Trouble shooting general

THINK before starting trouble shooting
Every fault location process should follow a logical and systematical order. Usually it is wisest to start at the beginning:

- Is the oil level correct when the pump is operating?
- Is the condition of oil and filters acceptable?
- Are pressure, flow and flow direction as specified?
- Is the oil temperature too high or too low (oil viscosity)?
- Are there any unrequired vibrations or noise (cavitation)?

If the driver of the vehicle is available ask him:

- what type of fault it is and how it affects the system,
- how long he has felt that something was wrong
- whether he has "fiddled" with the components
- whether he has any hydraulic and electrical diagrams available.

Diagrams are often found in the instructions included with vehicles/machines. Unfortunately they are often so technical that they are not of much use in a fault location situation. However, the order of and the connections between the individual components are often shown.

When a defect component has, with certainty, been found both the component and its surroundings must be cleaned before removal. Loose paint must also be removed from pipes and fittings.

Holes, hoses and pipe ends must be blanked off with plugs or sealed with, for example, plasic bags after removal to avoid the entry of dirt during standstill. Never dismantle hydraulic components outside. We recommend that repairs be carried out in a workshop on a clean workbench perhaps covered with newspaper.

Make sure that a Danfoss service manual dealing with the product in question is handy. Follow the instructions word for word both when dismantling and assembling because if these instructions are not followed closely serious faults may develop. NB. In some cases special tools are necessary for assembling. Our service manuals give full guidance as to when this is the case.

Fault	Possible cause	Remedy
Pump noisy	1. No or insufficient oil supply to pump.	1. Clean suction filter. Check that no damage or narrowing is to be found on suction line.
	2. Viscosity of oil too high.	2. Change the oil, adjust viscosity to working temperature.
	3. Pump takes in air: a) at the pump shaft b) at loose or damaged suction line c) oil level too low d) oil takes in air in the tank(return pipe discharging over oil surface)	3. Replace shaft seal. Tighten fittings or replace suction line. Refill with clean oil. Extend return pipe to 54 cm under the surface and as far as possible from the suction pipe.
	4. Pump worn out. 5. R.p.m. too high. 6. Oil pressure too high.	4. Repair or replace pump. 5. Adjust the r.p.m. 6. Adjust oil pressure.
No pressure	1. Oil level too low. 2. Pump does not run or runs in the wrong direction. 3. Relief valve is stuck in open pos. 4. Pump defectiv, broken shaft or key for rotor.	1. Refill with clean oil. 2. Adjust direction of rotation. Check driving belt or coupling. 3. Repair relief valve. 4. Repair pump.
No or unstable pressure	1. Working pressure too low. 2. Leaky pressure adjusting valve or pilot valve. 3. The oil flows more or less to the tank through defectiv valve or cylinder.	1. Check pressure adjusting valve. 2. Repair valve. 3. Repair cylinder or valve.
Noise in the relief valve	1. Excessive flow. 2. Dirt or chips between valve cone and valve seat.	1. Fit a larger valve corresponding to the actual oil volume. 2. Repair valve.
Air in the system, foam in the oil	1. Leaky suction line. 2. Excessive resistance in suction line. 3. Return line discharges above the oil level - could cause foam formation. 4. Incorrect oil type.	1. Retighten or replace line. 2. Clean filter and suction line, or replace with pipes having larger bores. Check fittings. 3. Remove return line from suction line and extend if necessary. 4. Change over to correct oil type.
Overheated system	1. No supply of cooling water. 2. Oil cooler blocked or dirty. 3. Excessive oil viscosity. 4. Abnormal internal leakage in one or more components. 5. Altered running conditions. 6. Pump, valves or motor overloaded.	1. Re-establish supply of cooling water. 2. Clean oil cooler. 3. Change over to correct oil type. 4. Repair or replace defectiv components. 5. Estabiish extra cooling if necessary. 6. Reduce load or replace component with a bigger one.

HYDRAULIC MOTORS		
Fault	**Possible cause**	**Remedy**
R.p.m. of motor lower than rated value	1. Pump worn out. 2. R.p.m. of pump too low. 3. Motor worn out. 4. Oil temperature too high (resulting in excessive internal leakage in motor, valves etc.) Possibly too high ambient temperature. 5. Insufficient diameter in pipes etc. 6. Pump cavitation. 7. Opening pressure of pressure relief valve too low. 8. Leaky control valve. 9. Overloaded motor.	1. Repair or replace pump. 2. Adjust the r.p.m. 3. Repair or replace motor. 4. Build in oil cooler or increase existing cooler or tank capacity. If necessary change over to oil with a higher viscosity. 5. Fit lines with larger diameter. 6. (See under: Pump noise). 7. Adjust to correct pressure. 8. Repair valve. 9. Eliminate the cause of the overload or change over to larger motor.
Motor shaft does not rotate	1. Pump does not run or runs in the wrong direction. 2. Motor spool has seized in housing. 3. Cardan shaft or spool broken (shaft and commutator valve in two). 4. Working pressure too low. 5. Sand, steel chips or similar impurities in motor.	1. Start pump or reverse direction of rotation. 2. Replace complete shaft and housing. 3. Replace cardan shaft or complete shaft and housing. Eliminate external forces which caused the fracture. 4. Adjust opening pressure of relief valve to higher value, however, within permissible limits. If necessary, change over to motor with higher torque. 5. Claean the motor, and flush system thoroughly. Replace defective parts. Use a better filter.
Motor shaft rotates in the wrong direction	1. Oil lines are wrongly connected to motor ports. 2. Gear-wheel and rotary valve incorrectly fitted.	1. Change the connections. 2. Adjust settings.
Leakage at motor shaft	1. Shaft seal worn out or cut.	1. Replace shaft seal.
Leak between motor spigot and housing	1. Spigot is loose. 2. O-ring defective.	1. Tighten screws with prescribed torque. 2. Replace O-ring.
Leaks between housing, spacer plate, gear wheel set and end cover, respectively	1. Screws loose. 2. O-rings defective. 3. Steel washers defective	1. Tighten screws with prescribed torque. 2. Replace O-rings. 3. Replace steel washers.

Steering systems with OSPB-OSPC-OVP/OVR-OLS

The following quick methods of testing steering systems can be recommended:

1. Start the motor (pump) and let it run for a couple of minutes.

2. Drive slowly in a figure of eight. Pay special attention to any shaking or vibration in the steering wheel or steered wheels. See whether the steering wheel movements are immediately followed by a corresponding correction of the wheel movements, without any "motoring" tendencies.

3. Stop the vehicle and turn the steering wheel with small quick movements in both directions. Let go of the steering wheel after each movement. The steering wheel must immediately go back to the neutral position i.e. there should be no "motoring" tendencies.

4. While the vehicle is still stationary turn the steering wheel from stop to stop. Count the number of times the steering wheel turns in both directions. Note: It must be possible to turn the steering wheel with one finger.

   Stop the motor (pump) and again turn the steering wheel from stop to stop. Again count the number of turns and compare with previous figures. If there is a large difference (1 turn or more) the leakage in the cylinder, gear wheel set, shock valve or suction valve is too large.

   With larger vehicles where there is no emergency steering function, turn the steering wheel whilst the motor is idling.

5. If there is a leak, remove a hose from one of the cylinder ends and plug this and the hose. Try to turn the steering wheel again. If the wheel cannot turn the cylinder is defective. If this is not the case the steering unit or valve block is defective.

Steering units
OSPB - OSPC - OVP/OVR - OLS

Fault	Possible cause	Remedy
Steering wheel is heavy to turn	1) No or insufficient oil pressure a) Pump does not run b) Pump defective c) Pump runs in the wrong direction d) Pump is worn out e) Pump is under dimensioned	a. Start up pump (loose V-belt) b. Repair or replace pump c. Correct direction of rotation of pump or replace pump d. Replace pump e. Install a larger pump (examine pressure need and flow)
	2) Pressure relief valve is stuck in open position or setting pressure is too low.	2) Repalr or clean pressure relief valve. Adjust the valve to the correct pressure.
	3) Priority valve is stuck in open posi-tion.	3) Repair or clean the priority valve.
	4) Too much friction in the mechanical pans of the vehicle.	4) Lubricate bearings and joints of steering gear or repair if necessary Check steering column installation.
	5) Emergency steering balls missing.	5) Install new balls.
	6) Combination: Downstream system + steering unit with suction valve and differential cylinder are inexpedient.	6) Change cylinder type (throughgoing piston rod). If necessary use two differerential cylinders.
Regular adjustments of the steering wheel are necessary ("Snake-like driving")	1. Leaf spring without spring force or broken.	1. Replace leaf springs.
	2. Spring in double shock valve broken.	2. Replace shock valve.
	3. Gear wheel set worn.	3. Replace gear wheel set.
Neutral position of steering wheel can-not be obtained, i.e. there is a tenden-cy towards "motoring"	4. Cylinder seized or piston seals worn.	4. Replace defective parts.
	1. Steering column and steering unit out of line.	1. Align the steering column with steering unit.
	2. Too little or no play between steering column and steering unit input shaft.	2. Adjust the play and, if necessary, shorten the splines journal.
"Motoring" effect. The steering wheel can turn on its own.	3. Pinching between inner and outer spools.	3. Contact the nearest service shop.
	1) Leaf springs are stuck or broken and have therefore reduced spring force.	1) Replace leaf springs.
	2) Inner and outer spools pinch, possibly due to dirt.	2) Clean steering unit or contact the nearest service shop.
Backlash	3) Return pressure in connection with. the reaction between dfflerential cylinder and steering unit too high.	3) Reduce return pressure, change cylinder type or use a non-reaction control unit.
	1) Cardan shaft fork worn or broken.	1) Replace cardan shaft.
	2) Leaf springs without spring force or broken.	2) Replace leaf springs.
	3) Worn splines on the steering column.	3) Replace steering column.

Steering units
OSPB - OSPC - OVP/OVR - OLS

Fault	Possible cause	Remedy
"Shimmy"-effect. The steered wheels vibrate. (Rough tread on tyres gives vibrations)	1) Air in the steering cylinder. 2) Mechanical connections or wheel bearings worn.	1) Bleed cylinder. Find and remove the reason for air collection. 2) Replace worn parts.
Steering wheel can be turned the whole time without the steered wheels moving.	1) Oil is needed in the tank. 2) Steering cylinder worn. 3) Gear wheel set worn. 4) Spacer across cardan shaft forgotten.	1) Fill with clean oil and bleed the system. 2) Replace or repair cylinder. 3) Replace gear wheel set. 4) Install spacer.
Steering wheel can be turned slowly in one or both directions without the steered wheels turning.	1) One or both anti-cavitation valves are leaky or are missing in OSPC or OVP/OVR. 2) One or both shock valves are leaky or are missing in OSPC or OVP/OVR	1) Clean or replace defect or missing valves. 2) Clean or replace defective or missing valves.
Steering is too slow and heavy when trying to turn quickly	1) Insufficient oil supply to steering unit, pump defective or number of revolutions too low. 2) Relief valve setting too low. 3) Relief valve sticking owing to dirt. 4) Spool in priority valve sticking owing to dirt. 5) Too weak spring in priority valve.	1) Replace pump or increase number of revolutions. 2) Adjust valve to correct setting. 3) Clean the valve. 4) Clean the valve, check that spool moves easily without spring. 5) Replace spring by a stronger (There are 3 sizes: 4, 7 and 10 bar).
"Kick-back" in steering wheel from system. Kicks from wheels.	1) Fault in the system.	1) Contact vehicle supplier or Danfoss.
Heavy kick-back in steering wheel in both directions.	1) Wrong setting of cardan shaft and gear wheel set.	1) Correct setting as shown in Service Manual.
Turning the steering wheel activates the steered wheels opposite.	1) Hydraulic hoses for the steering cylinders have been switched around.	1) Reverse the hoses.
Hard point when starting to turn the steering wheel.	1) Spring force in priority valve too weak. 2) Air in LS and /or PP pipes. 3) Clogged orifies in LS or PP side i priority valve. 4) Oil is too thick (cold).	1) Replace spring by a stronger (4, 7 and 10 bar). 2) Bleed LS and PP pipes. 3) Clean orifices in spool and in connecting plugs for LS and PP. 4) Let motor run until oil is warm.
Too little steering force (possibly to one side only).	1) Pump pressure too low. 2) Too little steering cylinder. 3) Piston rod area of the differential cylinder too large compared with piston diameter.	1) Correct pump pressure. 2) Fit a larger cylinder. 3) Fit cylinder with thinner piston rod or 2 differential cylinders.

Steering units OSPB - OSPC - OVP/OVR - OLS		
Fault	**Possible cause**	**Remedy**
Leakage at either input shaft, end cover, gear-wheel set, housing or top part.	1) Shaft defective 2) Screws loose. 3) Washers or O-rings defective.	1) Replace shaft seal, see Service Manual 2) Tighten screws Torque 3-3,5 daNm OR steering unit (2,5-3 daNm). 3) Replace washers and O-rings.

Steering systems with OSQA/B og OSPBX-LS

Fault	Possible cause	Remedy
Amplification too large	1) Dirty, leaky or missing check vave(1).	1) Clean or replace check valve.
	2) Piston (2) sticks in the open position.	2) Clean and check that the piston moves easily.
Amplification too small	1) Piston (2) sticks in the closed position. 2) Piston (2) incorrectly installed (only OSQA/B-5).	1) Clean and check that the piston moves easily. 2) Rotate the piston 180° on its axis.
Heavy turning of steering wheel and slow increase of amplification	1) Dirty orifices (3) in directional valve. 2) Dirty orifice (4) in the combi-valve spool. 3) Dirty orifice (5) in housing. 4) Dirty orifice (6) in LS-port. 5) Dirty orifice in throttle/check valve (7) in PP-port.	1) Clean or replace orifice. 2) Clean or replace orHice. 3) Clean or replace orifice. 4) Clean or replace orifice. 5) Clean or replace throttle/check valve.
No end stop in one or both directions	1) One or both shock valves (8) set too low. 2) One or both anti-cavitation valves (9) leaky, or stickins. 3) Missing end-stop plate (s) (pos. 10) for directional valve.	1) Setting takes a long time without special equipment. Contact the nearest serviceshop. 2) Clean or replace completely shock/anti-cavitation valve (s). 3) Fit end-stop plates .
"Hard" point when starting to turn the steering wheel.	1) Air in LS and/or PP pipes. 2) Spring force in the built in priority valve too weak (11). 3) Orifices in respectively LS-(6) or PP-(7) ports blocked.	1) Bleed pipes. 2) Replace spring by one which is more powerful. (There are three sizes: 4, 7 and 10 bar). 3) Take out and clean orifices.
No pressure build-up	1) LS-pressure limitation valve (12) adjusted too low. 2) Spool and sleeve in OSPBX steering unit put together incorrectly. 3) Emergency control ball in steering unit missing. 4) Pump does not run or is defective.	1) Remove plug and set to specified pressure. 2) Take out spool set and turn the inner spool 180° in the outer sleeve. (See Service Manual). 3) Install new ball. 4) Repair or replace pump.