Service Manual

FASTRAC
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PUBLISHED BY THE
TECHNICAL PUBLICATIONS DEPARTMENT
OF JCB SERVICE; ©
ROCESTER,STAFFORDSHIRE, ST14 5LS
ENGLAND
Tel. ROCESTER (01889) 590312
PRINTED IN ENGLAND

Publication No. 9803/8000

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All construction and agricultural equipment can be hazardous. When a JCB Fastrac is correctly operated and properly maintained, it is a safe machine to work with. But when it is carelessly operated or poorly maintained it can become a danger to you (the operator) and others.

Do not work with the machine until you are sure that you can control it.

Do not start any job until you are sure that you and those around you will be safe.

If you are unsure of anything, about the machine or the job, ask someone who knows. Do not assume anything.

Remember

BE CAREFUL
BE ALERT
BE SAFE

GEN-1-6

As well as the warnings in the following pages, specific warnings are given throughout the book. This section is designed to give a safety code for use of the machine generally and for operation and maintenance practices.

Note: This section includes a certain amount of operating safety information. But remember that whenever you drive the machine or operate its controls you are in effect a machine operator. Therefore you should read and understand the information given in the Operator Handbook before driving the machine or operating its controls.

General Safety

⚠ WARNING

Lifting Equipment

You can be injured if you use faulty lifting equipment. Make sure that lifting equipment is in good condition. Make sure that lifting tackle complies with all local regulations and is suitable for the job. Make sure that lifting equipment is strong enough for the job.

INT-1-3-7

⚠ WARNING

Clothing

You can be injured if you do not wear the proper clothing. Loose clothing can get caught in the machinery. Wear protective clothing to suit the job. Examples of protective clothing are: a hard hat, safety shoes, safety glasses, a well fitting overall, ear-protectors and industrial gloves. Keep cuffs fastened. Do not wear a necktie or scarf. Keep long hair restrained.

INT-1-3-6

⚠ WARNING

Alcohol and Drugs

* It is extremely dangerous to operate machinery when under the influence of alcohol or drugs. Do not consume alcoholic drinks or take drugs before or whilst operating the machine or attachments. Be aware of medicines which can cause drowsiness.

INT-1-3-9

⚠ WARNING

Care and Alertness

All the time you are working with or on the machine, take care and stay alert. Always be careful. Always be alert for hazards.

INT-1-3-5

⚠ WARNING

Raised Equipment

Raised equipment can fall and injure you. Do not walk or work under raised equipment unless safely supported.

13-1-1-6

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* All Models Except Fastrac 185 (not North American Machines)

Note: New engines DO NOT require a running-in period. The engine/machine should be used in a normal work cycle immediately. DO NOT use a special running-in oil but use the oil recommended below from new.

ITEM	CAPACITY Litres (UK Gal)	FLUID/LUBRICANT		INTERNATIONAL SPECIFICATION
Engine Oil	16.5 (3.6)	**JCB Super Multigrade 15W/40** -10 °C to 50 °C (14 °F to 122 °F) **JCB Super Universal Agricultural** -15 °C to 30 °C (5 °F to 86 °F)	SEE **Note** ABOVE	SAE15W/40, API CF4/SG SAE10W/30 API CE/SF
Coolant (to 636000) **(from 636001)**	28 (6.2) 34 (7.5)	**JCB Four Seasons Antifreeze & Summer Coolant/water** (See **Coolant Mixtures**)		ASTM D3306, BS6580
PTO and Range Boxes (to 636000)	20 (4.49)	**JCB Super Universal Agricultural**		API-GL-4, MIL-L-2105
Speed Box (to 636000)	10 (2.2)	**JCB HD90 Gear Oil**		API-GL-5, MIL-L-2105C
PTO/Speed/Range Box (combined from 636001)	38 (8.4)	**JCB Super Universal Agricultural**		API-GL-4, MIL-L-2105
Front Axle **Housing** **Hubs (x2)**	 11.5 (2.6) 1.5 (0.34)	**JCB HD90 Gear Oil**		API-GL-5, MIL-L-2105C
Rear Axle	21 (4.6)	**JCB HD90 Gear Oil**		API-GL-5, MIL-L-2105C
Brake System **Front** **Rear**	 0.75 (0.17) 0.75 (0.17)	**JCB Universal Brake Fluid** **⚠ CAUTION** **Do not use ordinary hydraulic fluid in the brake or clutch systems.** 13-3-1-13		SAE J1703 DOT 4
Clutch System	0.5 (0.11)	**JCB Universal Brake Fluid**		SAE J1703 DOT 4
† Hydraulic System	75 (16.5)	**JCB Special Hydraulic Fluid HP46** (Above 38 °C, 100 °F) **JCB Special Hydraulic Fluid HP32** (Below 38 °C, 100 °F)		ISO VG46 ISO VG32
Grease Points	---	**JCB HP Grease**		Lithium complex NLGI No. 2 consistency including extreme pressure additives
Front PTO Transfer Box (optional)	3.0 (0.67)	**JCB HD90 Gear Oil**		API-GL-5, MIL-L-2105C
Air Conditioning System **- Refrigerant** **- Compressor Lubricant**	 0.9 kg (2 lb) 0.24 (0.05)	 **HFC 134c** **Polyalkalineglycol**		 CH_2 FC F_3 PAG SP20

† Note: The total hydraulic system capacity depends on the equipment being used. Watch level indicator on hydraulic tank.

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Every 10 Operating Hours or Daily whichever occurs first

Clean

1 Machine generally.

Note: If an exhaust brake is fitted, ensure dirt is removed from around the foot pedal.

Drain

2 Air system - 3 tanks.

Check (Engine Stopped)

3 Generally for damage.
4 Engine coolant level and condition.
5 Fuel system for leaks and contamination.
6 Hydraulic fluid level.
7 Hydraulic system for leaks.
8 Engine and transmission for oil leaks.
9 Gearbox oil level.
10 Engine oil level and condition.
11 Brake fluid levels.
12 Tightness of wheel nuts.
13 Windscreen washer level.
14 Tyre pressures and condition.
15 Security of front weights (optional equipment).
16 Seat belt condition and security.
17 Level of fluid in brake system antifreeze pump (when fitted).
18 Check radiator for blockage and clean if required.

Check (Engine Running)

19 Instrument readings and warning lights.
20 Operation of all electrical equipment.
21 Exhaust for excessive smoke.
22 Operation of clutch and footbrakes.
* 23 Operation of parking brake.
24 Operation of steering.
25 Operation of transmission.
26 Operation of 3-point linkage.
27 Operation of front linkage (optional equipment).

Every 50 Operating Hours or Weekly whichever occurs first

Do the Daily jobs plus:

Drain

1 Fuel filter.
2 Fuel sediment bowl.

Check (Engine Stopped)

3 Fan belt tension and condition.
4 Air conditioning compressor drive belt.
5 Front PTO transfer gearbox oil level (optional equipment).
6 Clutch fluid level.
7 Cab air filter (Clean if required).
8 Propshaft Security.

Grease

9 Rear PTO drive shaft splines and universal joints.
10 Rear PTO drive shaft bearings.
11 Front PTO drive shaft (optional equipment).
12 Front axle propshaft.
13 Rear axle propshaft.

Note: It is essential that drive shaft and propshaft joints are lubricated as specified.

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Torque Settings

Use only where no torque setting is specified in the text. Values are for dry threads and may be within three per cent of the figures stated. For lubricated threads the values should be REDUCED by one third.

Note: All bolts used on JCB machines are high tensile and must not be replaced by bolts of a lesser tensile specification.

Metric Grade 8.8 Bolts

* Dia.	Bolt size (mm)	Hexagon (A/F) mm	Torque Settings Nm	kgf m	lbf ft
M5	(5)	8	7	0.7	5
M6	(6)	10	12	1.2	9
M8	(8)	13	28	3.0	21
M10	(10)	17	56	5.7	42
M12	(12)	19	98	10	72
M16	(16)	24	244	25	180
M18	(18)	27	350	36	258
M20	(20)	30	476	48	352
M24	(24)	36	822	84	607
M30	(30)	46	1633	166	1205
M36	(36)	55	2854	291	2105

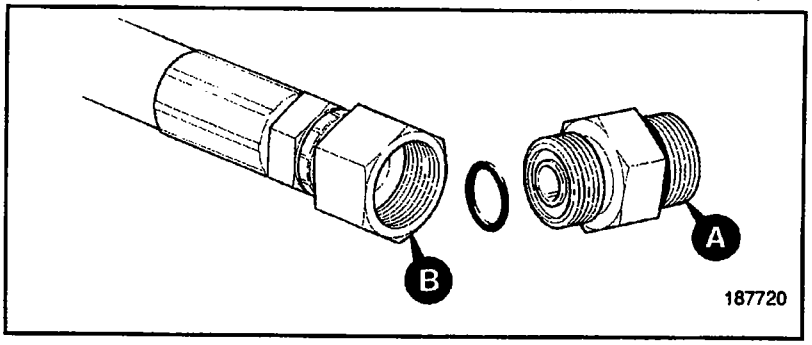
Metric - All Internal Hexagon Headed Cap Screws

Diameter mm	Torque Nm	kgf m	lbf ft
M3	2	0.2	1.5
M4	6	0.6	4.5
M5	11	1.1	8
M6	19	1.9	14
M8	46	4.7	34
M10	91	9.3	67
M12	159	16.2	117
M16	395	40	292
M18	550	56	406
M20	770	79	568
M24	1332	136	983

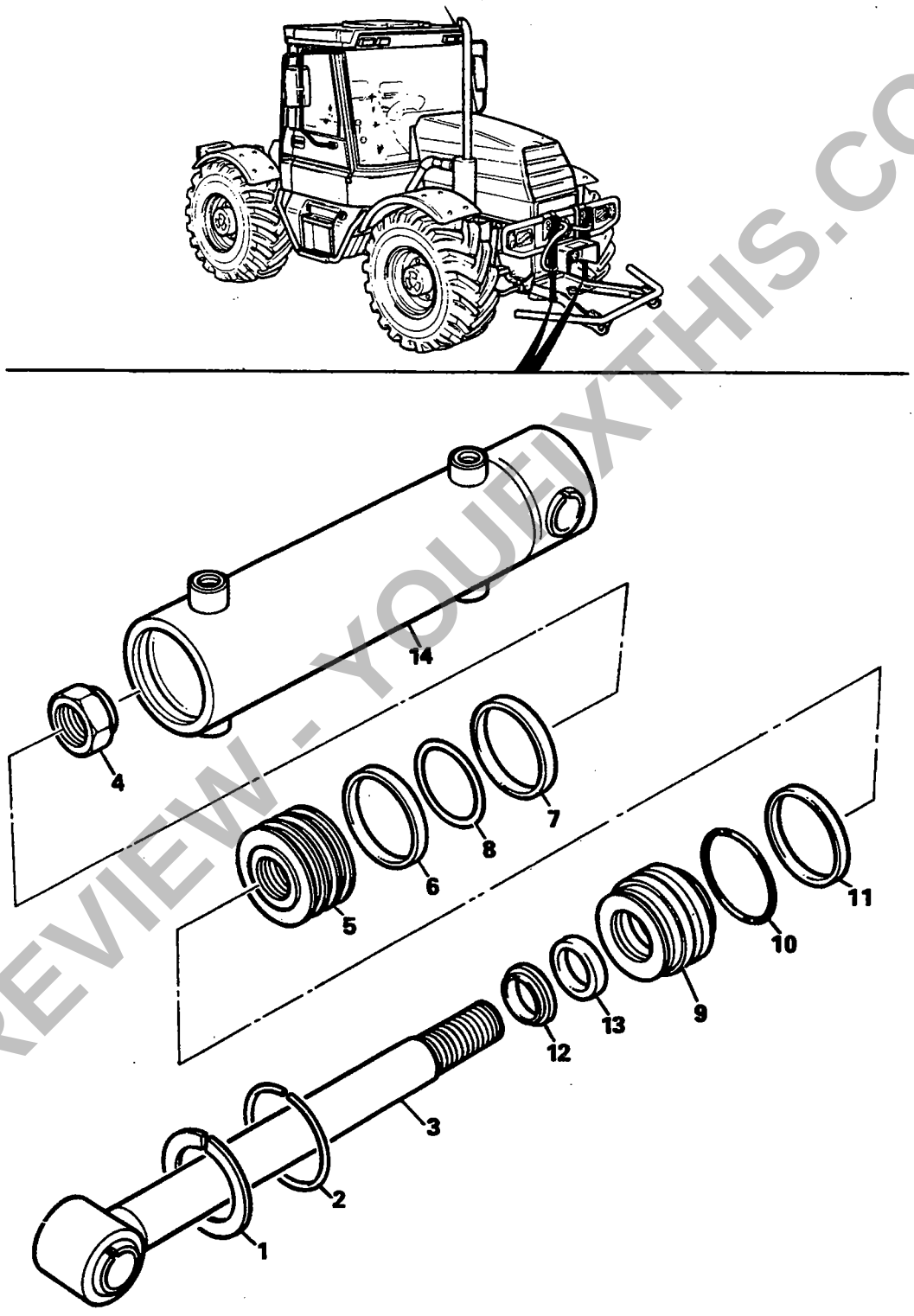
Hose and Pipe Connections

* All the hydraulic fittings on the Fastrac to machine number 636000 use the 'O' ring face seal system, with the 'O' ring located between the hose or pipe **B** and the adapter **A** as shown below. Adapters screwed into valve blocks etc. seal onto an 'O' ring which is compressed into a 45° seat machined in the face of the tapped port. Later machines have BSP hose connections without 'O' rings. Adapters are then sealed into components by means of bonded washers. See next page for torque settings.

* **Note:** Adapters have a UNF thread for the ORFS hose connection **B** but the thread **A** on the opposite end of the adapter may be either UNF or metric. Measure the thread diameter carefully before choosing the relevant torque setting table.



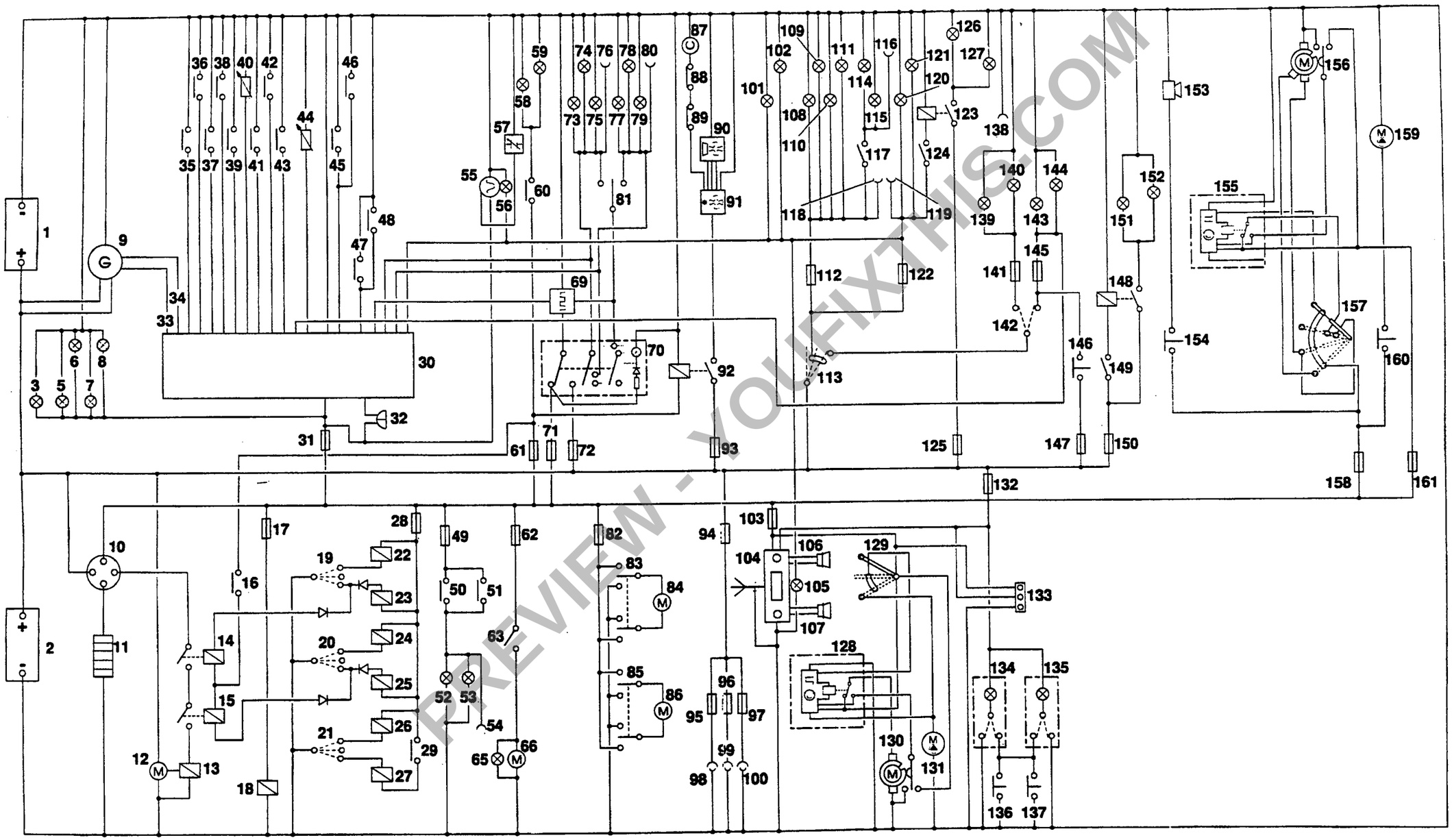
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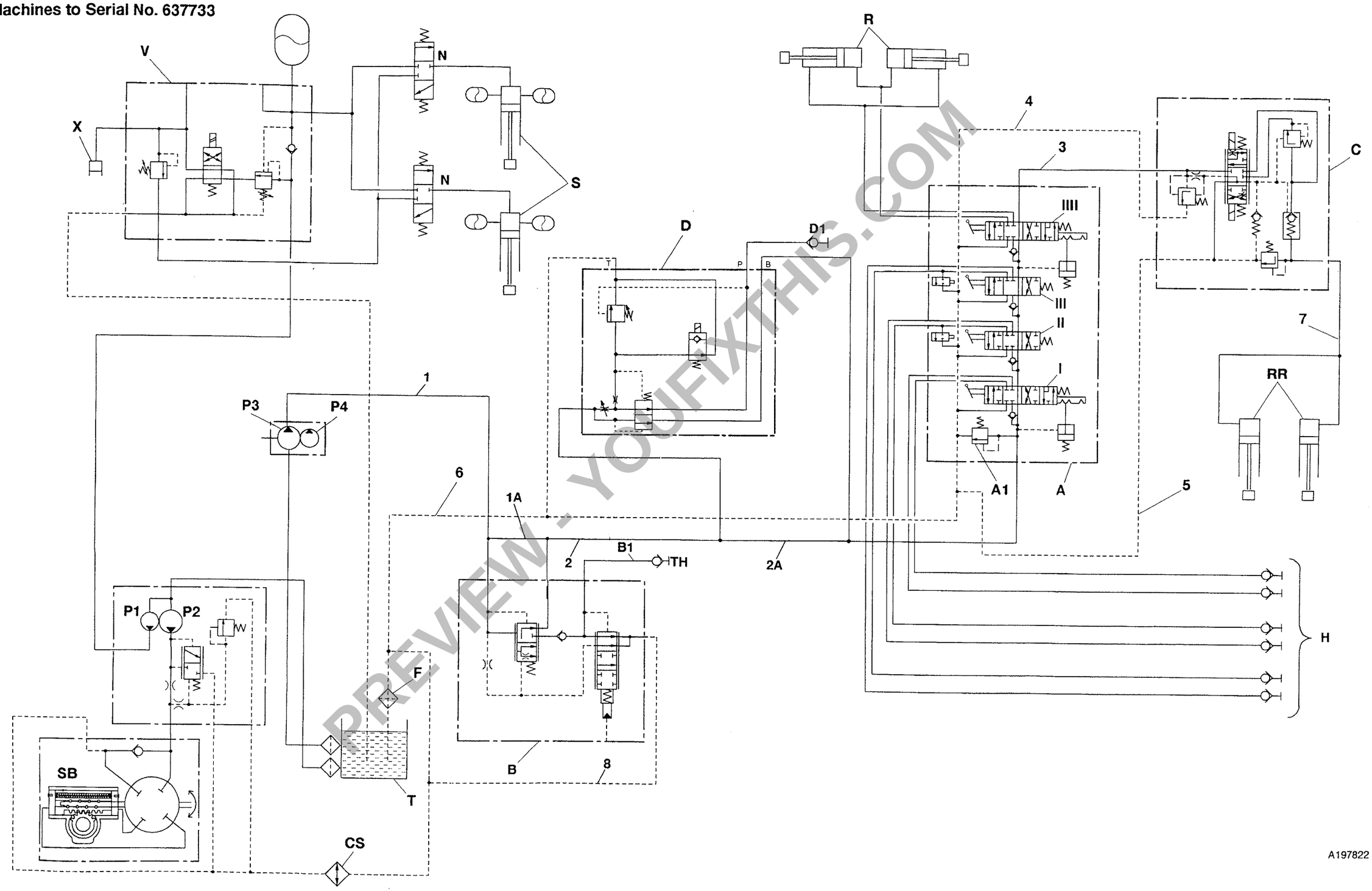


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Machines to Serial No. 637733



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Explanation of Error Codes ("E...")

If error messages are displayed by the Test Box, the faults must be eliminated and the result checked by repeating the test procedure.

All reference to terminals relate to the 25-pin connector on the wiring harness or the test box.

A fault in the extension lead is also a possible cause of an error message. This can be checked by connecting the test box directly to the wiring harness. If error message does not appear when the test step is repeated, the fault must be in the extension lead.

If message "Insert short-circuit connector" is displayed, plug the relevant short-circuit connector into wiring harness instead of connector of component to be tested. If error message "Resistance too low" appears when the test is repeated, then the wiring harness is in order; if "Resistance too high" appears, the wiring harness is defective.

E001 - Battery Voltage
Battery voltage at input terminals too low.
- Check battery
- Check connecting cables
- Press "**GO / TEST**" switch to **"GO"** to repeat test.

E002 - Battery Voltage
Battery voltage at input terminals too high.
- Check battery
- Press "**GO / TEST**" switch to **"GO"** to repeat test.

ERROR CODES E003 TO E039

These error messages may occur during test step "d003" ("Measuring Resistance"). If a fault cannot be eliminated immediately, press "**GO / TEST**" switch to **"TEST"** to signal to the test box that the error has been noted by operator and will be eliminated later. If, in the following function tests, the test box indicates to the operator that the corresponding test cannot be performed, as an error indicated during the resistance test has not yet been eliminated, e.g. loose connectors or wrong position of control elements, the test step can be repeated by pressing "**GO/TEST**" switch to **"GO"**.

After an error message, press "**GO/TEST**" switch to either:
"TEST" - If error has been noted but not yet eliminated, continue test procedure.
"GO" - If error has been eliminated, repeat test step (repeat test).

E003 -"Lower" Solenoid
Resistance at terminal 2 too low.
Short-circuit in solenoid or wiring harness to earth.
- Pull off connector from "LOWER" solenoid
- Repeat test
If E004: "Lower" solenoid defective.
If E003: Check wiring harness.

E004 - "Lower" Solenoid
Resistance at terminal 2 too high.
Open circuit.
- Reconnect connector on "LOWER" solenoid
- Repeat test
If E004: Pull off connector from "LOWER" solenoid; connect 2-pin short-circuit connector supplied in test kit.
- Repeat test.
If E004: Wiring harness defective.
If E003: "Lower" solenoid defective.

E005 - "Raise"Solenoid
Resistance at terminal 3 too low.
Short-circuit in solenoid or wiring harness to earth.
- Pull off connector from "RAISE" solenoid
- Repeat test
If E006: "Raise" solenoid defective.
If E005: Check wiring harness.

E006 - "Raise" Solenoid
Resistance at terminal 3 too high.
Open circuit.
- Reconnect connector on "RAISE" solenoid
- Repeat test.
If E006: Pull off connector from "RAISE" solenoid; connect 2-pin short-circuit connector supplied in test kit.
Repeat test.
If E006: Wiring harness defective
If E005: Raise solenoid defective.

E007 - "Lift Limit" Potentiometer
Resistance at terminal 6 too low.
Short-circuit in wiring harness or control box.
- Turn potentiometer to centre position
- Repeat test
- Pull off connector from control box
- Repeat test.
If E007: Wiring harness defective.
If E008: Fault in control box.

E008 - "Lift Limit" Potentiometer
Resistance at terminal 6 too high.
Open circuit, possibly terminal 17 not in order.

E009- "Lower" Control Lever
Resistance at terminal 7 too low.
Short-circuit in wiring harness or operation box.
- Move control lever to "LOWER" position
- Repeat test.
If E009: Pull connector from control box
- Repeat test
If E009: Wiring harness defective
If E... : Fault in operation box.

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Complete Transmission

If the problem is noise rather than loss of drive start at check 7.

CHECK			ACTION
1	Is drive being transmitted to the road wheels?	YES: NO:	Check 7. Check 2.
2	Is the clutch actuation system functioning?	YES: NO:	Check 3. Check clutch actuation.
3	Is the clutch slipping?	YES: NO:	Examine and repair clutch. Check 4.
4	Are range and speed gearboxes both in gear?	YES: NO:	Check 5. Engage gear/check gearchange linkages.
5	Is 6-speed gearbox heard to drive with the range gearbox in neutral?	YES: NO:	Check 6. Remove and examine 6-speed gearbox.
6	Does rear axle driveshaft rotate with both gearboxes in gear?	YES: NO:	Check rear axle. Check range gearbox.
7	Is fault noise rather than loss of drive?	YES: NO:	Check 8. Check 10.
8	Is transmission noisy with speed gearbox in gear and range gearbox in neutral?	YES: NO:	Examine speed gearbox for worn/damaged components. Check 9.
9	Isolate noise source to range box or rear axle or front axle by disconnecting relevant drive shafts.		Examine relevant transmission element for worn/damaged components.
10	Is transmission oil level low?	YES:	Fill to correct level.

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* Removal, Inspection and Replacement

Access to the main drive clutch is obtained by separating the engine/power take off (PTO) gearbox interface. See **Gearbox Removal** (Section F) or **Engine Removal** (Section T).

Removal

1 Mark the engine flywheel **7** and clutch cover assembly **3** to ensure their correct alignment when reassembling.

2 Progressively loosen the eight bolts **1** and, while supporting the clutch cover assembly, remove the bolts and their washers **2.**

3 Lift away the clutch cover assembly, taking care to catch the clutch driven plate **4** as it drops out. Also take care not to lose dowels **5** and **6** which should remain located in their holes in the engine flywheel. If the dowels do come out of the flywheel, or partially so, relocate them before proceeding.

Inspection

1 **Driven Plate.**

Note: If either the driven plate or the cover assembly are faulty, it is advisable for both to be replaced at the same time, together with the clutch release bearing/cylinder assembly (see **PTO/Splitter Gearbox, Input Section - Dismantling and Assembly,** item 10).

Renew the driven plate if any of the following are present:

a Excessive wear or cracking of the friction linings.

b Oil contamination of the friction linings caused by either a leaking crankshaft rear oil seal or a leaking PTO gearbox input shaft oil seal. Renew the faulty oil seal(s).

c Rim distortion, cracks, broken springs or loose rivets. Excessive wear of the splined hole.

Renew the PTO gearbox input shaft if its splines are damaged.

2 **Clutch Cover Assembly**

a Check the clutch cover assembly for deep grooves or heavy scoring to the machined friction surface. Renew the assembly if necessary.

b If there are any cracks or splits in the assembly, or if the diaphragm spring fingers are stepped due to wear from the clutch release bearing, renew the assembly.

3 **Engine Flywheel (Machines except Fastrac185)**

If the friction face of the engine flywheel is scored or worn by more than 0.5 mm (0.020 in), all cracking and scoring should be removed by machining off no more than 1.5 mm (0.060 in) from face **A.** The same amount must be machined from face **B** and from the inner ends of the dowels **C.**

Note: After machining, dimension **X** must not be less than 38.04 mm (1.498 in)

Note: It is not possible to do worthwhile machining on a 185 machine flywheel.

If the flywheel cannot be made serviceable, fit a new one as detailed in the engine service manual.

Check spigot bearing **8** for wear. If necessary fit a new bearing as follows:

a Extract the spigot bearing **8** from the engine flywheel **7.** Check that plug **9** is correctly positioned in the end of the crankshaft as shown.

b Press the new spigot bearing **8** as far as it will go into the flywheel **7.**

Note: Use only JCB parts when renewing the spigot bearing.

Replacement

1 The driven plate splines should be lubricated sparingly with JCB HP Grease. Position the plate centrally against the engine flywheel with the protruding splined boss facing the flywheel as shown on the sectioned view. While holding the driven plate in place, position the clutch cover assembly **3** over the top to align the locating marks on the cover and the flywheel.

Note: The cover assembly must locate with dowels **5** and **6.** Note that the dowel holes in the cover assembly are of different sizes and will only fit properly when located with the correct dowel. If you have difficulty locating the assembly on the dowels, turn it through 180° to achieve correct alignment.

2 Refit the eight bolts **1** and washers **2.** Hand tighten evenly all round.

3 Use a clutch alignment tool (JCB Part No. 892/00313) to align the clutch driven plate with the clutch cover assembly and spigot bearing **8** in the engine crankshaft.

4 Tighten the eight bolts **1** evenly all round, progressively increasing the torque to 78 Nm (58 lbf ft, 8 kgf m) for all machines except 185 or 48 Nm (36 lbf ft, 5 kgf m) for 185 machines.

5 Remove the clutch alignment tool.

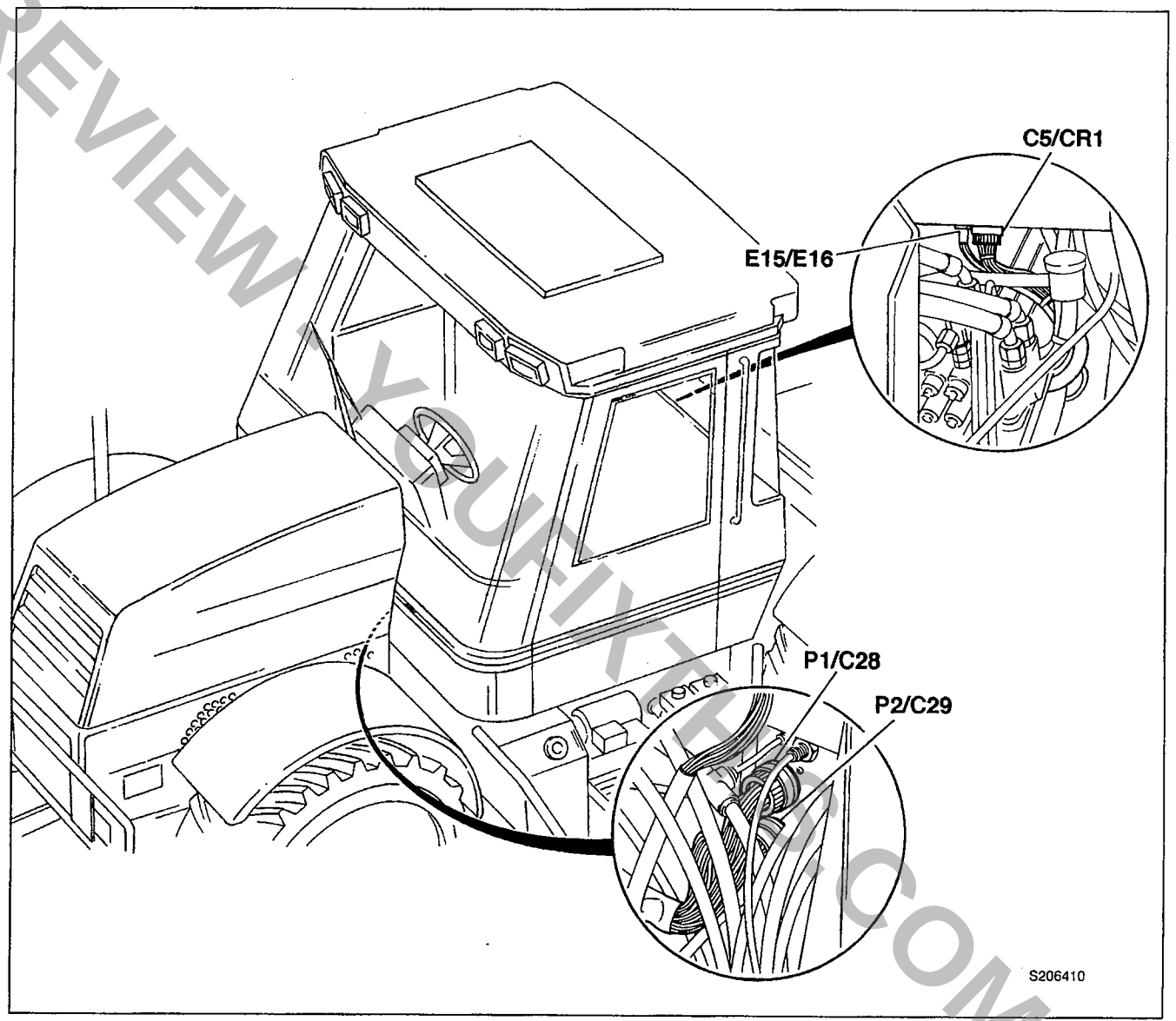
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Sectional Diagrams (UK Machines from 635330 to 636000 and All Other Machines to 636000)

Harness Connectors

Positions of bulkhead connectors which join the harnesses are as shown on the illustration.

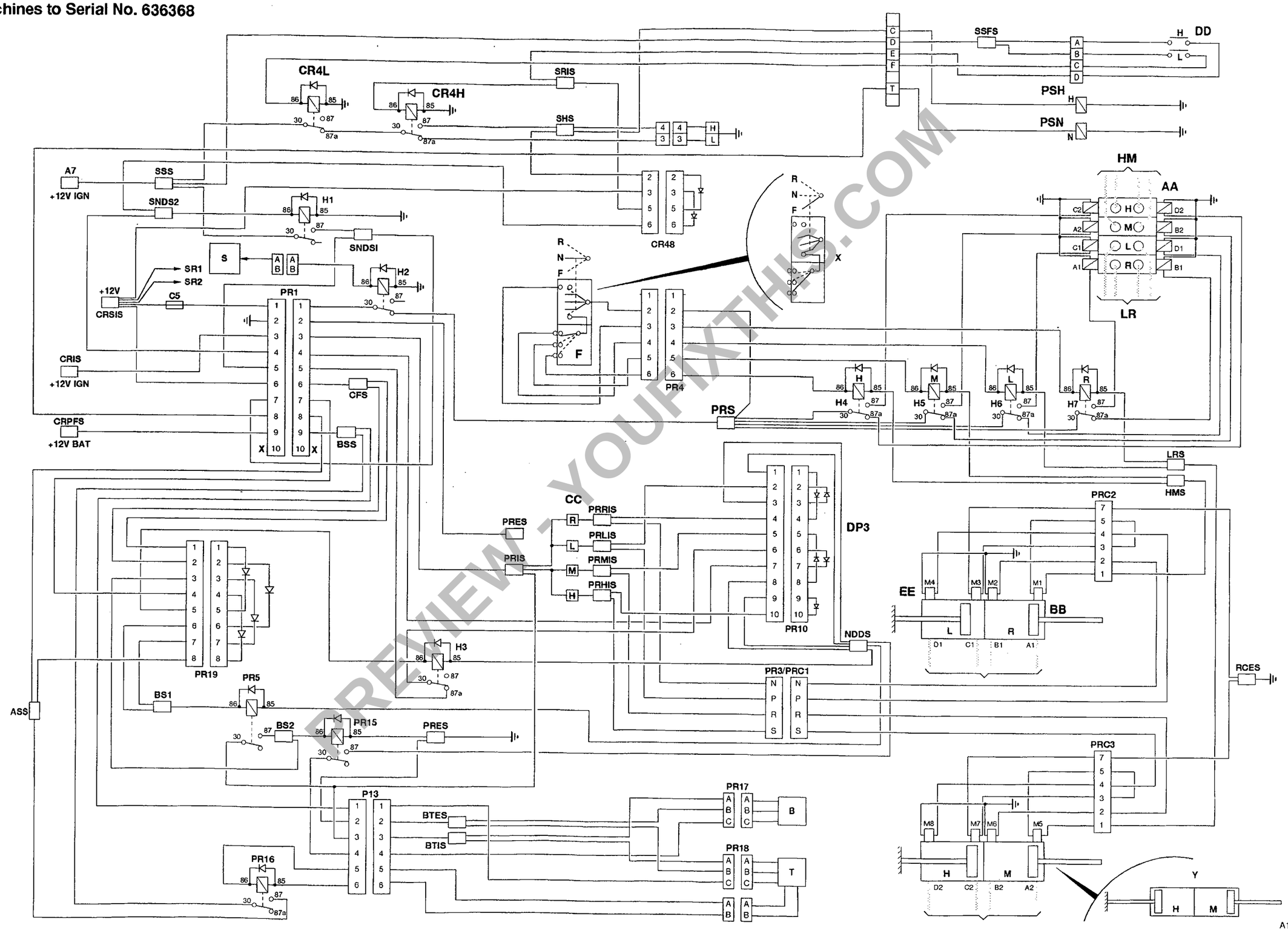
Note: Other harness connectors (as shown on the diagrams on the following pages) can generally be found close to the components which they feed.



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Machines to Serial No. 636368



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* Machines Except Fastrac 185

GENERAL

Model	1000 Series, 6 cylinder, water cooled,
Bore	100 mm (3.937 in)
Stroke	127 mm (5 in)
Swept Volume	5985 cm³ (365.2 in³)
Compression Ratio	
- Naturally aspirated	16.5 : 1
- Turbocharged	16.0 : 1
Compression Pressure	20 to 34 bar (290 to 500 lbf/in²) with maximum variation between cylinders of 3.5 bar (50 lbf/in²)
Firing Order	1, 5, 3, 6, 2, 4
Valve Clearance (hot or cold)	
- Inlet	0.20 mm (0.008 in)
- Exhaust	0.45 mm (0.018 in)
Oil Pressure (hot) at maximum speed	
- Naturally aspirated	2.1 bar (30 lbf/in²) minimum
- Turbocharged	2.8 bar (40 lbf/in²) minimum
Idling Speed	750 rev/min

FUEL SYSTEM

Engine Type	Engine No. Prefix	Pump Type	Setting Code	Max Governed speed	Max No Load Speed
1006-6	YA50347	CAV	FK59L/750/1/2860	2600 rev/min	2830 rev/min
1006-6	YA50474	CAV	FK59L/750/4/2640	2400 rev/min	2540/2640 rev/min
1006-6T	YB50375	CAV	AK77L/800/1/2860	2600 rev/min	2830 rev/min
1006-6T	YB50436	CAV	AK77L/800/1/2860	2600 rev/min	2830 rev/min
1006-6T	YB50431	CAV	2643M010AK/1/2860	2600 rev/min	2860 rev/min
1006-6T4	YB50472	CAV	RK90L/1100/3/2520	2400 rev/min	2470/2520 rev/min
1006-6T4	YB50477	CAV	RK90L/1100/3/2520	2400 rev/min	2470/2520 rev/min
1006-6T HR5	YB50473	Stanadyne	JL	2400 rev/min	2520/2620 rev/min
1006-6T HR5	YB50478	Stanadyne	JL	2400 rev/min	2520/2620 rev/min
145T	YB50400	Bosch (rotary)	2643J605 CK/1/2960	2600 rev/min	2930 rev/min
145T	YB50437	Bosch (rotary)	2643J605 CK/1/2960	2600 rev/min	2930 rev/min
160T	YB50403	Bosch (rotary)	2643J601 EK/1/2960	2600 rev/min	2930 rev/min
160T	YB50438	Bosch (rotary)	2643J601 EK/1/2960	2600 rev/min	2930 rev/min
160TW	YD50494	Bosch (in-line)	PL	2400 rev/min	2736 rev/min

For further details, see engine service manual, publication No. 9806/0100

Note: New engines **DO NOT** require a running-in period. The engine should be used in a normal work cycle immediately; glazing of the cylinder bores, resulting in excessive oil consumption, could occur if the engine is gently run-in. Under no circumstances should the engine be allowed to idle for extended periods; (e.g. warming up without load).

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Operation

There are three function buttons on the front of the instrument:

A Function Select
B Reset
C Calibration

1 Function Select

Press and hold function select button **A**. The chevron will move from one function to the next, so release the button when the chevron is in the required position. The selected function data will show for 5 seconds before the display defaults back to the forward speed display.

This button is also used in conjunction with the calibration button **C** to change program data.

2 Reset

The reset button **B** is used to zero the displays for trip distance (**Km Part** or **Part**) and trip area (**ha Part** or **Part**).

Press and hold function select button **A**, but release it when the chevron aligns with the required function. Press and hold reset button **B**; the display will flash the four-digit trip distance or trip area for 5 seconds and then reset to 0.000.

3 Calibration

The calibration button **C** enables the selection of different wheel sizes when wheels have been changed, such as changing from high speed to high traction tyres.

Press and hold function select button **A** but release it when the chevron aligns with **TYRE.** Press and hold calibration button **C** to prevent the display defaulting back to forward speed display.

With button **C** held down, press and hold function select button **A**. The tyre size indicator (a bar) on the left side of the display will move between **CAL** and **R24**, **R30** (on earlier instruments) or between **CAL** and **STD** on later instruments.

At each position of the tyre size indicator the display will show the effective rolling circumference according to the tyre size as shown in the table below. Release the buttons when the display is correct for the tyres fitted to the machine. If none of the displays is correct for the tyre size fitted, the **CAL** setting must be changed as detailed under **Field Callbration.**

Tyre Size	Size Indicator	Digital Display
445/70 R24	R24 or STD	3.910
480/70 R30	R30 or STD	4.395
495/70 R24	R24 or STD	3.910
* 495/70 R30	CAL	4.30
520/70 R30	CAL	4.61
540/65 R30	CAL	4.43
580/70 R26	CAL	4.30
600/55 B30.5	CAL	4.30

On switchable instruments, if the calibration button is depressed in any of the first four chevron positions, the right hand indicator will toggle up and down between metric and imperial modes. In either mode, the implement width and wheel circumference factors will be programmed in metres.

4 Field Calibration

A second mode of operation can be used to input an implement width or effective rolling circumference for the **CAL** wheel size.

a Set the starter switch to off. The digital display will go blank.

b Press and hold calibration button **C** and switch the starter switch to **IGN.** The chevron will align with the implement width **m.**

c Release calibration button **C.** The digital display will now show the default implement width (12.00 metres unless this has previously been changed) and the decimal point will be flashing. To input a new implement width, read from step **e** onwards.

d Alternatively to input a new effective rolling circumference for tyre sizes other than **R24**, **R30** or **STD**, press calibration button **C** to move the chevron to the **Tyre** position. The digital display will now show either the default value of 4.300 metres (or the value previously input) and the decimal point will be flashing.

***Note:** The rolling circumference cannot be set to less than 3.6 metres.*

e Press the calibration button **C** again and the chevron will move back to the implement width position **m.**

f To input either a new implement width or **CAL** effective rolling circumference, press and hold function select button **A.** The decimal point will move through its three available positions. Release button **A** when the decimal point is in the required position.

g The left digit will now be flashing. Press and hold function select button **A** to cycle the digit from 1 to 0. Release button **A** when the digit reaches the correct value.

h The second digit will now be flashing. Set this, and the third and fourth digits in the same way as the first.

Note: If a mistake is made, simply continue through each digit in turn. Each time button **A** is pressed and released, the flashing digit moves to the next position. The programming cycle can be repeated as often as required.

j When all the data has been correctly programmed, reset to the normal operation mode. This will occur automatically after one minute, or will happen if the starter switch is switched off and on again.

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Testing - Specific Gravity

The specific gravity of the electrolyte gives an idea of the state of charge of the battery. Readings should be taken using a hydrometer, when the electrolyte temperature is 15 °C (60 °F). If the battery has recently been on charge, wait approximately one hour (or slightly discharge the battery) to dissipate the surface charge before testing.

Readings should be as tabulated and should not vary between cells by more than 0.04. A greater variation indicates an internal fault on that particular cell.

If the electrolyte temperature is other than 15 °C (60 °F) a 'correction factor' must be applied to the reading obtained. Add 0.07 per 10 °C (18 °F) if the temperature is higher than 15 °C (60 °F) and subtract the same if the temperature is lower.

Specific Gravity at 15 °C (60 °F)

	Fully Charged	Half Discharged	Fully Discharged
Ambient temperature up to 27 °C (80 °F)	1.270 - 1.290	1.190 - 1.210	1.110 - 1.130
Ambient temperature above 27 °C (80 °F)	1.240 - 1.260	1.170 - 1.190	1.090 - 1.110

* Battery Testing

This test is to determine the electrical condition of the battery and to give an indication of the remaining useful 'life'.

Before testing ensure that the battery is at least 75% charged (SG of 1.23 to 1.25 for ambient temperature up to 27°C).

Ensure that the battery is completely disconnected from the vehicle.

* Connect up the battery tester (part no. 993/85700) as follows:

1 Set the CHECK/LOAD switch **A** to OFF.

2 Set rocker switch **B** to the battery voltage (12V).

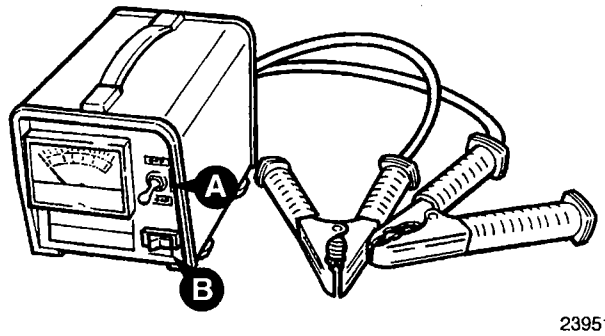
3 Connect the red flying lead to the battery positive (+) terminal and the black flying lead to the battery negative (-) terminal.

4 Set the CHECK/LOAD switch **A** to CHECK to read the battery no-load voltage which should be at least 12.4 volts.

5 Set the CHECK/LOAD switch **A** to LOAD and hold down for 5 - 10 seconds until the meter reading stabilises. The reading should be at least 9 volts.

Note: Do not hold the switch in the LOAD position for more than 10 seconds.

6 If the foregoing tests are unsatisfactory, consult Fault Diagnosis below.



239510

Fault Diagnosis

	Battery Tester Readings	Remedy
1	CHECK: 0 - 12.6 Volts LOAD: less than 6 Volts	Renew battery
2	CHECK: 6 - 12.4 Volts LOAD: less than 9 Volts and falls steadily but remains in yellow zone.	Recharge and re-test. If tests still unsatisfactory renew battery.
3	CHECK: less than 10 Volts LOAD: less than 3 Volts	Indicates battery has been over-discharged and unlikely to recover. Renew battery.
4	CHECK: more than 11 Volts LOAD: 6 - 10 Volts steady	Charge battery which will probably recover.

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Operation

The rotary section of the column selector switch selects high, low or medium range. Forward is selected by moving the lever forward, reverse is selected by moving the lever back. Neutral is selected with the lever centralised.

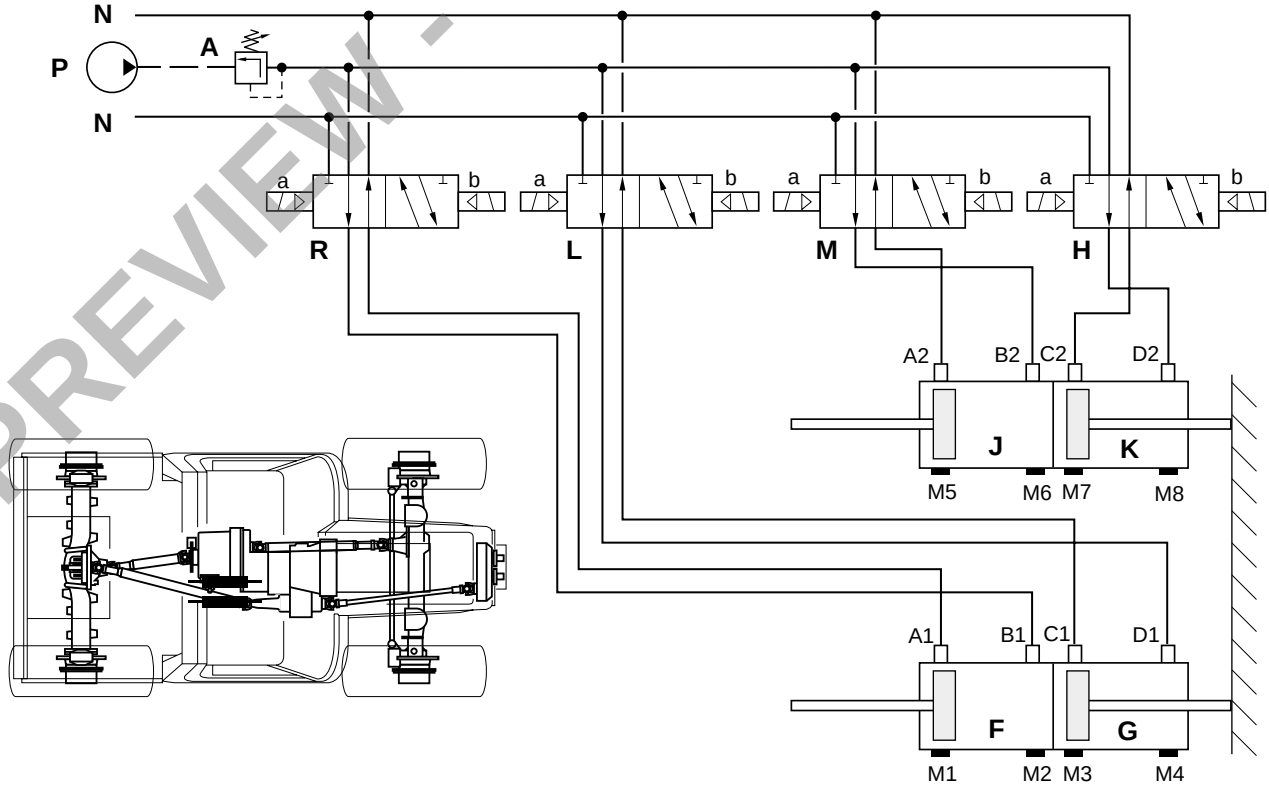
Before range or direction can be changed the speed must be below 3 km/h and only then if the clutch pedal is pressed. This arrangement allows a range or direction to be pre-selected, with the change made only when these conditions are met.

Every time the clutch pedal is pressed, drive is disconnected from the transmission at the splitter gearbox. When the range or direction is changed, drive can only be re-connected if the range/direction gears are properly engaged. If not properly engaged, a 12V signal energises the neutral dump relay, preventing the splitter gearbox clutch engaging to resume drive. See Electrical/Pneumatic Circuit Description.

The system is electrically configured so that if either the LOW or REVERSE cylinders are operated, microswitch contacts open, preventing the operation of the HIGH or MEDIUM range cylinders. Similarly, if either the HIGH or MEDIUM range cylinders are operated, the LOW and REVERSE cylinders are disabled.

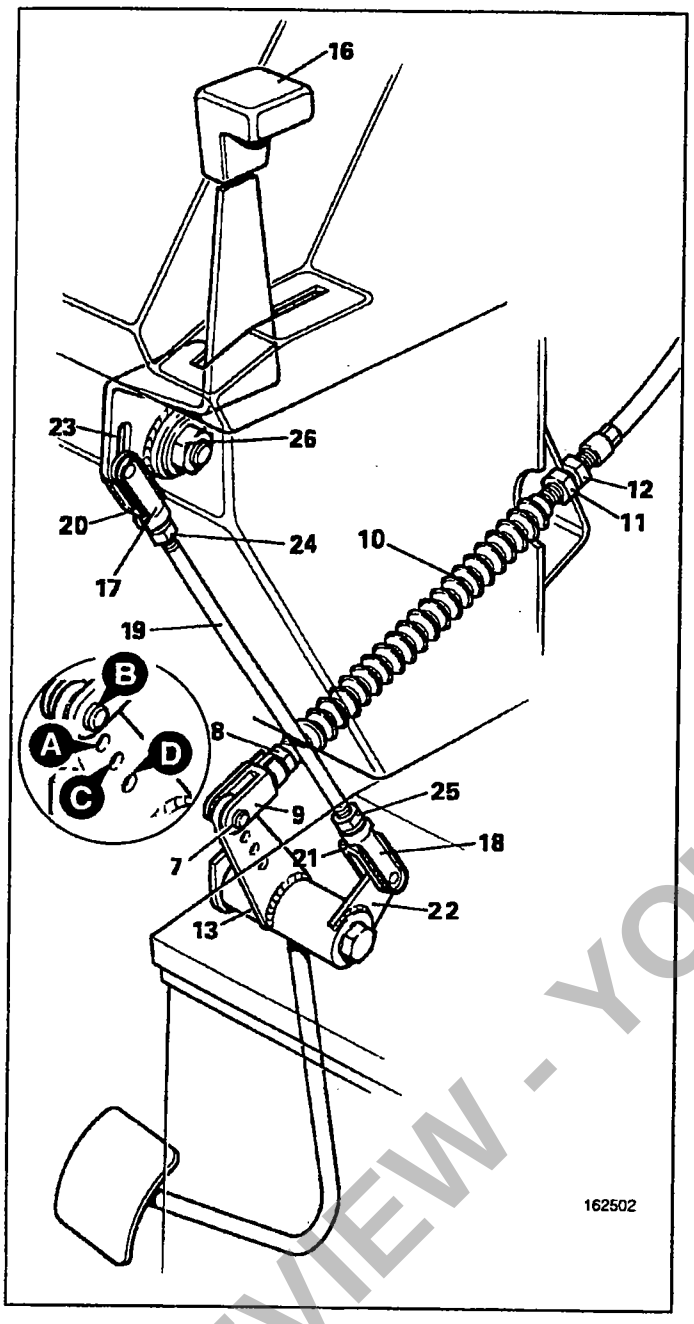
Compressed air from compressor **P** is fed to the pressure regulator **A**. When range selection has been made, relays switch the appropriate solenoid valve which then directs air to the cylinder required. The piston operates, actuating levers and selecting the required range. Air exhausts back through the solenoid valve and out to atmosphere beneath the cab. the pneumatic circuit components are as follows:

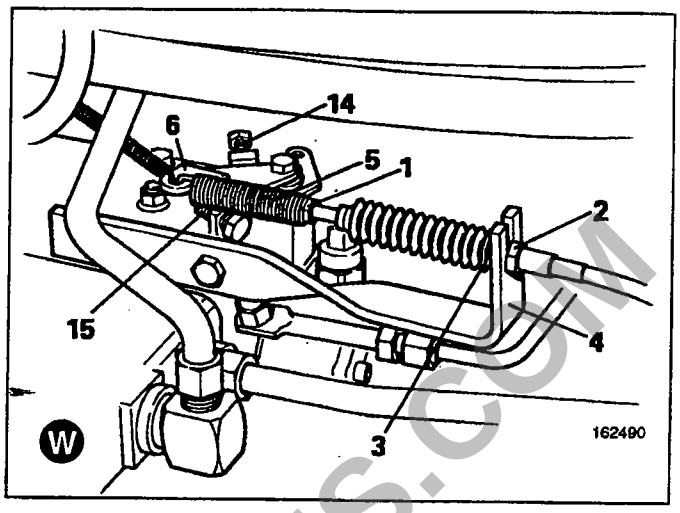
	A	Pressure regulator
*	**F**	Reverse cylinder
	G	Low range cylinder
	H	High solenoid
	J	Medium range cylinder
	K	High range cylinder
	L	Low solenoid
	M	Medium solenoid
	N	Exhaust
	P	Compressor
	R	Reverse solenoid

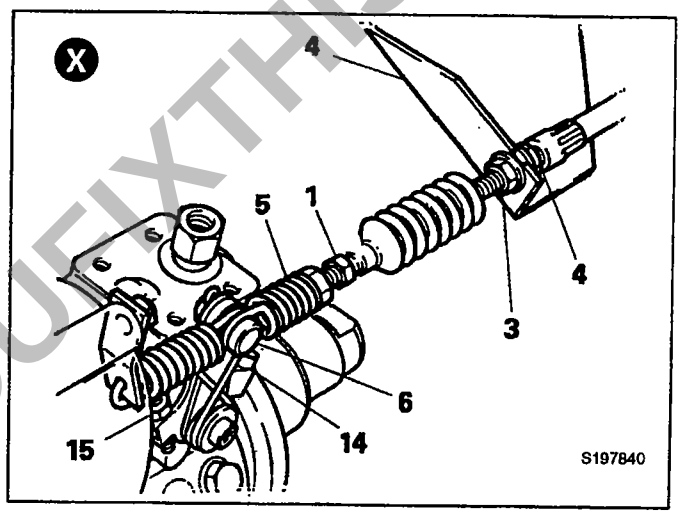


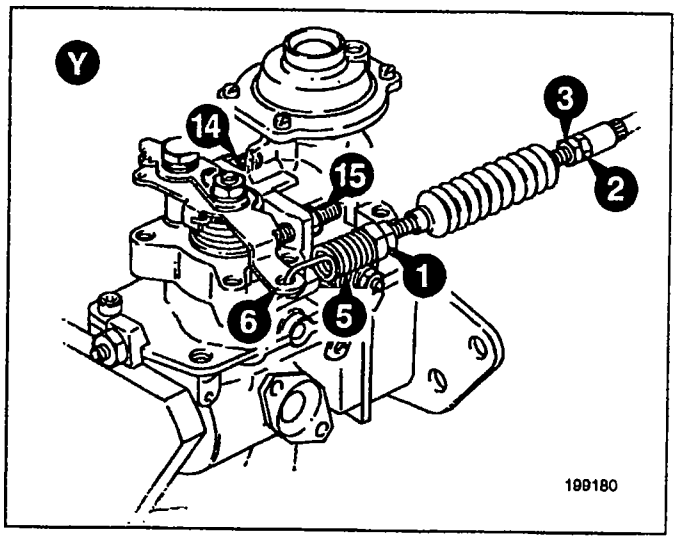
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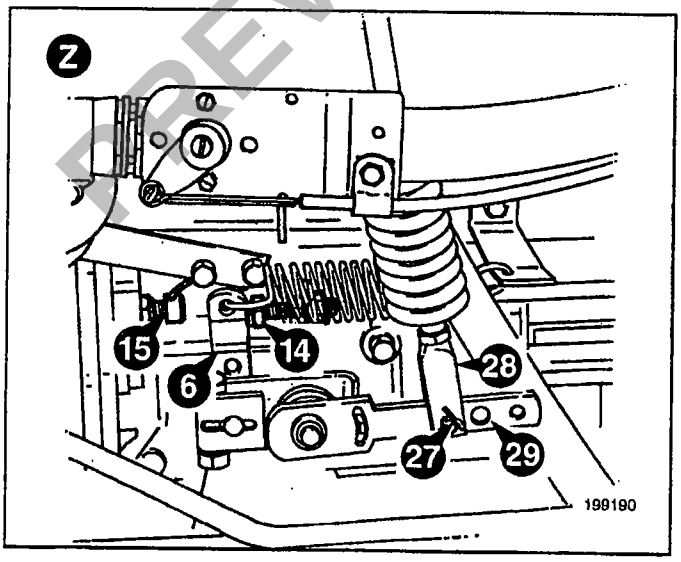
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*Transporting the Machine

The safe transit of the load is the responsibility of the transport contractor and driver. Any machine, attachments or parts that may move during transit must be adequately secured.
5-2-5-9

Note: Before transporting the machine make sure you will be obeying the rules and laws of all the areas that the machine will be carried through.

Make sure that the transporting vehicle is suitable. See **Static Dimensions** (SPECIFICATIONS section in the machine handbook) for the dimensions of the machine.

⚠ WARNING

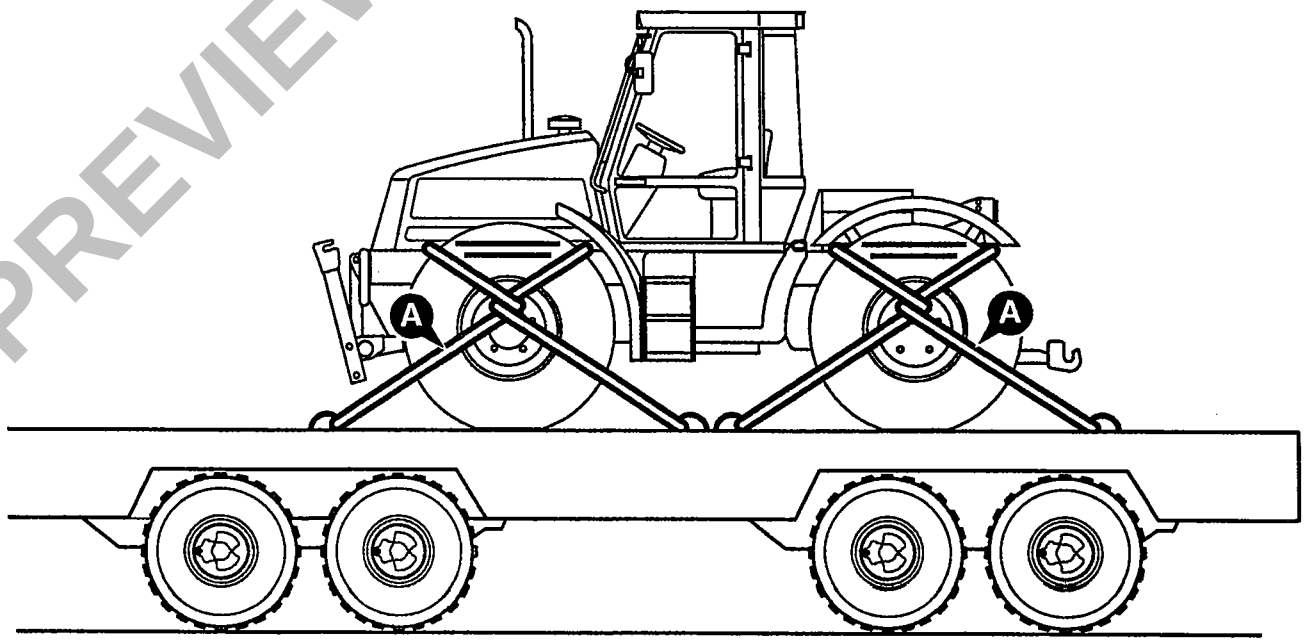
Before moving the machine onto the trailer, make sure that the trailer and ramp are free from oil, grease and ice. Remove oil, grease and ice from the machine tyres. Make sure the machine will not foul on the ramp angle. See Static Dimensions in SPECIFICATIONS **section for the minimum ground clearance of your machine.**
2-2-7-5/1

1 Place blocks at the front and rear of the trailer wheels.

2 Move the machine on to the trailer as follows:
- **a** Make sure the ramps are correctly in place and secure.
- **b** Carefully drive the machine onto the trailer.
- **c** Set the drive to neutral and engage the parking brake.
- **d** Switch off the engine.
- **e** Ensure that the overall height of the load is within regulations.
- **f** Secure the cab.

3 Anchor the machine to the trailer with chains or suitable webbing straps. The preferred fixing is to use webbing straps individually fixing all four wheels to the deck of the trailer as at **A**. If chains are used they should be connected to a suitable part of the drawbar at the rear of the machine. At the front, use the tie down points. Avoid chaining any part of the machine where the chains may damage critical componentry. For example, chaining around either axle provides the possibility of damaging the steel brake pipes running along their length.

4 Measure the maximum height of the machine from the ground. Try to make sure the truck driver knows the clearance height before he drives away.



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Alternator - Bosch (Fastrac 185)

Dismantling and Assembly

When Dismantling

Remove capacitor **2** by disconnecting lead **L** from its terminal and removing retaining screw **1.**

Unscrew bolts **3** and remove regulator and brush box assembly **4.**

Note: It is essential to remove the regulator and brush box at this stage otherwise the brushes will be damaged.

Check the protruding length of the brushes **7.** If this is less than 7 mm (0.28 in), the brushes must be renewed.

Remove nut **10** and washer **11.** Slide the pulley **12** and the impeller **13** off the Woodruff key **15** and rotor shaft.

Remove the Woodruff key **15** from the rotor shaft.

Mark the relative positions of items **18, 19** and **28** to assist correct assembly.

Remove terminal connections **16.** Unscrew bolts **17** and remove the end shield **18** taking care that the stator connecting wires **A, B** and **C** do not get caught by the bracket. If necessary tap under each fixing bolt lug with a mallet.

Unsolder rectifier terminal tags **X, Y** and **Z** and move the wires **A, B** and **C** clear of the rectifier.

Record the position of the stator output leads **A, B** and **C** relative to the alternator fixing lugs and remove the stator **19** by lifting it clear of the drive end bracket **28** and rotor **25.**

Remove screws **20** and remove rectifier **21.**

Remove screws **23** and separate the rotor **25** (complete with bearings **24** and **27** from the drive end bracket **28.**

If required, remove the bearings and the slip-rings **29,** using a suitable puller.

Note: If the slip rings are removed, unsolder the connections first.

When Assembling

Reverse the dismantling procedure, but note the following:

Pack bearings with high melting point grease.

Ensure that slip ring faces are clean and smooth, using very fine glasspaper if required. Do not use emery cloth.

Press slip rings and bearings as far as they will go onto the shaft.

Use resin cored solder when fitting slip-rings and rectifier. Do not allow solder to build up on the face of the slip-rings. Ensure that stator connecting wires will not touch against the rotor.

To ensure true running of the rotor, insert three 0.2 mm feeler gauges between the stator and the rotor and tighten screws **17** evenly in a diagonal sequence to the specified torque setting.

Lightly polish side faces of brushes to ensure free movement in brush box.

Torque Settings

Item	Nm	Kgf m	lbf in (inches)
1	2.9-4.1	0.3-0.4	26-36
3	1.6-2.3	0.2-0.2	14-20
17	4.1-5.5	0.4-0.5	36-48
20	1.4-2.0	0.14-0.2	13-18
23	2.4-2.9	0.25-0.3	21-26

Item	Nm	Kgf m	lbf ft
10	35-45	3.6-4.6	26-33

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Control Valve Solenoids

3 Lowering Test Procedure

3.1 Ensure that a minimum load of 500 kg is on the linkage and that the hydraulic oil is at normal operating temperature.

3.2 Set the linkage in the fully raised position. Measure the distance of a lift cylinder piston rod pin from the end of the cylinder barrel. Measure and note the piston rod diameter.

3.3 Run the engine at 1000 rev/min. Adjust the draft controls to the following settings:

Rate of drop control **C** at minimum (fully clockwise to position 0).
Maximum height control **E** slightly below maximum (clockwise) position.
Sensitivity **G** turned to mid position
Intermix Selector **H** turned fully clockwise (100% draft control)
Setpoint control **D** at position 10
Main control lever **A** at lower position 3

3.4 Slowly turn control **C** until indicator light **K** comes on. Stop the linkage when the arms are slightly above the fully down position by moving lever **A** to neutral (position **2**).

Make a note of the lowering time from when the indicator light **K** comes on to when the linkage stops.

Measure the distance the cylinder has retracted from the position noted at step 1. (This is the stroke of the ram for the purpose of the calculations.)

3.5 Calculate the flow, using the formula detailed on the previous page and using the following example for guidance.

Flow Calculation Example

Ram Diameter measured is 75 mm, therefore R = 0.53.

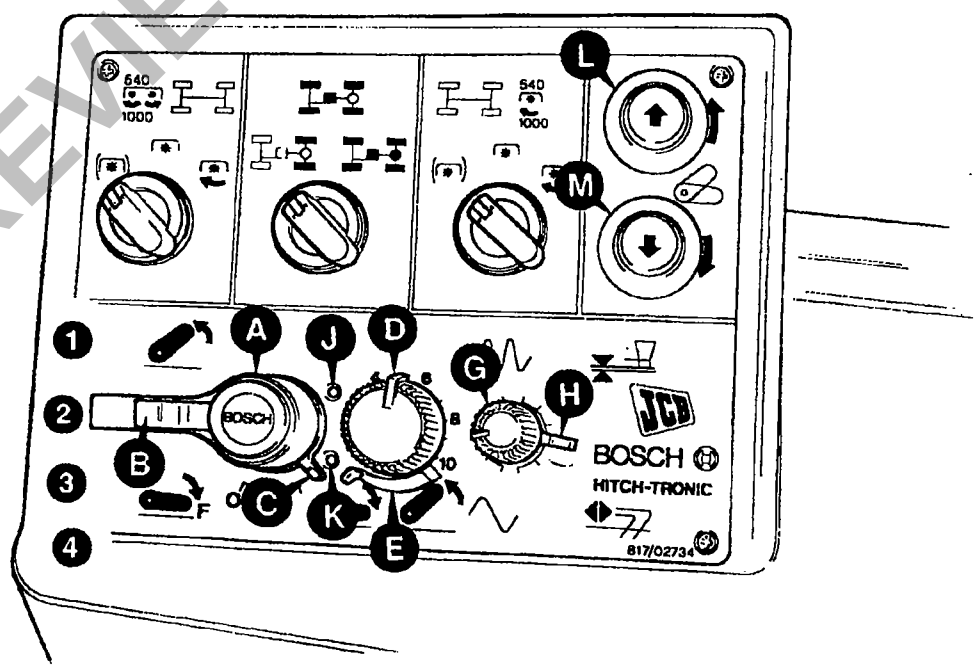
Stroke measured (S) is 240 mm

Time in seconds (t) is 45

Using the formula given under **Flow Requirements, Flow Calculation**.

$$\text{Flow} = \frac{0.53 \times 240}{45} = 2.8 \text{ litres/min}$$

The result of 2.8 litres/min is between the minimum and maximum flow rates of 2 and 4 litres/min required for lowering therefore no adjustment of the solenoid is necessary. If the result was outside the minimum and maximum flow rates, the solenoid would need to be re-set.



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NoSPIN Differential

Description

The main functions of the NoSPIN differential are:-

1 To allow variation in driving wheel rotational speed which must occur when the vehicle is either turning or travelling over an uneven surface.

2 To prevent loss of traction which would otherwise occur when one driving wheel spins out.

These functions are achieved by allowing, when necessary, either driving wheel to rotate faster than the crownwheel and by also ensuring that when power is applied, neither wheel can rotate more slowly than the crownwheel.

The NoSPIN assembly is mounted in a two-piece differential case which is bolted to the crownwheel. Drive is transmitted from the crownwheel, via the differential case, to the spider **A**. This is provided, on each side, with clutch teeth **B** which engage with corresponding teeth on clutch assemblies **C** and **D**. The clutches are splined to side gears, which in turn are splined to conventional axle shafts, thus conveying the drive to the road wheels.

When the machine is travelling straight ahead over an even surface as at **X**, both wheels are driven by positive engagement of the teeth on the spider **A** and on both clutches **C** and **D**. If one wheel loses traction, the clutches remain engaged, ensuring that drive is still transmitted by the other wheel until traction is regained.

When the machine negotiates a turn as at **Y**, the outer wheel **E**, due to the larger turning radius of its path, is forced to travel further and rotate faster than the inner wheel. This is permitted by the disengagement of clutch **D** from the spider as shown. A similar action occurs when one wheel is forced to rotate faster in order to negotiate irregularities in the ground surface.

The internal operation of the NoSPIN differential is shown on the lower illustration.

Spider **A**, rotating in the direction of arrow **Aa**, is driving clutch **C** by means of teeth **B**. (Positive tooth engagement being assured by the mating undercuts on the driving faces of the teeth.) Clutch **D**, rotating at a greater speed, is shown disengaged.

In addition to the driven teeth, each clutch is provided with a row of inner teeth **G**. Those on clutch **C** are in engagement with centre cam **H** which is therefore rotating and locked in relation to this clutch.

Due to the tooth backlash **J**, the engaged clutch **C** and centre cam **H** are trailing behind the spider **A**, with the effect that the cams are offset in relation to the spider teeth by distance **K**. When a clutch starts to rotate faster than the spider, the inner teeth of the clutch ride up the cams, thus forcing the clutch out against spring pressure until the driving teeth are disengaged as shown on clutch **D**.

The progressive stages of disengagement are shown diagrammatically at **Z**.

At position **1**, the spider teeth **B** are driving the clutch **D**, while the inner clutch teeth **G** are fully engaged with cam ring **H**. The cam is offset by distance **K**.

At position **2**, the clutch **D** is accelerating and the inner teeth **G** are caused to ride up the cam, thus forcing the clutch out of engagement.

At position **3**, the inner teeth have reached the peak of the cams and the clutch is now fully disengaged.

In the reverse condition the spider teeth take up the backlash in the unit so that the cams are now displaced to the opposite side of the spider teeth as shown at **1a**.

Acceleration of one road wheel in reverse causes clutch disengagement, as at **2a** and **3a**, in the same manner as in forward travel.

When a clutch is rotating faster than the spider, continual tooth re-engagement would cause excessive noise. This is prevented by the provision of a hold-out ring between each clutch and the spider to ensure that the clutch remains disengaged until the speeds again coincide.

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