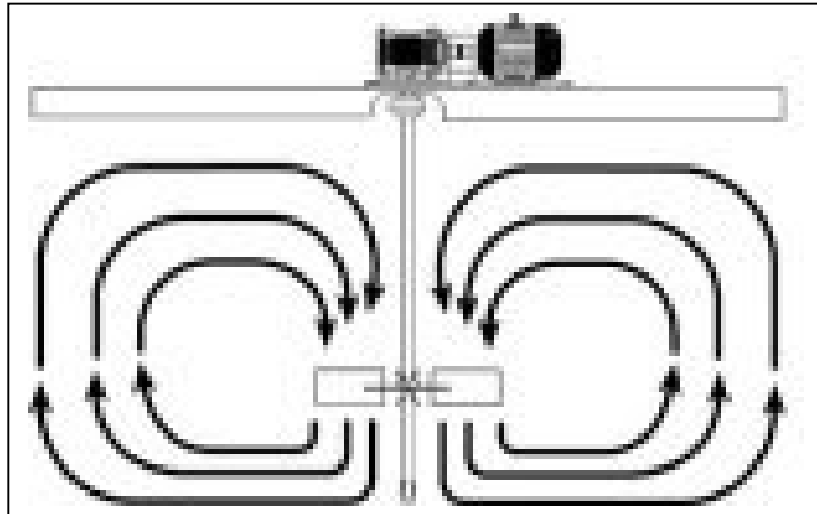


OPERATION & MAINTENANCE MANUAL

KOFE MUD AGITATOR (WORM TYPE)



KHALSA OIL FIELD EQUIPMENTS PVT LTD

46, BALLUPUR ROAD

DEHRADUN – 248 001 (UK), INDIA

Phone : 0135 – 273986, Fax : 0135 – 2759363

E-mail : sukhibabbar@gmail.com

SPECIFICATION FOR MUD AGITATOR (20 HP)

1.0 General Features :

- 1.1 Equipment suitable for continuous duty operation in oil field application.
- 1.2 Equipment new, unused and of recent manufacture.
- 1.3 Unit compact in design requiring low headroom.

2.0 Scope of supply :

1.	Liquid Handled	Mud slurry
2.	Specific Gravity	1 to 2.5
3.	Fluid Temperature	Upto 90 Deg. Cent.
4.	Direction of Rotation	Clockwise
5.	Painting	Sand blasted, coated with zinc primer and sealer, coating with 3-4 mils of Epoxy / Polyurethane paint
6.	Motor HP and Speed	20 HP (1000 - 1500)
7.	Impeller Diameter	40"
8.	Number of Blades	4
9.	Shaft Diameter	85mm
10.	Impeller Type	Aerofoil
11.	Blade Type	Canted 60 deg
12.	Operational Height	Min5ft and Max. 8 ft.
13.	Gear Reducer	Type Right Angle Worm
14.	Gear Reducer Speed	90 - 95 rpm.

3.0 Constructional Features

3.1 Impeller and Shaft :-

Impeller Dynamically balanced, incorporating high efficiency enclosed blades with vortex preventor and axial and radial flow and for maintaining uniform mud composition in the tank. Impeller shaft shall be solid and grooved at the bottom for impeller height adjustment with suitable supporting guide. Shaft length suitable for the operational height.

KOE AGIW-20

Cautions and General Safety Rules

This manual contains important information concerning installation, operation, and proper maintenance of the KOE 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.

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 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 Worm gear 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

GEAR REDUCER

The internal gears are lubricated with oil. For ambient temperatures below -23 F_0 or above 140 F_0 a synthetic lubricant should be substituted. A unique feature of the KOE-AGIW-20 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 breeched 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

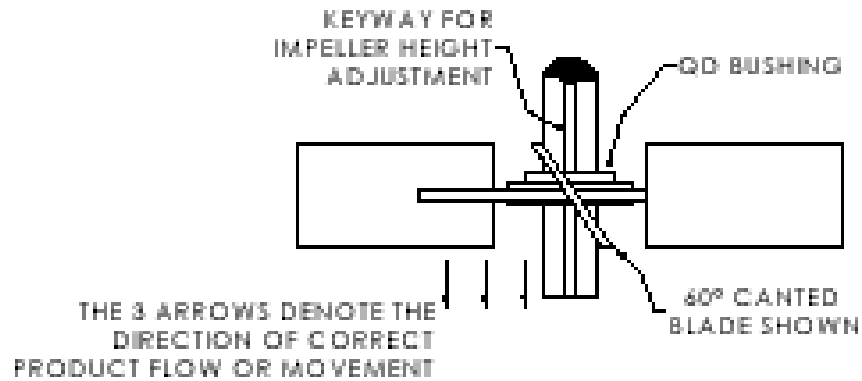
An oil dip guage has been provided so that the oil level can be checked at a single glance. Vent plugs are supplied, installed in the gearbox housing, to maintain a homeostatic internal pressure, preventing a pressure build up that could blow out an oil seal.

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 FLP motors are coupled to the gearbox housing after proper alignment thru Fenner F-70 taper lock coupling.

IMPELLERS

Optimal suspension and mixing results from the axial and radial flow patterns created by from impellers. Using a 60°, an axial or a hydrofoil impeller the optimal situation can be created for you application. The KOE-AGIW-20 Agitator is offered with a canted impeller 304 series stainless steel. On the welded impellers a QD bushing is provided to allow for adjustment of the height of the impeller.



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

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 within 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 agitation) to prevent aeration.

TOR= Volume X 60 divided by Pumping Rate
or

$$\text{TOR} = \frac{\text{Volume} \times 60}{\text{Pumping rate}}$$

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 in inches	Pumping rate @ 60 Hertz	Pumping rate @ 50 Hertz	Hp 20 (20 ppg mud)	Required Gearbox
20	900	750	1.20	3 Hp
24	2000	1300	1.44	3 Hp
28	2400	1900	1.68	3 Hp
30	3000	2600	2.16	5 Hp
32	4400	4000	2.40	5 Hp
36	5850	5400	4.80	7.5 Hp
40	7200	6000	7.19	10 Hp
42	8100	7000	9.59	15 Hp
44	8900	8100	10.55	20 Hp
48	12500	10200	17.99	25 Hp

Figure 1.2 - Pumping Rate and Gearbox Selection

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 KOE-AGIW-20 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 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 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 VG320.

Brand-B	Grade-B
Bharat petroleum	Cabol 320 or Amocam 320
Castrol	Alpha ZN320
Gulf	Harmony 320
Hindustan petroleum	Enklo 320
Indian oil	Servomesh SP 320 or Servosystem 320
Veedol	Avalon 320

DATA AND CHARTS

MODEL #	IMPELLER SIZE	MOTOR Hp	SHAFT WT. (lbs/ft)	WEIGHT LESS SHAFT	
				(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 X C) + 32
C=0.555(F - 32)

LUBRICANT QUANTITY FOR KOE-AGIW-20

MODEL #	CAPACITY QUARTS	CAPACITY LITERS
M2A-3	1.37	1.29
M2A-5	4.65	4.4
M2A-7.5	4.65	4.4
M2A-10	10.03	9.5
M2A-15	10.03	9.5
M2A-20	11.52	10.91
M2A-25	11.52	10.91
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 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 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 KOE-AGIW-20 Agitator

****It is very important to monitor the ambient temperature around the KOE-AGIW-20 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.*

A. Cautions

The KOE-AGIW 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 bottom support for wear, excessive wearing can cause high angles of shaft deflection, wearing out the lower bearing.

TROUBLESHOOTING GUIDE

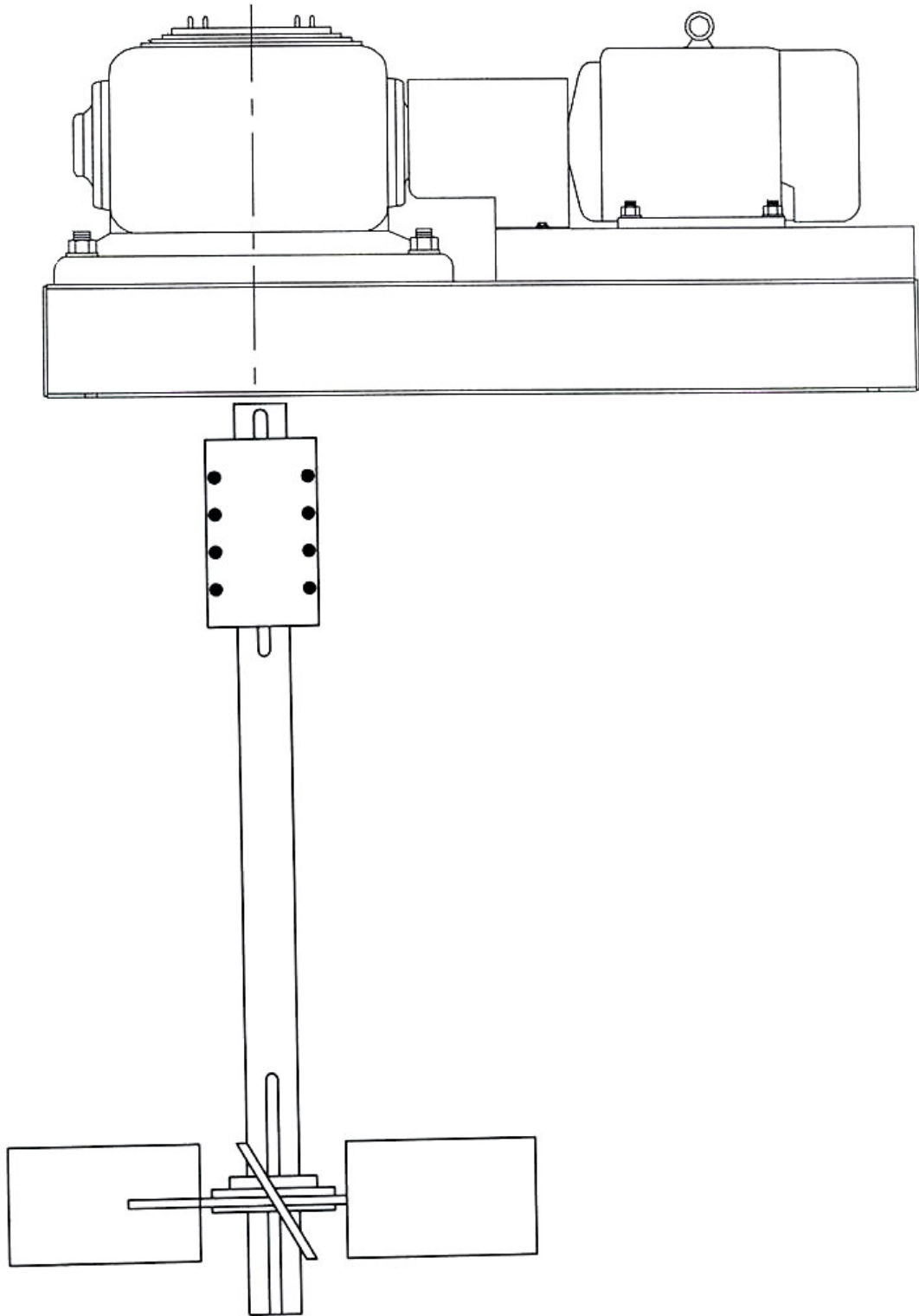
<u>Problem</u>	<u>Cause</u>	<u>Action –Solution</u>
Motor Will Not Start	-Power problem -Defective motor -Wrong or bad heaters/coil	-Check electrical supply -Replace motor -check heaters/starter
Motor Quits Running	-Starter tripped out -Burned out heater -Motor burned out	-Reset starter -Replace heater -Replace motor
Tripped Starter	-Bad heaters -Over amp draw -Agitator undersized	-Replace heaters -check amp draw -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...
<p>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.</p>		
Vibration	-Assembly loose -Broken weld (base to tank)	-Tighten all bolts -Re-weld base to tank

PARTS LIST : KOE – AGIW – 20 AGITATOR

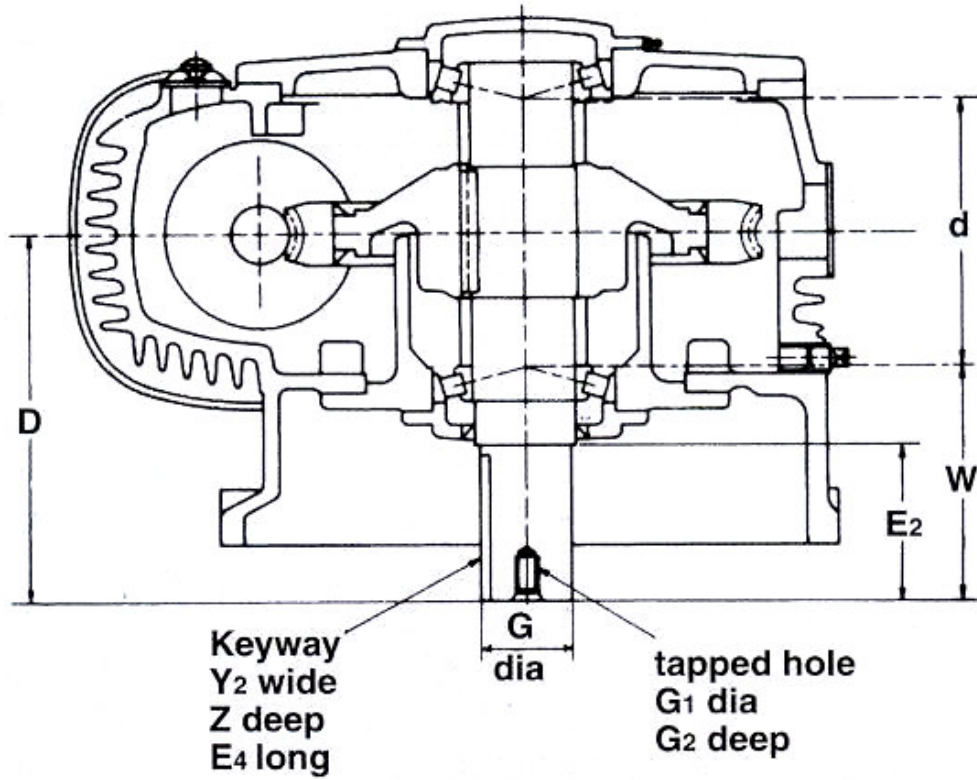
Replacement parts for the KOE-AGIW Agitators can be ordered from us. The Drawing labeled “Internal Parts”, page 18, gives you a drawing number for the parts you can order. A list of drawing numbers and description for the drawing numbers is located on page 19. When ordering, provide the drawing number 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.

Ser	Description	Part No	Qty / Unit
1.	Gear Box mounting Bolts Hex 2 x 70 S.S.	KOE-AGIW-20-1	04
2.	Worm Gear Box	KOE-AGIW-20-2	01
3.	Flexible tyre coupling Fenner F-70	KOE-AGIW-20-3	01
4.	Coupling Guard	KOE-AGIW-20-4	01
5.	FLP Motor 20 HP foot mounted 1450 RPM	KOE-AGIW-20-5	01
6.	Motor mounting Bolts Hex M12 x 40 Long, S.S.	KOE-AGIW-20-6	04
7.	Gear Box output Shaft Key	KOE-AGIW-20-7	01
8.	Shaft to Shaft coupling Bolts Alen M14 x 30L, S.S.	KOE-AGIW-20-8	08
9.	Shaft to Shaft Coupling	KOE-AGIW-20-9	01
10.	Agitator Shaft and 85 (Length to be specified by customer)	KOE-AGIW-20-10	01
11.	Canted Impeller Assy., 60 ⁰ 4 Blade, 40" Dia	KOE-AGIW-20-11	01
12.	Impeller Key	KOE-AGIW-20-12	01

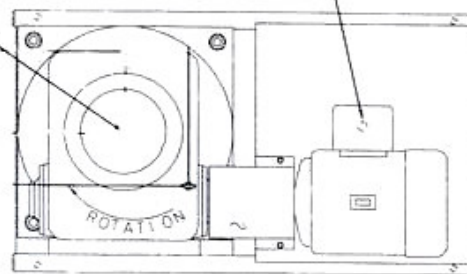


GEAR BOX SECTIONAL VIEW



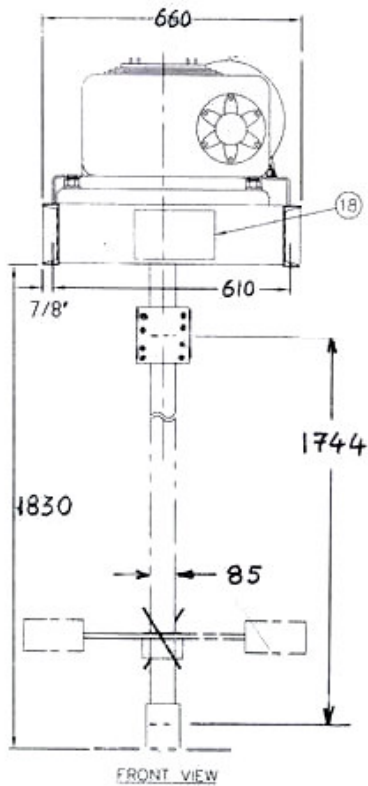
CENTER OF GRAVITY W/D SHAFT

1 1/4" ELEC. CONDN.

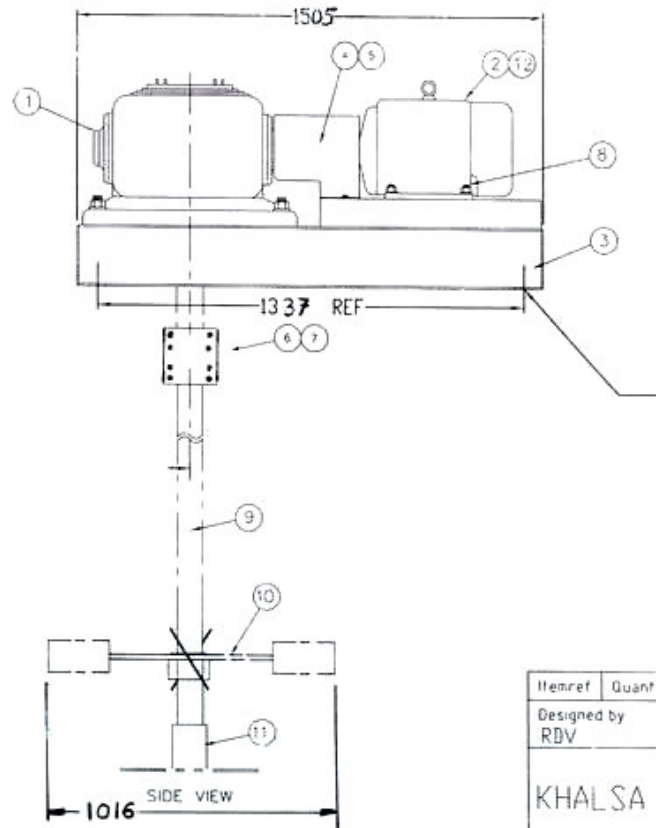


PLAN VIEW

BILL OF MATERIAL			
ITEM QTY	DESCRIPTION	MATERIAL	PART NO.
1	WORM GEAR REDUCER W/D 115 RATIO	STD. GRAVES	K/CVDM-7
2	ELECTRIC MOTOR FLAME PROOF 20 HP, 1450 RPM	STD. EXLOSKER/CRONPTON	K/LE160
3	SKID	IS 2062	K/AG1/203
4	COUPLING GUARD	IS 2062	K/AG1/204
5	FLEXIBLE COUPLING F- 70	STD. FENNIR MAKE	K/AG1/205
6	RIGID COUPLING	AISI-410	K/AG1/205
7	5/8" DIA. HEX HT BOLTS 3" LONG WITH NYLON NUTS	STD. UNBRAKO LPS MAKE	K/AG1/207
8	1/2" DIA. HEX HT BOLTS 4" LONG WITH NYLON NUTS	STD. UNBRAKO LPS MAKE	K/AG1/208
9	IMPELLER SHAFT	AISI-410	K/AG1/209
10	IMPELLER 1/2 BLADE, ACRO FOR TYPE	AISI-304	K/AG1/210
11	IMPELLER SHAFT BOTTOM SUPPORT	IS 2062	K/AG1/211
12	FLAME PROOF STARTER BOX	STD.	K/AG1/212



FRONT VIEW



SIDE VIEW

Item Ref	Quantity	Title/Name, designation, material, dimension etc	Article No /Refer	
Designed by	Checked by	Approved by - date	Filename	Date
RDV	RSJ	SSB 10/05/1999	DRAW/SCUSH	10/05/99
KHALSA OILFIELD EQPT			MUD AGITATOR ASSEMBLY 20 H.P	
			KOE/AG1/102/R1	Edition