

StraightLine Horizontal Directional Drill

Model 905

Repair Manual



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FOREWORD

Congratulations on your purchase of the StraightLine 905 Directional Boring System. 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 maintenance and repair 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, operate, or work on 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 and repair of the machine and make sure that the operator reads and understands this manual and the operator's 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 905 Directional Boring System from StraightLine Manufacturing, Inc. and if you have any questions pertaining to any repairs of the 905, which is not covered in this manual, please contact your StraightLine dealer

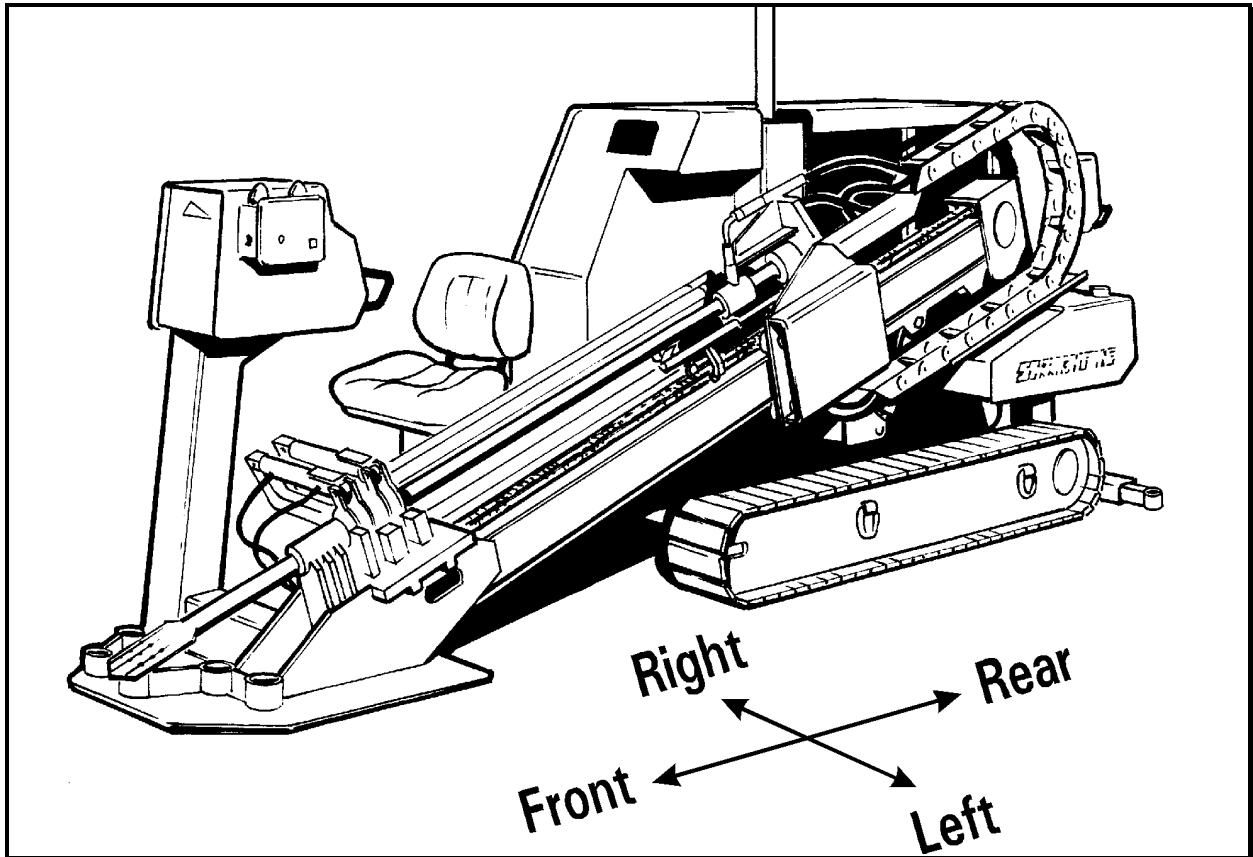


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Glossary

Bar

Measurement of pressure (metric).

Bentonite

Finely ground clay commonly mixed with water for drilling solution.

Breakout

Loosening a section of drill pipe prior to removing it from the drill string.

Breakout Wrenches

System of manually held or hydraulically powered friction wrenches for holding drill pipe from rotating when adding drill pipe. It is also used for loosening drill pipe joints when removing drill pipe.

Breakout Wrench

The rear most built-in drill pipe wrench which is hydraulically rotated and used when removing drill pipe sections when pulling back.

Carriage

The traveling unit, which pushes and rotates the drill pipe.

Control Panel

Panel containing all gauges, hydraulic valves, electric switches, and buttons required to operate the drill rack, and or power unit.

Drill Head

Assembly of cutting bit, steering shoe, and transmitter housing.

Drill Pipe

Sections of high-strength steel pipe with threaded tool joints attached. Drill pipe is sized for length, diameter, and thread size for each model of Drill Rack.

Drill Rack

The mobile portion of the drilling system capable of rotating and pushing drill stem into the soil.

Drilling Solution

The fluid mixture, which is pumped out of, and through the drill head to facilitate boring.

Drill String

The assembly of a drill head and all attached drill pipe.

GPM

Abbreviation of gallons per minute, a measure of liquid flow rate.

Hydraulic

Any function operated by liquid under pressure

Jets

Replaceable fluid outlets found in both drill heads and back reamers.

Makeup

Adding new sections of drill pipe to the already in-use drill string.

Makeup Wrench

The forward-most built-in drill pipe wrench on the drill rack used in both adding and removing drill pipe sections.

Pilot Bore

Process of guiding the drill string to a specific location, according to the planned bore path.

Pull Back:

Operation of pulling the material being installed into the finished bore path, usually combined with the back reaming operation.

PSI

Abbreviation of pounds per square inch, a measure of pressure.

Pushing

Thrusting the drill string without rotation to change the direction of the pilot bore.

Rotation

Rotating the drill string to give a straight pilot bore.

Rotation Motor

Hydraulic motor located in the carriage, which rotates the drill string.

Saver Sub

Replaceable connector through which the drill pipe is attached to the carriage. (Same as sub saver)

Stake

Headed steel pins, which are driven into the ground through holes in anchor plates.

Steering Shoe

Replaceable shoe on the drill head, mounted at an angle which causes the drill string to veer when being pushed without being rotated.

Strike Alert

An alarm system, which indicates the presence of electrical current in the drill string.

Sub Saver

Replaceable connector through which the drill pipe is attached to the carriage. (Same as saver sub)

Thrust

Force used in moving the carriage and drill string linearly, measured in pounds.

Thrust Chain

The roller chain, which moves the carriage up or down the drill rack chain bed.

Thrust Motor

Hydraulic motor located at the back of the main frame which powers the chain that draws the carriage up or down the chain bed.

Torque

Force used in rotating, measured in ft.-lbs. inside drill head necessary for accurate locating.

Umbilical

Drilling fluid hoses and Electrical cables connecting the drill rack to the mud system.

Viscosity

Measure of fluid thickness, measured in seconds. Sometimes expressed as weight.

Water Swivel

Fluid elbow at the carriage, which connects the drilling fluid to the drill pipe.

Water Pump

Hydraulically driven high-pressure pump, which pumps the drilling fluid.



905 Drill Mechanical Check-List

| |
|-------------------|
| Delivery Date: |
| Unit Model: |
| Unit Serial No. |
| Engine Serial No. |

| |
|-----------------------------------|
| Inspected By: |
| Date Inspected: |
| Number of Items Needing Repaired: |
| Date Repairs Were Made: |

Routine Checks

| Check | OK | NOT OK |
|-----------------------------|-------|--------|
| Hour Meter Reading @ | Hours | |
| Engine Oil Level | | |
| Engine Cooling System | | |
| Hydraulic Oil Level | | |
| Thrust Chain Tension | | |
| Track Chain Tension x 2ea. | | |
| Rod Guide Condition | | |
| Ground Lug & Cables | | |
| Fuel Tank Level | | |
| Lubrication Points | | |
| Carriage Rollers, Condition | | |

| Check | OK | NOT OK |
|--------------------------------|----|--------|
| Hydraulic Pump | | |
| Quick Disconnects | | |
| Hose Routings | | |
| Hoses & Fittings, Condition | | |
| Hydraulic Oil Filter Condition | | |
| Wrench Alignment & Condition | | |
| Battery Condition | | |
| Charging System Operation | | |
| Air Filter Condition | | |
| Seat Condition | | |
| Paint & General Appearance | | |

Operational Checks

| Check | OK | NOT OK |
|-----------------------------|----|--------|
| Ignition Start/Stop | | |
| Low Oil Pres. Warning Light | | |
| Alternator Warning Light | | |
| Pre-Heat Circuit | | |
| Engine RPM'S 1100/3000 | | |
| Thrust Forward | | |
| Thrust Reverse | | |
| Rotation Forward | | |
| Rotation Reverse | | |
| Breakout Wrench | | |
| Make-up Wrench | | |
| Breakout Cylinder | | |
| Hyd. Cooling Fans | | |

| Check | OK | NOT OK |
|---------------------------------|----|--------|
| Throttle Switch | | |
| Emergency Stop Switch | | |
| Drilling Solution Switch | | |
| Strike Alert | | |
| Right Tram | | |
| Left Tram | | |
| Tilt | | |
| Level | | |
| Stake Driver/Puller | | |
| Track Spread | | |
| Emergency Stop Switch | | |
| All Controls Operate Per Decals | | |
| Cooling Fan Override Switch | | |

Hydraulic System Pressures

| Check | OK | NOT OK |
|--|----|--------|
| Check Level With Hydraulic System at Operating Temp. | | |
| Main Relief (Thrust) 3000 psi. | | |
| Main Relief (Rotation) 3000 psi. | | |
| Rotation Port Reliefs 2900 psi. | | |

| Check | OK | NOT OK |
|-------------------------------|----|--------|
| Make-up Wrench 2400 psi. Min. | | |
| Breakout Wrench 2400 psi Min. | | |
| Stake Driver/Puller 2000 psi. | | |
| Filter Gauge in Green Scale | | |

“STRAIGHTLINE 905 MAINTENANCE”

905 Maintenance Schedule:

Daily

- Engine Oil Level
- Engine Fuel Level
- Engine & Hydraulics for Leaks
- Hydraulic Oil level
- Drilling Fluid Pump Oil Level
- Drilling Fluid Filter

Weekly

- Grease Lubrication Points
- Inspect Wrench Cogs
- Hydraulic Filter Condition Indicator
Replace Filter as needed
- Inspect Battery Fluid Level
- Inspect Thrust Chain
- Replace Hydraulic Filter elements after first 50 hours

Every 250 Hours

- Change Engine Oil & Filter
- Change/Clean Engine Air Filter
- Inspect & Clean Engine Cooling System
- Inspect & Clean Battery Cables
- Inspect & Adjust Engine Rpm's
- Check/Change Fuel Pre-Filter

Annually

- Change Drilling Fluid Pump Oil
- Replace Hydraulic Oil & Filter

Engine:

The 905 is equipped with a Hatz 2 cylinder, air-cooled diesel engine model number 2L40C. Refer to the engine manufacturer's Operation and Maintenance Manual for complete maintenance instructions and procedures.

Oil:

Check the engine oil level daily. Change the engine oil every 100 hours in dirty or dusty conditions, and every 250 hours in relatively clean conditions. It requires 4.5 quarts (5 Liters) of oil with filter change. The oil must meet API classifications of CD / CE / CF4. Refer to the engine manual to determine the proper viscosity for your local conditions.

Oil Filter:

Change the engine oil filter at every oil change.

Air Cleaner:

Inspect/clean the air cleaner every 250 hours and replace 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. There is a warning lamp in the engine control box that will light up if the filter is plugged.

Fuel Filters:

This unit is equipped with 2 fuel filters. The Pre-filter is located to the rear of the engine outside the cowling, and should be replaced every 500 hours. The main Fuel Filter is located inside the engine cowling and should be replaced every 1000 hours.

Fuel Tank:

Check fuel level daily, the capacity of the tank is 15 Gallons (55 Liters). Fuel used in the unit should have a sulfur content of less than 0.5%

Throttle Solenoid:

Engine rpm's are Low Idle 1100 rpm's; High Idle 3000 rpm's.

▲ Caution: Do not exceed the maximum operating engine speed.

Hydraulics:

Hydraulic Fluid:

Check hydraulic fluid level daily. The level should be slightly above half full in the sight gauge 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 | 30w |
| 15-40° | use | 20-20w |
| 0 - 15° | use | 10w |
| 0° - Below | use | 5w-20 |

Hydraulic Reservoir:

The reservoir has an 18-gallon (68 Liter) capacity.

Hydraulic Filters:

Replace the return filter in both the 905 unit and the 150G Mud Skid after the first 50 hours of operation, thereafter, check the filter condition indicator weekly and replace the filter elements as required, or at least once each year. To check the Indicator, run the engine at high Idle with the oil at operating temperature (70° or above).

Thrust Chain:

The thrust chain will begin to stretch and loosen up after it wears in. Visually inspect chain tightness during pull back to monitor chain tension. An extremely loose chain may get bunched up at the sprocket during a tough pull-back breaking the chain or damaging the thrust motor, sprockets, and bearings.

Thrust Motor:

The Thrust Motor is coupled directly to the Thrust Chain Drive Sprocket, there is no maintenance except for the lubrication of the Thrust bearings listed in the chart on page ___ in this manual.

Track Drive Motors:

The Track Drive Motor is coupled directly to the Track Drive Sprocket, there is no maintenance except for the lubrication of the Track Drive bearings listed in the chart on page ___ in this manual.

Track Idler:

The Track Idler is coupled directly to the Track Adjustment, there is no maintenance except for the lubrication of the bearings listed in the chart on page ___ in this manual.

Track Adjustment:

The Tracks will begin to stretch and loosen up after they wear in. Visually inspect the Tracks for tightness. Loose Tracks may make popping noises, slip or stick, and possibly slip off the Drive sprocket.

Carriage Roller Bearings:

Maintain the carriage lubrication intervals as outlined above. Monitor the bearings for flat spots and check for free-play in the carriage daily. Failure to replace worn bearings may result in accelerated wear to the drill stem and saver sub.

Water Swivel Filter:

The filter for the water swivel is located inside the

steel pipe on the inlet to the Water Swivel, on the carriage. Use a suitable filter for the type of drilling fluid used. If using straight water a 100-mesh filter is sufficient. If the fluid is a very thick mixture of Bentonite, use the largest mesh filter available (20 mesh). Check the filter at least once on every bore and carry plenty of spares to replace as necessary.

Rotation Motor/Spindle:

The rotation motor is coupled directly to the spindle shaft. Maintenance for the lubrication of the spindle bearings is listed in the chart on page ___ in this manual.

Saver Sub:

The purpose of the saver sub is to allow a replaceable tool joint for protecting drill stem and the carriage spindle. Always use plenty of thread lube on the threads every time you load another piece of drill stem. Constantly monitor the threads on the saver sub for wear. When the sharp edges of the threads begin to show rounding or, if the shoulders of the joint will not come together, completely bottoming out, it is time to replace the saver sub. Failure to maintain the saver sub will result in costly damage to the drill stem. Never run the drill stem directly to the carriage spindle shaft. Always carry an extra saver sub to allow servicing when needed. Try to replace the saver sub at the end of a day to allow ample curing time for the Loctite. See Maintenance Procedures to replace the saver sub.

Wrench Cogs:

Wrench cogs have a varying life expectancy. Depending on the manner of operation and the amount of drilling time they encounter. When the cogs fail to grip they need to be replaced. When new cogs fail to grip the drill stem, the wrench bodies will probably also need to be replaced.

Drilling Fluid System:

REMOTE MUD SYSTEMS:

If the mud system is of the remote type, such as a StraightLine 150G, which uses the on/off switch mounted in the front control panel of the 905 drill, the wiring in the drill to this switch only completes the circuit to the mud skid and does not connect to the drill's 12 volt system, and as such, is not depicted in the 905's electrical schematic or trouble shooting guide.

