Hydraulic Starting System Installation Operating Manual

1.0.0 COMMISSIONING OF SYSTEM

On new system installations, note the following for your records:
- Equipment compliance to the recommended specification.
- Equipment accessibility.
- Hose sizes and lengths.

1.1.0 PRIMING OF SYSTEM

- Fill reservoir with recommended oil (MIL-5606-H) within ISO 32 to 46 (SUS 140 - 230).

- Actuate hand pump and expel air by loosening outlet connection on the pump. Retighten connection.

- Bleed the system via the hand pump by loosening the fittings at the start valve inlet. Retighten all fittings when oil escaping is free from air (no bubbles).

- Charge the system by means of the hand pump. Resistance will be built rapidly as the oil pressure (shown on the pressure gauge) reaches the accumulator gas precharge pressure. This should correspond with the precharge indicated on the accumulator nameplate. Continue pumping until the system pressure of 3000 PSI is reached.

- Check all connections for leaks.

CAUTION: If any leaks are found do not attempt to tighten fittings under pressure. Release pressure via the bleed screw on the hand pump. Once satisfied that no pressure remains, replace thread sealant and/or tighten fitting and again pump by hand until the system pressure is reached.

1.2.0 STARTING PROCEDURE

1. Ensure engine is in a serviceable condition (oil level, fuel supply, coolant, etc.). Fuel system must be primed.
2. Disconnect engine from load. Alternatively if load cannot be disconnected, ensure that it is safe to drive the load once the engine rotates and / or fires.
3. Activate starter valve.
4. If engine fails to start, recharge accumulator with hand pump and repeat above step.
5. Release starter valve as soon as the engine has started.
6. Repeat the starting procedure a number of times to completely purge the system of air.
7. If the system is equipped with an automatic recharge pump, check that it is charging the accumulator(s) to the system pressure (3000 PSI).

- If the engine turns rapidly for approximately 3 - 5 seconds and does not start, the problem is not with the starting system. If oil emerges from the starter motor, check that the inlet and outlet connections are correctly connected to the pressure and return lines.

- On new installations, record the return line backpressure approximately 2 inches from the starter motor outlet. The backpressure must not exceed 75 PSI.

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• Hydraulic starting systems require virtually no maintenance apart from replacing the filter element and a periodic check of the gas precharge pressure and the system pressure. Prior to starting any repair work, ensure that the hydraulic system pressure is released. If in doubt seek professional service.

• Provided that the above points are observed, a hydraulic starting system can be expected to give years of trouble free life, but remember never try to overcome an engine or fuel problem by operating the hydraulic starter above its design pressure (3000 PSI).

• When having equipment repaired, ensure that the work is carried out by a factory approved repair facility that is equipped to test all components involved. This is particularly important for the accumulator which must be:

- subjected to a rigorous visual and dimensional inspection
- pressure tested under controlled conditions
- provided with a test certificate stating satisfactory completion of inspection and testing

1.3.0 MAINTENANCE

To ensure economic and trouble free starting cycles, the basic preventative maintenance principles have to be adhered to. Undertake all inspections when the machine is at ambient temperature.

1.3.1 DAILY

• Check system pressure at the pressure gauge which should read 3000 PSI as standard when the system is fully charged.

• As the system cools down it is normal for the pressure to drop slightly, however this should stabilize. If it continues to drop inspect for leaks.

1.3.2 WEEKLY

• Check oil level, which should be at the low-level mark when accumulator is at system pressure. A sudden drop of the oil level with no signs of external leakage in the system could indicate the loss of the accumulator gas precharge pressure.

• Visually inspect all hydraulic connections and hoses for leaks and retighten if necessary. This should never be done with the system under pressure. First, release system pressure by loosening the bleed screw on top of the hand pump (Fig 1). Once you are satisfied that no pressure remains, retighten the fitting or replace the damaged hose or component. Retighten the bleed screw on the hand pump. Pump the system up to 3000 PSI. Inspect that the leak has been eliminated.

• In the unlikely event that a leak should develop between the motor body and port plate, retighten the 8 bolts for starter motors as follows:

CMO / CMA Series - 110 IN-LBS
CMD / CME Series - 140 IN-LBS

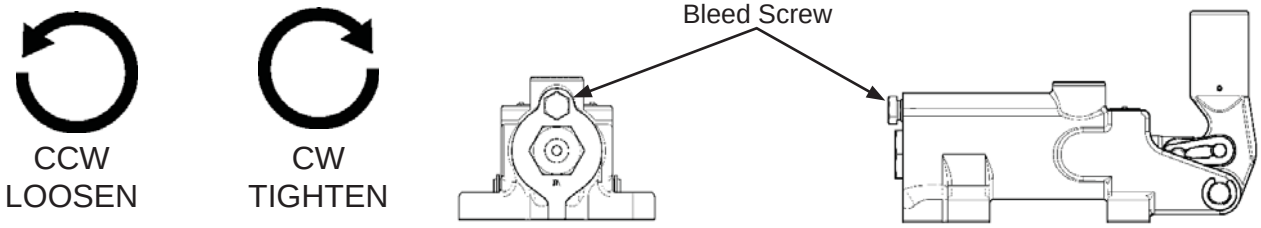

Figure 1

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1.3.3 QUARTERLY

• Check accumulator precharge. A simple method is to shut the engine off, release system pressure via the bleed screw on top of the hand pump then retighten the bleed screw (Fig 1) and actuate the hand pump. The pressure will rapidly rise and then stabilize. This pressure corresponds with the accumulator gas precharge. If, however, this pressure rapidly rises to 3000 PSI, it indicates that the accumulator has lost part or all of its gas precharge.

• To check the RPA unloading valve integrity, the engine has to be running. The cut out pressure of 3000 PSI is confirmed at the daily inspection (see above). Open the hand pump bleed screw (Fig 1) to reduce the system pressure slowly. Note the pressure reading as the pump starts to recharge the starting system. This pressure should read between 2400 PSI and 2700 PSI. Retighten the bleed valve(Fig 1). The pressure should rise to 3000 PSI at which point the valve should unload.

1.3.4 BI-ANNUALLY

Twice per year or every 2000 engine running hours (approximately 1500 starts) the high and low pressure filter elements must to be replaced. Very dusty environments require more frequent replacement.

FRH-300116 - Element Part Number: FE-200575
FRK-300382-3A - Element Part Number: FE-200575

1.4.0 TROUBLESHOOTING

Often times, when an engine does not start, the user will remove and/ or replace starting system components unnecessarily. Frequently, the issue with the engine not starting lies outside of the starting system. See the following sections of this manual for commonly reported issues and how to correct them.

If the engine turns at a fairly high speed (200 RPM or greater) for a reasonable period of time (3-5 seconds) but still does not start:

- check the engine for fuel at the injectors
- check for faulty protection system
- check for blocked air intake (filter or butterfly valve)
- check for correct compression, etc.

If the enclosed maintenance schedule is adhered to, any problems arising should be identified in time and therefore avoid costly breakdowns.

Always check to ensure that the correct equipment is installed (e.g. accumulator and motor size) and that the test equipment, especially the pressure gauge, is in good working order. Ensure that the equipment that has been commissioned at initial installation must match the original parts. Kocsis Technologies, Inc. strongly recommends using factory genuine equipment in the hydraulic starting systems.

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1.4.1 ENGINE DOES NOT TURN

• Verify that system pressure is at 3000 PSI.

• When the starter valve is actuated, observe if system pressure drops. If pressure is constant, it indicates a seizure. This could be in the engine and caused by mechanical failure. In this instance, refer to engine manufacturer's guidelines. If system pressure drops, inspect for leaks. If none are apparent, the failure is most likely within the starter motor. Remove the motor and inspect the drive. If the pinion teeth are damaged inspect the flywheel ring gear for damage, before rotating the engine to another position. Replace with a new starter or one known to be in good working order. Consult a factory representative for guidance.

Do not, under any circumstances, attempt to actuate the starter if it has been detached from the engine. The combination of the reactionary torque and high speed of the drive mechanism can be considered violent and may result in damage to equipment and/or personal injury.

• In the event the hydraulic accumulator has lost its gas precharge. This can be verified by using the hand pump. After a few strokes of the hand pump, appreciable resistance will be felt, and the pressure will immediately climb to 3000 PSI. Pressure can then be relieved by opening the hand pump bleed screw (Fig 1). In this event the accumulator should be inspected prior to re-applying a gas precharge. In multiple accumulator systems, each accumulator must be checked individually. (A short cranking cycle indicates failure of one accumulator in multiple accumulator systems.)

1.4.2 SLOW CRANKING OF ENGINE

• If the cranking cycle is slow and extended indicating starter motor overload, check for engine problems and/or excessive parasitic load. Ensure hydraulic fluid viscosity is within ISO 32 to 46 (SUS 140-230).

• Inspect circuit for correct hose/piping sizes. Also check for hose/piping damage, deformed hoses/piping or obstructions inside hydraulic lines.

• Ensure correct system pressure and precharge pressure. As a quick check, release system pressure at the hand pump bleed screw (Fig 1) and retighten screw. Once the hand pump is primed, commence pumping by hand. The pressure indicated on the gauge should increase rapidly until the accumulator gas precharge is reached after which the rise in pressure should be gradual. If the pressure rises rapidly to 3000 PSI it may indicate that no gas precharge is present within the accumulator.

• Replace start valve with new unit.

1.4.3 SHORT STARTING CYCLE

• Ensure correct accumulator and motor size.

• Test accumulator gas precharge. (In systems utilizing multiple accumulators, each unit must be tested.)

• If the parasitic load is excessive, it can also cause a short cranking cycle. In this instance, the initial system pressure is sufficient to rotate the load, but as the pressure drops the output torque of the starter drops to the point where it can no longer rotate the load. This results in stalling of starter, which produces a short cranking cycle.

• Replace starter with new unit.

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1.4.4 PRESSURE LOSS (SYSTEM WILL NOT HOLD PRESSURE)

• Visually inspect all system connections and piping for external leaks. If no external leaks are present, this indicates leakage is taking place internally. It is a simple matter to isolate the faulty component.

To ensure the safety of the maintenance personnel the following tests must be carried out with the engine shut off and system pressure at zero. System pressure may be released using the bleed screw within the hand pump assembly (Fig 1).

1. Ensure all system pressure has been relieved. Disconnect the starter return line at the connection to the reservoir. Allow remaining fluid in line to drain/flow out. Slowly begin pressurize the system to 1500-1800 PSI using the hand pump. If oil continues to flow from the starter motor's return line, this indicates a defective start valve. Replace the start valve. Ensure the return line has been reconnected to reservoir prior to use of system.

2. Ensure all system pressure has been relieved. Disconnect the RPA return line at the connection to the reservoir. Allow remaining fluid in line to drain/flow out. Slowly begin pressurize the system to 1500-1800 PSI using the hand pump. If oil continues to flow from the RPA return line, this indicates a defective check valve inside the RPA. Replace the RPA. Ensure the return line has been reconnected to reservoir prior to use of system.

3. If no leaks are detected after testing the above components, replace the hand pump assembly. DO NOT attempt to test the hand pump assembly. It requires the test to be conducted under pressure. This test should only be conducted by factory trained personnel.

1.4.5 HAND PUMP MALFUNCTION

• The hand pump assembly is double acting and a correctly functioning unit must have a pumping action in both directions.

1. Check for mechanical wear in the linkage assembly joining the handle to plunger.

2. Check for excessive mechanical wear in the pivot pin joining the handle to the pump housing.

• If excessive wear is present replace the hand pump assembly. If no signs of excessive wear are detected and pump action feels "sloppy" or loose proceed as follows:

1. Pull the handle rapidly in one direction for its full length of travel and observe if the handle tends to "spring" back. If it does, repeat procedure and pause for a few seconds prior to releasing handle at the end of its stroke. If the pump no longer "springs" back, this indicates a restriction in the oil supply line to the pump. Clear restriction and repeat procedure.

2. If the pump handle continues to "spring" all the way back, this indicates a malfunctioning suction valve within the pump. This may be caused by contamination and/or damage to the valve.

3. If handle is loose in both directions, this indicates a malfunctioning delivery valve within the pump. This may be caused by contamination and/or damage to the valve.

4. If the handle is "spongy", this indicates air may exist within the circuit. Check oil level and ensure there are no leaks present in the suction lines.

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1.4.6 GENERAL

• If fluid emerges from the reservoir during a starting attempt, check that it has not been overfilled. The oil level should be at its highest level when the accumulator(s) are discharged. The oil level should be at its lowest level when the accumulator(s) are charged.

• It may also be possible for fluid to emerge from the reservoir if the reservoir is improperly baffled, or the return connection is situated in close proximity to the filler/breather.

• If the starter motor appears to leak between the pinion housing and the motor housing (Fig 2) ensure the shaft seal assembly is still intact and functioning. In some applications where the flywheel housing is a wet clutch application, it may be necessary to install a gasket between the flywheel housing mounting face and the mating face of the pinion housing. Consult factory for gasket information (Reference ES-515).

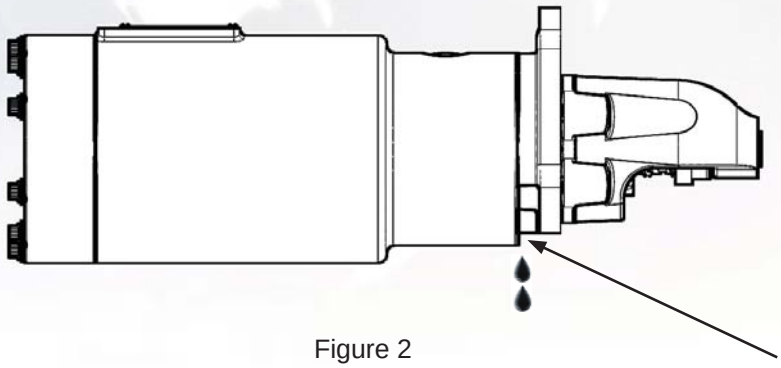

Figure 2

IF THE ABOVE GUIDELINES HAVE NOT RESOLVED THE PROBLEM PLEASE CONTACT KOCSIS TECHNOLOGIES, INC. OR AN AUTHORIZED DISTRIBUTOR FOR FURTHER ASSISTANCE.

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