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Service Training and Workshop Handbook

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KOMATSU

PREFACE

This handbook is intended to assist the student by supplementing the theoretical work presented by a training course lecturer.

The book is divided into groups, each of which covers a major topic or component. This enables the lecturer to select the appropriate group to suit his own scheme of work. We must emphasise that we expect the lecturer to amplify the content of the handbook where necessary.

This handbook is also intended as a quick reference work for experienced tradesmen employed in the workshop. For more detailed descriptions of repair work, reference must be made to the appropriate Service Manual.

In accordance with the company's policy of continuous improvement to its machines, alterations in the specifications of machines may be made at any time without notice and the company accepts no responsibility for any descrepancies which may occur between the specifications of its machines and the specifications contained in this handbook.

G R O U P I N D E X

GENERAL PART

Safety Precautions
Safety Equipment
Technical Data
Operation
Maintenance
Test Certificate

C O N T E N T S

SAFETY PRECAUTIONS

GENERAL

Accidents can be avoided by a few seconds thought and a more careful approach when working on the machine.

Your co-operation is essential to the success of an effective management policy on safety when at work. For example, you can avoid many accidents by observing certain precautions and insist that people working with you do the same.

As a guide the following are a few examples of safety precautions to be observed when working on the machine:

Never start the engine whilst standing beside the machine. Always start the engine when sitting in the driver's seat.

Never get on or off the machine whilst it is in motion.

Never carry out repairs or tighten hydraulic hoses or fittings when the system is under pressure or the engine running.

When checking the engine coolant, always remove the radiator cap very slowly and with care, especially when the engine is hot.

Do not exceed the lift capacities of hoists, cranes, jacks and slings when working on the machine.

If work is to be carried out beneath the machine, ensure that the machine is adequately supported, i.e. the weight is taken off the jack by using suitable blocks.

Ensure rules regarding flammable materials and other harmful substances are observed.

When working on fuel or electrical systems, ensure fire equipment is available for immediate use and you know how to use it.

Know the correct and safe way of doing the job, avoid dangerous working practices.

Observe caution when carrying out adjustments near moving parts when the engine is running, for example, shafts, belts, pulleys and gears.

When carrying out road or equipment performance tests observe the safety precautions given in the appropriate operator's manual.

The safety precautions are for your guidance and should be read and interpreted in conjunction with safety regulations valid in your country.

Remember "safety" is only a word until it is put into practice.

In the text throughout this book where this symbol is used caution must be observed according to local regulations and the task at hand.

Boom safety support

When carrying out maintenance or repair work where it is necessary to work under a raised boom (bucket), for obvious reasons the boom must must be supported to prevent it being accidently lowered.

Fig. N 537
The support is stowed in the RH side of the rear frame.

To support the boom

Fig. N 538
Fully raise the bucket and fit the support to the piston rod of one of the lift cylinders as shown.

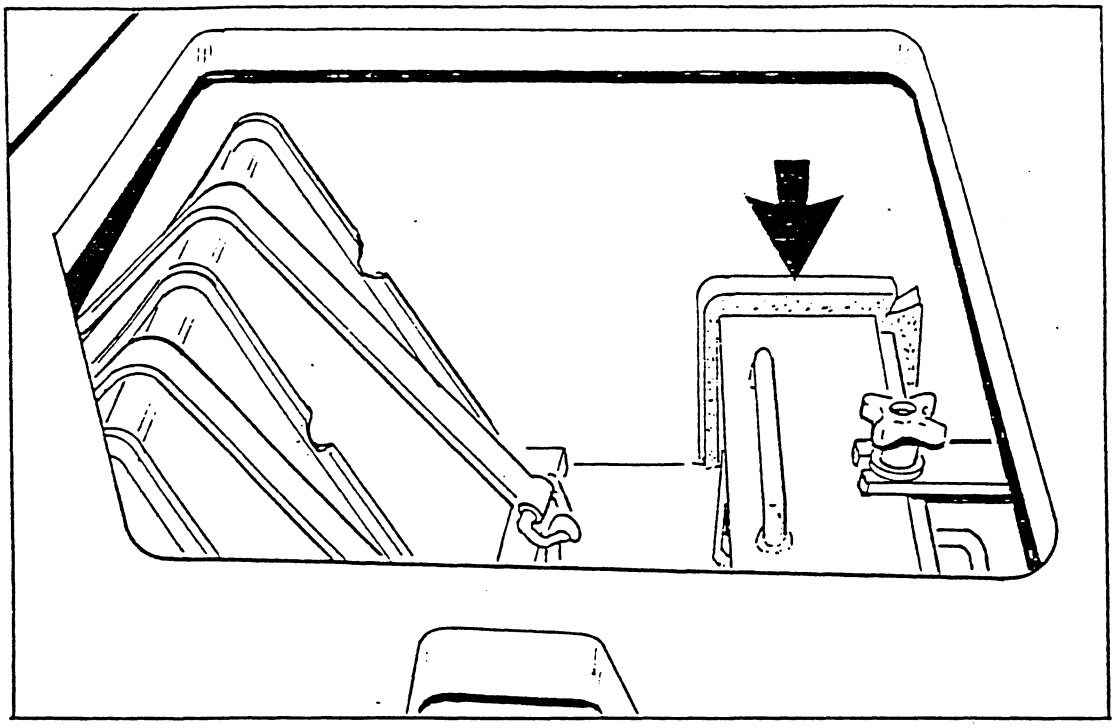
Adjust engine speed to low idle rpm.

Shift the bucket control lever into position 'S', slowly and carefully lower the bucket until the support is securely trapped on the cylinder piston rod.

Immediately shift the bucket control lever into neutral 'O'!

Secure the bucket control lever (see 'Securing the Bucket Control Lever' paragraph)

WARNING!
DO NOT USE THE 'SW' SHIFT POSITION TO LOWER THE BUCKET!



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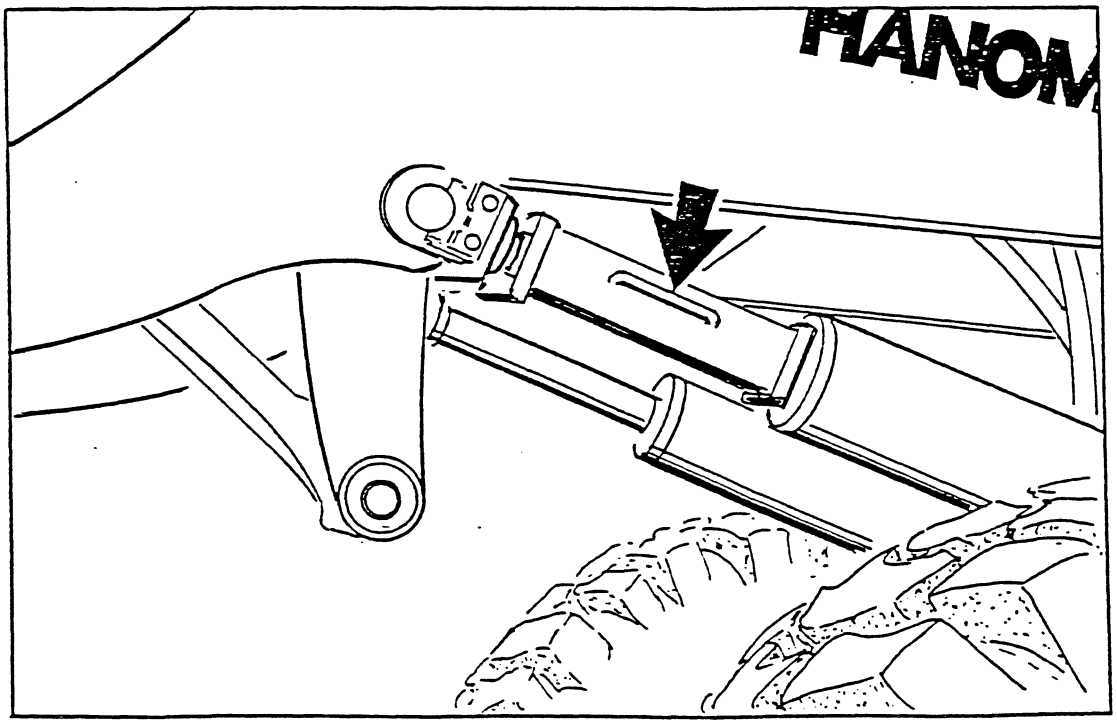

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ENGINE

Model/Type	D 964 T/Turbocharged diesel
Number of cylinders	Six, in line
Cycle	4-stroke
Combustion system	Direct injection
Bore	128 mm
Stroke	140 mm
Displacement	10 809 cm^3
Rated speed Low idle speed High idle speed (no load)	2200 rpm 750 to 850 rpm 2250 to 2410 rpm
Output rating to DIN 70 020 Maximum torque to DIN 70 020	132 kW (180 PS) 700 Nm at 1400 rpm
Compression ratio	17.2 : 1
Compression pressure with starter turning engine	27 to 33 bar, minimum 24 bar

Valve tip clearances:	Engine hot	Engine cold
inlet valves	0.30 mm	0.30 mm
exhaust valves	0.30 mm	0.30 mm

Firing order	1 - 5 - 3 - 6 - 2 - 4
Fuel injection pump	In-line pump with variable speed governor
Commencement of injection	28° before TDC
Fuel injectors - adjusting pressure	230 $^{+8}$ bar
Fuel filtering	Fuel prefilter and main fuel filter
Lubrication system	Forced feed lubrication system
Oil pressure - engine hot:	
low idle speed	Minimum 0.5 bar
rated speed	Minimum 2.5 bar
Engine cooling system Coolant	Dual-circuit with pusher-type fan A mixture of water, anti-freeze and corrosion inhibitor
Air induction system	Dry air cleaner with main and safety elements and a HD cyclone separator (precleaner) with exhaust-gas ejector (automatic dust unloading)
Max. permissible working angle	35° all round

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TRANSMISSION

Torque converter transmission	G 552 - 4
Torque converter	Single-stage
Torque converter oil inlet pressure	5.0 bar, minimum
Torque converter oil outlet pressure	3.5 to 4.0 bar
Torque converter safety valve - with the pressure holding valve closed and engine running at low idle rpm	Opens at 7 to 9 bar
Powershift transmission	G 423 - 1
Number of forward gears	4
Number of reverse gears	4
Gearshift pressure at engine rated speed	19 to 21 bar
Lubrication/cooling oil pressure	1.5 to 3.5 bar

AXLES

Front axle	Planetary rigid axle with disc-type self-locking differential
Rear axle	Planetary rigid axle with disc-type self-locking differential

BRAKES

Service brakes	Dual-circuit, power hydraulic (accumulator) brake system with oil immersed disc brake units installed in the axles
Operating pressures:	
Cut-out pressure	140 to 150 bar
Brake application pressure	63 to 70 bar
Parking brake	Mechanically operated disc brake mounted on universal drive shaft

STEERING

System	Hydrostatic, articulated frame steering with load dependent oil flow distribution and two steering cylinders
Operating pressure (test pressure):	
Machines without emergency steering pump Machines with emergency steering pump	170 to 190 bar
Oil flow capacity	195 ltr/min
Steering angle, both sides	40°
Steering time, full lock to full lock	2.6 to 3.0 secs.
Steering time, full lock to full lock at engine low idle speed	3.0 to 3.5 secs.
Rear axle oscillating angle	30° (20.5 - 25 tyres) 24° (23.5 - 25 tyres)

TRAVEL SPEEDS

Forward:	
1st gear	0 to 5.9 km/h
2nd gear	0 to 11.3 km/h
3rd gear	0 to 20.0 km/h
4th gear	0 to 38.3 km/h*
Reverse:	
1st gear	0 to 6.3 km/h
2nd gear	0 to 11.9 km/h
3rd gear	0 to 21.6 km/h
4th gear	0 to 40.3 km/h*

* = lockable in 4th gear

LOADER HYDRAULIC SYSTEM

System	Two-stage system with two hydraulic pumps (loader-and-steering pump and loader pump)
Operating pressures:	
1st stage	140 to 145 bar
2nd stage	220 to 225 bar
Oil delivery capacities:	
1st stage	345 ltr/min
2nd stage	195 ltr/min
Number of lift cylinders	2
Number of bucket cylinders	1
Directional control valve	Servo (remote power) controlled
Servo (remote power control) pressures:	
at engine low idle speed	25 bar minimum
at engine high idle speed	29 to 31 bar
Work cycle times:	
Lift with an empty bucket	5.5 secs.
Lift with a full bucket	6.2 secs.
Lower to ground with empty bucket	3.0 to 3.5 secs.
Lower to ground in float position with an empty bucket	3.5 secs.
Bucket rollback with bucket on ground	1.5 secs.
Bucket dump with bucket at full height (total piston rod stroke)	
Bucket dump with bucket dump rate throttled (factory setting)	2.0 to 2.2 secs.
Bucket dump with bucket dump rate unthrottled (special)	0.8 to 1.0 secs.

ELECTRICAL SYSTEM

Operating voltage	24 V
Batteries	2 x 12 V, 110 Ah
Alternator	28 V, 35 A with integral regulator

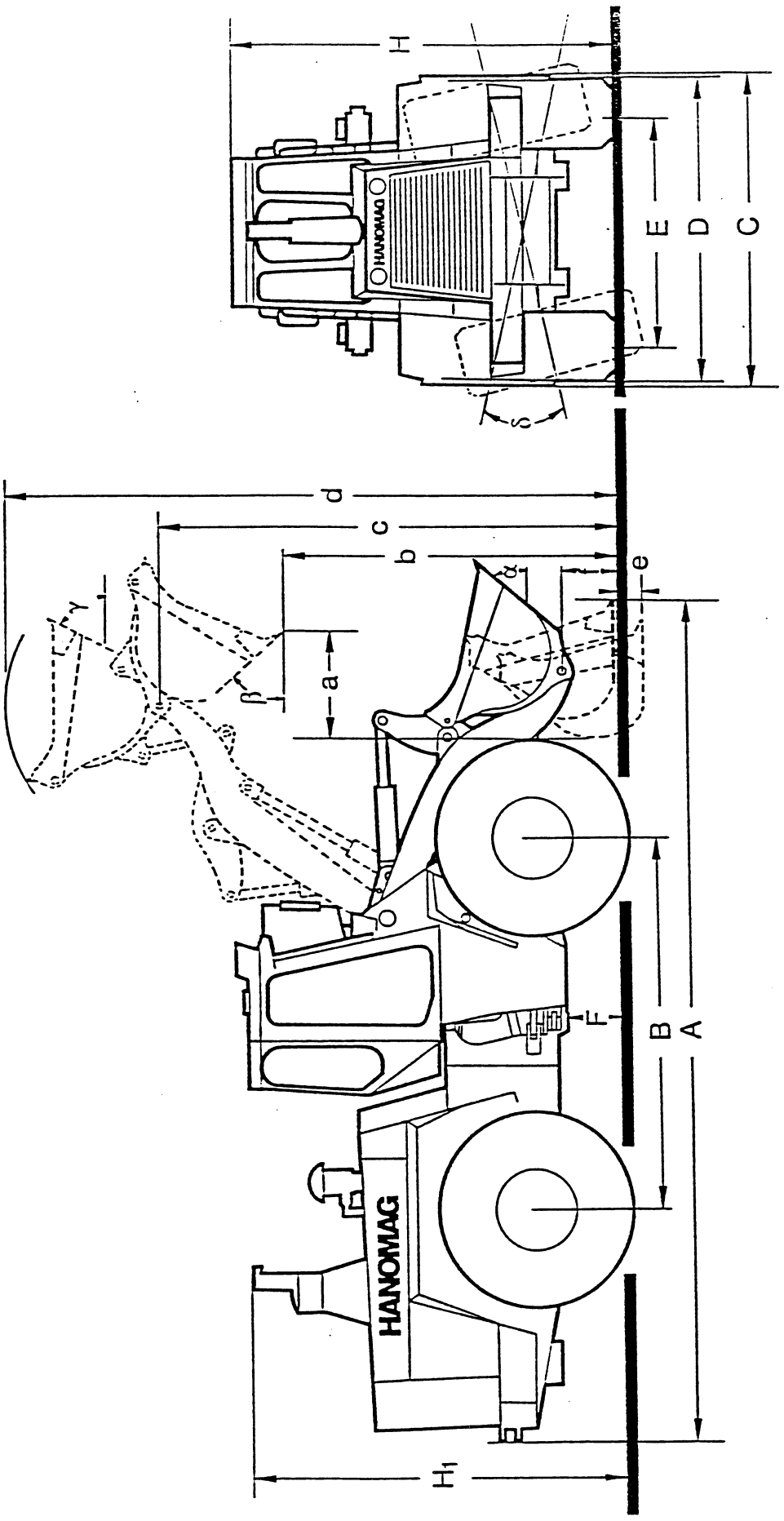
Measurements

Buckets		m³	2.6*	2.6 HD	2.8	3.0	3.8	5.0
A	Overall length	mm	7800	7935	7800	7900	8000	8100
B	Wheelbase	mm	3200	3200	3200	3200	3200	3200
C	Bucket width	mm	2500	2750	2750	2750	3000	3000
D	Width less bucket	mm	2500	2655	2655	2655	2655	2655
E	Gauge	mm	1930	1992	1992	1922	1922	1922
F	Ground clearance	mm	410	464	464	464	464	464
H	Overall height	mm	3315	3370	3370	3370	3370	3370
H_1	Exhaust height	mm	3015	3070	3070	3070	3070	3070
a	Reach at full lift, 45° discharge	mm	1107	1135	1040	1110	1145	1220
b	Dump clearance, 45°discharge	mm	2950	2910	3005	2935	2825	2755
c	Lift height, hinge pin	mm	3985	4040	4040	4040	4040	4040
d	Overall lift height	mm	5280	5300	5335	5335	5500	5800
e	Dig below ground level, 0° dump	mm	86	140	140	140	190	190
f	Carry height, hinge pin	mm	500	500	500	500	500	500
α	Rollback, carry	°	53	53	53	53	53	53
β	Dump, full height	°	50	50	50	50	50	50
γ	Rollback, full height	°	58	58	58	58	58	58
δ	Oscillation	°	30	24	24	24	24	24

Operating data

Buckets	m³	2.6*	2.6 HD	2.8	3.0	3.8	5.0
Specific gravity	to/m³	2.0	2.0	1.8	1.7	1.3	1.0
Stating tipping load, straight	kg	11800	11600	11700	11600	11400	11100
Stating tipping load, articulated	kg	10700	10500	10600	10500	10300	10000
Breakout force	kN	155	138	155	142	131	121
Lifting capacity	kN	164	164	164	164	164	164
Bucket weight incl. teeth	kg	1410	1620	1530	1600	1800	2100
Operating weight	kg	15600	16250	16150	16200	16400	16700

* = Only with 20.5-25 tyres (optional)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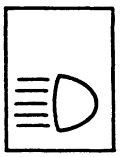
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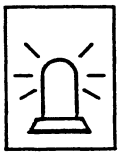
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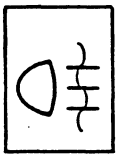
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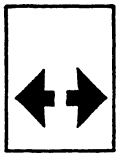
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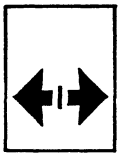
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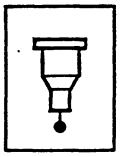
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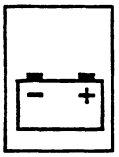
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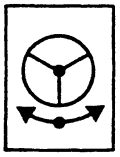
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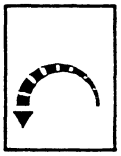
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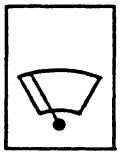
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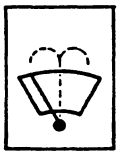
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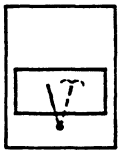
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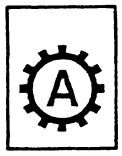

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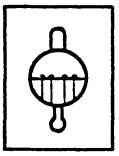
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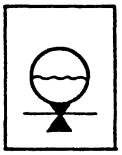
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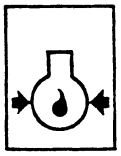
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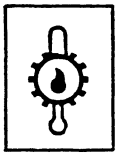
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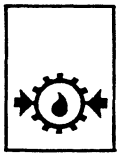
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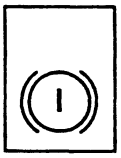

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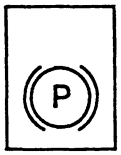

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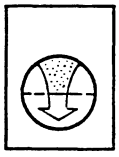
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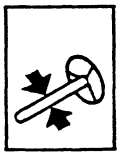
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P 441

Symbols

Fig. P 441

1 Headlamp main (high) beam
2 Working lamps
3 Hazard warning lamps
4 Rotating beacon
5 Fog lamps
6 Turn-signal lamps
7 Turn-signal lamps on bucket cutting edge guard
8 Engine preheat (flame-start system)
9 Battery charging
10 Emergency steering pump
11 'Central warning' overriding switch
12 Cab heater blower
13 Front windscreen wiper
14 Front windscreen wash system
15 Rear window wiper and wash system
16 Transmission disconnect
17 Bucket fast dump
18 Coolant temperature
19 Coolant level
20 Engine oil pressure
21 Torque converter / powershift transmission oil temperature
22 Powershift transmission gearshift pressure
23 Service brakes
24 Parking brake
25 Air cleaner
26 Steering
27 Brake oil level
28 Fuel
29 ALS (Automatic Load Stabilizer) system

Centronic Warning System Control Panel

Fig. P 442
The centronic system control panel has two rows of light-emitting diodes (LEDs) to warn the driver that appropriate action must be taken if any one of these LEDs light up.

The lower row of LEDs (7 to 12) signals the 'WARNING' phase where the driver is warned of an irregularity in any one of the machine's systems monitored in this phase (see 'Symbols on the Centronic Control Panel' paragraph below).

The top row of LEDs (1 to 6) signals the 'WARNING' plus 'ENGINE SHUTDOWN' phase where the driver is initially warned of an irregularity or defect in any one of the machine's critical (operating safety endangered) systems monitored in this phase. The initial warning signal is followed by an automatic shutdown of the engine if the driver fails to take the necessary action within a certain period of time after the initial warning signal has been given.

Symbols on the Centronic Control Panel

The warning phases and the systems monitored are as follows:

Fig. P 442

WARNING plus ENGINE SHUTDOWN		WARNING	
1	Engine coolant temperature	7	Battery charging
2	Engine coolant level	8	Air cleaner contamination
3	Engine oil pressure	9	Steering system oil pressure
4	Converter oil temperature	10	Service brakes accumulator pressure
5	Transmission gearshift pressure	11	Parking brake applied
6	Powershift transmission temperature	12	Service brakes oil level

Fig. P 443
Centronic 'Central Warning' warning lamps on the instrument panel.

Automatic Self-check of the Centronic System

Fig. P 442
When the starter key is turned to the operating position '1' an automatic self-check of the centronic system will commence and all LEDs will immediately light up. If the centronic system is in order all LEDs (except the engine coolant level LED 2 which will remain on) will go out after a test period of 2 to 3 seconds.

After the engine has started and sufficient oil pressure has been reached the automatic self-check process is completed.

If any one of the machine's systems monitored by the centronic system is defective then this will be signalled by the flashing of the appropriate LED immediately after the self-check period has ended.

NOTES:

a) When using the engine preheat system the centronic system will be automatically switched off to prevent an engine shutdown during the preheating period.

b) When the service brake pedal is depressed the centronic monitoring of the transmission gearshift pressure (LED 5) will be interrupted.

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