

# FOREWORD

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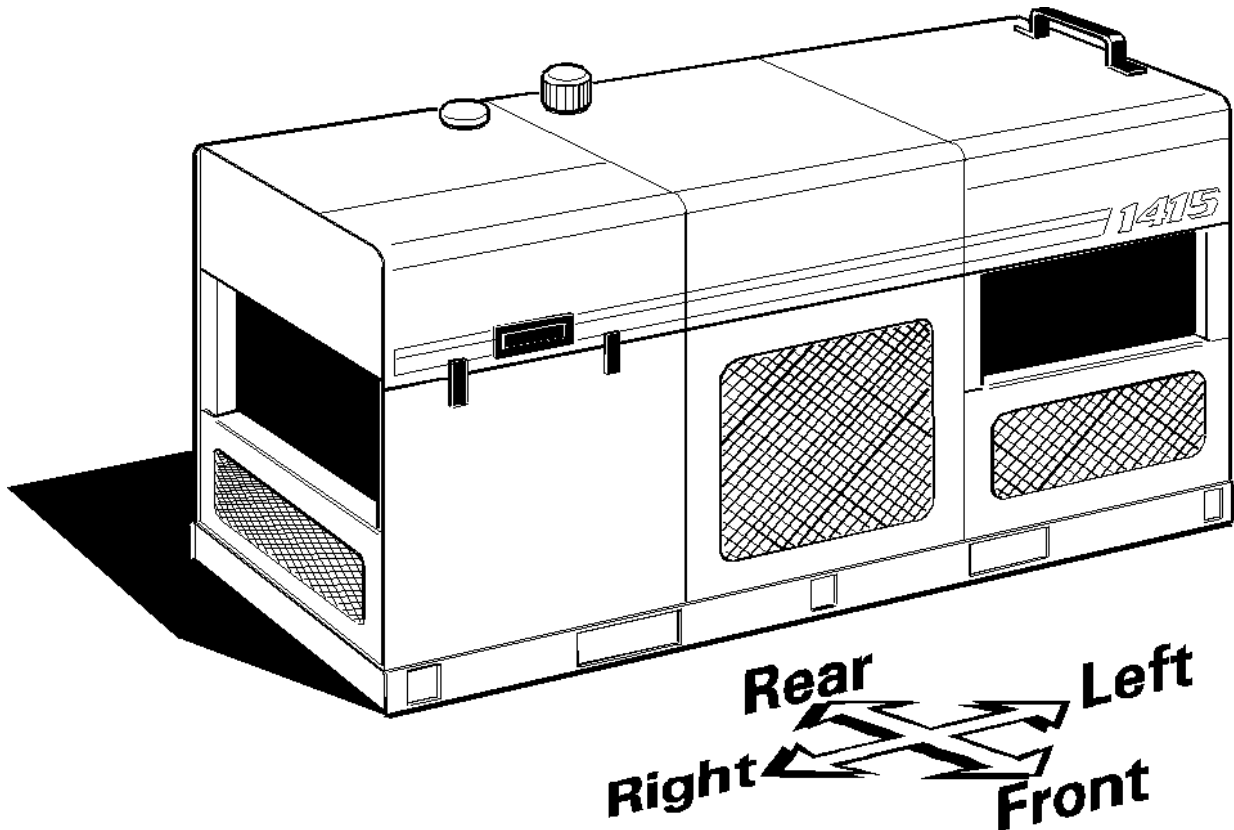
Congratulations on your purchase of the StraightLine 1415 Mud skid. StraightLine has a long tradition of "going the extra mile" to provide the best quality and most profitable-to-operate underground installation equipment in the world. This manual is intended to provide important safety information, operation instructions and maintenance information which will help you realize the maximum life and performance out of your StraightLine equipment.

Read this manual carefully and completely before you start and operate the equipment for the first time. If the equipment is to be used by an employee, rented or loaned, give instructions on the safe operation of the machine and make sure that the operator reads and understands this manual.

The orientation terminology used in this manual is front, rear, right, left, top & bottom as shown in the diagram below.

StraightLine Manufacturing, Inc. has an active program of product improvement and reserves the right to change both equipment and specifications at any time as part of normal product development and improvement. Some product changes may have been made after this manual was printed. For the latest information on your equipment, contact your StraightLine Dealer.

Thank you for buying the 1415 Mud Skid from StraightLine Manufacturing, Inc.



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## Chapter 1

# SAFETY

This section outlines basic safety procedures for using and your StraightLine Mud Skid. Read this entire section before using your equipment. It does not include all precautions for using the drilling unit. **You must read both this manual and the Operators Manual for the Drilling Unit for all the Safety Precautions.**



This safety alert symbol appears in this book and on the machine. When you see this sign, carefully read and understand the cause of possible injury or death. The safety alert symbol is used with one of three words to indicate the level of hazard.

**▲ DANGER** indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

**▲ WARNING** indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

**▲ CAUTION** indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

Two other notices you will find in this manual are:

**IMPORTANT:** can keep you from doing something that can damage the machine or someone's property,

**Operation Tip:** help you do a better job, or make your job easier in some way.

## Operator Training

Safety precautions and safe operation habits must be the principal consideration *before* you begin work and continue throughout the job.

Initial training shall be done at non-hazardous site, such as an open field, free of utility easements. Training shall include the proper use of safety, protective, and locating equipment.



## Operating Guidelines

- Read the operators manual and understand all operating procedures and operational safety requirements before starting this equipment.

- Additional safety information is included in component manuals supplied with this unit. Read and follow all precautions before operating any jobsite equipment.
- Do not operate any equipment unless you have been properly trained.
- Identify the location and type of all jobsite hazards and utilities, overhead, as well as buried.
- Review jobsite security. Erect proper warning signs and barriers. Identify authorized personnel.
- Wear personal protective equipment and clothing.
- Know the proper emergency procedures and have emergency telephone numbers at hand.
- Be alert to any change from normal during a boring job.

**+LOOK** for leaks, loose connectors, loosening anchors, changes to drilling fluids, problems with tools or drill pipe, or other equipment.

**+LISTEN** for unexpected engine lugging, bearing noises, high pressure squeals and any unexpected or unusual rattles, knocks, screeches, or any change to the normal operating noises.

**+SMELL** for unusual odors such as hot oil, burning insulation, natural gas, etc.

**+FEEL** for changes in how the equipment is operating.

**+STOP** and correct anything you see, hear, smell, or feel that is potentially unsafe.

## Safety Alerts

**▲ DANGER** Electric Shock.

Unprotected bystanders could be electrocuted if they come in contact with any part of the boring equipment, including the mudskid, if a "hot" line is hit.



**▲ DANGER** Electric Shock  
Always use personal protective gear such as safety glasses, hard

hats, electrical insulating gloves, and boots to guard against possible contact of hazardous underground utilities.

**Important:** Check the electrical protection gloves and boots for wear and damage. Know and follow the testing procedures recommended by the manufacturer of these items.

**▲ WARNING** Electrical shock possible. Do not operate the equipment when lightning is possible. Serious injury or death may result.



**▲ DANGER** Turning Shaft. Operate this machine with the shields in place to avoid being crushed or caught. Do not wear jewelry or loose clothing. Always shut unit down when performing maintenance.

**▲ WARNING** Turning Shaft

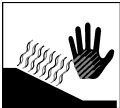
Casual bystanders may not be aware of possible hazards and must not be allowed near the equipment.



**▲ DANGER** High Pressure Fluid. Hydraulic fluid escaping under pressure can pierce skin and cause injury or death. Check for leaks using a piece of cardboard, not your hand.

**▲ WARNING** Crushing Weight.

Unit must be mounted to a firm stable structure. Operating this equipment with it unsecured, on unstable supports or surfaces, may cause the machine to tip over.

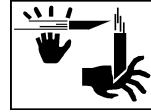


**▲ WARNING** Hot Muffler. Don't Touch! Skin contact with hot muffler may cause a serious burn. Locate muffler before reaching in to check oil level.



**▲ WARNING** High Pressure Fluid. Drilling fluid escaping under pressure can pierce skin and cause injury or death. Do not uncouple quick disconnects while fluid pump is on.

**▲ WARNING** Battery Explosion and Acid burn. Battery explosion can injure and blind! Acid can burn skin and blind! No smoke, flame or sparks around battery. Do not short across terminals. Wear eye, face, and skin protection when handling the battery.



**▲ WARNING** Crush Points. Keep hands away from edges of closing lid. Edges of lid can pinch and mangle trapped fingers and hands. Close lid by using handle on top and keep free hand outside the enclosure edges. Always wear appropriate protective gloves.



**▲ WARNING** Avoid Inhalation of Dust When Mixing Dry Drilling Clays! Work in ventilated Area. Wear breathing protection. Prolonged breathing of dust particles can cause serious respiratory illnesses.



**▲ WARNING** Fire or Explosion Fuel and fumes can catch fire or explode and cause serious burns or death. No smoking or open flames! Shut off engine before fueling! Wipe up all spills.

**▲ WARNING** Do Not Alter Controls. Do not tie down controls. If releasing a control lever does not cause the motion being controlled to stop, shut down power source and get the unit repaired immediately.

**▲ WARNING** Moving Traffic.

Moving vehicles present a hazard, wear high-visibility clothing, and properly secure the jobsite.

**▲ CAUTION** High noise levels can cause hearing loss. Always Wear hearing protection.

**▲ CAUTION** Slips and falls possible. Do not step in any spilled material (drilling fluid, hydraulic oil, etc.). Falling on slippery surfaces may cause serious personal injury.

**IMPORTANT:** Adequate lighting must be provided when operation of this unit occurs beyond daylight hours.

## Emergency Procedures For Hits

**Do not** let anyone touch the unit while boring. All persons who come in contact with the boring equipment should always wear protective clothing such as Class 2 electrical gloves and boots while boring.

**BE ALERT!** Hitting a "hot" line may be indicated by arcing at the front of the drill rack; a warning on a strike alert device, nearby power outage; smoke, explosion, arcing, etc. on or around nearby electrical transformers and equipment; or nothing at all. Most electrical strikes are not immediately noticeable but are still potentially lethal.

## Electrical Hits

If an electrical hit occurs, do not panic.

If you are on the machine, stay on the machine.

If you are standing on the ground, stay where you are and don't touch any equipment.

Stepping off a well-grounded equal potential mat may cause electrocution. If you are off the equipment, remain still and stay off the equipment.

Warn everybody in the area that an electrical strike has occurred and to stay away from the mudskid, drill rack, or any other equipment in the area.

If the operator is on the mat or otherwise in contact with the drill rack, he should retract the downhole tool and drill pipe away from the line. Pull back the carriage to the top of the rack to attempt to disengage from the electrical contact.

**▲ WARNING** Electrical Shock.

Do not try to disconnect a drill pipe or joint until electrical power is shut down. Do not rely on electrical circuit breakers as power can be rerouted and circuit breakers can be reset.

Contact the utility company immediately so they can shut off power and arrange repairs.

## Gas Or Liquid Line Hits

**▲ DANGER Explosion Possible.** If a gas or volatile liquid line hit occurs, immediately shut down any power sources such as generators, hydraulic power packs, or vehicles and leave the area. If the power sources cannot readily be shut down, leave the area immediately!

Contact the utility company immediately and warn people in the area. Do not return to the area until given permission by the utility company.

## Fiber Optic Cable Hits

**▲ CAUTION Do not** look into the severed ends of the cable! Laser light will cause permanent eye damage or blindness. If you do not know what kind of cable you have cut, do not look into the ends in case it is a fiber optic cable.

## Chapter 3

# Operation

### Pre Operation Check List

#### Engine

- Oil Level
- Air Cleaner
- Cooling air intake areas are clear
- Shrouds and guards are in place
- Battery and Cables

#### Hydraulics

- Oil Level
- Controls for proper Operation
- All components for leaks, damage

#### General

- Proper Lubrication
- Installation and condition of all Shields
- Condition of Decals
- Loose components

### Setup

**▲ DANGER** Read operators manual and understand all operating procedures and operational safety requirements before starting this equipment.

1. Upon arrival at the job site, park the trailer on a level area that is close enough to where the drill rack will be anchored to allow the umbilicals to be easily connected.

**Important:** Do not operate the engine in excess of 30° incline in any direction.

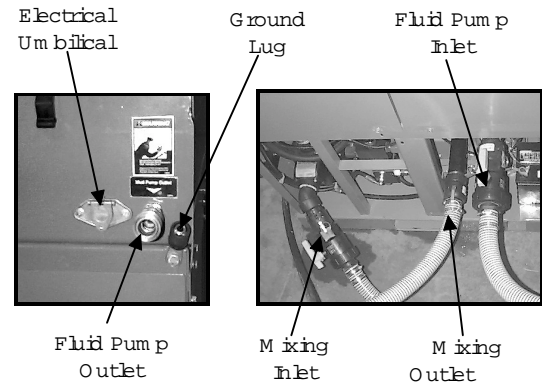
2. Use wheel chocks and the tongue jack to secure the trailer before unloading the drill rack.
3. Erect and activate the safety barriers, traffic cones, hazard lights, etc. around the site to prevent non-authorized personnel from coming in contact with the equipment.

### Fluid Connections

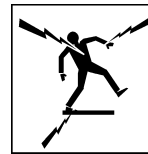
Review the illustration below, making sure the connections are attached properly.

**Important:** Make certain that all hose connections are air-tight. An air leak in the suction line to the fluid pump may prevent

priming, and cause cavitation which will reduce pump output and cause a “hammer” condition.

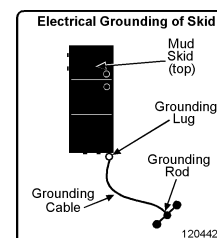


### Electrical Shock Protection



**▲ DANGER** Electric Shock  
Always wear electrical insulating boots and gloves.

1. Put on the electrical safety boots and gloves.
2. Auger the ground stake into the ground until no more than 1 foot is left exposed. If the ground is extremely dry, pour water down and around the ground rod to help with a proper ground. The earth ground should be tested with a device such as a Megger to determine proper resistance.
3. Review the illustration below, making sure the connections are attached properly to the ground rod.



## Starting the Engine

1. Verify the switch on the Fluid Control Module is OFF, and the Mixing Control Valve lever is in the neutral position.
2. Set the Throttle Control at the mid point and on the Kohler engine pull the choke control to ON position.
3. Start the engine with the key switch, release as soon as the engine starts.

**Important:** Do not crank the engine more than 10 seconds at time and wait 1 minute between attempts. Failure to follow these guidelines can burn out the starter.

4. On the Kohler engine, gradually return the choke control to the OFF position after the engine starts. Allow the engine to warm at idle. For a warm Engine return the choke to OFF position as soon as engine starts.

## Stopping the Engine

1. Verify the switch on the Fluid Control Module is OFF, and the Mixing Control Valve lever is in the neutral position.
2. Set the Throttle control at the mid point, allow the engine to run a minimum of 15 seconds, then stop the engine.

## Mixing

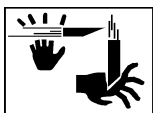
### Bentonite



**▲ WARNING** Avoid Inhalation of Dust When Mixing Dry Drilling Clays! Work in ventilated Area. Wear breathing protection. Prolonged breathing of dust particles can cause serious respiratory illnesses.

**▲ CAUTION** Improper lifting. Always use proper lifting techniques when handling heavy bags of material. Keep back straight and lift with the legs.

1. Verify the shutoff valves in the hoses to the tank are open.
2. Verify that the Mixing Control Valve is Closed. Fill the hopper with dry material, it will hold approximately 60 pounds (27kg).



**▲ WARNING** Crush Points. Keep hands away from edges of closing lid. Edges of lid can pinch and mutilate trapped fingers and hands. Close lid by using handle on top and keep free hand outside the

enclosure edges. Always wear appropriate protective gloves.

1. Start the Engine, and set to high Throttle position.
2. Move the Mixer Control Valve to the Mix position, to start the circulation of drilling fluid.
3. Slowly open the Mixer Control Valve a small amount.

**Operation Tip:** Do not open this valve more than ¼ travel of the handle. Excessive flow of bentonite will not mix properly, and likely cause the venturi to plug up.

**Operation Tip:** Always close this valve before reducing engine speed to prevent a “back-flush” into the hopper and plugging of the venturi.

6. Allow the mixer circuit to run as required to thoroughly mix the fluid and bring it to full “yield”.
7. Move the Mixing Control Valve lever to the Stir position to agitate the drilling fluid and keep the bentonite in suspension during the bore.

**Important:** For best results, always read and follow the instructions and advice of the companies that produce the drilling fluid ingredients.

### Polymer

1. Verify the shutoff valves in the hoses to the tank are open.
2. Verify that the Mixing Control Valve is Closed.
3. Start the Engine, and set to high Throttle position.
4. Slowly add the desired amount of Polymer to the fluid in the tank. Do not pour polymer in the hopper.
5. Allow the mixer circuit to run as required to thoroughly mix the fluid and bring it to full “yield”.

**Important:** For best results, always read and follow the instructions and advice of the companies that produce the drilling fluid ingredients.

## Combinations

When conditions require the combination of both bentonite and polymer, mix the bentonite first and then add the polymer.

## Drilling Fluid Control

The Fluid Control Module is tethered on a 100 foot (30m) umbilical and is to be positioned at the drill rack for easy control of the fluid during operation. The Fluid Control Switch is a three position switch.

*Off:* Push the switch down towards the bottom of the control module. This position turns all fluid off.

*Full Fill:* Push the switch up towards the top of the control module, this momentary position allows the fluid system to operate at full capacity to quickly fill the drill string after breaking a joint.

*On:* When the Full Fill position is released, the switch returns to ON (middle) position which directs the circuit to regulate the drilling fluid flow according to the setting of the Variable Flow Control knob.

Refer to the drill rack Operation Manual for complete procedures to control the fluid during a bore.

## Drilling Fluid

If the unit is not going to be used again the same day, the drilling fluid must be off-loaded and the entire fluid system flushed with clean water or antifreeze in freezing conditions.

**IMPORTANT:** Drilling Fluid is a non-hazardous material but should be disposed of in a responsible manner. Obey all local regulations regarding disposal of drilling fluids.



**▲ DANGER** High Pressure Fluid. Drilling fluid escaping under pressure can pierce skin and cause injury or death.

## Shut Down

When pumping bentonite it is important to flush the entire fluid circuit at the end of each day with fresh water. The small water tank is for fresh water or "RV" type antifreeze (polypropylene glycol), for conditions below freezing.

**Important:** This type of anti-freeze is not to be used with drilling fluid while boring.

## Flush Fluid Pump Circuit

1. Close the ball valve in the large hose to the bottom of the tank to prevent the bentonite mixture from entering the water pump.
2. Open the ball valve in the hose to the fresh water/antifreeze tank and allow fresh water or antifreeze to enter the pump.
3. Run fluid to the drill rack until fresh water or antifreeze begins to run out of the saver sub at the drill carriage.
4. Next plug the wash wand onto the umbilical and pull the trigger several times. This will force the pressure up to relief setting and allow the fresh water or antifreeze to run through the water relief bypass valve.

## Mixer Circuit

1. Remove the suction and discharge hoses to the mixer pump and allow to drain.
2. Remove the drain plug at the base of the pump.
3. Re-install the drain plug, and pour 2 cups of antifreeze into the mixer pump.



## Chapter 4

# Maintenance

The 1415 Mud Skid is equipped with a Kohler Commander 25 Gasoline powered engine or a Deutz/Ruggerini RD 211 diesel engine. Refer to the respective engine manufacturer's Operation and Maintenance Manual for complete maintenance instructions and procedures.

### Kohler Engine

**Oil:** Check the engine oil level daily. Use an oil that meets API classification **SG** or **SH**. For a new engine, change the oil after the first 5 hours and from then on, every 100 hours. It requires 2.5 quarts (2 Liters) of oil with filter change. Refer to the engine manual to determine the proper viscosity for your local conditions.

**Oil Filter:** Change the engine oil filter every 200 hours (every other oil change).

**Air Cleaner:** Inspect the Precleaner daily and replace the filter every 100 hours. Check all connections for mechanical tightness. In case of leakage, replace necessary parts or gaskets if adjustment does not correct the fault. Inspect for mud caking or signs of excessive wear or damage.

**Fuel:** This engine uses **unleaded fuel** only with an octane rating of 87 or higher.

**Fuel Filter:** This unit is equipped with a filter located to the rear of the engine outside the cowling, and should be replaced every 500 hours.

### Deutz/Ruggerini Diesel Engine

**Oil:** Check the engine oil level daily. Use an oil that meets API Service CD-MIL. L.2104 D. For a new engine, change the oil after the first 5 hours and from then on, every 100 hours. The sump capacity is 3 quarts (2.7 liters) of oil. Refer to the engine manual to determine the proper viscosity for your local conditions.

**Oil Filter:** Change the engine oil and filter every 200 hours.

**Air Cleaner:** Inspect the Precleaner daily and replace the filter every 500 hours. Check all connections for mechanical tightness. In case of

leakage, replace necessary parts or gaskets, if adjustment does not correct the fault. Inspect for mud caking or signs of excessive wear or damage.

**Fuel:** Diesel Fuel used in the unit should have a sulfur content of less than 0.5%

**Fuel Filter:** This unit is equipped with a filter located to the rear of the engine outside the cowling, and should be replaced every 500 hours.

**Fuel Tank:** Check fuel level daily, the capacity of the tank is 12 Gallons (45Liters).

### Hydraulics

**Hydraulic Fluid:** Check hydraulic fluid level daily. The level should be slightly above half full when the oil is cold to allow for normal expansion. Replace the hydraulic oil annually. The factory fill oil is Mobil HP 10-30. Engine oil with an API classification of SE is recommended, see below for the proper weight.

Above 40°	use	10-30w
15-40°	use	20-20w
0 - 15°	use	10w
0° - Below	use	5w-20

**Hydraulic Reservoir:** The reservoir has an 30 gallon ( 113 Liters) capacity.

**Hydraulic Filter:** Replace the return filter after the first 50 hours of operation, thereafter, check the filter condition indicator weekly and replace the filter element as required.

To check the Indicator, run the engine at high Idle with the oil at operating temperature (70° or above), read the gauge, if the indicator needle show in the Red , replace the filter element.

### Drilling Fluid System

**Drilling Fluid Pump (FMC):** Check the oil level daily at the fill plug on the crank case. After the first 100 hours of operation, drain the oil from the crankcase. Thereafter, drain the oil and clean the plug annually.

If oil has a milky appearance, this indicates water is present. Refill with 2 quarts of grade SAE 30 non-detergent oil.

**Flushing:** When using Bentonite, it is important to flush the entire water circuit at the end of each day with fresh water. The small tank is for fresh water or antifreeze (Dowfrost) when the drilling unit maybe exposed to below freezing conditions. See Chapter 3 Operation for the procedure to flush the system.

**Fluid Pump Valves:** The FMC water pump has four suction valves and four discharge valves located in the head of the pump at the fluid end. The amount of wear and service required to maintain the valves varies with the amount of Bentonite being pumped, properly mixing the Bentonite, and the amount of care used in flushing the system clean at the end of each day. Using contaminated water with foreign matter in it or not flushing the circuit clean each day will cause the valves to fail prematurely. These failures are not covered under warranty.

When a valve is worn out, stuck open, or unseated there will be a noticeable hammering sound at the pump and the hoses will be cavitating. If the Bentonite is mixed to a good smooth consistency there will be less chance of plugging up the valves. If the pump sucks in a large clump of Bentonite, the valve can become stuck open allowing the abrasive mixture to jet through the valve. This may cut the valve like a torch.

Another cause of hammering valves and cavitating is air in the circuit. Check all fittings on the suction side of the pump for cracks or looseness.

If the water has been drained from the pump, or the valves have recently been serviced, the pump may need to be primed to remove the air. Before priming the pump, try shutting off the flow to the pump at the ball valve for a second or two. Then open the ball valve fast. The quick suction may flush out the air. Use caution when doing this. Running the pump dry will ruin the valves.

To replace the valves follow the instructions in the FMC manual.

## Mixing System

There are no points on the pump which need lubrication. The shaft seal is self-lubricating, and designed to handle clean or dirty liquids.

## Maintenance Schedule

### Daily

- Fill fuel
- Engine Oil Level
- Air Cleaner
- Cooling Air Passages
- Hydraulic Oil Level

### Every 25 Hours

- Service the air Precleaner Element
- Inspect Hydraulic Filter Condition Gauge
- Inspect Fluid Pump Oil Level

### Every 100 Hours

- Service Air Cleaner Filter
- Kohler Change Oil
- Remove cooling shrouds and clean
- Inspect oil cooler fins

### Every 200 Hours

- Kohler Inspect spark plug condition and gap
- Kohler Change oil filter
- Deutz Change Oil and filter
- Inspect Fluid Pump Drive Coupling

### Every 300 Hours

- Deutz Inspect Valve Clearance

### Annual or 500 Hours

- Deutz Clean and set injectors
- Kohler Have starter serviced
- Replace Oil in Fluid Pump

## Chapter 5

# Troubleshooting Charts

### Engine Troubleshooting

Symptom	Cause	Remedy
Engine won't turn over	Weak Battery	Charge battery or replace if required.
	Defective ignition switch	Contact StraightLine Dealer
	Defective starter	Contact StraightLine Dealer
Engine turns but won't start	No fuel	Add fuel
	Wrong fuel	Replace with correct fuel
	Dirt or water in fuel	Drain, clean fuel system, replace fuel filter and fill with clean fuel
	Air in fuel system	Bleed air from fuel system
	Clogged air filter	Replace air filter
Lack of engine power	Wrong fuel	Replace with correct fuel
	Dirt or water in fuel	Drain, clean fuel system, replace fuel filter and fill with clean fuel
	Air in fuel system	Bleed air from fuel system
	Clogged fuel filter	Replace fuel filter
	Clogged air filter	Replace air filter
	Wrong engine oil	Replace with correct oil
	Engine overheats	Check cooling air flow contact StraightLine Dealer if required
	Fuel system out of calibration	Contact StraightLine Dealer
Internal engine wear	Contact StraightLine Dealer	

### Electrical Troubleshooting

Symptom	Cause	Remedy
Low battery voltage	Low water level	Add water
	Alternator not charging	Contact StraightLine Dealer
	Defective battery	Replace battery
	Defective battery cables	Inspect, clean, and tighten cables
	Continuous drain on battery	Find draining load and correct.
Control Module does not operate the fluid pump	Umbilical disconnected	Connect umbilical
	In-Line Fuse Blown	Replace 3 Amp Fuse
	Mud skid engine not running	Start engine
	Mud skid battery dead	Charge, or replace battery
	Defective solenoid valve	Contact StraightLine Dealer
	Defective solenoid switch	Contact StraightLine Dealer

## Hydraulic Troubleshooting

Symptom	Cause	Remedy
No hydraulic function on any circuit	No hydraulic fluid	fill reservoir with proper fluid
	Pump drive sheared	Contact StraightLine Dealer
Slow or weak hydraulic operation in all functions	Low hydraulic fluid level	Add hydraulic fluid
	Clogged hydraulic filter	Replace filter
	Aerated hydraulic fluid	Contact StraightLine Dealer
	Worn pump	Contact StraightLine Dealer
	Worn hydraulic motor	Contact StraightLine Dealer
	Cold hydraulic fluid	Allow machine to warm up before operating hydraulics
	Engine RPMs set too low	Contact StraightLine Dealer
	High operating temperature	Contact StraightLine Dealer
Aerated hydraulic fluid	Low hydraulic fluid Incorrect hydraulic fluid	Add hydraulic fluid Replace with correct fluid
	Water in hydraulic fluid	Drain and replace fluid
	Air leak in pump suction line	Contact StraightLine Dealer
High hydraulic fluid temp	Defective fan	Replace Fan Motor
	Blown fan motor fuse	Replace 30 Amp fuse
	Restricted air flow to oil cooler	Clean and remove obstructions from oil cooler
	Excess engine temperature	Contact StraightLine Dealer
	Low hydraulic fluid	Add hydraulic fluid
	Excess relief bypassed oil	Do Not hold functions at relief pressure for more than 2 minutes
	Worn hydraulic pump	Contact StraightLine Dealer
Noisy hydraulic system	Low hydraulic fluid	Add hydraulic fluid
	Incorrect hydraulic fluid	Replace with correct fluid
	Cold hydraulic fluid	Allow machine to warm up

## Drilling Solution System Troubleshooting

Symptom	Cause	Remedy
Fluid pump will not run	Umbilical disconnected	Connect umbilical
	Blown 3 amp fuse	Replace fuse
	Defective solenoid valve	Contact StraightLine Dealer
	Umbilical disconnected	Connect Umbilical
Fluid pump runs but low or no flow	Worn or stuck pump valves	Replace pump valves
	Fluid pump relief valve set too low or stuck open	Contact StraightLine Dealer
	Clogged fluid filter	Clean and or replace filter screen
	Defective solenoid valve	Contact StraightLine Dealer
	Clogged jets	Clean jets and filter screens

# 1415 Specifications

Length	72 Inches	183 Cm
Height	44 Inches	112 Cm
Width	29 Inches	74 Cm
Weight	1500 Lb.	680 Kg
Fuel Capacity	12 Gal	45 Liters
Hydraulic Oil Capacity	30 Gal	113 Liters
Fluid Pump	FMC E0410C	
Fluid Pump Speed	600 RPM	
Mixer Pump	Banjo 200 PI-HY	
Max Fluid Pressure	1500 PSI	107 bar
Max Fluid Flow	14 GPM	53 l/m
Max Hydraulic Pressure		
Fluid Pump Circuit	2500 PSI	180 bar
Mixing Circuit	2200 PSI	155 bar
Max Hydraulic Flow		
Mud Pump Circuit	9.5 GPM	35 l/m
Mixing Circuit	19 GPM	71 l/m

Engine (Gasoline)	Kohler	
Model	Command Ch25	
Specification #	68506	
Power	25 hp	18.4 kW
Max Engine Speed	3600 RPM	
Oil Capacity (With Filter)	2.1quarts	2 Liters
Operator Noise Level	95 dB (A)	
Exterior Noise Level	86 dB (A)	

Engine (Diesel)	Ruggerini/Deutz	
Model	RD211	
Power	21.4 Hp	15.7 kW
Max Engine Speed	3600 RPM	
Oil Capacity (With Filter)	3 Quarts	2.7 Liters
Operator Noise Level		
Exterior Noise Level		