

SKS 634 SERVICE-MANUAL

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1. General

The HML 51 S is equipped with a load-sensing hydraulic system (oil flow demand regulation). This system consists of:

- 1.) an axial piston pump for the main circuit with flanged pilot control pump
- 2.) a double Bosch pump for steering and service brake
- 3.) a base valve plate with flanged pressure cut-off and one valve section (control spool) for each of the following functions: Travel, slewing, boom cylinder, intermediate boom cylinder, dipperstick cylinder and bucket cylinder.

2. Functioning of the hydraulic system

Prior to the diesel engine's start, the pump is held in max. displacement by a spring. A stand-by pressure of 28 - 45 bar (at test point P at the valve bank) is built up between the pump (pump regulator) and the valve bank immediately after starting. The big setting piston is activated via the pump regulator and the pump slews to min. pump displacement. The stand-by pressure remains constant.

When the control spool is actuated and the oil is supplied to a consumer (e.g. lifting cylinder), the LS-regulator at the pump receives a signal, coming from the valve bank via the LS-line, to slew the pump to a larger displacement.

Inside the pump there is a small setting piston (Q max.), supported by a pressure spring, and a big setting piston (twice as large), which resets the pump to Q min.

Example: When a valve bank spool is activated, a specific quantity of oil is sent to the consumer. Via the LS-line, a signal is sent to the LS-pump regulator which sets the pump to the necessary oil flow. Each valve section is pre-set to a determined oil flow by a limit screw. If some or all valve sections are used simultaneously, the pump is regulated to more flow. Now the oil flow, however, is smaller than the flow which all valve sections could process due to their adjustments. The consumers receive a corresponding percentage of the oil flow from the pump, fed through each section. That means that all functions gradually slow down simultaneously. Since all sections have different working pressures, the pump regulation is dominated by the highest pressure.


3. Description of the individual functions

a.) Travel

The control piston of the pilot control valve (2 pedals) continuously varies from 0 to 32 bar. The variable displacement travel motor is at Q min. = highest rpm. As the pressure rises, the motor regulates to Q max. and the rpms decrease. The dual brake valve, flanged to the travel motor, is activated when the travel pressure decreases.

If, in downhill travel, the pressure in front of the travel motor decreases or collapses completely, the brake valve closes and throttles the oil flow coming from the travel motor. Two 420 bar pressure relief valves (forward-reverse) prevent an overload.

When the parking brake is closed, the P control line to the travel control valve is cut off by a solenoid valve (machine does not move anymore).

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2. Slewing

Gently activate the slewing function with the control lever. When the slewing procedure stops, the slew motor continues turning by the mass of the machine (boom with grab bucket) and, as the control piston is only possible in a blocked version in the load-sensing system, the return flow from the slew motor is braked by the slow return of the control lever or control piston. Two pressure relief valves (220 bar) incorporated in the slew motor safeguard the slew system. Both anticavitation valves are integrated in the slew section (valve bank).

Between the valve plate and the slew section there is a valve plate with a pressure relief valve which activates the slew pressure at the slew motor from 0 to 205 bar via a shuttle valve (slewing right - left) depending on the activated pilot control pressure. A sensitive slewing movement is herewith achieved.

Both control lines are connected to a shuttle valve which when slewing (right or left) activates a hydraulic valve with the control pressure which opens the spring-loaded disk brake via an adjustable throttle (see slew brake).

2a. Slewing

In the slew motor two pilot-operated line relief valves with pressure hook-up 110 - 230 bar are installed.

When slewing right or left both line relief valves receive pilot control pressure. Thus they reach the (higher) line relief pressure of 230 bar. Before the slewing procedure is stopped, the pilot control pressure decreases. The valves already open at 110 bar so that the upper carriage has a softer stop.

3. Raise and lower boom

The A-port of the valve section (hydraulic cylinder bottom side) is for raising, the B-port (hydraulic cylinder rod side) for lowering.

A throttle for lowering is not available. At the valve section A-port there is a check valve which safeguards the lifting cylinder or the boom against lowering during road travel.

4. Intermediate boom

The section intermediate boom is activated with a control valve (foot pedal). The intermediate boom cylinders are safeguarded against retracting and extending by two check valves flanged to the valve section.

5. Retract and extend dipperstick cylinder

When extending, the A-port of the valve section (hydraulic cylinder bottom side) is activated, when retracting, it is the B-port. In the base valve plate behind the flanged section (B-port) an adjustable lowering throttle is installed.

6. Open and close bucket or grab

With the A-port valve section the hydraulic cylinder bottom side of the bucket cylinder or grab cylinder is extended. In this line there is a 3-way ball cock valve at the dipperstick for changing to grab operation.

7. Dozer blade up and down

All hydraulic cylinders or feed lines have check valves (lock valves) at the bottom and rod ends.

8. Breaker operation (additional equipment)

For breaker operation a valve section is additionally installed at the valve plate (valve bank). This section is only connected to the A-port. The return oil of the breaker is fed back to the tank. The installed line relief valve is adjusted according to the specifications of the breaker manufacturer.

9. Pilot pressure

The pilot pressure is provided by the smaller auxiliary pump flanged to the main hydraulic pump (Linde). The oil flows into a pilot control block in which a pressure relief valve backs up the oil to 35 - 40 bar and a pressure relief valve leading the constant pressure of 32 bar to the control circuit. A check valve, pressure accumulator (0.7 ltr. 15 bar) and a test port are installed in the pilot control valve bank or screwed directly resp.

10. Pilot control circuit

All manually and solenoid-operated control valves are connected to the pilot control circuit.

A triple solenoid valve supplies the different functions (starting from P inlet port):

1. Valve for control valves in armrest (working hydraulics)
2. Valve for oscillating axle lock
3. Valve for pilot control valve travel (forward - reverse)


The solenoid valve no. 1 located in the instrument panel and manually switched with the armrest and proximity switch, situated at the maintenance access stairs, blocks all functions of the manual control valves in the armrests.

Attention: When the parking brake is closed and the engine is shut off, the electric circuit to this valve is interrupted, too. In order to be able to lower the working equipment even if the engine is turned off, push the by-pass switch at the instrument panel.

11. Oscillating axle lock

When the service brake is activated, the solenoid valve no. 2 (oscillating axle lock) is switched off via the brake light switches. With the rocker switch at the instrument panel, the oscillating axle can be locked when the service brake is released.

When the working function is switched on, the brake lights are out of order. The oscillating axle is closed automatically with the service brake. When the working function (road travel) is switched off, the brake lights are active. In addition, the oscillating axle solenoid valve gets current and remains open while braking.

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12. Gear shifting - parking brake (combination)

The gear can be shifted during travel. A shift safeguard prevents the shifting back from high speed to low speed when the speed is too high.

From the pilot control circuit (32 bar) the valve block for gear shifting and parking brake is supplied via a 0.5 bar check valve. The following parts are installed or assembled in the valve block:

1. A remaining pressure brake valve (pressure relief valve 11 bar)
2. The parking brake valve (1st solenoid valve with emergency locking)
3. The gear shifting valve (2nd solenoid valve)
4. A pressure accumulator (8 bar), a test port and a 24 bar pressure switch

Gear shifting function

Low speed solenoid valve without current

High speed solenoid valve switched on

At low speed the multiple disk brake is closed and the coupling open (planet engaged). At high speed the multi-disk brake is open and the coupling is closed (planet not engaged).

The lubrication of the gear is done by the drain oil of the opened coupling or multi-disk brake and fed back to the tank together with the drain oil from the travel motor.

Attention: When starting or doing repair jobs, the gear has to be activated in low speed first.

Between the planet and the spur wheels, there is a claw coupling which has to be switched off by a lever to tow the machine. In this case the parking brake is out of order.

Parking brake function

When activating the parking brake, the first solenoid valve does not get current any longer and the pressure existing at the coupling or brake piston relieves at the remaining brake pressure valve to the preset value of 11 bar.

Caused by the pressure drop, the 24 bar pressure switch cuts off the pilot-operated travel valve (see travel functions).

The parking brake valve has an emergency locking. At a power failure the parking brake valve (solenoid valve) can be released mechanically.

When closing the parking brake, the spring-loaded multi-disk coupling and the spring-loaded multi-disk brake are closed. By doing this, the existing pressure is slowly lowered to 11 bar via the remaining pressure valve so that the brake does not operate jerkily. The 8 bar pressure accumulator guarantees a sufficient oil flow for this procedure.

13. 2-circuit service brake 0 - 60 bar

The second (smallest) Bosch pump feeds the oil directly into a 2-circuit brake compact block (pedal valve). In this brake block the switch-off valve and the pedal valve are integrated. The switch-on pressure is 123 bar, the switch-off pressure 150 bar. At each brake circuit a pressure accumulator 0.7 l, 50 bar is installed. If the charge pressure drops below 85 bar, a pressure switch or a warning lamp indicates low pressure. In each brake circuit there is a 5 bar brake light switch.

14. Slew brake

As already described under 2 "slewing", the machine is hydraulically braked by the blocked slew section (control piston) by slowly releasing the control lever. As soon as the control pressure between the manually controlled valve and the slew section drops below 5 bar, the hydraulic control valve closes, the pressure at the disk brake drops and the brake closes. The closing of the brake can be adjusted by the throttle in the brake line.
The brake should only close when the uppercarriage is no longer turning.

15. Secondary circuit

The first Bosch pump at the engine is the so-called steering pump. It supplies the oil via priority valve from the preferred outlet to the steering, second outlet to the grab rotation valve.

16. Steering

From the priority valve the oil flows via a check valve to the steering unit. A load-sensing line between steering unit and priority valve controls the oil flow during steering.

17. Grab rotation


From the priority valve the oil reaches the grab valve block. In the inlet of the block there is a 160 bar primary valve situated as well as two 250 bar line relief valves. In the grab lines at the dipperstick, there is a double relief valve which is set to 100 bar. The control block is solenoid-controlled by the right-hand control lever (by means of a push button).

17 a. Slew bucket

If the machine is equipped with a hydraulic slew bucket, in each grab line there is a 3-way ball valve which does not feed the oil through the grab pressure limitation valve (100 bar) at slew bucket operation but directly to the slew bucket hydraulic cylinder. In this position the primary valve of 160 bar reacts and if the control block is not in function, the two secondary valves of 250 bar do.

17. b. Articulated boom

At articulated boom, the two lines to the articulated cylinder are connected to the grab lines via ball valves. The 3-way ball valves are set to the slew bucket and the primary pressure to 230 bar.

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