

## Maintenance & Operation Manual for MFS 1500

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\*\*\*\* Before Setting Up or Starting Unit make sure all Safety and Environmental Rules and Regulations are in Compliance and all personal have the required Personal Protection Equipment.



\*\*\*\* Before entering any tanks all Confined Spaces Procedures, Training, PPE and Proper Equipment is in place and in compliance.



\*\*\*\*The MFS 1500 is manufactured in an Explosion Proof and a Non Explosion Proof Version.

**NEVER USE THE NON-XP VERSION IN A CLASSIFIED AREA.**



\*\*\*\*High voltage is present, follow De-energize and Lock Out/Tag Out procedures before maintaining or working on any equipment.

### Set Up

1. Shore and Level Tank.
2. Mark where Underground Utilities are located.
3. Connect Ground Lug to Customers Source or Stake Ground Rod in accordance to applicable Local Electrical Codes and/or NEC.
4. Connection of Main Line Electrical:
  - 4.1. Should only be accomplished by trained electricians within compliance applicable Local Electrical Codes and/or the NEC
  - 4.2. Connect only to an opened circuit disconnected panel (fused or breaker) with over amperage protection. Refer to: 8. Electrical Power
  - 4.3. Follow all Lock Out /Tag Out, Connection of Power in a Hazardous Location and De-energized Procedures
5. Setting Up Tank:
  - 5.1. Setup mud slides
  - 5.2. Remove shipping tie downs from shakers
  - 5.3. Open valve D2-A
  - 5.4. Close and tighten dump gates
  - 5.5. Connect discharge line from Charge Pump back to Storage or Active Mud Tank
  - 5.6. Connect a hose to the Inlet of Scalping Shaker from the pit pump
6. Solids Control Equipment on MFS 1500:
  - 6.1. 126 Scalping Shaker (primary flow or first stage) over first tank compartment.  
Screen sizes 2' x 3' and can range from 10-60 mesh (2000-420um)
  - 6.2. Mud Cleaner 4-4/126 Shaker (removes fine sands to coarse silts) over second tank

- compartment. Screen size 2' x 3' and can range from 80-200 mesh (177-125um)
7. Pumps:
    - 7.1. 4-4" Mud Cleaner 2x3 250 Mechanical Seal 15hp 460V 3ph 60Hz 1780rpm 10.25" Impeller.
    - 7.2. Mud Hopper& Mud Gun 2x3 250 Mechanical Seal 15hp 460V 3ph 60Hz 1780rpm 10.25" Impeller.
    - 7.3. Charge 2x3 250 Mechanical Seal 15hp 460V 3ph 60Hz 1780rpm 10.25" Impeller.
  8. Electrical Power (RECOMMENDED):
    - 8.1. 480V, 3ph, 60Hz, Mainline Breaker, Generator Power.
    - 8.2. Minimal Wire Size for 60 Hz 4awg 3c w/ Ground, larger if length from generator or power source it Main Control Panel is longer than 50'.
  9. Checking Rotation:
    - 9.1. If this is the first time to start the MFS 1500 on a new power source, check phase sequence on control panel. Red light an indication of incorrect rotation and will disable the panel from any operations. Refer to: Set Up 4. Connection of Main Line Electrical. Open circuit, de-energize power source, lock out tag out, and switch any two of the main line wires.
    - 9.2. Green light is an indication of correct rotation.
    - 9.3. The correct rotation is also checked by removing the counter weight covers on the vibratory motor. The counter weights should rotate with top side of weight toward the discharge end.
    - 9.4. The impellers are threaded on pump shafts, so the wrong rotation could un-thread impeller off the end and cause severe damage. Motor should be decoupled from pump and checked individual for correct rotation.
    - 9.5. If an electric motor is changed on pumps, it is always safe practice not to couple pump with motor until rotation has been checked.
    - 9.6. Electrical Motors rotate clockwise looking at fan end, counter clockwise from shaft end.
    - 9.7. Pumps will have an arrow to indicate direction of rotation on body of pump.

## Start Up Procedures



\*\*\*\*Make sure that no personnel or material is close to moving parts (rotating shafts or vibrating decks).



\*\*\*\* NEVER START PUMPS WITHOUT FLUIDS PRESENT.

The Lack of fluid will Damage Mechanical Seals in Pumps. The Pump's Volute should be flooded before start up. All Electrical Motors on the MFS 1500 are controlled from Main Control Panel: Refer to Flow Diagram Figure 2

10. Start Up Sequence:

- 10.1. Main Breaker/ ON
- 10.2. Lights/ON/ Electrical Panel
- 10.3. Open Suction Valves (S-1, S-2 & S-3)
- 10.4. Discharge Valves (D-1 & D-2A, D-2B, D-3)
- 10.5. Make sure Charge Hose is connected

- 10.6. Open Mud Gun Line Valve (D-2A)
- 10.7. Open 4-4" Valve half open (P-1 & P-2)
- 10.8. Scalping Shaker/ ON/ Electrical Panel
- 10.9. 4-4/126 Mud Cleaner / ON/ Electrical Panel
- 10.10. Inlet Valve 7/8 Closed Valve (T-1)
- 10.11. Control Flow on the Primary Scalping Shaker by Adjusting Valve (T-1)
- 10.12. When the level in Primary Scalping Compartment One is 75% full engage 4-4" Pump / ON/ Electrical Panel, regulate the pressure with Valve (P-1) to 22-25psi



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## Processing

Compartments are numbered in the sequence that the fluids or slurry enters the tank. Compartment 1 is the inlet under scalping shaker, number 2 under 4-4" M/C. When all pumps and shakers are running, the weirs between each compartment should let the slurry flow from the second and then back into the first. This will help further assist in the removal solids and enhance performance. If the inlet and the outlet flow rate are near equal, the fluctuation in the flow balance is observed in the first compartment, under Scalping Shaker.

## Tank Levels

### 11. Control of Tank Levels:

- 11.1. Tanks' Levels are all equal and fluid level is rising, cut back on the incoming fluid, Valve (T-1) and or open up the discharge Valve (D-3).
- 11.2. Level in Compartment One is low, incoming fluid to slow and compartment Two is also low and is dropping, cut back on outlet Valve (C-3) to match flow rate.
- 11.3. Level in Compartment One is low and fluid in Compartment Two is flowing over weir wall open up Valve (T-1) slightly, try to maintain 50-75% tank level.
- 11.4. Level in Compartment One is rising, Compartment Two is low and before Compartment One is flowing fluid back into Compartment Two. Turn off Supply pump or Close Valve (T-1) Check the following:
  - 11.4.1. Motor to (Pump-1) is NOT running: Refer to Trouble Shooting Electrical.
  - 11.4.2. The Valve (P-1) on 4-4" is open, Pressure Gauge on 4-4" Manifold is NOT reading 22-25psi and Pump for 4-4" is running.
  - 11.4.3. The pump might have an airlock; turn 4-4" Pump/OFF/ Electrical Panel, wait until shaft stops spinning and try to re-start 4-4" Pump/ON/Electrical Panel.
  - 11.4.4. If fluid level in the first compartment is over  $\frac{3}{4}$  and still rising go through this procedure again.

## Shutdown Sequence

During the shutdown sequence the tank levels for each compartment will start to lower as the inlet fluids are shut off. It is recommended to stop each pump when the suction plumbing is seen. This will make start up easier, avoid airlock and keep fluids in the pumps volutes, preventing the mechanical seal from running dry. If this shut down is the last before a move, than turn off pumps immediately when the suction side plumbing loses prime.

### 12. Shut Down Sequence:

- 12.1. Supply or Pit Pump
- 12.2. Close Valve (T-1)
- 12.3. 4-4" Cleaner Pump, Turn/OFF/ Electrical Panel
- 12.4. Close Valve (D-2A)
- 12.5. Charge Pump, Turn /OFF/ Electrical Panel
- 12.6. Close Valve (D-3)
- 12.7. While Shakers are still running clean off screen panels. Use water and soft brush.

Any solids left on screened panel will cause blinding when placed back into service.

- 12.7.1. Scalping Shaker, Clean, Turn /OFF/ Electrical Panel
- 12.7.2. Mud Cleaner Shaker 4-4, Clean, Turn /OFF/ Electrical Panel
- 12.8. Close Suction Valves (S-1, S-2, S-3)
- 12.9. Close Discharge Valves (D-1, D-2A, D-2B & D-3)
- 12.10. Lights/OFF/ Electrical Panel
- 12.11. Main Breaker/OFF/ Customers Power Supply

## Winterization

- 13. Because of so many variables the suggestion will reflect only generic conditions.
  - 13.1. Light freeze lasting no more than 6 hour and unit is not operational.
    - 13.1.1. Shut Down system as outline in Section 12 Shut Down Sequence.
    - 13.1.2. Suction Plumbing Valves (S-1, S-2 & S-3) are closed.
    - 13.1.3. Open the ½” ball valves located on the pumps’ case lower front, open, slightly open Valves (D-1, D-2A & D-2B).
    - 13.1.4. If this is an Environmentally Sensitive Area or Zero Discharge, thread in hose barbs, with hose long enough to reach past the end of skid and gravity drain to bucket or pan.
  - 13.2. Light freeze under operating conditions, blanket all exposed headers, casings and plumbing.
  - 13.3. Heavy freeze lasting for long durations and unit is not operational.
    - 13.3.1. Empty all fluids and any solids from tank.
    - 13.3.2. Shut Down system as outline in Section 12 Shut Down Sequence.
    - 13.3.3. Suction Plumbing Valves (S-1, S-2 & S-3) are closed.
    - 13.3.4. Open the ½” ball valves located on the pumps’ case lower front, open, slightly open Valves (D-1, D-2A & D-2B).
    - 13.3.5. If this is an Environmentally Sensitive Area or Zero Discharge, thread in hose barbs, with hose long enough to reach past the end of skid and gravity drain to bucket or pan.
    - 13.3.6. Leave dump gates open slightly so not to accumulate water.
    - 13.3.7. Cover to protect from elements all pumps, motors and electrical systems.
  - 13.4. Heavy freeze under operating conditions, blanket with heat trace all exposed headers, casings, troughs and plumbing.
  - 13.5. In extreme cold weather tarp in unit with source of heat.



\*\*\*\*The conductive heat source must comply with all Zone or Classified Area Restrictions.

## Screen Change

The screens used on the MFS 1500 are Pretension Panels (PTP) and are held in place by polyurethane wedges. Strike with mallet on “Flag” end toward the angled retainer to loosen and the opposite end to tighten.



\*\*\*\* Power down and Lock Out/Tag Out Starter before Performing any Maintenance or Screen

## Changes



\*\*\*\* Heavy Leather Gloves, Safety Glasses, Ear Protection and Head Protection are needed.

14. Installation of 126E Shakers has two PTP Screens per Shaker deck. The screens location dictates the numerical sequence. The direction of flow where cuttings or slurry first enters onto deck is 1<sup>st</sup> screen and the screen at the end is 2<sup>nd</sup>. In order to change the 1<sup>st</sup> screen, the 2<sup>nd</sup> screen needs to be removed completely.
15. Removal of 126E PTP Screen Panels:
  - 15.1. Remove the lock wedges as described in opening paragraph
  - 15.2. Remove panels toward end of discharge.
  - 15.3. When the panels are removed, clean and inspect rubber seals on shaker deck.
16. Installation of 126E PTP Screen Panels:
  - 16.1. Clean and inspect rubber seal on shaker deck as well as bottom of panel.
  - 16.2. Feed the panels from discharge end of shaker basket, toward the #1 position, then panel 2. Push back and center panel in the basket, make sure that panel 2 has cleared holding hooks and panel 1 is tight to back.
  - 16.3. Place locking wedge blocks under retainers and strike firmly on the end, toward retainer. Alternate from side to side to insure proper seal and even pressure.

## Screen Selection

17. Screen to the flow or cut point, if screens are discharging wet, correct by the following:
  - 17.1. Too much flow. Adjust the liquid or slurry by lower the flow.
  - 17.2. Slurry Solid Content is high, dilute bring solids to liquid ratio to a manageable level.
  - 17.3. Correct the underflow from hydro-cyclones by adjusting Apex nut and Bushing
  - 17.4. Check for screen blinding (solids stuck in the screen opening or fibers wrapping and/or matting) Try using a smaller opening if blinding is apparent by going up to the next mesh size.
  - 17.5. Last choice, screen to lower mesh, this will let more solids through that section and may interfere with the downstream equipment.
  - 17.6. Suggested screen selection for each shaker:
    - 17.6.1. 126E Scalping Shaker Suggested Screen Mesh: 10-60 mesh.
    - 17.6.2. 4-4/126E Shaker Suggested Screen Mesh: 80-200 mesh

## Equipment Operation

18. 126E Scalping Shaker: Removes large debris to coarse sand, before fluids enter system.
  - 18.1. All Slurry, Fluids and Water entering system must flow over the Scalping Shaker via Possum Belly.
  - 18.2. The Possum Belly function is to de-accelerate and evenly spread the incoming flow onto the Shaker.
  - 18.3. Scalping Shaker removes large debris to coarse sand.
  - 18.4. Valve to control flow (T-1) is in place to help from flooding off shaker, but also controls tank levels.

- 18.5. The Supply pumps and hoses should have the capabilities for decreasing flows (even complete close down) by the use of the (T-1) butterfly valve without damage to pumps, hoses or plumbing.
- 18.6. Select a screen mesh in accordance with the desired flow and cake dryness.
- 18.7. Vibratory Motor on the 126E creates a High Speed Unbalanced Elliptical Motion.
- 18.8. Counter Weights inside of covers of Vibratory Motor are preset at Factory for the best frequency, aptitude and longevity. If these counter weights are adjusted, it will directly void warranty.
- 18.9. Maintenance and Electrical Schematics Vibratory Motor: Refer to Manual Vimar Section.
- 19. Mud Cleaner 4-4"/126E PTP Shaker: Consists of 4 four inch Hydro-Cyclones attached to a common manifold with individual outlets and valves. The underflow from cone is collected in a trough which is directed onto a 2'x6' drying shaker. The overflow is plumbed into individual tubes collected into a common trough and is deposited into the tank below: Figure 21



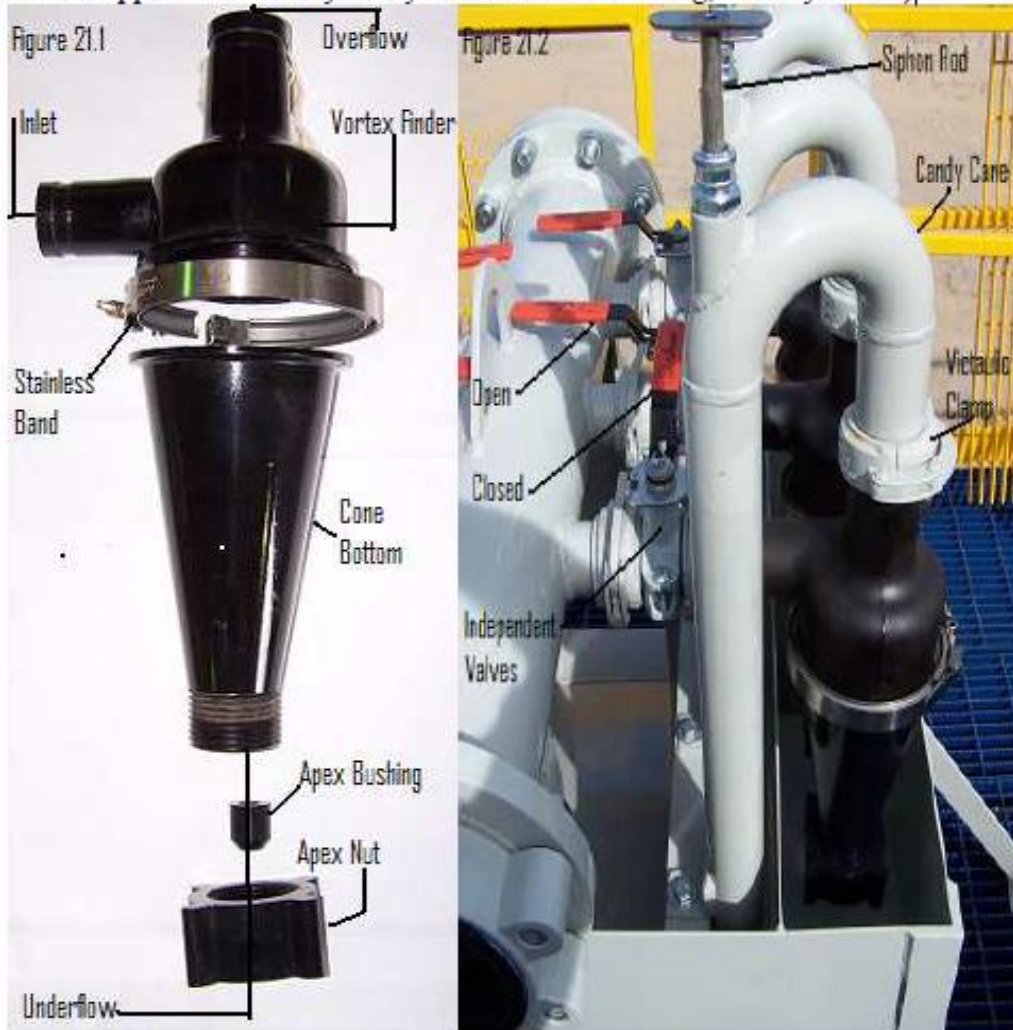
FIG. 21  
Mud Cleaner 4-4"/126E Shaker

- 19.1. After starting 4-4" pump make sure the de-silting hydro-cyclones manifold pressure is up to 22-25psi. Adjust the 6" Valve (P-1) to the adequate pressure, this valve is located at the front of 4-4" manifold  
Check each Four Inch Hydro Cyclone and spray pattern coming out of underflow. If there is a heavy spray coming out of the cones underflow, tighten Apex Nut until spray has diminished.
- 19.2. Check the manifold for excessive or inadequate pressure
- 19.3. If spray pattern is unchanged, a piece of debris might have lodged in the Vortex Finder of hydro-cyclone. Close independent valve for that cone, disconnect the



- Victaulic Clamp at the connection to Victaulic BF Valve, rotate port around for visual inspection and check the inside of cone. Rotate back to original position and reinstall gasket and clamp. Open valve, check spray
- 19.4. If no change, check the Apex Bushing by removing Apex Nut completely, remove Apex Bushing inspect for any debris or a clogged opening. Clean, reinstall Apex Bushing (flat side up and bevel side down) re-thread Apex Nut
  - 19.5. Whenever the Apex Nut and Bushing are removed check cone bottom for excessive wear. A dip above or very little shoulder where Apex Bushing seals, into cone bottom, is an indication of wear.
  - 19.6. If hydro-cyclone is reverberating or no solids/fluids are coming out, there is something stuck in the bottom of cone and solids are building up. Try turning the individual valve for that cone closed and then open to see if that improves performance, if still shaking, close valve for that cone, take off Apex Nut completely, pull out Apex bushing and try fluctuating valve (open, closed, open, closed).
  - 19.7. If debris is not dislodged, the cone bottom must be cleaned, by sticking a thin rod into the bottom. In case solids are still packed in the bottom of cone, the bottom section will need to be disassembled and the solid cleaned out. Shut valve for that cone, remove Stainless Steel Band, locate at the connection between Vortex Finder and Cone Bottom, and take off Cone Bottom, clean solids from inside. Reinstall cone bottom, band, open valve and check for leaks. If pressure is good, cone is not plugged; no excessive wear and no solids are coming out. Check bottom of cone for vacuum, if vacuum is present there are no solids to discharge.

21.8 The 4" cone assembly has the capability of fine tuning, by lifting the Siphon Rod up or down to control the vacuum break which will in turn affect the vacuum inside the cone. Up will lessen and down will increase vacuum. The Siphon Rod is located on the opposite side of hydro-cyclones overflow tubing, "Candy Cane")



## Equipment Maintenance

20. Lubrication and Maintenance: Listed below is a short overview of the require maintenance. All components will have a separate manual which will cover maintenance, lubrication, parts breakdown, schematics and trouble shoot.



\*\*\*\*Before working on any rotating machinery make sure that Lock Out/ Tag Out is followed.

- 20.1. Pumps: are greased for the first year. After the first year the bearing should be greased or changed to an oil bath. Grease with a high quality EP #2 (Exxon Unirex N2) grease as manufacture specifications. \*It is the techs opinion that five shot per insert every other month in a 24 hour operation and change to oil bath after the first year.
- 20.2. Electrical Motors: Are greased for the first year. 27g of Polynex EM103 Exxon or equivalent should used after that time period. Greased as per manufactures specifications: Refer to Electrical Motor Manual.
- 20.3. Vimar Vibratory Motors: The vibratory motors are greased for the life of the motor. Refer to Vimar Manual.
  - 20.3.1. The bolts that hold motor to motor mount should be re-torque after the first two weeks and re-checked every 3 weeks to 280 foot pounds
  - 20.3.2. If a tapping noise is noticed, re-torque all motor mount bolts.
  - 20.3.3. Side plate bolts should also be check and re-torque at the same intervals. They are located where the motor mount mates to the side of shaker basket.

## Electrical:

21. This is a brief trouble shoot and description of the Electrical components refer to the individual equipment manuals for schematics, full load amperage, high/low voltage connections, hertz deviation,



\*\*\*\*De-energize the entire system and disconnect power before any attempt to open panel or work on any electrical systems or wiring. Only a Trained Electrician operating in compliance with the NEC, Local Electrical Codes, Hazardous Location (if applicable) and Lock Out/ Tag Out Procedures and with approval of Site Specific per Location.

- 21.1. Pump Motors have the following electrical components: Breaker, Contactor, Overload, OFF/ON Hand Operators and Run Lights. This equipment is located in the Central Control Panel: Refer to Electrical Schematics MFS 1500.
  - 21.1.1. If an overload should trip right at the start up of motor it might be because of a rapid start/stop/start, causing a spike of amperage draw. Reset button on overload and try to start motor.
  - 21.1.2. A breaker that trips in the middle of a run situation needs further investigation.
  - 21.1.3. If a breaker should trip upon start-up, this is an indication of a possible direct short in motor, wiring or arched contactor. Shut off all Electricity until the problem is resolved.
  - 21.1.4. All Pump Motors are wired to Manufactures Delta configuration for High

Voltage: Refer to Motor Manual

- 21.1.5. The most important part of any motor is the name plate. Check the data on the plate before any connection.
- 21.2. Shakers have the following electrical components: Breaker, Contactor, Overload and OFF/ON Hand Operators. This equipment is located in the Central Control Panel: Refer to Electrical Schematics MFS 1500
  - 21.2.1. If the overload should trip right at the start up of the vibratory motor it might because of a rapid start/stop/start causes a spike of amperage draw. Reset button on overload and try to start motor.
  - 21.2.2. A breaker that trips in the middle of a run situation needs further investigation. Sometimes a small piece of wire may break off inside the junction box, located on the top of vibratory motor and moves around. A wire may break into causing a single phase condition. Do not re-set breaker without further investigation.
  - 21.2.3. Vibratory Motors are wired to Manufactures Star configuration for high Voltage: Refer to Vimar Motor Manual
  - 21.2.4. The most important part of any motor is the name plate. Check the data on the plate before making any connection.
- 21.3. Lighting Circuit have the following electrical components: Breaker, Contactor and OFF/ON Hand Operators:

## **Agitation**

22. Compartment 2 has a slurry jet (MUD GUN) that is located a few inches off the bottom. The jet is directed to cause a whirlpool affect keeping solids in suspension. This “mud gun” is jetted with the same fluid that is being pumped away for that compartment.
  - 22.1. Compartment Two jet is supplied by pump 2 and is controlled by Valve (D-2A)