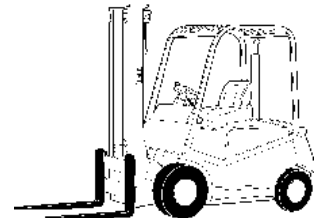
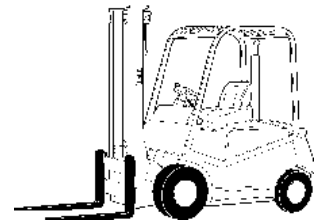


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BOLOGNA'S FACTORY, AFTER SALES SERVICE

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SERVICE MANUAL

INTERNAL
COMBUSTION

TECHNICAL DATA

TECHNICAL AND WORKING SPECIFICATIONS				FORKLIFT MODEL (Standard Configuration)			
CHARACTERISTICS				CESAB - BT			
1.1	Manufacturer			CESAB - BT			
1.2	Model			DRAGO 150 - CDB/CBE 1,5			
1.3	Power: Electric (battery) - Diesel - Petrol - LPG			Diesel / LPG			
1.4	Control type: Standing/seated/pedestrian			seated			
1.5	Capacity (Nominal capacity)	Q [kg]		1500			
1.6	Load centre	c [mm]		500			
1.8	Front overhang (Distance from front axle)	x [mm]		390 (a)			
1.9	Wheel-base	y [mm]		1450			
WEIGHTS							
2.1	Service mass	kg		3100			
2.2	Load per axle with load, front/rear	kg		4130 / 470			
2.3	Load per axle without load, front/rear	kg		1530 / 1570			
WHEELS - CHASSIS							
3.1	Tyres: C=Cushion, PN=Pneumatic, SE=Superelastic, G=Twin			SE-PN / SEG (f)			
3.2	Tyres: Size, front			23x9-10 / 6.50-10 (c) (d) (e)			
3.3	Tyres: Size, rear			18x7-8			
3.5	Wheels (x = drive)			2x-4x / 2			
3.6	Track centre of tyres, front	b10 [mm]		892 / 1061 (c) (d) (e)			
3.7	Track centre of tyres, rear	b11 [mm]		863			
DIMENSIONS							
4.1	Mast tilt: Forward/Backward	$\alpha / \beta [^\circ]$		5° / 10°			
4.2	Overall dimensions: Height, mast closed	h1 [mm]		2160			
4.3	Overall dimensions: Height, mast free (travel)	h2 [mm]		80			
4.4	Overall dimensions: Lift travel	h3 [mm]		3170			
4.5	Overall dimensions: Height, mast open	h4 [mm]		3720			
4.7	Overall dimensions: Height, overhead guard	h6 [mm]		2120 (g)			
4.8	Overall dimensions: Height, overhead guard	h7 [mm]		1040			
4.12	Hook height	h10 [mm]		330			
4.19	Overall Length	l1 [mm]		3235 (a)			
4.20	Overall Length included forks back	l2 [mm]		2235 (a)			
4.21	Overall width	b1 [mm]		1098-1135 / 1446 (c) (d) (e)			
4.22	Fork size: Height(s) x Width(e) x Length(i)	b1/b2 [mm]		35x100x1000			
4.23	Fork carriage According to DIN 15173, class type A, B	slat [mm]		II A			
4.24	Fork carriage width	b3 [mm]		900			
4.31	Free height under the mast, with load	m1 [mm]		89			
4.32	Free height from chassis to ground in the middle of the truck	m2 [mm]		125			
4.33	Stacking at 90° aisle width, 1000x1200 pallet, forks on the 1200 side	As1 [mm]		3555 (a)			
4.34	Stacking at 90° aisle width, 800x1200 pallet, forks on the 800 side	As2 [mm]		3755 (a)			
4.35	Overall Turning radius	wa [mm]		1965			
4.36	Min turning radius	b13 [mm]					
PERFORMANCE							
5.1	Travel speed without load	km/h		18			
5.2	Lifting speed without load	m/s		0,50 / 0,55			
5.3	Lowering speed without load	m/s		≤ 0,55			
5.5	Normal draw-bar pull, with/without load, hourly	N		10500 / 10800			
5.6	Max. draw-bar pull, with/without load, S2 5°	N		10500 / 10800			
5.7	Surmountable inclination, with/without load (S2 30°)	%		16 / 28			
5.8	Max surmountable inclination, with/without load (S2 5°)	%		15 / 26			
5.9	Acceleration time, with/without load	s					
5.10	Service brake: Mechanical / Hydraulic / Electric / Pneumatic			Hydraulic			
POWER UNIT							
7.1	Manufacturer/Model			Toyota 1DZ-II / Toyota 4Y			
7.2	Continuous motor power (ISO 1585)	kW		40 / 37			
7.3	Number of revolutions	min ⁻¹		2400 / 2400			
7.4	Number of cylinders / displacement	cm ³		4-2486 / 4-2237			
7.5	Fuel consumption (VDI cycle)	l/h-kg/h					
VARIE							
8.1	Transmission			stepless hydrostatic			
8.2	Working pressure for attachment	bar		140			
8.3	Oil capacity for attachment	l/min		79,3 / 79			
8.4	Noise level to driver's ear	dB (A)					
8.5	Tow hook / DIN Type						

a) + 36 mm with integral shifthead hooked

b)

c) optional SE 6,50-10 with Overall Width 1043 mm and Track 872 mm

d) Overall width with triplex mast, SE (6,50-10) 1105 mm and Track 934 mm

e) Overall width with triplex mast, PN (6,50-10) 1155 mm and Track 964 mm

n with triplex mast Twin Tyres are not available

g) std version without panels

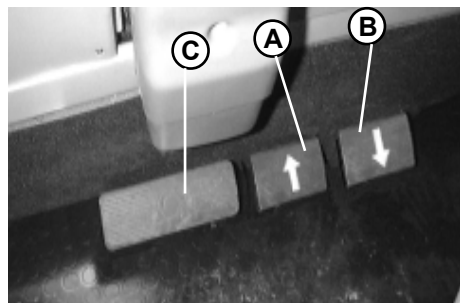
h)

i)

j)

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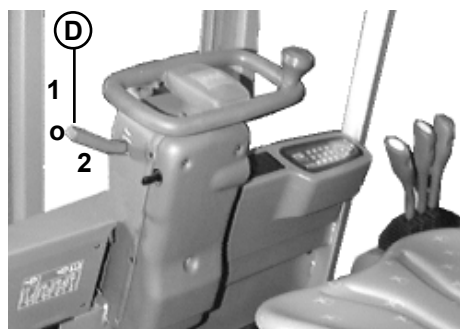
OPERATOR'S SEAT



FOOT PEDALS VERSION

FOOT DRIVE DIRECTION (Standard version)

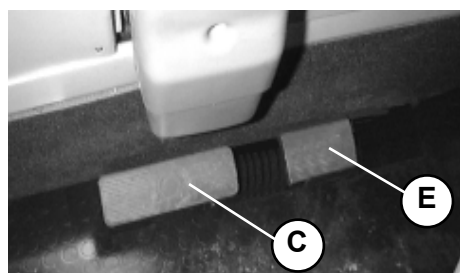
- Forward direction (A)
- Reverse direction (B)
- Service brake pedal (C)



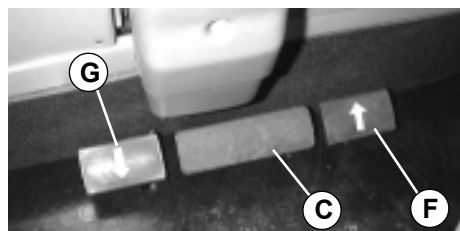
HAND DIRECTION LEVER VERSION (ON STEERING COLUMN)

Direction selector lever (D)

- ↑ 1 Forward direction
- 0 Neutral
- ↓ 2 Reverse direction



Single drive pedal (E)



BALANCED PEDAL VERSION

- Forward pedal (F)
- Reverse pedal (G)
- Brake pedal (C)

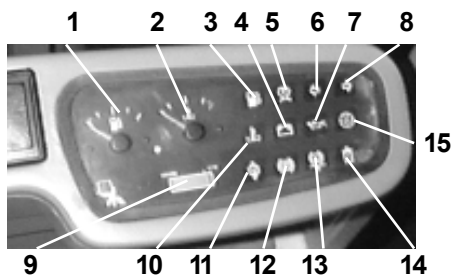
SERVICE BRAKE

Foot service brake (C) controls a hydrostatic braking in the first part of the stroke by means of the proportional valve; if fully pressed, it engages the oil-bath disc brakes (over the front driving wheels).

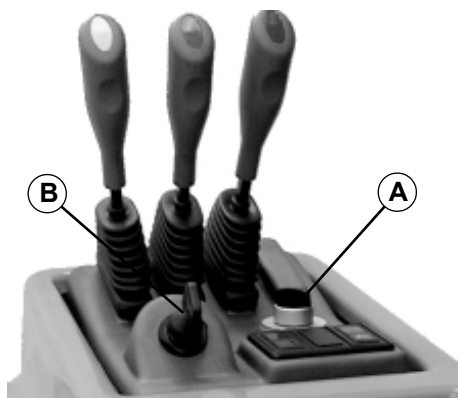
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DASHBOARD

During ordinary operation, all warning lights in the dashboard are to be off.



- 1) Fuel gauge
- 2) Water temperature indicator
- 3) Fuel level warning light
- 4) Generator warning light
- 5) Glow plug warning light (Diesel engine)
- 6) Parking brake-on warning light
- 7) Oil pressure warning light
- 8) Indicator light (optional)
- 9) Electronic hour counter
- 10) Water temperature warning light
- 11) Transmission oil temperature warning light
- 12) Hydraulic oil filter clogged warning light
- 13) Brake liquid level warning light (not used)
- 14) Lifting oil filter clogged warning light
- 15) Warning light indicating air filter clogged

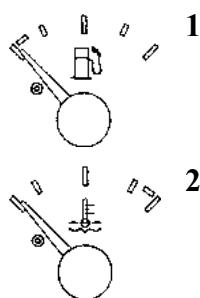


- A) Parking switch
B) Ignition key

CAUTION

The vehicle could instantaneously stop if buttons (A) is pressed; never press this button during the truck ordinary operation.

DASHBOARD INDICATORS



- 1) Fuel gauge

- 2) Coolant temperature level

Indicates the coolant temperature. The pointer must never reach the red sector; the working temperature corresponds to 95 °C.



- 3) Fuel level warning light

The fuel level warning light turns on when approx. 5.5 l of fuel are left in the tank (diesel engines).



- 4) Generator warning light

That warning light is to be off when the engine is running. If not, it indicates that the alternator does not supply any current for the battery or the electric system charge. This may be caused by the breaking of the belt that drives the alternator pulley, or by a failure of the alternator.

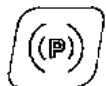
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5

5) Glow plug warning light (Diesel engine).

This warning light turns on when the ignition key is in position (2);



6

6) Parking brake on warning light



7

7) Engine oil pressure warning light

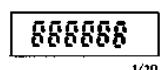
During ordinary operation, this warning light is to be off.

If it turns on, immediately check the oil level in the engine. That warning light could turn on when the engine is idling and hot, due to a lesser lubricant viscosity, even if no failure has occurred.



8

8) Direction indicator on warning light (optional)



9

9) Electronic hour counter

It indicates the working hours and hour fractions of your truck; it is controlled by the contact key and has the function to simplify scheduled maintenance programming.



10

10) Coolant temperature warning light

It indicates the engine overheating. Should it turn on, stop the vehicle immediately. Check the correct operation of the radiator fan, the water pump and the coolant level in the radiator.



11

11) Transmission oil temperature warning light

It indicates that the temperature limits required for the correct operation of the pump and the hydrostatic engine have been exceeded.

Should it turn on, stop working and determine the reasons for the overtemperature transmission oil.

Check the oil level and that the radiator is clean and in good operating conditions.



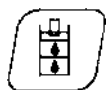
12

12) Transmission oil filter clogged warning light (replace filter)



13

13) Low brake fluid warning light (not used)



14

14) Lifting oil filter clogged warning light (replace filter)

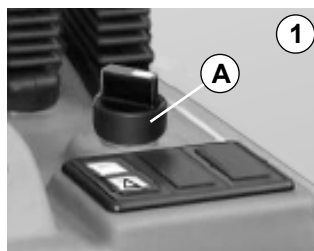


15

15) Air filter clogged warning light (replace filter)

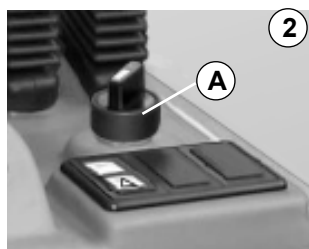
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A: PARKING SWITCH



position 1 - parking - start up

Switch A in **position 1** allows the engine start and disables the traction to prevent any accidental start up; brakes are engaged (parking condition)(the brake light (6) in the dashboard is on).



position 2 - running enabling

Switch A in **position 2** enables the truck running(the brake light (6) in the dashboard is off).

HYDROSTATIC BRAKING

Lift the travel pedals or the accelerator to enable the hydrostatic braking until the truck stops.



IGNITION KEY

- 0 fitting;
- 1 power supply
- 2 glow plug on
- 3 ignition contact and automatic return to position 1.



TRUCK START UP

- the operator must be seated
- parking rotary switch A in **position (P)(park)**.
- fit the key and turn it to **position 1** (power supply on)
- turn the key to **position 2** (glow plug on)
- turn the key to **position 3** to start the engine
- once the engine has started up, release the key which will turn back to **position 1** and turn the rotary parking switch A to **position (R)(run)**.
- select the forward or reverse direction ; the truck is ready to travel.

If the start up procedure has not been correctly performed, the truck will not start up. If so, repeat the procedure above.

MODEL Type	MOTOR	RATED CAPACITY
	kW	kg
SERIAL N°	DRAW-BAR PULL (1h)	
	N	
BATTERY MASS	SERVICE MASS	
kg min.	kg max.	Without Battery kg
MANUFACT. YEAR	TENSION	
	V	

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LIFTING ACCELERATION DEVICE

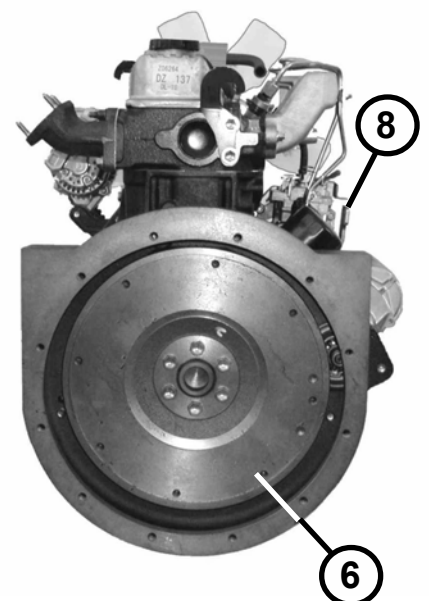
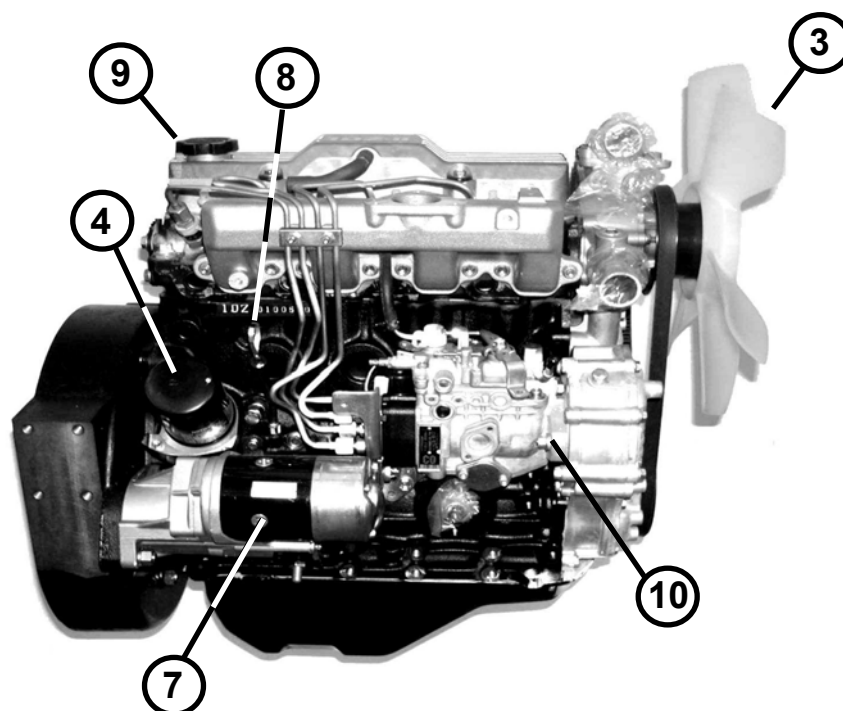
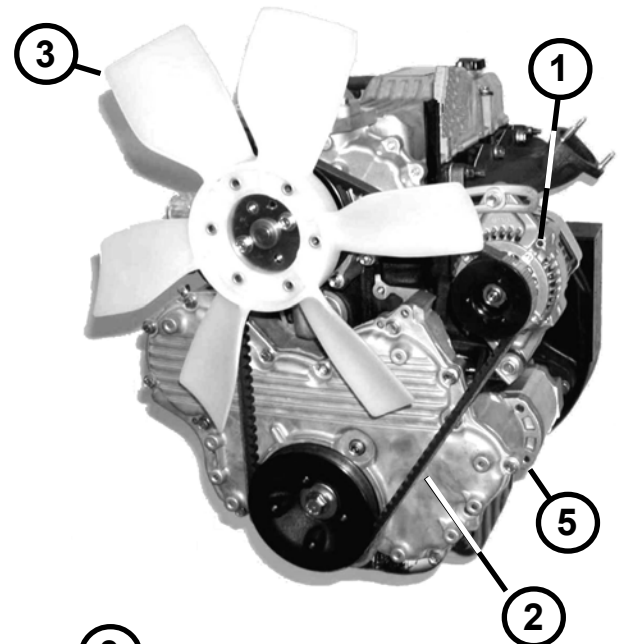
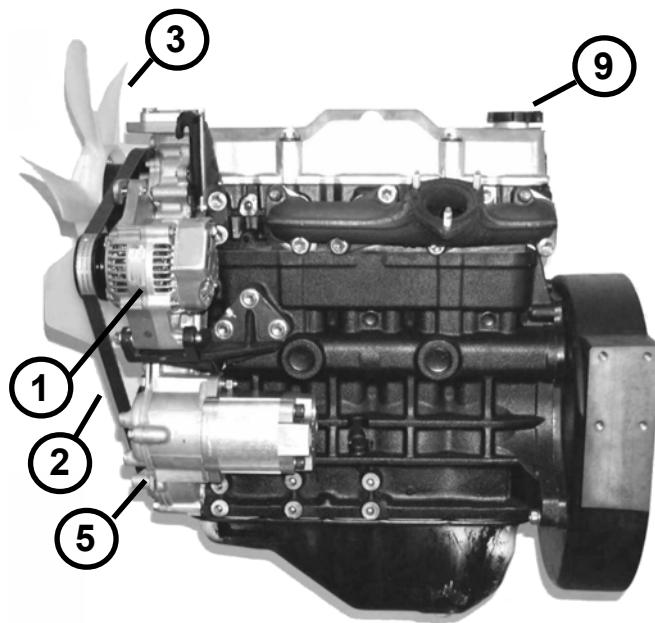
ENGINE	CONTROL PEDALS	STANDARD	WITH LIFTING ACCELERATOR (OPT)
TOYOTA 4 Y	HAND DIRECTION	ACCELERATOR mechanic with cable LIFTING mechanic with cable TILTIN, SIDE-SHIFT hydraulic control	
	DOUBLE FOOT PEDALS	ACCELERATOR mechanic with cable LIFTING mechanic with cable TILTIN, SIDE-SHIFT hydraulic control	
	FOOT BALANCE PEDALS	ACCELERATOR mechanic with cable LIFTING mechanic with cable TILTIN, SIDE-SHIFT hydraulic control	
TOYOTA 1 DZ II	HAND DIRECTION	ACCELERATOR mechanic with cable	ACCELERATOR mechanic with cable LIFTING mechanic with cable TILTIN, SIDE-SHIFT hydraulic control
	DOUBLE FOOT PEDALS	ACCELERATOR mechanic with cable	ACCELERATOR mechanic with cable LIFTING mechanic with cable TILTIN, SIDE-SHIFT hydraulic control
	FOOT BALANCE PEDALS	ACCELERATOR mechanic with cable	ACCELERATOR mechanic with cable LIFTING mechanic with cable TILTIN, SIDE-SHIFT hydraulic control

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ENGINE DATA

ENGINE	TOYOTA 1 DZ II	TOYOTA 4Y
No. cylinders	4 in line	4 In line
Bore	86 mm	91 mm
Travel	107 mm	86 mm
Displacement	2197 cm ³	2237 cm ³
Compression ratio	21,5:1	8,8:1
SAE J1349 power	40 kW	37 kW
Maximum torque	166 Nm at 1600 rpm	157 Nm at 1800 rpm
Maximum speed (with load)	2400 rpm	2400 rpm
Cooling	water	water
Injection	indirect	
Injection pump	Bosch VE	
Induction	atmospheric	atmospheric
Feeding	DIESEL	LPG
Electrical system	12 V	12 V
Lubrication	forced	forced
Oil sump (capacity)	7,9 L including filter	4,0 L including filter
Alternator	12 V - 50 A	12 V - 50 A
Starter motor	2.7 kW	1,4 kW

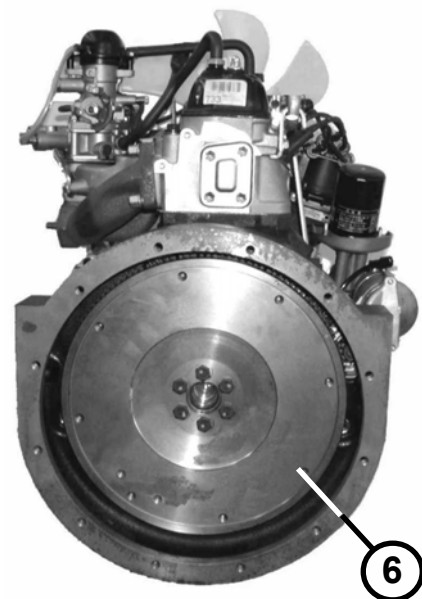
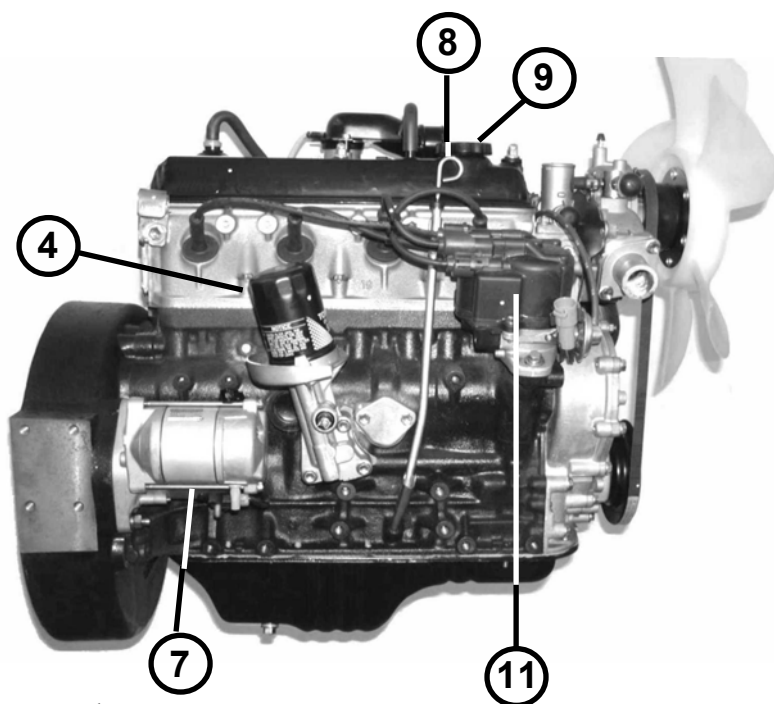
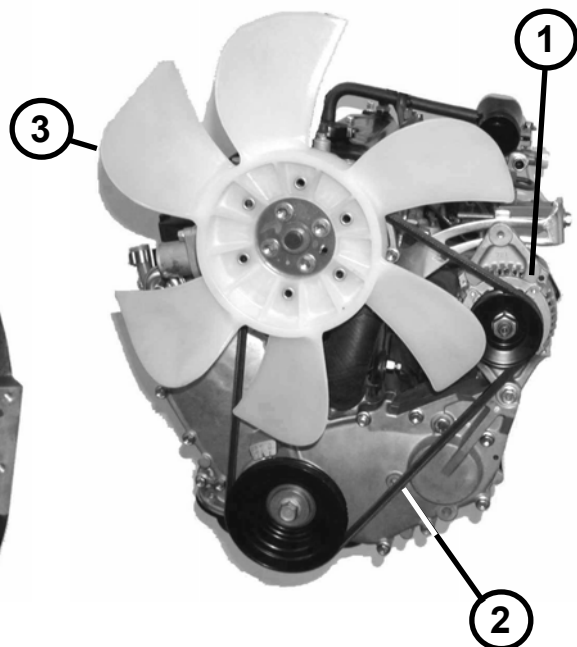
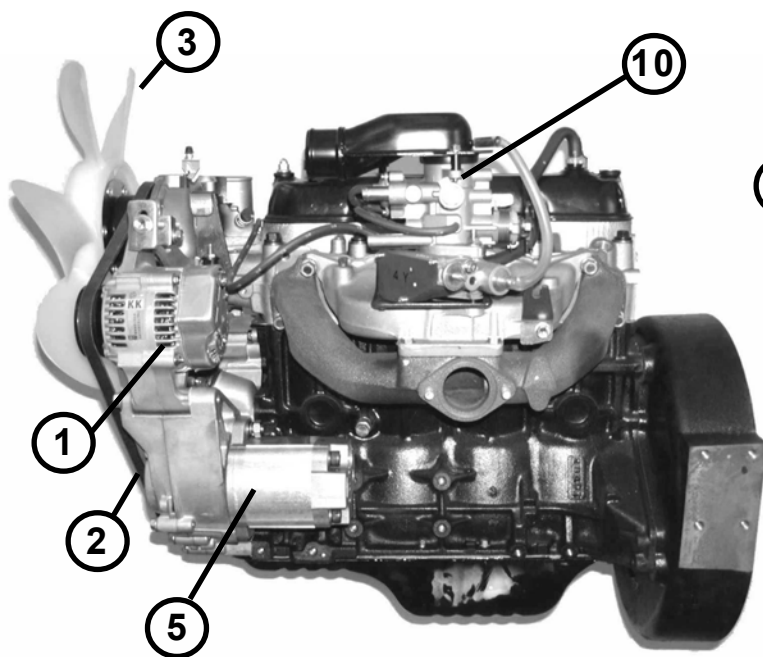
TOYOTA 1DZ II ENGINE



- 1 - Alternator
- 2 - Fan belt
- 3 - Cooling fan
- 4 - Oil filter cartridge
- 5 - Service pump (lifting & steering pump)
- 6 - Flywheel
- 7 - Starter
- 8 - Oil level dip stick
- 9 - Oil plug
- 10- Ignition pump

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TOYOTA 4 Y ENGINE



- 1 - Alternator
- 2 - Fan belt
- 3 - Cooling fan
- 4 - Oil filter cartridge
- 5 - Service pump (lifting & steering pump)
- 6 - Flywheel
- 7 - Starter
- 8 - Oil level dip stick
- 9 - Oil plug
- 10- Carburettor
- 11- Distributor

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OIL CHANGE AND ENGINE OIL FILTER REPLACEMENT

The oil level in the sump is checked with the dip-stick, making sure that the level is between the MIN and MAX notches.

If it is necessary to top up, use the same oil as that used for filling.

CHANGING OIL AND FILTER

After the first 50 hours:

change oil and filter of the engine and then

every 50 hours:

check oil engine level

every 250 hours:

change oil and filter of the engine

To replace the oil and the filter, proceed as follows:

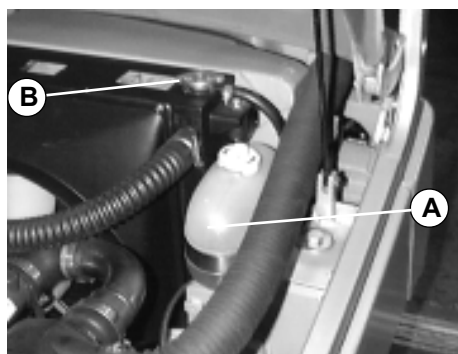
- With the engine hot, remove filling cap, then unscrew the discharge cap and allow the oil to drain out.
- Unscrew the engine filter cartridge.
- Fit the new filter and tighten it, paying particular attention to the position of the seal that should be previously oiled.
- Tighten the drain cap and fill the oil sump up to the Max level on the dip-stick.

TOPPING UP WITH COOLANT

Every 50 hours

- Make sure the coolant licks up the radiator plug (B).
- Check the level of the cooling liquid in the expansion tank (A) with the MIN level indicator.

The plugs of the tank and radiator must only be removed when the engine is cold.



Every 250 hours

- clean the outside of the radiator.

Every 2,000 hours

- change the cooling liquid
 - check the density, if possible, at the start of the cold season.
- The truck is delivered with the antifreeze diluted 50%. To change the percentage dilution, follow the values in the table below.

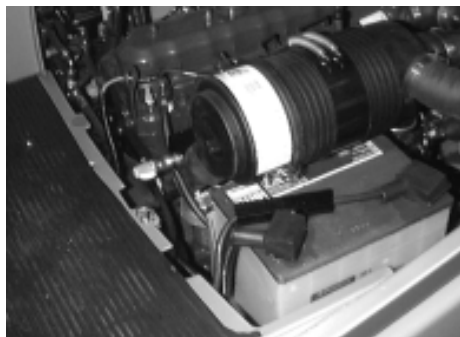
ANTIFREEZE APPLICATION RANGE

10%	20%	30%	40%	50%
-4°C	-10°C	-17°C	-24°C	-40°C
101°C	102°C	104°C	106°C	109°C

% VOLUME OF ANTIFREEZE
FREEZING TEMPERATURE
BOILING TEMPERATURE

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AIR FILTER



The air suction filter for the fuel supply is composed of two filtering elements.

Every 250 hours

- Clean the element outside the filter (the element inside is not to be cleaned).

The filter is to be cleaned also when relevant **warning light (15)** on the dashboard turns on.

Every 3 cleaning cycles

- replace the element inside the filter

Every 6 cleaning cycles, or once a year

- replace the element outside the filter.

Disassembling and cleaning the filter

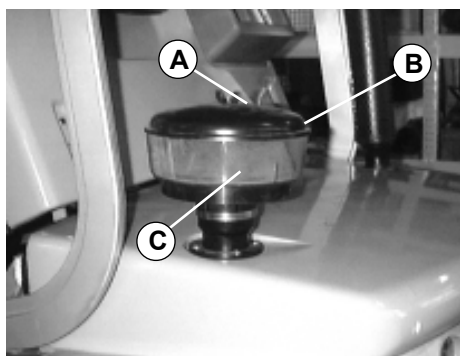
- release the cover fastening screws and remove the filter cartridge;
- clean with compressed air (MAX. 5 bar pressure) from the inside towards the outside;
- check that no tear is to be found.

Never hit the cartridge on hard surfaces.

Never use any mixture of water and detergent to clean the filter.

When reassembling the filter cover, make sure that the dust emptying opening is turned downwards.

CYCLONE PREFILTER



Every 8 hours

- clean the cyclone prefilter.

Cleaning the cyclone prefilter

- loosen wing-nut (A);
- remove the cover (B);
- extract the tank (C);
- empty the tank and fit it again.

ENGINE RUNNING-IN

During the running-in period, the truck should be used at 60-80 % of its power for the first 50-100 working hours.

During the running-in period, the engine may consume more oil than usual. It is recommended that the oil level be checked every 8 working hours, with engine standstill for at least 10 minutes.

Do not use the engine at its peak RPM until it has reached its working temperature.

HYDROSTATIC TRANSMISSION

An exact awareness of control possibilities is fundamental to the correct use of the truck with optimum exploitation of the installed power.

The hydrostatic transmission is of prime importance. It transmits power from the internal combustion engine to the drive wheels.

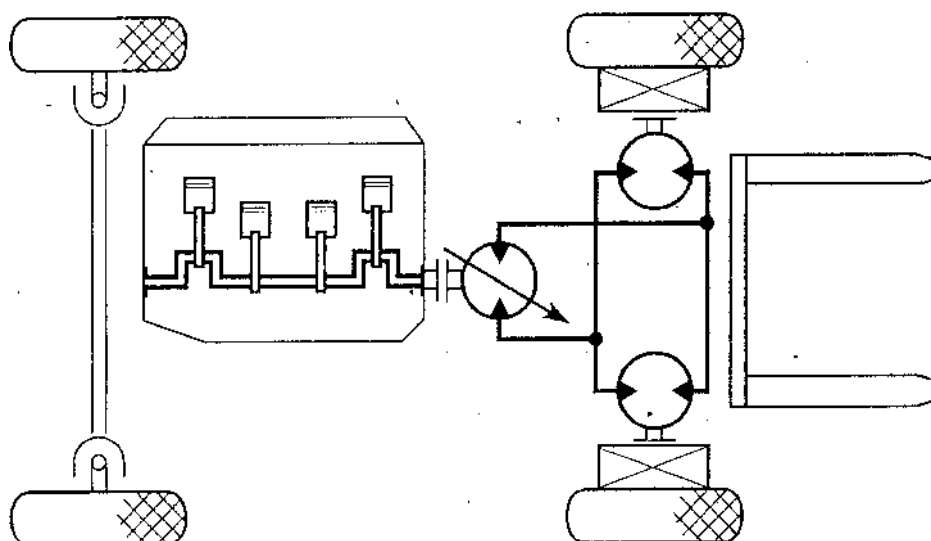
This kind of transmission allows the transfer of powerful torques to the wheels, with automatic system feedback. That is to say, when the drive wheels require an increased torque, for example when a level surface leads onto a ramp, the speed is automatically reduced and the torque increased, without the intervention of the operator.

The hydrostatic transmission consists of a pump with variable capacity, driven by an internal combustion engine.

The pump supplies oil to two fixed capacity hydraulic motors.

The hydraulic connection between the two drive motors allows proportional division of the flow supplied by the hydrostatic transmission, so that on a curve the outer wheel is favoured; this kind of transmission behaves in the same way as a differential transmission.

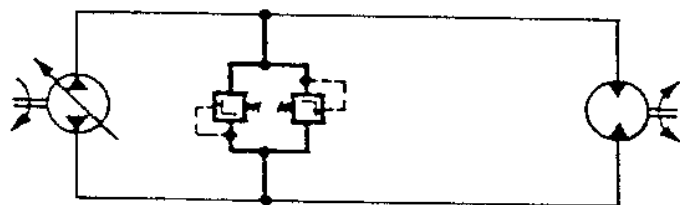
An auxiliary pump deals with any leakage from the circuit.



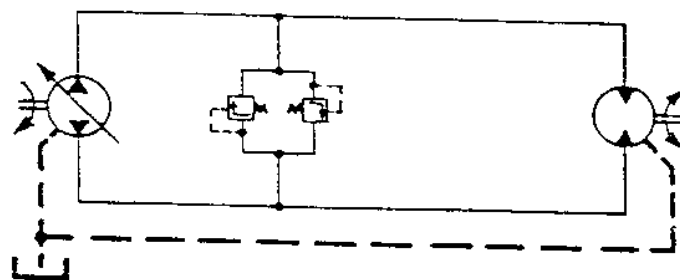
Example of closed circuit hydraulic transmission



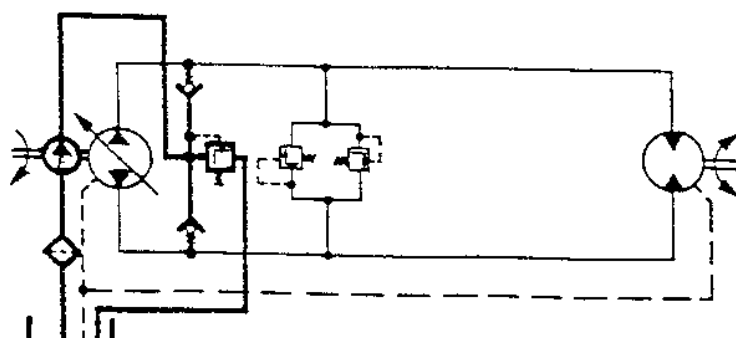
Base system - pump/hydraulic motor



The pump is equipped with two max. pressure valves on the sides of high pressure which have the function to protect the hydrostatic transmission (pump and motor) from overloads.



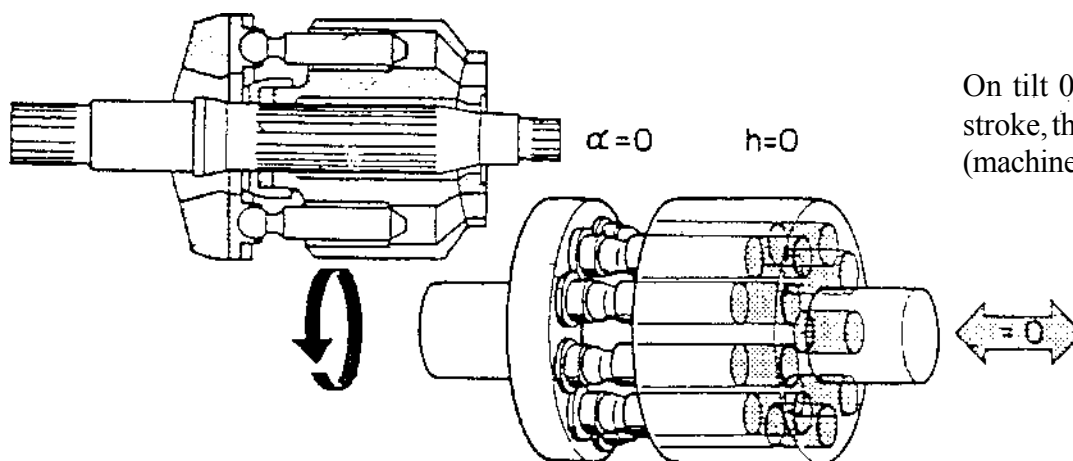
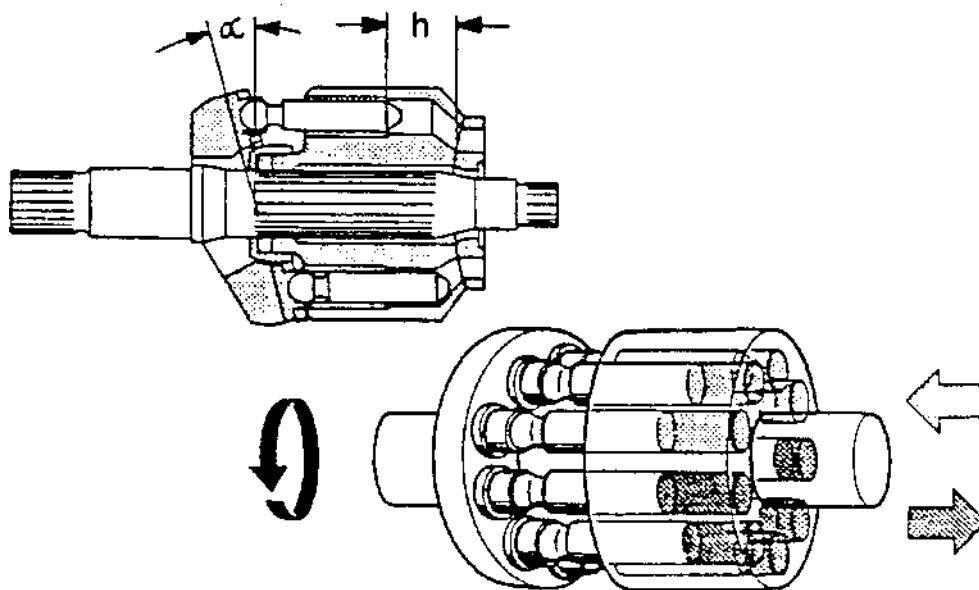
On the hydraulic motor and on the pump there are some oil leakages which are flown into the tank.



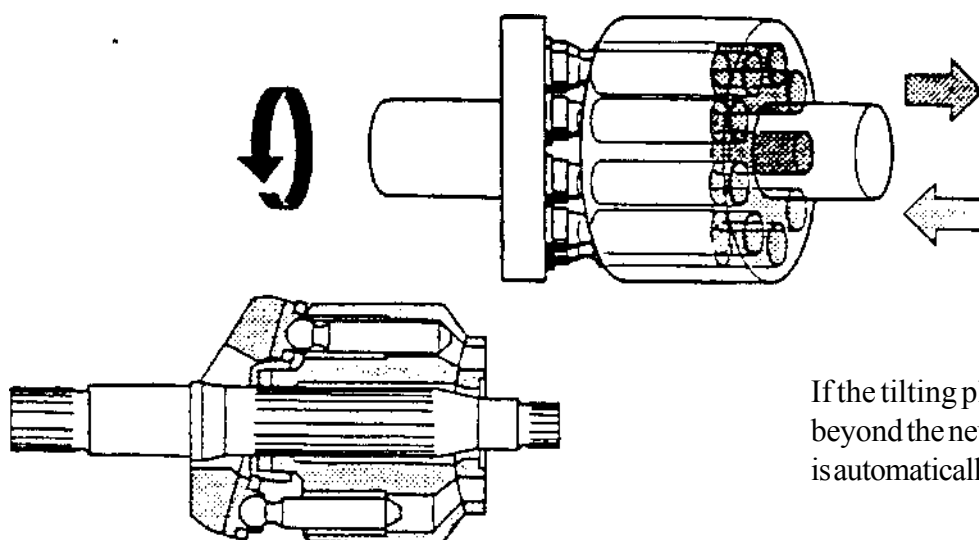
An integrated auxiliary pump is used for the restore of the leaked oil. The system is completed by an adjusting valve of the restoring pressure oil.

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Operative description of the variable capacity pump with axial pistons



On tilt 0, it corresponds to 0 stroke, therefore 0 capacity.
(machine stopped)



If the tilting plate of the pump is positioned beyond the neutral point, the pump direction is automatically inverted.

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DESCRIPTION OF THE MAIN FUNCTIONS

TRUCK MOVEMENT The thermal engine may only be started if the parking brake is on.

The system allows the pump to increase the displacement (truck motion) only if:

- the motor is running
- the parking brake is off
- the running selector is not in neutral position.

Should one of those conditions be not true, the actuation of the accelerator pedal will only result in thermal engine speeding up.

The position of the accelerator pedal - through the thermal engine and the hydrostatic pump - affects the truck speed.

ACCELERATION / DECELERATION The truck acceleration depends on the speed with which the accelerator pedal is pressed.

BRAKING / INCHING The brake pedal has two functions: 1) hydrostatic braking (the pump displacement cancels itself out) with a strength depending on the pedal stroke; 2) “inching” function, that can be obtained by simultaneously pressing the brake pedal and the accelerator pedal.

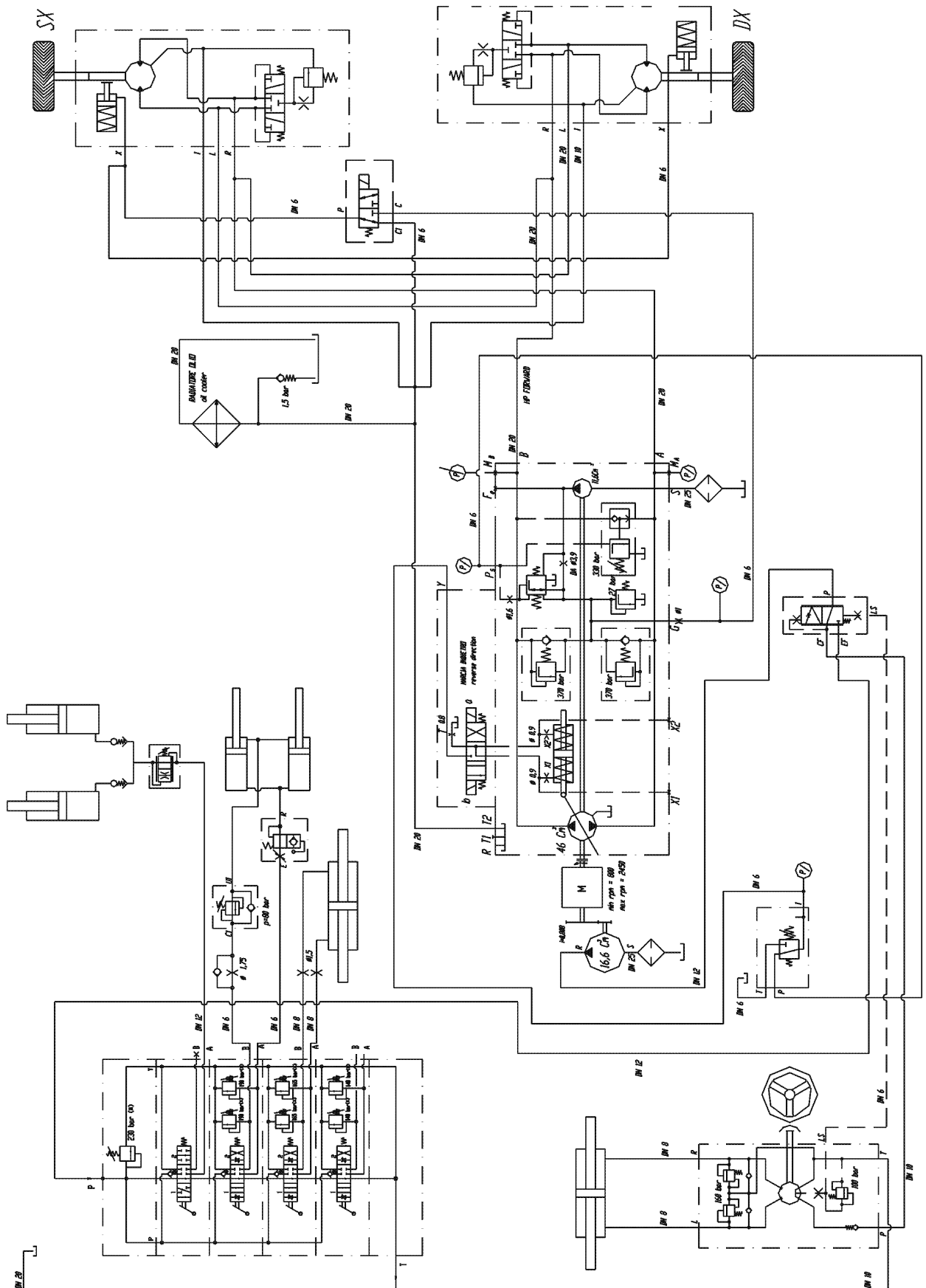
PUMP DISPLACEMENT The displacement of the hydrostatic pump depends on the stroke of the accelerator pedal (and on the stroke of the brake pedal in the “inching” function). The accelerator pedal also determines the rate of rotation of the thermal engine.

ANTISTALL FUNCTION During the truck ordinary operation, if the power required by the hydrostatic transmission exceeds the power that may be supplied to the thermal engine, the pump displacement will be automatically reduced to avoid the engine stall.

PARKING BRAKE The parking brake is engaged by pressing a switch located next to the control valve levers. When the parking brake is on, the accelerator pedal is disabled (the thermal engine accelerates, but the truck cannot run). If the parking brake is engaged while the truck is running, the driving wheels will be automatically locked. Therefore, avoid engaging the parking brake while the truck is running, unless you are in an emergency condition.

RUNNING DIRECTION May be selected through the steering-wheel operated reverse gear (for simple pedals) or the forward/reverse pedals (for the double and swaying pedal system). If the lever of the steering-wheel operated reverse gear is shifted to the neutral position while the truck is running (or the accelerator pedal is released in case of double pedal system), the truck will hydrostatically brake. If the running direction is reversed while the truck is running, a hydrostatic braking will occur, which will be immediately followed by the acceleration in the opposite running direction.

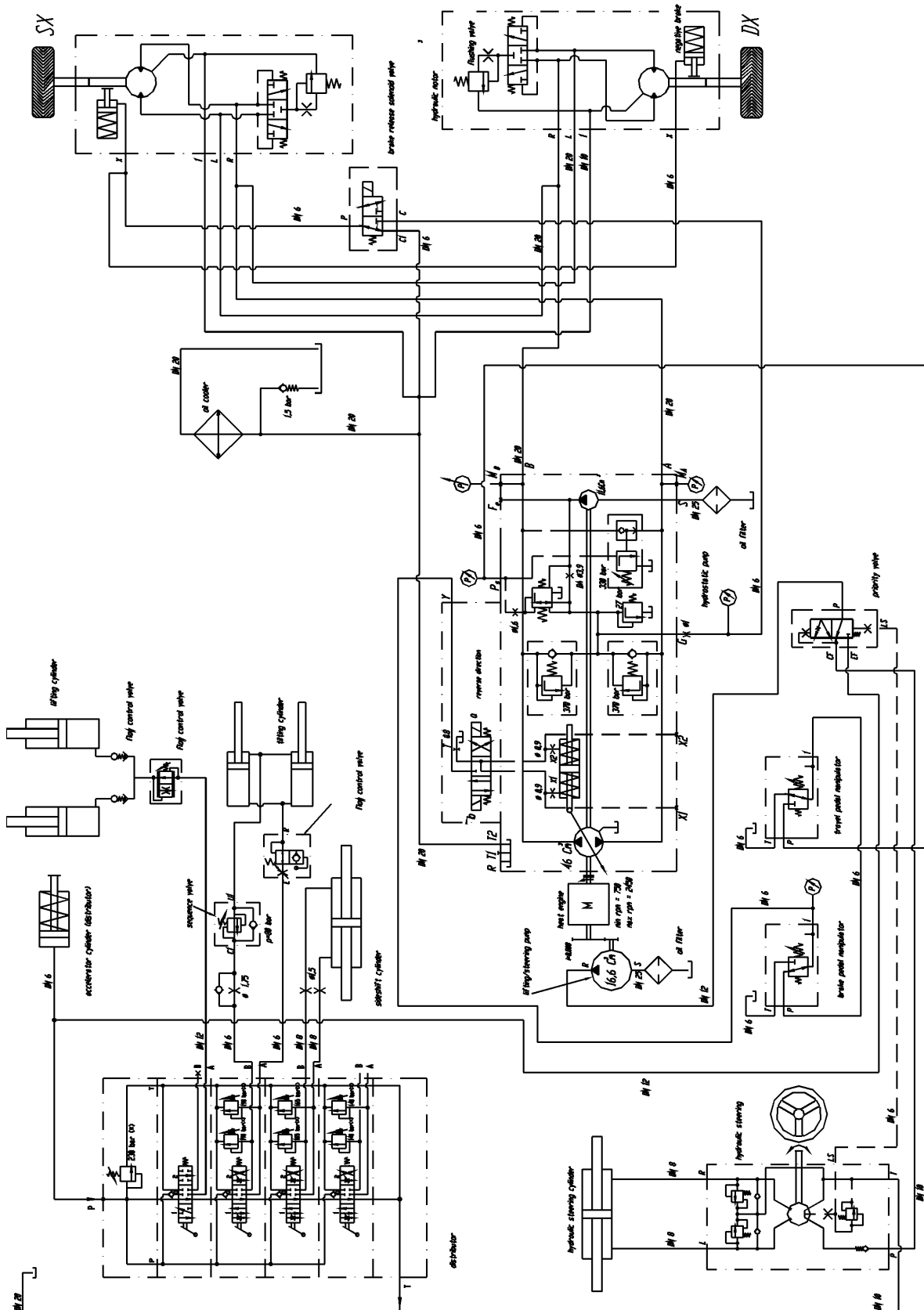
HYDRAULIC DIAGRAM - TOYOTA 1DZ II ENGINE (STANDARD VERSION)



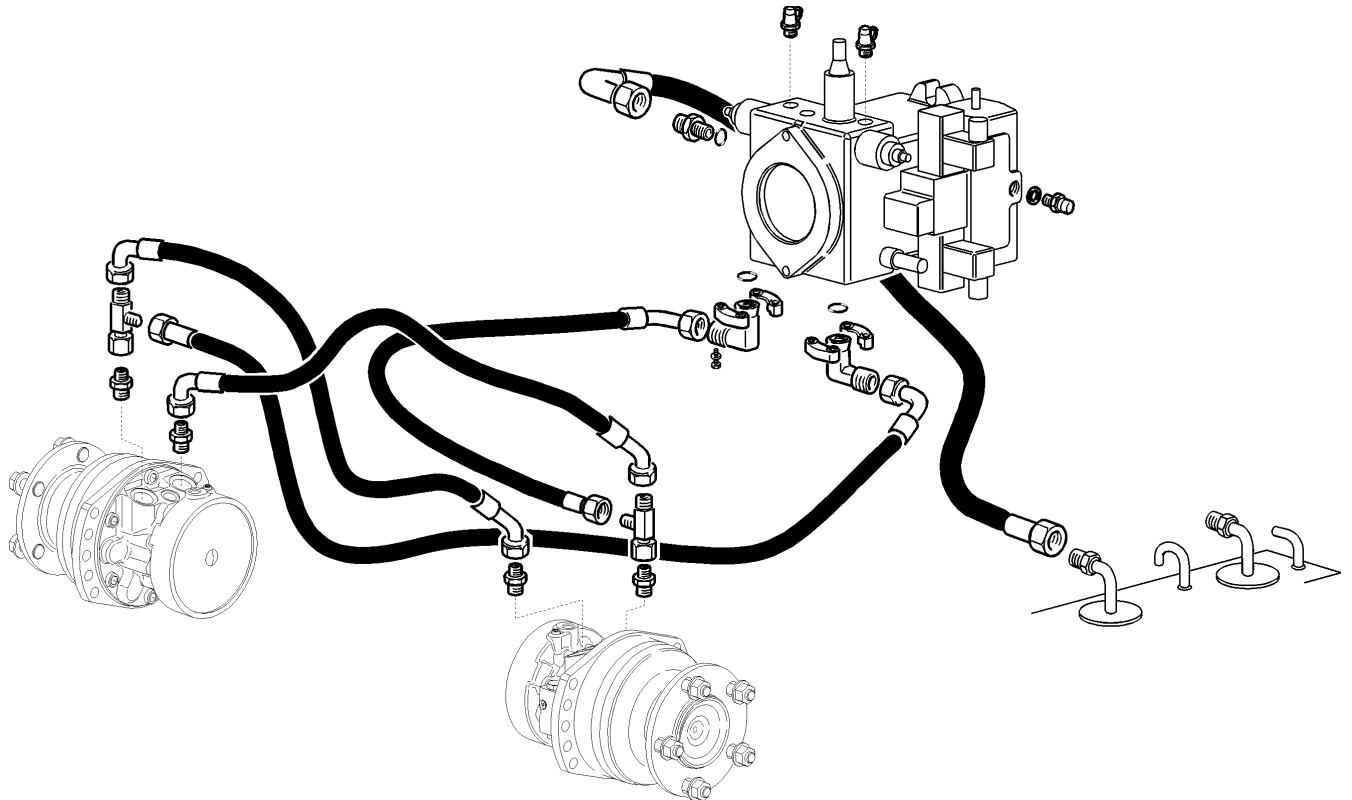
SERVICE MANUAL

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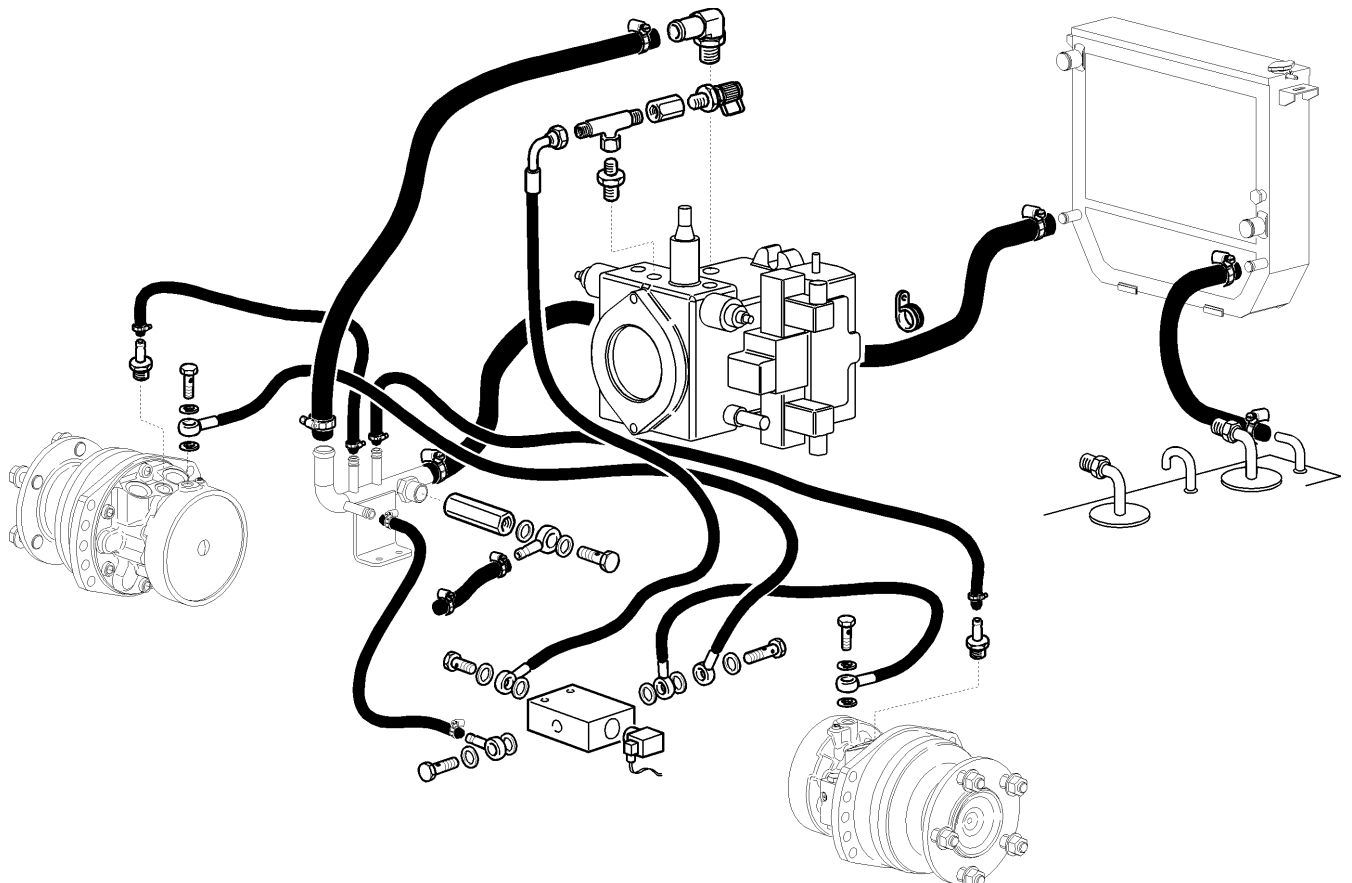
HYDRAULIC DIAGRAM - TOYOTA 4 Y ENGINE (STANDARD VERSION) TOYOTA 1DZ II ENGINE (WITH LIFTING ACCELERATOR, OPTIONAL)



HIGH PRESSURE CIRCUIT



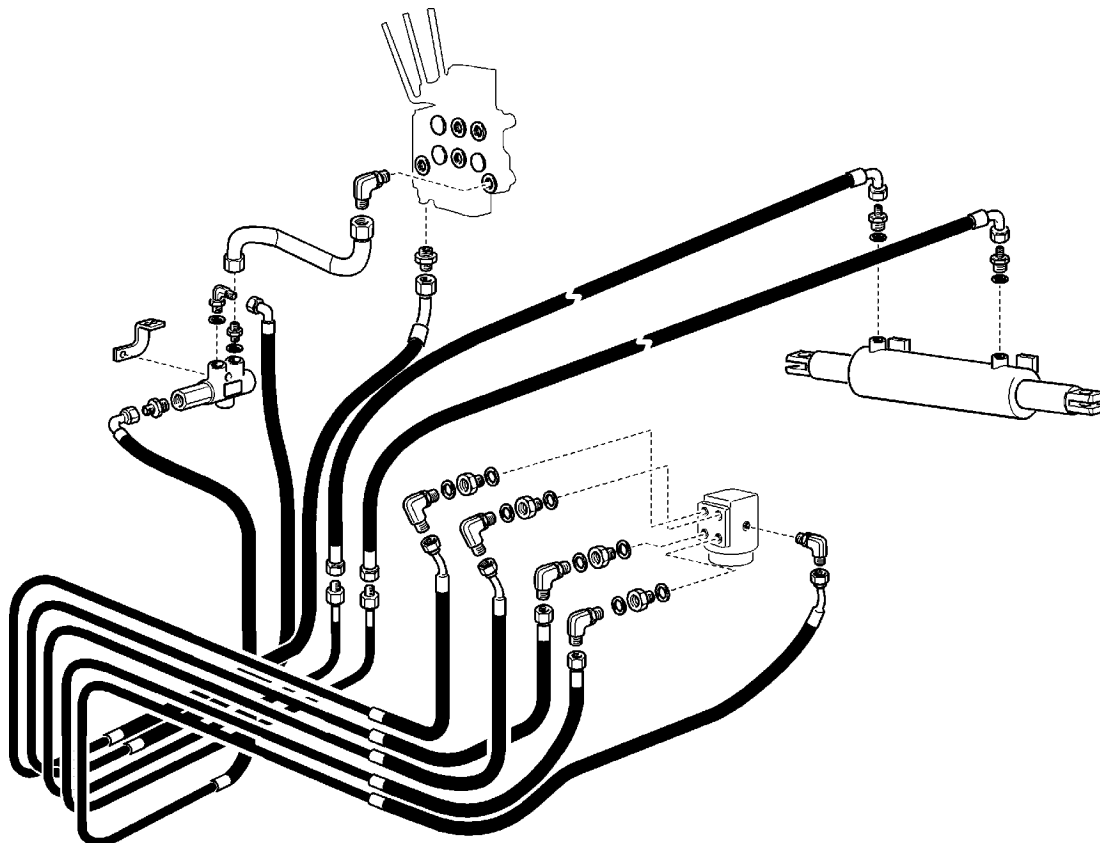
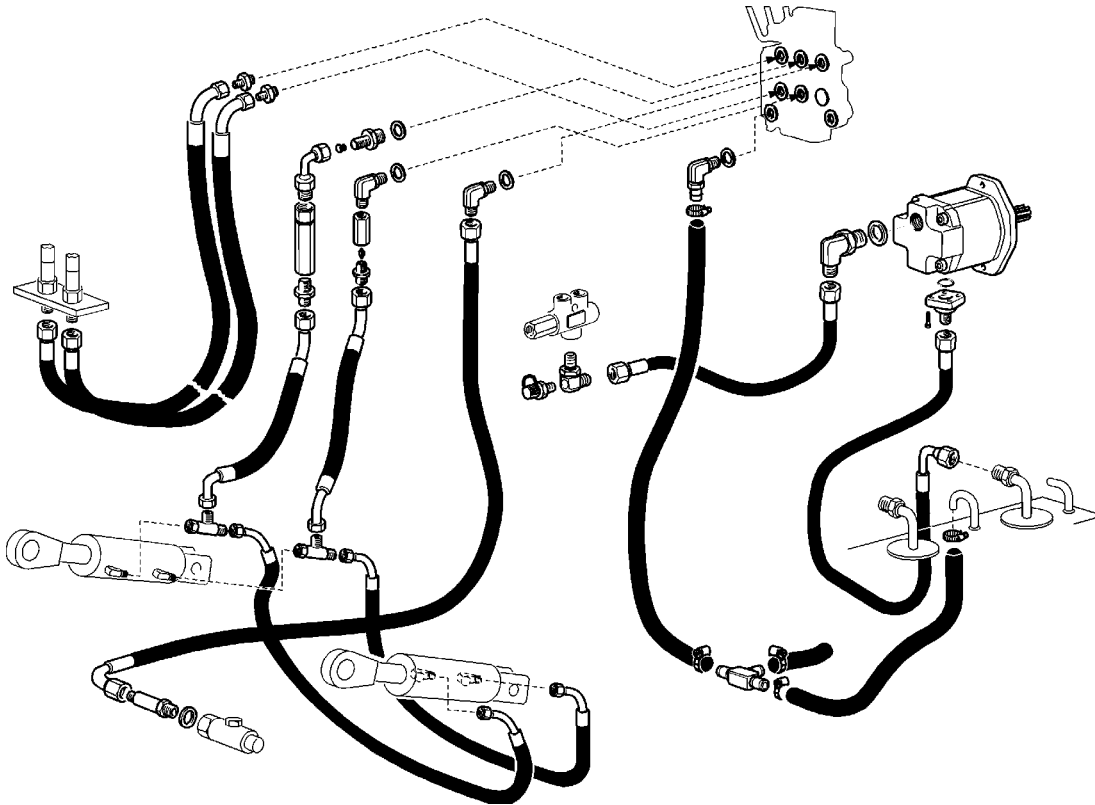
LOW PRESSURE CIRCUIT



SERVICE MANUAL

INTERNAL
COMBUSTION

HYDRAULIC LAYOUT



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ADJUSTMENT VALUES

ENGINE	TOYOTA 1DZ II	TOYOTA 4 Y
R.P.M. min.	850	750
R.P.M. max.	2400	2450

HYDROMATIC PUMP A10 VG 45 DA

ENGINE		TOYOTA 1DZ II	TOYOTA 4 Y
Boost pressure	G	from 25 bar R.P.M. min. to 28 bar R.P.M. max. without load	from 25 bar R.P.M. min. to 28 bar R.P.M. max. without load
Control piston pressure	X1 X2	from 4 bar R.P.M. min. to 28 bar with locked tyres 2400 R.P.M.	from 4 bar R.P.M. min. to 28 bar 2450 R.P.M. with locked tyres
High pressure	MA MB	from 50-60 bar on starting 800-850 R.P.M. to 330 bar 2400 R.P.M. with locked tyres	from 50-60 bar on starting 750-800 R.P.M. to 330 bar 2450 R.P.M. with locked tyres

Standard restrictors

Valve DA = Ø 3,9
 X1+X2 = Ø 0,9
 T = Ø 0,8

HYDROMATIK TRANSMISSION

PRESSURE CHECKING POINTS

G = Boost pressure

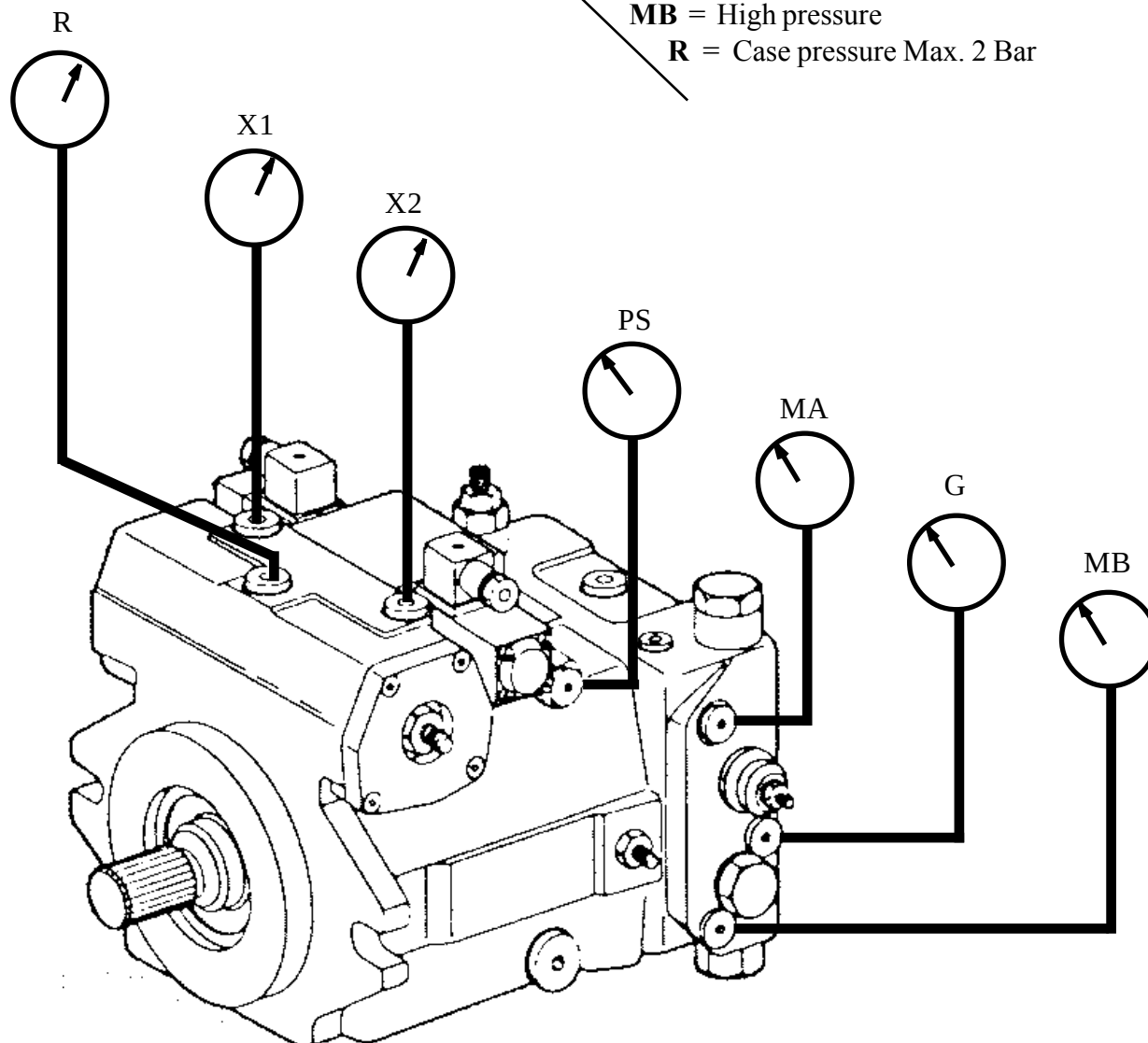
X1 = Pilot pressure - Forward direction

X2 = Pilot pressure - Reverse direction

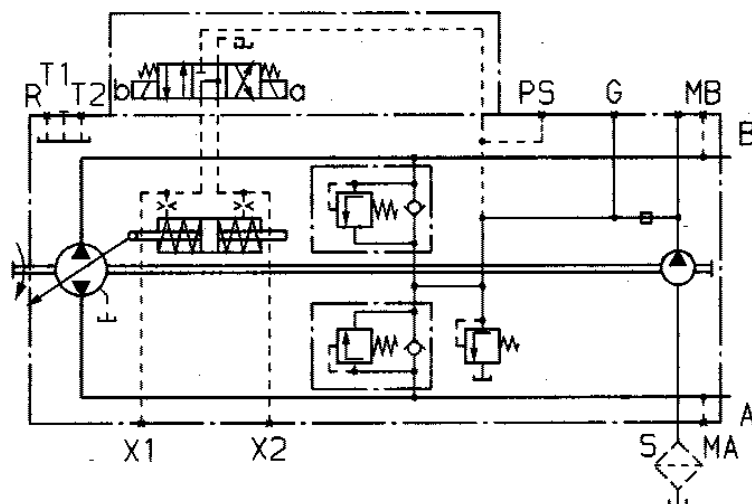
MA = High pressure

MB = High pressure

R = Case pressure Max. 2 Bar



HYDRAULIC DIAGRAM



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ADJUSTMENTS TO BE CARRIED OUT ON THE HYDROMATIK TRANSMISSION

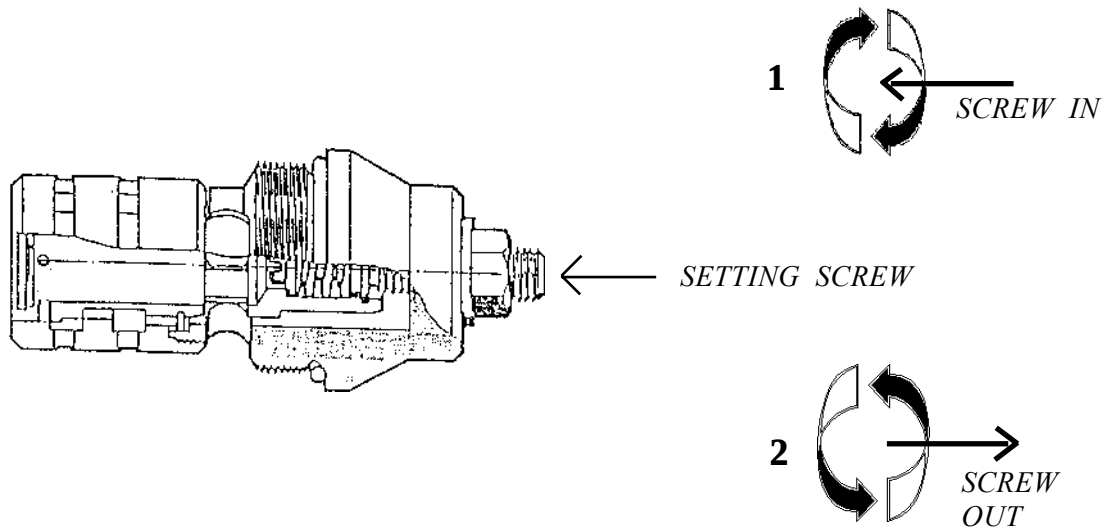
Adjustment of the truck starting point

The starting point is the minimum R.p.m. of the thermal engine, when the truck must start to move on the flat floor and in normal floor conditions.

The adjustment is carried out by setting the screw placed on the DA valve

1 - Screw in means higher starting point

2 - Screw out means lower starting point



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Adjustment of the R.p.m. under load of the thermal engine

The R.p.m. under load is the number of revolutions obtained when the truck is used with the hydraulic transmission under stress (ex. upward, in acceleration).

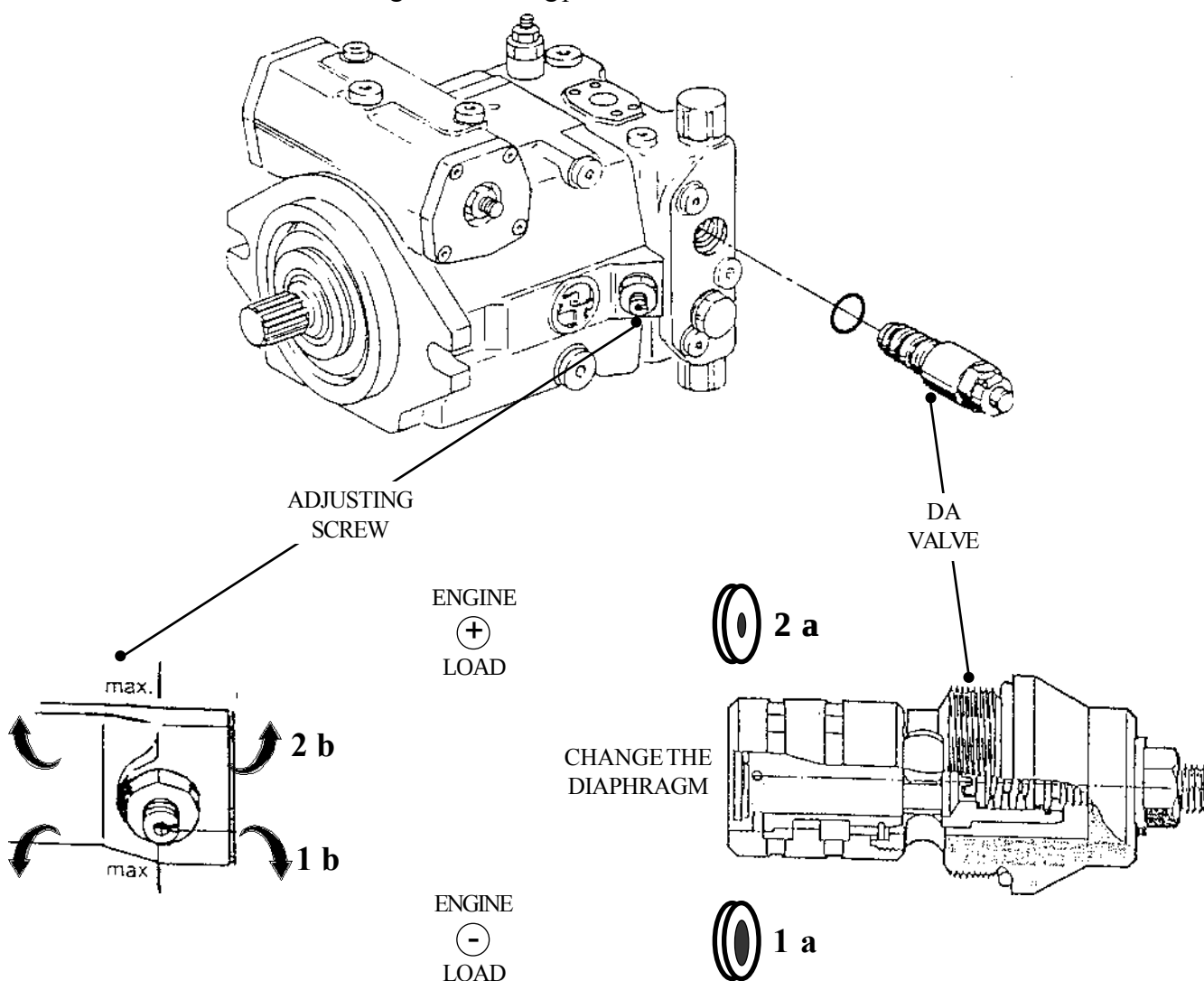
This adjustment is used to optimize the operative function of the truck according to the environment and the kind of work:

If the truck has the motor too loaded, it makes a lot of smoke upward and it decreases the revolutions under stress:

- 1 a** - Operate by replacing the diaphragm of the **DA** valve with one of larger dia. or:
- 2 b** - Rotate the adjusting screw, shown on the figure, of some degrees by removing the notch towards the right side of the truck sitting on the driving position.

If the truck with engine having the revolutions very high, it works only on the flat and with a few load:

- 1 a** - Replace the DA valve diaphragm with another one with smaller diameter, or:
- 2 b** - Rotate the adjusting screw shown on the figure, by moving the notch towards the left side of the truck sitting on the driving position



N.B.: By the truck on stall the engine R.p.m. has to settle between 200 - 500 revolutions less than the max. R.p.m.

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Adjustment of the release braking

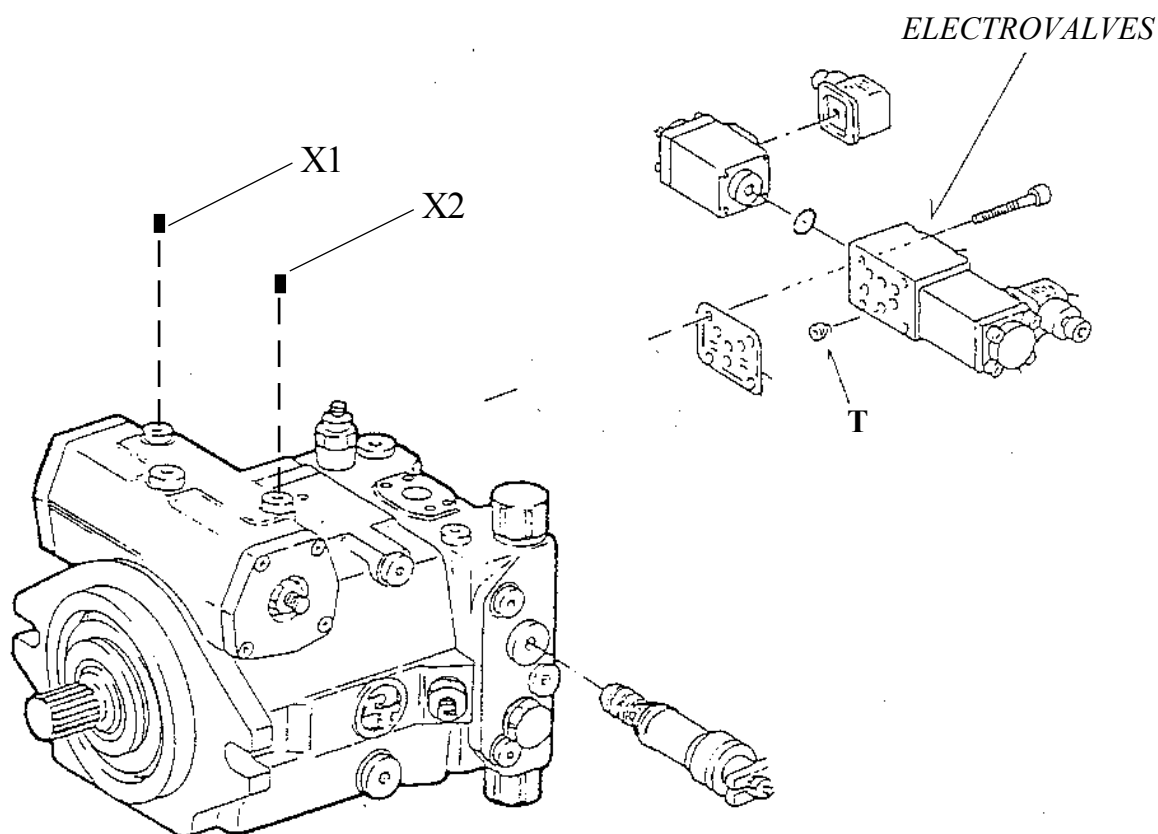
The release braking is the truck deceleration obtained, when you release the accelerator pedal.

Acceleration and electrical release braking adjustment

By release braking is meant the amount of deceleration of the truck when the accelerator pedal is released.

The regulation of acceleration and braking is done by altering the flow of oil from the solenoid valve to the positioning piston and drain.

Adjust throttle valves **X1**, **X2** or **T** positioned as shown in the illustration.



To achieve:

Better acceleration and braking at release:

widen throttle valves **X1**, **X2** or **T** or replace with larger diameter valve



(Max 1,5 mm)

Less acceleration and braking at release:

fit smaller diameter throttle valve **X1**, **X2** or **T**



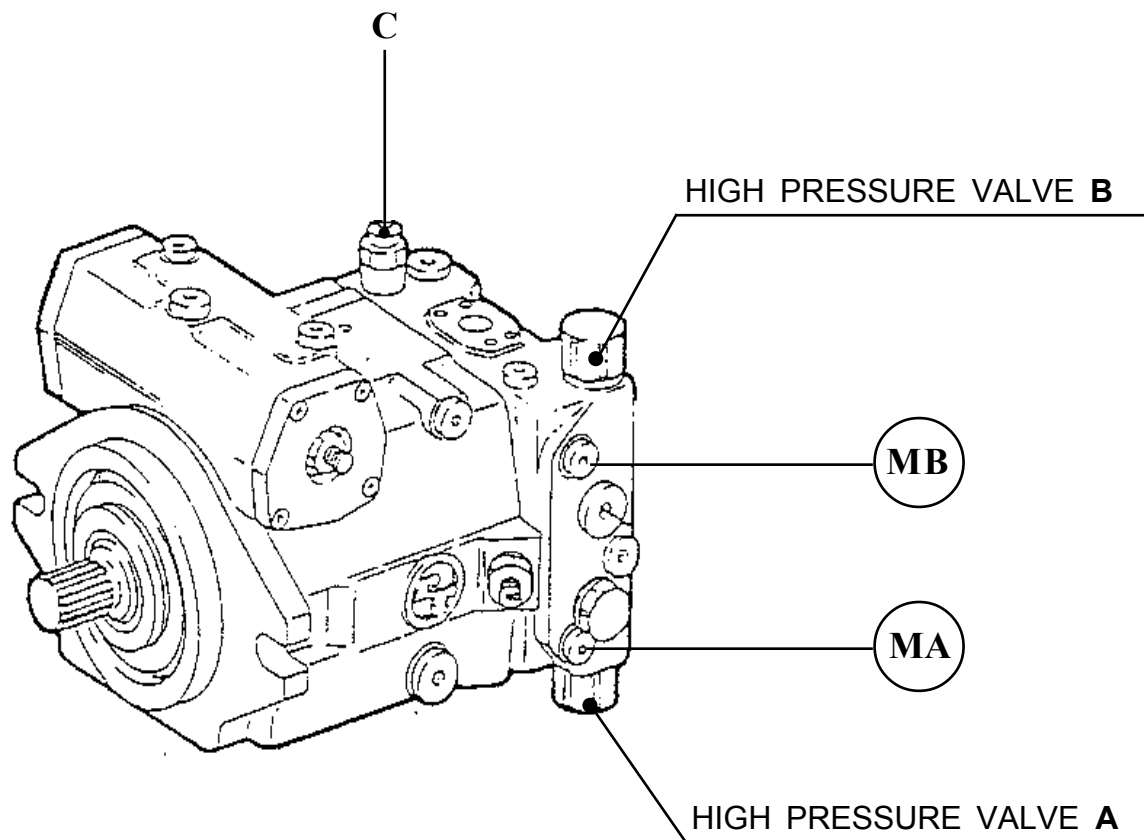
(Max 0,6 mm)

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ADJUSTMENT OF THE "PRESSURE CUT-OFF VALVE"

The high pressure valves **A** and **B** limit the max pressure off the hydraulic circuit.

The cut-off pressure valve **C** is necessary to lighten the work of the high pressure valves **A** and **B**.



VALVE ADJUSTMENT

- Screw in completely the cut-off pressure valve and verify that the max pressure MA - MB is 370 bar at least.
- Screw out the cut-off pressure valve until you obtain (MA - MB) 350 bar with Kubota and GM engine, and 330 bar with Toyota engine.

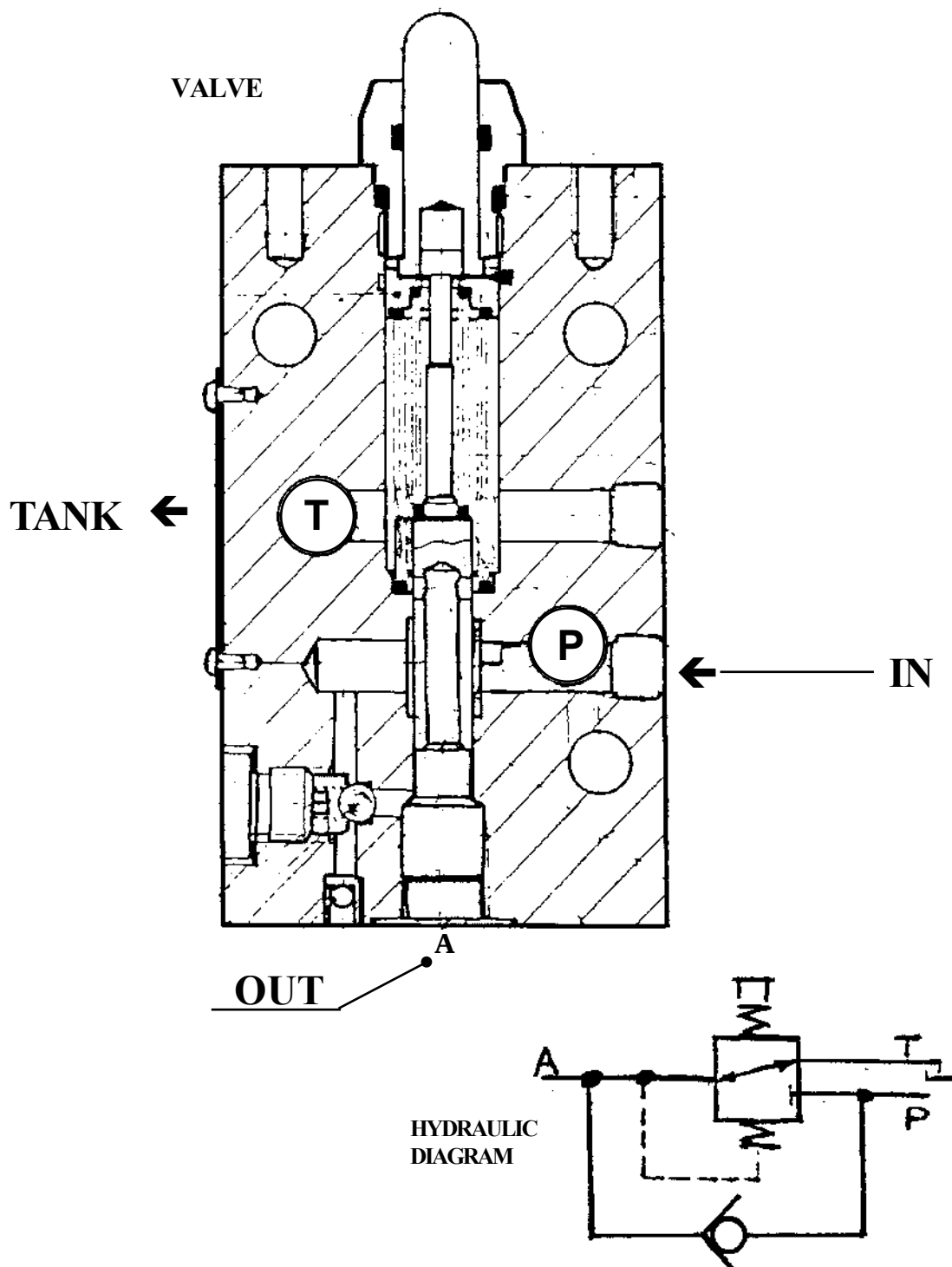
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TRACTION, BRAKE/INCHING AND LIFTING ACCELERATION DEVICE

CABLE CONTROL VERSION

By the lifting acceleration device you can increase the mast speed (lifting, tilting, side-shift) without having to use the inching to stop the truck.

It is consisted of a valve fitted on the acceleration pedal and of a block between the pump and the electrovalve. The device intercepts the pilot pressure and it releases a quantity of oil, which pressure is proportional to the position of the acceleration pedal and not to the thermal engine R.p.m.

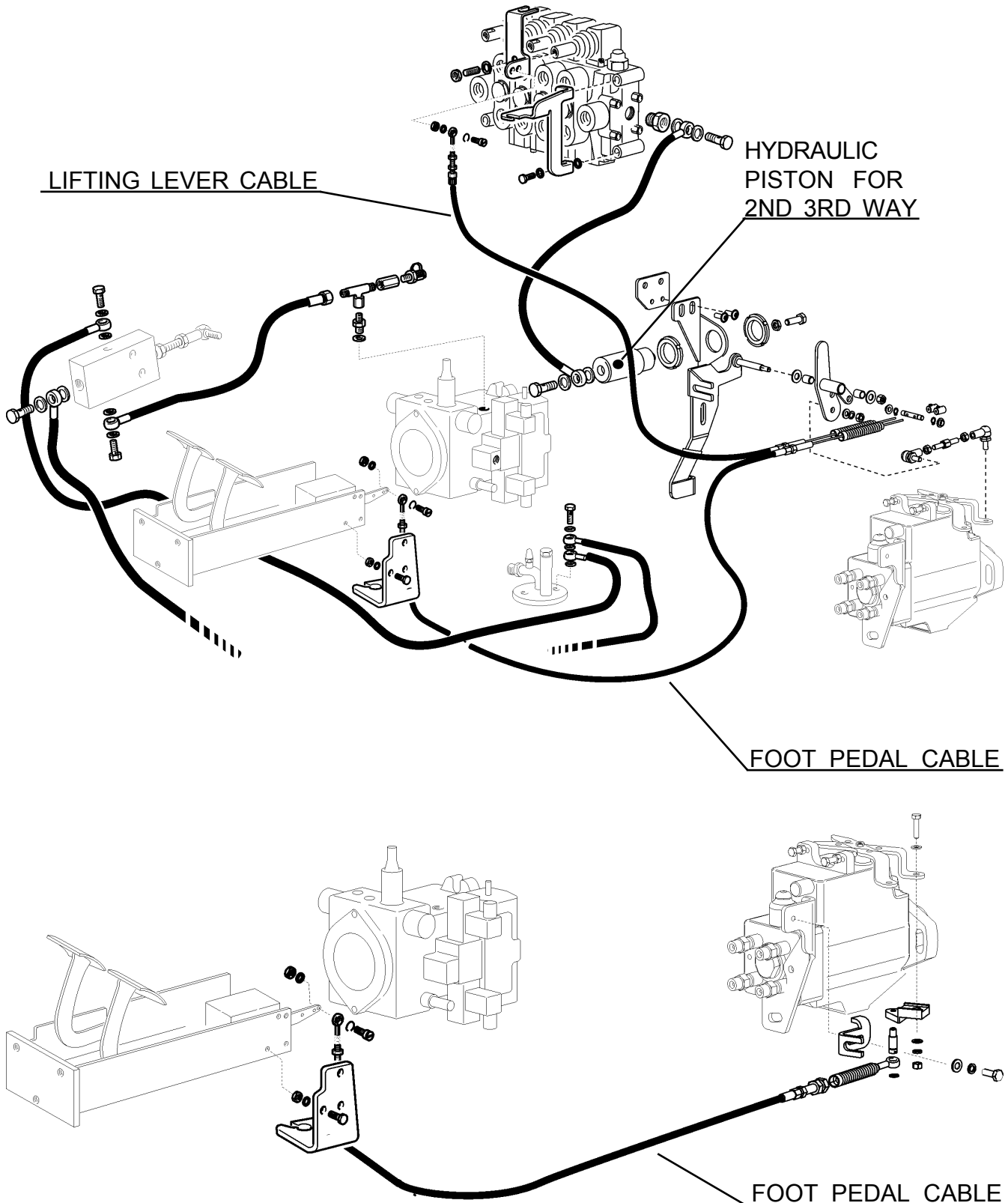


LIFTING ACCELERATOR DEVICE

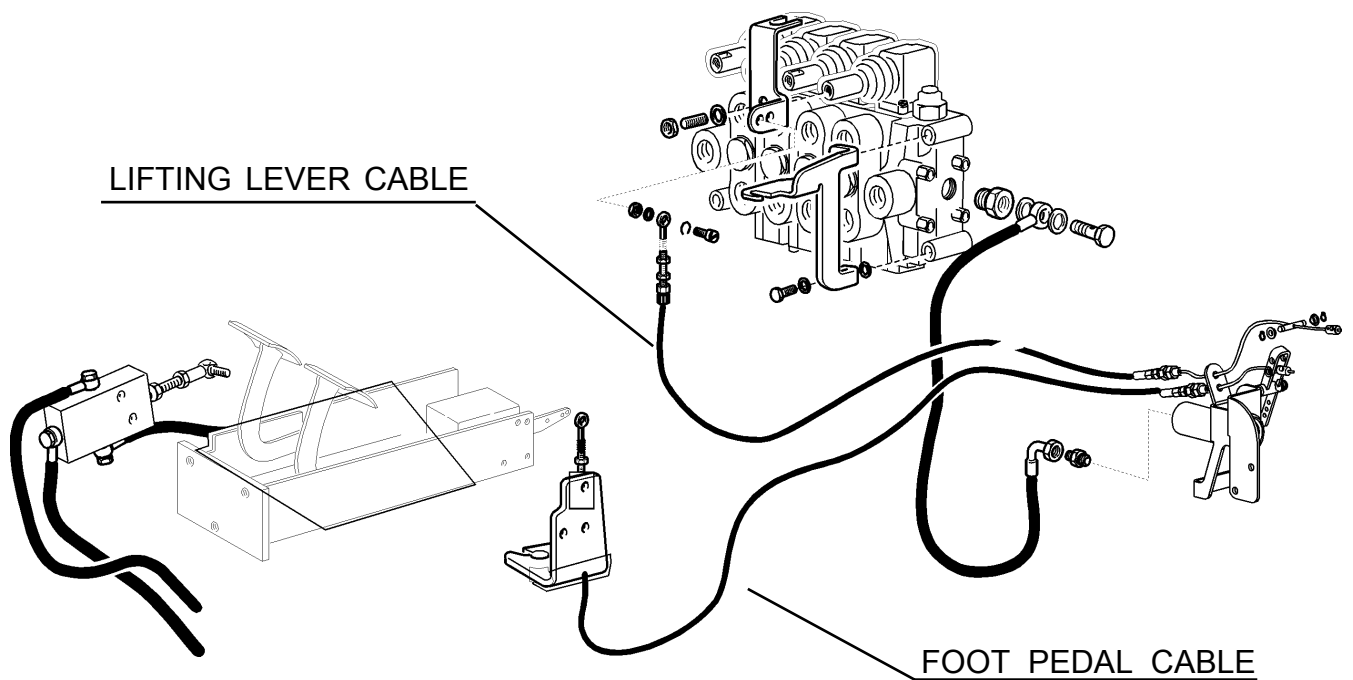
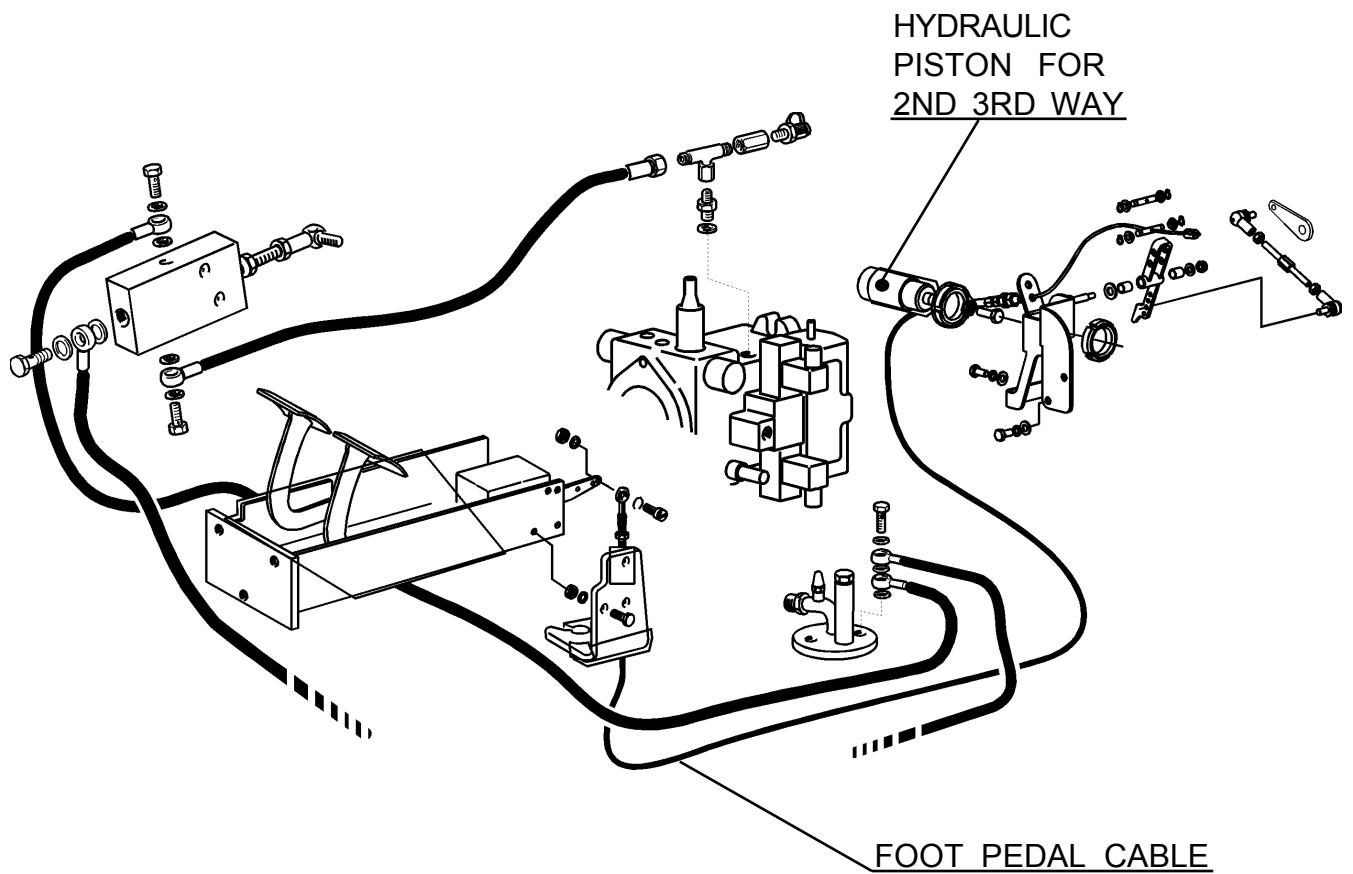
Acting on the distributor levers you contemporarily accelerate the thermal engine. In order to carry out it, two systems are used:

- with a steel flexible cable for the lifting lever
- a hydraulic piston connected to the distributor for the other levers

1DZ II ENGINE



4Y ENGINE

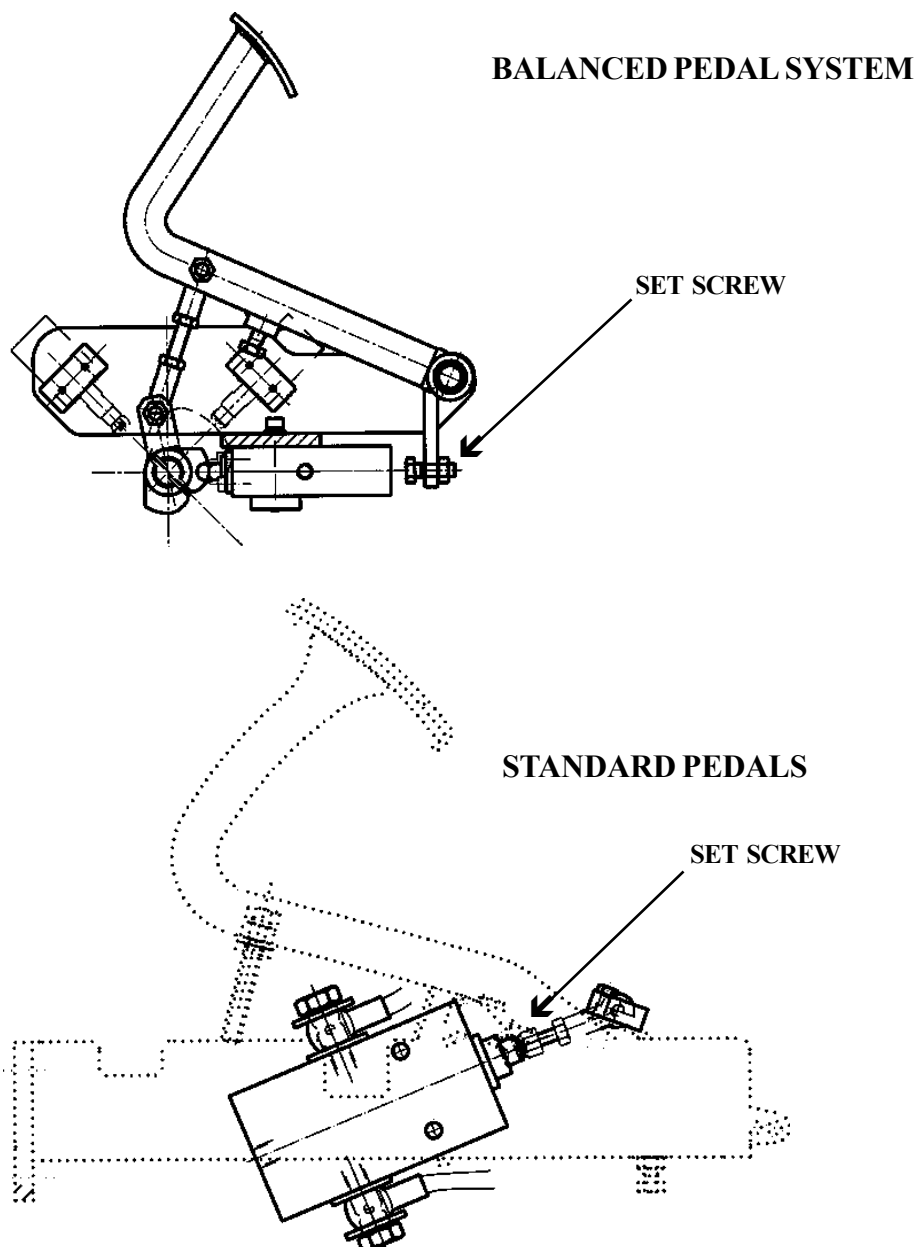


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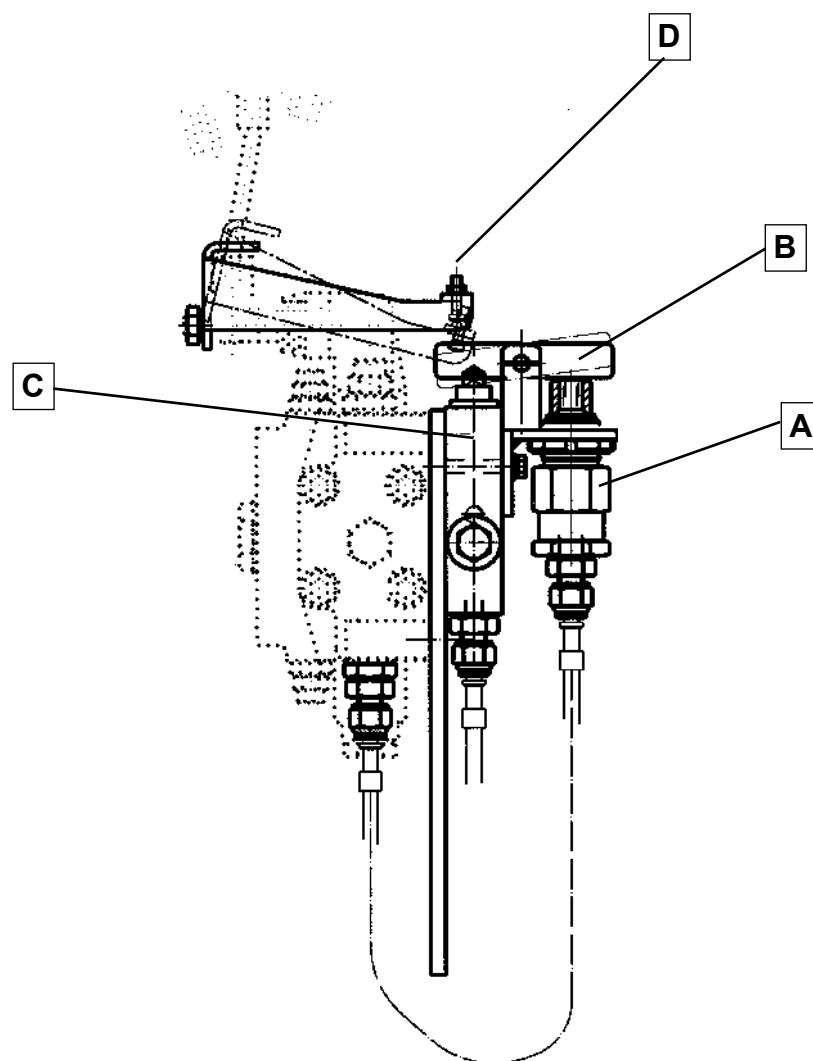
Adjusting the accelerator pedal

With the pedals in idle position (pedal raised) and the motor at minimum rpm, the pressure downline of the handling device, must be 3-5 bar. This pressure can be achieved by preloading the valve rod by about 1.5-2 mm by means of the setscrew.

Note that the truck starts with a driving pressure of about 6 bar while the cylinder starts accelerating the Diesel engine with pressures of 8-12 bar. Consequently, the truck moves at slow speed without increasing the engine rpm.



Hoisting hydraulic accelerator



The small accelerator cylinder **A**, driven by the pressure of the distributor, presses, by means of lever **B**, the handling device valve **C**, which in turn provides pressure to the accelerator cylinder.

The small cylinder (**A**) is threaded to permit adjustment.

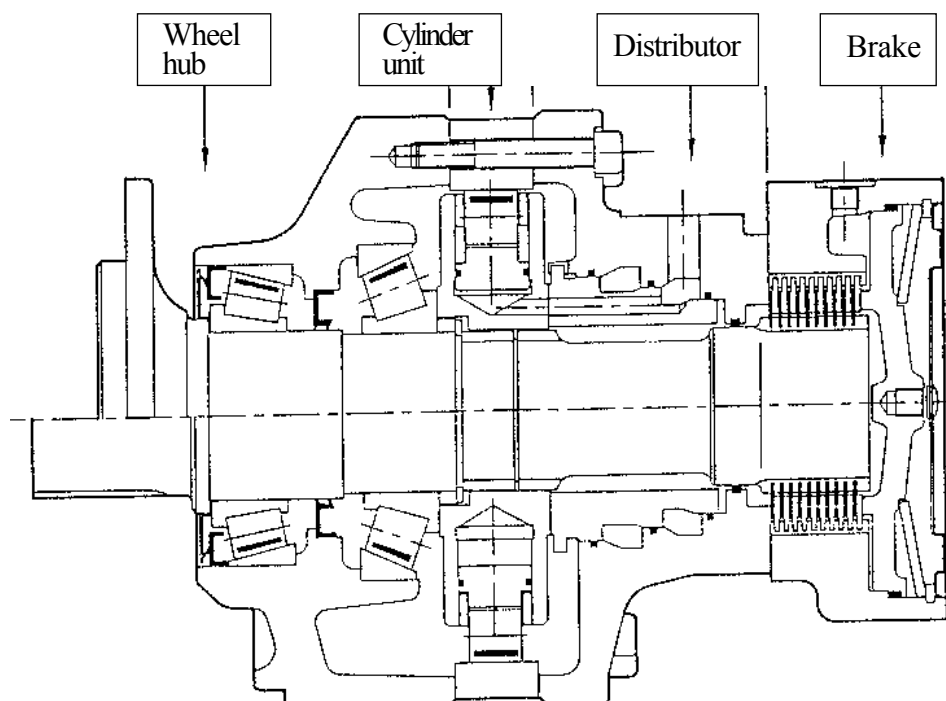
By operating the levers, swing and sideshift of the distributor, at most 1200-1250 rpm must be achieved.

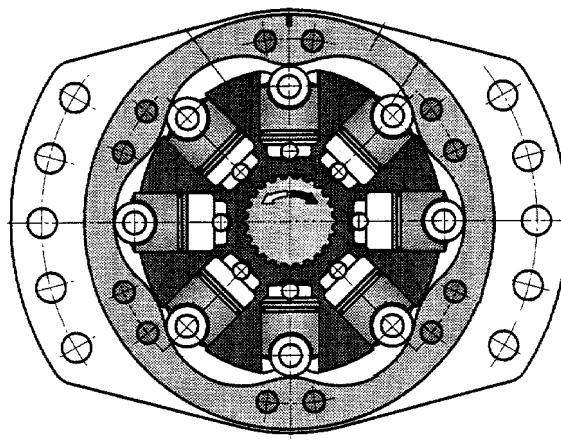
By means of screw **D**, maximum hoisting rpm can be set: this must be 1800-1900 rpm.

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RADIAL HYDRAULIC MOTOR

Motors Poclain MS 02 (radial pistons)	P/N 0093374 L-R
Maximum displacement	332 cc/rev
Maximum pressure	400 Bar
Theoretical torque	525 Nm
Maximum speed	200 RPM
Brake	multidisc type
Braking torque	max. 2500 Nm
Number of pistons	8
Brake driving pressure (measured in x)	12-30 Bar
Displacement shifting driving pressure (measured in y)	10-30 Bar
Drain pressure (measured in 1) with cold motor after temperature stabilization	max. 3 Bar max. 1.5 Bar



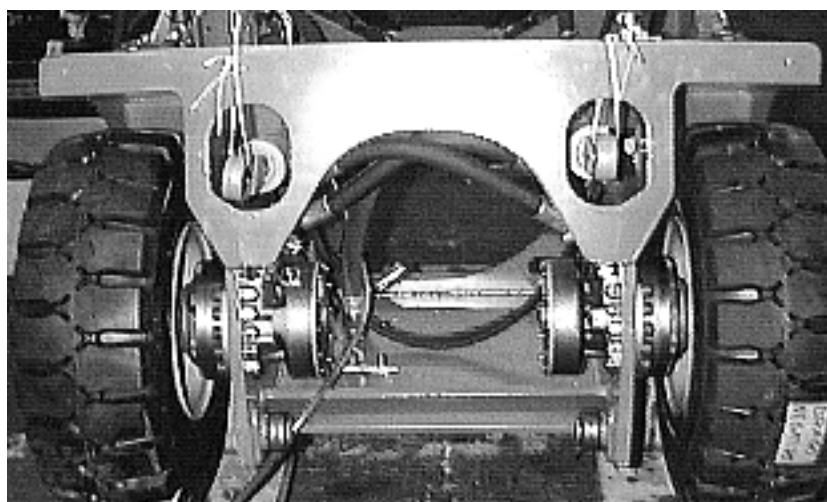


The hydraulic motor is of “slow” type. Due to its radial pistons, it is characterized by a high displacement/rev (if compared to engines with axial pistons) so it produces a high torque at a low speed rate, with no reduction gear between the engine and the wheel hub.

The engine is also equipped with an oil-bath multidisc brake that is normally engaged (wheel locked) by the pre-load of a Belleville washer (negative brake); the brake is hydraulically released by means of a solenoid valve controlled by the control unit: when the solenoid is fed, the valve opens and the fuel boost pressure on the brake piston releases the brake.

The multidisc brake on the motor is used only for the truck parking and emergency braking; on the other hand, service braking is a hydrostatic one.

The motor-brake unit is fully lubricated by the transmission oil (oil dripping from the hydraulic motor).



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HYDROSTATIC TRANSMISSION OIL/FILTER MAINTENANCE

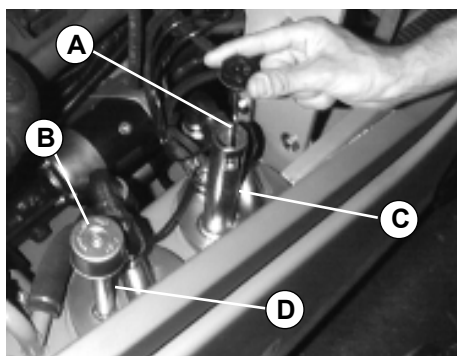
The transmission and the hydraulic lifting system use the same oil tank which is fitted with two oil filters (transmission and lifting). It is very important not to mix these two filters, because they have different features.

Components of the transmisson system:

- A) Oil dip-stick
- B) Transmission oil bleeder
- C) Lifting oil 90 μ filter body
- D) Transmission oil 10 μ filter body

To keep the circuit clean maintenance only involves changing the oil and the filters.

Change of the filters and oil transmisson /lifting



After 50 hours

- the first filters change

Every 500 hours

- second filters change
- first oil change

Subsequently, every 2000 hurs

- filters change
- oil change

The oil should be changed at least once a year. The filters have to be changed also when they get clogged. When the warning lights on the dashboard (12 and 14) are on, replace the filter cartridges immediately.

To change the filters it is necessary to:

- loosen the screws that secure the filter support placed to the tank
- extract the unit from the tank, release the used cartridge unscrewing it in an anticlockwise direction and replace it by a new one;
- tighten the new cartridge and restore the original position.



To change the transmission and lifting tank oil:

- change the oil when the motor is still hot;
- remove the filler cap (A) and drain cap (T) and allow the fluid to drain out
- clean the sediment from the oil tank
- replace the drain cap (T), fill the tank with new oil until the maximum level on the dip-stick (A) is reached (39 lt.)
- use only the oil indicated in the specifications table (see pag.85).

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TOWING THE TRUCK

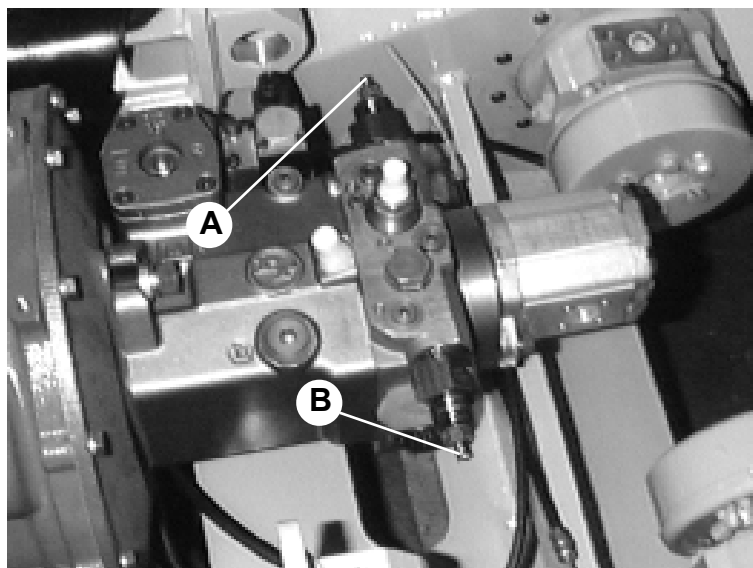
The standar fork lift trucks are not suited for towing.

In special cases, the rear hook can be used to town a faulty lift truck.

Lift trucks with hydraulic drive motors (without differential axle) in order to avoid serius damage to the trasmission gear, take the following precautions:

- screw-in completely the screw A and B;
- unlocking the brake (see page 50);
- town the truck;
- restore engine functioning conditions, set the screw A and B like the original conditions, lock the brake and start the truck.

The truck has to be towed only for a few meters (**max 100**), after towing is completed and the screw A and B have been setted , let the engine run at minimum speed (with an occasional acceleration) for 3-5 minuts to allow the transmission oil to circulate. Then resume work.



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HYDROSTATIC TRANSMISSION TROUBLE SHOOTING

THE TRUCK MOVES NEITHER FORWARDS NOR BACKWARDS		
FAULT	OPERATIONS TO BE CARRIED OUT	VALUE TO CHECK
The electrovalve is not excited	Restore electric circuit	12 Volt
No feeding pressure G (Hydromatik)	Check suction of filter and pipe _____ Check internal leakage _____ Check maximum pressure	G 28-30 BAR _____ Max 1 liter per minute with a pressure 100 BAR _____ Hydromatik 350 Bar
The release braking restrictor T is clogged	Disassembly electrovalve and clean restrictor	
Setting device of pilot system pressure	Restore device and check pilot system pressure valves	Hydromatic X1,X2=4-30 Bar
The inching valve is blocked or faulty	Unblock or replace valve	

POOR EFFICIENCY IN BOTH DIRECTIONS		
Low feeding pressure G (Hydromatic) or excessive leak	Check suction filter and pipes	G 28-30 Bar
	Check internal leakages	Max 1,5 liter per minute with a pressure of 100 Bar
	Check maximum pressure	Hydromatik 350 Bar
Low pilot system pressure	Check pilot system pressure	Hydromatic X1,X2=4-30 Bar

THE TRUCK WORKS ONLY IN ONE DIRECTIONS		
The electrovalve of the non - working direction is not excited	Restore electric circuit	12 Volt
Restrictor A and B of the non-working direction is clogged	Clean restrictors	

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BRAKES

The brake pedal has two different functions :

- hydrostatic braking function; you can have a mechanical braking function only if the brake pedal is pushed completely down. involving in this way the negative brakes
- " inching " function if it is used simultaneously with the accelerator pedal.

The braking effect may also be obtained by releasing the accelerator pedal (hydrostatic braking) or by reversing the running direction (hydrostatic reverse braking, more efficient than the hydrostatic braking).

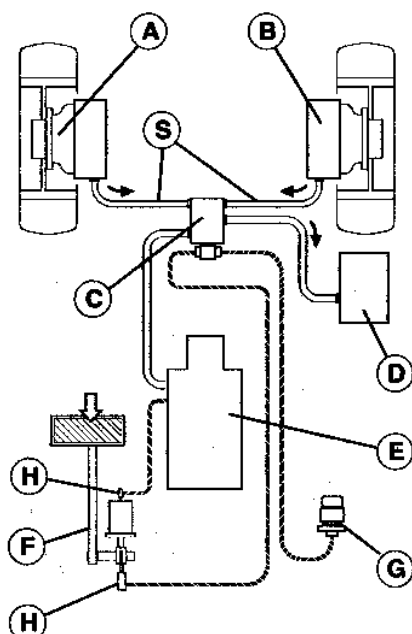


DIAGRAM OF THE SERVICE BRAKE AND PARKING BRAKE SYSTEMS

- A) Hydraulic motor
- B) Brake unit
- C) Solenoid valve
- D) Hydraulic oil tank
- E) Hydraulic transmission
- F) Service brake pedal
- G) Parking switch
- H) Microswitch
- S) Brake Hoses

Every 4.000 hours

- replace solenoid valve (C) for the brake control.

Every 10.000 hours

- replace brake hoses (S).



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BRAKE CONTROL

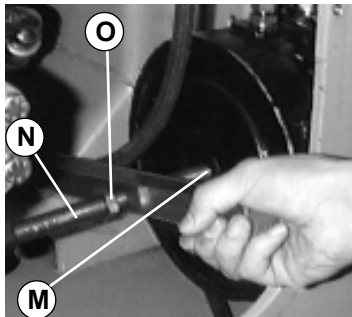


BRAKE CONTROL

The brakes are in an oil-bath; they use the same oil as the drive hydraulic motors

Every 250 hours

- control the pedal functioning, that must be smooth and with no jamming.



BRAKE UNLOCKING FOR THE TRUCK TOWING

In case of damage, in order to tow the truck, unlock the brake disks located inside the two traction units.

Brake unlocking

Once the special equipment has been correctly positioned, one for each brake unit, tighten screw M12 (N) into hole (M) on the body brake; keeping it tightened, screw nut (O) until brakes unlock

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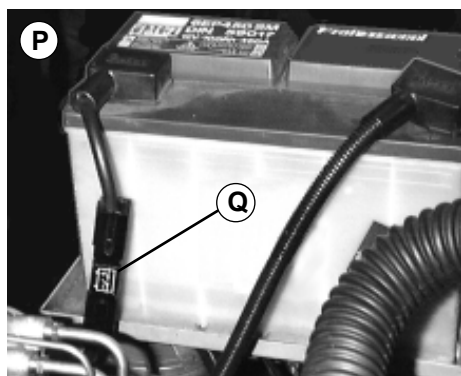
ELECTRIC SYSTEM

Every 500 hours

- check the push-buttons wiring and operation;
- check the operation of the microswitches located on the pedals;

Every 1,000 hours

- inspect wiring and connections; check if the cable terminals are properly tightened and the cable insulation is intact.



WARNING:

DISCONNECT THE TRUCK BATTERY BEFORE SERVICING THE ELECTRIC SYSTEM AND THE ELECTRONIC EQUIPMENT.

BATTERY

Battery (P) is located under the engine bonnet; before servicing, always disconnect safety connector (Q).

Every 500 hours

- clean the battery poles and terminals;
- grease and tighten the terminals;

Every 1,000 hours

- check the earth connections.

Every 4,000 hours

- replace the battery.

The battery supplied has a min. 80 Ah capacitance.

If the battery is a maintenance-free one, inspect as follows:

Every 50 hours

- check the electrolyte level and density; top up with distilled water, if necessary.

The battery is to be recharged when its voltage has decreased by 1.7V or the electrolyte thickness is under 1.16 kg/dm³.

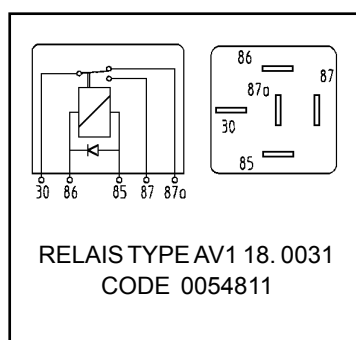
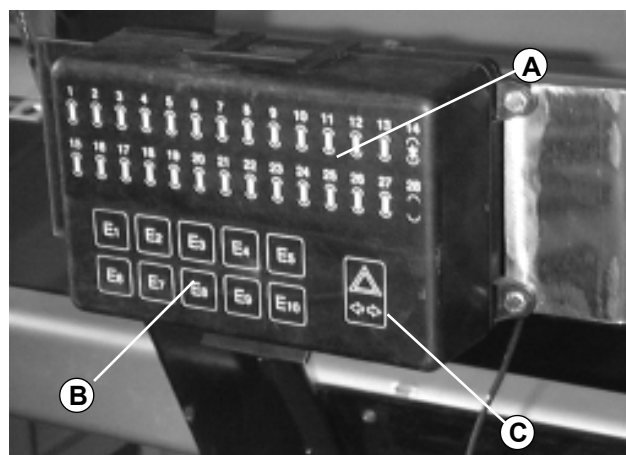
When the truck is running, never disconnect the battery cables, so as to avoid dangerous voltage peaks to the alternator diodes.

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ELECTRIC COMPONENTS

ELECTRICAL CONTROL PANEL

This is situated under the driver's platform
The panel consists of a group of fuses (A), relays (B) and optional intermittent circuit (C).
To replace the components, remove the protective panel.



Fuse characteristics

Engine		Toyota 1DZ II	Toyota 4 Y
Fuse	Description		
F1	System protection	40 A	40 A
F2	Horn	5 A	5 A
F5	Dashboard, brakes	10 A	10 A
F6	Alternator	-	5 A
F7	Glow plug timer	7,5 A	-
F7	Spark plugs	-	7,5 A
F8	Ignition pump	7,5 A	-
F13	Electric fan	40 A (opt)	40 A (opt)
F15	Reverse direction lights	5 A	5 A
F16	Stop lights	5 A	5 A

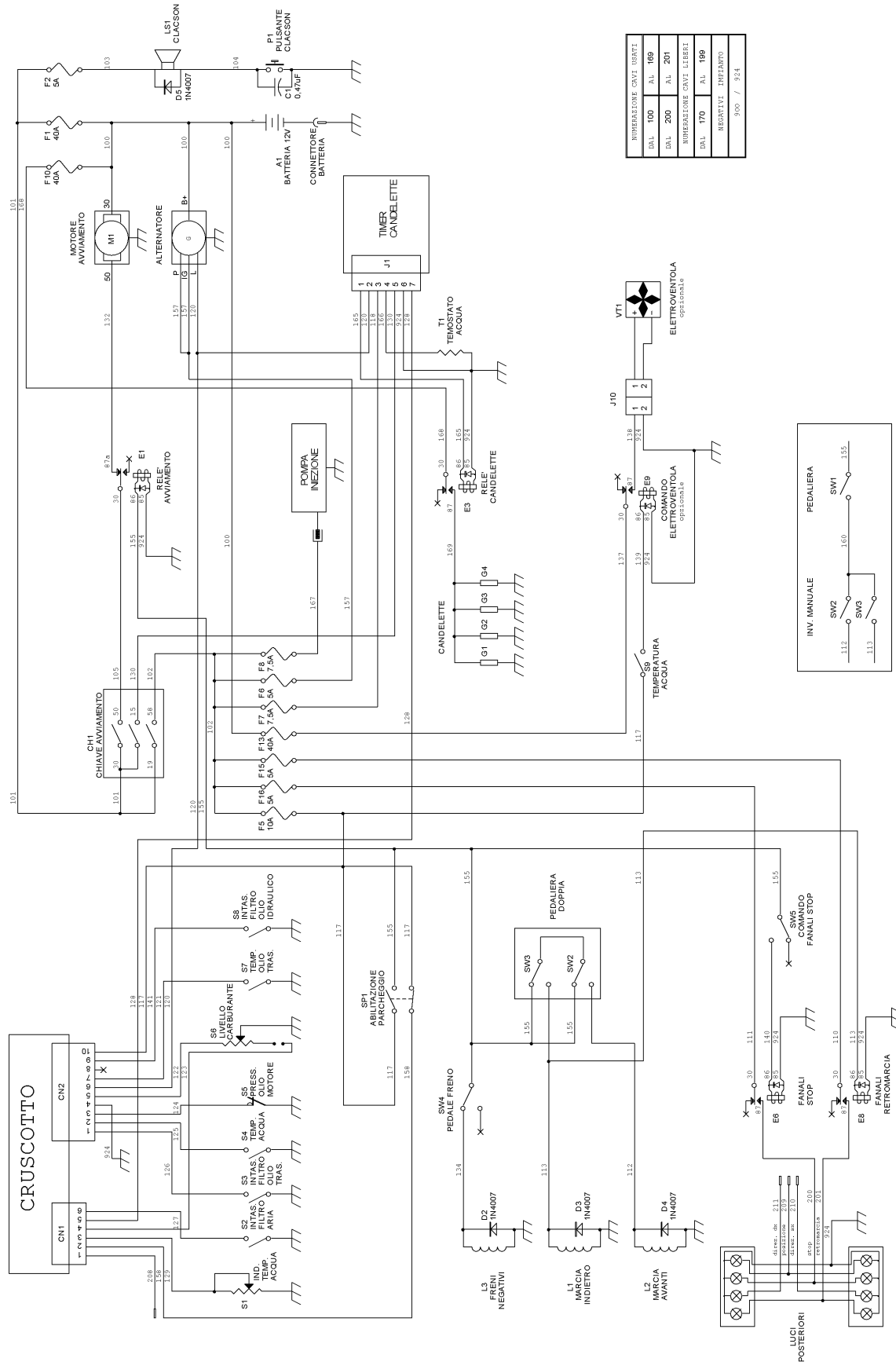
The others are reserved for optional systems.
Before changing the fuses, make sure that causes that made them trip have been removed.

Relay characteristics

Engine		Toyota 1DZ II	Toyota 4 Y
Relay	Description		
E1	start-up	YES	YES
E2			
E3	glow plug indicator	YES	
E4			
E5			
E6	stop rear light	YES	YES
E7			
E8	reverse rear light	YES	YES
E9	electric fan	(OPT.)	(OPT.)
E10			

The others are reserved for optional systems.

WIRING DIAGRAM - TOYOTA 1DZ II ENGINE



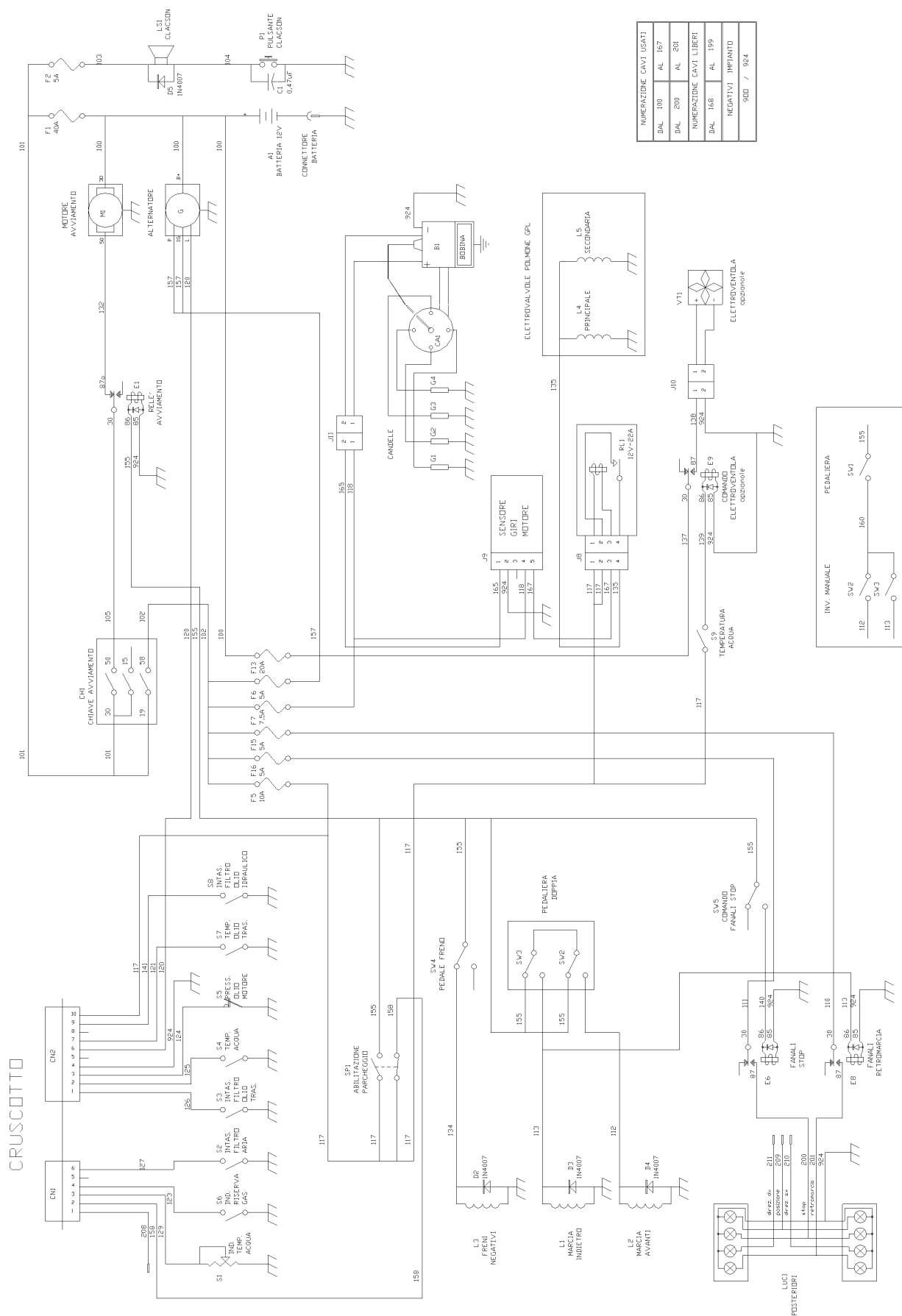
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WIRING DIAGRAM - TOYOTA 4 Y ENGINE



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WHEELS / TYRES

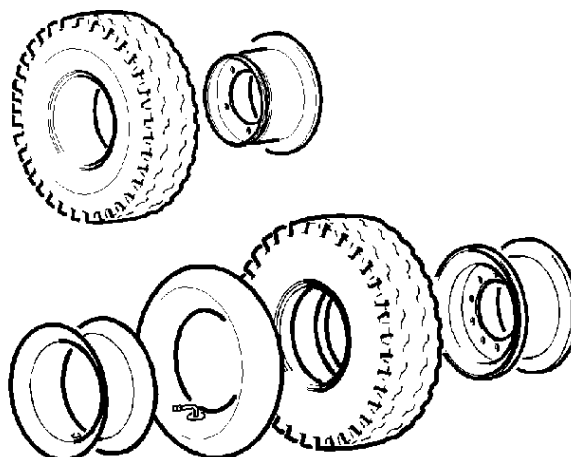
SAFETY OF WHEELS AND RIMS WHILE USING THE TRUCK

“TYRES” are to be replaced when the tyre tread is under 1.6 mm.

“SUPERELASTIC” tyres are to be replaced when the tyre tread reaches the “60 J” mark, which is printed on the tyre side.

SUPERELASTIC (SE)

PNEUMATIC (PN)



TYRE PRESSURES TIGHTENING TORQUES

8.7 bar
10 bar

21 daNm
14 daNm

12 daNm

6 daNm
0.8÷1.2 daNm
30 daNm

TYRE PRESSURE

steering wheels
driving wheels

TYRE TIGHTENING TORQUES

steering wheels
driving wheels

DRIVE UNIT TORQUE

engine fixing to chassis

VARIOUS TORQUES

bolts securing mast
jack collar self-locking nuts
counterweight blocking screws

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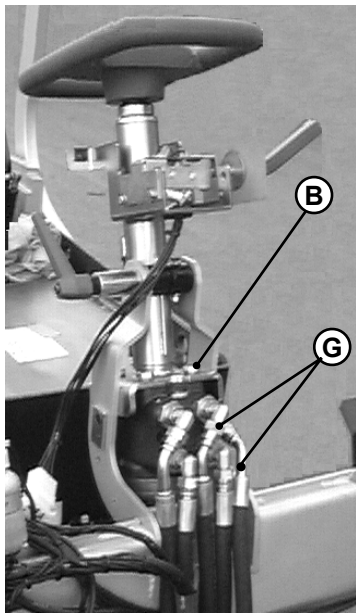
STEERING CONTROL

The steering uses the same oil as the lifting by means a priority valve, so that a sufficient oil flow to the power steering is always assured.

The oil capacity is checked by the Ls signal (load - sensing) coming from the steering unit and it occurs so that the oil capacity sent to the power steering is equal to its actual request.

The exceeding oil is sent to the control valve for other functions.

When the steering wheel is turned the steering unit “measures” a volume of oil proportional to the above rotation and sends it into the steering cylinder.



Every 250 hours

- check the entire system to identify any leak; any intervention must be carried out without pressure in the system.

Every 4 000 working hours

- replace hoses (G) connecting the orbitrol device to the steering jack.

Every 10 000 hours

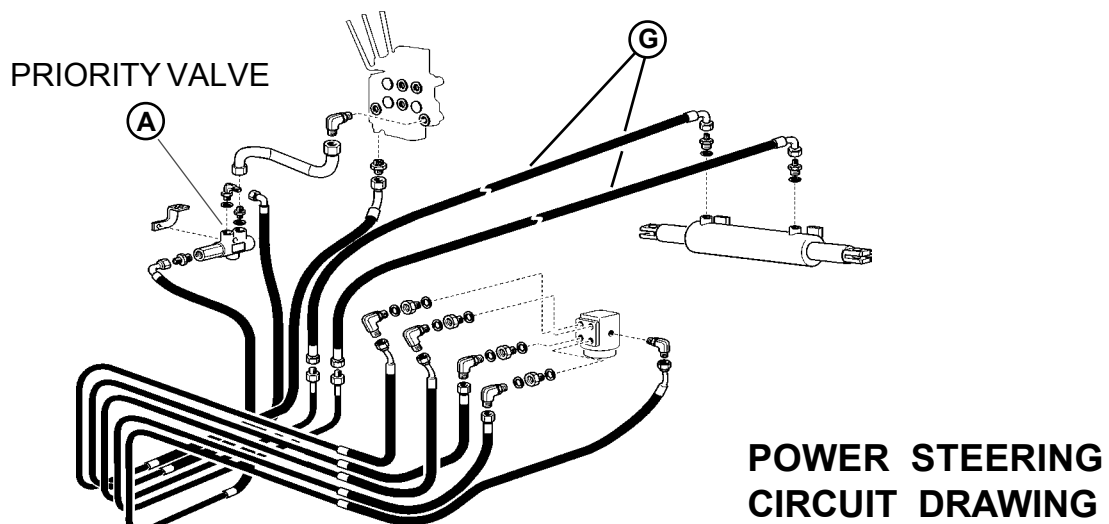
- replace the hydraulic system tubing.

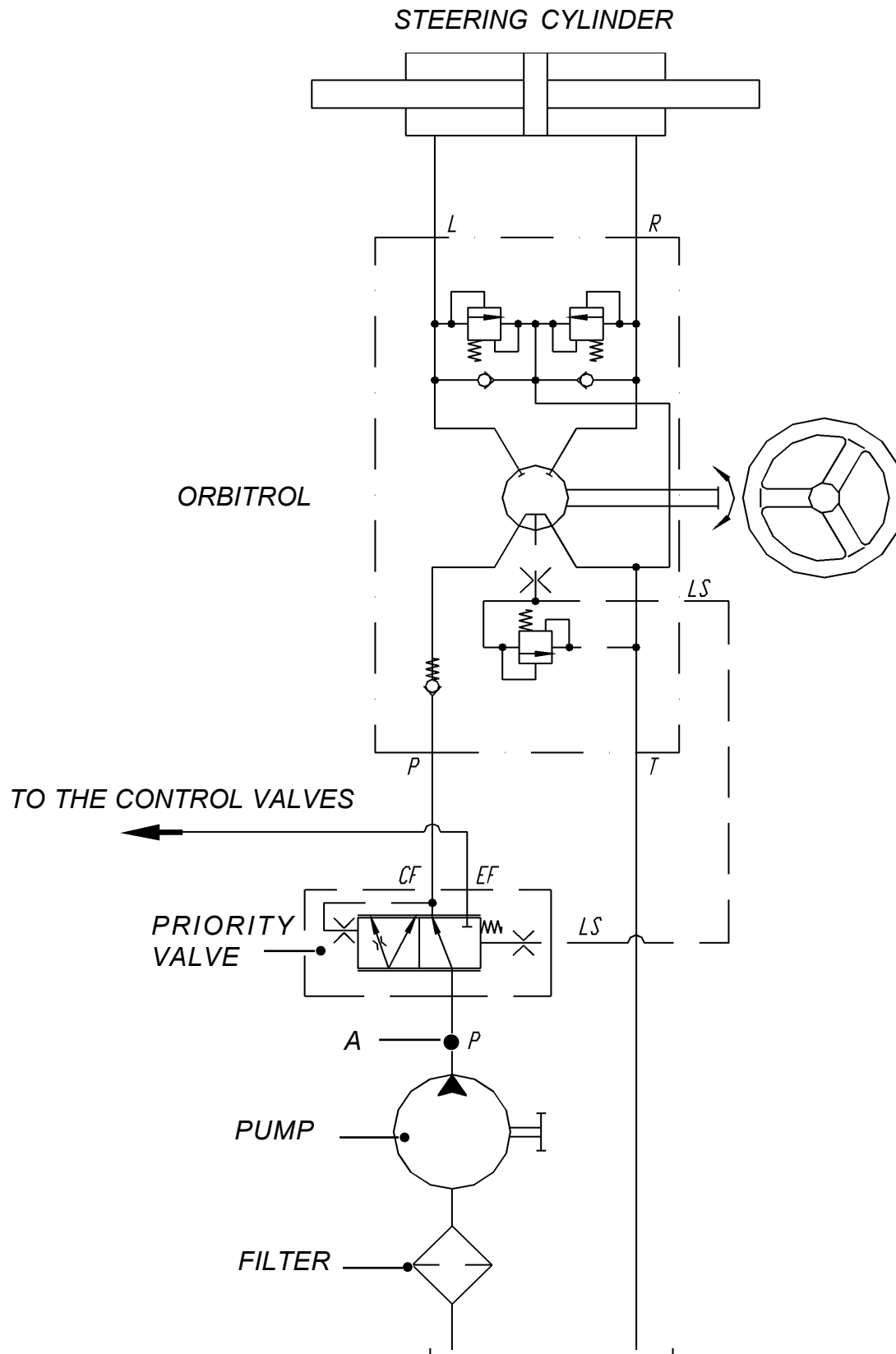
Power steering pressure setting

The max power steering pressure must be 90 Bar

In order to set the power steering pressure, the following operation are necessary:

- 1 - Fit a manometer on the priority valve (A);
- 2 - In order reach the adjusting screw (B) remove the cap (by allen wrench) positioned in the upper side of the orbitrol (power steering unit);
 - screw in to increase the pressure
 - screw out to decrease the pressure





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STEERING AXLE

Steering axle check

Every 500 hours

- lubricate the steering gear joints using the appropriate grease nipples (D), (E) and (C);
- check the steering angles.

Every 2.000 hours

- check and if it is necessary, adjust the wheel hub bearings.

Every 500 ore check the angles

Max steering angle (internal wheel $\cong 80^\circ$)

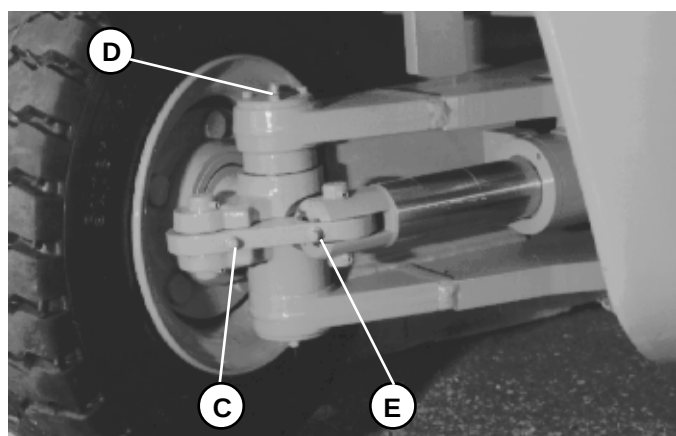
End stroke setting (adjustment):

take the cylinder to the internal end stroke, then operate on the special screws putting them on the spindles. Then screw in the adjusting screws till when you obtain the desired steering angle

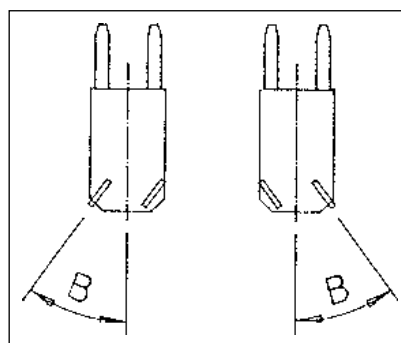
B = 80°

If any abnormal consumption of the wheel tread is observed, the following controls should be made:

- check the parallelism of the steered wheels;
- check that the steering angle of the wheels is the same in both directions.

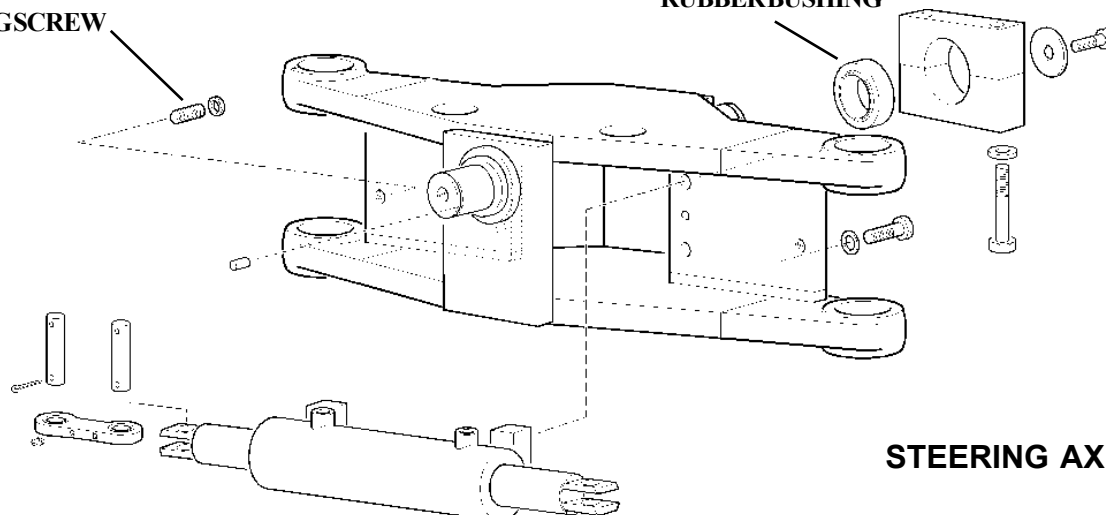


B = 80° Standard
ANGLE MEASURED BY THE AXLE FRAME TO THE INTERNAL WHEEL THROUGH A SPECIAL DEVICE



ENDSTROKE SETTINGSCREW

RUBBERBUSHING



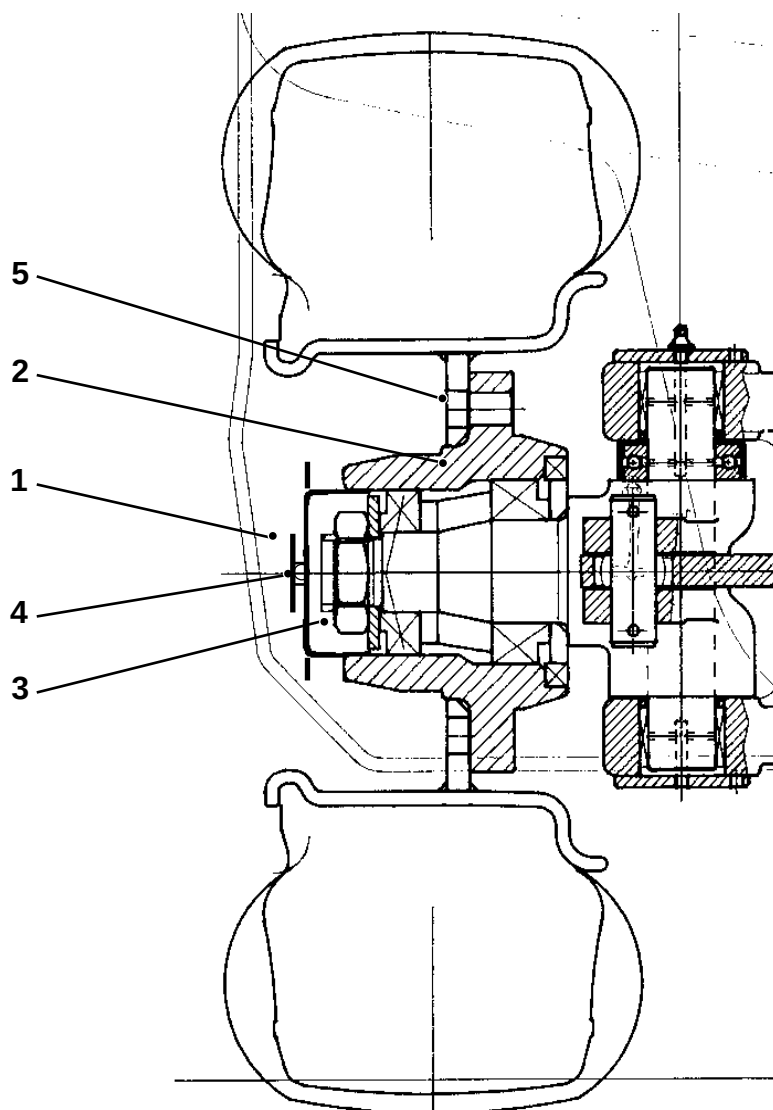
STEERING AXLE

BEARING ADJUSTMENT

Steering wheel bearings require an adjustment once a year.

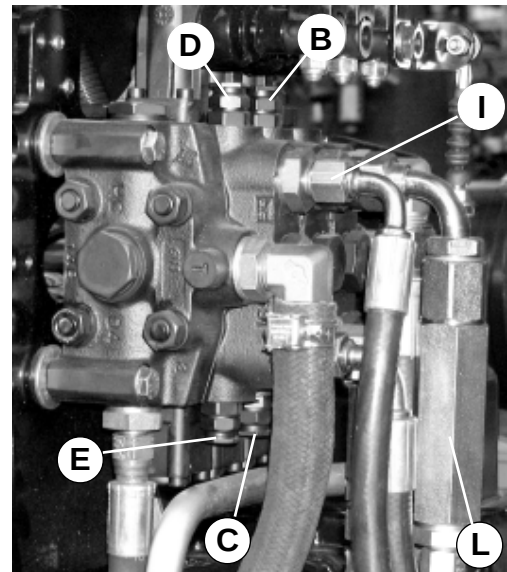
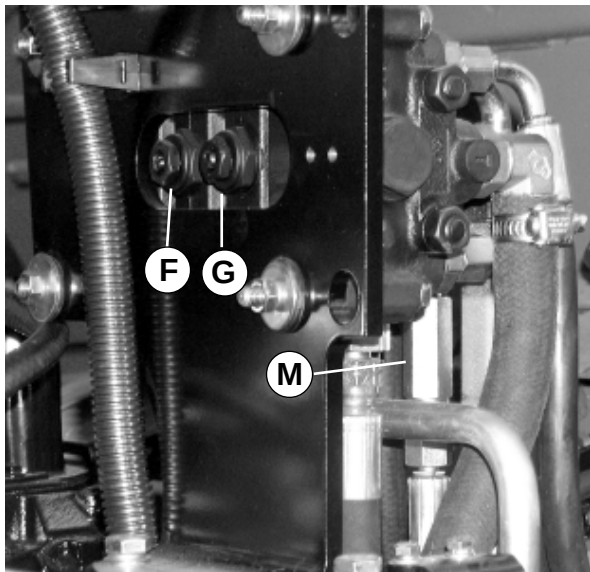
Steering wheels

- lift the steering wheels
- remove cap (1);
- remove check pin (4);
- fasten the nut with a torque setting of 6 dNm;
- turn the hub of 2-3 turns in both senses;
- unfasten nut (3) and retighten with a 2-1 daNm torque;
- check that the wheels slide correctly (max. rolling final torque: 0.2 dNm) and that there is no side play (maximum axial play of 0.05 mm);
- reassemble the check pin;
- reassemble the cap (1);
- lower the wheels again and check that all nuts fixing the wheel disk (5) to hub (2) are well tightened.

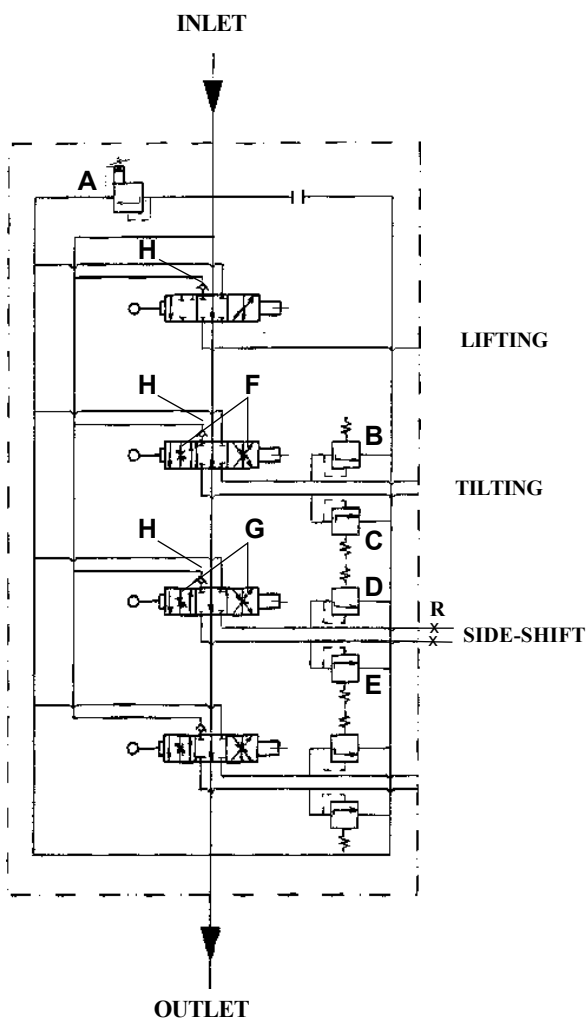


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CONTROL VALVES



CONTROL VALVES DIAGRAM



VALVE A lifting max pressure
 screw in = increasing
 screw out = decreasing

VALVES B-C tilting pressure
 screw in = increasing
 screw out = decreasing

VALVES D-E side-shift pressure
 screw in = increasing
 screw out = decreasing

VALVE R side-shift speed reduction

VALVES F-G tilting and side-shift speed reduction
 screw in = increasing
 screw out = decreasing

VALVES H no return valves

INTERNAL
COMBUSTION

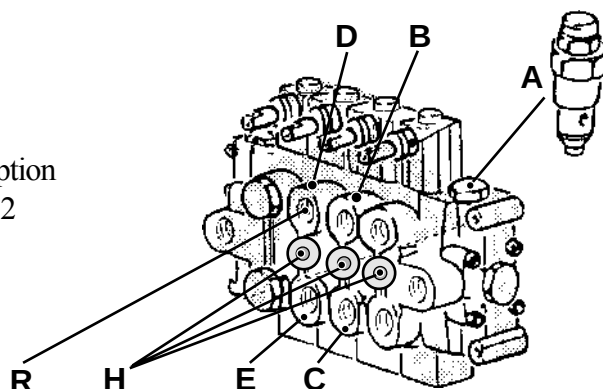
SERVICE MANUAL

1,5 - 1,8 - 2,0 t

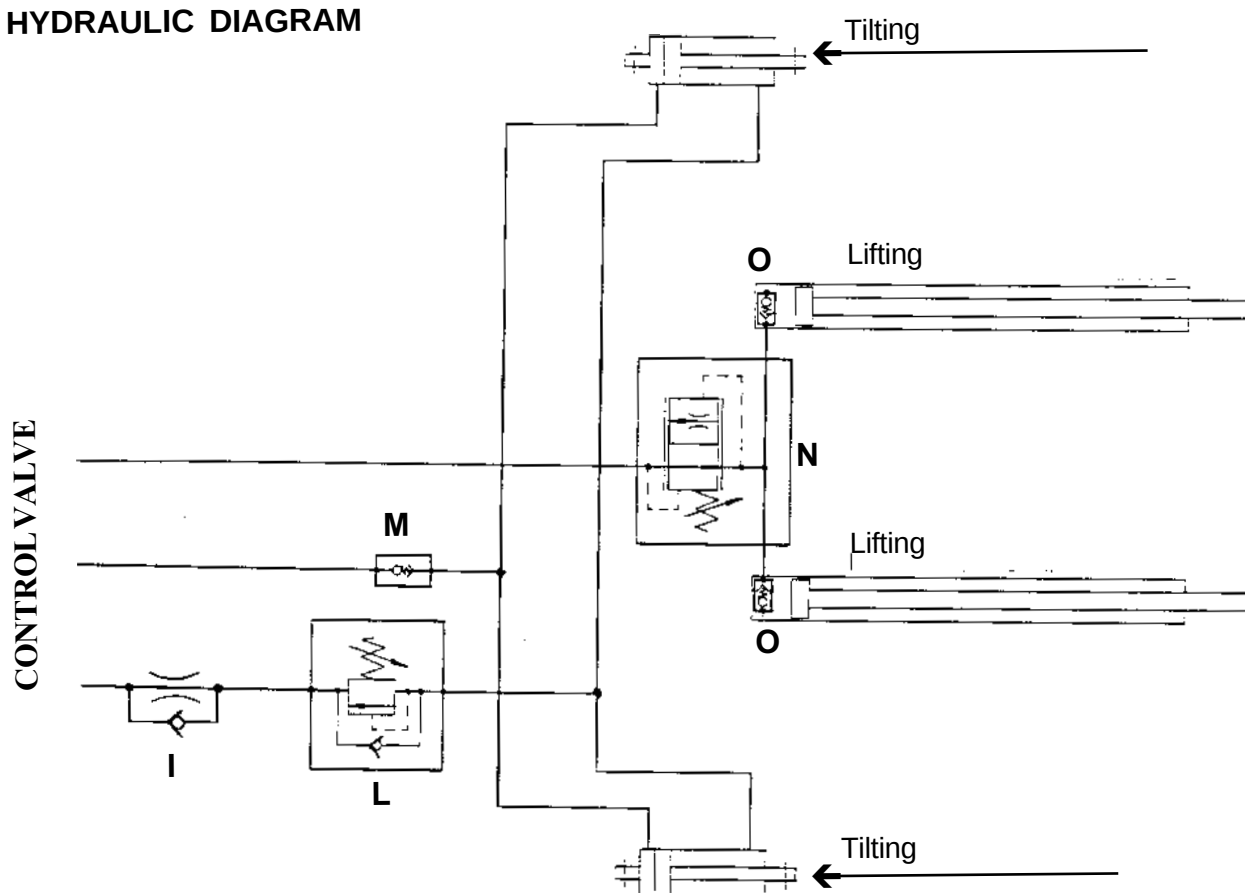
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A
B
C
D
E
H
R

Description
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HYDRAULIC DIAGRAM



- VALVE I** tilting speed reduction from backward to forward position
- VALVE L** security valve. The tilting movement (from backward to forward) is locked when the engine is switch off
- VALVE M** security valve. The tilting movement (from forward to backward) is locked when the lifting speed is to high
- VALVE N** mast lowering speed
- VALVES O** security valve. Locked the mast lowering if a pipe is broken.

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MAST GROUPS

The mast profile - CESAB design - with double stiffening flange is characterised by a high flexural and torsional strength.

It allows wide visibility thanks to the reduced dimensions of the profile itself.

Cylinders are single-acting type.

The sideshift system has been housed inside the profiles.

The mast group is a roller type with a variable centre distance (i.e. a fixed roller is fitted on the outer mast and a mobile one on the inner mast, instead of a number of mobile rollers only on the inner mast). This solution ensures better grip and stability on operation.

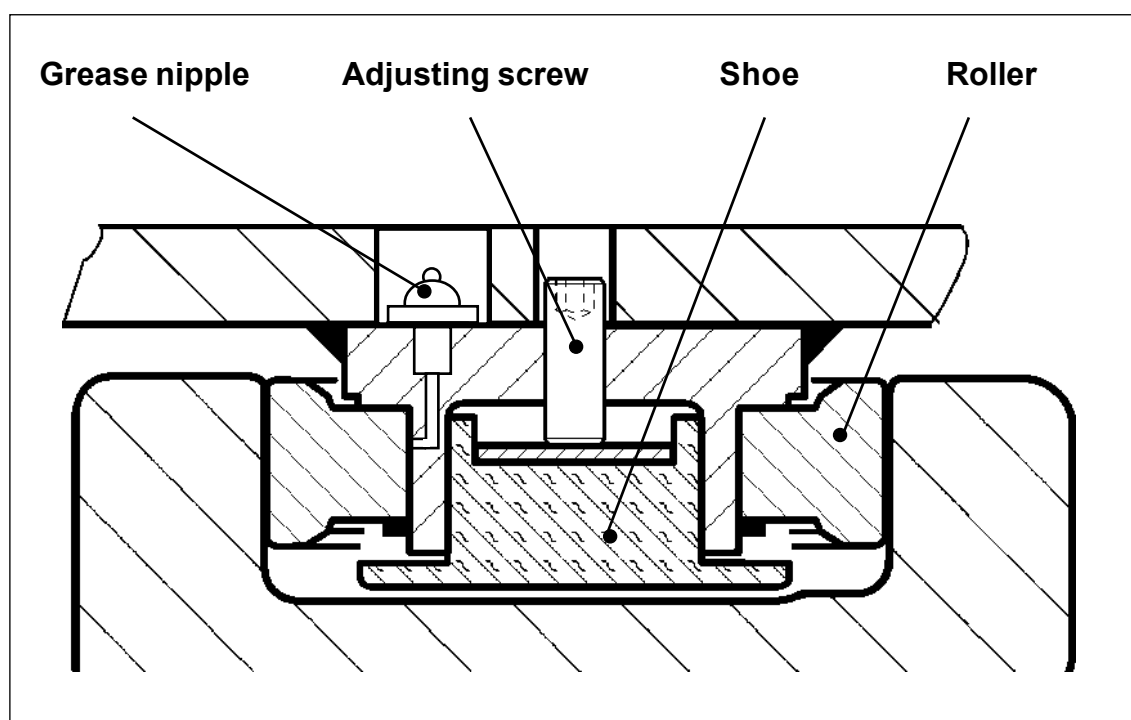
Other features: side plays adjustable from outside. Plastic guide shoes. Roller bearings with grease nipples, ball joints on axle couplings and tilt cylinders.

Lifting cylinders:

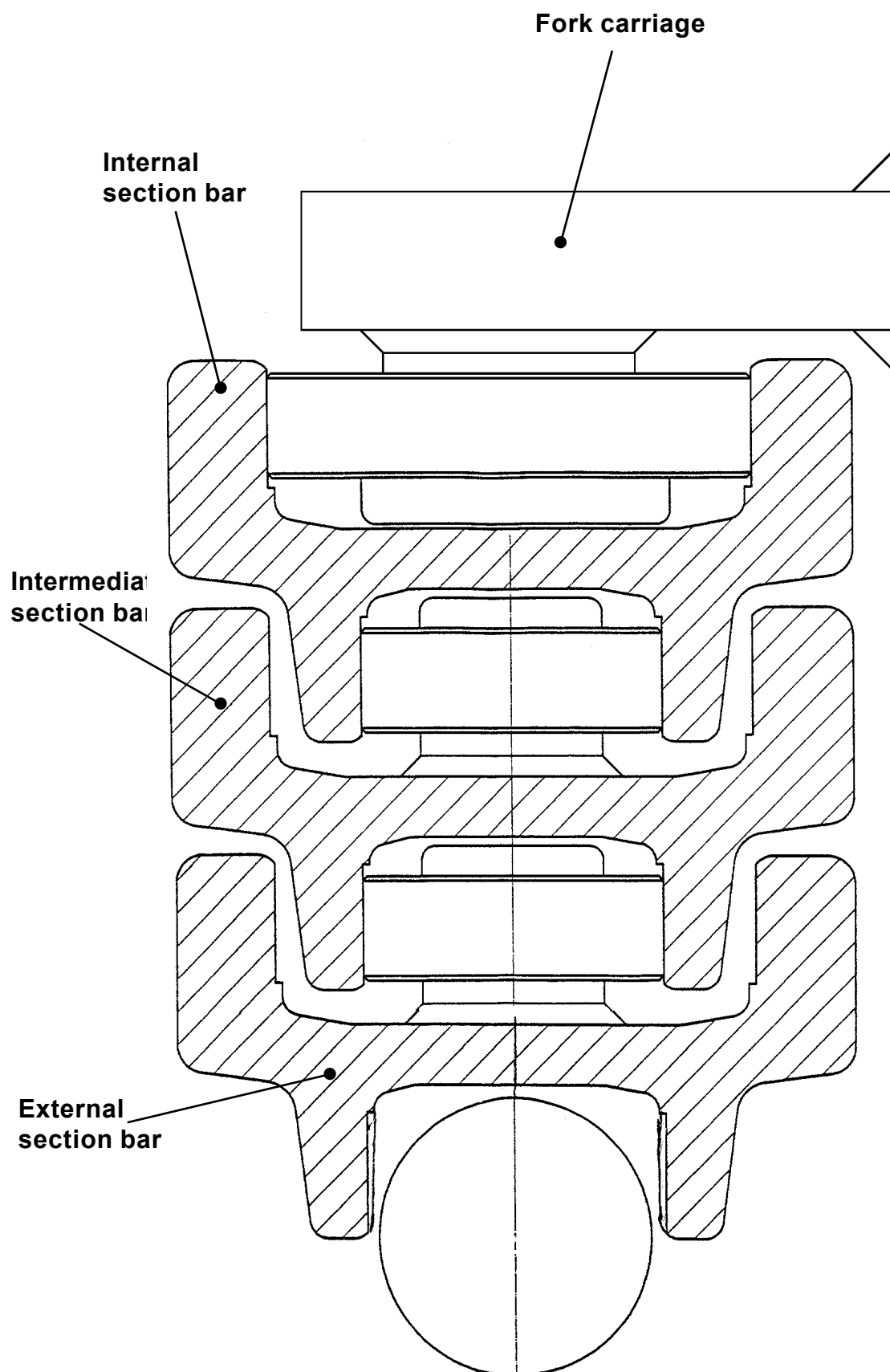
Duplex mast: TV 2 side cylinders
 FFL 2 side cylinders
 2 central cylinders

Triplex mast TV 2 side cylinders
 FFL 2 side cylinders
 2 central cylinders

	CENTRAL CYLINDERS	SIDE CYLINDERS
2M TV	/	TELESCOPIC CYLINDERS
3M TV	/	TELESCOPIC CYLINDERS
2M FFL	DISPLACEMENT CYLINDERS	DISPLACEMENT CYLINDERS
3M FFL	DISPLACEMENT CYLINDERS	TELESCOPIC CYLINDERS

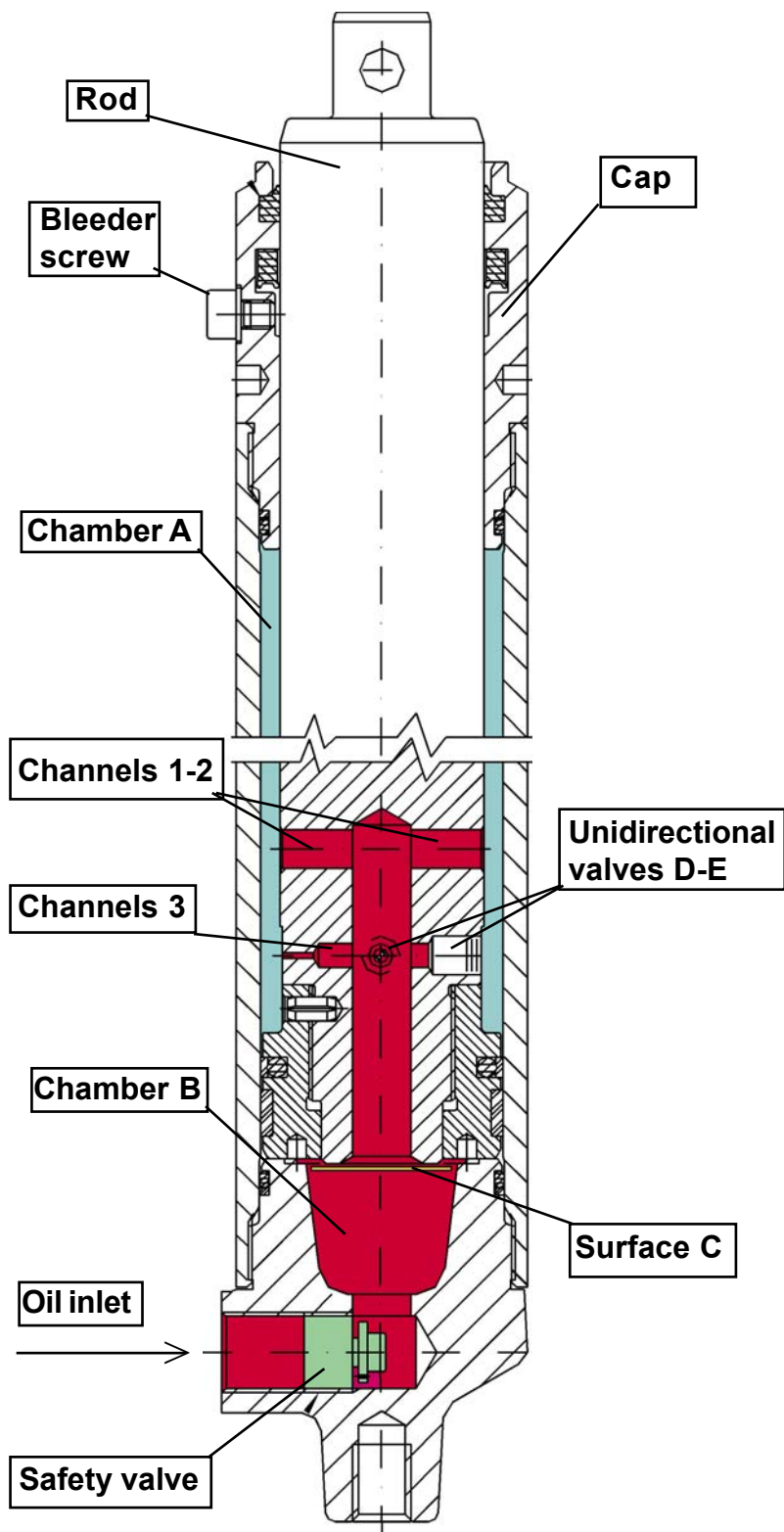


TRIPLE MAST SECTION



1,5 - 1,8 - 2,0 t	SERVICE MANUAL	INTERNAL COMBUSTION
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CENTRAL DISPLACEMENT CYLINDER WITH BRAKING EFFECT ON THE LIFTING



The oil flows into the cylinder from the "Oil inlet" when the control valve is operated.

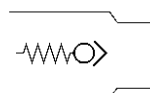
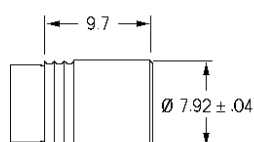
Flowing through channels 1, 2 and 3, it fills chamber A until the inner oil pressure exerts an upward force against the surface C. The outward sliding of the rod is, thus, set off. This movement is enacted by the oil flow from chamber A to chamber B through the above mentioned channels.

At the end of the expanding process channels 1 and 2 are plugged by the cap. Therefore, since the oil flowing between the two chambers passes only through channel 3, it has a lower capacity. The outcome is a slowing-down or "Braking effect".

The downward sliding of the rod is allowed by the opening of the "Oil inlet" circuit, so that the oil can be retrieved into the tank by means of the control valve.

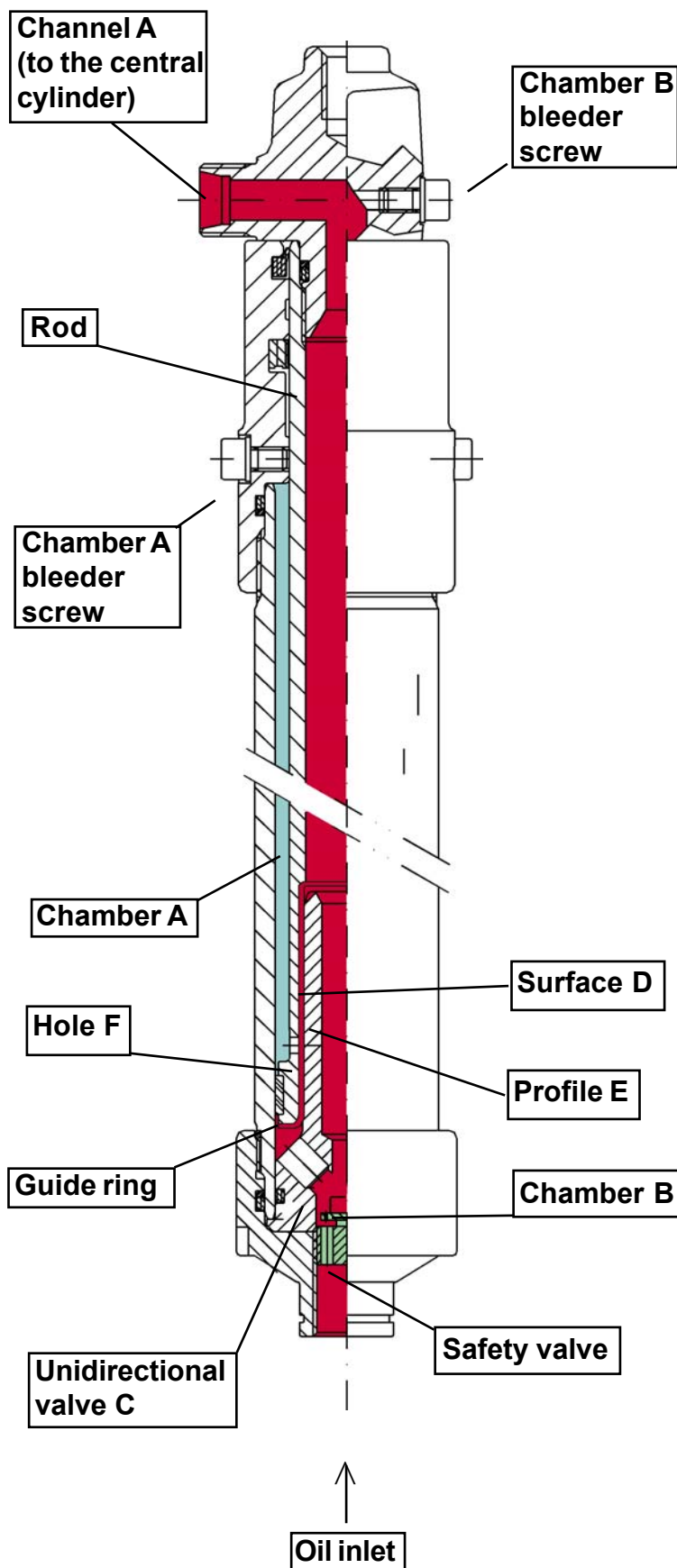
At the beginning of this phase chamber A contains no oil. A more constant filling is allowed by the two unidirectional valves D and E that, when open, permit avoiding jolts.

Once beyond the cap, the oil flow between the two chambers passes through channels 1 and 2, which are now open.



Unidirectional valves D-E

SIDE CYLINDER WITH BRAKING EFFECT ON THE LOWERING



The oil flows into the cylinder from the “Oil inlet” when the control valve is operated.

Flowing through chamber B and channel A it fills first the central cylinders, then chamber A through hole F and the unidirectional valve C.

The oil exerts thus an upward force against the surface D, which sets off the outward sliding of the rod.

This movement is allowed by the oil flow from chamber A to chamber B through hole F and the guiding ring.

The downward sliding of the rod is allowed by the opening of the “Oil inlet” circuit, so that the oil can be retrieved into the tank by means of the control valve.

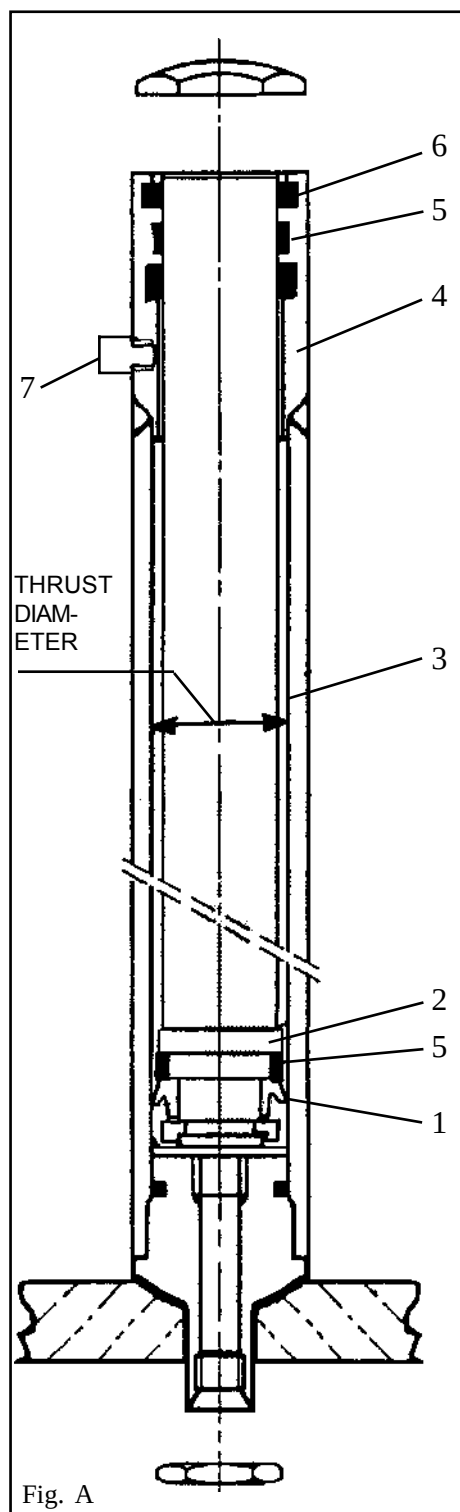
In this phase the oil flows between the two chambers only through the hole F, as valve C is closed.

The downward speed of the rod remains constant until hole F is closed by profile E. The remarkable reduction of oil flow has a slowing-down or “Braking effect”.

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DESCRIPTION OF THE CYLINDER COMPONENTS

The cylinder pistons are single-acting types (fig. A).



In these cylinders a seal (1) has been fitted on the piston (2) that works on the inner surface of the cylinder liner (3).

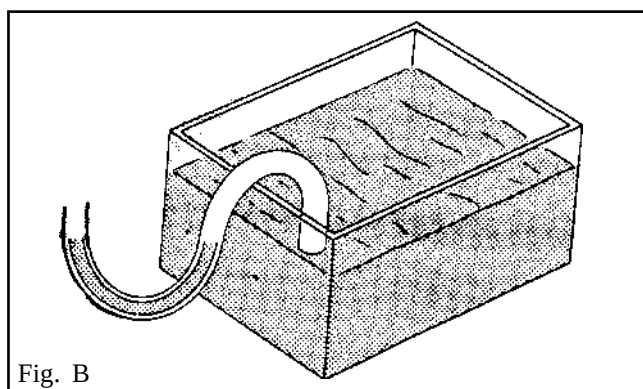
The rod guide is made by the plug (4) and by the piston through anti-friction rings (5).

The dust control ring (6) prevents any dirt and water from penetrating the cylinder.

Slight leakages that may occur are directed to the tank through the drain pipe connected to the pipe coupling (7).

The drain pipe shall reach the oil tank (fig. B)

A small quantity of oil will always remain in the loop formed by the pipe before connecting to the tank. It acts as a trap and constantly moisturizes the cylinder liner, when it is completely closed (fig. B).



CYLINDER CHECKING METHODS

1ST CHECK

Remove the drain pipe from the cylinder (fig. C)

Lift the cylinder some times to end stroke, so as to discharge any oil residual.

Put a load on the forks and lift it by at least 200 mm.

After 10 minutes, measure the amount by which the load has lowered. A drop of a few millimetres is quite normal, as in the distributor there are always some leakages.

Now, lift the cylinder to its end stroke, if no oil leaks from the drain pipe coupling, it means that the load lowering is only due to the leakages on the distributor.

In the presence of leakages, it will be necessary to replace the seal. Should this be the case, inspect the cylinder liner.

2nd CHECK

(To be carried out if the 1st inspection has been successful and after seal replacement).

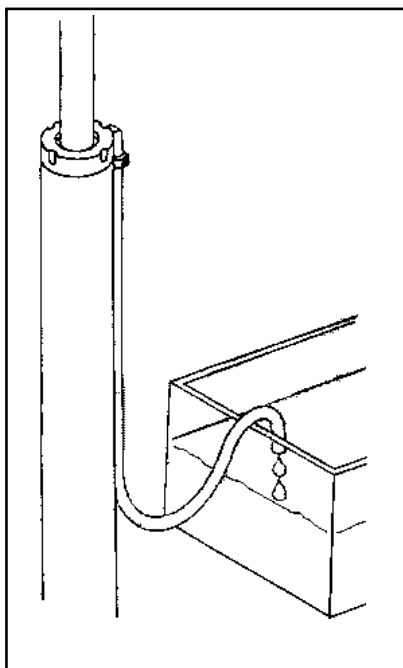
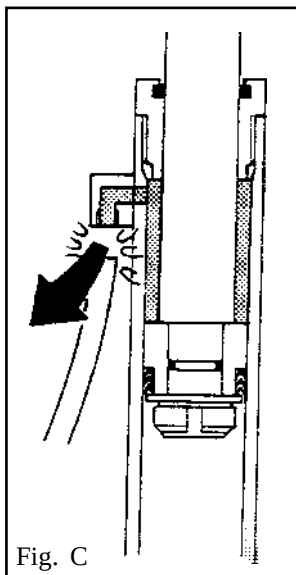
Remove the drain pipe from the cylinder.

Lift the cylinder some times to end stroke, so that all the possible remaining oil is discharged.

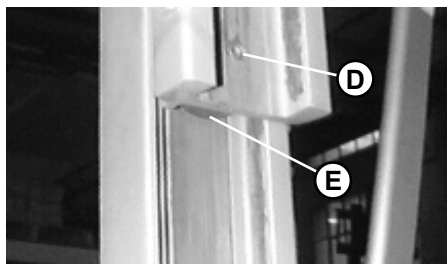
Put a load on the forks. Lift and lower it for 10 minutes, making sure that the limit stop is never reached.

Lift the cylinder to end stroke.

If any leakages should be still present, the cylinder is damaged and then it must be replaced.



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LUBRICATION OF LIFTING EQUIPMENT

Masts

After the first 50 hours

- adjust the guide shoes adjusting the Allen screw (D)
For the adjustment use a 0.2-0.5 mm thickness gauge, inserted from below and up to the centre of the Allen screw (D) passing behind the roller (E).

Every 50-100 hours

- lubricate with grease the mast sliding guides
- lubricate the tilting jacks and the mast connections.

A) Tilting jacks 2+2 grease nipples

B) Mast connections 1+1 grease nipples

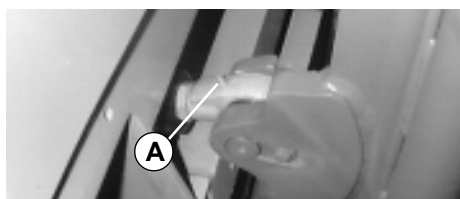


Every 250 hours

- adjust the guide shoes;
- grease the mast guide rollers (E)

Every 2 000 hours

- check the condition of the guide rollers (E); they must turn freely without jamming and not show excessive wear.



Fork carriage and sideshift unit

After the first 50 hours

- adjust the guide shoes adjusting the Allen screw (G)
For the adjustment use a 0.2-0.5 mm thickness gauge, inserted from below and up to the centre of the Allen screw (G) passing behind the roller (H).

Every 50 hours

- lubricate the sideshift guides with grease through the grease nipples.

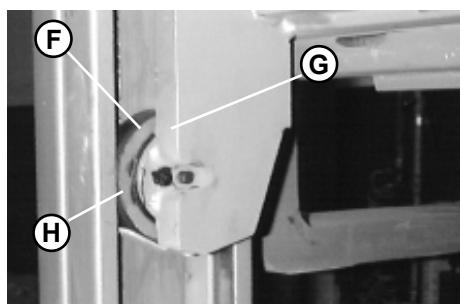


Every 250 hours

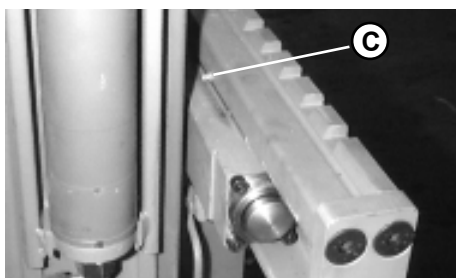
- lubricate the fork positioning pins and notches with grease.
- grease the fork carriage guide rollers (F)
- adjust the guide shoes

Every 2 000 hours

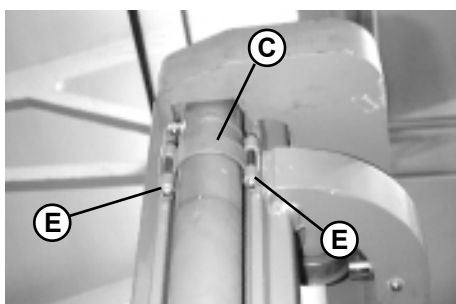
- check the condition of the guide rollers; they must turn freely without jamming and not show excessive wear.



INTERNAL COMBUSTION	SERVICE MANUAL	1,5 - 1,8 - 2,0 t
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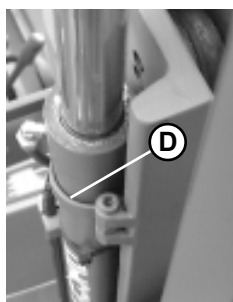


- C) Sideshift unit**
(upper part)
 3 grease nipples
(lower part)
 without grease nipple excessive wear.



Make sure that:

- the lifting chain stay bolts are free of defects and that the adjusting nuts are locked by the appropriate cotter pins (A);
- the fork carriage (B) safety end stops are present and tightly fixed.
- the collars (C) are present and tightly fixed.

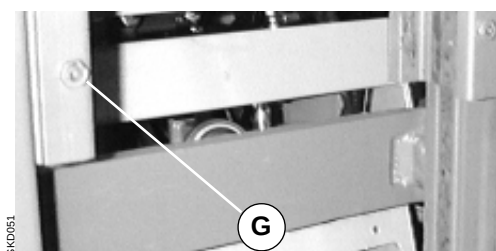


Every 500 hours

- check that there is a clearance (D); of 0.5 to 3 mm between the collar and external lifting jack cylinder.
- check that there self-lockin nuts (E) are tight.

Locking torques:

- collar self-locking nuts 0.8-1.2 daNm



SAFETY FORK CARRIAGE END STOP

The lifting unit is equipped with a mechanical safety end stop, to avoid the accidental escape of the fork carriage from the bottom of the mast.

The end stops (A) consists of two Allen bolts. To remove the fork carriage, first of all unscrew the end stops.

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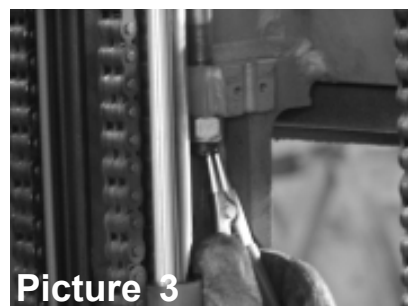
GUIDE ROLLERS AND GUIDE SHOES REPLACING



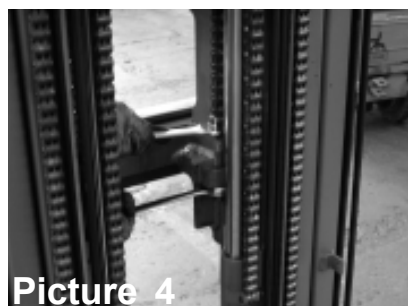
Picture 1



Picture 2



Picture 3



Picture 4



Picture 5

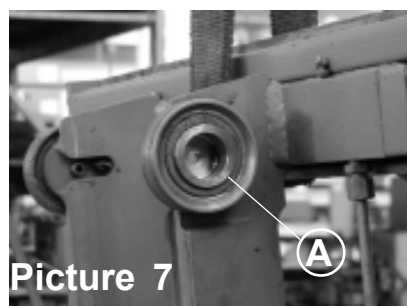
Guide rollers and guide shoes Mast-Fork carriage replacing

In order to carry out the job proceed as follows:

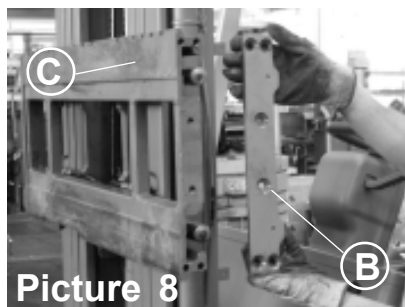
- 1) remove the two forks from the carriage
- 2) disconnect the two sideshift hoses on the fork carriage (**Picture 1**)
- 3) tie the fork carriage with a sling (**Picture 2**)
- 4) remove the safety clip of the chain pin on the carriage (**Picture 3**)
- 5) remove the nut stopping the chain pin with a tools as shown in **Picture 4**. After that put the two chains in the opposite side in order to have more space.
- 6) remove the two Allen screws (**Picture 5**)
- 7) remove the complete fork carriage from the bottom
- 8) remove the guide shoes with two screw drivers (**Picture 6**) and screw out the Allen a screw **G** (see **page 69**) in order to give the possibility at the new guide shoes to go inside completely.
- 9) remove the snap ring **A** and take out the guide roller (**Picture 7**)
- 10) reassembly all parts in the opposite sequence and adjust the guide shoes as shown at **page 62**.



Picture 6



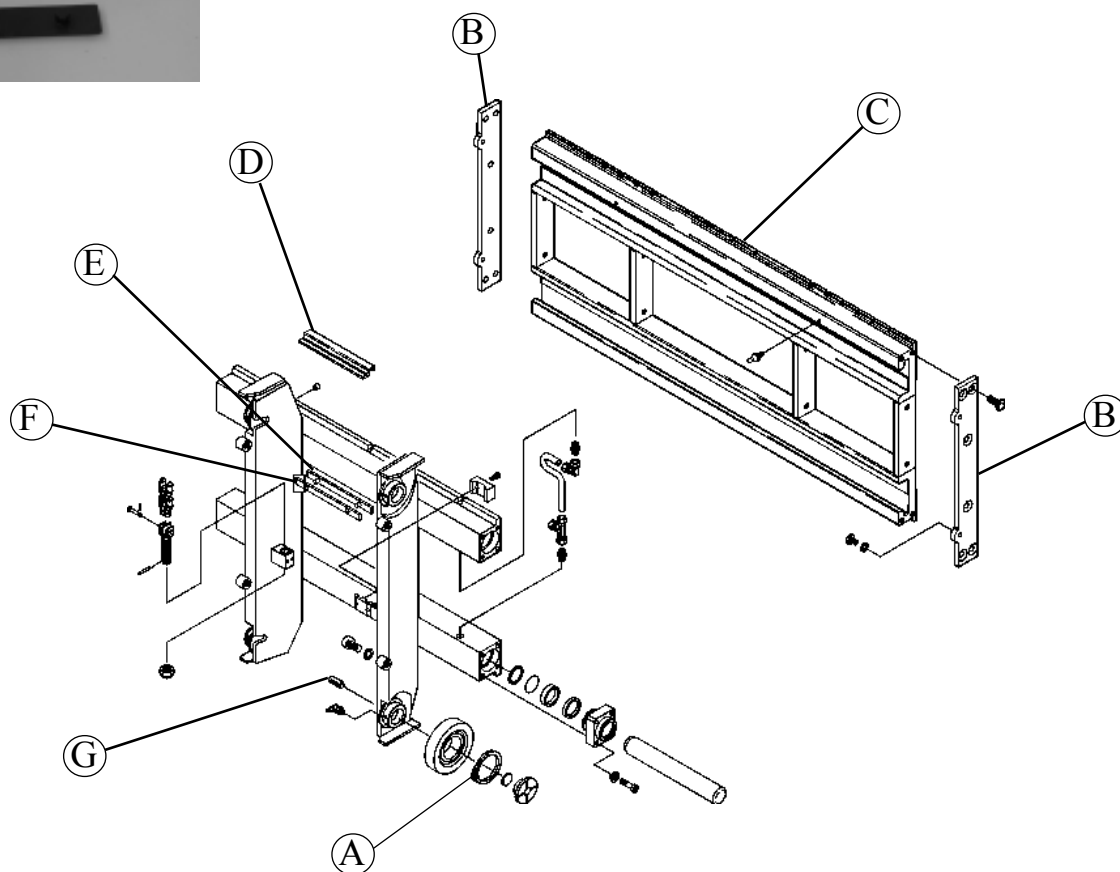
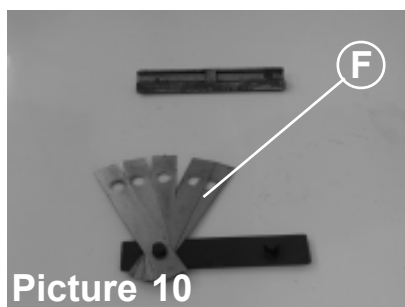
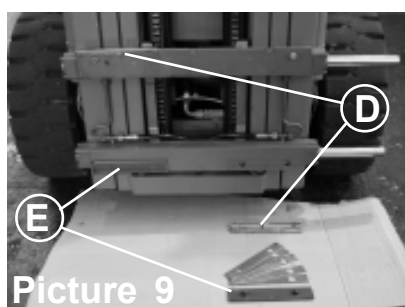
Picture 7



GUIDE SHOES FORK CARRIAGE REPLACING

In order to carry out the job proceed as follows:

- 1) remove one of the two side bars **B** from the fork carriage (**Picture 8**)
- 2) take out the mobile plate **C** (**Picture 8**)
- 3) replace the upper and lower guide shoes **D-E** (**Picture 9**)
- 4) make sure to introduce the shims **F** as necessary in order to have a correct clearance of the mobile plate **C** on the fork carriage
- 5) reassembly all parts in the opposite sequence and lubricate the guide shoes as shown at **page 62**



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MAST CHAINS INSPECTION

CHECKING THE CHAINS:

Every 500 hours (anyway, chains are to be checked every 3 months)

- check the condition of the chains which in any case must not be faulty, worn out or damaged. To check the links for wear, use the appropriate gauge, paying attention that, **when 33 links are counted in a space corresponding to 34, the chains must be replaced.**

Every 1 000 hours

- remove the chains, clean them thoroughly, refit them inverting the original working position and lubricate them.

Every 10 000 hours

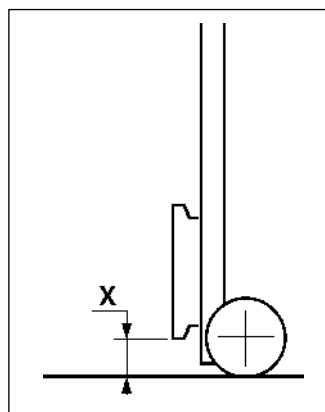
- replace the chains and the fixing tie rods

Use of original CESAB chains will guarantee that the safety requirements stated by the regulations in force are complied with.

POSITIONING THE FORK MOUNTING CARRIAGE

Every 500 hours

- After testing the chains as described above, with the truck on an even surface and the mast in a vertical position, check the position of the fork carriage plate, as follows:
- remove the forks, completely lower the fork carriage and measure the height (X), comparing it with the value shown in the table, corresponding to the capacity in kg of the truck.
(e.g. the correct value of (X) for a truck with a capacity of 2000 kg (class II B), must be 152 ± 5 mm).



X = 76 mm (A)

X = 152 mm (B)

TABLE ISO 2328 - 1993			
Rate	lifting load (kg)		"X" (± 5)
I A	0	÷ 999	76 mm
II A	1 000	÷ 2 500	76 mm
III A	2 501	÷ 4 999	76 mm
IV A	5 000	÷ 8 000	127 mm
V A	8 001	÷ 10 999	127 mm

TABLE ISO 2328 - 1993			
Rate	lifting load (kg)		"X" (± 5)
I B	0	÷ 999	114 mm
II B	1 000	÷ 2 500	152 mm
III B	2 501	÷ 4 999	203 mm
IV B	5 000	÷ 8 000	254 mm
V B	8 001	÷ 10 999	257 mm

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FORK INSPECTIONS

General criteria

Fork arms in use must be **inspected at intervals of not more than 1 000 hours**, and whenever a defect or permanent deformation is detected. If the truck is subject to intensive use, more frequent inspections may be required.

Inspection

Fork arm inspection must be carried out carefully by trained personnel to detect any damage, failure, deformation, etc., which may impair safe use.

Surface cracks

The fork arm must be thoroughly examined visually for cracks giving special attention to the heel (D) and top (E) and bottom (F) hooks. If necessary, the forks may be subjected to a non-destructive crack detection process.

Difference in height of fork tips

Check the difference in height between the blade tips on each pair of forks, this must not be more than 3% of blade length with the forks fitted on the fork plate.

Positioning lock

Check that the fork positioning lock (G) is in good working order.

Legibility of marking

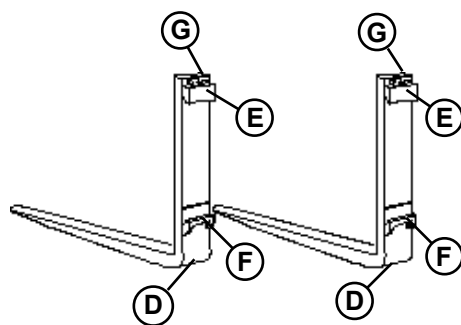
If the fork arm marking is not clearly legible, it must be renewed by the original fork supplier.

Fork wear control

The fork arm blade and shank must be thoroughly checked for wear, paying special attention to the area around the heel (D). When maximum wear is detected, with thickness reduced to 90% of the original, the fork arm must be replaced.

Fork mounting wear control

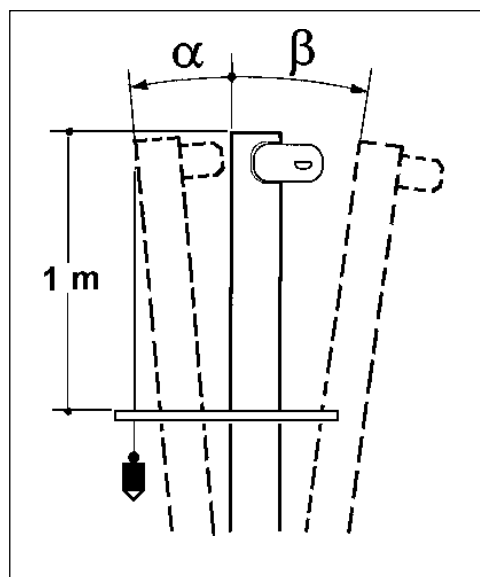
The horizontal supporting surface of the top hook (E) and the contact surfaces of both hooks (E) and (F) must be checked for wear and any damage.



WITHDRAWAL OF THE FORKS FROM SERVICE

Any fork with defects revealed during the above controls must be withdrawn from service.

<= FORWARD - BACKWARD >=



1° = 17,4 mm

MAST GROUP TILTING SETTING

Every 500 hours

- control the tilting of the masts; the standard values (β) (α) are the following:

$\alpha = 5^\circ$ FORWARD
 $\beta = 10^\circ$ BACKWARD

The tilt angle can easily be checked using a plumb-line dropped from the front outside edge of the top of the fixed masts and measuring the distance between the line and the front edge at a metre from the top of the masts.

N.B. 1 tilting degree corresponds to a 17.4 mm movement on 1 mt.

$\alpha = 5^\circ$ FORWARD = 87,5 mm
 $\beta = 10^\circ$ BACKWARD = 176,4 mm

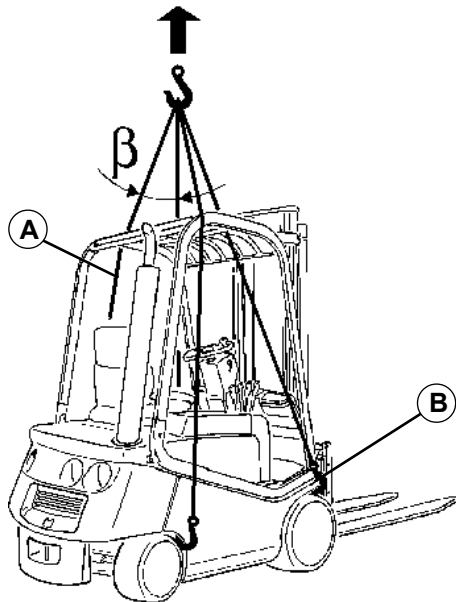
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LIFTING OF THE TRUCK

If the truck is equipped with mudguard extensions, chains can only be hooked by previously disassembling the extensions themselves.

HOOKS ATTACHMENT POINTS FOR LIFTING THE TRUCK

The hooking points are shown on the carriage with the symbol shown on the side (see figure).



LIFTING OF THE FORKLIFT TRUCK

To lift the truck the following equipment must be used:

A- CHAINS: ø 8 mm - Degree 8 - UNI EN 818-2

B- HOOKS: for 2 t - UNI/ISO 7597

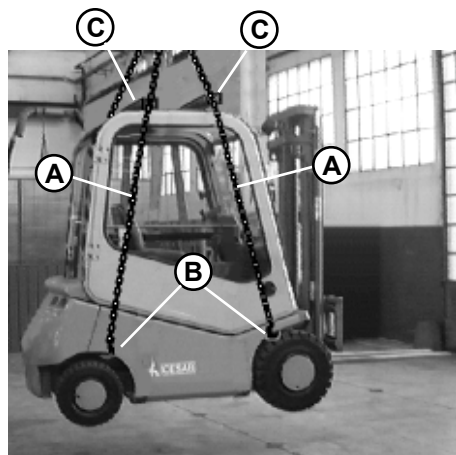
LIFTING OF THE FORKLIFT TRUCK WITH CABIN

To lift the truck with cabin the following equipment must be used:

A- CHAINS: ø 8 mm - Degree 8 - UNI EN 818-2

B- HOOKS: for 2 t - UNI/ISO 7597

C- N° 2 upper brackets to hold the chains.



It is important to remember that the chain length must be sufficient to lift the truck in a horizontal position, with the lifting angles (β) ≤ 45° with respect to the vertical lifting line.

Ensure that the chain is protected where it comes into contact with edges, then arrange the chains on the truck so that it remains in a horizontal position during the entirely lifting operation.

Make sure that there are no personnel in the vicinity of the truck, before carrying out the lifting operation.

If any maintenance operations need to be performed on the truck in a raised position, the vehicle must be rested on appropriate supports, sufficient to bear the overall weight of the vehicle, keeping the chains taut.

1.5 t
1.8 t
2.0 t

TRUCK WEIGHT		ON THE AXLE WITHOUT LOAD (FRONT / REAR)	
3100	kg	1530 / 1570	kg
3250	kg	1650 / 1600	kg
3400	kg	1700 / 1700	kg

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SAFETY INFORMATION

Work clothes

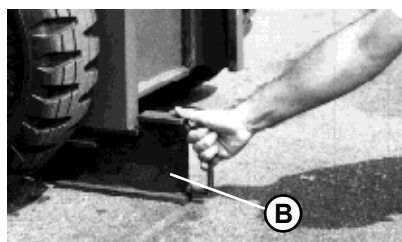
- 1 protective gloves
- 2 overalls
- 3 safety boots
- 4 protective goggles

Work place

The work place must be lighted and aired.

The area around the truck must be obstacles free

Oil signs or grease substances must not be presents on the pavement (danger of sliding).



Lifting the truck

Before doing any job, it is obligatory to lift the front wheels with blocks to avoid the risk of accident.

1. Block the steered wheels with chocks (A).
2. Tilt the mast back and place blocks (B) under their base.
3. Tilt the mast forwards: the direction wheels must be lifted and free to rotate



To carry out correctly all the lifting operation of the truck it is necessary to have the following tools:

- . a hydraulic jack to 5 ton
- . metal or hard wood blocks

before putting the blocks below the must, check the inclination of the floor, the truck must be parked on a flat, horizontal surface.

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Welding

It is suggested to wear a leather overall, gloves and welding mask.

It is obligatory to wear gloves and protective goggles during the grinding operations because they could cause the projection of metallic particles.

Make sure that these two operations are feasible inside the working area where you are.

When these operations are carried out on a truck, in order to avoid any danger of explosion, pay attention to cover and protect the battery and the fuel concerned parts

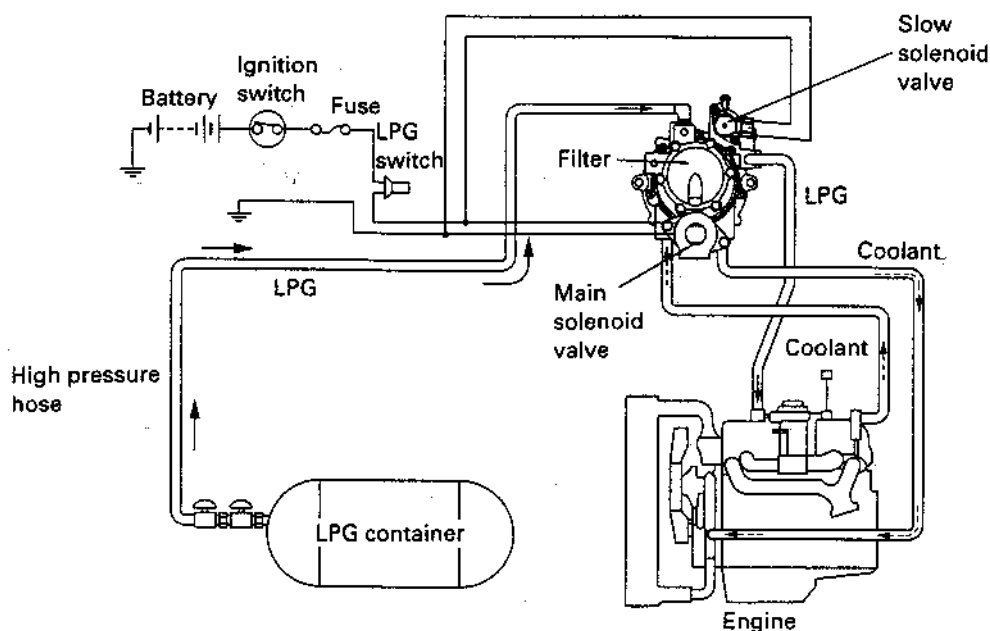
Make sure that around the working area there are not any inflammable products.

Disconnect the battery before carrying out any arc-weldings on the trucks.

Truck washing

During this operation be careful when using water on all the electric components

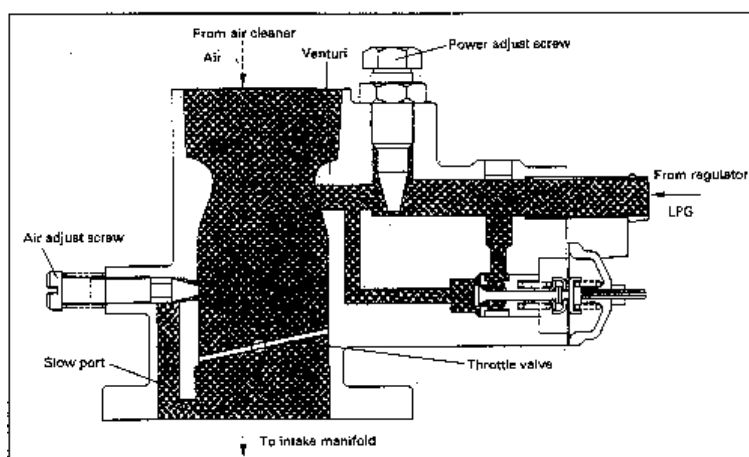
TOYOTA 4Y ENGINE LPG SYSTEM (AISAN)


Fig. 1

The liquid LPG from the LPG cylinder is taken into the regulator for filtration of foreign matters by the built-in filter. The filtered LPG is then sent to the pressure reduction chamber, where it is vaporized into gas which is sucked into the engine through the carburetor. The engine cooling water is led to the regulator as the heat source for LPG vaporization.

Carburetor

This carburetor functions to mix the LPG after pressure reduction in the regulator with the air at an appropriate ratio and lead the mixture into the cylinders. A negative pressure type power valve is built in to improve the performance in a heavily loaded state. The carburetor body is integrated with a venturi tube.



Specification:

Power valve operating pressure	kPa(kgf/cm ²) [psi]	-12.0~-22.0 (-0.122~-0.224) [-1.74-3.19]
Bore diameter	mm (in)	35 (1.38)
Venturi diameter	mm (in)	24 (0.94)
Power jet diameter	mm (in)	3.0 (0.118)

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Idling speed (minimum RPM adjustment)

1) Warm up the engine

cooling water temperature: 80°C or above
engine oil temperature: 70°C or above
hydraulic oil temperature: 50°C or above

2) Connect an engine revolution counter

3) Inspect the idling speed (750 RPM)

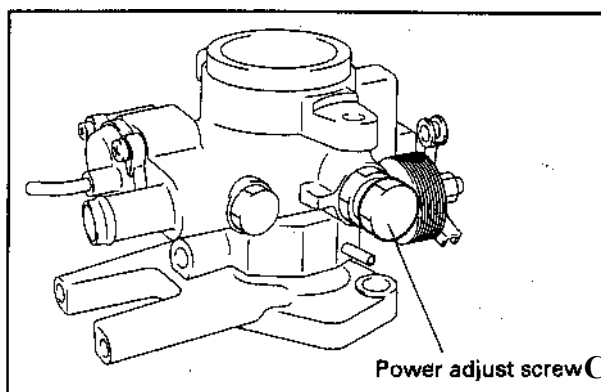
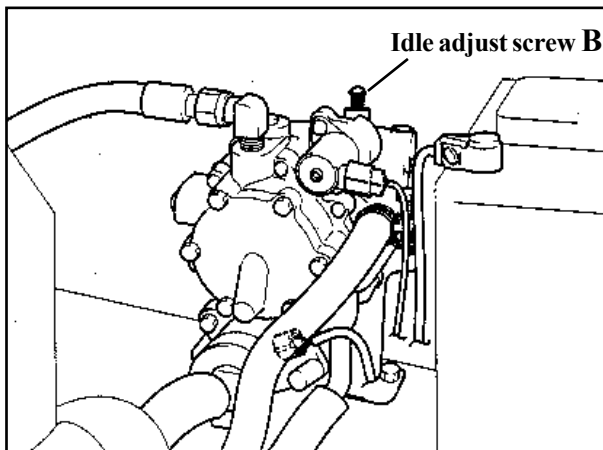
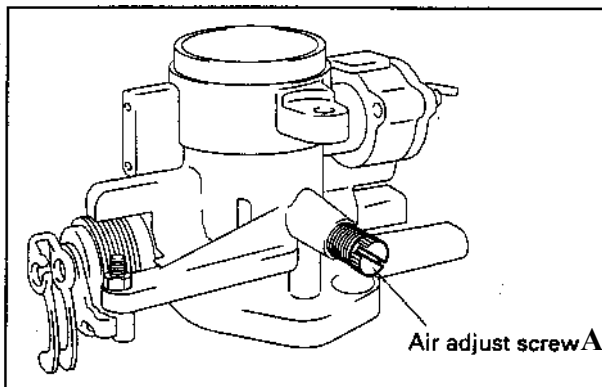
4) If the idling speed does not satisfy the standard, turn the Air adjust screw **A**.

If the idling speed cannot be adjusted to the standard value, first turn the idle screw **B** counterclockwise until reaching the highest engine RPM, now set the air adjusting screw **A** in order to find 750 RPM.

Turn idle adjusting screw **B** slowly clockwise to find the opening where the speed starts to drop, and turn it counterclockwise by 45° from that position.

The above adjustment attains the standard idling speed and CO value.

In any case it is possible to adjust the CO value through the power adjust screw **C**.



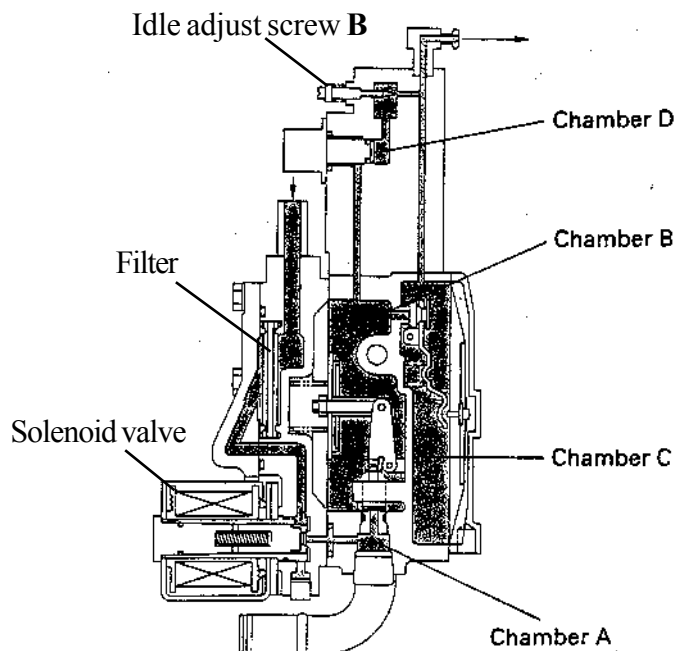
TOYOTA 4Y ENGINE LPG REGULATOR

Regulator

The regulator for the gasoline engine corresponds to a part of the carburetor. It supplies the LPG fuel to the engine while maintaining the vaporized LPG after pressure reduction at a constant pressure level.

The regulator is made very compact since the filter and solenoid are integrated.

The LPG in the liquid phase is vaporized by taking the heat of vaporization from the engine cooling water. The regulator consists of chamber **A** where the LPG starts to vaporize, chamber **B** for reducing the pressure of the vaporized LPG (primary pressure reduction chamber), chamber **C** (secondary pressure reduction chamber) where the pressure is further reduced to near the atmospheric pressure to supply the fuel according to the negative pressure at the venturi in the carburetor, and chamber **D** that forcibly supplies fuel at the time of the engine starting or idling.



Specification:

Primary pressure	kPa (kgf/cm ²) [psi]	29 (0.3) [4.26]
Primary seat inside diameter	mm (in)	3.2 (0.126)
Secondary seat inside diameter	mm (in)	6.0 (0.236)
Slow look		Solenoid valve type
Filter precision	mm (in)	10 μ

Filter

The filter is set to 10 μm and two types of materials are used inside with rubber packing for sealing in-between (see Fig. 1).

Solenoid valve

A solenoid valve integrated with the regulator is installed between the filter and the chamber **B**.

The LPG switch (see page 78 and 81), installed on the regulator support, starts and stops the LPG supply. A slide valve is located inside the solenoid valve. The current flowing in the coil generates a magnetic force to attract the slide valve toward the solenoid against the spring force, opening the path.

When no current flows, the spring forces the valve seat to close the path.

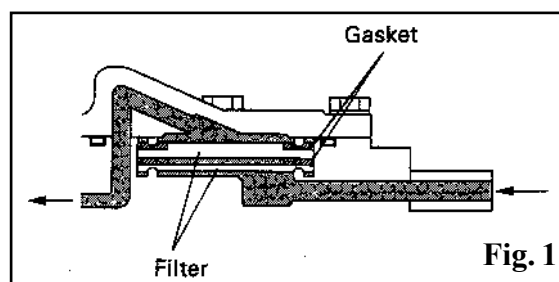


Fig. 1

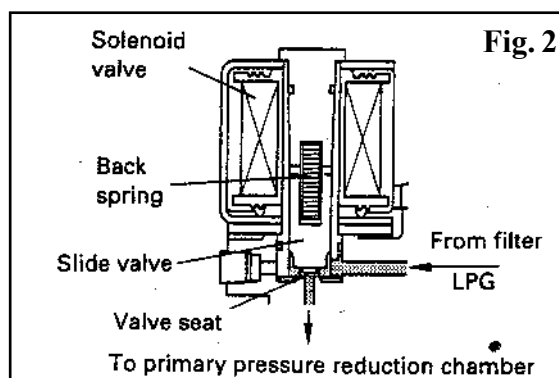
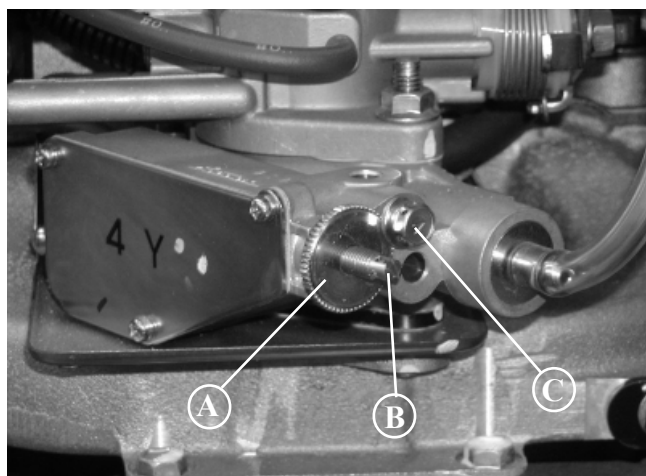
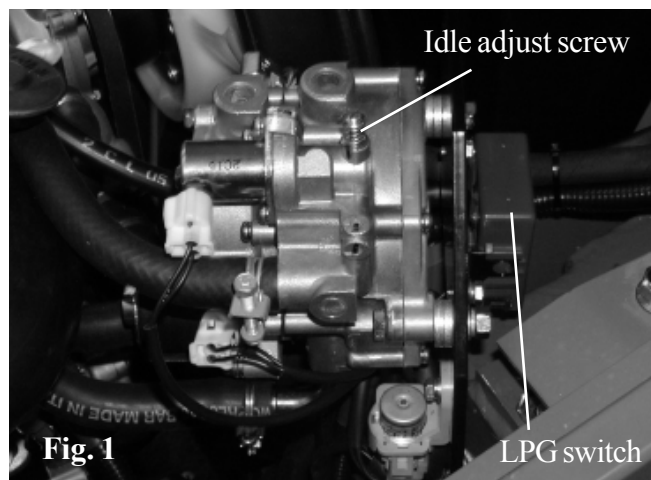


Fig. 2

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TOYOTA 4Y ENGINE ADJUSTMENT



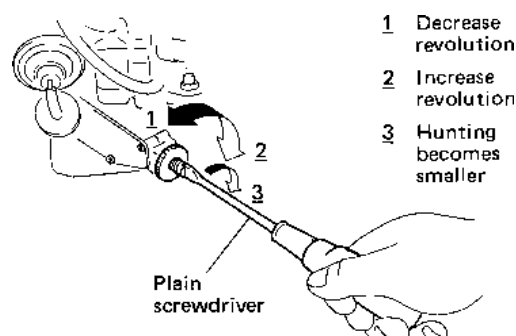
Max. RPM adjustment

- 1) Warm up the engine
cooling water temperature: 80°C or above
engine oil temperature: 70°C or above
hydraulic oil temperature: 50°C or above
- 2) Connect an engine revolution counter
- 3) Inspect maximum speed (2450 RPM)
- 4) Loosen the safety bolt (C), turn the adjusting screw bushing (A) counterclockwise if the maximum RPM exceed from the standard value or turn it clockwise if the maximum RPM are lower than the standard.
If it is necessary keep the screw (B) locked with a plain screwdriver
- 5) In case check the hunting with load and repeat the precedent point.

Hunting adjustment

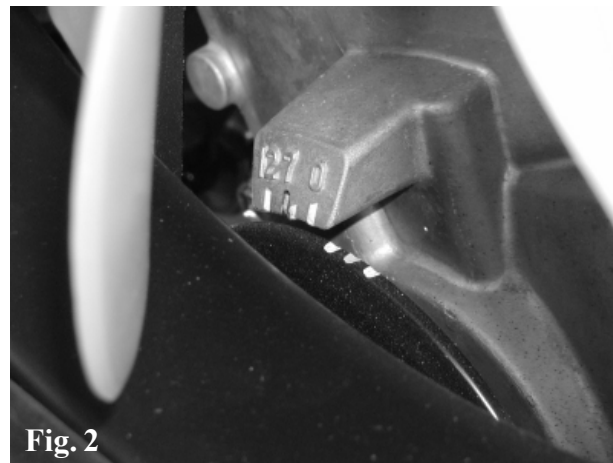
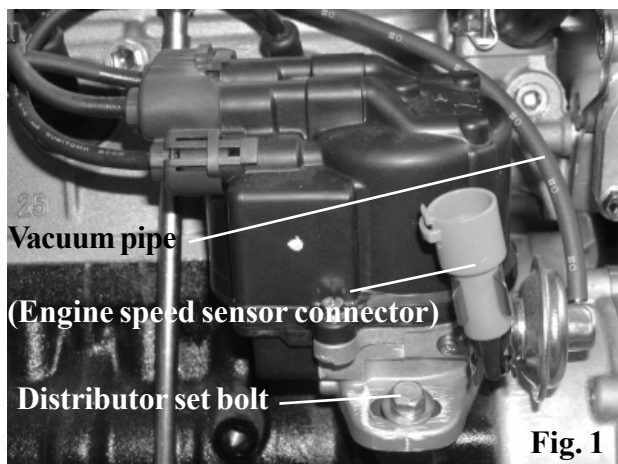
If hunting is remarked, i.e. the irregular variation of the minimum and maximum engine RPM, you have to proceed as follows:

- 1) Turn the adjusting screw (B) clockwise to reduce the hunting
- 2) Verify that the maximum RPM are not changed (in case set the adjusting screw bushing (A) again)
- 3) Plumb the adjusting screw (B) to prevent the screw from moving during engine vibration.



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TOYOTA 4Y ENGINE INITIAL TIMING ADJUSTMENT



1) Warm up the engine

cooling water temperature: 80°C or above

engine oil temperature: 70°C or above

hydraulic oil temperature: 50°C or above

2) Connect the stroboscopic gun to the n° 1 spark plug wire

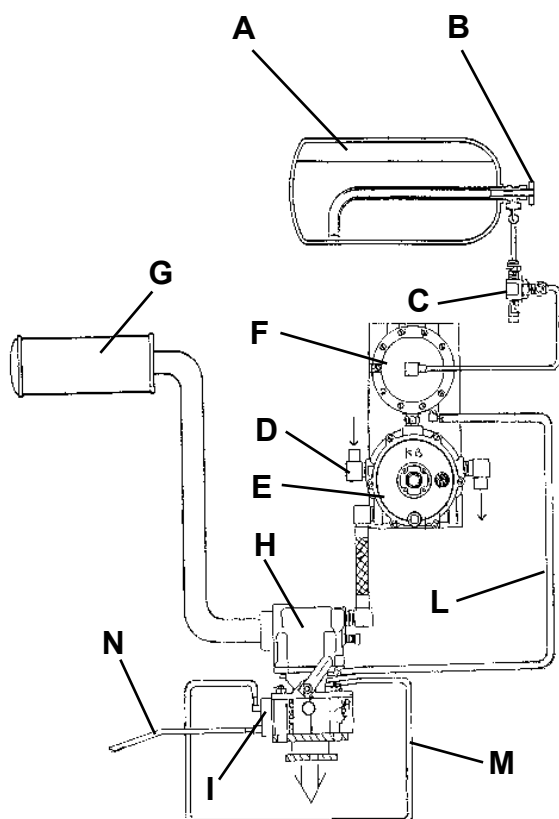
3) Disconnect the vacuum pipe (see Fig. 1)

4) Check the timing on the crankshaft pulley next to the pointer on the timing cover that has to be of 7 degrees (see Fig. 2)

5) In order to adjust the timing loosen the distributor set bolt (see Fig. 1) and turn the distributor on the appropriate side

6) Tighten the set bolt and connect the vacuum pipe.

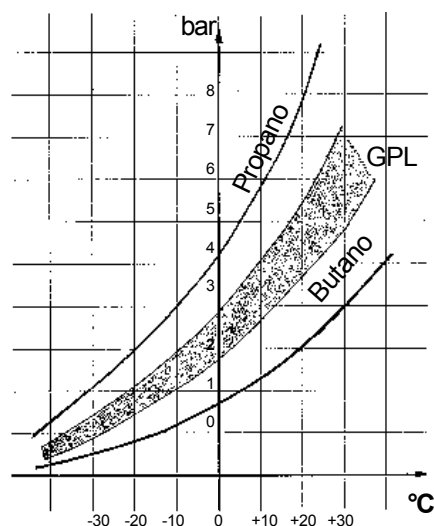
OPTIONAL LPG SYSTEM (IMPCO)



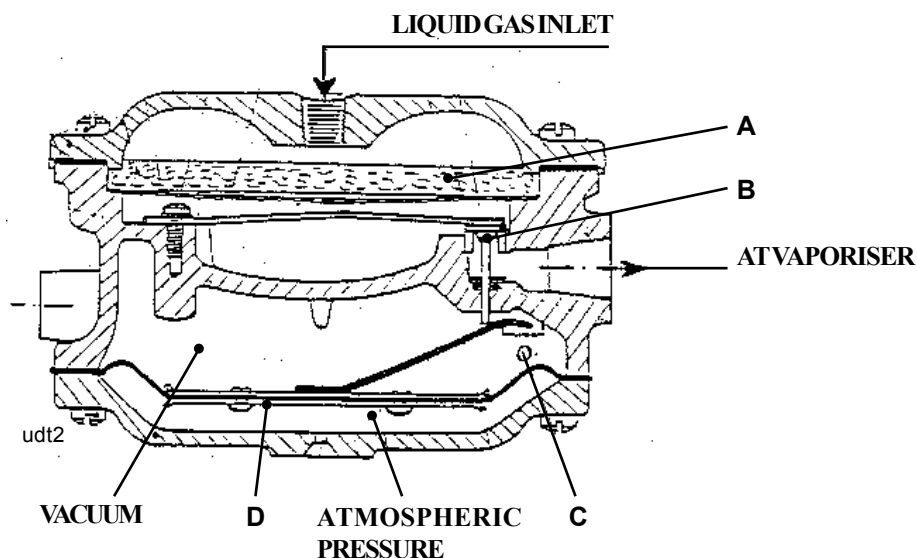
- A = Liquid gas cylinder
- B = Liquid gas cylinder stopcock
- C = Safety valve (max 15 bar)
- D = Water fitting for vaporiser heating
- E = Vaporiser
- F = Liquid gas filter valve
- G = Air filter
- H = Carburetor
- I = Rpm setting (done by Cesab)
- L = Connection of carburetor vacuum to filter valve
- M = Connection of carburetor vacuum to rpm adjuster
- N = Connection of carburetor vacuum to distributor to change spark advance

Vapour pressure curves

(switch from liquid to gaseous state)



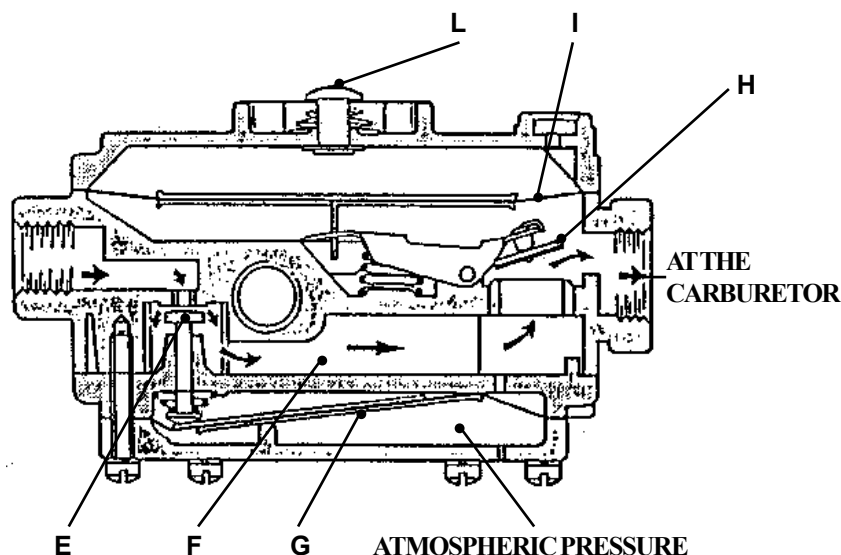
The liquid gas is a mixture of propane and butane in varying percentages. The higher the percentage of propane, the higher the vapour pressure (pressure being equal), the better the system will work.



FILTER VALVE

The liquid gas flows in through filter **A** which traps all impurities (replace every 1000 hours). Liquid gas flow is interrupted by valve **B** (the pressure of the liquid gas keeps this valve closed: active safety)

The vacuum of the carburetor, connected through hole **C**, acts on diaphragm **D** and causes valve **B** to open.



VAPORISER (shown in operating position)

By means of primary valve **E**, the liquid gas becomes gaseous, passing from 6-8 bar to 0.5 bar, with heat absorption.

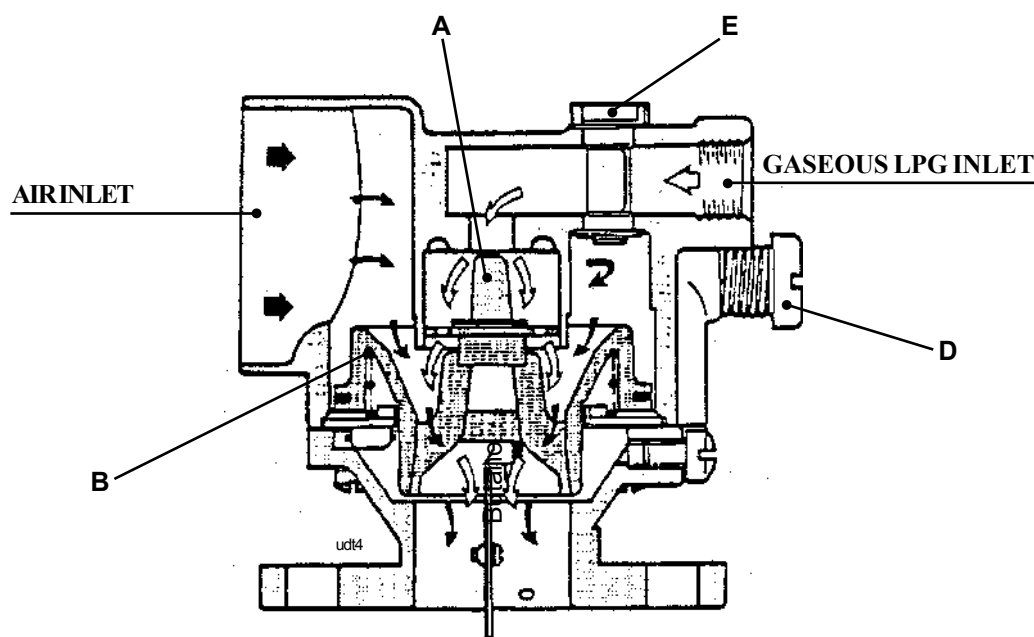
Valve **E** maintains a pressure of 0.5 bar in chamber **F**.

Valve **E** is operated by diaphragm **G**. The secondary valve **H** (this opens at 0.038 bar) is controlled by diaphragm **I** which is affected by the carburetor vacuum (active safety).

L = manual control for opening valve **H**.

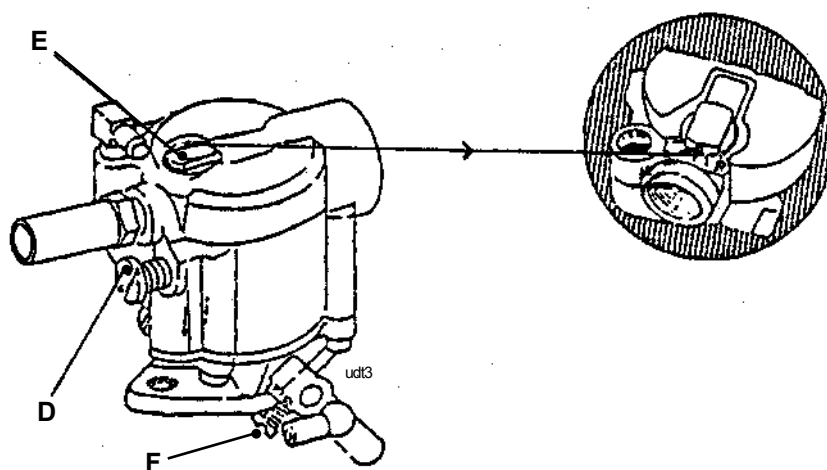
SERVICE MANUAL

INTERNAL
COMBUSTION



CARBURETTOR (here shown in fully open position)

The liquid gas is metered by valve **A** controlled by the vacuum operating on piston **B**.



D = CO adjustment at minimum rpm (completely screw up and then unscrew by 3 full turns)

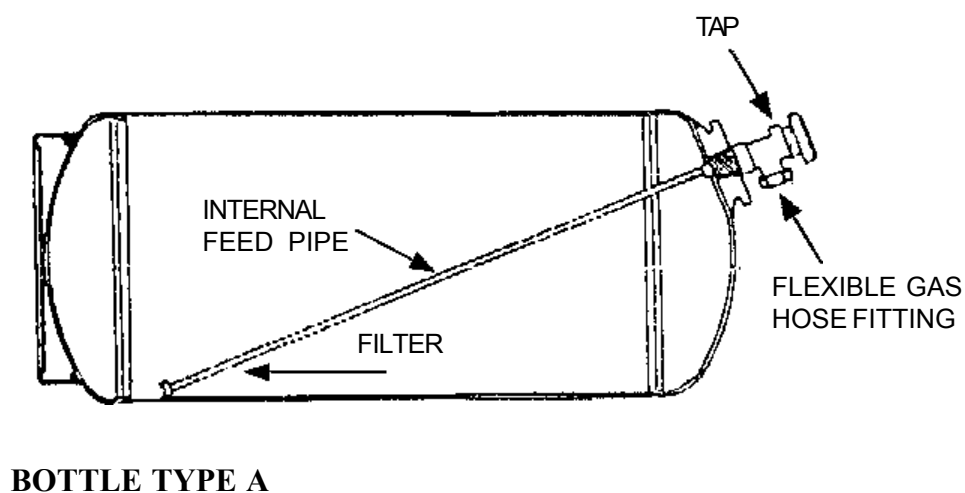
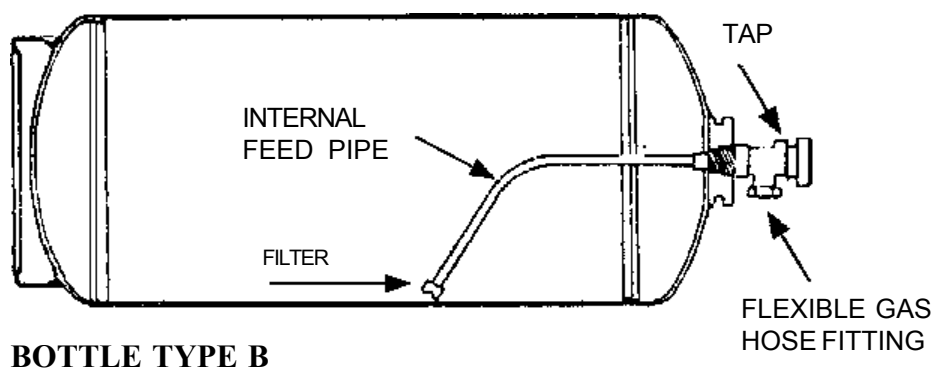
E = CO adjustment at peak rpm. Switching from R (open) to C (closed), the percentage of gas is reduced.

F = adjustment of minimum rpm

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LPG BOTTLE

The LPG bottle is not supplied with the truck. For correct truck operation, you should request and use **only** bottles designed for VEHICLES, with an INTERNAL FEED PIPE. These bottles are available from authorized suppliers, whose fitting and maintenance instructions must be scrupulously followed. Secure the bottle to the support on the truck. Position the bottle so that the internal feed tube points downwards (ask the bottle supplier for advice).



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OIL AND GREASE SPECIFICATIONS

FOR NORMAL ENVIRONMENTS

USED TYPE	SPECIFICATIONS	QTY.
AGIP ARNICA 46	ISO - L - HV FZG test to stage 11	39 L
MOBIL ANTICONGELANTE	-	-
MOBIL DELVAC MX SAE 15W-40	API CG-4 MIL-L-2104 G ACEA-98 E2 RVI E2R	-
20 ÷ 40 SAE	-	-
MOBILGREASE SPECIAL	Lithium base ASTM 275÷305 NLGI N.2 dropping point 180°	-

INVOLVED PARTS
Hydraulic system, lifting, power steering, and hydrostatic transmission
Cooling liquid
Diesel and Lpg engines
Mast chain lubrication
Mast securing joints, sideshift unit, steering joints, general lubrication with grease nipples

FOR COLD CLIMATES AND COLD-STORAGE CELLS

AGIP ARNICA 22	ISO - L - HV FZG test to stage 10	39 L
MOBILTEMP SHC 100	Thickening infusible ASTM 275÷295 NLGI N.2 dropping point > 260°	-

INVOLVED PARTS
Hydraulic system, lifting and power steering units
Mast securing joints, sideshift unit, steering joints, general lubrication with grease nipples, mast guides

TYRE PRESSURES TIGHTENING TORQUES

TYRE PRESSURE

8,7 bar
10 bar

steering wheels
driving wheels

TYRE TIGHTENING TORQUES

21 daNm
14 daNm

steering wheels
driving wheels

DRIVE UNIT TORQUE

12 daNm

engine fixing to chassis

VARIOUS TORQUES

6 daNm
0,8÷1,2 daNm
30 daNm

bolts securing mast
jack collar self-locking nuts
counterweight blocking screws

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RUNNING IN MAINTENANCE TIME TABLE

50	500	at # hours for MEDIUM/INTENSE USE
7/-	-/3	at # days/months FOR OCCASIONAL USE

ENGINES

		engine oil and cartridge
		clearances engine values
		fan belt and alternator belt

CHASSIS AND CONTROLS

		general bolt and nuts
		wheel torque (1)

(1) During the first 500 working hours, check the torque every 50 hours

LIFTING UNIT - MASTS

		mast guide pads
		lifting oil filter

HYDROSTATIC TRANSMISSION

		transmission oil filter
		transmission oil

LEGEND



In the maintenance table showing a visual control and cleaning of the parts indicated.



In the maintenance table showing the replacement of the parts indicated.



In the maintenance table showing lubrication of the parts indicated.



In the maintenance table showing tightening or adjustment of the parts indicated.

The servicing periods are divided into hours, considering an average working day of 8 hours of effective operation. If the truck is used on average for less than 8 hours per day, refer to the schedules expressed in days/months

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MAINTENANCE TIMES TABLE

8	50	250	500	1 000	2 000	4 000	10 000
1/-	7/-	-/1	-/3	-/6	-/12	-/24	-/60
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							

at # hours for MEDIUM/INTENSE USE
at # days/months FOR OCCASIONAL USE
mast guide pads
carriage - sideshift unit slides
mast rollers and chain rollers
tilting jacks supply tubes
fork positioning pins
lifting oil filter
mast guides, mast and jack fixing
lifting jack collars
fork carriage position
forks
mast tilting
mast secured to chassis
lifting chains
chain securing bolts
high pressure hydraulic hoses
system seal and connections

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MAINTENANCE TIMES TABLE

8	50	250	500	1000	2000	4000	10 000
1/-	7/-	-/1	-/3	-/6	-/12	-/24	-/60

after # hours FOR MEDIUM/INTENSE USE

after # days/months FOR OCCASIONAL USE

CHASSIS AND COMMANDS

chassis - cleaning
bolts in general
fuel tank cleaning
fuel tank control
driver's seat
wheels - hub bearings
tyre inspection and wheel tightness
tyre pressures
steering system and tubing seal
hoses from orbitrol to steering jack
rear axle and wheel hub bearings
steering lock
pedals in general - linkage
parking brake pedal
service brake pedal
hoses of brake
brake liquid

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MAINTENANCE TIMES TABLE

8	50	250	500	1 000	2 000	4 000	10 000
1/-	7/-	-/1	-/3	-/6	-/12	-/24	-/60

			(*)				
					(*)		

at # hours for MEDIUM/INTENSE USE
at # days/months FOR OCCASION USE

ENGINE

cooling liquid
fuel filter cartridge
air filter
dusty environment air filter
cyclone prefilter
water and oil radiator (external cleaning)
water and oil radiator in dusty environments
fan belt and alternator belt
engine oil
oil filter cartridge - (*) Toyota 4 Y
engine supports
engine linkage and fuel connections
flexible fuel and water hosing
DIESEL engine injection pressure control
DIESEL engine valve clearance
LPG engine valve clearance - (*) Toyota 4 Y
LPG engine spark plugs
LPG system control
LPG bottle hose and safety valve
LPG pressure reducer

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MAINTENANCE TIMES TABLE

8	50	250	500	1000	2000	4000	10000
1/-	7/-	-/1	-/3	-/6	-/12	-/24	-/60

at # hours for MEDIUM/INTENSE
USE

ati # days/months for OCCASIONAL
USE

ELECTRIC SYSTEM

pushbuttons - pedal microswitches

cable terminals - cable sheaths

battery electrolyte level and density - replacement

battery terminals and poles

HYDROSTATIC TRANSMISSION

system seal

transmission oil filter

transmission oil

complete unit



Service Manual

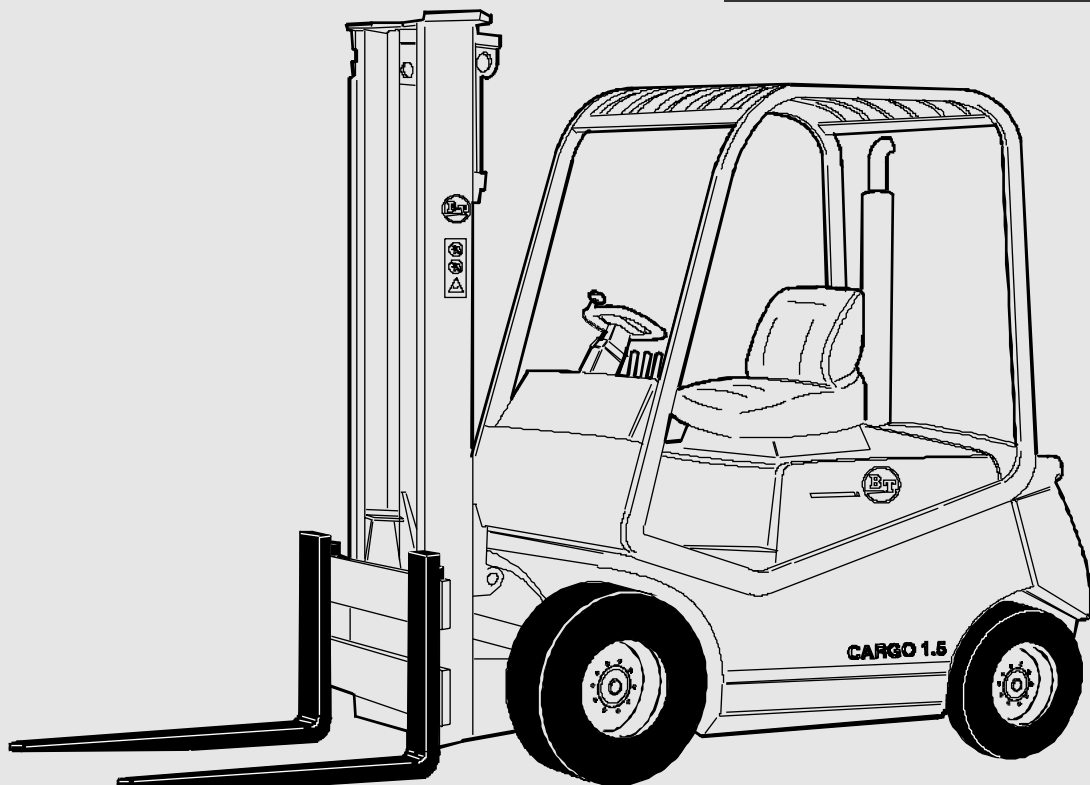
CBD/G

1,5

1,8

2,0

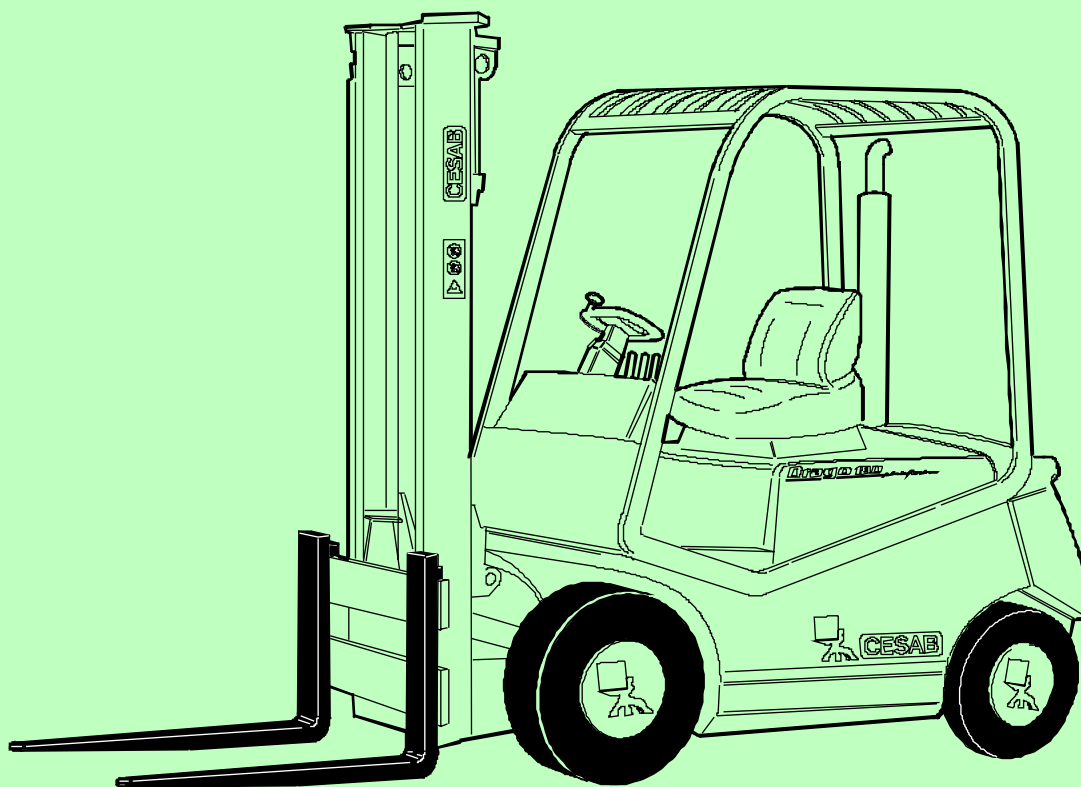
Cargo Range





SERVICE MANUAL

Drago **150 180 200** *pininfarina*





Cargo Range

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