O'DRILL/MCM, INC.

MUD AGITATOR

Installation, Operation & Maintenance Manual

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CAUTIONS AND GENERAL SAFETY RULES

All personnel responsible for the installation, operation and maintenance of this equipment should read the following safety precautions to prevent injury to personnel or equipment damage

Turn off power, engage lock out, and tag out BEFORE PERFORMING ANY MAINTENANCE TO THIS AGITATOR.

Do not perform any maintenance or service on the motor before disconnecting the power source.

Discharge all capacitors before servicing motor.

Electrical repairs should be performed by trained and qualified personnel only.

Serious injury could result if safe electrical procedures and instructions are not followed.

INSPECT THE UNIT REGULARLY, AND REPLACE WORN OR DAMAGED COMPONENTS ONLY WITH THE PARTS SUPPLIED BY THE ORIGINAL EQUIPMENT MANUFACTURER.

Always keep hands and clothing away from moving parts.

The agitator gearbox has a designated gear ratio to maximize the suspension of solids in solution. This gear ratio greatly increases the torque that is transmitted to the impeller. **NEVER ATTEMPT TO STOP OR RETRIEVE ANY OBJECT THAT HAS FALLEN INTO THE AGITATOR TANK.**

Mud agitators should be locked out and tagged out before entering a mud tank for any reason.

SECTION 1 - INTRODUCTION

A. PRINCIPLE OF MUD AGITATORS

Agitators play an important role in the surface treatment of drilling fluids. Impeller-type mixers provide both axial and radial flow, which lowers mud costs and improves mud properties. Impeller-type mixers are basically low-shear and low-energy, inexpensive to operate and easy to maintain. Low-shear mixers are used to suspend and mix mud additives minimizing particle size degradation and polymer shear.

Mud Agitators serve three purposes:

1. Ensure mud additives are homogeneously mixed, preventing spot over treatment of chemicals, dilution water or weighting agents.
2. Prevents the pits from "gelling" by keeping the active mud system moving when the mud pumps are disengaged.
3. When drilling with weighted mud, properly sized agitators will keep the weighting agents in suspension, minimizing solids from settling in corners or dead spots of the pit.

B. DESIGN FEATURES

Design features that minimize maintenance and maximize reliability include: Gearboxes house 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, eliminating a "slamming" effect of the gears at start up, promoting a longer life. Each helical bevel gear set is 98% efficient. Therefore, a double reduction gearbox is 96% efficient and a triple reduction gearbox 94% efficient. A typical worm gear set is only 85% efficient and loses most of its efficiency through the generation of heat. Odrill/MCM's Roughneck Agitator features an ultra-tough cast iron gearbox that houses a double-reduction helical bevel gear set, providing one of the highest levels of efficiency available today.

MOTORS

Explosion proof motors are designed to withstand pressure washing and exposure to corrosive fluids with no contamination. Odrill/MCM uses Nema C-face motors that bolt directly to the gearbox housing eliminating any alignment issues.

IMPELLERS

Axial and radial flow patterns created by the impellers provide optimal suspension and mixing. Odrill/MCM offers a 60, 45, or a hydrofoil style impeller, available in carbon steel and 310 series stainless.

C. SELECTING AGITATOR

To properly select the agitator's horsepower, impeller diameter and number of agitators required, use the information provided below.

Tank Geometry

a. Width
b. Length
c. Mud Depth

Maximum Anticipated Mud Density

a. Specific Mud Weight
b. If unknown use 20 pounds per gallon (lb/gal)

Power Requirement

a. Voltage
b. Frequency

D. LOCATING AGITATORS

A canted blade impeller creates a simultaneous radial and axial flow providing a 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. Example: 16-foot by 16-foot suction tank would require two agitators for each 8-foot by 8-foot area. All data below is for canted blade impellers.

E. AGITATOR SIZING

1. Calculate the volume of the sizing area using the equation below:

$$V=(L) \times (W) \times MD) \times 7.5$$

Where
- V = Volume in Gallons
- L = Tank Length in Feet
- W = Tank width in feet
- MD = Max. Mud Depth in Feet

2. Select an impeller diameter using Table 2.2 to find an impeller that gives a pumping rate close to the calculated Volume **V.**

3. The Turnover Rate (TOR) is defined as the number of seconds required for the impeller to pump the full mud volume within the sizing area. TOR should be in the range of 40 to 90 seconds for all sizing areas, with the exception of the suction tank, which is closer to 90 (less agitation) preventing aeration of mud pumps. Use the following equation to calculate the TOR.

$$TOR = (V) \times (60) / (PR)$$

Where
- V = Volume in Gallons
- PR = Pumping Rate in GPM

Please note: **The lower the TOR the more agitation, as the tank will turn over in fewer seconds.**

4. Use table 1.1 to identify the horsepower and gearbox required for 20 ppg drilling fluids/

5. The "tank depth" is measured from the top of the structure (beams, etc...) on which the agitator will be mounted to the bottom of the tank.

TABLE 1.1 - GEARBOX / IMPELLER SELECTION AND PUMPING RATE

IMPELLER DIAMETER (inches)	PUMPING RATE 60 HERTZ	PUMPING RATE 50 HERTZ	Hp (20ppg Mud)	Required Gearbox
20	900	750	1.2	MA-3GB
24	1600	1300	1.4	MA-3G
28	2400	1900	1.7	MA-3G
30	300	600	2.2	MA-5G
32	3700	3100	2.4	MA-5G
36	5400	4500	4.8	MA-7.5G
40	7200	6000	7.2	MA-10G
42	8100	7000	9.6	MA-15G
44	9900	8100	10.6	MA-20G
48	12500	10200	18	MA-25G

SECTION 2 - INSTALLATION

A. LIFTING THE AGITATOR

Lift the agitator only at the lift points. Use properly rated slings capable of handling the weight of the equipment. The impeller should be installed after the agitator base has been lifted into the tank, but before the base has been securely mounted if possible. When lifting with the impeller shaft installed, make sure the shaft couplings have been completely tightened and that the shaft is securely attached before lifting.

B. INSTALLING THE AGITATOR

Prior to installing the agitator necessary precaution should be taken to ensure that the structure on which the agitator will be mounted is capable of withstanding both the static and dynamic loads that will be transferred to the tank structure.

As a rule, the shaft should be installed before lifting the unit into place. Some conditions, such as limited headroom above may require that the shaft be installed after the unit has been lifted in place.

Lift the unit where indicated and place in position on the mud tank using blocks to provide at least 12 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 ¾ of the impeller diameter. Example, if the impeller diameter is 36, then the distance from the bottom of the tank should be 27 inches 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, blocks can be removed and the agitator should be secured to the mud tank using the mounting bolt-hole 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.

C. WEIGHT AND DIMENSIONAL DATA

Weight and dimension Data for all eight models of the Roughneck Agitator is given in Figure 2.1. Note, that impeller diameters and shaft lengths will vary depending on the volume of the mud tank and the maximum mud density, per section 1.E Agitator Sizing.
Note that certified drawings, if requested or required provided with the equipment will take precedence over any information in this manual.

TABLE 2.1 - AGITATOR WEIGHTS (lbs)					
MODEL NO	**IMPELLER (dia/wt)**	**MOTOR HP WT**	**SHAFT WT. (lbs/ft)**	**SHAFT DIA.**	**GEARBOX/ COUPLINGS/ BASE**
OD-03-MAG	24" 50	111	12.8	2-3/16	223
OD-05-MAG	28" 53	126	12.8	2-3/16	223
OD-7.5-MAG	32" 64	170	12.8	2-3/16	243
OD-10-MAG	36" 60	232	23	2-15/16	277
OD-15-MAG	40" 67	333	23	2-15/16	427
OD-20-MAG	44" 72	356	23	2-15/16	451
OD-25-MAG	48" 77	516	23	2-15/16	614

D. 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 explosion proof 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.

E. CHECKING MOTOR ROTATION

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

The proper direction of rotation for all Roughneck 2000 Agitators is clockwise when viewed from above. The electrical installation is not complete until the motor rotation has been checked. Reversing any two legs on a three phase motor will reverse direction of rotation if necessary.

F. START - UP

1. Ensure that switches, alarms, heaters, coolers and other safety and protection devices are installed and operational for their intended purposes.
2. Verify that the installed mounting position is the same as the nametag mounting position. If not, adjust the oil level accordingly and relocate the vent plug, fill plug and drain plug according to the mounting position. See following.

AUTOVENT PLUG

The autovent plug is brass in color and will be located at the highest point on the gearbox. It operates like a check-valve to allow the reducer to relieve internal pressure while preventing lubricant contamination during cooling. A spring presses a ball or plunger against a machined orifice until pressure exceeds 2 psi. Above 2 psi the air is allowed to escape depressurizing the gearcase. When internal pressure drops below 2 psi, the autovent re-seals closing the unit to the outside environment. After shutdown, the reducer cools along with the air inside the reducer. The unit will temporarily maintain a slight vacuum until normalization occurs. The autovent is a standard feature for all Roughneck Agitators.

FILL LEVEL AND DRAIN PLUGS

The drain plugs are metric socket head cap screws. They will be located at the lowest part of the gearbox for ease of draining. The fill level plug is a hex head cap screw. It will be located between the Autovent and drain plug. Both types of plugs will have gaskets to prevent oil from leaking.

G. CHECKING OIL LEVEL

All gearboxes are shipped from the factory properly filled with lubricant and all plugs are installed according to the mounting position given on the nametag. Acceptable oil fill level is within ½ inch of the bottom of the fill plug threads.

SECTION 3 – OPERATION

A. STARTING THE AGITATOR

Prior to proceeding, Make sure that the coupling from the input adaptor and the motor are securely engaged. Once installation is complete and proper lubrication levels have been confirmed, press the start button on the motor starter to start the unit. (Note that motor starters are not supplied with agitators and need to be ordered separately) Good practice dictates that all rotating equipment be checked for any unusual noise or vibration upon startup.

B. OPERATION

Agitators will consume more horsepower as mud weight increases with no adjustments required to compensate for changes in drilling conditions. During drilling operations, mud agitators are kept running at all times.

Aeration of the Suction Tank To prevent air in the suction tank that can cause mud pump problems, adjusting the height of the impellers or temporarily increasing mud volume will usually solve the problem.

C. SAFETY

The agitator gearbox has a designated gear ratio to maximize the suspension of solids in solution. This gear ratio greatly increases the torque that is transmitted to 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. **NEVER ATTEMPT TO STOP OR RETRIEVE ANY OBJECT THAT HAS FALLEN INTO THE AGITATOR TANK. DOING SO CAN RESULT IN A POTENTIALLY LIFE THREATENING SITUATION FOR THE PERON ATTEMPTING TO REMOVE THE OBJECT FROM THE TANK.**

D. OPERATION AND MAINTENANCE CHECKLIST

1. Operate the equipment as it was intended to be operated.
2. Do not overload.
3. Run at correct speed
4. Maintain lubricant in good condition and at proper level.
5. Dispose of used lubricant in accordance with applicable laws and regulations.
6. Apply proper maintenance to attached equipment at prescribed intervals recommended by the manufacturer.

Perform periodic maintenance of the gear drive as recommended.

SECTION 4 - MAINTENANCE

A. MAINTENANCE

The only regularly scheduled maintenance needed for the Roughneck Agitator is a weekly check of oil level and an oil change every 3 months. All Roughneck Agitators have vent plug, fill plug, and drain plug

STANDARD OIL – ISO VG220

Ambient Temperature	Formulation	Oil Manufacturer	Oil Brand Name	Origin of Gearbox Assembly
20 to 104 F (-5 to 40 C)	Mineral	Texaco	Meropa 220	NORD USA
20 to 104 F (-5 to 40 C)	Mineral	Shell	Omala EP 220	NORD Canada

OPTIONAL LUBRICANTS

Ambient Temperature	Formulation	Oil Manufacturer	Oil Brand Name	Origin of Gearbox Assembly
14 to 176 F (-10 to 80c)	Synthetic	Texaco	Pinnacle EP 680	NORD USA
14 to 176 F (-10 to 80c)	Synthetic	Shell	Omala HD 2680	NORD Canada
-35 to 140 F (-25 to 60c)	Synthetic	Texaco	Pinnacle EP 220	NORD USA
-35 to 140 F (-25 to 60c)	Synthetic	Shell	Omala HD 220	NORD Canada
-40 to 50 F (-40 to 10c)	Synthetic	Texaco	Pinnacle EP 32	NORD USA
-20 to 104 F (-5 to 40c)	Synthetic	Shell	Omala HD 32	NORD Canada
-40 to 50 F (-40 to 10c)	Food Grade	Chevron	FM ISO 220	NORD USA
-40 to 50 F (-40 to 10c)	Synthetic Food Grade	OilJAX	Magnaplate 85W140-FG	NORD Canada
5 to 125 F (-20 to 50c)	Fluid Grease	Mobile	Mobilux EP023	NORD USA
-30 to 140 F (-35 to 60c)	Synthetic Fluid Grease	Mobile	Mobilux SHC 007	NORD USA
30 to 140 F (-35to 60c)	Synthetic Fluid Grease	Shell	Tivela compound A	NORD Canada

STANDARD BEARING – NLGI-2EP lithium

Ambient Temperature	Formulation	Oil Manufacturer	Oil Brand Name	Origin of Gearbox Assembly
'-20 to 140 F (-30 to 60 C)	Mineral	Texaco	Multifak 220	NORD USA
'-20 to 140 F (-30 to 60 C)	Mineral	Texaco	Cypermia RA/C3	NORD Canada

OPTIONAL BEARING GRASE

Ambient Temperature	Formulation	Oil Manufacturer	Oil Brand Name	Origin of Gearbox Assembly
'-58 to 230 F (-50 to 110 C)	Synthetic	Texaco	Starfak 2202	NORD USA
'-20 to 140 F (-30 to 60 C)	Food Grade	Lubriplate	SIF 1	NORD USA

SECTION 5 – TROUBLESHOOTING

TROUBLESHOOTING GUIDE

Problem	Cause	Solution
Motor Will Not Start	Power Problem	Check electrical supply
	Defective Motor	Replace motor
	Wrong or bad heaters/coil	Check heaters/starter
Motor Stops Running	Starter tripped	Reset starter
	Burned out starter	Replace heater
	Over- amped	Check amp draw
Tripped Starter	Bad heaters	Replace starters
	Over amped	Check amp draw
	Agitator undersized	Replace agitator
Whining Noise	Check motor bearings	Replace motor
Random Noise (Gearbox)	Contamination in oil	Drain and replace oil
Vibration	Assembly loose	Tighten all bolts
	Broken weld (base to tank)	Re-weld base to tank

SECTION 6 – SPARE PARTS

ONE-YEAR RECOMMENDED SPARE PARTS

SPARE PARTS FOR 3HP (180TC2) INPUT ADAPTER		
PART NUMBER	**DESCRIPTION**	**QTY**
24630820	INPUT ADAPTER BALL BEARING	1
27205500	SNAP RING	1
24621140	INPUT ADAPTER BALL BEARING	1
27310000	SNAP RING	1
51483380	BOWEX COUPLING (M38) 1-3/8" HUB	1
51483400	BOWEX COUPLING (M38) SLEEVE	1

SPARE PARTS FOR 3HP (SK9032) GEARBOX		
PART NUMBER	**DESCRIPTION**	**QTY**
25070020	OIL SEAL, DOUBLE LIP	2
25070070	OIL SEAL, SINGLE LIP	2
22012005	AUTO VENT	1

SPARE PARTS FOR 5HP (180TC2) INPUT ADAPTER		
PART NUMBER	**DESCRIPTION**	**QTY**
24630820	INPUT ADAPTER BALL BEARING	1
27205500	SNAP RING	1
24621140	INPUT ADAPTER BALL BEARING	1
27310000	SNAP RING	1
51483380	BOWEX COUPLING (M38) 1-3/8" HUB	1
51483400	BOWEX COUPLING (M38) SLEEVE	1

SPARE PARTS FOR 3HP (SK9032) GEARBOX		
PART NUMBER	**DESCRIPTION**	**QTY**
25070020	OIL SEAL, DOUBLE LIP	2
25070070	OIL SEAL, SINGLE LIP	2
22012005	AUTO VENT	1

SPARE PARTS FOR 7.5HP (210TC) INPUT ADAPTER		
PART NUMBER	**DESCRIPTION**	**QTY**
24630810	INPUT ADAPTER BALL BEARING	1
27205500	SNAP RING	1
24621140	INPUT ADAPTER BALL BEARING	1
27310000	SNAP RING	1
51483380	BOWEX COUPLING (M38) 1-3/8" HUB	1
51483400	BOWEX COUPLING (M38) SLEEVE	1

SPARE PARTS FOR 7.5HP (SK9032) GEARBOX		
PART NUMBER	**DESCRIPTION**	**QTY**
25070020	OIL SEAL, DOUBLE LIP	2
25070070	OIL SEAL, SINGLE LIP	2
22012005	AUTO VENT	1

SPARE PARTS FOR 10HP (210TC) INPUT ADAPTER		
PART NUMBER	**DESCRIPTION**	**QTY**
24631010	INPUT ADAPTER BALL BEARING	1
27205500	SNAP RING	1
24631140	INPUT ADAPTER BALL BEARING	1
27312000	SNAP RING	1
51483390	BOWEX COUPLING (M38) 1-3/8" HUB	1
51483400	BOWEX COUPLING (M38) SLEEVE	1

SPARE PARTS FOR 10HP (SK9042) GEARBOX		
PART NUMBER	**DESCRIPTION**	**QTY**
25080120	OIL SEAL, DOUBLE LIP	2
25080110	OIL SEAL, SINGLE LIP	2
22012005	AUTO VENT	1

SECTION 6 – SPARE PARTS

ONE-YEAR RECOMMENDED SPARE PARTS

SPARE PARTS FOR 15 (250TC) INPUT ADAPTER		
PART NUMBER	**DESCRIPTION**	**QTY**
25055100	INPUT ADAPTER OIL SEAL	1
24631110	INPUT ADAPTER BALL BEARING	1
27206000	SNAP RING	1
24631240	INPUT ADAPTER BALL BEARING	1
27313000	SNAP RING	1
52683390	BOWEX COUPLING HUB (M42) 1-5/8" HUB	1
51483370	BOWEX COUPLING SLEEVE (M42) SLEEVE	1
SPARE PARTS FOR 15HP (SK9042) GEARBOX		
PART NUMBER	**DESCRIPTION**	**QTY**
25080120	OIL SEAL, DOUBLE LIP	2
25080110	OIL SEAL, SINGLE LIP	2
22012005	AUTO VENT	1

SPARE PARTS FOR 20HP/STD DUTY (250TC) INPUT ADAPTER		
PART NUMBER	**DESCRIPTION**	**QTY**
25055100	INPUT ADAPTER OIL SEAL	1
24631110	INPUT ADAPTER BALL BEARING	1
27206000	SNAP RING	1
24631240	INPUT ADAPTER BALL BEARING	1
27313000	SNAP RING	1
52683390	BOWEX COUPLING HUB (M42) 1-5/8" HUB	1
51483370	BOWEX COUPLING SLEEVE (M42) SLEEVE	1
SPARE PARTS FOR 20HP (SK9042) GEARBOX		
PART NUMBER	**DESCRIPTION**	**QTY**
25080120	OIL SEAL, DOUBLE LIP	2
25080110	OIL SEAL, SINGLE LIP	2
22012005	AUTO VENT	1

SECTION 6 – SPARE PARTS

ONE-YEAR RECOMMENDED SPARE PARTS

SPARE PARTS FOR 20HP (250TC) INPUT ADAPTER		
PART NUMBER	**DESCRIPTION**	**QTY**
25055100	INPUT ADAPTER OIL SEAL	1
24631110	INPUT ADAPTER BALL BEARING	1
27206000	SNAP RING	1
24631240	INPUT ADAPTER BALL BEARING	1
27313000	SNAP RING	1
52683390	BOWEX COUPLING HUB (M42) 1-5/8" HUB	1
51483370	BOWEX COUPLING SLEEVE (M42) SLEEVE	1
SPARE PARTS FOR 20HP (SK9052) GEARBOX		
PART NUMBER	**DESCRIPTION**	**QTY**
25100060	OIL SEAL, DOUBLE LIP	2
25100050	OIL SEAL, SINGLE LIP	2
22012005	VENT BREATHER	1

SPARE PARTS FOR 25HP (280TC) INPUT ADAPTER		
PART NUMBER	**DESCRIPTION**	**QTY**
25055100	INPUT ADAPTER OIL SEAL	1
24631110	INPUT ADAPTER BALL BEARING	1
27206000	SNAP RING	1
24631240	INPUT ADAPTER BALL BEARING	1
27313000	SNAP RING	1
52683390	BOWEX COUPLING HUB (M42) 1-5/8" HUB	1
51483370	BOWEX COUPLING SLEEVE (M42) SLEEVE	1
SPARE PARTS FOR 25HP (SK9052) GEARBOX		
PART NUMBER	**DESCRIPTION**	**QTY**
25100060	OIL SEAL, DOUBLE LIP	2
25100050	OIL SEAL, SINGLE LIP	2
22012005	VENT BREATHER	1

SECTION 6 – SPARE PARTS

A. ORDERING PARTS

Replacement parts for Roughneck Agitators are available through O'Drill/MCM or its agents worldwide. The above part lists provide part numbers facilitating simpler ordering.

O'Drill/MCM carries a full complement of replacement parts for immediate shipment.

B. FIELD SERVICE

O'Drill/MCM has skilled field service personnel available around the clock. To request that a specialist visit your location, please contact O'Drill/MCM.

C. CONTACT INFORMATION

To order parts, schedule field services or request additional information, please contact:

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