

## Triflo International MFS 3000 T.I.



# Maintenance & Operation Manual

## MFS 3000 T.I.

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### INTRODUCTION

The Triflo MFS 3000 T.I. Micro Fluid System has been designed specifically to accept feed directly from the cuttings pit at a maximum rate of 450 GPM. In two (2) self contained stages, this system removes the solids from the dredged slurry that are larger in size than approximately 25 microns (um).

The Triflo MFS 3000 T.I. Micro Fluid System consists of the following equipment:

1. One (1) Triflo 148L-8 Linear Shale Shaker ([15-00-010](#))
2. One (1) Triflo 8-4S Mud Cleaner ([12-01-092](#))
3. Three (3) Centrifugal Pumps 250 Series 3 x 4 x 12
4. Leveling jacks on each corner of the trailer
5. Central Control Panel with motor starters and stop/start buttons for all electric motors located on top of system
6. Fixed handrails with toe plate for safety
7. Fiberglass grating covering all open areas of tank top and catwalks
8. One (1) removable man way with tank access in each compartment on side of tank
9. One (1) fold down mud slide for shaker
10. One (1) dump gate in each compartment
11. Complete plumbing system with valves
12. Trailer is complete with air brakes, highway marks and U.S. DOT lighting

In addition, the solids that are removed are dewatered to a stackable state, which can readily be moved with a front end loader and/or dump truck. The effluent or discharged fluid is pumped off by a centrifugal pump.

The process is continuous and operates completely mechanically without any chemical enhancement.

## SAFETY

- Before setting up or starting unit make sure all safety and environmental rules and regulations are in compliance and all personnel have the required Personal Protection Equipment.
- Before entering any tanks all confined spaces procedures, training, PPE and Equipment is in place and in compliance.
- The MFS 3000 T.I. 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.
- Only trained Personnel should operate or repair the equipment.
- The successful and safe operation of the equipment on this system depends on proper Handling, Installation, Operation and Maintenance.
- Power down and Lock Out/Tag Out starter before performing any Maintenance or Screen changes or any work on Rotating Machinery.
- Safety Shoes, Safety Glasses, Ear Protection and Head Protection are needed.
- If welding is done – **DO NOT** Ground welder through vibrating screen.
- No person should stand, hold or lean against the vibrating frames.
- Never lay tools or spare parts on the screens while operating.

## SET UP PROCEDURES

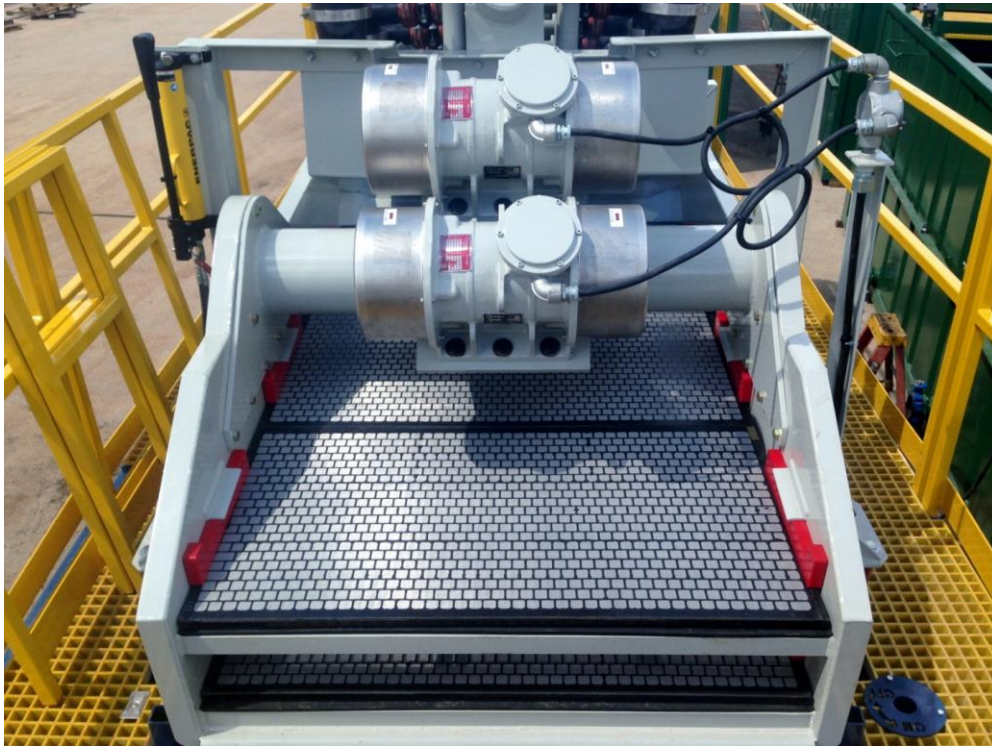
 **MAKE SURE THAT LEVELING JACKS ARE DOWN AND THAT THE TANK IS ON LEVEL GROUND AND SECURED IN OPERATING POSITION.**

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 main line electrical:
  - 4.1. Should only be accomplished by trained electricians within compliance applicable local electrical codes and/or NEC.
  - 4.2. Connect only to an opened circuit disconnected panel (fused or breaker) with over amperage protection.
  - 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. Remove shipping tie downs from shakers. Save tie downs for using when moving the tank to another location.
  - 5.2. Raise telescoping lights and lock in place.
  - 5.3. Open and tighten dump gates.
  - 5.4. Connect a hose to the Inlet of feed inlet from the Pit Pump.

## OPERATING PROCEDURES

1. Main Breaker/On.
2. Lights/On/Electrical Panel.
3. Open Suction Valves (1A, 2A, 3A)
4. Open Discharge Valves (1B, 2B, 3B)
5. Make sure Charge hose is connected (both ends) one to (3C or 3D) and the other back to reserve or drilling rig.
6. Open Mud Gun Lines Valve (1E, 1F, 1G)
7. Open 8-4S (2C) valve half way
8. 148L-8 Shaker/On/Electrical Panel
9. Mud Cleaner 8-4S/148L-8 Shaker/On/Electrical Panel
10. Inlet valves 7/8 of the way closed (PB1)
11. Pump supplying slurry (customers pump or pit pump)/On
12. Control Flow on the Shaker 148-8L by adjusting inlet valve (PB1)
13. When level in the primary compartment is 75% full, engage the 8-4S Pump/On/ Electrical Panel.
14. When level in compartment is 75% full engage charge pump/ON/Electrical Panel. This discharges clean mud to the hold tank or drilling rig.
15. You will have a control valve for the possum belly (PB1). Its function is to adjust inflow to the shaker.
16. Once this is set, it should not have to be readjusted unless there is a major change of the feed stream or your fluid levels need to be adjusted.
17. The electrical controls are unified into one panel for each 450 GPM system to enable operator control from one location.
18. Adequate walkways allow the operator to visually check the operation of all equipment and watch tank levels.
19. The weir divider in the tank is purposely set at a lower level to allow a small portion of the slurry to over flow the weir in a “clean to dirty” direction.
20. The point of entry for the slurry from the cuttings pit to the Triflo MFS 3000 T.I. is the Receiver tank (Possum Belly).
21. The possum belly is used to “kill” velocity of the flow and spread the slurry evenly across the scalper screen.
22. Solids removed by the screens are deposited on the discharge slide, while the fluid portion goes through the screen and drops into the tank section below.
23. This fluid is picked up by a centrifugal pump and discharged through the 8-4S Mud Cleaner.
24. Passing the slurry through these hydro-cyclones will remove sand and silt above 25 um.
25. This underflow is deposited on a drying shaker for dewatering and then to the discharge slide.
32. The overflow or effluent drops into the tank section to be picked up by a centrifugal pump for discharge of the operator’s choice.

## 148L-8 Elliptical PTP Shale Shaker ([15-00-010](#))



### GENERAL INFORMATION

The Triflo 148L-8 LINEAR PTP SHALE SHAKER (148L-8) is a compact and reliable solids removal method. This shaker easily removes down to 74 micron particles for proper mud weight maintenance and efficient solids control. This in turn will produce balanced mud rheology which will lengthen pump life, lessen daily fluid maintenance expense and increase penetration rates.

The intensity of vibrations may be varied to suite conditions by changing the position of the adjustable counterweights. Position of 100% gives the maximum, and each successive notch or setting reduces the motion. Position of 0% gives the minimum intensity of vibrations.

BOTH COUNTERWEIGHTS MUST HAVE THE SAME SETTING. This is easily checked by a scale located on both inner counterweights.

Replacement screens are available from a coarse 10 mesh screen to a fine 325 mesh screen and they are easily changed in the field. (See [Triflo.com](http://Triflo.com) for a full list of screens)

## POWER REQUIREMENTS

- 33. The Triflo 148L-8 PTP SHALE SHAKERS are normally wired at the factory for 460 V.A.C. 60 HZ, 3 Phase or 380 V.A.C., 50 HZ, 3 Phase.
- 34. If 230 V.A.C. 60 HZ, 3 Phase is needed it is necessary to:
  - 34.1 Rewire the motor.
  - 34.2 Replace or adjust overloads.
- 35. Turn the starter switch on and check the motor rotation.
  - 35.1 The two (2) motors should rotate towards each other, this necessary to obtain linear motion.

## SCREENS

- 36. The screens used on the 148L-8 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.
- 37. The 148-8L has seven (7) PTP Screens per Shaker deck, four (4) lower screens and three (3) upper screens.
- 38. Removal of 148L-8 PTP Screen Panels:
  - 38.1. Remove the lock wedge as described above
  - 38.2. Remove panels toward end of discharge.
- 39. When the panels are removed, clean and inspect rubber seals on shaker deck.
- 40. Installation of 148-8L PTP Screen Panels:
  - 40.1 Clean and inspect rubber seal on shaker deck as well as bottom of panel.
  - 40.2 Feed the panels from discharge end of shaker basket.
- 41. Push back and center panels in basket, make sure that the panels have cleared over holding hooks and panels are tight to the back.
  - 41.1 Place locking wedge blocks under retainers and strike firmly on the end toward retainer and then alternate side to side to insure proper seal and even pressure.

## SCREEN SELECTION

42. Screen to the flow or cut point, if discharging wet, correct by the following:
- 42.1. Too much flow. Adjust the liquid or slurry by lowering the flow.
  - 42.2. If Slurry Solid Content is high, dilute bring solids to liquid ratio to a manageable level.
  - 42.4. Check for screen blinding (solids stuck in the screen opening or fibers wrapping and/or matting). If blinding is apparent try going up to the next mesh size.
  - 42.4. Last choice, screen to lower mesh, this will let more solids through that section and may interfere with the downstream equipment.
43. Suggested screen selection for the shaker is Mesh 80-325. (This of course will differ depending on the drilling fluid being processed)

## CHANGING THE SPRING COILS ON VIBRATING DECK

44. The Spring Coils on the vibrating deck should be checked every 6 months. New springs measure 6 ¼" tall, when they collapse to less than 5 5/8" they should be replaced.
45. To replace springs you simply lift the shaker deck and swap in the new spring  
Part Number: [03-00-618](#)

Please see [triflo.com](http://triflo.com) for spring selection and replacement

## ADJUSTMENTS

46. Refer to the "Adjustment of Centrifugal Force Output" Section of the Vibratory Motor Manual.
47. The intensity of vibrations may be varied to suit conditions by changing the position of the adjustable counterweights. Position 100% gives the maximum, and each successive notch or setting reduces the motion. Position 0% gives the minimum intensity of vibrations.
- 47.1 **BOTH COUNTERWEIGHTS MUST HAVE THE SAME SETTING.** This is easily checked by a scale located on both inner counterweights.



## **MAINTENANCE and INSPECTION**

- 48. A regular schedule of complete dismantling, and inspection intervals assure maximum screen life and minimum downtime.
- 49. The customer should keep a complete record of all such preventive maintenance plus a record of any repairs.
- 50. Because the Triflo 148L-8 SHAKER is a vibratory machine, it is important to correct all minor troubles before serious damage develops.
  - 50.1. Replace faulty shaker springs and any missing bolts at once.
  - 50.2. Inspect the equipment for unusual noises and motion.
  - 50.3. Consult Triflo immediately in the event of any failure.

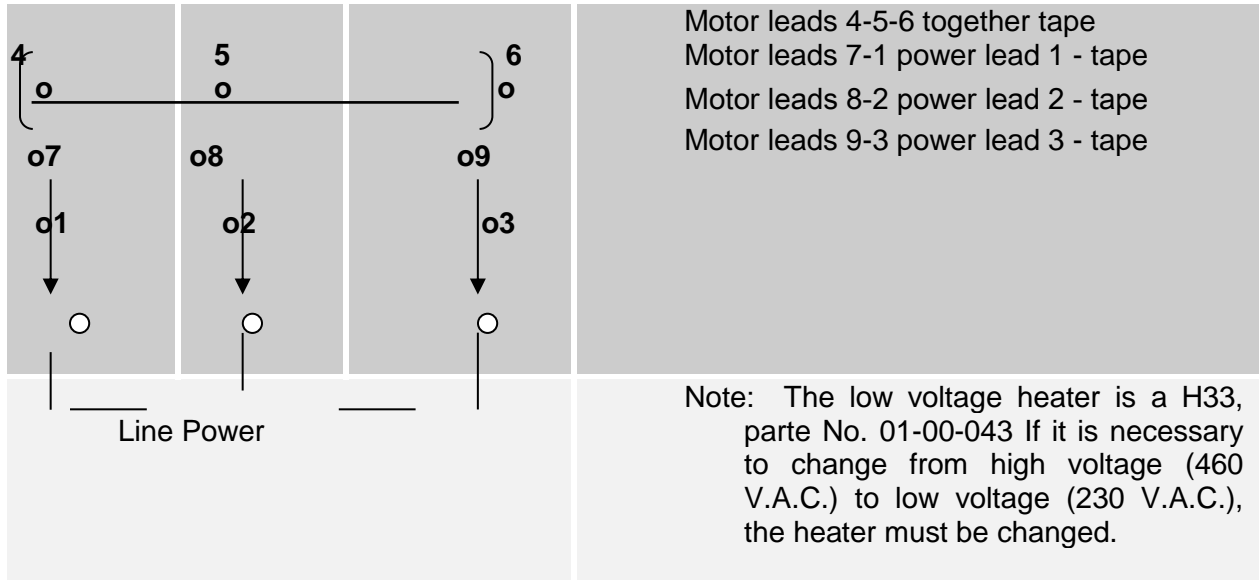
## **ELECTRIC MOTOR**

- 51. Check the mounting bolts.
- 52. Inspect the power cable for wear between the switch and the motor.
- 53. Vibratory motor mounting bolts are to be torque to 288ft/lbs. (This is done at the Triflo facility upon initial installation).

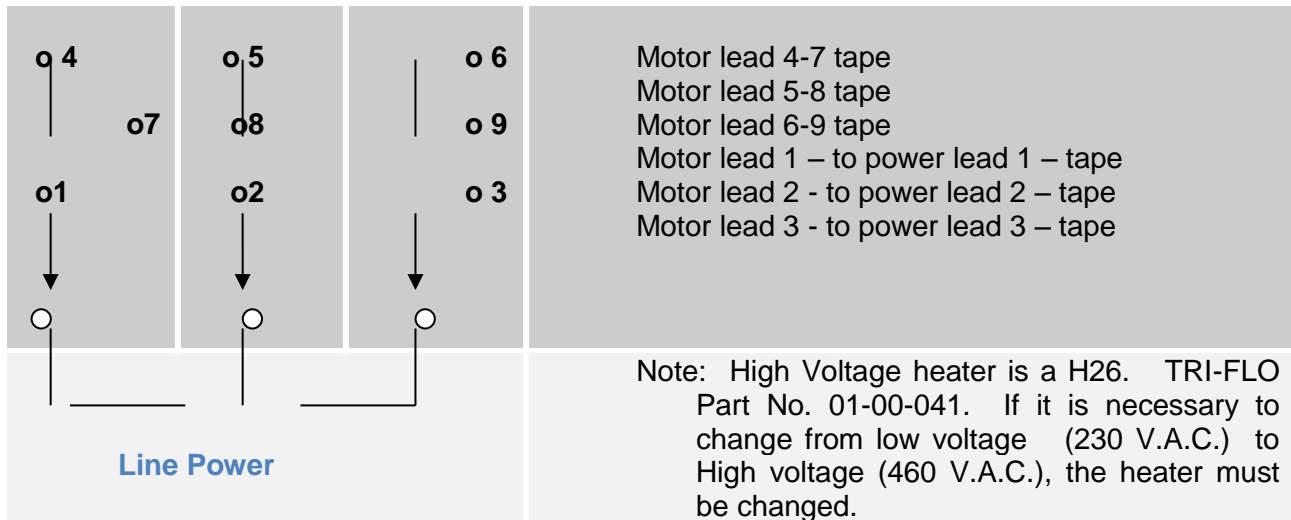
## **SHORT SCREEN LIFE**

- 54. Careless handling and installation.
- 55. Failure to clean all support surfaces prior to screen installation.
- 56. Improper installation of wedgelocks.
- 57. Cuttings build up under the edge of the screen.

### LOW VOLTAGE WIRING



### HIGH VOLTAGE WIRING



**NOTE:** (If the motor rotates in wrong direction reverse any two of the power leads.)

**NOTE:** IF THE MOTOR JUNCTION BOX IS REWIRED OR CHANGED, IT MUST BE PACKED WITH FOAM RUBBER TO PREVENT THE WIRES FROM RUBBING TOGETHER WHEN THE SHAKER IS VIBRATING



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### RECOMMENDED SPARE PARTS FOR ONE (1) YEAR

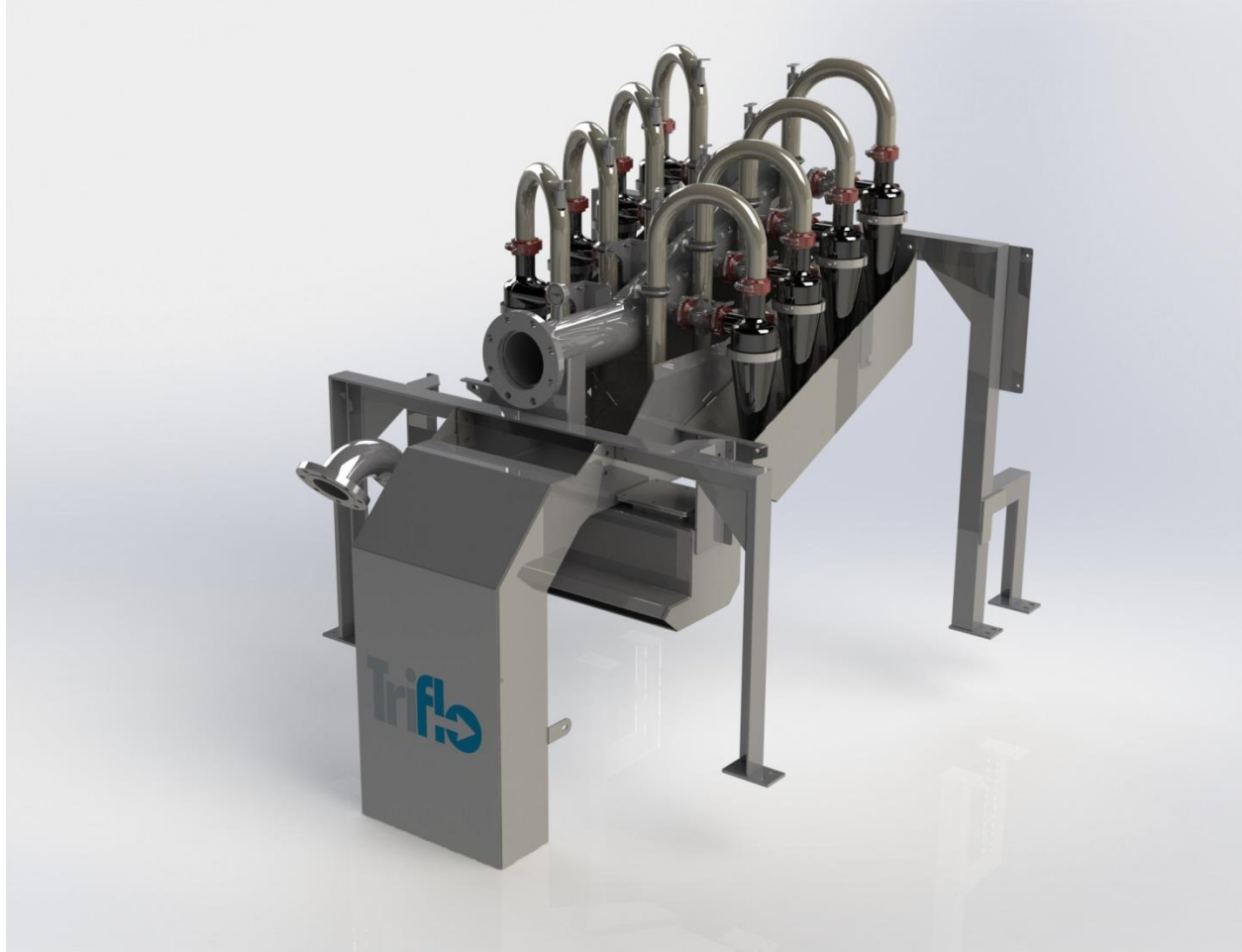
<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY</u>
01-01-179	VIBRATORY MOTOR XP 60Hz, 460v, 1750 RPM <b>(IF YOUR UNIT IS EXPLOSION PROOF)</b>	2
12-00-446	VIBRATORY MOTOR NON-XP 60Hz, 460V, 1750 RPM <b>(IF YOUR UNIT IS NON EXPLOSION PROOF)</b>	2
03-00-618	DECK SPRINGS 146L/148L	4
12-00-489	SCREEN WEDGE LOCKS	14

### PTP SCREENS

<u>Part Number</u>	<u>Description</u>
12-00-625	12 Mesh 146/148 PTP screen
12-00-491	20 Mesh 146/148 PTP screen
12-00-492	30 Mesh 146/148 PTP screen
12-00-493	38 Mesh 146/148 PTP screen
12-00-580	50Mesh 146/148 PTP screen
12-00-581	70 Mesh 146/148 PTP screen
12-00-650	80 Mesh 146/148 PTP screen
12-00-651	100 Mesh 146/148 PTP screen
12-00-164	110 Mesh 146/148 PTP screen
12-00-582	140 Mesh 146/148 PTP screen
12-00-652	175 Mesh 146/148 PTP screen
12-00-817	210 Mesh 146/148 PTP screen
12-00-818	325 Mesh 146/148 PTP screen

Please see [triflo.com](http://triflo.com) for any additional information on replacement parts

## MUD CLEANER 8-4S ([12-01-092](#))



### INTRODUCTION

The Triflo 8-4S Mud Cleaner is capable of processing up to 520 gallons per minute and can get do to cut point of approximately 35 microns. After processing the Effluent (Clean water) is discharged through the back down comer trough and the solids discharge from the cones are dumped on to the shakers that is operated in addition underneath the Mud Cleaner. This equipment is designed to remove the sand and silt sized particles before they have a chance to break down even smaller.



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The Triflo 8-4S Mud Cleaner is designed to save barite and remove low gravity solids larger than barite from weighted mud system. The Sand/Silt Separator hydro-cyclones will separate the low solid liquid slurry from the barite and larger than medium silt range particles. The barite and larger silt size particles will be directed on the screen surface to save barite and drilling fluid while the large silt size particles will go off the end of the screen.

On the unweighted mud systems the Triflo 8-4S Mud Cleaner paired with a Triflo shaker will reduce the costs by reduced jetting, less chemical replacement and less replacement of water and/or oil. With the use of 325 mesh screens it is possible to remove solids to approximately 25-35 micron silt size particle.

The Triflo 8-4S Mud Cleaner Shaker combination has several design characteristics that justify its ability to remove sand and silt sized solids from the drilling fluid. The feed manifold is designed to ensure balanced feed pressure into the hydro-cyclones. System balance is achieved by opening or closing individual control valves on each hydro cyclone, by lowering or raising the siphon tubes on each overflow tube, and/or increasing or decreasing the apex bushing size. Any of these adjustments can alter the GPM rate and handle most volume requirements. These adjustments can make particle interference, mud viscosity, and rejection volume less critical and enable the system to work more efficiently. The Triflo 8-4S Mud Cleaner can remove solids that are often found to be the cause of drill collar sticking and wear on mud pump expendables.

## OPERATION

1. The feed slurry of solids and liquid is fed through the inlet at a high velocity obtained by steady pressure of twenty-five (**25-32 psi**). The high velocity transmitted to the feed section creates a spinning velocity and resulting centrifugal forces. The vortex finder causes the stream to spiral downward towards the underflow solids discharge. Centrifugal force and inertia causes solids to settle outward toward the hydro cyclone wall, in a downward spiraling stream.
2. The solids separate according to size and weight of the particles. In the density range of solid particles in drilling fluids, size is of far more influence than the variations in density so that basically the biggest particles settle first and fastest.
3. The cone section narrows, inner layers of the downward spinning liquid turn back toward the overflow because of the increasing centrifugal forces near the center.
4. In Triflo's hydro cyclone, as the last of the liquid moves to the center and back upward toward the overflow, the downward spiraling solids continue out the apex, not being able to turn back because of their greater inertia and high downward velocity. Therefore, the actual solids removal at the underflow is by inertia, not by settling. The underflow rate and density varies with the volume and size of solids being separated to the underflow.
5. The underflow from the fluids, even under extreme conditions, will be approximately 40 GPM and ordinarily under 30 GPM. This makes it possible to use fine mesh screen (150-200 mesh) to clean all of the mud returning from the bore hole. 200 mesh screens have openings of 74 microns and the 150 mesh screens have openings of 104 microns. Theoretically, particles smaller than these opening should remain with the mud and larger particles and would be carried off the end of the shaker.
6. The TRIFLO Mud Cleaner 8-4S/148-8L PTP Shaker is operated at **25-32 psi** of pressure. A six (6) inch butterfly valve should be placed in the discharge line between the centrifugal pump and the manifold inlet. This valve would be used for adjusting the manifold pressure to **25-32 psi**.
7. Each hydro cyclone has a two (2) inch butterfly valve located before the feed inlet. This valve permits the operator to turn off each hydro cyclone individually for system balance and removal of the hydro cyclone, without shutting down the entire system.
8. Triflo does not recommend this valve to be used as a flow adjustment and should be either fully open or fully closed.
9. The siphon rod, located on the top of the overflow tubes are an adjustment of the underflow. When the siphon tube is completely down, the air entering the apex bushing is increased and less drilling fluid is permitted to spray out the apex of the hydro cyclone.
10. When a wetter underflow with finer solids is desired, the siphon tube should be raised. This adjustment will reduce the amount of air permitted through the apex and cause a wetter underflow to travel to the shaker screen. The distance the siphon tube should be raised will vary with the drilling conditions and no hard fast rule will apply.

11. The apex nut and apex bushing are designed for easy removal when plugging becomes a problem and are adjustable to permit the required amount of spray discharge desired. When a smaller opening is necessary tighten the apex nut to the desired setting. The tighter the adjustment the less air permitted to enter the bottom of the hydro cyclone. At times when plugging is a problem, the apex nut and the apex bushing can be removed. This may be necessary when drilling a surface hole or when large amounts of sand are present.



Over tightening of the apex nut and apex bushing will cause the hydro cyclone to become plugged. When the hydro cyclone becomes plugged severe erosion will occur in the feed section of the hydro cyclone and may damage the interior of the hydro cyclone. The damage will first be noticed in the zone of maximum wear and may make the hydro cyclone virtually useless.

## MAINTENANCE

1. The Triflo 8-4S Mud Cleaner is a high performance piece of mud equipment and requires a regular maintenance program.
2. Hydro cyclone wear and performance is highly dependent of the feed pressure and the conditions of the hydro cyclones. The pressure should never exceed 32 psi, as more than 32 psi will cause excessive wear on the hydro cyclones. Recommended pressure is between 25 and 32 psi, however this will vary depending on the concentration of solids.
3. Damaged or worn, hydro cyclones will not separate the fine drill solids from the drilling fluid and need to be checked periodically for wear.



## TROUBLESHOTTING

**PROBLEM:** Pressure at the manifold too low:

**CAUSE:** Is the pump impeller large enough to deliver at least 25 psi?  
Is the pump speed correct?  
Is the supply line from the pump to the manifold six (6") in diameter?  
Is the pump supplying any other piece of equipment?  
Is the supply line to the manifold plugged?  
Is the centrifugal pump suction plugged?

**PROBLEM:** No underflow or too little underflow:

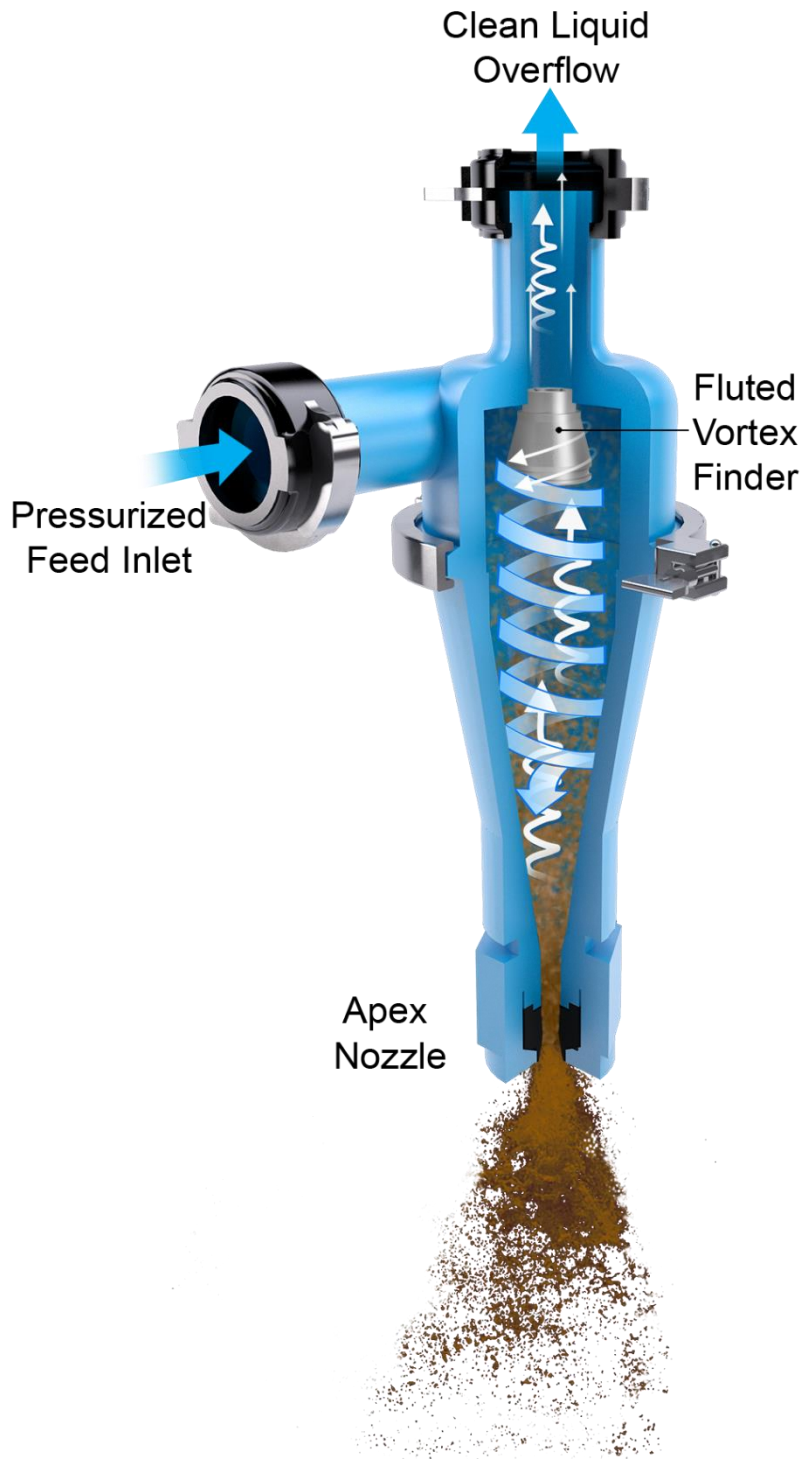
**CAUSE:** Is the feed pressure at least 25 psi?  
Is the apex bushing plugged?  
Is the apex bushing closed too tightly?  
Are there fine-drilled solids in the mud?  
Is the valve to the hydro cyclone open?  
Is the pump running?

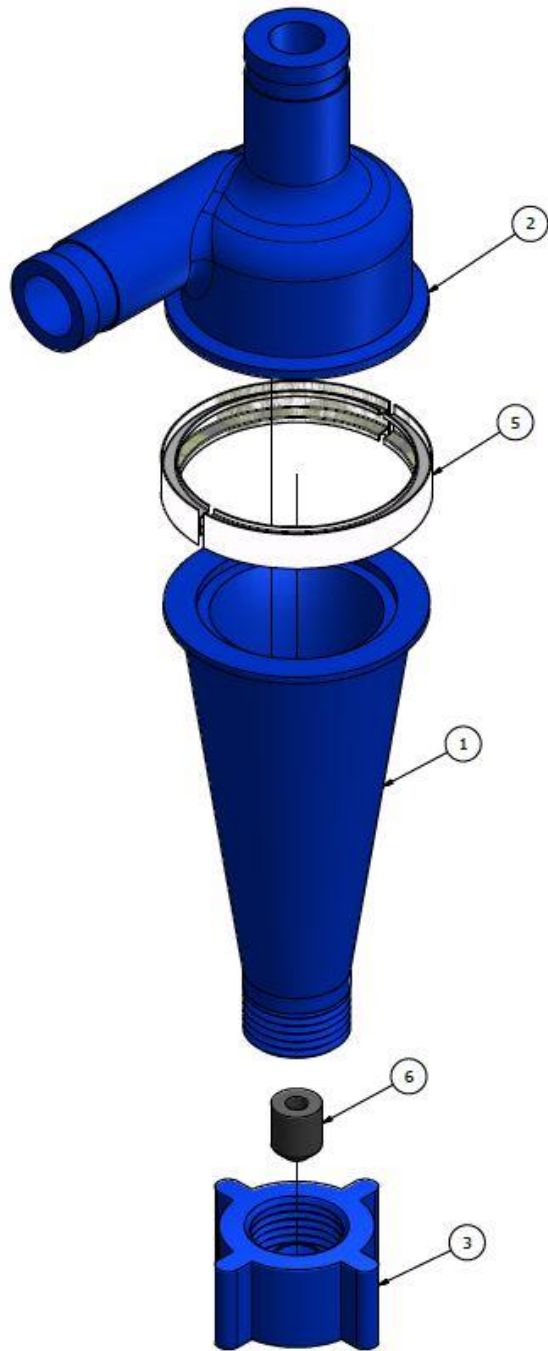
**PROBLEM:** Too much underflow:

**CAUSE:** Is the hydro-cyclone feed section or cone section damaged?  
Is the apex bushing in the hydro cyclone?  
Is the pressure too high?



**DRAWING – SPRAY DISCHARGE OF HYDRO-CYCLONE**





ITEM	PART #	DESCRIPTION
1	03-00-046	4" CONE LOWER
2	03-00-045	4" CONE INLET
3	03-00-047	4" APEX NUT
5	03-00-049	STEEL BAND
6	03-00-048	APEX BUSHING



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## RECOMMENDED SPARE PARTS

1. Always order spare parts from TRIFLO INTERNATIONAL, INC.
2. This is particularly true of bearings, which may not be available from the local bearing sources because of the special internal clearance requirements.
3. It is advisable to stock the following spare parts so that breakdowns can be repaired promptly and costly delays eliminated.

## SPARE PARTS FOR ONE (1) YEAR

NAME OF PARTS	QUANTITY	TRIFLO PART NO.
Hydro Cyclone Complete 4"	8	03-00-044
Victaulic Coupling 2"	24	00-00-047
Victaulic Gasket 2"	24	00-01-008
Siphon Rod Seals	8	01-00-011
Pressure Gauge	1	02-00-020
Apex Bushing	8	03-00-048
Apex Nut	8	03-00-047
Vibratory Motor XP If your unit is explosion proof	2	01-01-179
Vibratory Motor Non XP If your unit is non explosion proof	2	12-00-446
Deck Springs 146L/148L	4	03-00-618
Screen Wedge Locks	14	12-00-489



## Transportation Checklist

- \_\_\_\_\_ 1. Collapse and secure mud slide braces
- \_\_\_\_\_ 2. Ensure shaker tie downs are in place and tight. Shaker must not bounce.
- \_\_\_\_\_ 3. Ensure that shaker screens and wedges are secured properly in place or removed from shakers
- \_\_\_\_\_ 4. The Generator doors are secured/closed properly and disconnect battery
- \_\_\_\_\_ 5. The electrical panel doors are secured/closed properly
- \_\_\_\_\_ 6. The grounding rod is secured
- \_\_\_\_\_ 7. The light poles are retracted and secured
- \_\_\_\_\_ 8. Both pins at front of trailer must be secured and in place so trailer does not tilt up
- \_\_\_\_\_ 9. Pit pump, pit pump electrical cord, and hose are secured to trailer
- \_\_\_\_\_ 10. Check all lights that they are working on trailer
- \_\_\_\_\_ 11. Check air pressure on trailer tires
- \_\_\_\_\_ 12. Check lug nuts on trailer tires
- \_\_\_\_\_ 13. Ensure that all four (4) landing gears are up and pinned
- \_\_\_\_\_ 14. Ensure that the tank is empty and dump gates/o rings are secured



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**OR TOLL FREE: 1-888-255-2440    EMAIL: [info@triflo.com](mailto:info@triflo.com)**

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**NOTES:**



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