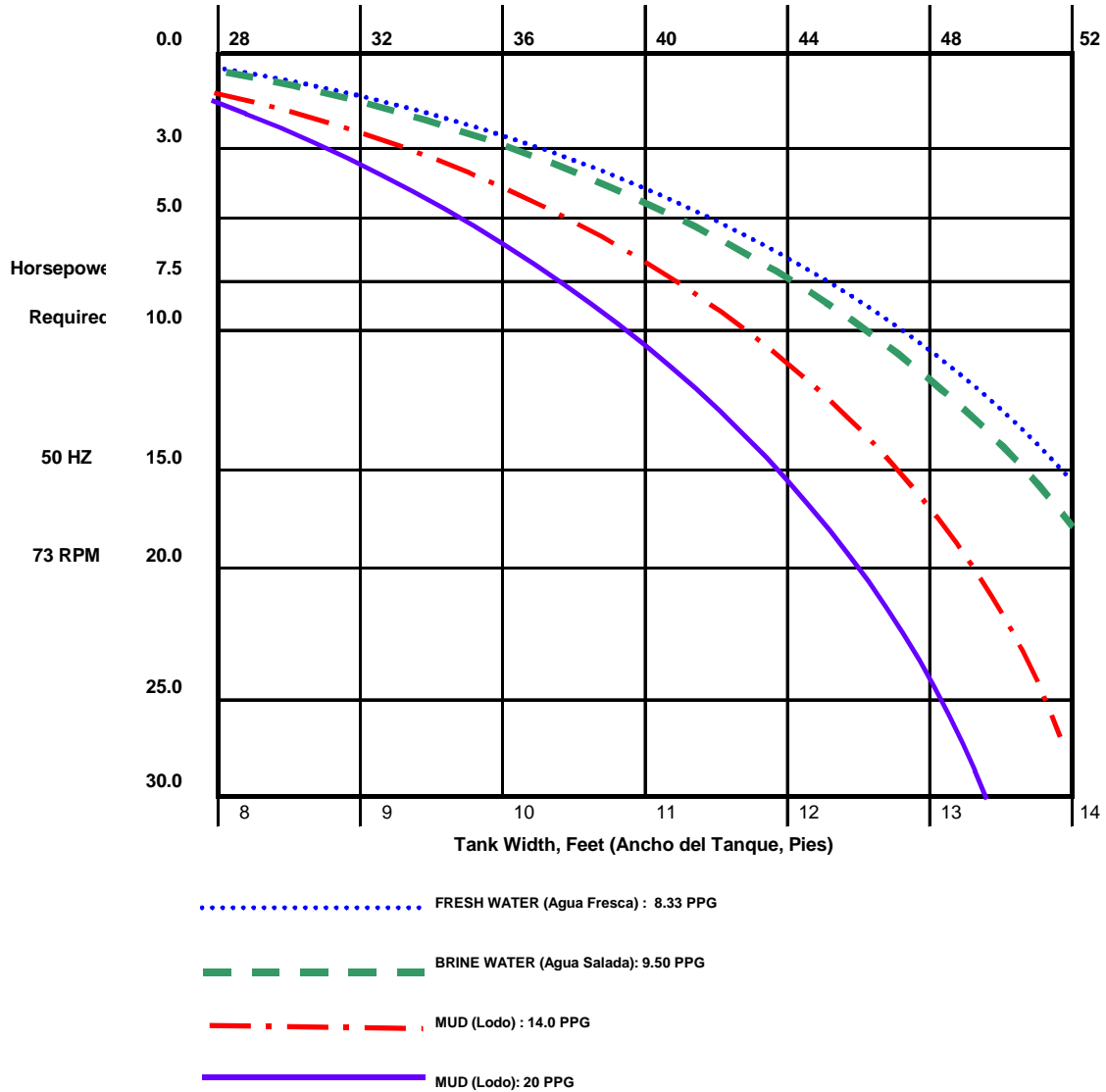
Figure No. 1 88 RPM - 60 HZ

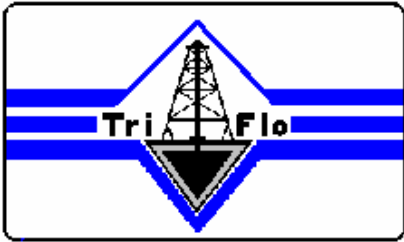




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Figure No. 2 73 RPM - 50 HZ





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EXAMPLE NO. 1

Agitators are required for a tank 9 ft. wide x 30 ft. long x 7 ft. deep and an anticipated mud weight of 14 PPG. Rig power is 60 HZ. Work in "squares"; in this case three 9 ft. x 10 ft. squares. Locate the impeller diameter/tank width line for a 9-ft. wide tank; follow it up to the top of the graph to determine the impeller diameter of 32 inches. Follow the same line down to its intersection of the 14 PPG mud curve. Read horizontally to the left to determine the horsepower required: in this case three 5 horsepower units with 32 inch impellers would be needed.

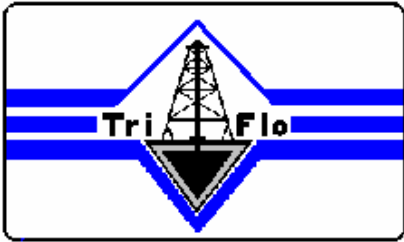
EXAMPLE NO. 2

Agitators will be required for a pit 12 ft. wide x 48 ft. long x 8 ft. deep. Anticipated mud weight is 20 PPG and the power supply is 50 HZ. Work in "squares"; in this case four 12 ft. x 12-ft. squares. Following the 12-foot Tank Width line up to the Impeller Diameter, notice that a 44-inch impeller will be required. Come back down the Impeller Diameter line to the intersection of the 20 PPG curve to find that a total of 20 horsepower units are needed.

SIZING VERIFICATION

The Displacement Speed is the time, in seconds, required to completely displace the total volume of mud in the mud tanks.

A DS of 35 to 90 is within the acceptable range. The slower the Displacement Speed (the closer to 90), the more settling that will occur in the corners and between agitators. As the Displacement Speed increases (approaches 35), vortexing and air entrapment can be expected.



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DISPLACEMENT SPEED CALCULATION

Tank volume (Gallons) x 60 sec = Displacement Speed (Sec.) Displacement (GPM) 1 min

(Long ft x Wide ft x Deep ft) x 7.459 Gal x 60 sec = Sec Displacement Speed
Displacement Gal/min 1 ft³ 1 min

Tank volume, as indicated above, must be calculated in gallons. To do so, multiply the length of the tank (or compartment) in feet by the width in feet and the usable depth of the tank in feet. Multiply the result by 7.459 gallons per cubic feet to obtain the desired tank volume. The Displacement Rate for Axial configuration impellers is shown in the table below.

Table 1

Displacement Rate (GPM)

Four Axial Flow

<u>Impeller Diameter Inches</u>	<u>60 HZ Blades (GPM)</u>	<u>50 HZ Blades (GPM)</u>
28	3832	3179
32	5765	4783
36	8179	7565
40	10886	9032
44	14974	12423
48	19387	16084
52	24592	20402



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INSTALLATION & OPERATION

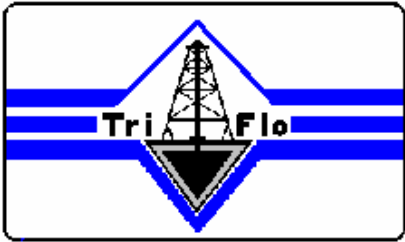
IMPELLER POSITIONING

To ensure optimum performance, location of the impeller is critical. An Axial type impeller should be positioned with the centerline of the impeller body $0.7 \times$ Impeller Diameter above the tank floor. A Radial type impeller should be located with the bottom of the impeller blades a maximum of 6 inches above the tank floor, or 2 inches above the bottom shaft stabilizer, if used. To determine the impeller shaft length, assume that a bottom stabilizer will be used.

AGITATOR INSTALLATION

It is essential that the agitator mounting be sufficient to support the weight and torque of the complete unit. The gearbox itself must be securely bolted in position with four bolts secured with locknuts.

Remove all protective coating from the shaft and flange, using solvent if necessary. Carefully mount coupling on shaft as close to the shaft shoulder as possible. If the shaft and coupling are a tight fit, do not use force; **DO NOT HAMMER ON SHAFT.** The shaft and impeller, with bottom stabilizer in place, are then coupled to the gearbox with a rigid coupling. Be certain the stabilizer is properly aligned before tightening the rigid coupling. After tightening the coupling, weld the stabilizer to the tank bottom. Check the oil level in the gearbox. Install the breather plug in the plughole at the top of the gearbox and **REMOVE THE PIN FROM THE CENTER OF THE PLUG.**



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ELECTRICAL & GENERAL

Inspect unit for damage during shipment. Verify speed, horsepower, voltage and Hertz for conformance to power supply.

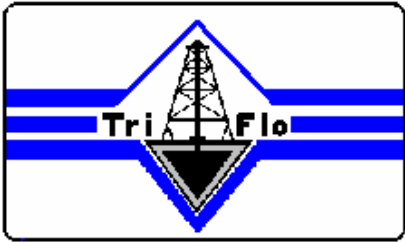
Eyebolts or lugs are provided for lifting the unit: additional weight is prohibited. Lifting angle must not exceed 15 degrees with shank of eyebolt. Use caution when lifting units near overhead power lines.

Agitators perform longer in a clean, well-ventilated area and should be located in a suitable enclosure to prevent access by unauthorized personnel.

Guards should be provided for exposed rotating parts to prevent injuries. Keep fingers and foreign objects away from ventilation and other openings. Applications involving high inertia loads may damage this equipment due to motor overspeed during shutdown. DO NOT force drive coupling or other equipment into shaft, as bearing damage may result.

The power supply must agree with values on nameplate. Terminal voltage should not vary by more than +/- 10% of nameplate voltage at rated frequency. Unbalance line voltage, even a small amount, will cause overheating. Do not exceed the continuous rated operating current on the nameplate. Starting controls and overload protection should be properly sized in accordance with the National Electrical Code and the control manufacturer's recommendations.

Motor connections should be made by following instructions on connection diagram. Determine direction of rotation before connecting driven equipment. If direction of rotation label is supplied, operate only in specified direction. Rotation may be reversed on three phase motors by interchanging any two-line connections. Wiring of units, controls and grounding shall be in accordance with local and National Electrical Code requirements. Failure to properly ground unit may cause serious injury to personnel. Where unexpected starting could be hazardous to personnel, do not use automatic reset starting devices.



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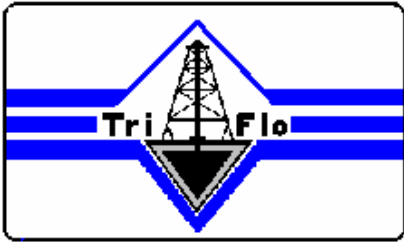
Using the facts in the previous examples 1 and 2, calculate the GPM to verify the agitator requirements.

EX 1: 32" Axial impeller, 60HZ

- (A) 5765 GPM (table 1, page 8) x 3 (agitators) = 17295 GPM
- (B) (9ft. x 30ft. x 7ft.) x 7.459 gal/cf. = 14098 gal, Tank Volume
- (C) $DR = \frac{14098 \text{ gal}}{17295 \text{ gal/min}} \times \frac{60 \text{ sc.}}{1 \text{ min}} = 48.9 \text{ seconds}$

EX 2: 44" Axial impeller, 50 HZ

- (A) 12423 GPM [table 1, page 8] x 4 (agitators) = 49692 GPM
- (B) (12 ft. x 48 ft. x 8 ft.) x 7.459 gal/ cf. = 34371 gal, Tank Volume
- (C) $DR = \frac{34371 \text{ gal}}{49692 \text{ gal/min}} \times \frac{60 \text{ sc.}}{1 \text{ min}} = 41.5 \text{ seconds}$



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MAINTENANCE

To ensure safe operation and avoid problems, it is recommended that the gearbox be visually inspected every 50 hours of operating time.

It is also recommended that the following items be checked each 5000 hours of operating time:

- Check oil level and add oil if necessary.
- Make sure vent hole in the breather plug is clean.
- Be sure breather plug is open before operating.

Motor for use in hazardous locations-Class I & II installations: repairs of these motors must be made by the manufacturer or manufacturers authorized service shop to maintain the U.L. listing. The U.L. listing applies to the electrical motor only and not to the belt or gear transmissions or other devices that may be connected to the motor.

NOTE: Field repair of Gearbox is not recommended. All internal repairs should be conducted by the manufacture.

LUBRICANT RECOMMENDATION

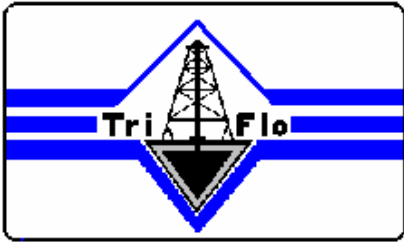
The TRI-FLO AGITATOR gearbox is shipped with synthetic extreme pressure oil, SINTOGEAR 125, for ambient operating temperatures of -25 to 125 degrees F (-31 to 51 degrees C).

Synthetic oil does not require an oil change. It is, however, recommended that oil be checked periodically for proper oil level. NEVER MIX SYNTHETIC OIL WITH MINERAL OIL.

The gearbox manufacturer recommends the synthetic oils listed below.

Manufacturer	Lubricant Type - Synthetic Oil
COFRAN	SINTOGEAR 125
MOBIL	SHC 629

Tri-Flo Agitator Part List



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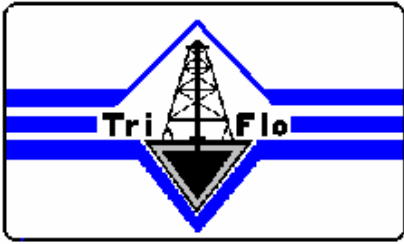
TFI –30 AGITATOR

TFI PART No.	DESCRIPTION
03-01-805	TFI-30 Agitator (Complete) 3 HP
01-00-128	3 HP 230/460 Motor 3 Phase XP
03-00-300	2303 Gear Box
00-00-023	6 S Sure Flex Coupling 1-1/8"
00-01-141	6 J Sure Flex Coupling 5/8"
00-00-028	6 JEM Element (Coupling)
00-00-091	R 25 F Rigid Coupling
05-00-098	2517 Taper Lock Bushing 2"
00-00-092	R 25 M Rigid coupling
05-00-100	2517 Taper Lock Bushing 1-1/2"
05-00-090	3030 TAPER Lock Bushing 2"
03-00-316	Shaft 2 "
05-00-032	Impeller 28"

TFI – 50 AGITATOR

TFI PART No.	DESCRIPTION
05-00-029	TFI-50 Agitator (Complete) 5 HP
01-00-138	5 HP 230/460 Motor 3 Phase XP
03-00-299	2403 Gear Box
00-00-023	6 S Sure Flex Coupling 1-1/8"
00-00-084	6 E Sleeve (Coupling)
05-00-094	2517 Taper Lock Bushing 1-3/4"
05-00-098	2517 Taper Lock Bushing 2"
00-00-092	R 25 M Rigid coupling
00-00-091	R 25 F Rigid Coupling
05-00-090	3030 TAPER Lock Bushing 2"
03-00-316	Shaft 2"
05-00-034	Impeller 32"

TFI – 75 AGITATOR



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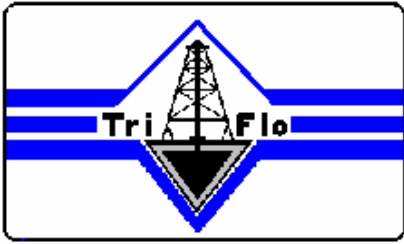
TFI PART No.	DESCRIPTION
03-00-308	TFI-75 Agitator (Complete) 7-1/2 HP
01-00-139	7-1/2 HP 230/460 Motor 3 Phase XP
03-00-301	2503 Gear Box
00-00-096	6 S Sure Flex Coupling 1-3/8"
00-00-023	6 S Sure Flex Coupling 1-1/8"
00-00-028	6 JEM Element (Coupling)
00-00-379	2517 Taper Lock Bushing 2-3/8"
05-00-098	2517 Taper Lock Bushing 2"
00-00-092	R 25 M Rigid coupling
00-00-091	R 25 F Rigid Coupling
05-00-090	3030 Taper Lock Bushing 2"
03-00-316	Shaft 2"
05-00-033	Impeller 36"

TFI – 100 AGITATOR

TFI PART No.	DESCRIPTION
03-00-309	TFI-100 Agitator (Complete) 10 HP
01-00-131	10 HP 230/460 Motor 3 Phase XP
03-00-301	2503 Gear Box
00-00-096	6 S Sure Flex Coupling 1-3/8"
00-00-023	6 S Sure Flex Coupling 1-1/8"
00-00-028	6 J M Element (Coupling)
00-00-091	R 25 F Rigid Coupling
00-00-092	R 25 M Rigid coupling
05-00-098	2517 Taper Lock Bushing 2"
00-00-379	2517 Taper Lock Bushing 2-3/8
05-00-090	3030 Taper Lock Bushing 2"
03-00-316	Shaft 2"
05-00-023	Impeller 40"

TFI – 150 AGITATOR

TFI PART No.	DESCRIPTION
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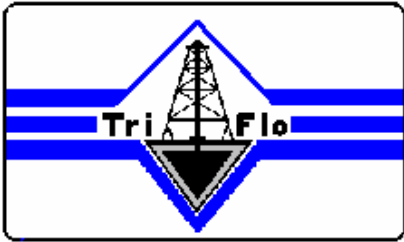
05-00-030	TFI-150 Agitator (Complete) 15 HP
01-00-125	15 HP 230/460 Motor 3 Phase XP
03-00-301	2503 Gear Box
00-00-700	8 S Sure Flex Coupling 1-5/8"
00-00-712	8 S Sure Flex Coupling 1-1/8"
00-00-086	8 JEM Element (Coupling)
00-00-091	R 25 F Rigid Coupling
05-00-098	2517 Taper Lock Bushing 2"
00-00-092	R 25 M Rigid coupling
00-00-379	2517 Taper Lock Bushing 2-3/8"
03-00-316	Shaft 2"
05-00-090	3030 Taper Lock Bushing 2"
05-00-033	Impeller 36"

TFI – 200 AGITATOR

TFI PART No.	DESCRIPTION
03-00-305	TFI-200 Agitator (Complete) 20 HP
01-00-135	20 HP 230/460 Motor 3 Phase XP
03-00-302	2603 Gear Box
00-00-648	9 S Sure Flex Coupling 1-5/8"
00-00-475	9 S Sure Flex Coupling 1-3/8"
00-00-012	9 JEM Element (Coupling)
00-00-090	R 30 F Rigid Coupling
05-00-086	3030 Taper Lock Bushing 2-7/8"
00-00-089	R 30 M Rigid coupling
03-00-316	Shaft 2"
05-00-090	3030 Taper Lock Bushing 2"
05-00-014	Impeller 42"

TFI – 250 AGITATOR

TFI PART No.	DESCRIPTION
03-00-311	TFI-250 Agitator (Complete) 25 HP



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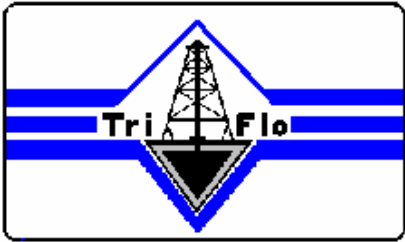
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01-00-148	25 HP 230/460 Motor 3 Phase XP
03-00-302	2603 Gear Box
00-00-081	9 S Sure Flex Coupling 1-7/8"
00-00-475	9 S Sure Flex Coupling 1-3/8"
00-00-012	9 JEM Element (Coupling)
00-00-090	R 30 F Rigid Coupling
05-00-086	3030 Taper Lock Bushing 2-7/8"
00-00-089	R 30 M Rigid coupling
03-00-316	Shaft 2"
05-00-090	3030 Taper Lock Bushing 2"
05-00-014	Impeller 42"

MAX2000[®]

MUD AGITATOR

Installation, Operation and Maintenance Manual



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Prepared for:

A Division of.. **Safety First!**

Cautions and General Safety Rules

This manual contains important information concerning installation, operation, and proper maintenance of the MAX2000 ® Mud Agitator. To prevent injury to personnel or equipment damage, this manual should be read by those responsible for the installation and operation of the Mud Agitators. In addition, the safety precautions below should be followed at all times.

- **Lift the agitator only at lift points** detailed in this manual and use properly rated slings capable of handling the equipment weight.
- The structure on which the agitator is to be installed must be capable of supporting both the static weight and dynamic loads listed in this manual.
- **TURN OFF, LOCK OUT, AND TAG OUT** the electrical power supply to the agitator before working on the agitator.
- Inspect the unit regularly, and replace damaged or worn components only with parts supplied by the original equipment manufacturer.
- The gearbox on the Agitator has a pre-selected gear ratio to maximize the suspension of solids in solution. This gear ratio provides a great increase in torque that is transmitted to the impeller. Any object that might fall into or be placed in the mud tank runs the risk of being caught by and wrapped up by the agitator. ***** NO ATTEMPT SHOULD BE MADE TO STOP A ROPE OR HOSE OR ANY OTHER OBJECT ONCE IT HAS BEEN WRAPPED AROUND A MOVING AGITATOR!!!**
- Before entering a mud tank for any reason, the mud agitators should be locked out and tagged out.

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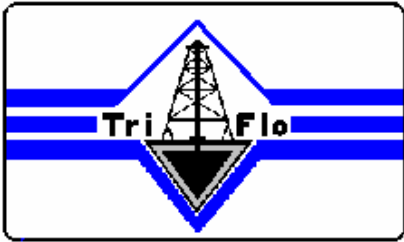
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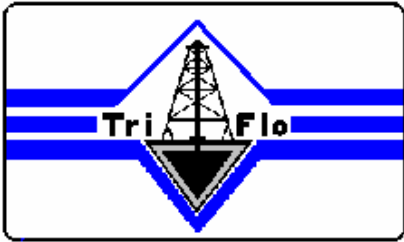
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SECTION 1- Introduction

A. Role of Mud Agitators

Agitators or “mud mixers” serve an important role in the surface treatment of drilling fluids. Using an impeller mixer that promotes both axial and radial flow will lower mud costs and improve mud properties.

Unlike centrifugal pumps or sub-guns, impeller mixers are relatively low shear and low energy devices making them easy to maintain and inexpensive to



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operate. Using low shear mixers to suspend and mix mud additives minimizes particle size degradation and polymer shear.

Properly sized agitators serve three purposes:

1. Impeller mixers ensure that mud additives are homogeneously mixed.

This prevents spot over treatment of chemicals, dilution water or weighting agents.

2. Agitators keep the active mud system moving when the mud pumps are disengaged and will prevent the pits from "gelling".

3. When drilling with weighted mud, properly selected agitators will keep the weighting agents in suspension and minimize any tendencies for solids to settle in corners or dead spots.

B. Design Features

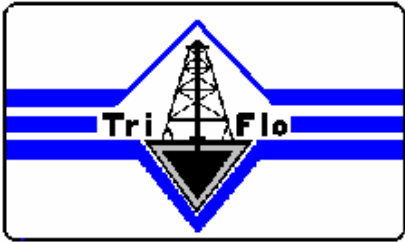
The design features of the Agitator that minimize maintenance and maximize reliability include:

A rugged cast iron gearbox houses either a double or triple reduction helical bevel gearing set that is so precisely ground that there is a minimal amount of back lash in the gear sets. This feature eliminates a "slamming" effect of the gears at start up, promoting longer life. Each helical bevel gear set is 98% efficient. Therefore a double reduction box is 96% efficient and a triple reduction box is 94% efficient. A typical worm gear set is only 85% efficient, losing most of its efficiency through the generation of heat.

The internal gears are lubricated with oil. For ambient temperatures below -23°F or above 140°F a synthetic lubricant should be substituted. A unique feature of the MAX2000® Agitator is the greased lower bearing. This lower bearing can be maintained, greased, from the topside of the tank, eliminating the need for in-tank inspections of the lower bearing. This design feature provides a barrier layer of grease that can be expunged out the lower seal. Which allows the lower bearing to be in contact with good, uncontaminated lubricant at all times. The lower seals are arranged to accommodate the grease pocket and makes for a four-tier layer of protection for the gearing. All four of these levels must be breached prior to the gearbox losing its oil:

1. Lower seal-drop bearing
2. Grease pocket
3. Upper seal-drop bearing
4. Lower seal in gearbox

An external oil sight glass has been provided so that the oil level can be checked at a single glance. Vent plugs are supplied, installed in the gearbox housing, to maintain a homeostatic internal pressure, preventing a pressure build up that



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could blow out an oil seal.

MOTORS

Explosion proof motors are designed to withstand pressure washing and exposure to corrosive fluids without bearing contamination. Motors are available with either a foot mount design or a NEMA C-face input. The foot mount or "T" frame motors are mounted using flexible coupling between the motor and gearbox, for ease of alignment. The NEMA C motors bolt to the gearbox housing and no alignment issues are seen.

IMPELLERS

Optimal suspension and mixing results from the axial and radial flow patterns created by from impellers. Using a 60°, 45°, an axial or a hydrofoil impeller the optimal situation can be created for you application. In addition to the standard welded impeller, the MAX2000® Agitator is offered with a "bolt-on" design blade in carbon steel and the 310 series stainless. On the welded impellers a QD bushing is provided to allow for adjustment of the height of the impeller.

60° CANTED

BLADE SHOWN

QD BUSHING

KEYWAY FOR

IMPELLER HEIGHT

ADJUSTMENT

THE 3 ARROWS DENOTE THE

DIRECTION OF CORRECT

PRODUCT FLOW OR MOVEMENT

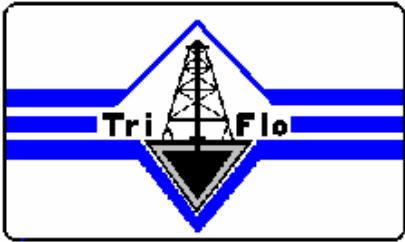
Section 1 – Introduction

C. Selecting Agitator

To properly select the correct horsepower and impeller diameter needed for a mud tank agitator, the information below is needed.

Tank Geometry

- a. Width
- b. Length
- c. Mud Depth



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Maximum Anticipated Mud Density

- a. Specify if know
- b. Otherwise use 20 pounds per gallon (lb/gal)

Power Available

- a. Voltage
- b. Amperage Available
- c. Frequency

D. Locating Agitators

A canted blade impeller creates a combination of radial and axial flow that provides for uniform suspension and mixing in circular or square areas. A rectangular tank with a length to width ratio of greater than 1.5 should be "divided" into "sizing areas" that are square (or close to square areas) with an agitator located at the center of each. For example, two agitators would be given the responsibility for mixing each of the two 8-foot by 8-foot area of a 16-foot by 8-foot suction tank. All data below is for canted blade impellers.

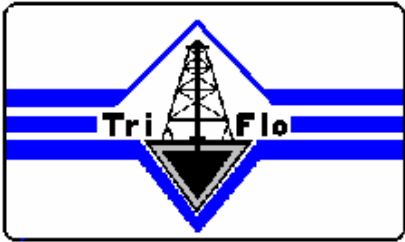
E. Sizing Agitator

1. Calculate the volume of the mud located with in the "Sizing Area".

Volume (in gallons)=length X width X max mud depth X 7.5

2. Select an impeller diameter using Figure 1.2 to find an impeller that gives a pumping rate close to the calculated volume V. (Note the frequency of the electric motor will affect pumping rate since 50 Hz motors turn slower than 60 Hz motors.)

3. Calculate the turn over rate. The TOR is the number of seconds required for the impeller to pump the full volume within the sizing area. **Remember that a lower TOR indicates more agitation because the tank turns over in fewer seconds.** TOR should be in the range of 35 to 90 seconds for all "sizing areas". Although, for the suction tank, it should have a TOR closer to 90 (less



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agitation) to prevent aeration.

TOR= Volume X 60 divided by Pumping Rate

or

TOR= volume X 60

Pumping rate

4. If TOR is over 90 select a bigger impeller. If TOR is below 35 select a smaller impeller. Then recalculate the TOR using the new impeller diameter.

5. Using Figure 1.2, look up the horsepower (**Hp20**) required for 20 ppg drilling fluids.

6. Using Figure 1.2, select the minimum gearbox size for this application.

7. Specify the shaft length using the data on page 9 & 10.

"Tank depth" is obtained by measuring from the top of the structure (beams, channels, etc.) on which the agitator base will be supported to the bottom of the tank. Shaft length is typically sized to allow 3 inches of clearance from the bottom of the tank to the agitator shaft.

Impeller diameter Pumping rate @ Pumping rate @ Hp 20 Required in inches 60 Hertz 50 Hertz (20 ppg mud) Gearbox

20 974 806 1.20 3 Hp

24 1684 1303 1.44 3 Hp

28 2674 2213 1.68 3 Hp

30 3289 2722 2.16 5 Hp

32 3991 3303 2.40 5 Hp

36 5683 4703 4.80 7.5 Hp

40 7795 6451 7.19 10 Hp

42 9024 7468 9.59 15 Hp

44 10375 8587 10.55 20 Hp

48 13470 11148 17.99 25 Hp

Figure 1.2 - Pumping Rate and Gearbox Selection

MOUNTING PATTERN

DIMENSION M2A-3 M2A-5 M2A-7.5 M2A-10 M2A-15 M2A-20 M2A-25

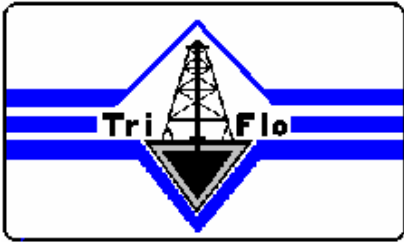
A 28" 40.5" 41.5" 49.625" 55.5" 65.75" 65.75"

B 8.5" 11" 11" 15" 15" 18.5" 18.5"

C 15" 23.75" 24.5" 27" 27" 37.375" 37.375"

D 15" 21.5" 21.5" 26" 26" 36" 36"

E 2.25" 2.5" 2.5" 3.5" 3.5" 3" 3"



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F 3.5" 3.25" 3.25" 3.5" 3.5" 3.375" 3.375"

G 9" 16" 16" 19" 19" 30" 30"

H 0.75" .875" .875" 1.125" 1.125" 1.31" 1.31"

I (Impeller Diameter, TYP) 24" 28" 32" 36" 40" 44" 48"

J (Impeller Height) Recommended height for canted blades is .75 X Impeller Diameter.

K (Tank Depth)* *

L (Shaft Length) K-M-3 K-M-3 K-M-3 K-M-3 K-M-3 K-M-3 K-M-3

M 0.0" 5.5" 5.5" 7.5" 7.5" 7" 7"

*Measure from bottom of agitator support to the bottom of the tank.

Section 2 – Installation

A. Dimensional Data

The weight data for all models of the Agitator is given in Figure 2.1. Since the length of the impeller shafts vary, shaft weight must be added by using the weight per foot data.

Dimensional Data for the MAX2000® Agitator is given on page 10. Again, the customer must specify the "Tank Depth" in order to properly size the agitator shaft. Note that certified drawings, if requested or required, provided with the equipment will take precedence over any information in this manual.

"Tank Depth" is obtained by measuring from the top of the structure (beams, channels, etc.) on which the agitator base will be supported to the bottom of the tank. Shaft length is typically sized to allow 3 inches of clearance from the bottom of the tank to the bottom of the agitator shaft.

B. Lifting the Agitator

Lift the agitator only at the lift points provided. Use properly rated slings capable of handling the weight of the equipment. In most cases, the impeller will be installed after the agitator base has been lifted into the tank but before the base has been securely mounted. If the agitator is lifted with the impeller shaft installed, make sure that the shaft coupling has been completely tightened and that the shaft is securely attached before lifting. It is always good practice to remove the impeller shaft before removing an existing agitator.

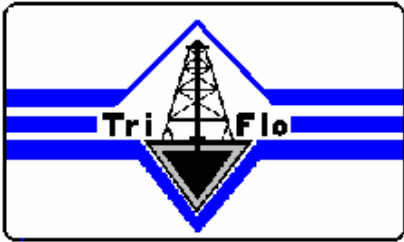
C. Before Installing Agitator

Before installing the agitator, care should be taken to ensure that the structure on which the agitator will be mounted is capable of withstanding both the static load and the dynamic loads that will be transferred to the tank structure.

D. Installing the Agitator

Typically, the shaft but not the impeller will be installed before lifting the unit into place. Some conditions, like limited head room above the tank, may require that the shaft be installed after the unit has been lifted in place. Anti-seize compound should be applied to all threaded fasteners.

Lift the unit where indicated and place in position on the mud tank using blocks



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to provide at least 18 inches of clearance between the bottom of the shaft and tank bottom. Before removing the blocks and fastening the base to the tank structure, the impeller must be

Page 11. installed. Using the QD bushing and the key that are attached to the impeller,

install the key and the QD bushing first. Locate the key so that when the impeller is installed, the distance from the bottom of the canted blades to the tank bottom is roughly $\frac{3}{4}$ of the impeller diameter. Example, if the impeller diameter is 36", then the distance from the bottom of the tank should be 27" when installation is complete. Do not install impeller upside down; the product flow or direction should be downward or toward the bottom of the tank. Once the impeller has been installed, the blocks can be removed and the agitator should be secured to the mud tank using the mounting bolthole pattern shown on the dimensional drawing for the unit. Alternately, the agitator base can be welded directly to the mud tank. Check impeller height and adjust if necessary.

A. Electrical Installation

TURN OFF. LOCK OUT AND TAG OUT the electrical power supply to the agitator before working on the agitator or opening the motor starter or junction box on the side of the motor. A qualified electrician should make electrical connections inside the junction box on the side of the motor. Care should be taken to make sure that voltage and frequency of the power supply match the motor nameplate voltage and frequency.

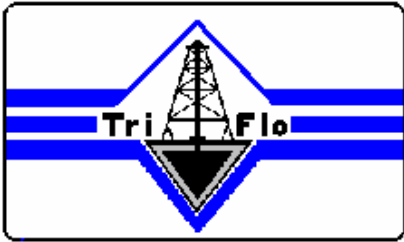
B. Checking Motor Rotation

BEFORE STARTING OR EVEN "BUMPING" THE MOTOR, MAKE SURE THAT GEARBOX IS FILLED WITH OIL.

The electrical installation is not complete until the motor rotation has been checked. Reversing any two legs on a three-phase power will reverse direction of rotation if necessary.

C. Checking Oil Level

All Agitators are shipped from the factory filled with the proper type and quantity of gear oil. Nonetheless, gear units must be checked for oil level before startup. Oil level should be checked using the sight glass on the side of the gearbox housing. When mounted level, the oil level should hit the mid point on the sight glass. In addition to oil level, check the lower bearing for grease. A grease gun can be used to pump grease into the zerk and through the grease tube down to the lower bearing. Mobil CM-P is recommended. However, if not available, a moly-fortified grease should be used. Other recommended grease characteristics include: washout resistant, broad temperature range, ISO 320, NLGI Grade II,



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Lithium based.

DATA AND CHARTS

IMPELLER MOTOR SHAFT WT. WEIGHT LESS SHAFT

MODEL # SIZE Hp (lbs/ft) (LBS) (KG)

M2A-3 24" 3 5.5 215 98
M2A-5 28" 5 12.8 420 191
M2A-7.5 32" 7.5 12.8 495 225
M2A-10 36" 10 23.0 790 359
M2A-15 40" 15 23.0 940 427
M2A-20 44" 20 31.6 1,250 567
M2A-25 48" 25 41.4 1,400 635

TABLE 2.1- WEIGHT DATA

FIGURE 4.1

TEMPERATURE RANGE (ambient) AGMA No. ISO VG Example

Fahrenheit Celsius - Mobil Product

40 below to 32 40 below to 0 - 220 SHC630

32 to 100 0 to 37.7 5 EP 220 Mobilgear 630

Over 100 Over 37 8 EP 680 Mobilgear 636

Temperature conversions

$F=(1.8 \times C) + 32$ $C=0.555(F - 32)$

LUBRICANT QUANTITY FOR MAX2000

CAPACITY CAPACITY

MODEL # QUARTS LITERS

M2A-3 2.4 2.6

M2A-5 3.79 4

M2A-7.5 3.79 4

M2A-10 6.82 7.2

M2A-15 6.82 7.2

M2A-20 12.31 13

M2A-25 12.31 13

ABOVE 25 Hp CONSULT FACTORY

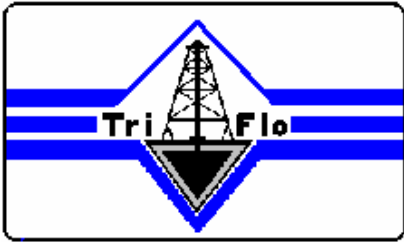
FIGURE 4.2

Section 3 – Operation

A. Starting the Agitator

Prior to proceeding, check the alignment of the motor to gearbox coupling alignment. If couplings are not aligned properly, you may wear out the flexible element before an acceptable length of operating time has passed.

Once installation is complete and proper lubrication levels have been confirmed, pressing the start button on the motor starter can start the unit. (Note that motor starters are NOT supplied with agitators unless they have been ordered separately.) As is good practice with all rotating equipment, check for unusual



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noise or vibration upon start up.

B. Operation

As with centrifugal pumps, agitators will consume more horsepower as mud weight increases. There is no adjustment of the agitator that is required to compensate for changes in drilling conditions. During drilling operations, mud agitators are kept running at all times.

***Aeration of the Suction Tank - Adjusting the height of the impellers in the suction tank is very important to prevent the agitators from introducing air that can cause mud pump problems. If air entrainment starts causing problems with the mud pump, while drilling with acceptable mud volume, impeller height should be lowered at the next opportunity, to minimize aeration. Temporarily increasing mud volume, to prevent aeration, can usually solve the problem.

C. Safety

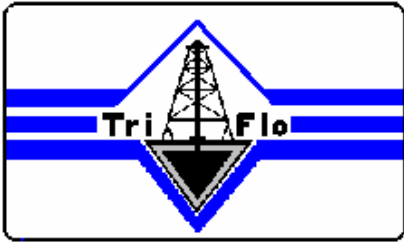
The gearbox on the Agitator has a speed reduction ratio, which greatly increases the torque output at the impeller. Despite their relatively slow speed, a mud agitator can be extremely dangerous. Any objects that might fall into or be placed in the mud tanks run the risk of being caught by and wrapped up by the agitator. Typical examples of items that pose the threat of being caught by the agitator are: hoses, mud sample buckets, ropes, etc.

*****No attempt should be made to stop a rope or hose once it has been wrapped around a moving agitator!!! Doing so can result in a potentially life threatening situation for the person attempting to remove the object from the agitator.**

Section 4 – Maintenance

A. Maintenance

The primary maintenance item for the Agitator is a weekly check of lubrication levels. This includes the oil level coating the gearing and the grease in the lower bearing. The oil level can be easily checked through the sight glass on the side of the gearing section. The correct fill quantities are listed in Figure 4.2, on page 13. The design of the grease pocket allows for the "old" grease to be expunged out of the lower seal. You have the ability to add as much grease as you wish, however, the more you add to the lower bearing, an equal amount of grease that is pushed out. It is recommended, in a normal operating range of mud levels, (i.e. below the output shaft of the agitator) during your weekly



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maintenance check of the agitator, you take the opportunity to put 8-10 pumps of a grease gun into the zerk on the side of the housing.

In the event you find a component of the Agitator Assembly that needs to be repaired, consult the Drawing labeled "Internal Components", page 18, for which items can be replaced in the field. At no time, should anyone other than a **FACTORY TRAINED** individual attempt any repair on the gearing section. The gears sets are so exactly positioned that without the proper tools and presses, it is emphatically discouraged to attempt any field repair. If any field attempt is made to repair the gearing section of the MAX2000 ® Gearbox, any warrantee either implied or express is voided, IMMEDIATELY. Please advise any and all personnel to observe this important statement.

B. Periodic Oil Changes

During the course of normal operation, the oil in the gearbox should be changed every three months. The use of a high quality lubricant, as listed in Figure 4.2 on page 13, will assist in the removal of any particles that might foul out the gearing, and provide trouble free operation of the MAX2000 ® Agitator.

*** It is very important to monitor the ambient temperature around the MAX2000 ® Agitator. There are two (2) critical points at which an oils lubrication property must be altered. Extended periods of the ambient temperature below 32 °F and above 100 °F require changing the ISO grade of the oil to accommodate these temperature ranges.

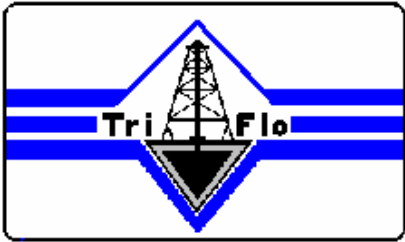
C. Cautions

The MAX2000 ® Agitator is a very rugged product, however through the abuse and misuse of any piece of equipment, the operational life of the unit can be greatly diminished. When in a cold environment, 8 °F and below, CAST IRON becomes fragile and must be prevented from receiving impacts, as this can crack the housings and cause oil leakage. Whenever possible, check the impeller shaft stabilizer for wear, excessive wearing can cause high angles of shaft deflection, wearing out the lower bearing.

Troubleshooting Guide

Problem Cause Action -Solution

Motor Will Not Start -Power problem -Check electrical supply



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- Defective motor -Replace motor
 - Wrong or bad heaters/coil -check heaters/starter
 - Motor Quits Running -Starter tripped out -Reset starter
 - Burned out heater -Replace heater
 - Motor burned out -Replace motor
 - Tripped Starter -Bad heaters -Replace heaters
 - Over amp draw -check amp draw
 - Agitator undersized -Replace Agitator
 - Whining Noise -Check motor bearings -Replace motor
 - Random Noise
 - (Gearbox) -Contamination in oil -Drain and replace oil
 - Rhythmic noise
 - (Gearbox) -Possible bur on gear set -See next line...
- A bur on a gear set has a tendency to correct itself over time. In the event that the noise is overly obtrusive, remove gearbox and return to factory for evaluation.
- Vibration -Assembly loose -Tighten all bolts
- Broken weld (base to tank) -Re-weld base to tank

Parts List

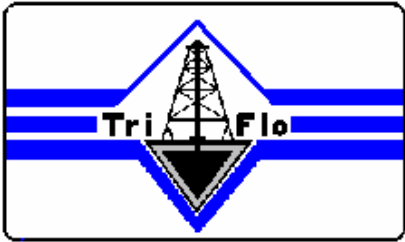
Replacement parts for the MAX2000 ® Agitators can be ordered from Process Solutions International or any of their agents, worldwide. The Drawing labeled "Internal Parts", page 18, gives you a drawing number for the parts you can order. A list of drawing numbers and description for the drawing numbers is located on page 19. When ordering, provide the drawing number and description of the part you need. Please include the horsepower of the Agitator you are repairing. If you desire a parts list with exact catalog numbers of replacement parts, contact Process Solutions International using the information listed below.

To order parts, schedule field service or to receive technical support, contact Process Solutions International using the information listed below.

Parts Numbers and Descriptions

DRAWING NUMBER DESCRIPTION

- 1 Gearbox
- 2 Output Shaft
- 3 Internal Keys
- 4 Retaining Ring
- 5 Cover
- 6 Socket Head Cap Screw
- 7 Lock Washer
- 8 Socket Head Cap Screw
- 9 Hose Connector
- 10 Drop Bearing Housing

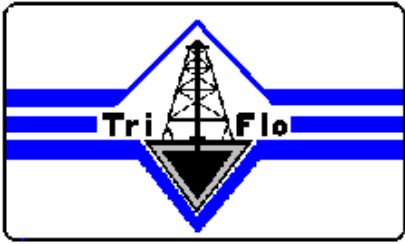


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- 11 Grease Zerk
- 12 Upper Seal, Drop Bearing
- 13 Lower Seal, Drop Bearing
- 14 Spherical Roller Bearing
- 15 O-Ring
- 16 Grease Envelope
- 17 Grease Tube
- 18 End Cap
- 19 Hex Head Cap Screw
- 20 Lock Washer
- 21 Hose Connector
- External Key

NOTES



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