

GX 40 - 45 - 50

SERVICE/TRAINING MANUAL
SM 8-30110 GB (3665441M1)

McCORMICK

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SAFETY NOTES

Personal risk

This warning symbol draws your attention to messages that are important for your safety.
Read the safety notes carefully and comply with the recommended precautions to avoid potential dangers and safeguard your health and personal safety.
This symbol appears in the text along with the following key words:

WARNING - To warn of unsuitable repair operations with potential consequences that could affect the repair technician's safety.

DANGER - To indicate warnings that specifically denote potential dangers for the operator's safety or for other directly or indirectly involved persons.



1

Avoid accidents

The majority of accidents that occur in workshops are caused by failure to comply with some simple and fundamental rule of caution and safety. This is why ACCIDENTS CAN BE AVOIDED IN MOST CASES: all that's needed is to foresee the possible causes and consequently act with due care and caution.

However well a machine is designed and built, it is never possible to absolutely exclude all hazardous situations.

A careful and prudent mechanic is the best guarantee against accidents.

Strict compliance with even only one elementary safety rule would be sufficient to avoid many serious accidents.

DANGER. Never carry out any cleaning, lubricating or servicing operations whilst the engine is running.

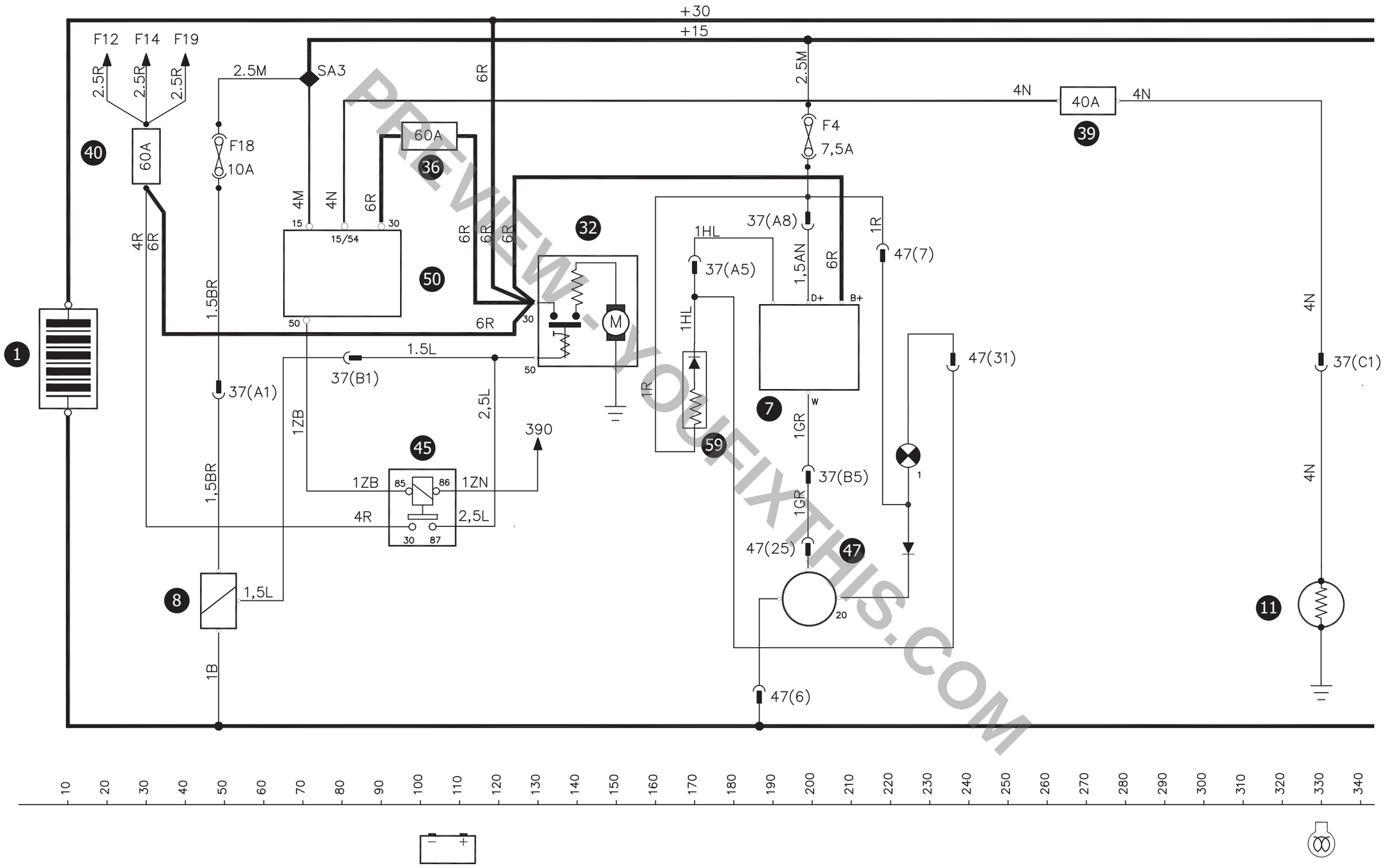
General rules

- Carefully comply with the prescribed maintenance and repair procedures.
- Never wear rings, wrist watches, jewellery, loose or flapping garments such as, for example: ties, torn clothing, scarves, unbuttoned jackets or with open zip-fasteners that could become caught in moving parts. You are advised to wear approved safety garments, such as: non-slip footwear, gloves, safety goggles, helmets, etc.
- Never carry out repair work on the machine whilst someone is sitting in the driver's seat, unless this person is an authorized operator who is helping with the operations in progress.
- Only operate the machine and use the relative implements when you are sitting in the driver's seat.
- Do not carry out any work on the machine when the engine is running, unless this is specifically prescribed.
- Stop the engine and make sure that the pressure has been relieved from the hydraulic circuits before removing any caps, covers, valves, etc.
- All servicing work must be carried out with the utmost care and attention.
- Ladders and platforms used in workshops or in the field must comply with the current safety regulations.
- Disconnect the batteries and label all the controls to warn others that work is being carried out. Block the machine and all implements that must be raised.
- Do not check or fill fuel tanks, batteries, or use ignition fluid when smoking or near naked flames as these liquids are inflammable.
- The brakes are disengaged when released by hand for servicing work: in these cases, the machine must be kept under control by means of chocks or similar.

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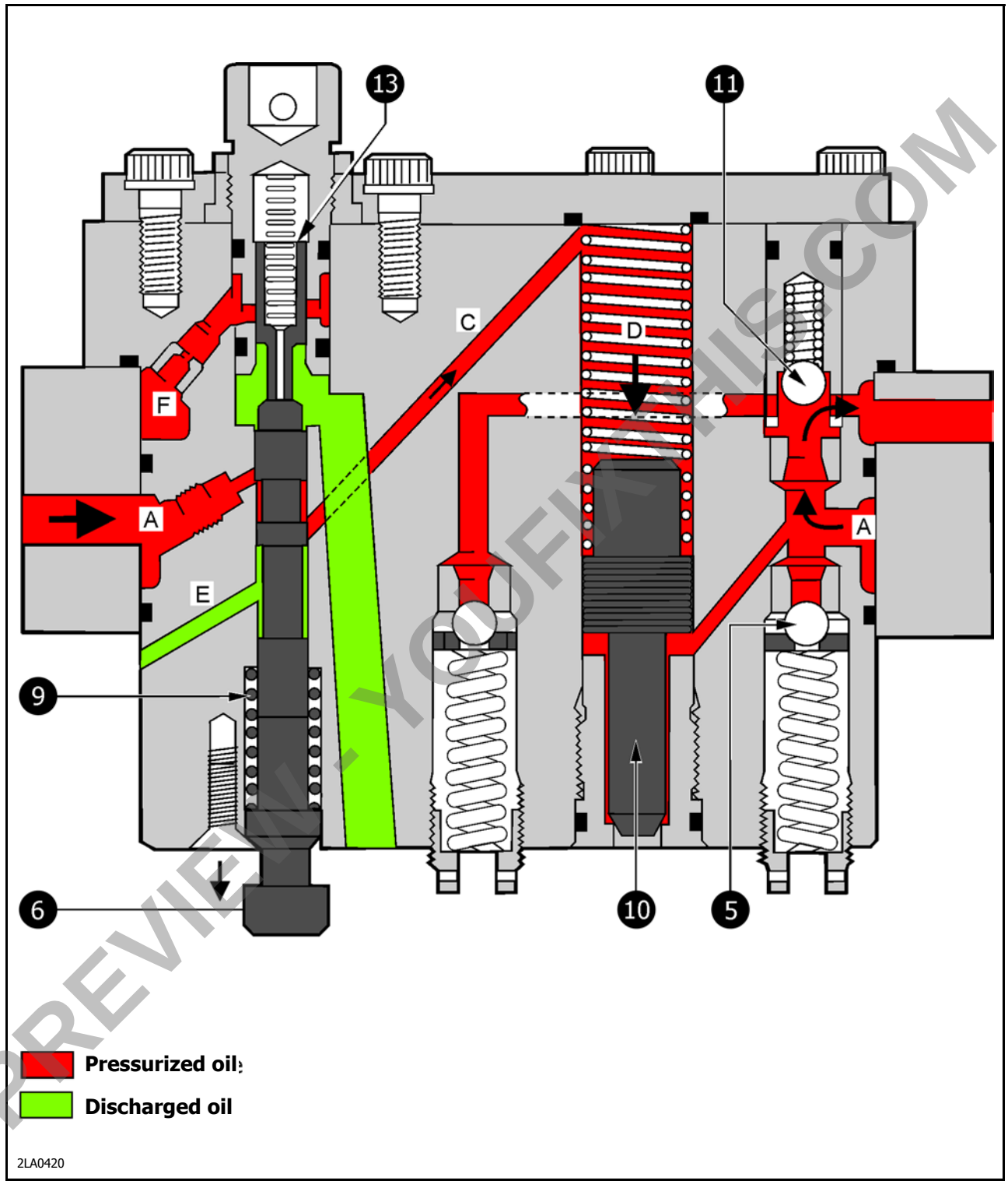
STARTING AND RECHARGING DIAGRAM – Diagram A



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In figure 14, different colours are used to show the oil flows in the different operating conditions, in the lifting phase.

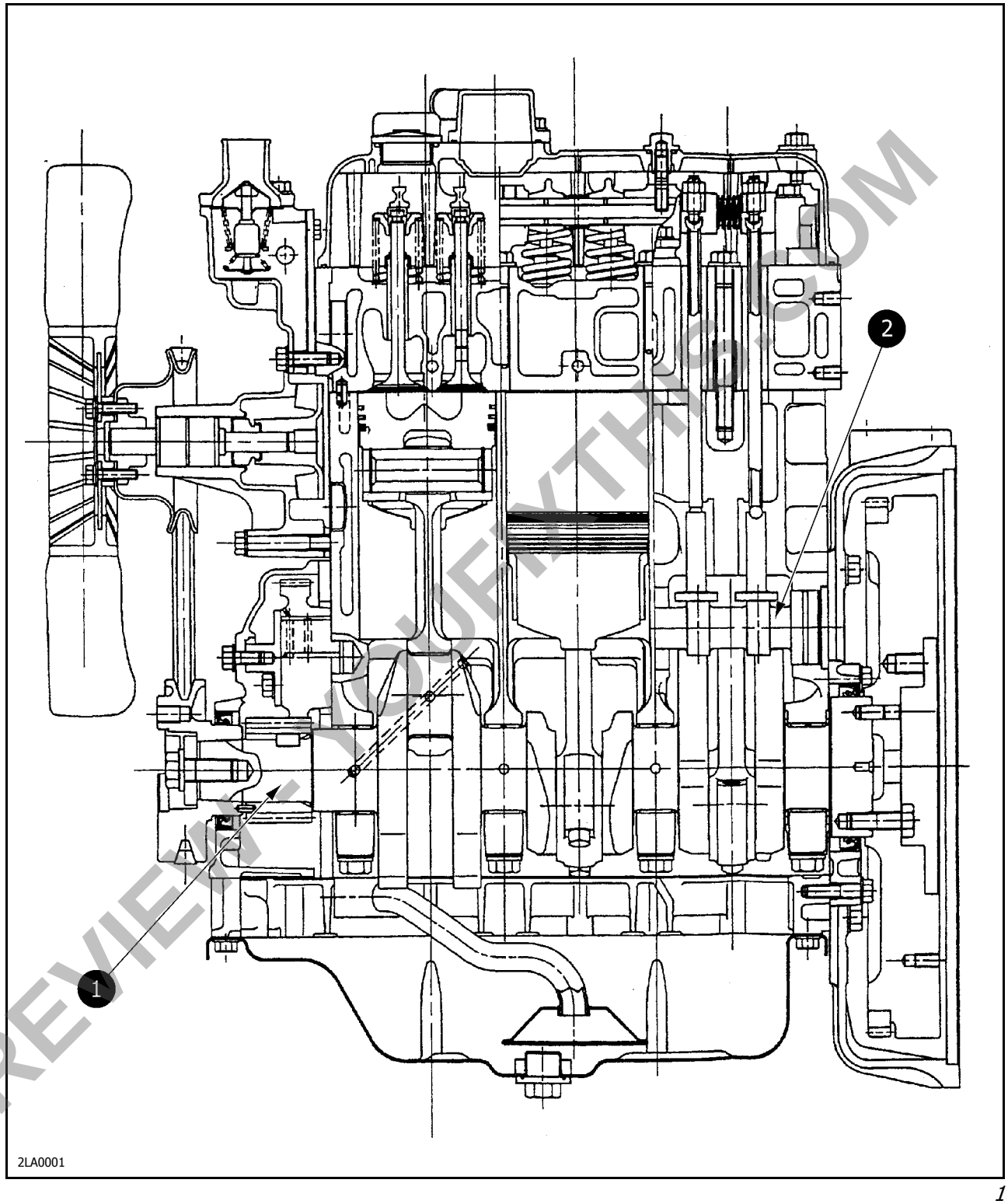


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SECTIONS



1

Longitudinal section of engine (mod. GX40)

1. Drive shaft
2. Camshaft

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DRIVING TORQUES

PARTS TO TORQUE	Thread	Driving torque	
		Nm	kgm
Cylinder head fixing bolts (1)	M10 x 1.25	85.3 – 91.2	8.7 – 9.3
Connecting rod cap fixing bolts (1)	M9 x 1.0	44.1 – 54.0	4.5 – 5.5
Flywheel fixing bolts (1)	M10 x 1.25	83.4 – 88.3	8.5 – 9.0
Main bearing cap fixing bolts (1)	M12 x 1.5	96.1 – 100.1	9.8 – 10.2
Drive shaft V-pulley fixing bolts (1)	M14 x 1.5	112.8 – 122.6	11.5 – 12.5
Injector nuts (2)	M6 x 1.0	6.9 – 8.8	0.7 – 0.9
Automatic lead fixing nuts (2)	M12 x 1.75	58.9 – 68.7	6.0 – 7.0
Bearing nut nut centrifugal weights of governor (2)	M12 x 1.25	44.1 – 49.1	4.5 – 5.0
Fixing nut of high pressure diesel fuel pipe sleeve (2)	M12 x 1.5	29.4 – 34.3	3.0 – 3.5
Hex bolts (7T) and nut (2) (3)	M6 x 1	9.8 – 11.8	1.0 – 1.2
	M8 x 1.25	22.6 – 28.4	2.3 – 2.9
	M10 x 1.5	44.1 – 54.0	4.5 – 5.5
	M12 x 1.75	78.5 – 98.1	8.0 – 10.0
PT plugs (2)	1/8″	9.8	1.0
	1/4″	19.6	2.0
	3/8″	29.4	3.0
	1/2″	58.9	6.0
Pipe joining bolts (2)	M8	12.8 – 16.7	1.3 – 1.7
	M12	24.5 – 34.3	2.5 – 3.5
	M14	39.2 – 49.1	4.0 – 5.0
	M16	49.1 – 54.0	5.0 – 5.5

(1) Parts spread with lubricating oil.

(2) Parts not spread with lubricating oil.

(3) a. When aluminium parts are mounted, tighten the bolts to 80% of the driving torque value given in the table.

b. 4T bolts and check nuts must be tightened to 60% of the torque value given in the table.

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ENGINE TROUBLESHOOTING

Faults	Possible causes	Remedies
The engine fails to start	**1.** Battery slightly low.	Check, recharge the battery and replace it if necessary.
	2. Connections to battery terminals corroded or slack.	Clean, inspect, tighten the nuts and, if necessary, replace any excessively corroded terminals and nuts.
	3. Circuit open.	Close the circuit.
	4. Intake/exhaust valve play incorrect.	Adjust valve play.
	5. Intake/exhaust valve seized.	Replace.
	6. Piston rings seized or broken.	Replace piston ring.
	7. Cylinder and piston rings worn.	Lap and use larger size parts.
	8. Big end pins and bearings seized.	Repair or replace.
	9. Foreign body in combustion chamber.	Demount and repair the chamber. Remove the foreign body.
	10. Intake/exhaust valve timing incorrect.	Adjust the valve play and check the timing of the intake/exhaust valves.
	11. Incorrect timing of injection pump on engine.	Correctly time the injection pump on engine.
	12. Impurities or water accumulated in the fuel pipes.	Detach the pipes, the injection pump and thoroughly clean them. If necessary, clean and dry the fuel tank.
	13. No fuel in tank	Fill tank.
	14. No fuel supplied to injection pump	Check and, if necessary, replace the fuel pump.
	15. Air in the fuel circuit.	Check the pipes, unions, fuel pump, filters and injection pump for air. Lastly, bleed the circuit.
	16. Starter motor damaged.	Repair or replace the starter motor.
	17. Thermostarter inefficient.	Check or replace the thermostarter.

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GENERAL FEATURES

GENERAL FEATURES	GX40
Engine	
- Version/Position	3TNE88 - ELAN
- Manufacturer	Yanmar
- Cycle	diesel, four-stroke
- Injection	direct
- Number of cylinders in line	3
- Cylinder liners	formed in the crankcase
- Bore (mm)	88
- Piston stroke (mm)	90
- Total swept volume. (cc.)	1642
- Firing order	1 - 3 - 2
- Compression ratio.	18:1
- Power DIN 70020 (ISO 3046/1) (HP/kW)	34/25 (37.5/27.5)
- Top rate on load (RPM)	2800
- Idling rate (RPM)	2995
- Maximum torque (Nm)	103
- Maximum torque rate (RPM)	1800
- Idling rate (RPM)	1000
- Rotation direction	Anti-clockwise (viewed from flywheel)
- Number of main bearings	4
- Recommended diesel fuel	ISO 8217 DMA, BS 2869 A1 or A2 (cetane N.: 45 min)
- Lubrication system	Forced lubrication with trochoid pump
- Capacity of lubricating oil reservoir. (litres)	4.7
- Recommended lubricating oil	See section 100
- Cooling system.	Coolant/Radiator
- Capacity of cooling fluid reservoir. (litres)	2.0
- Cooling fan	Fan with 6 blades, ∅ 335 mm
- Regulator.	Centrifugal mechanical type (all speeds)
- Ignition system	Electrical

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ENGINE SPLITTING AND REMOUNTING

Splitting

WARNING

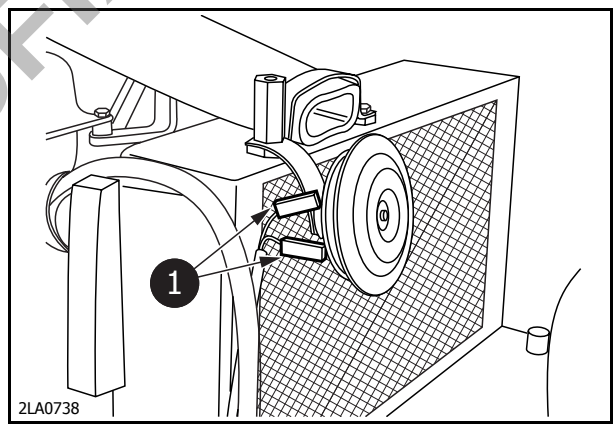
Lift and handle all heavy parts with lifting equipment of a suitable capacity.
Make sure that the units or parts are supported by appropriate harness and hooks.
Make sure that there are no bystanders near the load being lifted.

WARNING

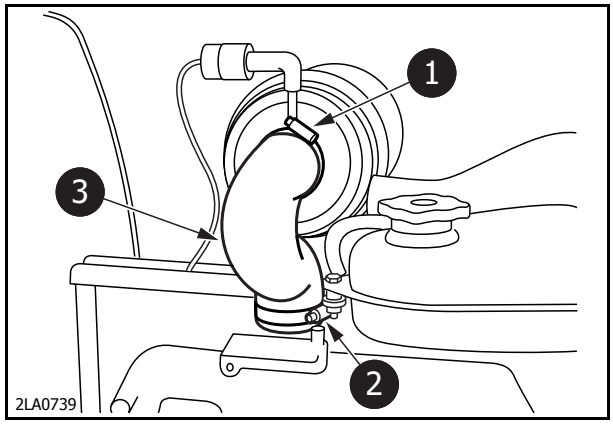
Handle all parts with the utmost care. Do not put your hands or fingers between one part and the next. Wear approved safety garments such as goggles, gloves and safety footwear.

Proceed in the following way:

1. Split the clutch assembly (see section 300).
2. Disconnect the electrical connection (1) from the horn.
3. Unscrew the clamps (1, 2) and remove the intake sleeve (3).



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Faults	Possible causes	Remedies
Excessive vibration in engine.	**1.** Intake/exhaust valves jammed.	Replace.
	2. Spring rings jammed or damaged.	Replace.
	3. Big end pin and bearings jammed.	Repair or replace.
	4. Big end bearings and main bearings worn.	Measure or replace.
	5. Big end fixing bolts slackened.	Tighten to the prescribed torque value.
	6. Injection pump regulator damaged.	Repair or replace.
	7. Excessive injection pump lead.	Check and adjust.
Excessive fuel consumption.	**1.** Loss of compression from valve housing.	Lap valve housing.
	2. Radiator cools too much.	Thermostat defective.
	3. Excessive injection pump delay	Check and adjust.
Excessive consumption of lubricating oil.	**1.** Piston rings seized or broken.	Replace.
	2. Cylinder and piston rings worn.	Lap and use larger size parts.
	3. Incorrect alignment of piston ring gap.	Correct gap alignment.
	4. Inverted assembly of piston rings	Mount correctly.
	5. Impurities in combustion chamber.	Demount and remove the impurities.
	6. Intake/exhaust valve guide worn.	Measure or replace.
	7. Lubricating oil with wrong specifications.	Use suitable lubricating oil.
	8. Leaks from lubricating oil pipes.	Repair/replace.
Water in the lubricating oil.	**1.** Damaged cylinder head housing seal.	Replace.
	2. Cylinder liners cracked	Replace.
Fuel in the lubricating oil.	**1.** Intake/exhaust valves seized.	Replace.
	2. Piston rings seized or broken.	Replace.
	3. Cylinder and piston rings worn.	Lap and use larger size parts.
Lubricating oil pressure too low.	**1.** Big end bearings and main bearings worn.	Measure/replace.
	2. Big end bolts slackened.	Tighten bolts.
	3. Cylinder liner cracked	Replace.

(continued)

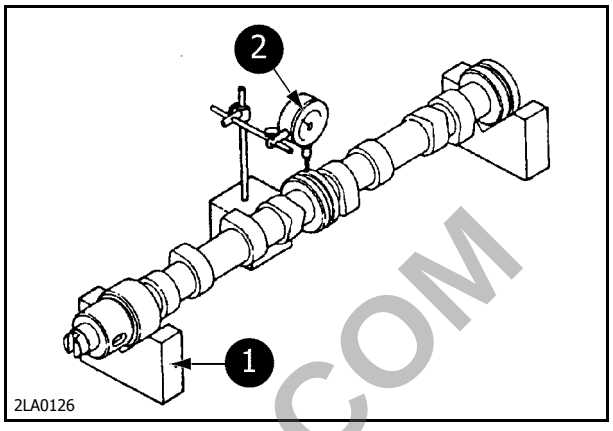
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Camshaft incurvation measurement

1. Support the camshaft with V-blocks (1).
2. Using a comparator (2), measure the eccentricity of the main journal in the center of the camshaft, by allowing this shaft to turn.
3. Consider 50% of the measured eccentricity as incurvation value.

Compare the obtained measuring results with the standard values given in the table on page 15.

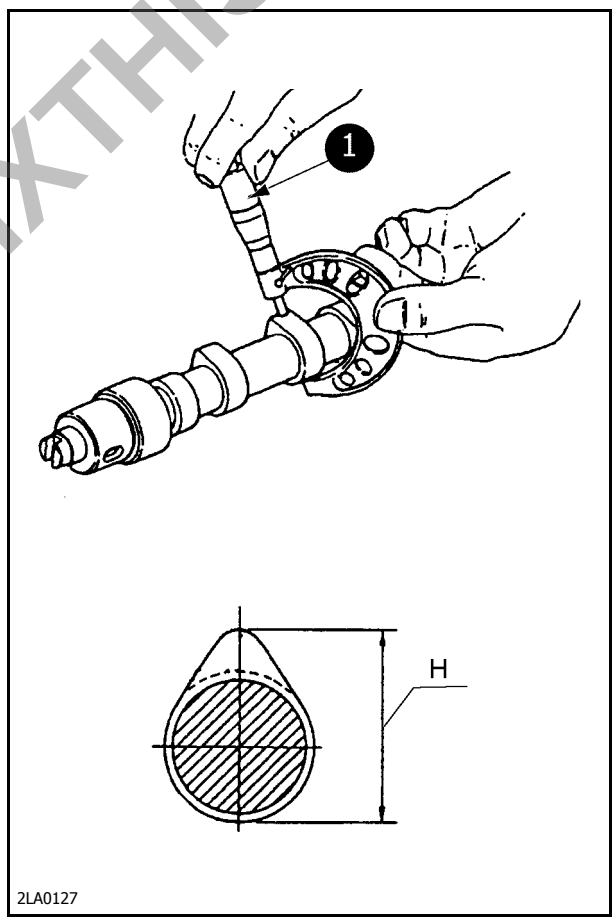


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Intake/exhaust cam height measurement

1. Make the measurements by positioning the micrometer (1) as shown in the figure.
2. Compare the obtained measuring results with the standard values given in the following table.

		GX40 GX45 GX50	
		Value nominal (mm)	Value at limit of wear (mm)
Cam height (H)	Intake cam	38.635 - 38.765	38.40
	Exhaust cam	38.635 - 38.765	38.40



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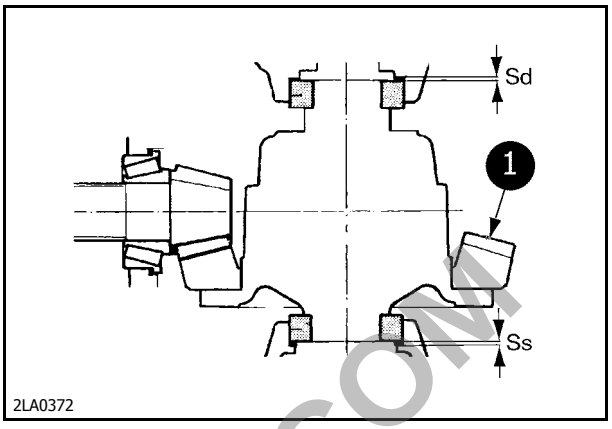
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17. The left (S_s) and right (S_d) adjuster shims to insert behind the taper bearing of the left and right ring bevel gear supports will be given by:

$$S_d = S_t - Z$$

$$S_s = S_t - S_d$$

Round off to the lower figure within 0.5 mm.



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18. Mount the ring gear supports with the calculated adjuster shims and, as previously described, check the ring gear-pinion rolling torque and the play between the flanks of the ring bevel gear teeth.

Example

S_t = 2.5 mm.
Theoretic dimension of the test shim.

L = 0.2 mm.
Dimension measured.

S_t = 2.5 – 0.2 = 2.3 mm.
Total adjuster shim.
Round off to the lower figure.

G = 0.38 mm.
Dimension measured.
0.18 mm
= Theoretic dimension.

Z = 0.38 – 0.18 = 0.2 mm.
Ring gear float.

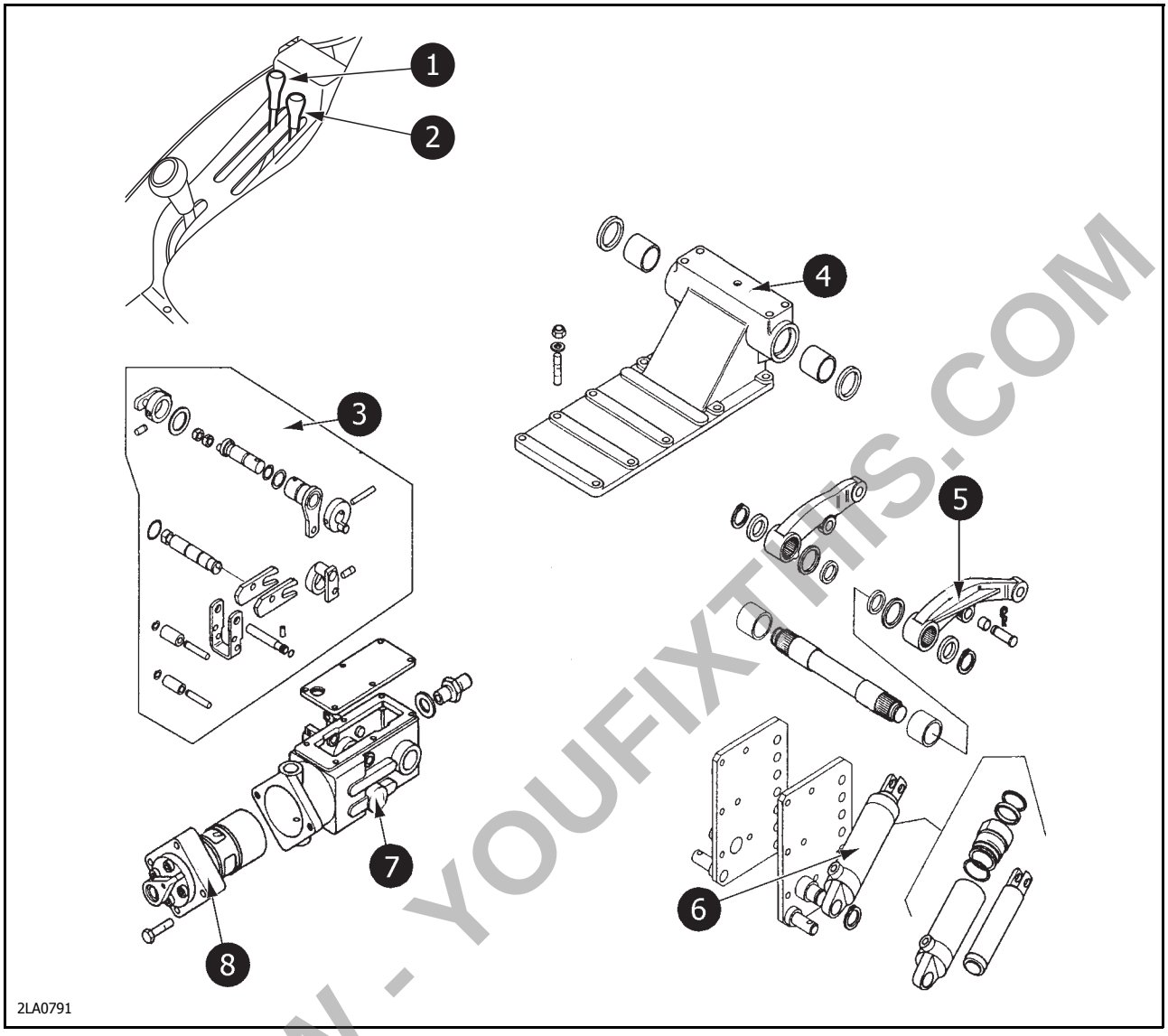
S_d = 2.3 – 0.2 = 2.1 mm.
Adjuster shim on the right ring bevel gear support.

S_s = 2.3 – 2.1 = 0.2 mm.
Adjuster shim on the left ring bevel gear support.

Round off to the lower figure within 0.5 mm.

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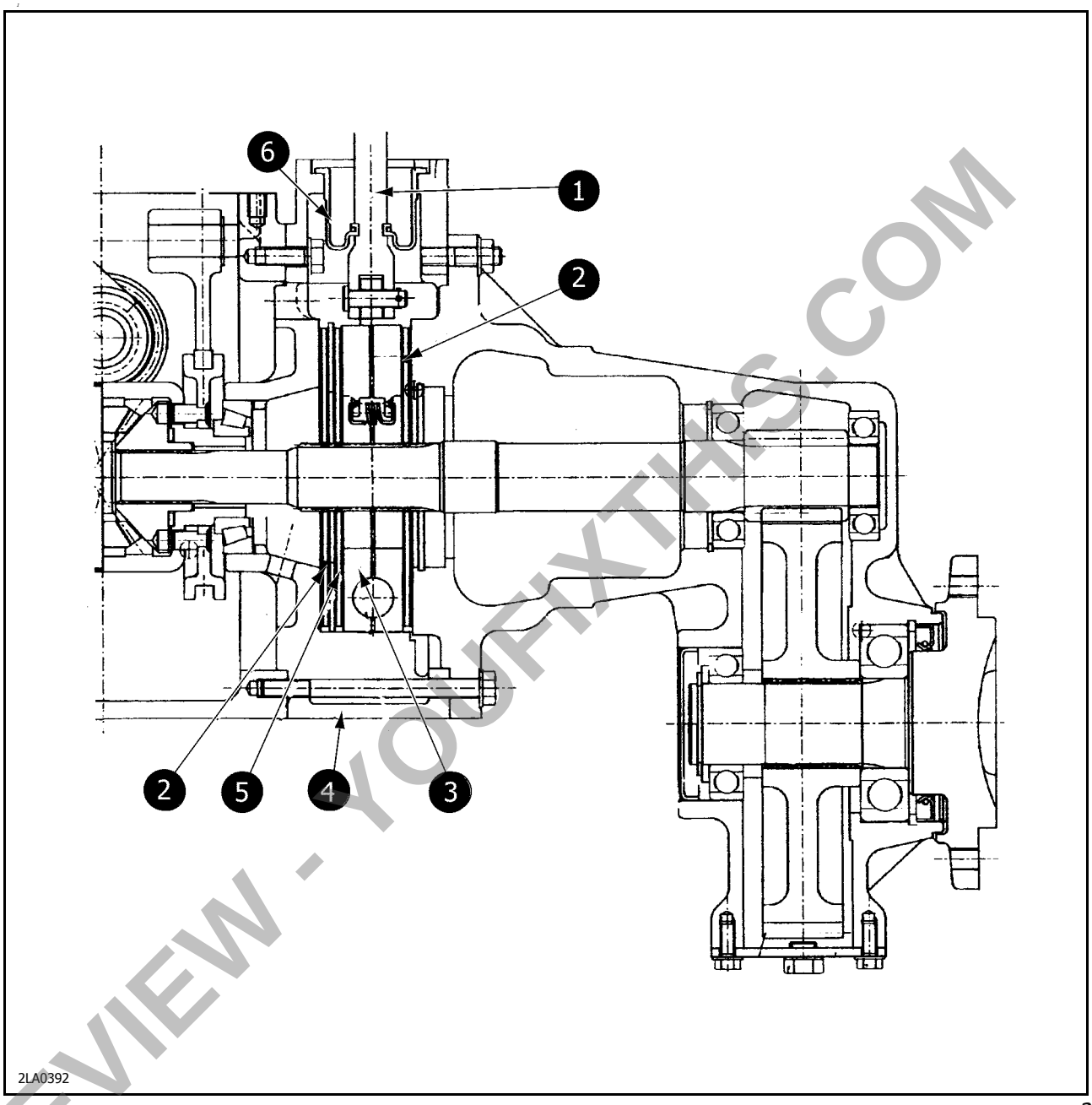
Exploded view of the main components

1. Draft control lever
2. Position control lever
3. Control lever unit
4. Power lift unit
5. Link
6. Cylinder
7. Casing of the control lever unit
8. Hydraulic valve system

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SECTIONS



2

Section drawing of main and parking brake systems

1. Rod.
2. Friction disc.
3. Pressure plates.
4. Rear transmission housing.
5. Steel disc.
6. Rubber guard.

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Maintenance

DANGER

Batteries contain sulphuric acid. When they are charged they generate a highly explosive mixture of hydrogen and oxygen gas.

- Never use tools that produce flames or sparks to check the level of the battery acid.
- Never remove the caps from the battery without protecting your eyes and hands.

Take the following steps during battery maintenance:

1. Keep the electrolyte at the recommended level, i.e. 17 mm above the plates. Failing this, the acid will reach a high concentration that could damage the separators and impair the efficiency of the plates.
2. Use only distilled or demineralized water. Do not overfill and do not use tap water, rain water or water from other sources to top up the battery acid.
3. Always keep the battery at least 75% charged, otherwise the plates will become sulphated.This will lead to a drop in efficiency with possible damage from freezing at low temperatures.
4. Do not overcharge the battery as this can lead to excessive internal heat which damages the plate grid and leaks to water leaks.
5. During rapid charges, make sure that the temperature of the battery does not exceed 50°C.
6. Do not add sulphuric acid to an element unless the battery acid has been lost through leaking. Before filling, make sure that the specific gravity of the solution is correct. Slow charging is the only method to use if the battery is to be fully charged. A high current battery charger can be used to charge the battery quickly, but this latter must subsequently be slowly charged in order to ensure full charging.

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