FIAT

446
446 DT

WORKSHOP MANUAL

SERVIZI TECNICI DI ASSISTENZA

06910073
Reprint

FIAT

446
446 DT

WORKSHOP MANUAL

QUICK REFERENCE INDEX

S E R V I Z I   T E C N I C I   D I   A S S I S T E N Z A

FOREWORD

- The manual is divided into separately numbered sections.

- Two-digit sections contain:
  – tractor specification (00);
  – tractor sub-assembly specification and data (10 Engine, 20 Power Train, etc.).

- Three-digit sections deal with the overhaul of the sub-assemblies whose data are listed in the two-digit sections. The first two digits are the same as those of the associated data sections (e.g. 20 - Power Train; 201 - Clutch; 202 - Transmission, splitter etc.).

- An index is provided to facilitate retrieval of desired information.

- Each sheet carries the print number of the manual and the date of issue at the bottom of the page.

- Revised sheets will carry the same print number followed by a 2-digit number (e.g. first revision 603.54.235.01; second revision 603.54.235.02 etc.) and date of issue.
  Revised sheets will be accompanied by the updated index.

- All information herein is correct at the time of printing but is subject to alteration without prior notice. In case of discrepancies contact the nearest dealer, distributor or branch.

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GENERAL: Index

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SHIMS

When adjusting, measure each shim with a micrometer gauge and add the values obtained. Do not rely on overall shim thickness or the nominal value indicated for each shim.

ROTARY SHAFT SEALS

To fit rotary shaft seals proceed as follows:
- prior to fitting, soak the seals for at least half an hour in the fluid to be retained;
- carefully clean the shaft and ensure that the contact surface is free from damage;
- turn the end of the sealing lip towards the fluid. If of the thrower lip type, turn the grooves so that during shaft rotation the fluid tends to be thrown back;
- smear the sealing lip with a very thin coat of lubricant (oil is better than grease) and pack the space between sealing lip and dust shield with grease (applicable to double-lip seals);
- fit the seals into their housing using a flat-ended tool or ram. Under no circumstances fit with a mallet or hammer;
- avoid entry of the seal into the recess in a tilted position. Exert a firm and uniform pressure squarely on it and ensure that the seal is pressed fully home;
- to prevent sealing lip damage during fitting, use a protection before sliding over the shaft.

O-RINGS

Lubricate each ring prior to fitting and, on reassembly, slide over the part but do not twist, otherwise leakage will result.

SEALING COMPOUNDS

On the mating surfaces indicated with X apply one of the following sealing compounds: RTV SILMATE, RHODORSIL CAF 1 or LOCTITE PLASTIC GASKET.
Before applying the sealing compound, prepare the surfaces as follows:
- using a wire brush, remove any deposits;
- thoroughly degrease using one of the following detergents: Solvent, kerosene or hot water/soda solution.

BEARINGS

To fit bearings:
- before installing on shafts, heat to 80°C to 90°C;
- cool before pressing them into their seats.

ROLL PINS

When fitting straight roll pins ensure that they face in direction of work to stress the pin.
Coil roll pins can be installed in any position.

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SPARE PARTS

Use exclusively **FIAT spare parts**, bearing the trade mark below.

ricambi
originali
FiatTrattori
FIAT

10168

These are the only parts that guarantee the quality, durability and safety of the original parts, being parts fitted in production.
Only **FIAT spare parts** can offer this guarantee.
When ordering spare parts please state:
— tractor model (marketing code) and frame number;
— engine type and number;
— part number (given on "Microfiches" or "Spare parts Catalogue").

SERVICE TOOLS

The service tools indicated in this manual are:
— designed specifically for tractors of the FIAT range;
— essential for reliable repair work;
— manufactured and tested in such a way as to offer efficient and durable working instruments.
The mechanic is also reminded that being equipped means:
— operating in optimum working conditions;
— obtaining the best results;
— saving time and energy;
— working in greater safety.

NOTICE

Wear limits recommended for some parts are not binding, being given for guidance only. "Front", "rear", "right" and "left" references are with operator facing normal direction of travel of tractor.

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WARNING

This symbol is your safety alert sign. It means
"ATTENTION - BECOME ALERT - YOUR SAFETY IS INVOLVED"

AVOID ACCIDENTS

Most accidents occurring in the workshop are caused by the failure of some individual to follow simple and fundamental safety rules or precautions. For this reason MOST ACCIDENTS CAN BE PREVENTED by recognizing the real cause and doing something about it before the accident occurs. Regardless of the care used in the design and production of any type of equipment, there are many conditions that cannot be completely safeguarded against without interfering with reasonable accessibility and efficient operation.

A careful operator is the best insurance against an accident. The complete observance of one simple rule would prevent many thousand serious injuries each year.

That rule is:

ATTENTION. Never attempt to clean, oil or adjust a machine while it is in motion.

SAFETY PRECAUTIONS

GENERAL

- Strictly adhere to the maintenance and repair procedures indicated.
- Do not wear rings, wrist watches, jewelry or loose or hanging apparel, such as ties, torn clothing, scarves, unbuttoned or unzipped jackets that can catch on moving parts. Wear proper safety equipment as authorized for the job. Examples: hard hats, safety shoes, heavy gloves, safety glasses or goggles.
- Machine should not be serviced with anyone in the operator's seat unless they are qualified to operate the machine and are assisting in the service.
- Never attempt to operate the machine or its tools from any other position other than seated in the operator's seat.
- Never lubricate, service or adjust a machine with the engine running, except when specified.
- Shut off engine and check that the hydraulic circuits are no longer under pressure before removing camps and covers.
- Carry out all servicing operations with maximum care and attention.
- Shop or field service platforms and ladders used to maintain or service machinery should be constructed and maintained according to local or national requirements.
- Disconnect batteries and all controls to indicate operation in progress. Secure machine and any equipment to be lifted.
- Never check or fill fuel tanks, storage batteries or use starter fluid while smoking or near open flames, due to the presence of flammable fluid.
- Brakes are inoperative when manually released for servicing. Provision must be made to maintain control of the machine by chocking or other means.
- Ensure that the fuel gun is in contact with the filler when refuelling. To reduce the chance of static electricity sparking, maintain contact until after fuel flow is cut off.
- Use only designated towing or pulling attachment points. Use care in making attachment points. Be sure pins and locks as provided are secure before pulling. Stay clear of drawbars, cables or chains under load.

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GENERAL: Safety precautions

- To move a disabled machine, use a trailer or low body truck if available.
- Load and unload on level ground giving full support to the trailer wheels. Anchor tractor to truck or trailer loading platform and chock wheels as requested by carrier.
- Use only grounded auxiliary power source for heaters, chargers, pumps and similar equipment to reduce the hazards of electrical shock.
- Lift and handle all heavy parts with a lifting device of proper capacity.
- Watch out for bystanders.
- Never place gasoline or diesel fuel in an open pan.
- Never use gasoline or solvent or other flammable fluid to clean parts. Use authorized commercial, non-flammable non-toxic solvents.
- When cleaning parts with compressed air use safety glasses with side shields or goggles.
- Limit the pressure to 2.1 bar (30 psi) according to local or national requirements.
- Do not run engine indoors without adequate ventilation.
- Do not smoke or permit any naked light or spark near when refuelling or handling highly flammable materials.
- Do not use a naked light as a light source to look for leaks or for inspection anywhere on the tractor.
- Move carefully when under, in or near machine or implements. Wear required protective equipment, such as hard hats, safety glasses, safety shoes.
- When checking equipment requiring the engine running, an operator should be in the operator's seat at all times with the mechanic in sight.
- For field service, move machine to level ground if possible and chock machine. If work is absolutely necessary on a gradient, chock machine and its attachments securely. Move the machine to level ground as soon as possible.
- Guard against kinking chains or cables. Do not lift or pull through a kinked chain or cable. Always wear heavy gloves when handling chain or cable.
- Be sure cables are anchored and the anchor point is strong enough to handle the expected load. Keep bystanders clear of anchor point and cable or chain.
- Keep maintenance area CLEAN and DRY. Remedy water or oil spillage immediately.
- Do not pile oily, greasy rags — they are a fire hazard. Store in a closed metal container. Before starting machine or moving attachment, check, adjust and lock operator's seat. Be sure all personnel in the area are clear before starting or moving machine and any of its attachments.
- Do not carry loose objects in pockets that might fall unnoticed into open compartments.
- Wear proper protective equipment such as safety goggles or safety glasses with side shields, hard hats, safety shoes, heavy gloves where metal or other particles are apt to fly or fall.
- Wear welder's protective equipment such as dark safety glasses, helmets, protective clothing, gloves and safety shoes when welding. Dark safety glasses must be worn by anyone standing by when welding is in progress. DO NOT LOOK AT ARC WITHOUT PROPER EYE PROTECTION.
- Wire rope develops steel slivers. Use authorized protective equipment such as heavy gloves and safety glasses when handling.
- Handle all parts with extreme care. Keep hands and fingers from between parts. Wear authorized protective equipment such as safety glasses, heavy gloves, safety shoes.

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START UP

- Do not run the engine of this machine indoors without proper ventilation to remove deadly exhaust fumes.

- Do not place head, body, limbs, feet, fingers or hands near a rotating fan or belts.

ENGINE

- Turn radiator cap slowly to relieve pressure before removing. Add coolant only with engine stopped or idling if hot.

- Do not run engine when refuelling and use care if engine is hot due to the increased possibility of fire if fuel is spilled.

- Never attempt to check or adjust fan belts when engine is running. Do not adjust engine fuel pump when the machine is in motion.

- Never lubricate a machine with the engine running.

ELECTRICAL SYSTEM

- When auxiliary batteries are used, connect both cable ends to the terminals as specified: (+) with (+) and (–) with (–). Do not short circuit terminals. BATTERY GAS IS HIGHLY INFLAMMABLE. Leave battery box open to improve ventilation when charging batteries. Never check charge by placing metal objects across the terminals. Keep sparks or naked light away from batteries. Do not smoke near battery to guard against the possibility of accidental explosion.

- Check for fuel or battery electrolyte leaks before starting service or maintenance work. Eliminate leaks before proceeding.

- Do not charge batteries in a closed room. Provide proper ventilation to guard against an accidental explosion from an accumulation of explosive gases given off in the charging process.

- Disconnect batteries before working on electrical system, or starting repair work of any kind.

HYDRAULIC SYSTEM

- Fluid escaping under pressure from a very small hole can almost be invisible and can have sufficient force to penetrate the skin. Use a piece of carboard or wood to search for suspected pressure leaks. DO NOT USE HANDS. If injuried by escaping fluid, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.

- When making pressure checks use the correct gauge for expected pressure.

WHEELS AND TYRES

- Be sure tyres are properly inflated to manufacturer's specified pressure. Inspect damage periodically.

- Stand to one side when correcting tyre pressure.

- Check tyres only when the machine is empty and tyres are cool to avoid overinflation. Do not use reworked wheel parts. Improper welding, heating or brazing weakens them and can cause failure.

- Never cut or weld on the rim of an inflated tyre.

- When servicing tyres, chock all wheels front and back. After jacking up, place stands under machine according to local or national requirements.

- Deflate tyres before removing objects from tread.

- Never inflate tyres with flammable gas. Explosion and personal injury could result.

ATTACHMENTS

- Lift and handle all heavy parts with a lift device of proper capacity. Be sure parts are supported by proper slings and hooks. Use lift eyes if provided. Watch out for bystanders.

- Handle all parts with extreme care. Keep hands and fingers from between parts. Wear authorized protective equipment such as safety glasses, heavy gloves, safety shoes.

- Guard against kinking chains or cables. Always wear heavy gloves when handling chains or cables.

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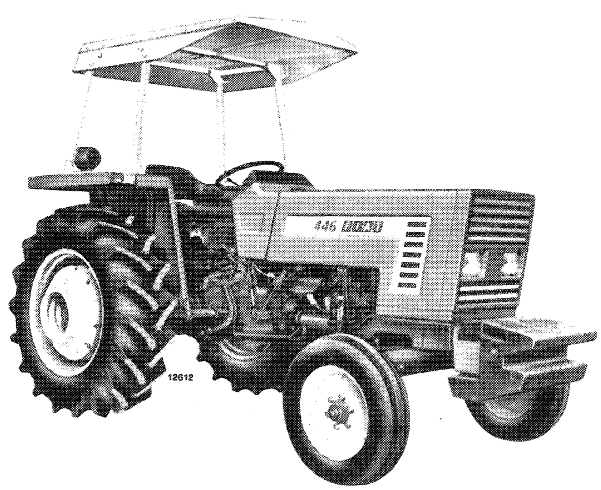
SPECIFICATION

Marketing code:	
— Two-wheel drive	446
— All-wheel drive	446 DT
Engineering code:	
8-speed, two-wheel drive	673.100.000
12-speed, two-wheel drive	673.100.000 - Var. 720.111
8-speed, all-wheel drive	673.127.000
12-speed, all-wheel drive	673.127.000 - Var. 720.111
FIAT engine type, same on all four versions { with BOSCH pump. . .	8035.02.276
{ with C.A.V. pump . . .	8035.02.376
Clutch type	LUK or O.M.G. 11/11"

WEIGHTS

		mod. 446	mod. 446 DT
Operating weight: Front tyres 6.00-16 (two-wheel drive) or 8.3/8-24 (all-wheel drive) and rear tyres 12.4/11-32, lift, implement attachment, front hook, swinging drawbar and ROPS frame	kg	1950 (*)	2160 (*)
Same as above, with front ballasting (10 plates) and 6 ballast rings on rear wheels.	kg	2690 (*)	2900 (*)

(*) Weight increases by 10 kg on models with 12-speed transmission.



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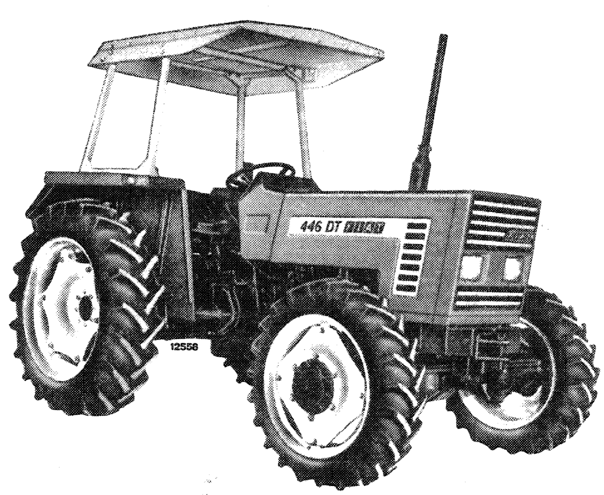
SPECIFICATION

Engine

Diesel	4-stroke, naturally aspirated
Injection	Direct
Number of cylinders	3
Cylinder liners	Dry, pressed on engine block
Bore and stroke	100 x 110 mm
Displacement	2592 cm^3
Compression ratio	17 to 1
Max. horse power DGM/DIN	36.8 kW (50 hp)
at speed	2600 rpm
Max. torque speed	1450 rpm
Main bearings	4
Sump	Cast iron
Valve gear	OH valves, push rod/crankshaft operated.
Inlet { opens: BDTC	3°
Inlet { closes: ABDC	23°
Exhaust { opens: BDTC	48° 30′
Exhaust { closes: ADTC	6°
Valve clearance for timing check	0.45 mm
Normal (irrespective of whether engine hot or cold) { inlet	0.25 mm
Normal (irrespective of whether engine hot or cold) { exhaust	0.35 mm



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ENGINE

Fuel system	
Air cleaner	Oil bath or dry, duplex cartridge, both with automatic drain centrifugal precleaner.
Fuel filters (on feed pump delivery)	Two, in-line, cartridge type, water separator integral with first filter.
Feed pump	Double diaphragm
– Operation	Cam
Injection pump	Distributor
Type: BOSCH	EP/VA3/110 H 1300 CL: 134-8-770798
or	
C.A.V.	DPA-3233 F420-770535
– Integral all speed governor: BOSCH	Hydraulic
C.A.V.	centrifugal
– Integral advantage device	Hydraulic
– Pump timing, BTDC: BOSCH	10° ± 1°
C.A.V.	17° ± 1°
Injectors	3-orifice
– Type	See page 8, Section 10
– Release pressure	221 to 230 bar (225 to 235 kg/cm^2)
Firing order	1-2-3
Lubrication	Forced feed, gear pump
Pump drive	Camshaft
Oil filters	Strainer on pump inlet and full flow cartridge on oulet.
Relief valve	In pump body
– Oil pressure at governed speed	2.9 to 3.9 bar (3 to 4 kg/cm^2)
Cooling system	Water, centrifugal pump
Radiator	3 or 4 deep core vertical tube
Fan, water pump-pulley mounted	Suction, steel, four-bladed
Temperature control	Wax thermostat
Tractor meter	On instrument panel
– Drive	Oil pump gear
– Hourmeter activation speed	1840 rpm
– Meter drive ratio	1 to 2

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SPECIFICATION

POWER TRAIN

Clutch

Twin, dry single plate type LUK or O. M. G. 11 in. with separate controls: pedal for transmission and manual lever for PTO.

Plate material for both transmission and PTO plates is organic.

Transmission

Constant mesh, spur gear type.
Planetary gear splitter box for 8 forward speeds and 2 reverse speeds, with total of 12 forward speeds and 3 reverse speeds on version using crawler box (series with splitter box).
Gear box and splitter/crawler with separate control levers.

Bevel drive on differential with differing ratios depending on front-wheel or all-wheel traction.

Two pinion differential with pedal-control differential lock.

Final drives of single reduction planetary type.

BRAKES

Service

Drive brake bands acting on wheel drums fitted to halfshafts of differential with separate pedal control with pedals latched for simultaneous road speed braking.

Parking/emergency on transmission (on tractors with front-wheel drive).

Brake drums acting on corresponding synchronized PTO drive gear, mating bevel pinion shaft with manual lever control.

Parking/emergency (on tractors with all-wheel drive)

Same facilities as for the service brakes permitting blocking by manual lever.

STEERING

Steering wheel system with circulating ball steering box or with power steering optional.
Linkage joints sealed permanently.
Turning radius (without brake systems)
– mod. { 446 . . . . 3400 mm
– mod. { 446 DT, with front axle in 4300 mm

FRONT AXLE

Inverted U, telescoping, center pivoting with track adjustment by sliding axle ends . . . . 6 off.

LIVE FRONT AXLE

Fully floating, center pivoting unjointed drive shaft and articulations on tractor centerline.
Two-pinion differential with planetary final drives.
Five disc/rim/hub repositioning.

REAR WHEELS

Disc/rim/hub repositioning: . . . . 7 off.

POWER TAKE-OFF

Fully independent (540 rpm)

Shaft. .13/8" – 6 splines
Control. . . . . mechanical by manual lever.
Engine speed with PTO at standard speed of 540 rpm . . . . 2160 rpm.
Rotation: Clockwise (tractor seen from rear).

Synchronized PTO

Drive shaft and rotation same as for fully independent PTO.
Speed of spline shaft with 12/47 bevel drive on front-wheel traction models, or with 10/43 bevel drive on all-wheel traction models) per rear wheel turn :
– Front-wheel drive . . . . 13.78 rpm
– All-wheel drive . . . . 14.47 rpm

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HYDRAULIC LIFT

Hydraulic, draught and position control with manual sensitivity adjustment. Draught control by three-point attachment.
Gear-type pump with engine valve gear drive.
Hydraulic fluid taken from gearbox.
Design lift capacity, max. lift capacity and max. lift stroke at end of arms (see Section 50, pages 1 and 4).
Three-point category I and II implement attachments, with normal arms or extra-long, reinforced arms optional.

Remote control valves

Single remote control valve (for right - or left-hand control) for remote single and double-acting cylinder control.
Trailer power braking remote control valve with extra remote control valve for double-acting remote control with left-hand control).

TOWING ATTACHMENTS

Rear:

- Swing over sector drawbar
- Cross member drilled for implement attachment
- Tow hook;
- Rockinger jaw hook: designed to rotate on its own longitudinal axis and equipped with an automatic device for tow pin coupling/locking.

Front:

- Fixed hook no applicable with front ballast-ting.

BALLASTING

Front axle

Comprising support of 80 kg (176 lb) for mountting total of 6 or 10 plates of 33 kg (73 lb) each for a total weight of 278 kg or 410 kg.

Rear wheels

Comprising 4 or 6 rings secured to the wheels rims, each weighing 55 kg (110 lb) to provide a total weight of 220 kg or 330 kg.

BODY

Forward-tilt hood for complete accessibility to engine and other assys such as radiator, battery, air cleaner, engine oil filter, fuel filters, fuel pump, injection pump and power steering reservoir (optional).
Partial wrap-around rear fenders with ROPS frame mounts, with or without roof.
Sheet metal fuel tank located in front of seat. Operator's seat padded, with parallelogram suspension, adjustable for position and suspension.

ELECTRICAL SYSTEM

Voltage .... 12 V
33A alternator with integral electronic voltage regulator.
- Bosch: GI ➞ 14V - 33A 27;
- Marelli: AA 108 - 14V - 33A - 1;
- ISKRA: AAG1104 - 14V - 33A;
- LUCAS: 18 A CR - 14V - 40A.

Starter:
- Marelli 2.5 kW (3.4 hp) MT 71AA;
- Bosch 1.8 kW (2.5 hp) JF ➞ 12V;
- Lucas 2.5 kW (3.4 hp) M45G.

Battery located ahead of radiator, capacity 88/92 Ah or 110/120 Ah.

Lighting

Twin, high and asymmetric low beam headlamps, 45/40 W.
Two front lights comprising:
- parking (5 W bulb);
- turn signal (21 W bulb);

Two tail lights comprising:
- parking (5 W bulb);
- turn signal (21 W bulb);
- stop (21 W bulb);
- license plate (doubles as LH parking lights).

Instruments and accessories

13-function instrument panel (see Section 60, p. 9)
Dashboard (see Section 60, page 9).
Rear flood light (35 W bulb).
Rear power point, DIN, 7-pole.
Dash power point single-pole.
Horn.
Thermostarter.
Fuses: max. 8 off (see Section 60, page 9).
Tractor and trailer hazard warning lights.

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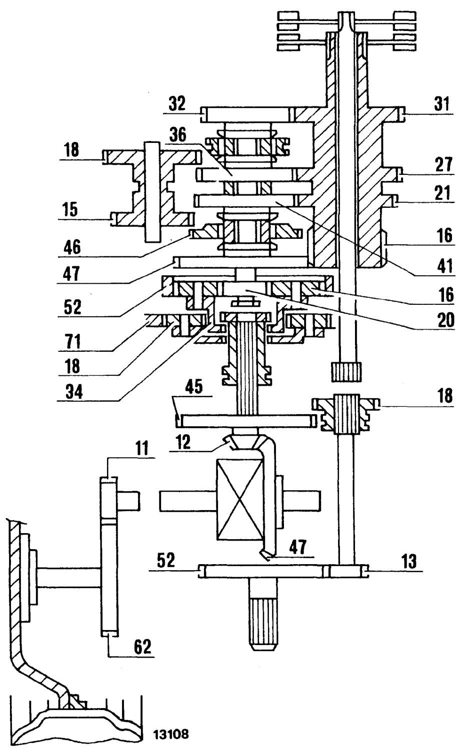
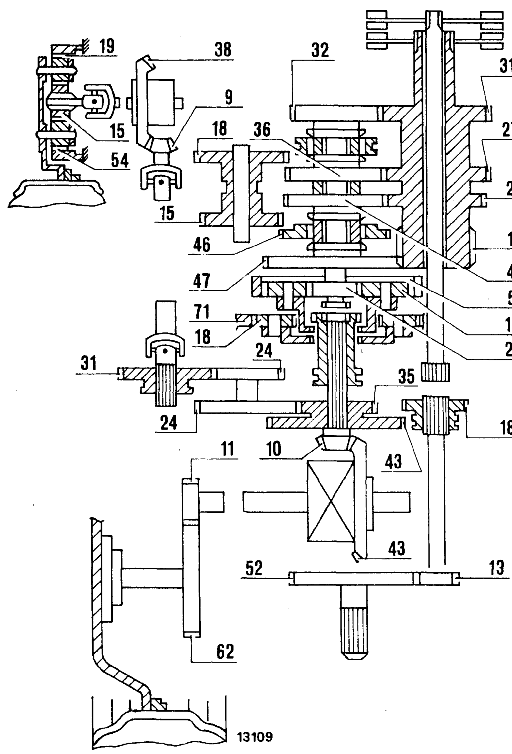
SPECIFICATION

POWER TRAIN SCHEMATIC

Mod. 446
(8/12-speed version)



Mod. 446 DT
(8/12-speed version)



Tractor speed, at max. engine speed, with 8 and 12-speed transmission (km/h)							
GEARS		Mod. 446 with rear tyres:			Mod. 446 DT with rear tyres:		
		13.6/12-28	14.9/13-28	12.4/11-32	13.6/12-28	14.9/13-28	12.4/11-32
Low (*)	1st.	0.9	0.9	0.9	0.8	0.8	0.8
	2nd.	1.2	1.3	1.3	1.2	1.2	1.2
	3rd.	1.9	2.0	2.0	1.7	1.8	1.8
	4th.	2.4	2.5	2.5	2.2	2.3	2.3
	Reverse	1.1	1.2	1.2	1.0	1.1	1.1
Normal	1st.	2.6	2.7	2.7	2.4	2.5	2.5
	2nd.	3.8	4.1	4.1	3.5	3.7	3.7
	3rd.	5.6	5.9	5.9	5.1	5.4	5.4
	4th.	7.4	7.7	7.7	6.7	7.0	7.0
	Reverse	3.6	3.8	3.8	3.3	3.5	3.5
High	1st.	9.3	9.8	9.8	8.5	8.9	8.9
	2nd.	14.0	14.7	14.7	12.8	13.4	13.4
	3rd.	20.5	21.5	21.5	18.7	19.6	19.6
	4th.	26.5	27.8	27.8	24.1	25.3	25.3
	Reverse	13.4	14.0	14.0	12.2	12.8	12.8

(*) On 12-speed transmission only.

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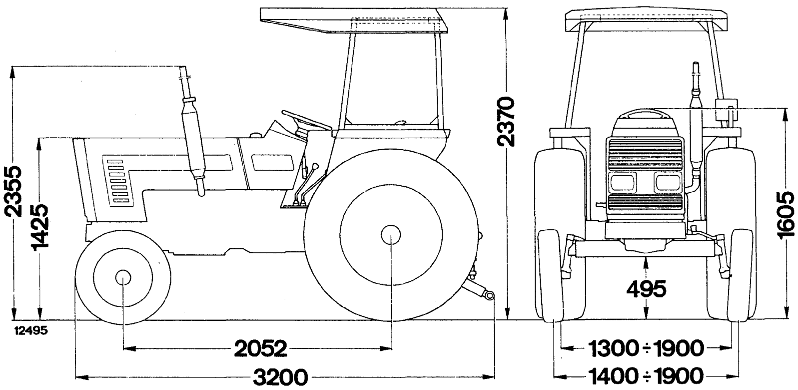
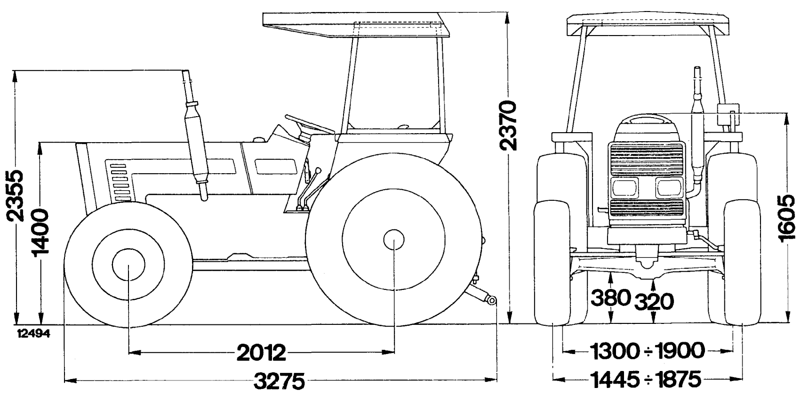
MAIN DIMENSIONS (in mm)



Mod. 446
(6.00-16 front tyres
and 12.4/11-32
rear tyres)

Mod. 446 DT
(8.3/8-24 front tyres
and 12.4/11-32
rear tyres)



TYRE SIZES

	446	446 DT
Front.	6.00-16 7.50-16	8.00-20 (*) 9.5/9-20 (*) 11.2/10-20 (●) 8.3/8-24 (°)
Rear	13.6/12-28 14.9/13-28 12.4/11-32	13.6/12-28 (*) 14.9/13-28 (●) 12.4/11-32 (°)

(*)(●) (°) Tyre marching references.

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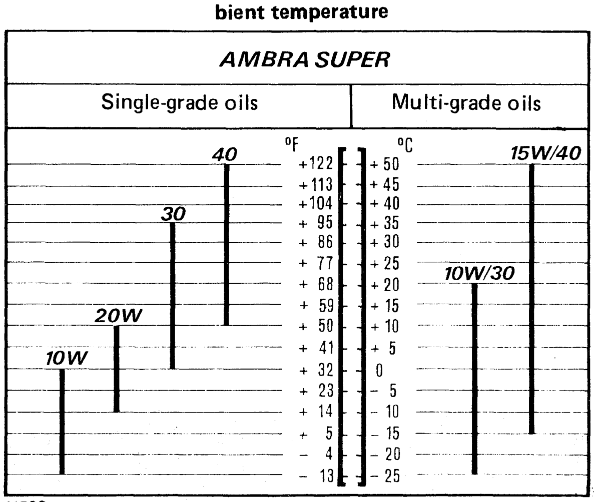
SPECIFICATION

CAPACITIES

DESCRIPTION	LIQUIDS AND LUBRICANTS			
	FIAT RECOMMENDED PRODUCTS	QUANTITY 446 and 446 DT dm³ (liters)	QUANTITY 446 and 446 DT pints	International designation
Sump and filter oil	oil Fiat AMBRA SUPER	7.5	13	Diesel engine oil to MIL-L-2104C and service API CD
Sump oil		6.7	11.5	
Air cleaner oil (1)		0.95	1.85	
Transmission system, rear axle and lift:	TUTELA MULTI F			Transmission, oil bath brakes and lift oil corresponds to Massey Ferguson MF 1135 and Ford M2C 86A
– 2-wheel drive		13.3	23	
– All-wheel drive		18.5	32.5	
Steering unit		0.50	1	
Power steering		1.8	3	
Final drives (each)		1.7	3	
Front axle:				
– Axle cases		4.3	7.5	
– Planetary drives (each)		0.8	1.5	
Front wheel hubs	**grease Fiat** TUTELA G 9	–	–	Lithium-calcium grease to NLG12
Pressure lubricator		–	–	
Coolant	Water and FIAT 'PARAFLU 11' (2)	dm³ (liters) 10.5	18.5 galls.	
Fuel tank	Diesel fuel	61	13.5 galls.	

Oil viscosity to be chosen in relation to ambient temperature



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(1) Change filter oil when dirt level is approx. 1 cm thick.
(2) See page 1, Section 106.

Attention

Note on models using above OLIO FIAT products that AMBRA SUPER and AMBRA oils are interchangeable.

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ENGINE BLOCK - CYLINDER HEAD

Engine Block	
Cylinder bore diameter in engine block	102.890 to 102.940 mm (4.051 to 4.053 in)
Sleeve OD	103.020 to 103.050 mm (4.056 to 4.057 in)
Sleeve interference fit in block	0.08 to 0.160 mm (0.003 to 0.006 in)
Sleeve diameter oversize	0.2 mm (0.008 in)
Sleeve bore diameter	100.000 to 100.018 mm (3.937 to 3.938 in)
Maximum ovality and taper due to wear (2)	0.12 mm (0.005 in)
Sleeve bore oversize	0.2-0.4-0.6-0.8 mm (0.008-0.016-0.024-0.031 in)
Housing bore diameter: — camshaft bushings: front	54.780 to 54.805 mm (2.1567 to 2.1577 in)
Housing bore diameter: — camshaft bushings: intermediate	54.280 to 54.305 mm (2.1370 to 2.1379 in)
Housing bore diameter: — camshaft bushings: rear	53.780 to 53.805 mm (2.1173 to 2.1183 in)
Tappet housing bore diameter	15.000 to 15.018 mm (1) (0.590 to 0.591 in)
Tappet oversize	0.1-0.2-0.3 mm (0.004-0.008-0.012 in)
Main bearing housing bore diameter	80.587 to 80.607 mm (3.1727 to 3.1734 in)

CYLINDER HEAD

Valve guide housing bore diameter in head	13.966 to 13.983 mm (0.5498 to 0.5505 in)
Valve guide oversize	0.2 mm (0.0079 in)
Valve seat dimensions	Section 101, page 2
Valve stand-in	0.7 to 1.1 mm (0.027 to 0.043 in)
— maximum seating allowed	1,4 mm (0.055 in)
Injector projection	1 to 1.5 mm (0.039 to 0.059 in)
— maximum stand-out allowed	1.8 mm (0.071 in)
Cylinder head height	92 mm (3.622 in)
Maximum head skimming depth	0.5 mm (0.020 in)

CRANKSHAFT

Crankshaft - Bearings	
Main journal diameter	76.187 to 76.200 (1)
Main journal undersize	0.254-0.508-0.762-1.016 mm (0.0099-0.0199-0.0299-0.0399 in)
Main bearing wall thickness	2.162 to 2.172 mm (0.0851 to 0.0855 in)
Main bearing undersize	0.254-0.508-0.762-1.016 mm (0.0099-0.0199-0.0299-0.0399 in)
Main journal clearance in bearings	0.042 to 0.096 mm (0.0025 to 0.0038 in)
— maximum wear clearance	0.180 mm (0.0071 in)

(1) After reaming 0.1 mm oversize tappets may be fitted in production coupled to corresponding oversize housing bores.
(2) After reaming 0.1 mm oversize sleeves may be fitted in production coupled to corresponding oversize pistons.

(cont.)

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CRANK GEAR *(continued)*

Crankpin diameter	58.730 to 58.743 mm (1) (2.3122 to 2.3127 in)
Crankpin undersize	0.254-0.508-0.762-1.016 mm (0.0099-0.0199-0.0299-0.0399 in)
Big end bearing wall thickness	1.805 to 1.815 mm 0.0710 to 0.0715 in)
Big end bearing undersize	0.254-0.508-0.762-1.016 mm (0.0099-0.0199-0.0299-0.0399 in)
Crankpin clearance in big end bearing	0.035 to 0.080 mm (0.0014 to 0.0032 in)
– maximum wear clearance	0.180 mm (0.0071 in)
Crankshaft thrust washer thickness	3.378 to 3.429 mm (0.1329 to 0.1349 in)
Thrust washer oversize	0.127 mm (0.0049 in)
Width of main bearing housing over thrust washers	31.766 to 31.918 mm (1.2506 to 1.2566 in)
Length of corresponding main journal	32.000 to 32.100 mm (1.2598 to 1.2638 in)
Crankshaft end float	0.082 to 0.334 mm (0.0032 to 0.0131 in)
– maximum wear end float	0.40 mm (0.016 in)
Maximum main journal and crankpin ovality or taper after grinding	0.01 mm (0.0004 in)
Maximum main journal and crankpin ovality or taper due to wear	0.05 mm (0.0019 in)
Maximum main journal misalignment with crankshaft resting on end journals	0.10 mm (0.0039 in)
Maximum misalignment of crankpins relative to main journals (in either direction)	0.25 mm (0.0098 in)
Maximum tolerance on distance from outer crankpin edge	± 0.10 mm (± 0.0039 in)
Maximum crankshaft flange run-out with stylus in A, (Section 103, page 2) over 108 mm (4.25 in) diameter, T.I.R.	0.02 mm (0.0008 in)
Maximum flywheel seat eccentricity relative to main journals (See B, section 103, page 2) T.I.R.	0.04 mm (0.0016 in)
Connecting Rods	
Small end bore diameter	35.861 to 35.899 mm (1.4118 to 1.4133 in)
Small end bushing OD	35.979 to 36.017 mm (1.4165 to 1.4179 in)
Bushing interference fit in small end	0.080 to 0.156 mm (0.0031 to 0.0061 in)
Small end bushing fitted ID	32.005 to 32.012 mm (1.2600 to 1.2603 in)

(1) 0.1 mm undersize crankpin and main journal crankshafts may be fitted in production coupled to corresponding undersize bearings.

(follows)

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PISTONS *(continued)*

Big end bore diameter	62.408 to 62.420 mm (2.4570 to 2.4575 in)
Maximum connecting rod axis misalignment at 125 mm (5 in)	± 0.07 mm (± 0.003 in)
Maximum connecting rod weight difference over a complete set of the same engine	25 grams (0.88 oz.)
Pistons	
Piston diameter 50 mm (2 in) from base of skirt, at right angles to pin	99.828 to 99.840 mm (3.9302 to 3.9307 in)
Piston clearance in sleeve	0.160 to 0.190 mm (0.0063 to 0.0075 in)
– maximum wear clearance	0.30 mm (0.012 in)
Piston oversize range	0.2-0.4-0.6-0.8 mm (0.008-0.016-0.024-0.032 in)
Piston stand-out	0.462 to 0.787 mm (0.0184 to 0.0314 in)
Piston pin diameter	31.983 to 31.990 mm (1.2592 to 1.2594 in)
Piston pin housing bore in piston	31.993 to 32.000 mm (1.2596 to 1.2598 in)
Piston pin clearance in piston	0.003 to 0.017 mm (0.0001 to 0.0007 in)
Piston pin oversize	0.2-0.5 mm (0.008-0.019 in)
Piston pin clearance in small end bushing	0.015 to 0.029 mm (0.0006 to 0.0011 in)
– maximum wear clearance	0.06 mm (0.0024 in)
Maximum weight difference over a complete set of pistons	20 grams (2/3 oz.)
Piston ring clearance in groove:	
– Top	0.090 to 0.122 mm (0.0035 to 0.0048 in)
– 2nd	0.050 to 0.082 mm (0.0019 to 0.0032 in)
– 3rd	0.040 to 0.072 mm (0.0016 to 0.0028 in)
Maximum wear clearance:	
– Top	0.50 mm (0.008 in)
– 2nd and 3rd	0.20 mm (0.019 in)
Piston ring gap:	
– Top	0.35 to 0.55 mm (0.0138 to 0.0216 in)
– 2nd	0.30 to 0.45 mm (0.0118 to 0.0177 in)
– 3rd	0.25 to 0.40 mm (0.0098 to 0.157 in)
Maximum wear gap	1.20 mm (0.047 in)

(follows)

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VALVE ASSEMBLY

Camshaft	
Camshaft bushing O.D.:	
– front	54.875 to 54.930 mm (2.1604 to 2.1626 in)
– intermediate	54.375 to 54.430 mm (2.1407 to 2.1429 in)
– rear	53.875 to 53.930 mm (2.1210 to 2.1232 in)
Bushing interference fit in housing	0.070 to 0.150 mm (0.0028 to 0.0059 in)
Camshaft bushing fitted I.D. after reaming:	
– front	51.080 to 51.130 mm (2.011 to 2.013 in)
– intermediate	50.580 to 50.630 mm (1.9913 to 1.9933 in)
– rear	50.080 to 50.130 mm (1.9716 to 1.9736 in)
Camshaft journal diameter:	
– front	50.970 to 51.000 mm (2.0067 to 2.0079 in)
– intermediate	50.470 to 50.500 mm (1.9870 to 1.9882 in)
– rear	49.970 to 50.000 mm (1.9673 to 1.9685 in)
Camshaft journal clearance in bushing	0.080 to 0.160 mm (0.0031 to 0.0063 in)
Maximum wear clearance	0.20 mm (0.0079 in)
Camshaft end float (thrust plate to associated seat in camshaft)	0.070 to 0.220 mm (0.0028 to 0.0087 in)
Tappets	
Tappet O.D.	14.950 to 14.970 mm (0.5886 to 0.5894 in)
Tappet clearance in housing on engine block	0.030 to 0.068 mm (0.0012 to 0.0027 in)
– maximum wear clearance	0.15 mm (0.0059 in)
Tappet oversize	0.1-0.2-0.3 mm (0.004-0.008-0.012 in)

(cont.)

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VALVE GEAR

(continued)

Rockers	
Rocker bushing O.D.	21.006 to 21.031 mm (0.8270 to 0.8280 in)
Rocker bore diameter	20.939 to 20.972 mm (0.8244 to 0.7902 in)
Bushing interference fit in rocker	0.030 to 0.090 mm (0.0012 to 0.0036 in)
Rocker bracket bore diameter	18.016 to 18.034 mm (0.7093 to 0.7100 in)
Rocker shaft diameter	17.982 to 18.000 mm (0.7079 to 0.7087 in)
Rocker shaft clearance in bracket	0.016 to 0.052 mm (0.0006 to 0.0020 in)
– maximum wear clearance	0.15 mm (0.006 in)
Rocker spacer spring length:	
– free	59.5 mm (2.3425 in)
– under 46 to 52 N (4.7 to 5.3 kg, 10.4 to 11.7 lb)	44 mm (1.7323 in)
Valves, Guides and Springs	
Valve dimensions	see page 2, Section 102
Valve face angle	45° 30′ ± 7′
Valve clearance — Timing check	0.45 mm (0.0177 in)
Valve clearance — Normal (cold or warm) — inlet	0.25 mm (0.0010 in)
Valve clearance — Normal (cold or warm) — exhaust	0.35 mm (0.0138 in)
Cam lift — Inlet	5.250 mm (0.2067 in)
Cam lift — Exhaust	5.777 mm (0.2274 in)
Valve lift — Inlet	9.3 mm (0.3661 in)
Valve lift — Exhaust	10.2 mm (0.4016 in)
Valve guide O.D.	13.988 to 14.016 mm (0.5507 to 0.5518 in)
Valve guide oversize	0.2 mm (0.0079 in)
Valve guide interference fit in housing on cylinder head	0.005 to 0.050 mm (0.0002 to 0.0020 in)
Valve guide fitted I.D. after reaming	8.023 to 8.038 mm (0.3159 to 0.3165 in)
Valve stem clearance in guide	0.023 to 0.053 mm (0.0009 to 0.0021 in)
– maximum wear clearance	0.13 mm (0.0051 in)
Maximum valve stem eccentricity over one revolution with stylus on sealing face — inlet	0.03 mm (0.0012 in)
Maximum valve stem eccentricity over one revolution with stylus on sealing face — exhaust value	0.04 mm (0.0016 in)

(cont.)

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ENGINE: Specification and Data

VALVE ASSEMBLY

(cont.)

Inlet and exhaust valve spring length:	
– free	65.5 mm (2.579 in)
– valve closed, under 295 to 332 N (30.1 to 33.9 kg, 66.4 to 74.7 lb)	41 mm (1.614 in)
– valve open, under 472 to 511 N (48.1 to 52.1 kg, 106 to 115 lb)	30.8 mm (1.213 in)
Valve Timing Gears	
Timing gear backlash	0.08 mm (0.0031 in)
Idler gear jack shaft diameter	31.975 to 32.000 mm (1.2589 to 1.2598 in)
Idler gear bushing fitted I.D. after reaming	32.050 to 32.075 mm (1.2618 to 1.2628 in)
Jack shaft journal clearance in bushing	0.050 to 0.100 mm (0.0019 to 0.0039 in)
– maximum wear clearance	0.15 mm (0.0059 in)
Bushing interference fit in idler gear	0.063 to 0.140 mm (0.0025 to 0.0055 in)
Lift and power steering pump drive gear shaft diameter	36.975 to 37.000 mm (1.4557 to 1.4567 in)
Bushing fitted I.D. after reaming	37.050 to 37.075 mm (1.4586 to 1.4596 in)
Shaft clearance in bushing	0.050 to 0.100 mm (0.0019 to 0.0039 in)
Bushing interference fit in housing	0.063 to 0.140 mm (0.0025 to 0.0055 in)
Pump drive gear thrust washer thickness	1.45 to 1.50 mm (0.0571 to 0.0591 in)

LUBRICATION SYSTEM

Oil Pump	gear, camshaft driven
Oil pump drive ratio	2 to 1
Oil pressure, warm, at governed speed	2.9 to 3.9 bar (3 to 4 kg/cm^2, 42.6 to 56.9 psi)
Relief valve crack-off setting	3.5 bar (3.6 kg/cm^2, 51.2 psi)
Shaft clearance in bushing	0.016 to 0.055 mm (0.0006 to 0.0022 in)
Shaft clearance in driven gear	0.033 to 0.066 mm (0.0013 to 0.0026 in)
Gear backlash	0.100 mm (0.0039 in)
Gear clearance in pump body	0.060 to 0.170 mm (0.0024 to 0.0067 in)

(cont.)

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LUBRICATION SYSTEM *(continued)*

Drive and driven gear width	40.961 to 41.000 mm (1.6126 to 1.6142 in)
Gear housing depth in pump body	41.025 to 41.087 mm (1.6152 to 1.6176 in)
Drive and driven gear end float	0.025 to 0.126 mm (0.0009 to 0.0049 in)
Pressure relief valve spring length:	
– free	45 mm (1.77 in)
– closed, under 88 to 94 N (9 to 9.6 kg, 19.8 to 21 lb.) ..	30.5 mm (1.20 in)
Oil Filters	gauze on suction and main cartridge on delivery

COOLING SYSTEM

Water Pump	centrifugal, vane
Water pump drive ratio	1.407 to 1
Shaft interference fit in impeller	0.027 to 0.060 mm (0.0011 to 0.0024 in)
Shaft interference fit in fan hub	0.020 to 0.054 mm (0.0008 to 0.002 in)
Face sealing bushing interference fit in impeller	0.012 to 0.058 mm (0.0005 to 0.0023 in)
Thermostat	
Type	FLEXIDER or SAVARA or BEHR-THOMSON
Opening temperature	79 ± 2°C
Fully open at — FLEXIDER or SAVARA	94°C
Fully open at — BEHR-THOMSON	95°C
Valve travel when fully open	7.5 mm (0.295 in)
Radiator	vertical tube and steel fins, 3
Expansion tank	transparent plastic
Fan	suction, steel, 4-bladed
Water Temperature Gauge	three coloured sectors
Temperature range:	
– white sector	30° to 65°C
– green sector	65° to 105°C
– red sector	105° to 115°C

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FUEL SYSTEM

Feed Pump	double diaphragm
Operation	engine driven
Minimum fuel flow at 1.600 rpm shaft	100 litre/hour (22 Gall/hour)
Drive shaft eccentricity	3 mm (0.118 in)
Feed Pump Drive	
Shaft journal diameter	31.975 to 32.000 mm (1.2588 to 1.2598 in)
Bushing fitted I.D. after reaming	32.050 to 32.075 mm (1.2618 to 1.2628 in)
Shaft clearance in bushing	0.050 to 0.100 mm (0.0020 to 0.0040 in)
Bushing interference fit in housing	0.063 to 0.140 mm (0.0025 to 0.0055 in)
Inner washer thickness	1.450 to 1.500 mm (0.0025 to 0.0055 in)
Outer washer thickness	2.930 to 3.000 mm (0.1153 to 0.1181 in)
Injection pump	distributor, integral governor and advance device
Type — BOSCH	EP/VA3/110H1300 CL: 134-8-770798
Type — C.A.V.	DPA3233 F420-770535
Direction of rotation	anticlockwise
Firing order	1-2-3
Fuel injectors:	
– type — FIAT	EPPZ10F1 - 770577
– type — BOSCH	EPPZ50F3 - 771064
– type — C.A.V.	EPPZ60F3 - 770897
– type — O.M.A.P.	EPPZ70F3 - 770957
– FIAT — nozzle holder	KB70S1F10 - 767107
– FIAT — spray nozzle	DLL140S64F - 770578
– BOSCH — nozzle holder	KBL70S177/4 - 771065
– BOSCH — spray nozzle	DLLA141S662 - 771066
– C.A.V. — nozzle holder	BKBL69S5376 - 770899
– C.A.V. — spray nozzle	BDLL140S6655 - 770902
– O.M.A.P. — nozzle holder	OKLL70S2974 - 770958
– O.M.A.P. — spray nozzle	OLL140S64F - 770959
Number of spray orifices	3
Spray orifice diameter	0.35 mm (0.0140 in)
Release pressure	221 to 230 bar (225 to 235 kg/cm^2)
Delivery pipes:	
– type — with pump BOSCH	PRR25F15Z - 767452
– type — with pump C.A.V.	PRR11F15Z - 768356
– pipe size — with pump BOSCH	1.5 x 6 x 427 mm (0.006x0.24x17.0800 in)
– pipe size — with pump C.A.V.	2 x 6 x 427 mm (0.08x0.24x17.0800 in)

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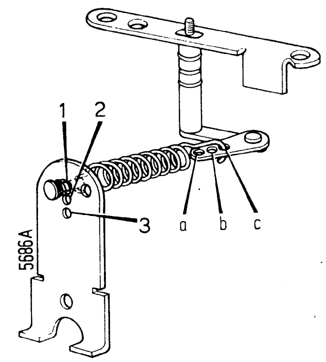
MODEL 446-446 DT - CALIBRATION DATA - CAV INJECTION PUMP TYPE DPA 3233 F 420 - 770535

ASSEMBLY DATA

Pump rotation (drive end) .... Anti-clockwise
Firing order 1-2-3
Governor control stud to metering valve lever pin $54 \pm ^{0}_{1}$ mm (2.12 $\pm ^{0}_{0.04}$ in)
Roller spacing .... 50.03 mm (1.97 in)
Pump timing: 17° ± 1° B.T.D.S., cylinder No. 1 in compression stroke.
External timing mark degree position with respect to shaft key (on tool **290757**). 268°
Delivery connection of cylinder No. 1. Marked with letter W.



Governor Spring Attachment Position on Control Arm 1 and c.

TEST PLAN

Procedure A

BOSCH test machine with WSF 2044/4X injector springs and EFEP 182 spray nozzles.
RABOTTI test machine with FIAT **656829** injector springs and EFEP 182 spray nozzles.
Release pressure .... 171.6 bar (175 kg/cm^2) 2483 psi
Pipes .... 2x6x865 mm

Procedure B

Test machine incorporating injector bodies and nozzles as fitted to the engine.
Release pressure .... 221 to 230 bar (225 to 235 kg/cm^2, 3200 to 3343 psi)
Pipes .... 2x6x700 mm
Calibration fluid .... FIAT CFB at 30° + 5°C
Fuel pressure ...... 0.2 bar (0.2 kg/cm^2, 2.8 psi)

Test No.	Lever Position L1 = Throttle L2 = Shut-off	Speed rpm	Transfer pressure bar (kg/cm^2)	Advance degrees	PROCEDURE A Injector delivery cm^3/1000 shots	PROCEDURE A Back leakage cm^3/100 shots	PROCEDURE B Injector delivery cm^3/1000 shots
1-2	—	100	1.2 to 1.8	—	—	—	—
3	—	800	—	3 to 4	—	—	—
4	—	1300	—	5.8 to 6.3	—	—	—
5	—	180	—	1.2 to 1.5	—	—	—
6 (1)	—	300	—	0	—	—	—
7 (2)	—	900	—	5.8 to 6.3	—	—	—
8-9 10 (3)	L1 = Full L2 = Out	1300 $^{+0}_{-20}$	5 to 6	—	51 to 54 (0)	min 14	48.5 to 51.5 (0)
11-12		800 ± 5	3.8 to 4.6		46.5 to 49.5 (0)	—	52 to 54 (0)
13 (1)		100	—	—	min 44	—	—
14	L1 = Full L2 = In	200	—	—	max 4	—	—
15 (3)	L1 = Idle L2 = Out	200	—	—	max 5	—	—
16 (4)	L1 = Full L2 = Out	1370	—	—	max 9	—	—
17 (5)		1300 $^{+0}_{-20}$	—	—	51 to 54	—	—

(0) Max. spread 4 cm^3/1000 shots
(1) Manual start-retard activated
(2) 3-cylinder engine only
(3) Back off throttle lever adjusting screws fully
(4) Governor cut-in. Adjust maximum speed screw
(5) Recheck fuelling.

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MODEL 446-446 DT - CALIBRATION DATA - BOSCH INJECTION PUMP TYPE EP/VA3/110 H 1300 CL - 134 - 8 - 770798

ASSEMBLY DATA

Direction of rotation (drive end) . . Anti-clockwise
Firing order 1-2-3
Rotor stroke to spill cut-off . . . . 0.7±0.02 mm
Pump timing: 10° ± 1° B.T.D.C., cylinder No. 1 in compression stroke.
Preloaded shuttle spring length. —
Delivery connection to cylinder No. 1: marked with letter A.

TEST PLAN

Procedure A

Bosch test machine with WSF 2044/4X injector springs and EFEP 182 spray nozzles.

RABOTTI test machine with FIAT 656829 injector springs and EFEP 182 spray nozzles —
Release pressure 147.1 bar (150 kg/cm², 2133 psi)
Pipes . . . . 2x6x840 mm

Procedure B

Test machine with injector bodies and nozzles as fitted to engine.
Release pressure . . . . 221 to 230 bar (225 to 235 kg/cm², 3200 to 3343 psi)
Pipes: . . . . 1.5x6x700 mm
Calibration fluid . . . . FIAT CFB at 40°+5°C (for lower test temperatures add 0.25 cm³/1000 shots to each degree)
Fuel pressure . . . . . . 0.2 bar (0.2 kg/cm², 2.8 psi)

Test No.	Lever position L_1 = shuttle L_2 = throttle	Speed rpm	Transfer pressure bar (kg/cm²)	Advance piston stroke (*) mm	PROCEDURE A		PROCEDURE B	
					Injector delivery cm³/1000 shots	Back leakage cm³/100 shots	Injector delivery cm³/1000 shots	Back leakage cm³/100 shots
1	L_1 = shut-off L_2 = full	700±5	–	–	0	–	0	–
2	L_1-L_2 = full	700± 5	–	–	58 to 60	–	51 to 53	–
3	L_1-L_2 = full	1370	–	–	32 to 40	–	25 to 33	–
4	–	100	0.6 to 1.1	–	–	–	–	–
5		700±5	4.5 to 5	–	–	–	–	–
6		1300	6.7 to 7.2	–	–	–	–	–
7	L_1-L_2 = full	250	–	–	57 max.	–	54 max	–
8	L_1-L_2 = full	100	–	–	130 min.	–	130 min.	–
9	–	250 to 400	–	0 (start)	–	–	–	–
10		700 ± 5	–	3.5 to 4.5	–	–	–	–
11		1050 to 1100	–	6.8 (end)	–	–	–	–
12	L_1 = full	1450 to 1500	–	–	0	–	0	–
13	L_2 = full (1)	1370	–	–	32 to 40	–	25 to 33	–
14	L_1 = full (2) L_2 = full	$1300 \pm^{0}_{20}$	–	–	53 to 55 (°)	–	49 to 51 (°)	–
15		1000	–	–	–	30 to 55	–	30 to 55
16		700 ± 5	–	–	58 to 60	–	51 to 53	–
17		500 ± 5	–	–	55 to 57	60 to 90	51 to 53	60 to 90
18	L_1 = full	400 to 500	–	–	0	–	0	–
19	L_2 = idle (3)	350	–	–	12 to 22	–	10 to 18	–

(*) Using tool 292817.
(°) Max. spread 2.5 cm³/1000 shots
(1) Adjust max. speed screw
(2) Adjust max. fuel screw
(3) Adjust idling speed screw

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TIGHTENING TORQUE FIGURES

DESCRIPTION	Thread Size	Tightening torque figures		
		Nm	kgm	ft lb
Engine block and Cylinder Head-Valve Gear-Crank Gear (Sect. 10)				
Capscrew, cylinder head (C_1, page 12)	M 12x1.25	147	15	108
Capscrew, rocker bracket (C_2, page 12)	M 8x1.25	23	2.3	16.5
Nut, rocker bracket	M 8x1.25	23	2.3	16.5
Capscrew, timing cover and case (C_3, page 12)	M 8x1.25	23	2.3	16.5
Capscrew, main bearing caps (C_4, page 12)	M 14x1.25	147	15	108
Capscrew, connecting rod caps (C_5, page 12)	M 12x1.25	88	9	65
Capscrew, flywheel (C_6, page 12)	M 12x1.25	118	12	87
Nut, crankshaft pulley hub (C_7, page 12)	M 30x1.5	294	30	217
Cap screw, fan and alternator drive pulley (C_9, page 12)	M 10x1.25	49	5	36
Fuel system				
Nut, injection pump shaft gear:				
– BOSCH	M 12x1.75	64	6.5	47
– C.A.V.	9/16"18 UNF	81	8.3	60
Nuts, injection pump to support	M 8x1.25	23	2.3	16.5
Thermostarter spark-plug	1/2 GAS	66	6.7	48.5
Adapter, spark-plug to thermostarter reservoir	3/8" -24 UNF-2B	13	1.3	9.4

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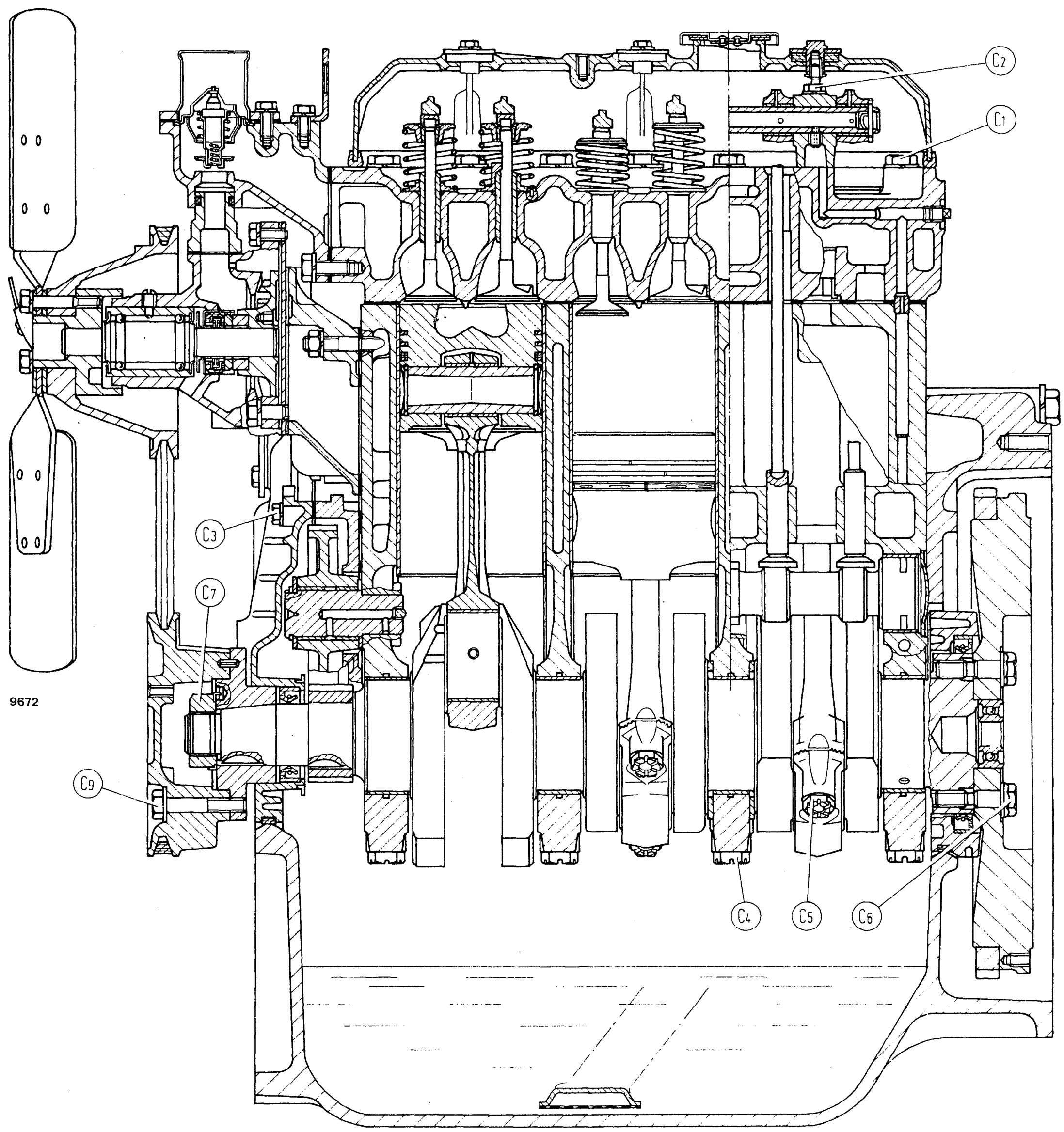
ENGINE: Longitudinal Section



TIGHTENING TORQUE FIGURES

C_1	=	147 Nm	(kgm 15)
C_2	=	23 Nm	(kgm 2,3)
C_3	=	23 Nm	(kgm 2,3)
C_4	=	147 Nm	(kgm 15)
C_5	=	88 Nm	(kgm 9)
C_6	=	118 Nm	(kgm 12)
C_7	=	294 Nm	(kgm 30)
C_9	=	49 Nm	(kgm 5)

Longitudinal Section through 446 and 446 DT Engines

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DESCRIPTION

FIAT engines installed on 466, and 466DT models are high-speed, 4-stroke, direct injection, in-line Diesel units.

Engine block — Single iron casting, dry sleeve, crankshaft, camshaft and valve tappet seats.

Cylinder head — integral valve seats.

Valve gear — Pushrod operated valves, helical gear driven camshaft.

Crank gear — Crankshaft running on 4 bearings 3-ring light alloy piston. (One compression ring and two oil scraper rings).

Air induction system — Through oil-bath or dry air cleaner.

Fuel system — Rotating distributor injection pump, three-orifice injectors.

Lubrication system — Forced-feed, gear pump, full-flow oil filter and pressure relief valve.

Cooling system — Water, centrifugal pump, wax thermostat.

Engine starting — 12 V, electromagnetically operated starter and thermostarter (if applicable).

ON-BENCH PERFORMANCE DATA

Test plan

Engine without fan, air cleaner and exhaust silencer.
Barometric pressure 740 ± 5 mm Hg at 239 metres (785 ft) above sea level.
Ambient temperature: 20 ± 3 °C.

R. H. 70% ± 5.
Fuel density, 830 ± 10 g/l.
Pump timing, B.T.D.C. cylinder No. 1 on compression stroke:

– BOSH . . . . 10° ± 1°
– C.A.V. . . . . 17° ± 1°

BOSCH injection pump

Throttle	rpm	kW		Time to burn 100 cm³ (6.1 cu. in) of fuel (seconds)
		2-hour run-in	50-hour run-in	
Maximum, full load	2600	⩾ 35.3 (48 Hp)	⩾ 37.5 (51 Hp)	⩾ 32.4
Maximum, full torque	1400	⩾ 20.6 (28 Hp)	⩾ 22.8 (31 Hp)	⩾ 53.8
Maximum, no-load	⩽ 2960	–	–	–
Minimum, no-load	650 to 700	–	–	–

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ENGINE: Performance Data - Compression Test

C.A.V. injection pump

Throttle	rpm	kW		Time to burn 100 cm³ (6.1 cu. in) of fuel (seconds)
		2-hour run-in	50-hour run-in	
Maximum, full load	2600	⩾ 35.7 (48,5 Hp)	⩾ 37.5 (51 Hp)	⩾ 31.5
Maximum, full torque	1600	⩾ 24.3 (33 Hp)	⩾ 25.8 (35 Hp)	⩾ 47.8
Maximum, no-load	⩽ 2800	–	–	–
Minimum, no-load	650	–	–	–

COMPRESSION TEST

If engine perfomance is found to be unsatisfactory, check the injection system (nozzle and injection pump overhaul) and the compression in each cylinder.

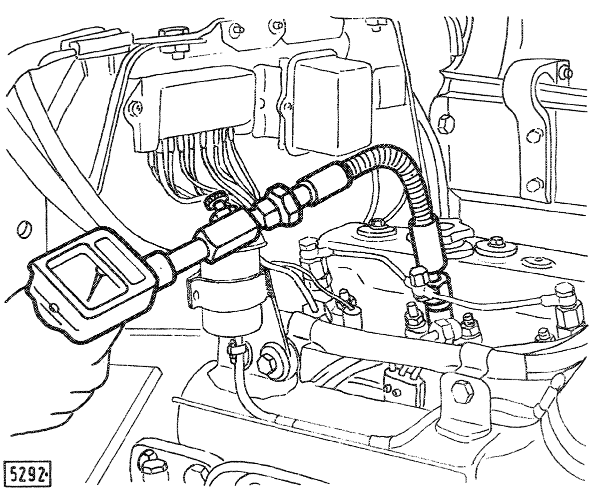
To check engine compression use tester **291309** proceeding as follows:

- Remove the fuel injectors;
- Fit dummy injector **292631**, in place of the injector of the cylinder under test, together with the associated copper washer;
- Hold the injection pump in shut-off condition and take the readings cranking the engine through the starter.

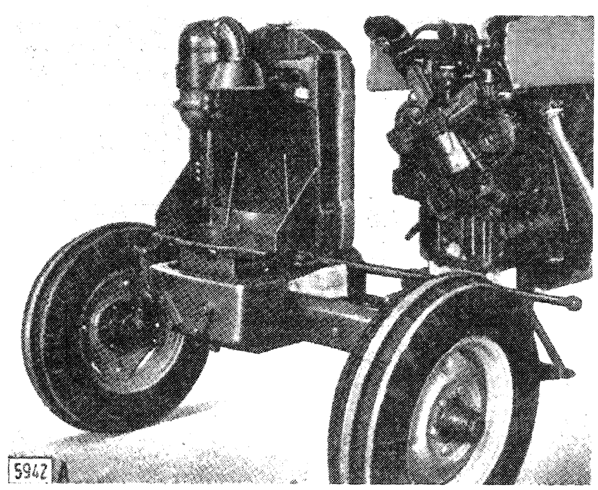
Compression should be 25.5 to 27.5 bar (26 to 28 kg/cm², 370 to 398 psi) as recorded at 40°C sump oil temperature, 760 mm Hg (sea level) barometric pressure with the engine running at 200 to 280 rpm.

The minimum acceptable compression is 21.6 bar 22 kg/cm² (330 psi).
The maximun compression differential between cylinders must not exceed 3 kg/cm² (24.7 psi).
In this connection it should be noted that every 100 metres (328 ft) altitude increase from sea level results in approximately 1% decrease in compression.
Insufficient compression may be due to faulty valves and seats, pistons and associated rings, sleeves or cylinder head gaskets.

Note – The purpose of the compression test is merely to assess the consistency of compression in the cylinders and obtain an indication of the degree of wear affecting the parts which help to seal the combustion chambers, and the results should not be taken as an absolute indication of engine efficiency.



Checking engine compression using test 291309



Removing (installing) front axle

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REMOVAL

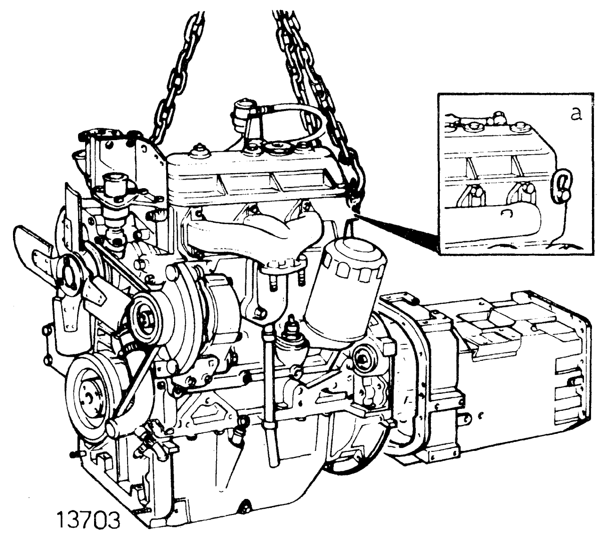
Tilt the hood, disconnect the negative battery lead and drain cooling system by the corresponding drain cock and on the power steering unit. Disconnect power steering hoses and piping: disconnect tractor-meter angle drive lead, throttle link and engine shut off cable, linkage connecting the LH clutch - PTO, disconnect fuel lines, disconnect starter and alternator and connections to the electrical system.

Then disconnect the lift suction and delivery lines from the hydraulic pump on the motor, scavenge line and corresponding muffler, front drive shaft and its guard (only on all-wheel drive versions).

Remove tilt hood, fuel tank assy together with rear mounting assy and support for power steering unit.

Place a jack under the transmission case, disconnect radiator assy and air cleaner, removing the rubber elbow clamps and removing the drag link.

Place a jack under the engine sump and insert two wooden wedges between front axle and associated carrier, unbolt the axle carrier or live front axle from the sump and separate the axle or live axle assy from the engine as shown in the figure on page 2, taking care to avoid any damage to the cooling fan.



Removing (installing) engine using lifting tackle 290740

a. Rear LH detail of cylinder head (arrow indicating identification marking of type clutch fitted).

Drain oil from sump, connect engine to hook of lifting tackle **290740/1** as shown in the figure, undo the nuts and bolts securing the engine to the gearbox and then separate the two.

Remove engine sump and secure engine to rotary stand **290090** using universal bracket **293002/2**.

INSTALLATION

Reverse the removal procedure and note the following points:

- when mating engine and gearbox mesh the transmission and the PTO clutch at splines without forcing;
- strictly adhere to the specified tightening torque requirements.

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CYLINDER SLEEVES

To inspect for wear proceed as follows:

- measure the sleeve bore diameter over the swept area (X).
- the diameter reading should be taken in both the upper and lower part of the swept area in plane (a) parallel to the crankshaft and in plane (b) at right angles to it.
- compare the readings to establish the amount of sleeve ovality and taper.

To check the piston working clearance measure the liner bore diameter over (Z) in plane (b) only.

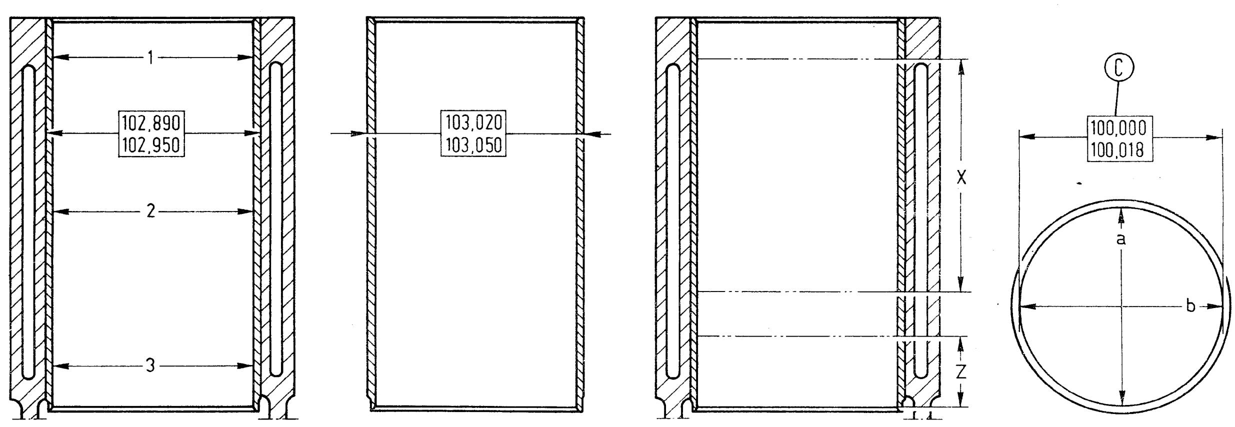
If ovality or taper in excess of 0,12 mm(.0048 in), or piston working clearance in excess of 0,3 mm (.012 in) is detected, rebore (or renew) the sleeves to the oversize values envisaged (see table on page 1, Section 10).

After machining, check the size by taking 2 dial gauge readings at right angles (a and b, page 1) and at 3 depths (1, 2 and 3).

Subsequently, fit replacement pistons of suitable size and weight (see page 3, section 10).

For sleeve removal and installation, do not heat sleeves, use a suitable press and proceed as follows:

- withdraw the worn sleeve from the bottom of the engine block using plate **292507**;
- check engine block bore ovality and if necessary rebore to 0,2 mm (0.008 in) oversize;
- Press a new sleeve (0,2 mm oversize if necessary) from the top of the block using plate **291501**;
- Ream the sleeve to the specified diameter.



9763A

Sleeve and Block inspection Data

a, b. Sleeve bore measurements at right angles — C. Sleeve fitted bore diameter (see table, page 1, Section 10) — Z. Sleeve wear inspection length for assessment of piston fit on plane a at right angles to crankshaft - X. Sleeve wear inspection length (swept area) for assessments of ovality and taper on planes a and b — 1, 2, 3. New or re-bored sleeve bore measuring depth on planes a and b.

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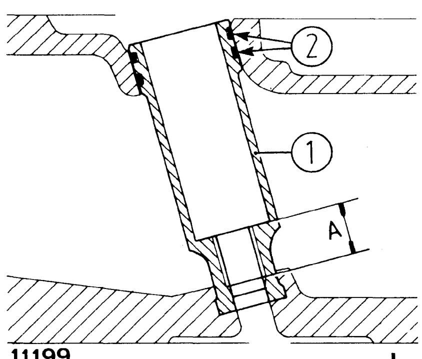
CYLINDER HEAD

The cylinder head face may be skimmed if necessary, removing not more than 0.5 mm (0.02 in).

After skimming, check that fuel injector projection is as specified in the illustration. If projection is more than 1.8 mm (0.071 in) replace injector sleeve (1, fig. b) as follows:

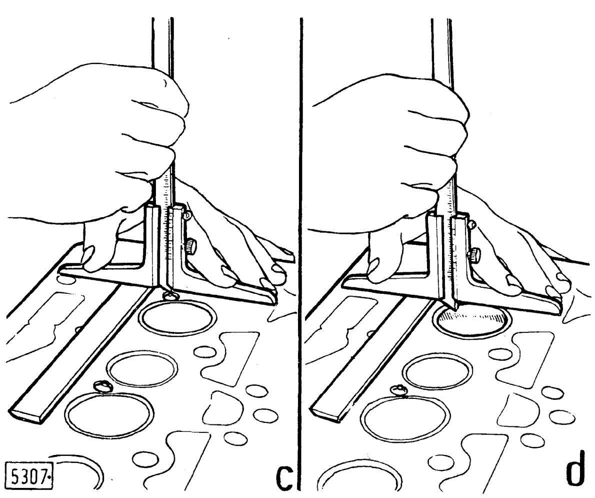


Section through injector Sleeve

A = 15 mm (0.59 in) depth of thread (M 12x1.75) for sleeve removal - 1. Sleeve - 2. O-rings.

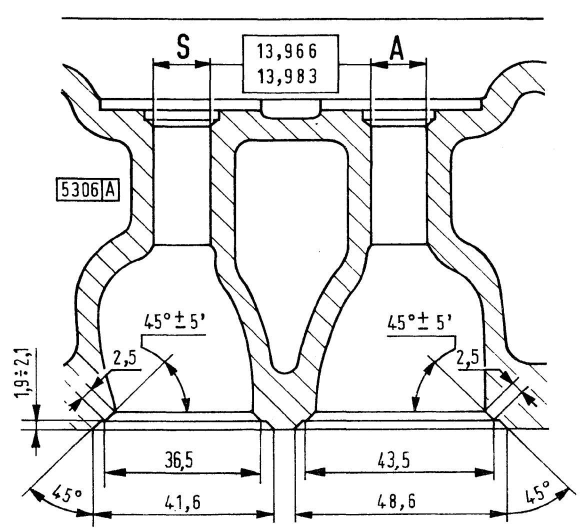
For that exchang do as follows:

- thread inner seat of old sleeve using M 12 x 1.75 taps for 15 mm (0.59 in) (A, fig. b);
- secure tool **293784 (A 342137)** (B, fig. e, page 3) to cylinder head by tightening M 8 x 1.25 nuts (E) on injector retaining studs;
- fully tighten part (C) on thread and turn nut (D) to remove sleeve (1) from cylinder head;
- install O-rings (2, fig. f) on sleeve, insert sleeve in housing and ensure that lower part contacts seat in cylinder head. Burnish using tool **293386/1** (F, fig. f);
- position bushing (G) **293746** in new sleeve (1, fig. g). Secure bushing in seat by tightening part (H) anticlockwise, insert dresser (1) **293747** in bushing (G) and dress bottom of sleeve;
- insert cutter (L, fig. h) **293748** in bushing (G), position bushing in sleeve (1) and secure by tightening part (H) anticlockwise;
- using cutter, remove material until seat is perfectly smooth and free form burrs or tool marks;



Checking fuel injector projection and valve seating

c. Injector projection 1 to 1.5 mm (0.039 to 0.059 in) (Max. 1.8 mm 0.071 in) - d. Valve seating 0.7 to 1.1 mm (0.028 to 0.044 in) (Max. stand-in seating 1.4 mm - 0.055 in).



Valve seat and guide housing dimensions.

A. Inlet - S. Exhaust.

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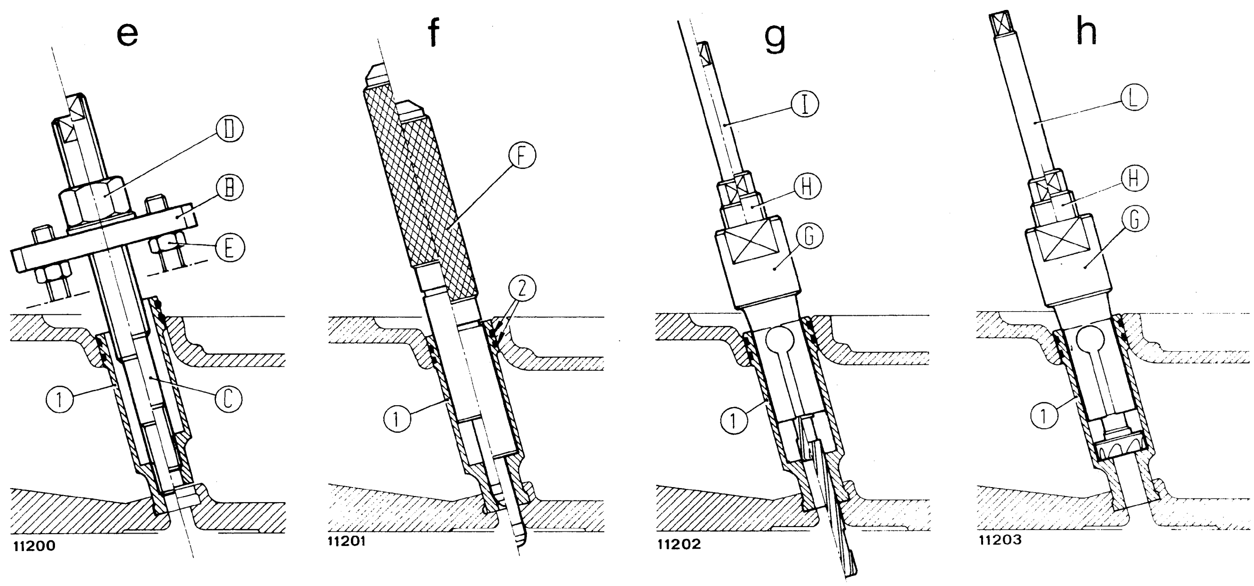


Removing (e) installing (f) and dressing (g, h) sleeve on cylinder head using set 293742/1.

B, C, D. Sleeve puller **293784 (A342137)** - E. Injector nuts M 8 x 1,25 - F. Burnisher **293386/1** - G, H. Guide bushing **293746** - **I.** Dresser **293747** - L. Cutter **293748** - 1. Sleeve - 2. O-rings.

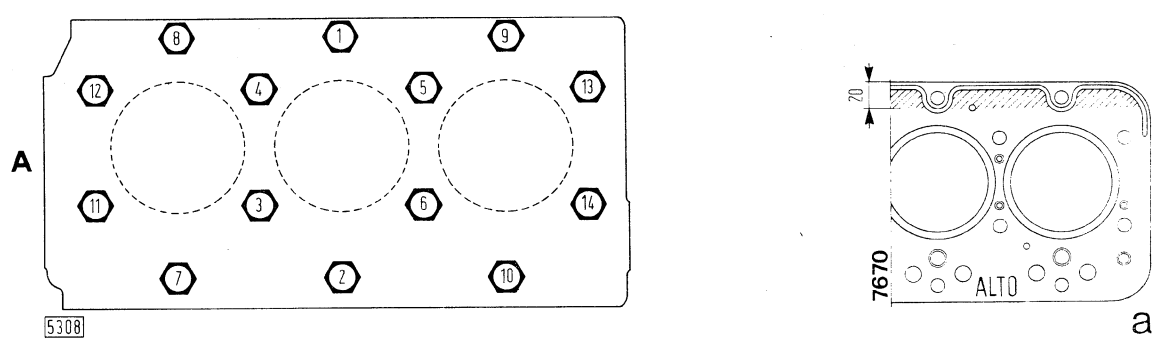
– insert injector in sleeve (1) and check that stand-out is 1 to 1.5 mm (0.04 to 0.06 in) (fig. c. page 2).

To recut the valve seats, use fixture **A. 60041 (291113)** and hand lathe **A. 60419 (292913)** alternatively set of milling cutters **291978.**

Check that valve seating is as shown in figure (d) on page 2.

When installing the cylinder head, thoroughly clean the mating surfaces and reposition the head gasket noting the following points:

– place the gasket (provided with adhesive face) on the block with the mark "ALTO" facing towards the cylinder head (page 4). Replace the cylinder head and tighten the retaining bolts to the correct torque in the order shown (see note a on page **4**).



Cylinder head bolt tightening sequence and detail of cylinder head gasket (a).

A = Fan end.

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ENGINE: Cylinder Head

NOTE

- Shaded area of gasket (see detail a, figure on page 3) bordered by the mm indication is the adhesive surface already provided in production.

- The required cylinder head cap screw tightening torque must be obtained in three phases as indicated in the adjacent table.

Phase	Nm	kgm	ft/lbs
1st	49	5	36
2nd	98	10	72
3rd	147	15	108.5

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CAMSHAFT

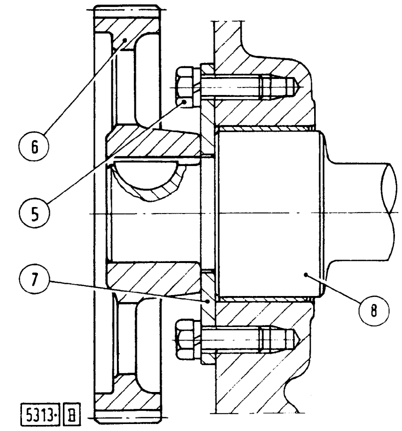
To remove the camshaft back off screws (5) securing thrust plate (7).

To inspect, place the camshaft on V-blocks and check journal eccentricity using a suitable dial gauge. Maximum allowance is 0,02 mm (0,0008 in).

To straighten the camshaft use a press for up to 0,2 mm (0,008 in) distortion. If distortion exceeds 0,2 mm (0,008 in), replace the camshaft.

Replace worn bushings using suitable pullers and installation tools. Such as series **292103.**

After installation, the new bushings must be reamed to size shown in figure, using reamer **A. 390363 (293269).**



Section through Camshaft Drive

5. Retaining screw for plate (7) - 6. Drive gear - 7. Thrust plate - 8. Camshaft.

VALVES, GUIDES AND SPRINGS

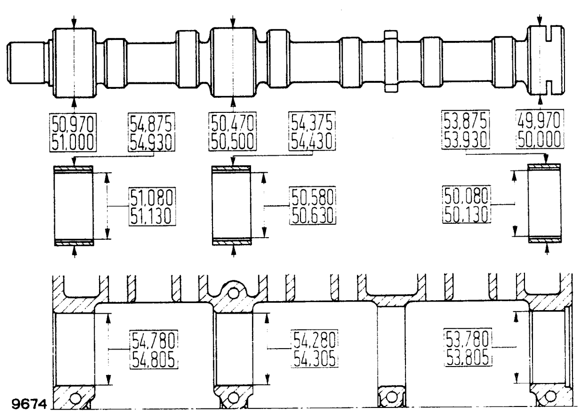
To remove and install the valves use tool **291050.**

If sealing is defective grind valves together with seats using air grinder **290064** or hand grinder **290891**. If necessary, re-cut the valve seats as directed and grind the valves (page 2).

After grinding, check that the minimum depth below valve head chamfer is not less than 0,5 mm (0,020 in).

To remove and install the valve guides, use driver **291046/1** as shown on page 2 and socket **291780.**

Valves guides should require only light pressure to fit in their housings. If loose, they should be renewed using oversize guides.



Camshaft, journal and housing details.

Note - Bushings fitted I. D. given.

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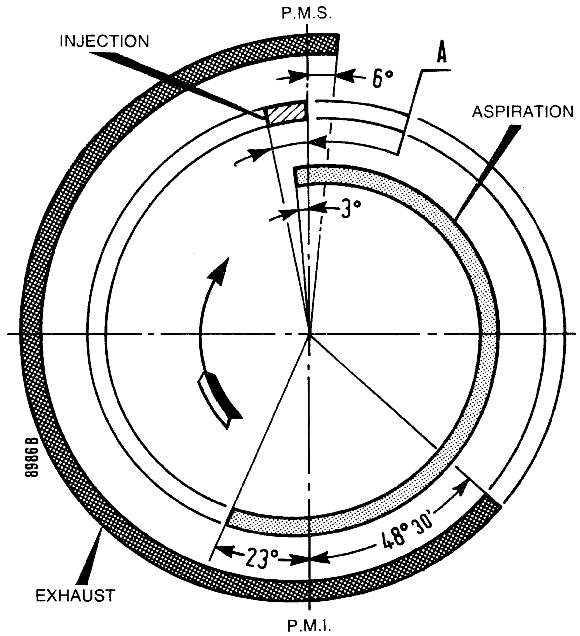
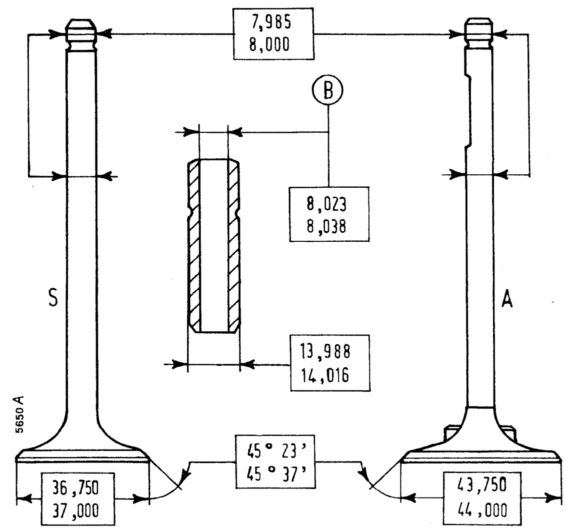


Valve timing diagram

a. Static advance according to injection pump type and tractor model (see section 100, page 1).

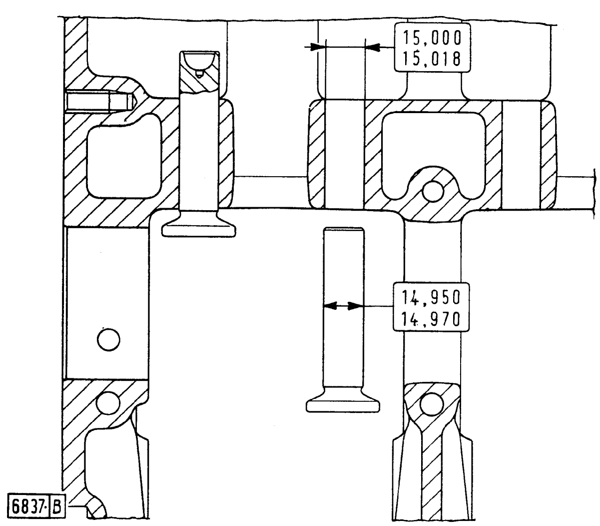


Valve and guide details (mm).

A. Inlet - B. Fitted diameter after reaming - S. Exhaust.

After installation each guide should be reamed with tool **291177** as shown.

Note – Fit valve springs noting that the closer windings must face the cylinder head.

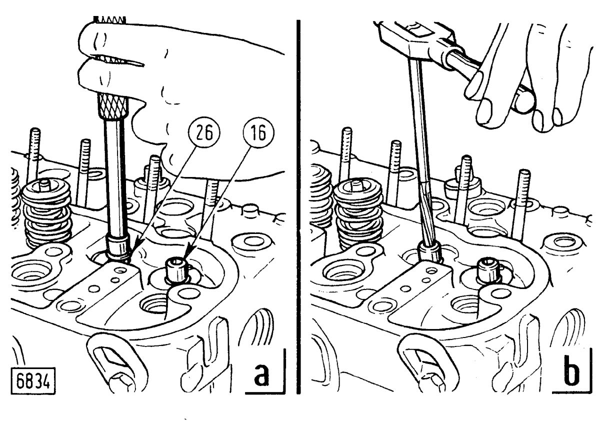


Tappet and housing details (mm).

TAPPETS, PUSHRODS AND ROCKERS

Ensure that the tappets slide smoothly in their housings without excessive clearance.

If excessive clearance is detected, replace with oversize tappets and open out the associated housing bores.



Installing and reaming valve guide (16).

a. Pressing guide using driver **291046/1** - b. Dressing guide bore using dresser **291177** - 26. Retaining ring.

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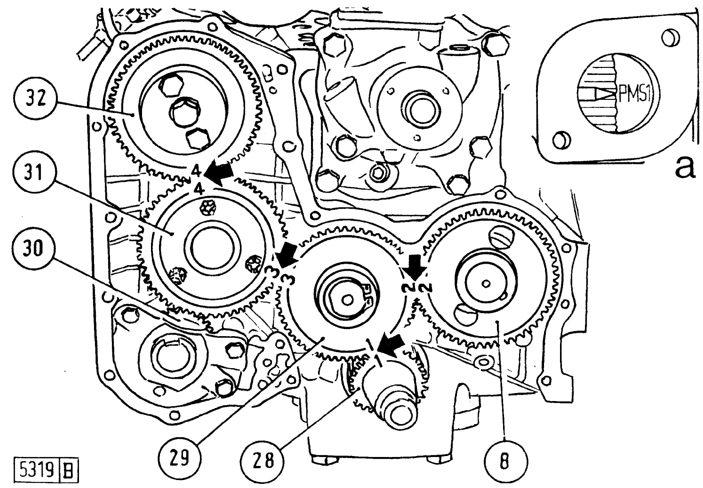
Valve timing

Note — Arrows point to timing marks to line up with piston No. 1 at T.D.C. on compression stroke (insert a).

a. Flywheel timing mark "P.M.S.1" and pointer - 8. Camshaft gear - 28. Crankshaft pinion - 29. Idler gear - 30. Lift pump gear - 31. Fuel pump drive gear - 32. Injection pump drive gear.



The pushrods should be perfectly straight and the rocker screw seat should not show signs of pick-up or undue wear. Replace as necessary.

Prior to removing the rocker end brackets take off the bracket-to-shaft retaining screw.

Inspect the rocker and screw working surfaces. When dressing becomes necessary, remove as little material as possible.

— Adjust other valves bearing in mind that T.D.C. mark is not the same for pistons No. 2 and 3. In balance position mark flywheel or pulley.

Valve clearance adjustment

To adjust, use feeler gauge and wrench **291883**. For the correct clearance see table, section 10, page 5.
To adjust proceed as follows:

— Turn the crankshaft to bring piston No. 1 to T. D.C. position (inlet) as shown by flywheel timing mark "P.M.S.1";

— turn the cranshaft through 360° and check that valve clearance is as shown on table (page 5, section 10);

VALVE TIMING GEAR TRAIN

For valves timing, proceed as follows:

— turn the crankshaft to bring piston No. 1 to C. position on compression stroke;

— Install the drive gears and align as indicated.

For valve timing check during overhaul, adjust valve clearance provisionally to 0.45 mm (0.018 in). Turn crankshaft and, using an angle gauge, check that valve opening and closing angles are as specified in the diagram on page 2.

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CRANKSHAFT

Remove the pulley hub using tool **291504.**

Carefully inspect the crankshaft. Remember that even the slightest crack necessitates crankshaft replacement.

Check both main journals and crankpins noting the following points:

- Pick-up and scratch marks may be remedied using extra-fine emery paper;
- Score marks, ovality and taper in excess of 0.05 mm (0.002 mm), necessitate journal dressing to the nearest undersize dimension (see table).

After dressing blend the journal fillet radii as shown in (c) and (d) and inspect the crankshaft to ensure that:

- journal ovality does not exceed 0.008 mm (0.0003 in);
- journal taper does not exceed 0.01 mm (0.0004 in);
- maximum main journal misalignment with the shaft over V-blocks does not exceed 0.10 mm or 0.004 in (D, page 2);
- maximum misalignment of crankpin centerlines with respect to main journals does not exceed ± 0.25 mm (± 0.010 in)(a, fig. on page 2);
- the distance from top of crankpin to crankshaft centerline does not exceed ± 0.10 mm (± 0.004 in);
- Run-out and eccentricity, as measured with the dial gauge stylus at (A) and (B) respectively, does not exceed the limits specified in the table on page 2, section 10.

Check the core plugs for leakage with oil at 14.7 bar, 15 kg/cm², 230 psi. Replace core plugs as necessary, peen in position and recheck for leakage.

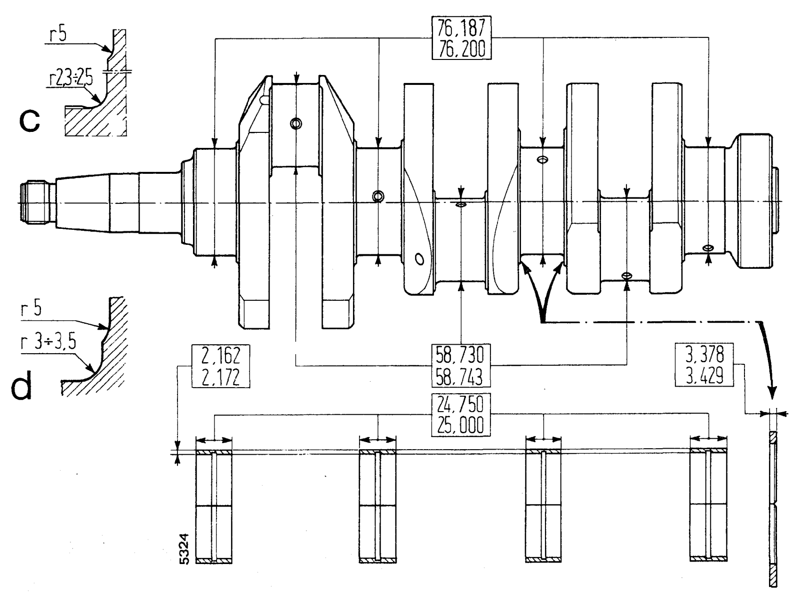
After installing the crankshaft and tightening the bearing caps, check the end float at the last but one cap. If play is excessive (see table) install oversize thrust washers.

Crankshaft front and rear seals

Check the metal-caged, double-lip spring-loaded rubber seals (fig. on page 12, section 10).

When replacing the seals note the following points:

- wipe off all traces of oil and thoroughly clean the seal seat.



Normal dimensions (mm) of crankpins, journal bearings and thrust washers

c. Crankpin fillet detail - d. Journal fillet detail

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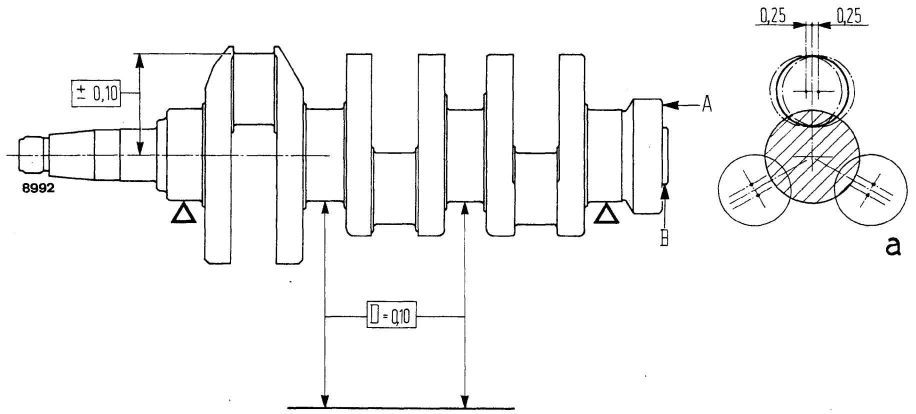
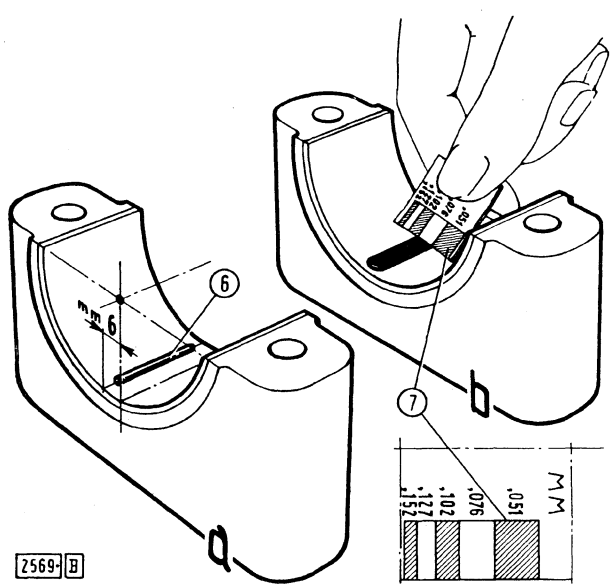
ENGINE: Crank Gear



Checking main journal (a) and crankpin alignment.

A and B. Stylus positions for flange runout and eccentricity check - D. Maximum main journal misalignment.

- soak the seal in engine oil for 30 minutes and install, applying a steady even pressure all round using a suitable drift;
- smear the lips with a film of thick oil and pack the cavity with grease to prevent the seal from running dry when the engine is started for the first time.



Checking crankshaft journal running clearance

a. Calibrated wire in position on bearing cap - b. Comparing width of compressed calibrated wire with reference scale - 6. Calibrated wire - 7. Graduated scale printed on wire container.

MAIN AND BIG END BEARINGS AND CAPS

The bearing caps fitted with thin shell bearing are numbered for correct installation.
The cap identification number should tally with that stamped on the engine block.

The crankshaft bearing running clearance may be checked using "Perfect Circle·Plastigage" calibrated wire (see figure below).

PISTONS AND RINGS

Assess piston and sleeve wear as directed on page 1, section 101, in the figures on page 1-section 101 and on page 3.

If the clearance is found to be in excess of 0.30 mm (0.012 in), rebore the sleeves and fit oversize pistons and rings (see table).

When replacing pistons, note that the weight difference between pistons of the same engine should not exceed 20 grams (2/3 oz).

To remove and install piston rings use tool **291160**.

Check that ring side clearance (b, page 3) and fitted gap (c) do not exceed specified limits. If less, the gap can be increased by grinding.

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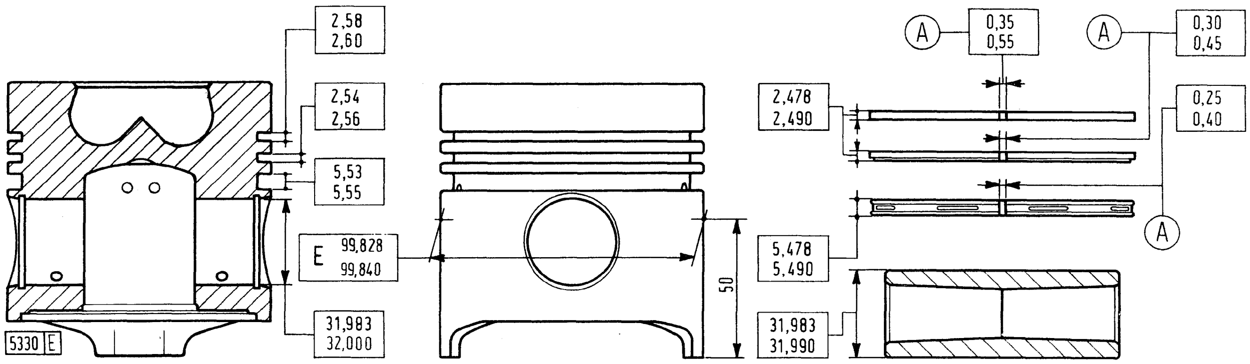


Piston, pin and ring dimensions in mm.

A. Piston ring fitted gap - E. Piston diameter as measured 50 mm (2 in) from base of skirt.

Install the rings in the order shown in the figure above.

When inserting the pistons in the cylinder sleeves ensure that the ring gaps are staggered at 180° from one another.

CONNECTING RODS

Check the small end bushing for looseness and displacement. They should be flush with connecting rod sides.

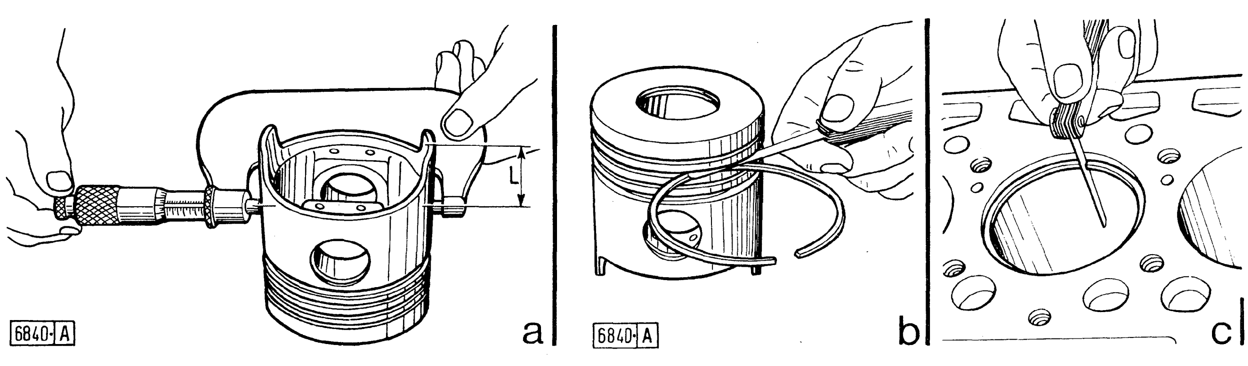
If necessary, replace bushings or open out bushings and piston hubs to the specified piston pin oversize (see table).

In this case the same oversize must be obtained also for the piston bosses.

Use gauge **293459** to check connecting rod axis alignment. Maximum misalignment of big and small end axis at 125 mm (5 in), away from the rod centreline, should be as specified in the table. Any slight distortion may be remedied using a suitable press; however, if distortion is serious, replace the connecting rod.

Replacement rods should be stamped with the reference numbers of the cylinder to which they belong. Also ensure that the weight difference between rods of the same engine does not exceed 25 grams (1 oz).

Ensure that the connecting rod lubricating ports (L and M fig., page 4) are unobstructed.



Inspecting pistons and rings.

a. Measuring piston diameter at distance (L) from base of skirt - b. Measuring piston ring side clearance c. Measuring piston ring gap - L. Measuring distance from skirt base, 50 mm (2 in)

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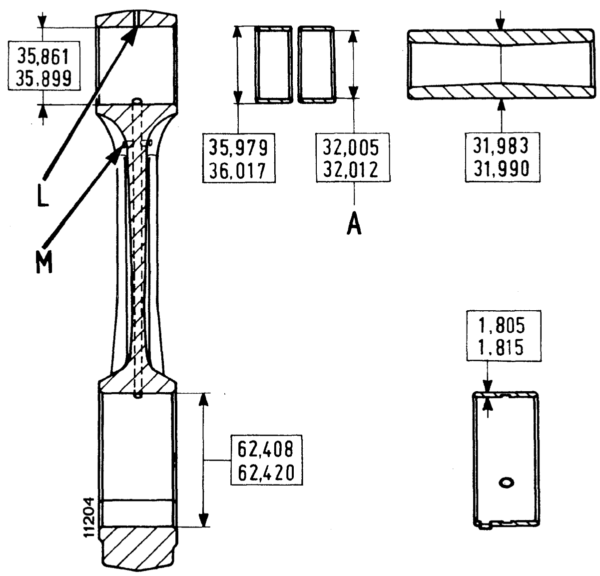

Connecting rod, bearing, bush and piston pin dimensions (mm).
A. Dressed requirement with bushes fitted - L and M Lube oil drillings

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Note – When disassembling connecting rods, scrap and replace the cap capscrews.

Connecting rod/piston installation

Introduce the pistons with attached rings and connecting rods in the associate sleeves, preferably using ring compressor **291048**, and positioning each assembly so that reference mark on the connecting rods face towards the side opposite the camshaft.

Installed piston T.D.C. stand-out from engine block should be 0.46 to 0.79 mm (0.018 to 0.031 in).

FLYWHEEL

Flywheel is secured to crankshaft by means of self-locking capscrews. Starter ring gear is shrunk on flywheel.

When replacing starter ring gear, heat to 80-90°C and locate tooth chamfers facing inwards.

Flywheel capscrew holes are staggered to ensure correct flywheel positioning on crankshaft.

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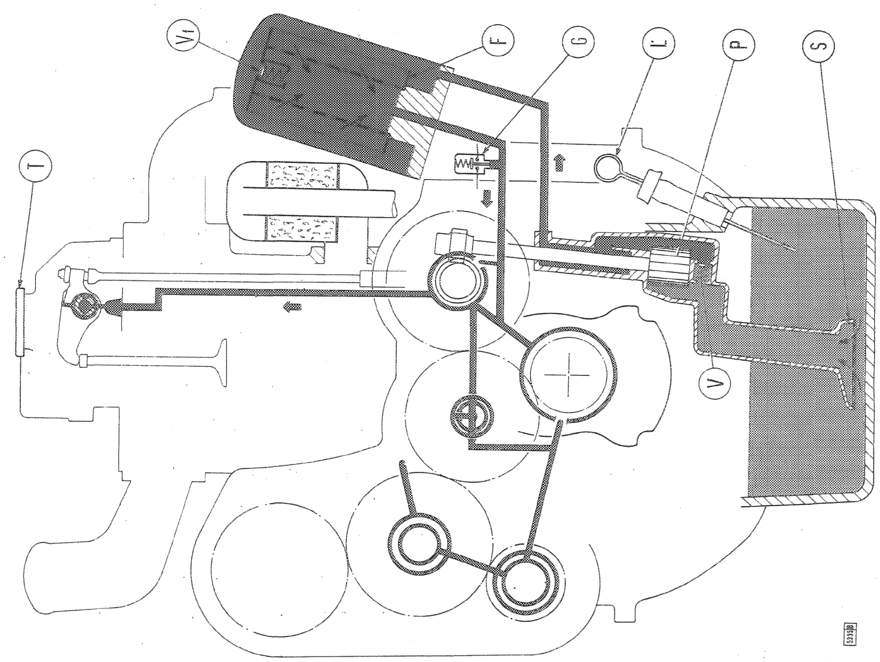

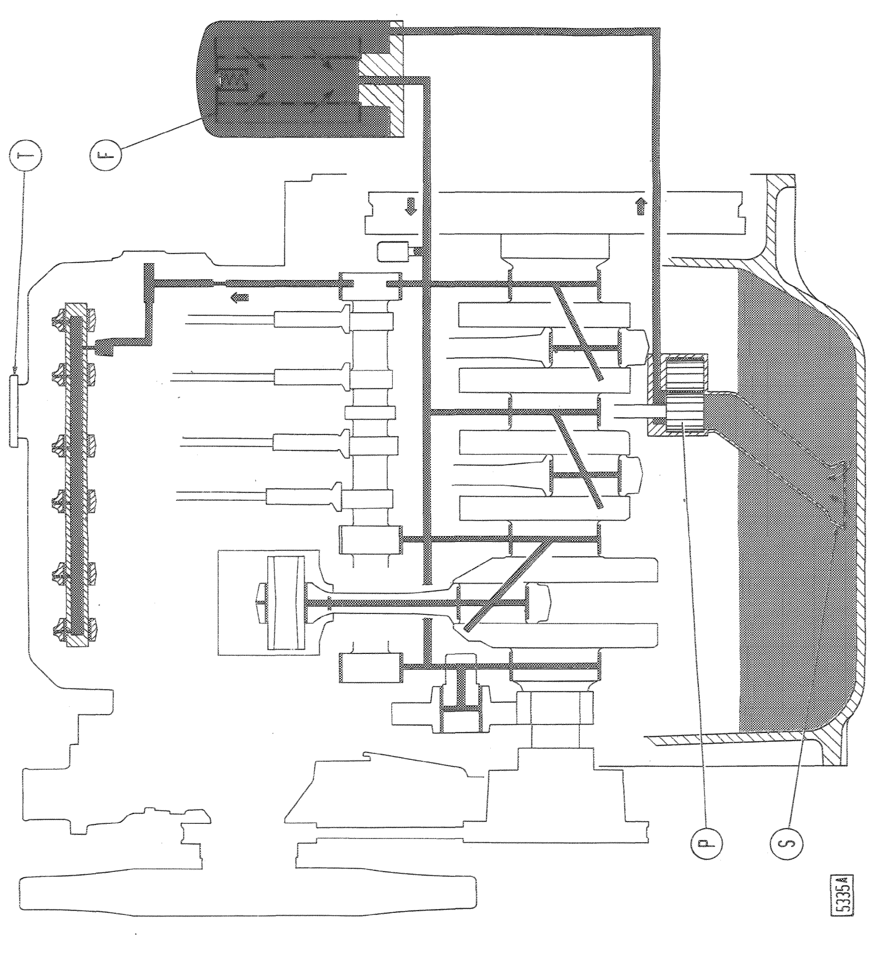

Lubrication System Diagram

F. Filter - G. Oil pressure transmitter unit (dashboard) - L. Dipstick - P. Pump - S. Suction filter - T. Oil filler cap - V. Relief valve - Vf. By-pass valve (cuts in when inlet pressure in 1.5 to 1.7 bar (kg/cm^2) or 22 to 25 psi higher than outlet pressure).

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OIL PUMP

The oil pump is accessible after removing the engine oil sump.

In the course of overhaul, assess the amount of wear affecting the various components by comparing with the dimensions given in the table.

Drive shaft (2) and associated gear are to be replaced together as gear is shrunk on shaft.

OIL FILTER

The paper cartridge oil filter (F, page 1) is a full-flow unit fitted on the outlet side of the pump. A by-pass valve (Vf) will enable unfiltered oil to enter the engine should the filter become obstructed.

Every 400 working hours, replace the cartridge noting the following points:

- smear the external seal with engine oil.
- fit the cartridge by turning until contact with the mounting flange is established;
- turn the cartridge **by hand** through a further 3/4 turn.

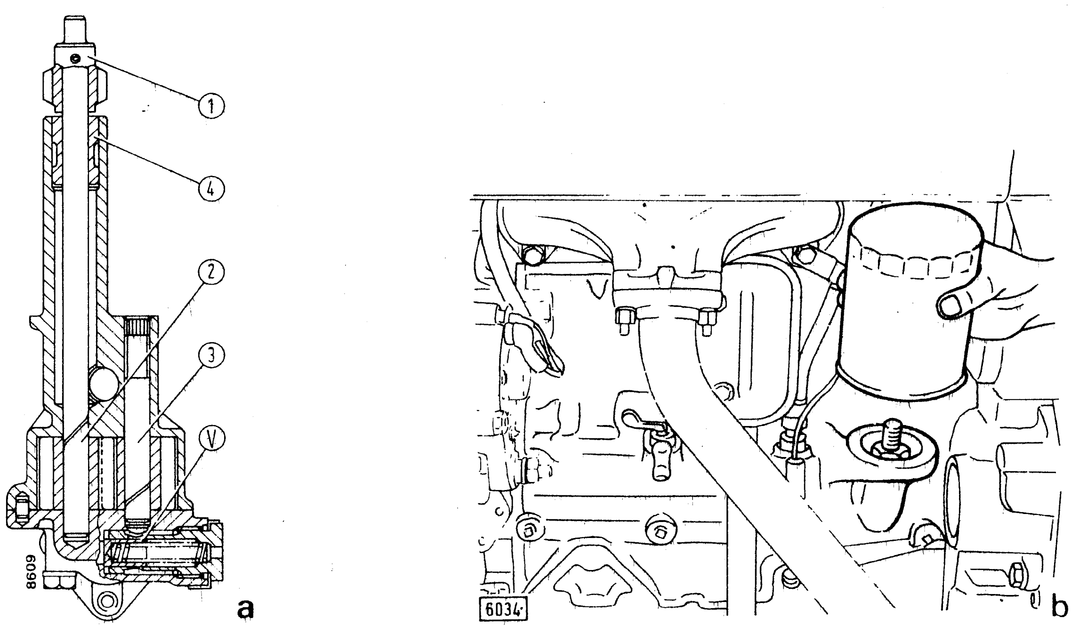
OIL PRESSURE WARNING SYSTEM

The oil pressure warning system includes a sending unit (G, page 1) and a dash-mounted warning light which appears if:

- oil pressure is low. The light may appear when the engine runs hot at low rpm; however, this is not an indication of anomaly;
- sending unit is inefficient.

If the warning light fails to light on when the master switch is operated, the possible causes are:

- blown fuse;
- burnt warning light bulb filament;
- open circuit across sending unit and warning light.



Section through oil pump (a) and disassembling (assembling) oil filter (b).

V. Relief valve - 1. Outer drive gear - 2. Drive gear and shaft - 3. Driven gear and shaft - 4. Bushing

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DESCRIPTION

The cooling system installed on model 446 is filled with a mixture of water and **FIAT PARAFLU 11** (50% by volume) anti-freeze effective down to:

Degrees Centigrade	-8	-15	-25	-35
(Degrees Farenheit)	17.6	5	-13	-30
PARAFLU 11 % by volume	20	30	40	50

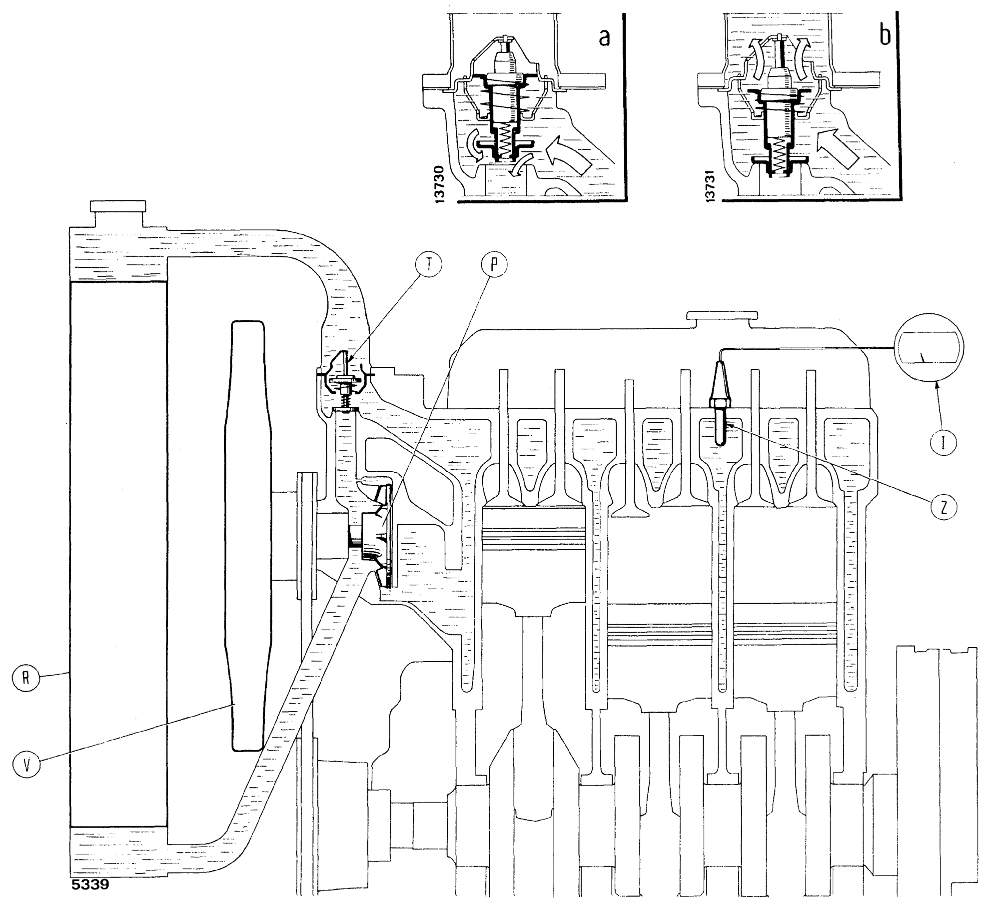
Moreover, this mixture has oxidation, corrosion, foam and scale control properties to ensure long life protection to the system.

Vapour inside radiator is exhausted through a plastic pipe (12, page 3) connected to hole on filler neck.

Periodically check that coolant level is about 3 cm ($1^1/_4$ in) from top of filler neck.

When topping up radiator, allow engine to cool down before removing cap.

Your coolant is effective for a period of **2 years** or **1600 hours,** after which time the system should be drained, flushed and refilled with fresh coolant.



Cooling System Diagram

a. Thermostat closed - b. Thermostat open - I. Water temperature gauge - P. Pump - R. Radiator - T. Thermostat - V. Fan - Z. Sending unit.

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WATER PUMP

To overhaul pump proceed as follows:

— Remove cover (8) and shaft retaining screw (3).

— Tap end of shaft (2) lightly to break the film of oxide between shaft and impeller using puller **291182/1.**

— Using a suitable punch, withdraw shaft complete with bearing and fan hub.

Remove seal (5) only if replacement is necessary, i.e. when graphitized surface in contact with impeller bushing is no longer sufficiently smooth to prevent leakage.

Reassemble parts bearing the following in mind:

— Bearing (2) requires no lubrication.

— Impeller (7) must be installed flush with end of drive shaft.

RADIATOR

Radiator cap incorporates two valves: a pressure release valve (13, page 3) calibrated at 0.5 bar (0.5 kg/cm^2, 7 psi), and a vacuum release valve (14). Periodically check that valves operate correctly.

On overhaul, eliminate scale in radiator proceeding as follows:

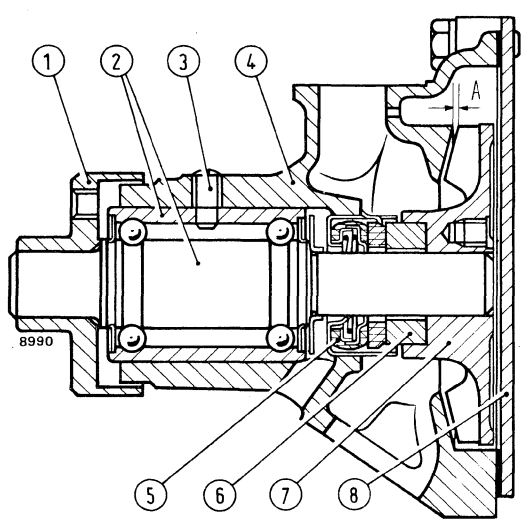
— Prepare and filter a solution of warm water and sodium bicarbonate (30 grams/litre), or use FIAT flushing solution in quantity indicated on container.

— Pour solution in radiator, drain and rinse with abundant running water.

To check for radiator leakage, submerge radiator in a tank of water at $30 \pm 10°C$ ($86 \pm 50°F$) and introduce internal air pressure of 0.98 bar (1 kg/cm^2, 14.2 psi) for 2 minutes. Repeat test at least three times.

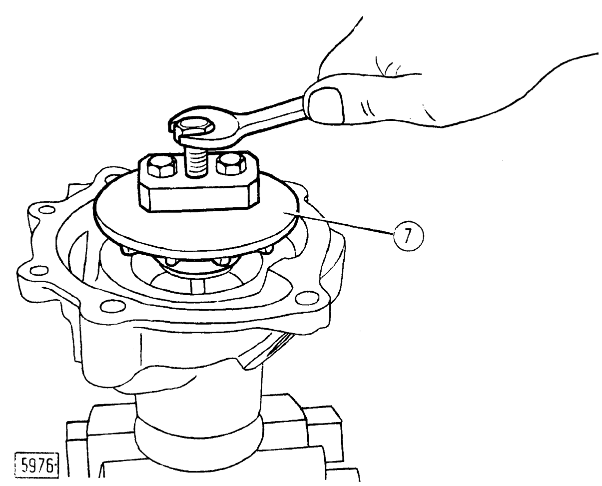
When flushing the radiator, also flush the rest of the cooling system using the solution and procedures indicated above.

Operate tractor for about 1 hour before draining solution with the engine off.



Section through Water pump.

A = 0.5 to 0.7 mm (0.02 to 0.03 in). Clearance between impeller blades and pump body - 1. Drive hub - 2. Drive shaft assembly - 3. Capscrew - 4. Pump body - 5. Seal - 6. Bushing - 7. Impeller - 8. Cover.



Removing Water Pump Impeller using Puller 291182/1.

7. Impeller.

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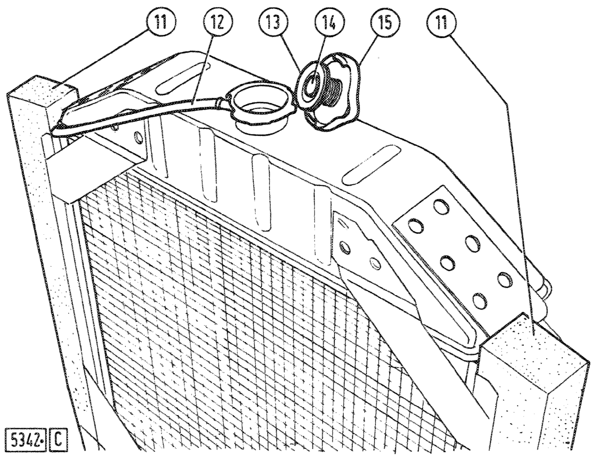
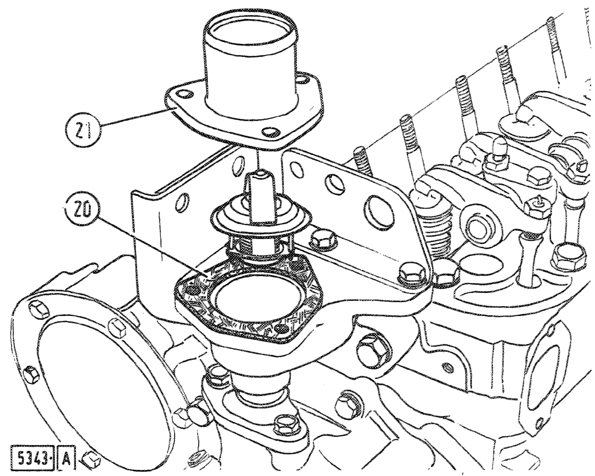


Radiator.

11. Sealing strips - 12. Vent pipe - 13. Pressure release valve (0.5 kg/cm² - 0.5 bar - 7 psi) - 14. Vacuum release valve - 15. Filter cap.



Assembling (disassembling) Thermostat.

20. Gasket - 21. Cover.

WATER TEMPERATURE GAUGE

The water temperature gauge scale is divided into three coloured sectors corresponding to the following temperatures:

— White sector	30 to 65 °C (86 to 149 °F)
— Green sector	65 to 105 °C (149 to 222 °F)
— Red sector	105 to 115 °C (222 to 239 °F)

In normal conditions, pointer should be over green sector.

To test instrument, submerge bulb in water and check scale with a reference thermometer **291979**; repeat test several times.

THERMOSTAT

Thermostat (T, page 1) is installed in cylinder head water outlet pipe. Since calibration is not possible, replace thermostat assy when temperature data specified in table are not met.

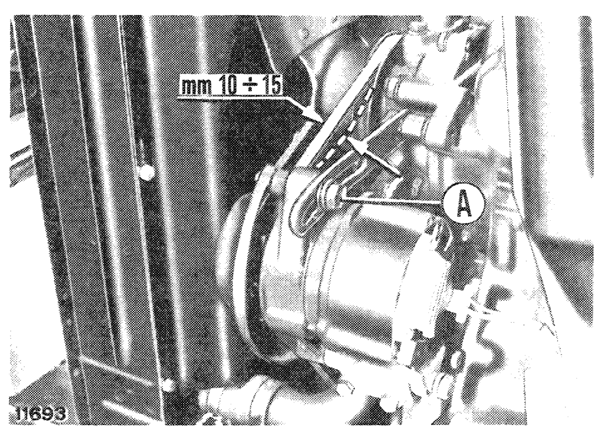
BELT TENSION ADJUSTMENT

To check tension of fan, water pump and alternator drive belt, apply a 118 N (12 kg, 26,5 lb) load on belt section between alternator and water pump pulley. Belt should deflect by 10 to 15 mm (0.4 to 0.6 in).

If necessary, adjust as follows:

— Slacken nut (A) securing alternator to belt tensioner.

— Move alternator along bracket to obtain the desired tension and tighten nut (A).



Adjusting Fan, Water Pump and Alternator Drive Belt Tension.

A. Alternator nut on belt tensioner.

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CLUTCH (LUK or O.M.G.)

Type	Twin, single dry plate
Control	Mechanical: pedal for transmission: manual lever for PTO
Release mechanism	Dished spring
Plate material	Organic compound
Plate thickness:	
— transmission	8.8 to 9.6 mm 0.34 to 0.38 in
— PTO	8.3 to 8.9 mm 0.33 to 0.35 in
— wear limit	see page 3, section 201
Plate with pressure springs..........................	tangential springs
Transmission clutch control sleeve working clearance	0.050 to 0.151 mm 0,002 to 0.006 in
PTO clutch control sleeve working clearance...............	0.072 to 0.205 mm 0.003 to 0.008 in
Release lever adjustment	see page 4, section 201
Clutch linkage adjustment............................	see page 5, section 201
Transmission pedal requirements	
Pedal pin diameter....................................	27.948 to 28.000 mm 1.101 to 1.103 in
Supporting bush internal diameter (fitted, non-dressed)	28.020 to 20.072 mm 1.1 to 0.8 in
Pin/bush play	0.020 to 0.124 mm 0.0008 to 0.005 in
Pedal bracket internal diameter.........................	32.927 to 32.966 mm 1.29 to 1.3 in
Bush outer diameter	33.009 to 33.030 mm 1.3 to 1.301 in
Pedal bracket/bush interference fit	0.043 to 0.103 mm 0.002 to 0.004 in

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TRANSMISSION AND SPLITTER

Transmission type	8 forward speeds (3rd, 4th, 7th, and 8th synchronized) and two reverse speeds
Gears	spur
Splitter	planetary, with three spur pinions
— Reduction ratio	20 : (20 + 52) = 1 : 3,6
Transmission and splitter controls	separate manual lever
Driven gear bushing ext. dia (64, page 3, Section 202)	49.925 to 49.950 mm 1.967 to 1.968 in
Driven gear int. dia	50.050 to 50.089 mm 1.971 to 1.973 in
Bushing clearance in gear	0.100 to 0.164 mm 0.004 to 0.006 in
Driven shaft dia	39.166 to 39.191 mm 1.534 to 1.554 in
Bushing int. dia	39.200 to 39.239 mm 1.26 to 1.27 in
Shaft clearance in bushing	0.009 to 0.073 mm 0.0004 to 0.003 in
PTO clutch shaft dia	24.964 to 24.985 mm 0.983 to 0.984 in
Bushing fitted int. dia (28, page 3, Section 202)	25.040 to 25.092 (1) 0.986 to 0.988 in
PTO shaft clearance in bushing	0.055 to 0.128 mm 0.002 to 0.005 in
Bushing interference fit with drive shaft	0.037 to 0.091 mm 0.001 to 0.003 in
Shim thickness (A, page 3, Section 202) for adjusting end float of driven gears	3.7-4-4.3 mm 0.145 - 0.157 - 0.169 in
Washer thickness (52, page 2, Section 202) and inboard (47) and outboard (47a) baulk rings for driven gears and planetary gear splitter supports	1.470 to 1.530 mm 0.057 to 0.06 in
Selector shaft detent ball spring length (13, page 6, Section 202):	
— free	61.5 mm (2.42 in)
— loaded 50 to 56 N (5,1 to 5,7 kg)	48 mm (1.89 in)

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TRANSMISSION AND SPLITTER

(Cont.)

Selector shaft detent ball spring length (71, page 6, Section 202):	
– free	35.5 mm (1.4200 in)
– loaded 50 to 51 N (5.15 to 5.25 kg)	31.5 mm (1.2600 in)
Selector shaft detent ball spring length (splitter only) (81, page 6, Section 202):	
– free	35.5 mm (1.4200 in)
– loaded 115 to 126 N (11.7 to 12.9 kg)	31.5 mm (1.2600 in)

CREEPER

Type	planetary with three spur pinions in-line with splitter
Reduction ratio	34 : (34 + 71) = 1 to 3.088
Control	by same lever as on transmission/ splitter box
Shim thickness availability	1.470 to 1.530
Selector shaft detent ball spring length (13, page 1, Section 203):	
– free	35.5 mm (1.4200 in)
– loaded 115 to 126 N (11.7 to 12.9 kg)	31.5 mm (1.2600 in)

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POWER TRAIN: Specification and Data

REAL BEVEL DRIVE AND DIFFERENTIAL

Bevel drive ratio { mod. **446** .... mod. **446 DT**	12/47 = 1 : 3.9 10/43 = 1 : 4.3
Bevel drive backlash	0.15 to 0.20 mm (0.0060 to 0.0080 in)
Differential .... Differential lock	2-pinion pedal-controlled
Differential pinion bore dia (18, page 9, Section 204)	24.040 to 24.061 mm (0.9616 to 0.9624 in)
Differential pinion journal dia. (19)	23.939 to 23.960 mm (0.9575 to 0.9584 in)
Differential pinion running clearance on journal	0.080 to 0.122 mm (0.0032 to 0.0048 in)
Side gear boss housing dia. in differential case (11, page 9, Section 204)	44.080 to 44.119 mm (1.7632 to 1.7647 in)
Side gear boss dia. (16)	43.961 to 44.000 mm (1.7584 to 1.7600 in)
Side gear boss clearance in case	0.080 to 0.158 mm (0.0032 to 0.0063 in)
Bevel pinion bearing adjustment	see pages 3 and 4, Section 204
Bevel pinion bearing shim thickness availability (page 2, Section 204)	1.0-1.05-1.10-1.15-1.20-1.40- 1.50-1.70-1.75-1.85-1.90-1.95- 2.0-2.05-2.10-2.15 (0.04-0.042-0.044-0.046-0.048- 0.056-0.06-0.068-0.07-0.074- 0.076-0.078-0.08-0.082-0.084-0.086 in)
Bevel pinion backlash adjustment	see page 5, Section 204
Bevel pinion backlash shim availability (page 2, Section 204)	3.8-2.9-4.0-4.1-4.2-4.3-4.4- 4.5-4.6-4.7-4.8 (0.152-0.116-0.160-0.164-0.168- 0.172-0.176-0.180-0.184-0.188- 0.192 in)
Bevel drive bearing adjustment	see pages 6, 7 and 8, Section 204
Bevel drive bearing shim availability (Sd, Ss, page 2, Section 204)	0.15-0.20-0.50 mm (0.006-0.008-0.020 in)
Side gear and differential pinion backlash	0.15 mm (0.006 in)
Side gear thrust washer thickness availability (15, page 9, Section 204)	1.5-1.6 mm (0.06 to 0.064 in)
Differential pinion thrust washer thickness (17)	1.5 mm (0.06 in)
Side gear end float adjustment	see page 9, Section 204
Differential lock fork spring (27) length (28, page 9, Section 204):	
– free	188 mm (7.5200 in)
– loaded 279 to 309 N (28.5 to 31.5 kg)	126.5 mm (5.0600 in)

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BRAKES

Type:		
— service		dry brake drum band, axle shaft mounted
— parking and transmission emergency (mod. 446)		brake shoes acting on corresponding synchronized PTO drive gear boss
— parking (mod. 446)		same as service brake arrangement with locking by manual lever
Control:		
— service brake		mechanical, latched pedals
— parking and transmission emergency (mod. 446)		mechanical, manual lever
— parking (mod. 446 DT)		mechanical, manual lever
Brake band thickness (8, page 1, Section 205)		6 mm (0.2400 in)
— critical wear thickness		3.5 mm (0.1400 in)
Brake band width		50 mm ((2.0000 in)
Brake drum outer dia.		225 mm (9.0000 in)
— critical wear dia.		224 mm (8.9600 in)
Brake band pin dia. (6, page 1, Section 205)	bush end	23.948 to 24.000 mm (0.9579 to 0.9600 in)
	bracket end	26.948 to 27.000 mm (1.0779 to 1.0800 in)
Pin bore dia.	in bush (15)	24.040 to 24.092 mm (1) (0.9616 to 0.9636 in)
	in bracket (16)	27.040 to 27.092 mm (1.0816 to 1.0836 in)
Clearance between brake band lever/bracket and bushing		0.040 to 0.144 (0.0016 to 0.0057 in)
Interference fit of brake band control lever pin bushing		0.037 to 0.091 (0.0014 to 0.0036 in)
Brake pedal shaft dia. (12, page 1, Section 205)		27.948 to 28.000 (0.0014 to 0.0036 in)
Brake pedal shaft bushing ID in transmission case and RH brake pedal (13 and 14)		28.020 to 28.072 mm (1) (1.1208 to 1.1228 in)
Clearance between brake pedal shaft and bushing		0.020 to 0.124 mm (0.0008 to 0.0049 in)
Interference fit between bushing in transmission case and RH brake pedal		0.043 to 0.103 (0.0017 to 0.0041 in)
Service brake control adjustment		see page 1, Section 205
Transmission parking brake control adjustment		see page 3, Section 205

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POWER TRAIN: Specification and Data

TRANSMISSION PARKING BRAKE (on two-wheel drive tractors)

Type	inclined segment acting on disc solid with bevel pinion shaft
Control	mechanical, manual lever
Lining material	organic (SILA 4) or (FINAFF ATM SNM)
Pin diameter (3, page 2, Section 205) of hand brake lever:	
– Transmission housing end	21.967 to 22.000 mm (0.8786 to 0.08800 in)
– Outer bracket end	15.973 to 16.000 mm (0.6389 to 0.6400 in)
Hand brake pin hole diameter:	
– in transmission housing	22.020 to 22.072 mm (0.8808 to 0.8828 in)
– in outer bracket (2)	16.016 to 16.059 mm (0.6406 to 0.6423 in)
Pin hole clearance:	
– in transmission housing	0.020 to 0.105 mm (0.0008 to 0.0042 in)
– in outer bracket	0.016 to 0.086 mm (0.0006 to 0.0034 in)
Lever (8) hinge pin (13) diameter	19.967 to 20.000 mm (0.7986 to 0.8000 in)
Hole diameter for pin of lever (8)	20.020 to 20.072 mm (0.0808 to 0.8028 in)
Pin hole clearance	0.020 to 0.105 mm (0.0008 to 0.0042 in)
Hand brake lever pin connection	see page 3, Section 205
Parking brake adjustment	see page 3, Section 205

FINAL DRIVE

Type	planetary, single reduction
Gears	spur
Reduction ratio	11 to 62 = 1 to 5.636
Backlash	0.15 to 0.25 mm (0.0060 to 0.0010 in)
Final drive spline fits:	
– interference	0.050 mm (0.050 in)
– clearance	0.048 mm ((0.0019 in)

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POWER TAKE-OFF

Type	independent or synchronized with transmission
Clutch control	manual lever
Output shaft shift	by manual lever situated on transmission housing cover
Rotation (viewed from rear)	clockwise
Engine speed with PTO at 540 rpm	2160 rpm
PTO speed with engine at top speed	650 rpm
Output shaft diameter (4, page 2, Section 207)...........	1 3/8" (6 splines)
Output shaft speed with PTO synchronized to transmission:	
– mod. **446** (12/47 bevel drive)	13.79
– mod. **446** DT (10/43 bevel drive)	14.47

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TIGHTENING TORQUE FIGURES

DESCRIPTION	Thread size	Torque		
		Nm	kgm	ft.lbs.
Clutch - Section 201				
Capscrews, LUK or O.M.G. 11"/11" clutch to flywheel (C_2, fig. b, page)	M 8 x 1.25	25	2.6	19.8
Capscrews, release fork (C_3, page 3)	M 16 x 1.5	206	21	152
Capscrews, transmission housing to engine (C_4, page 3)	M 12 x 1.25	103	10.5	76
Transmission and splitter - Section 202				
Nuts on studs securing front/rear transmission housing (C_{10}, page 3)	M 12 x 1.5	93	9.5	69
Nut, driven gear shaft (C_{13}, page 3)	M 24 x 1.5	255	26	188
Nuts for studs securing transmission shaft bearing cover (C_2, page 3)	M 8 x 1.25	18	1.8	13
Capscrews securing planetary reduction fixed gear	M 12 x 1.5	93	9.5	69
Capscrews, transmission housing cover (C_3, page 3)	M 8 x 1.25	25	2.6	19
Capscrews, segment spring bracket (C_4, page 6)	M 8 x 1.25	25	2.6	19
Capscrew, splitter shift fork rod bracket	M 10 x 1.25	59	6	43
Capscrew securing end of lift pump suction (C_{11}, page 9)	M 12 x 1.25	98	10	72.3
Creeper - Section 203				
Nut for studs securing spacer to transmission housing and power train (C_1, page 1)	M 12 x 1.5	93	9.5	69
Capscrews securing creeper fixed gear bracket (C_2, page 1)	M 10 x 1.25	49	5	36

(continued)

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TIGHTENING TORQUE FIGURES

(Cont.)

DESCRIPTION	Thread size	Torque Nm	kgm	ft. lbs.
Self-locking capscrews securing creeper housing fixed gear (C_3)	M 12 x 1.5	78	8	58
Capscrews securing creeper shift rod bracket (C_5)	M 10 x 1.25	59	6	43
Bevel drive and differential - Section 204 Self-locking nuts for capscrews securing ring gear (C_2, page 9)	M 12 x 1.25	123	12.5	90.4
Nut locking bevel pinion shaft (C_3)	M 40 x 1	294	30	217
Capscrews securing differential ring gear supports (C_4)	M 10 x 1.25	59	6	43
Capscrews securing differential lock pedal bracket	M 10 x 1.25	59	6	43
Brakes - Section 205 Capscrew securing LH brake pedal (C_1, page 1)	M 16 x 1.5	206	21	152
Capscrew securing inner lever (C_2)	M 16 x 1.5	206	21	152
Nuts locking brake drums to halfshafts (C_6, page 1, Section 206)	M 38 x 1.5	176	18	130
Final drive - Section 206 Capscrews, final drive cover (C_1, page 1)	M 10 x 1.25	59	6	43
Capscrews securing retaining bracket for external bearing of driven gear (C_2)	M 10 x 1.25	59	6	43
Capscrews securing final drive housing to transmission housing (C_3)	M 12 x 1.5	93	9.5	69
Nuts for bolts securing disc (C_4) to rims: W 12-28 and 13-38	M 16 x 1.5	191	19.5	141
Nuts for bolts securing disc (C_4) to rims: W 11-32	M 16 x 1.5	235	24	173.6
Capscrews securing disc (C_5)	M 16 x 1.5	265	27	195.3
Nut securing final drive driven gear to disc spindle (C_7)	M 55 x 1.5	932	95	687
Power take-off - Section 207 Capscrews securing transmission housing rear cover (C_1, page 2)	M 12 x 1.5	98	10	72.3
Capscrews securing transmission housing rear cover (C_2)	M 16 x 1.5	225	23	166.4
Capscrew securing PTO cover (C_3)	M 14 x 1.5	157	16	115.7
Nut securing PTO shaft driven gear (C_4)	M 22 x 1.5	255	26	188

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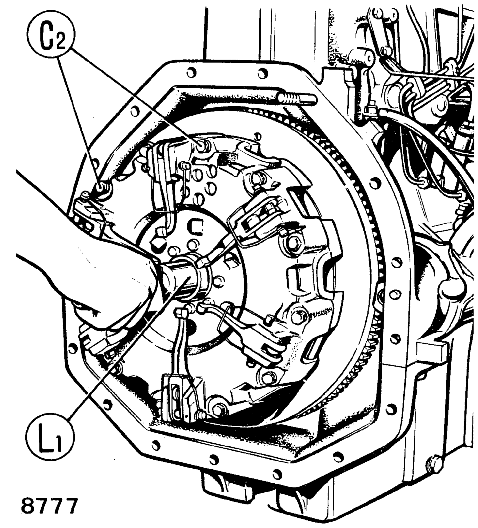
LUK OR O.M.G. CLUTCH REMOVAL AND INSTALLATION

Important – Cylinder head is stamped as follows to distinguish clutch type on 446 and 446 DT tractor models (see fig. a, section 100, page 3):

2 – indicating LUK clutch;

3 – indicating O.M.G. clutch.



Removing/installing LUK 11"/11" or O.M.G. 11"/11" clutch from flywheel.

Capscrews securing clutch to flywheel; L_1 centralizing pin 291184.

Separate engine with front axle from transmission to gain access to clutch and then proceed as follows:

– tilt the hood, disconnect the battery negative lead, drain the power steering and remove the power steering piping; disconnect tractor-meter accelerator and engine shut off linkage from injection pump, PTO clutch linkage, fuel delivery and return lines as well as the connection for the electrical system;

– disconnect hydraulic lift suction and delivery lines from the engine, exhaust line and corresponding muffler; drive shaft connecting front axle and corresponding guard (on all-wheel drive versions);

– remove fuel tank assy together with rear cover and power steering support bracket from the clutch transmission case and place a hydraulic stand under the latter;

– attach engine to lifting tackle **290740/1**, unbolt engine from transmission case and using a crane separate engine with front axle from rest of tractor.

Remove clutch assy from flywheel proceeding as follows:

– remove ten capscrews (C_2) securing the clutch and then slacken the two remaining capscrews;

– insert centering pin **291184** in clutch plate shaft seats, back off the two remaining capscrews and remove assy complete with PTO driven disc.

On reassembly bear the following points in mind:

– check condition of ball bearings (10, page 3) pressed in flywheel. Replace in the event of excessive noise or binding.
Refit new bearing with double seal packing the seat with grease;

– use centralizing pin to install clutch assy with clutch PTO driven disc on flywheel;

– tighten capscrews (C_2) to specified torque;

– connect transmission to engine front axle unit after smearing **grassofiat TUTELA G 9** in clutch driven disc slots and joint in compound as per page 5 of section A on clean mating surfaces.

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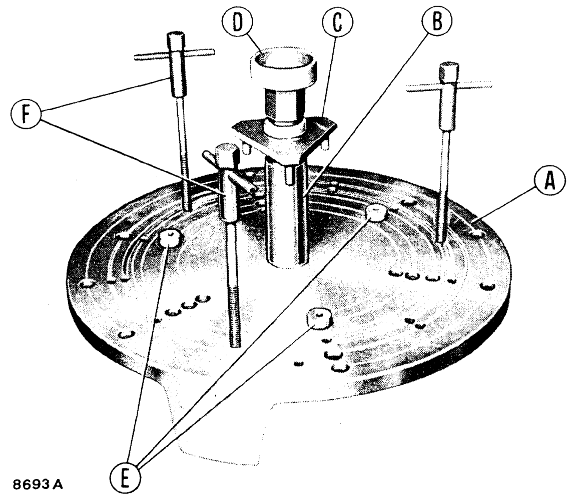


Component parts of kit 291291/2 for LUK clutch adjustment

A. Base plate **292598** - B. Central spacer **292342** - **C.** Register **291299** - D. Spacer and register retaining nut **292344** - E. Locater **293454** - F. Fastener **291292/1.**

LUK OR O.M.G. CLUTCH OVERHAUL

Remove, install and adjust clutch using kit **291291/2** or universal kit **293650** (page 3).

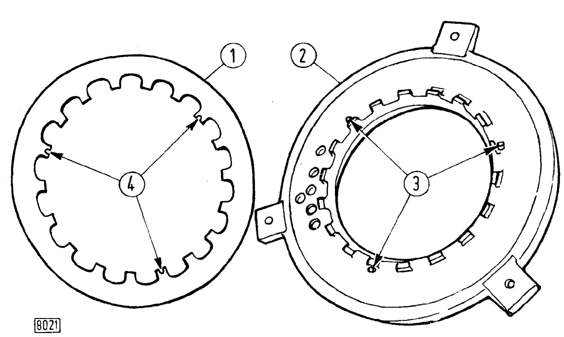
To install clutch on kit **291291/2** proceed as follows:

– install control spacer (A, see adjacent) base plate (B) and the three spacers (E) on circumference 241 mm (9.5 in);
– bring clutch assy into contact with control spacer and secure by means of three spacers (F) without the PTO plate.

To install clutch on universal kit **293650** proceed as follows:

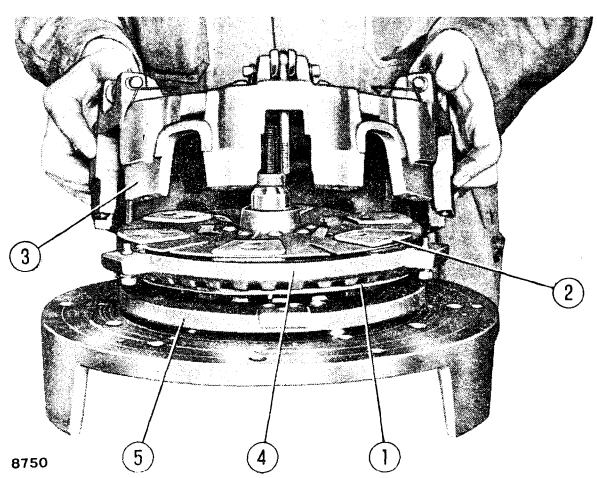
– install central spacer (A, page 3) on base plate (B). Position spacer at height of 123 mm (4.84 in) through register and secure through locknut (D);
– install spacers (E) on top surface at a level X (X = actual thickness of PTO clutch driven disc to be fitted, amounting to 2 mm) and lock the hand wheels (M);
– locate the clutch assy without the PTO disc on the plate and secure by means of the three fastening spacers (F) using the locking features (1) and spacers (N).

Back off nuts (7, page 3) for regulating PTO clutch disengagement and gradually release the fastening spacers (F, page 3) to permit detachment of the dish springs and to separate the clutch into its two component parts.



PTO clutch pressure plate (2) and dish ring (1) alignment. dish ring (1) alignment.

3. Spring dowel - 4. Notches.



Disassembling (installing) housing with levers.

1. Dish spring - 2. Transmission clutch plate - 3. Clutch housing - 4. Transmission clutch pressure plate - 5. PTO clutch pressure plate.

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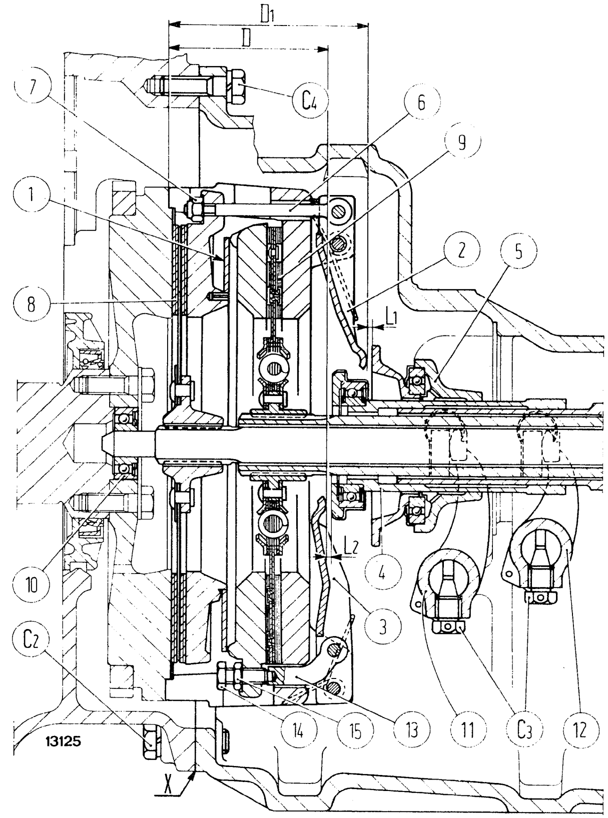
Longitudinal section through 11"/11" LUK or O.M.G. clutch.

C_2 and C_4 clutch housing capscrews - C_3 fork lever bolt - D = 96 mm nominal distance of transmission clutch release lever (3) from flywheel face - D_1 = 121 mm nominal distance of lever (2) from flywheel face - L_1 = 2.5 mm L_2 = 2.5 mm nominal distance of PTO clutch release levers and transmission clutch release lever - 1. Dish spring - 2. PTO clutch release levers - 3. Transmission clutch release levers - 4 and 5. Release control sleeves with thrust bearings - 6 and 7. PTO clutch release lever locknuts and adjusting link - 8. PTO clutch plate - 9. Transmission clutch plate - 10. Flywheel bearing - 11 and 12. Sleeve control forks - 13, 14 and 15. Transmission clutch release lever locknut, adjusting screw and lever.

Note — On assembly, throughly clean and degrease mating surfaces X and apply jointing compound as per section A, page 5.



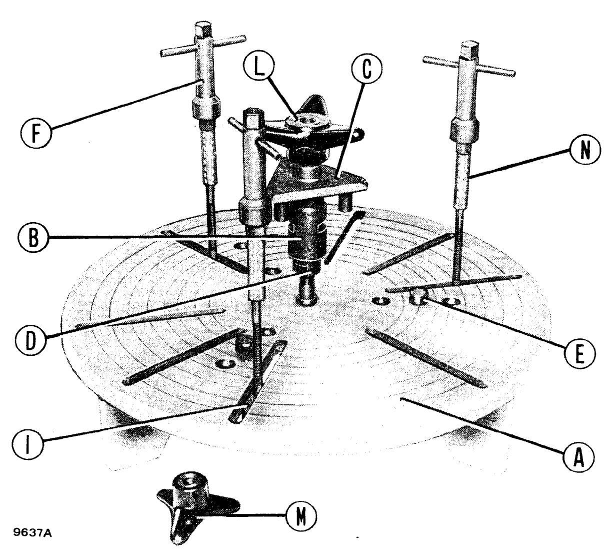
Check clutch driven plates for wear and replace if rivets are near to or flush with top facing. Plates are also to be replaced if the organic facings are found to be soaked with oil. Check condition of clutch housing and pressure plate friction surfaces. If necessary dress noting that dimensions (A, B, C, D) of each part **must not be reduced** below the limits given below, otherwise replace as necessary:

Proceed as follows:

— dress pressure plate surfaces;

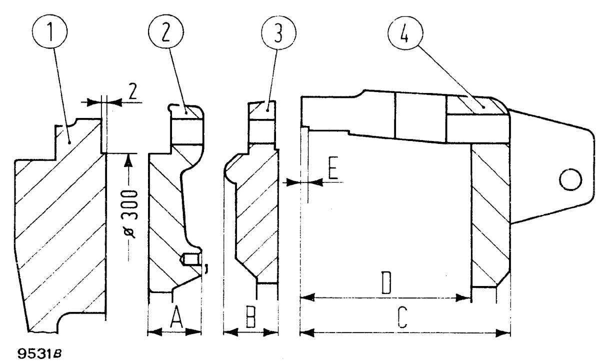
— replace damaged or worn plates;

— dress clutch housing face;



Component parts of universal kit 293650 for LUK or O.M.G. clutch adjustment.

A. Base plate **293332/1** - B. Central spacer **293728** - C. Register **293731** - D. Central spacer locknut **293730** - E. Locaters **293726** - F. Fasteners **293725** - I. Pads **293755** - L. Register retaining hand wheel **293739** - M. Locator hand wheels **293740** - N. Fastener spacers **292345**.



Minimum dimensions after dressing LUK or O.M.G. 11"/11" clutch.

A ⩾ 22 mm; B ⩾ 24 mm; C ⩾ 87 mm; D = 70 ± 0.15 mm; E ⩾ 2.5 mm.

1. Flywheel - 2. PTO clutch pressure plate - 3. Transmission clutch pressure plate - 4. Housing.

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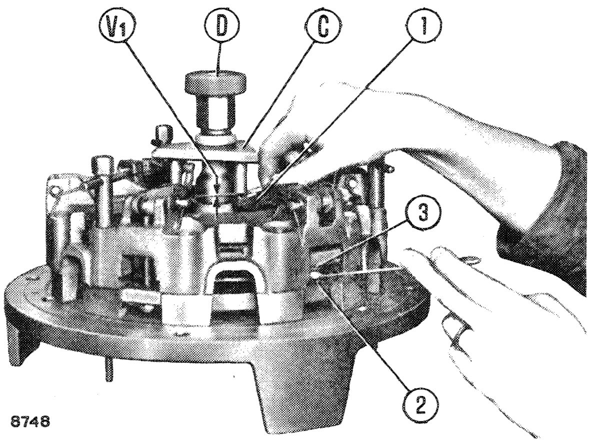
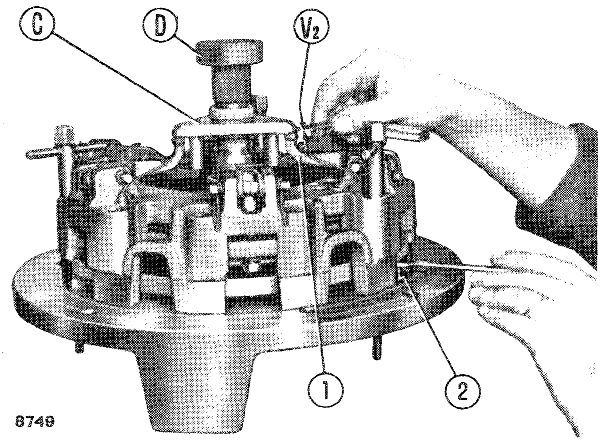


On-bench inspection and adjustment of transmission clutch release lever height using kit 291291/2 or universal kit 293650.

C. Register - D. Nut **292344** (for kit **291291/2**) or handwheel **293739** (for universal kit **293650**) V_1 = 0,1 mm (0.004 in) release lever to register pin gap between (C) and (1). - 1. Release lever - 2 and 3. Adjusting screw and locknut.



On-bench inspection and adjustement of PTO clutch release lever hight using kit 291291/2 or universal kit 293650.

C. Register - D. Nut **292344** (for kit **291291/2**) or handwheel **293739** (for universal kit **293650**) - V_2 = 0.1 mm (0,004 in). Register (c) to release lever (1) gap - 1. Release lever - 2. Adjusting nut.

– calculate dimension (D) as follows:

$$D = A + B + S_1 + S_2 + P + L$$

where:

A and B = measured dimensions of both pressure plates after dressing;

S_1 and S_2 = measured dimensions of PTO and transmission clutch plate;

P = 4.5 mm (0.12 in) (LUK clutch) or 4 mm (0.16 in) (O.M.G. clutch);

Spring dimensions to restore original load;

L = 2 mm (0.08 in) in flywheel undercut;

– check that value (D) is greater than or equal to that shown in the figure. In restoring value (D) check that housing dimension (C) does not fall below the values given. If necessary, replace one or both pressure plates, bearing in mind the following note.

Note - Clutch housing thickness should not fall below 17 mm (0.67 in); therefore, ensure that the following condition exists at all times:

$$C - D \geqslant 17 \text{ mm}$$

Check that the undercut (E) is deeper than indicated in the figure and restore as necessary.

If necessary dress friction face on flywheel and restore external undercut of 2 mm (0.08 in).

Note – On reassembling locate the PTO pressure plate (8, page 3) so that the boss faces the transmission.

Reassemble clutch using suitable tools of kit **291291/2** or universal kit **293650** and noting the following points:

– correctly position dish spring (1, page 2) on PTO clutch pressure plate, ensuring that the centralizers register with the slots;

– adjust clutch as directed below.

LUK OR O.M.G. CLUTCH ADJUSTMENT

For correct clutch adjustment, the release levers must be aligned at the dimensions given (D and D_1, page 3) relative to flywheel face.

Clutch adjustment may be carried out with clutch on-bench or fitted to flywheel.

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1. On-bench clutch adjustment.

Install clutch on base plate of kit **291291/2** or universal kit **293650** and secure using as described for disassembling (page 2).

Install register (C) and secure by means of nut (D) for kit **291291/2** or handwheel (L) for universal kit **293650** (pages 2 and 3).

Tighten or back-off transmission clutch release lever adjusting screws (2, page 4) using set of wrenches **293763** to obtain correct clearance (V_1) between register pin ends and transmission clutch release levers. Secure screws in position by means of nuts (3).

Tighten or back off PTO clutch release lever adjusting link nut (1) (2, page 4) using set of wrenches **293763** to obtain correct clearance, (V_2) between release lever ends and register face (C).

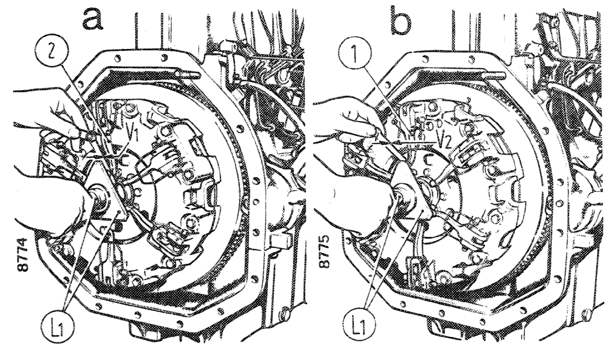
After clutch lever adjustment remove register (C, page 4) and replace by means of presser **292176** (fig. C, page 5) on kit base plate and check PTO and transmission clutch release by applying pressure to the levers accordingly. Remove presser, refit register and check that the clearances (V_1) and (V_2) — see fig. page **4** — previously set have not changed, otherwise reset as necessary.

2. On-flywheel clutch adjustment.

Insert pin (L_1) **291184** in clutch drive plate shaft seats, ensuring that end is in contact with bearing (10, page 3) and press associated register against pins.

Adjust clearances (V_1 and V_2) as indicated above.

Note — Kit **291291/2** or universal kit **293650** and on-flywheel clutch adjustment may result in quite considerable differences in terms of positioning, a fact which does not affect clutch efficiency being due to varying PTO clutch plate thickness as owing to machining tolerance built-up or wear, plus the modification inherent in the high average ratio.



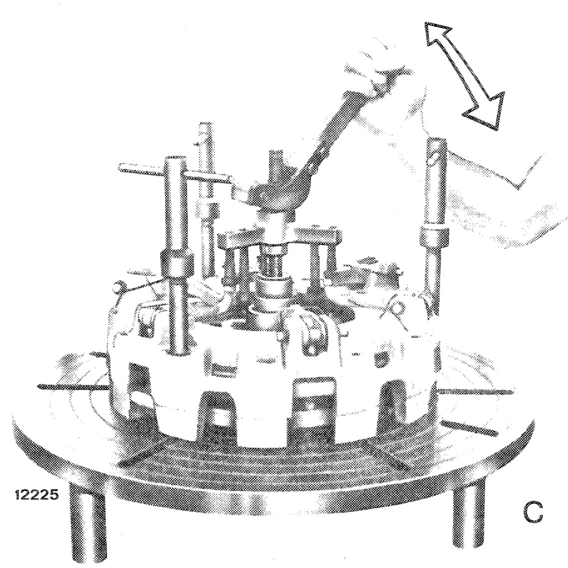
Checking clutch release lever alignment on-flywheel.

a. Transmission clutch - b. PTO clutch - L_1. pin **291184** for centering clutch complete with register - V_1 = 0.5 mm - Clearance between end of register pins (L_1) and release lever (2) - V_2 = 0.5 mm clearance between end of release lever (1) and register level (L_1) - 1. PTO clutch release lever - 2. Transmission clutch release lever.

TRANSMISSION CLUTCH LINKAGE ADJUSTMENT

Engine-transmission (fig a, page 6).

Check that the pedal free travel before clutch release is approx. 40 mm.
When free travel is down to 20 mm adjust clutch as follows:
— remove pin A;
— back-off locknut B and turn sleeve C counterclockwise



Using kit 291291/2 or universal kit 293650 to check transmission and PTO clutch release mechanisms with the aid of presser 292176.

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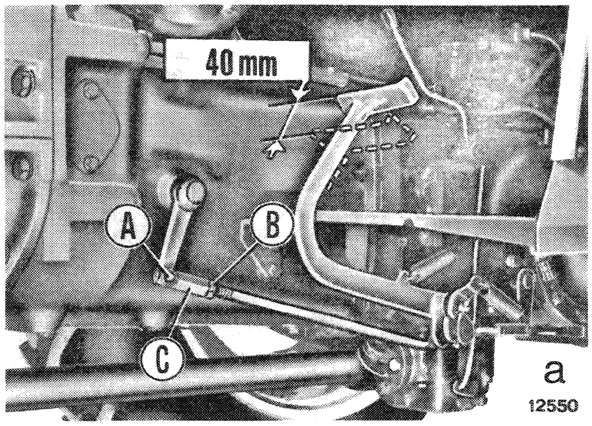
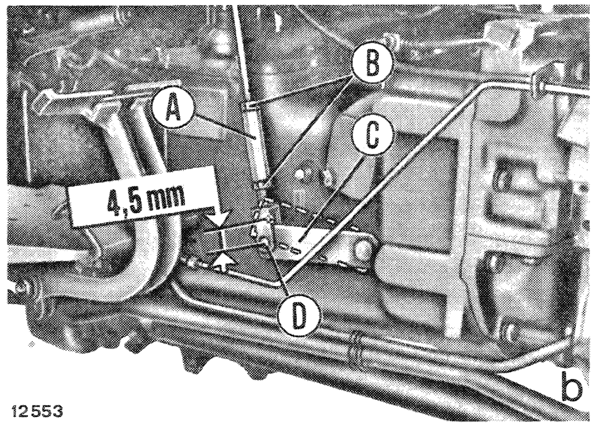


Adjusting transmission clutch control pedal free travel



Adjusting PTO clutch control lever free travel

(each sleeve turn is equivalent to 10 mm pedal displacement);

- refit pin A;
- tighten locknut B;
- ensure that free pedal travel is 40 mm;

PTO clutch linkage adjustment (fig. b)

Bring lever (C, fig. b) to rest position (fully down) and check free travel pin (D) is 4.5 mm before clutch release.

When free travel is down to 2.5 mm adjust clutch as follows:

- back off locknuts (B) and rotate sleeve (A) counter-clockwise through 1 1/1 turn (each turn shifting the pin (D) 3 mm);
- tighten locknuts (B);
- ensure that lever free travel is 4.5 mm.

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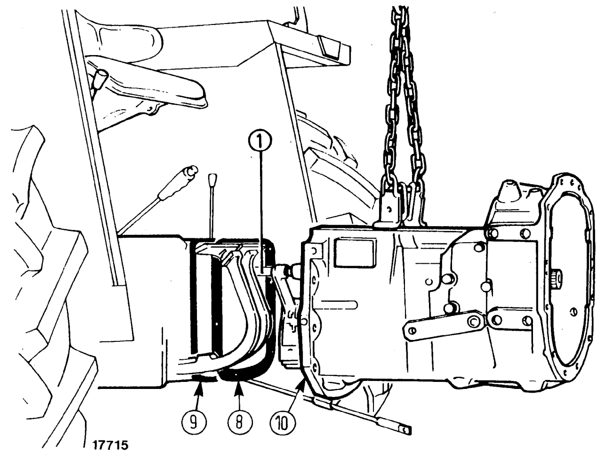
REMOVAL — INSTALLATION

To remove the transmission, first separate engine with front axle as described on page 1, sect. 201 for the removal of the clutch. Then proceed as follows:
— drain the lubrication oil from the transmission and remove the RH and LH footboards;
— install a mechanical stand under the rear transmission housing;
— connect lift hook 291517 to the transmission housing;
— remove the stud bolts and nuts securing transmission housing and remove transmission housing, moving it forward slightly and taking care not to deform the clutch-PTO shaft (1).



Transmission housing removal (installation) from tractor

1. PTO clutch shaft. - 8. Spacer - 9 e 10. Seals.

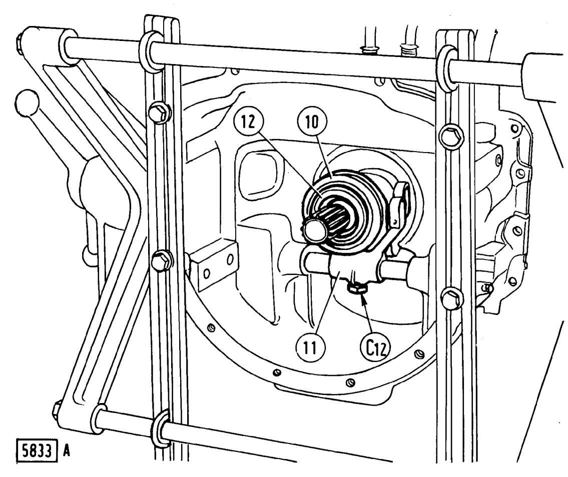
Before installing the transmission housing after overhaul, thoroughly clean and degrease the mating surfaces and install new seals (9 and 10).

DISASSEMBLY

To facilitate disassembly, install the transmission-rear transmission housing on rotary stand 290086, as shown in the figure on the right.
Then remove:
The transmission (12) and PTO (10) clutch sleeves with associated forks, after removing the associated shafts (15 and 14, page 2) and outer levers.
The complete transmission housing cover.
The shifter rods, detent and inner transmission and splitter control levers, pulling the dowels towards the inside of the housing.
The support, the splitter shifter rod, fork and sleeve, removing the screws (C6, page 2) and retrieving the detent ball (80, page 6) and associated spring (81).
The splitter, removing the fixed gear retaining screws (C9, page 2).
Disassemble the driven gear support (54, page 2), removing the ring (47) and pulling out the pins (50).
The drive shaft and associated gears:
— remove bearing shoulder covers and retrieve seals (29 and 30, page 3);

Note — Before removing the drive shaft, engage two gears and slacken the driven shaft retaining nut (C_{13}, page 3).

— remove the retaining ring (26, page 2) and the end float adjustment shim (A) and, if necessary, pull the seal (27) from its seat on the shaft;
— if necessary, remove the bushing (28, page 3) using a slide hammer;
— using a suitable puller, knock out the drive shaft (16, page 2) and retrieve the gears inside the housing.
The reverse drive shaft and gear:
— pull out the shaft (35, page 4) together with the rear ball bearing (36) and retrieve the gear (37 and the retaining pin (72, page 3) inside the housing;



Transmission housing inside view, installed on rotary stand 290086

C_{12} . Lever (11) lock nut - 10 and 11. PTO clutch disengagement sleeve and fork lever - 12. Transmission clutch disengagement sleeve

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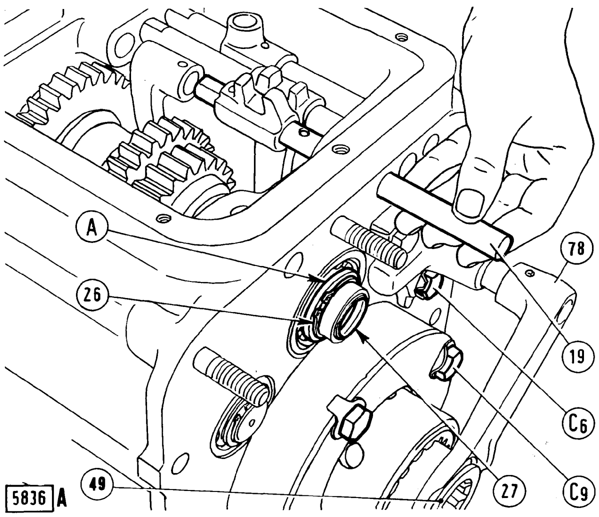
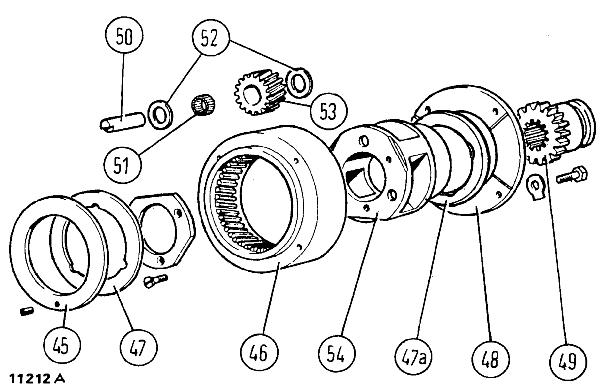


Transmission shifter rod removal (installation)

A. End float adjustment shim - C_6. Splitter control rod support retaining screws - C_9. Splitter fixed gear retaining screws - 19. 3^{rd} and 4^{th} gear shifter rod - 26. Retaining ring - 27. Lip seal - 49. Splitter engagement sleeve - 78. Splitter engagement control fork.

— if necessary, remove the ball bearing (36, page 4) by removing the retaining ring (33) and thrust washer (34);
— then remove the roller bushing (1, page 4).

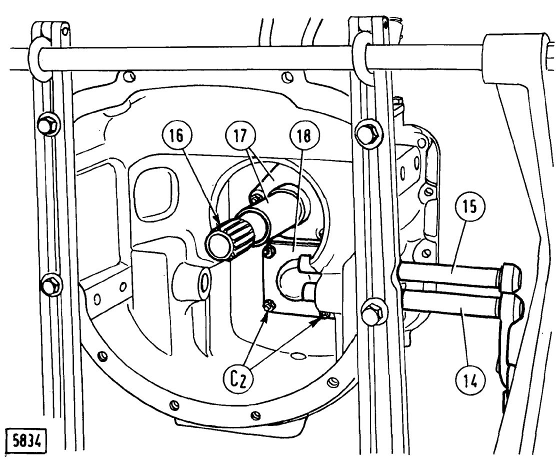
The shifter forks (38, page 6), pulling out the associated rod (39) and retrieving the balls (70) and spring (71).



Splitter components

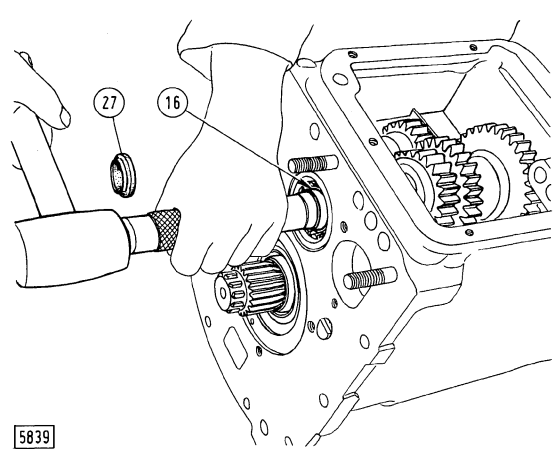
45. Splitter support internal thrust washer - 46. Splitter fixed gear - 47. Internal thrust washer and retaining pins (50) - 47a. Outer thrust washer - 48. Splitter support outer thrust washer - 49. Splitter engagement sleeve - 50. Splitter driven gear pins - 51. Rollers - 52. Gear (53) shim washers - 53. Splitter driven gears - 54. Splitter support

The driven shaft and associated gears:
— pull the driven shaft (40, page 3) out from the rear together with the roller bearing (41), beating on the front end with a suitable punch;
— retrieve the gears and synchromesh from inside the housing.



Removal (installation) of transmission shaft front bearing shoulder covers

C_2. Nuts for cover retaining studs (17 and 18) - 14. Outer lever with PTO clutch control rod - 15. Outer lever with transmission clutch control rod - 16. Shaft - 17. Driving gears - 18. Driver shaft bearing cover.



Drive shaft (16)) removal using a punch

27. Lip seal

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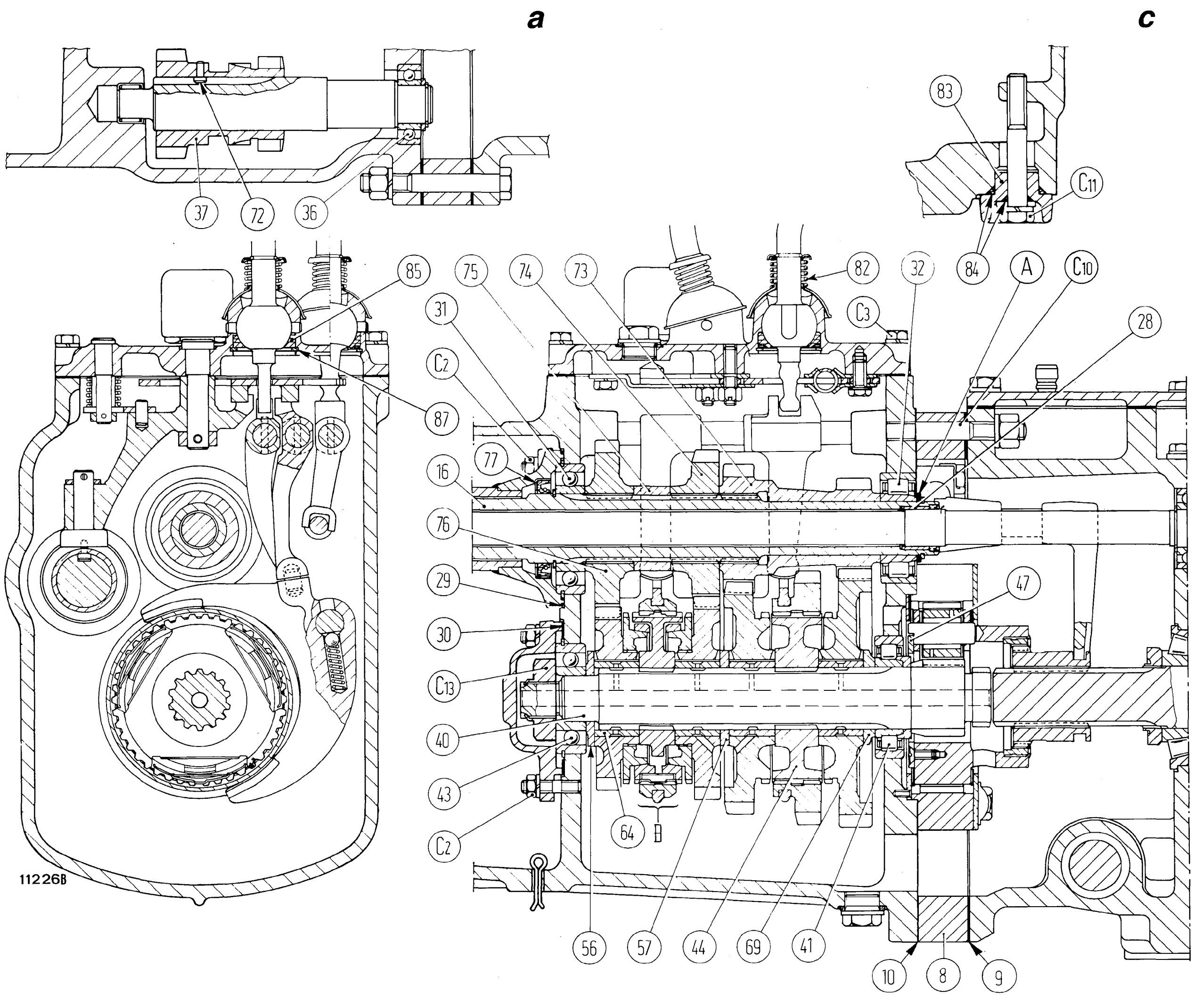

8-speed transmission longitudinal and cross sections

a. Reverse gear drive shaft section - c. Detail of lift pump intake tube end retention - A. Drive gear end play adjustment ring - B. 3^{rd} and 4^{th} gear synchromesh - C_2. Shaft bearing cover retaining screws - C_3. Top cover retaining screws - C_{10}. Nuts for transmission housing retaining studs and screws - C_{11}. Lift pump intake tube end retaining screws - C_{13}. Driven gear shaft lock nut - 8. Spacer - 9 and 10. Seals - 16. Drive gear shaft - 28. PTO shaft bushing - 29 and 30. Seals - 31. Ball bearing - 32. Roller bearing - 36. Ball bearing - 37. Reverse drive gear - 40. Driven shaft - 41. Roller bearing - 43. Ball bearing - 44. 1^{st} and 2^{nd} gear engagement fixed sleeve - 47. Splitter driven gear dowel retaining ring - 56, 57, and 69. Front, middle and rear thrust washers - 64. Driven gears support bushings - 72. Gear (37) keying pin - 73. 1^{st} and 2^{nd} drive gear - 74. 3^{rd} drive gear - 75. Drive gear spacer - 76. 4^{th} drive gear - 77. Seal - 82. Hand lever retaining spring - 83. End of lift pump intake tube - 84. O-ring - 85 and 87. Hand lever joint seal and retaining ring.

Note — On installation, fit new seals (9 and 10) after thoroughly cleaning and degreasing the surfaces.

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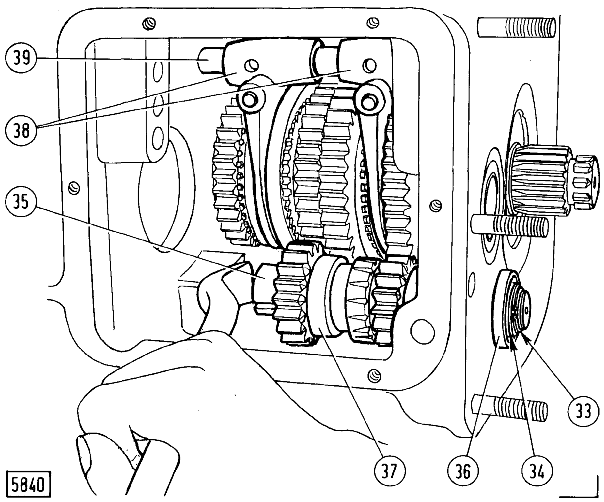


Reverse drive shaft (35) removal.

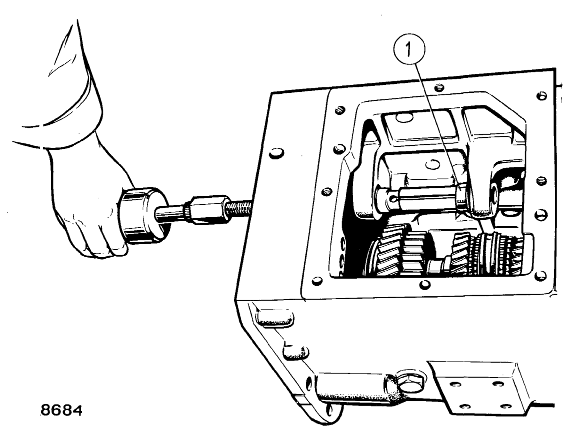
33. Retaining ring - 34. Thrust washer - 36. Rear ball bearing - 37. Reverse relay gear - 38. Transmission shifter forks - 39. Shifter fork (38) rods.

INSPECTIONS

Check the state of the seals, making sure there is no scoring, lip damage or permanent deformation, and replace if necessary.
Check synchromesh spring (60, page 5) efficiency as follows:

— place spring on a flat surface (see detail a), depress spring in the centre applying a load (P) of 13.7 - 15.2 N (1.4 - 1.55 kg or 3.1 - 3.42 1b) and check that deflection is 1.5 mm (0.06'').

Check that the shifting plates (61) are not deformed or dented, especially on the centre relief (R).



Reverse drive shaft roller bearing (1) removal using a slide hammer punch.

If replacement is required, remove the bearing from their seats using universal pullers.
When fitting new bearings, use suitably dimensioned punches and refer to page 3 for correct orientation.

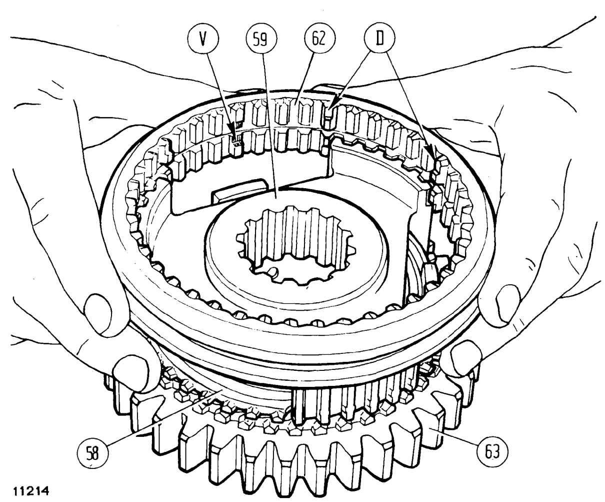
ASSEMBLY

Refer to the figures on page 3 and on the following page and assemble the following:

The 3rd/4th synchromesh:

— fit a synchrocone (58) and synchrohub (59) on 3rd driven gear (63) complete with baulk ring so that the three toothed sectors match the recesses in the baulk ring and lead-in chamfer on the splines faces towards the gear.
— install a sliding sleeve (62) so that the three toothed synchrohub sectors (59) are included in the width spanning stepped teeth (D).
— position springs (60, page 4) on shifting plate (61) as shown and refit in their recesses.
— install the second synchrocone with the three front fins in register with those of the first synchrocone previously fitted and position the 4th driven gear.
— test synchromesh effectiveness by operating the sliding sleeve by hand in both directions.

Install the driven shaft, associated gears and complete synchromesh:



Synchhromesh sliding sleeve (62) installation

D. Stepped teeth - V. Recess for spring shifting plate - 58. Synchrocone - 59. Synchrohub - 62. Sliding sleeve - 63. Driven gear.

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– install front ball bearing (43, page 3) complete with circlip in transmission housing and fit the corresponding cover using the two single nuts;

– upend the transmission housing so that the bottom end is at the top;

– place the front thrust washer (56, page 3) in the housing and mount the complete synchronizer (B, page 5), intermediate baulk ring (57, page 3), second speed gear (63, page 5) complete with internal ring, synchrohub (44), reverse gear (67) first speed gear (68) complete with internal ring and rear thrust washer (69) oriented as shown in the figure on page 3;

– prefit the rear roller bearing (41) to the shaft by heating it in oil at a temperature of 80 - 90° C and orientate it as shown in the figure on page 3;

– insert transmission drive shaft fully equipped (40, page 5) at the top returning the transmission housing to the horizontal position, remove the front cover and tighten the locking nuts fully, (C_{13}, page 3).

The shifter rod and forks operate as shown in the figure on page 6.

Now install the reverse relay gear and shaft:

– support gear (37, page 3) inside the housing and locate the shaft complete with the bearing from the outside, making sure that the pin (72) mates with the corresponding spline.

Then install the transmission drive shaft and its gears as follows:

– install transmission drive shaft complete with seal (27, page 2) and bush (28, page 3) front ball bearing (31) and secure with corresponding circlip;

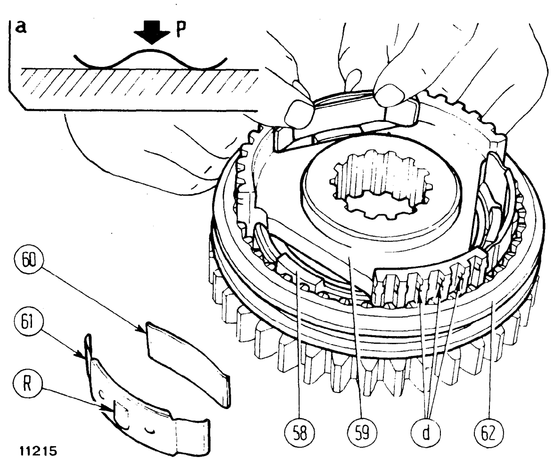
– fit external race of rear ball bearing (32, page 3) to the transmission housing and introduce the complete transmission drive shaft at the front end and fit inner housing in the same order with gear (76), spacer (75), gears (74 and 73) and then the internal race of the roller bearing (32) oriented as shown in the figures;

– mount the front cover (17, page 2), complete with gasket, making sure that the rear bearing is in perfect alignment (32, page 3) and fit shim (A), selected in thickness to reduce the end float of the gear and bearing assy to a minimum. Then mount the corresponding circlip;

– by shifting the sliding sleeves and inserting two speeds at the same time, torque nut (C_{13}, page 3) to prescribed torque, peen it and fit the end plate (18, page 2) together with the corresponding gasket.

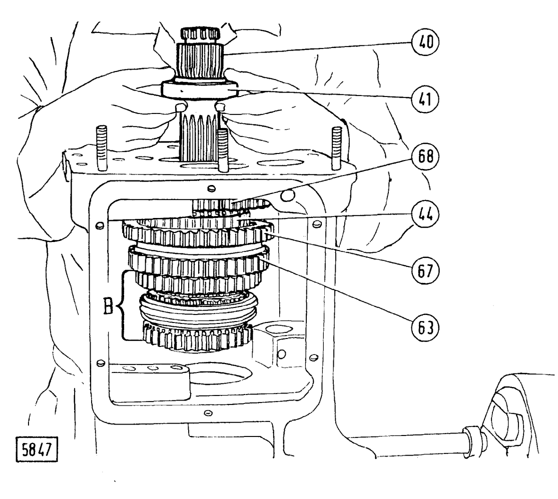
Splitter:

– fit the driven gears (53, page 2) to the corresponding bracket (54) on the bench, using grease **grassofiat TUTELA G9** to seat the balls in each gear.



Installing shift spring (60) and corresponding shift plates (61) of synchronizer.

a. Checking shift plate spring - d. Detent pips - p = 13.7 to 15.2 N (1.40 - 1.55 kg). Test load - R. Shift plate relief - 58 Synchrocone - 59. Synchrohub - 60. Spring - 61. Shift plate for spring (60) - 62. Sliding sleeve.



Installing 8-speed transmission driven gear shaft (40).

B. 3rd and 4th speed synchronizer assy, compl. - 41. Rear roller bearing - 44. 1st and 2nd speed synchrohub - 63. 2nd gear - 67. Reverse gear - 68. 1st gear.

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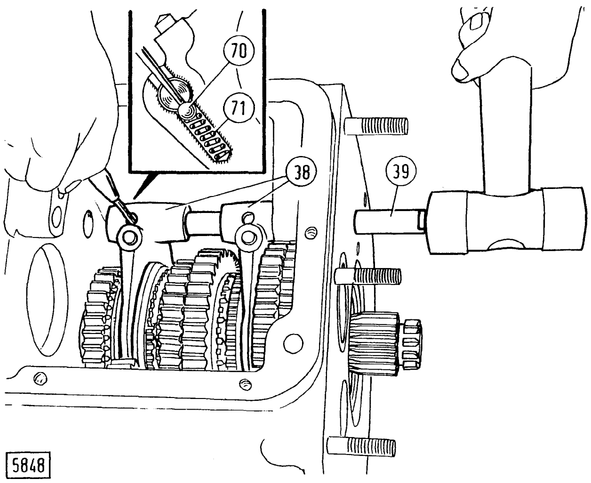
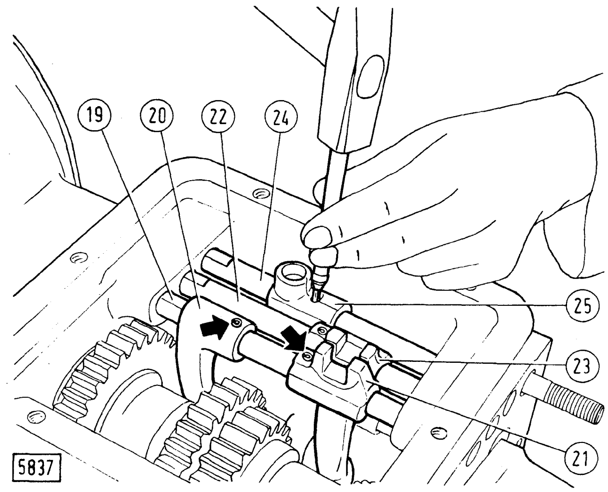


Installing shifter rod (39) for fork (38).

70 an 71 shifter rod detent ball and spring.



Installing pin retaining plunger to internal shifter lever (arrows indicate orientation of roll pin split)

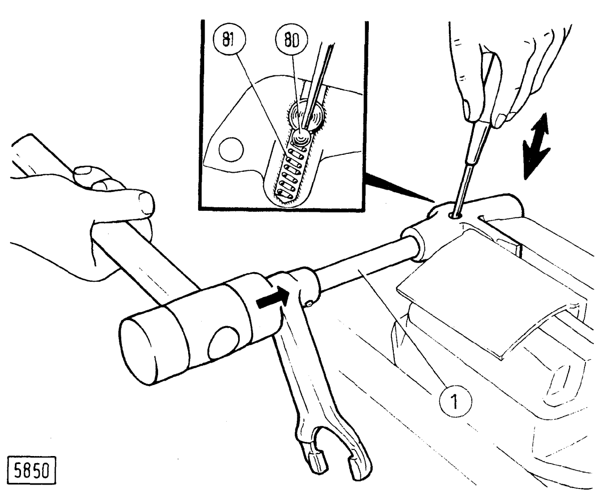
19, 20 and 21. 3rd and 4th speed shifter rod, internal lever and plunger - 22 and 23. 1st and 2nd shifter rod and internal lever-24 and 25. Splitter shifter rod and internal lever. Internal lever (arrows indicate orientation of roll pin split).

- refer to figure on page 3 for subsequent installation procedures as regards correctly orienting items and cap screw (C_9, page 2) torque requirement.

Install support, rod, splitter shifter fork as indicated in the figure below. The rods, finger and internal transmission-splitter shifter levers can be seen correctly oriented in the two figures above.

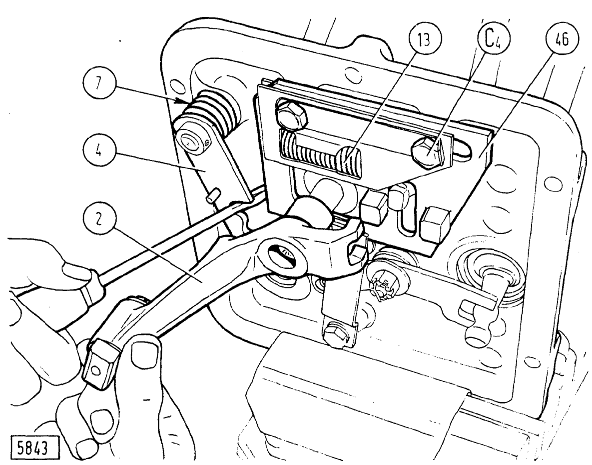
Fit transmission housing cover:

- where disassembled, coat studs and cap screws securing the shifter levers with jointing compound for a proper seal;
- prefit assy on bench noting that the internal lever (2) (see figure below) for reverse shifting it is necessary to compress the detent spring (7) of the lever (4) using a screwdriver;
- when locating the cover of the transmission housing make sure that the end of the gear shift lever and the pad on the internal reverse gear shift lever seats in the internal levers (23 and 25, see figure above) and in the relay gear (37, page 3).



Installing splitter shifter rod (1) and fork, complete.

80 and 81. Detent spring and ball.



Installing (removing) internal reverse shifter lever (2).

C_4 Cap screw securing brackets for spring (13) - 4. Detent lever - 7. Lever detent spring (4) - 13. Segment return spring - 46. Shifter segment.

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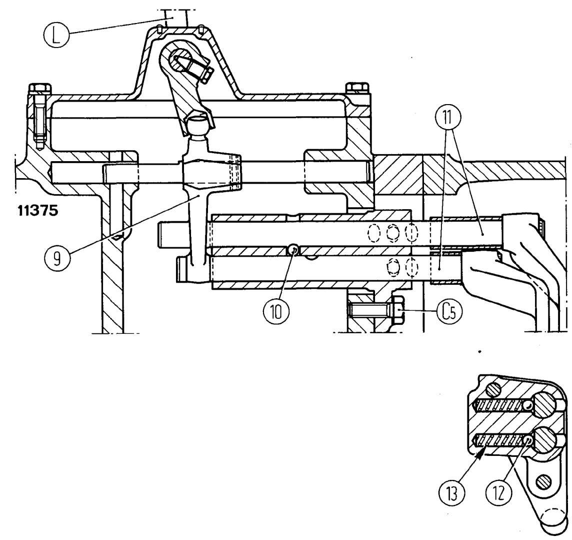
DESCRIPTION

An epicyclic type creeper is fitted standard on the transmission-splitter (appropriately provided with connection fittings and splines) and permits four more forward speeds and one more reverse speed to be obtained.
It is controlled by means of the gear lever itself.

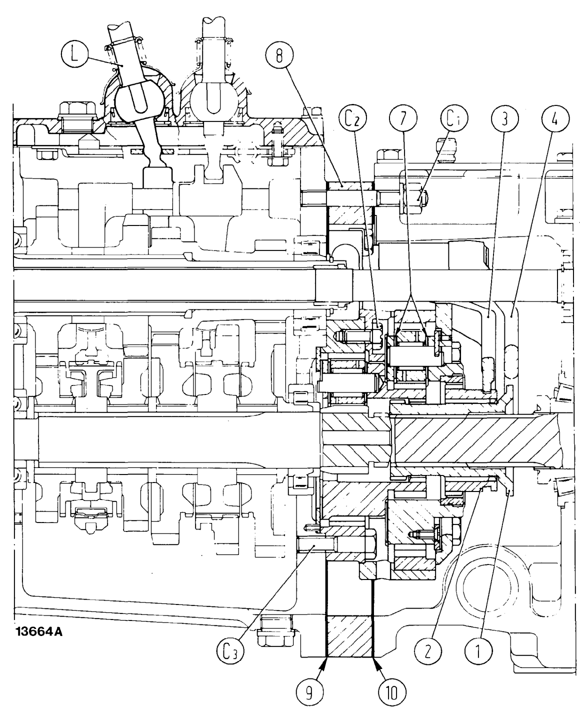


Section through control levers.

L. Creeper control lever - C_5. Creeper shifter rod support self-locking retaining screws - 9. Creeper engagement selection lever - 10. Shifter rod (11) detent ball - 11. Shifter rods complete with engagement sleeve shifter forks - 12. and 13. Rod (11) detent balls and springs.

OVERHAUL

Proceed as for the transmission-splitter.



Section through creeper installed on tractor

L. Creeper control lever - C_1. Nuts for screws and studs retaining creeper box to transmission housing - C_2. Creeper fixed gear support retaining screws - C_3. Splitter fixed gear self-locking retaining screws - 1. Top gear and splitter engagement sleeve - 2. Creeper engagement sleeve - 3 and 4. Engagement sleeve forks - 7. Creeper drive gear shims - 8. Spacer between creeper box and transmission housing - 9 and 10. Seals.

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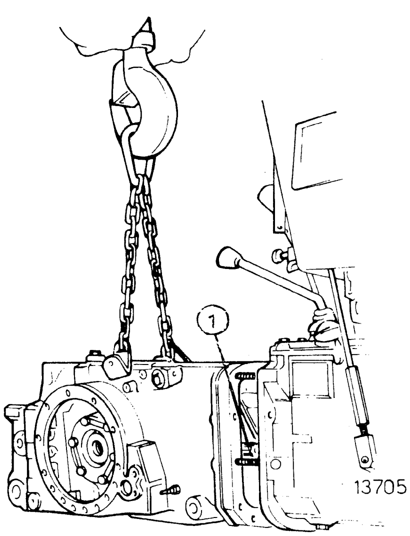
REAR TRANSMISSION HOUSING; REMOVAL – INSTALLATION

Tilt the hood, disconnect the negative battery lead, drain the front and rear transmission housing oil and remove:

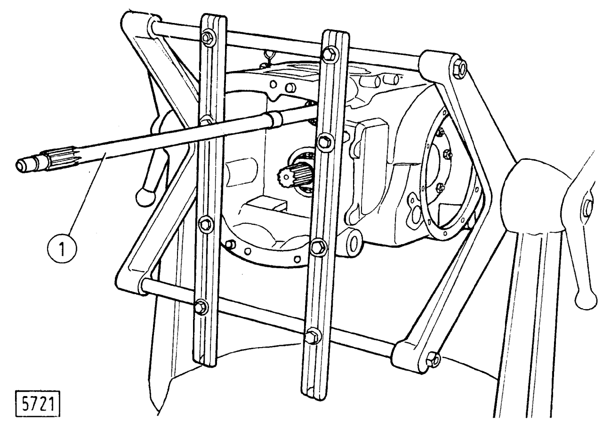
- ROPS frame, fenders left and right, floorboards, hydraulic lift complete with suction and delivery piping, implements mounting attachments and towing features;
- remove final drives as described in the relative chapter and position the PTO control lever to "MOTORE" and remove the corresponding cover complete with the lever.

Connect the transmission housing to a lifting tackle with hook **291517**, undo studs and nuts securing the transmission housing and detach by slowly lifting it with all due care to avoid damaging the PTO shaft (1).



Detaching rear transmission housing.

1. PTO shaft.



Rear transmission housing mounted in rotary stand.

1. PTO clutch shaft.

Remove the bevel drive and differential bearing supports (6 and 7, page 2) collecting the oil baffles (5 and 14) and the corresponding shims (Sd and Ss) before removing the complete bevel drive differential assy.

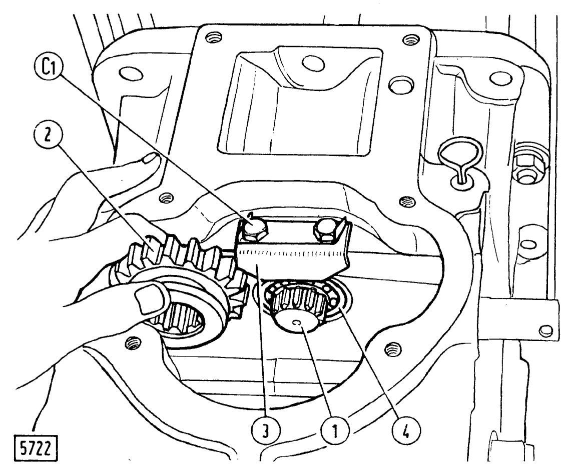
BEVEL DRIVE AND DIFFERENTIAL REMOVAL – INSTALLATION

Remove rear PTO cover complete with PTO input and output gears and shafts and removing the sliding gear (2) from the PTO clutch shaft (1) via the top side of the housing. Using a lead mallet tap the PTO (1) clutch shaft end and remove from the rear complete with bearing (4) after having opened up the corresponding retaining plates (3).

Detach the differential lock pedal and the pedal bracket, removing the spindle (29, page 8) using a punch and mallet, if necessary, from the left-hand side of the transmission housing after having removed the plug (T, page 2) and collecting spring (27, page 8) and the shift fork (28).

Disassemble the assy as follows:

- separate the ring gear from the differential case by undoing the studs (C_2, page 2);



Disassembling (assembling) PTO synchronizer sliding gear.

C_1. Cap screws securing plate (3) - 1. PTO clutch shaft - 3. Plate retaining bearing (4) - 4. Ball bearing.

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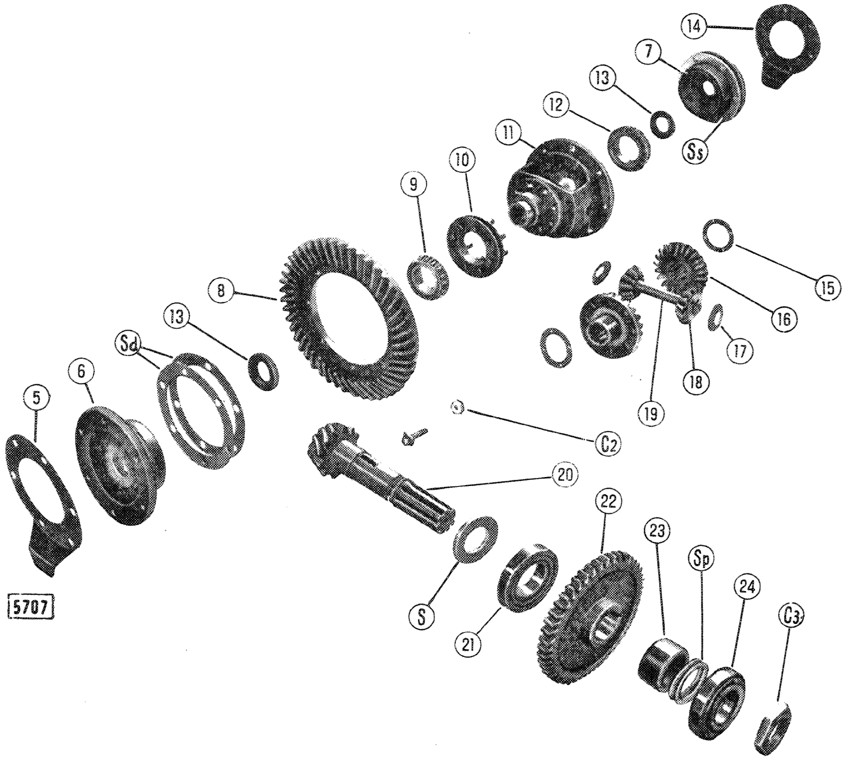
POWER TRAIN:
Bevel drive and differential



Exploded view of bevel drive and differential assy components.

C_2. Nut for cap screw securing ring gear - C_3. Nut locking bevel pinion shaft - S. Pinion shim - Sd and Ss ring gear bearing and backlash shims - Sp. Pinion bearing shims - 5. Oil baffle RH - 6. Support, RH - 7. Support, LH - 8. Ring gear - 9. Internal race of taper roller bearing, RH - 10. Differential locks sleeve - 11. Differential housing - 12. Internal race of taper roller bearing, LH - 13. Seals - 14. Oil baffle, LH - 15. Side gear thrust washer - 16. Side gear - 17. Baulk ring for differential pinion - 18. Differential pinion - 19. Pinion journal - 20. Bevel pinion shaft - 21. Rear taper roller bearing - 22. Synchronized PTO drive gear - 23. Spacer - 24. Front taper roller bearing.

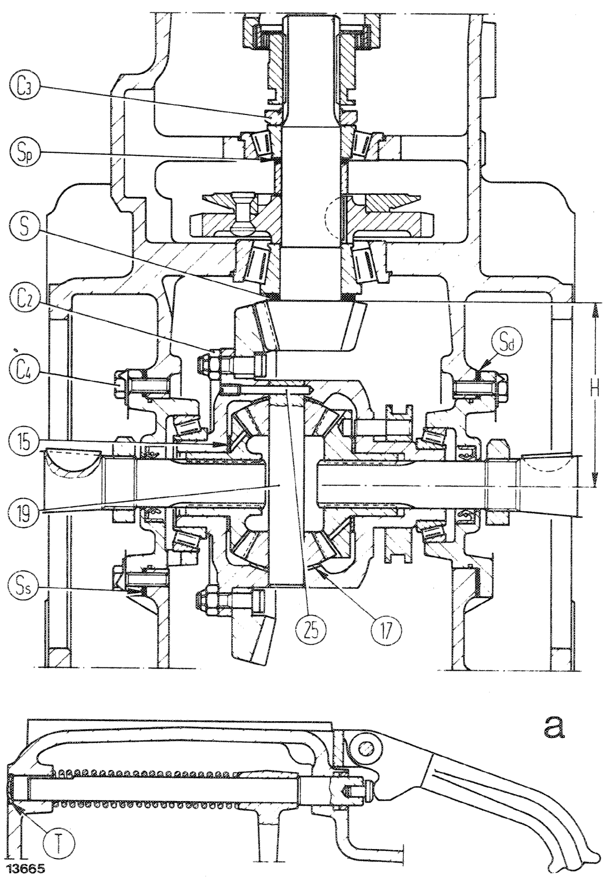
- remove capscrew (25, page 2) securing the differential journal (19), collecting the differential pinions and the side gears.

Check all items for good condition, noting the requirements in the table on page 4, Section 20.

Remove damaged bearings using universal puller.

When reassembling, note the following:

- coat the baulk rings of the differential pinions with **grassofiat TUTELA G 9** grease;
- tap new bearings into place using a suitable punch or heat up the inboard races of the bearings in oil at 80-90° C.



Scrap view of bevel drive.

a. Section through differential lock - C_2. Nuts for capscrews securing ring gear - C_3. Nut locking bevel pinion shaft - C_4. Capscrew securing differential/bevel drive bearing assy H = 128 mm nominal distance between centerline of ring gear and back of pinion - S. Bevel pinion shim - Sp. Bevel pinion bearing shim - Sd and Ss. Differential/bevel drive bearing shims - T. Plug - 15 and 17. Thrust washers - 19. Differential journal - 25. Capscrew securing differential journal (19).

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– tighten nuts (C_2, page 2) to prescribed torque;
– tighten capscrew (25) securing differential journal (19) without peening it, since the head features the self-locking plastic insert;
– adjust the taper roller bearings as indicated in the relative chapter on page 6);
– fit the differential lock components as described in the corresponding chapter on page 8.

BEVEL PINION SHAFT DISASSEMBLY – ASSEMBLY

To disassemble the bevel pinion shaft (20, page 2) it is necessary to:
– remove nut (C_3) using torque wrench and tube wrench **293342/1**;
– remove bevel pinion shaft by tapping it out with a punch at the splined end of the shaft, collecting the PTO gear (22) together with its spacer (23) from the top opening.

Remove the outer races of the bearings from the case using suitable universal pullers.

When reinstalling preload the bevel pinion as prescribed and adjust it with respect to the ring gear as indicated in the chapters on pages 3, 4 and 5.

BEVEL DRIVE ADJUSTMENT

1. Adjusting taper roller bearings of bevel pinion shaft and establishing required shims (Sp, page 2) using tool (R) 293101/1 (figs. a, a_1, b).

Fit tool (R) **293101/1** with the internal races (1 and 3) of the pinion bearings then:
– spacer (2) and gear (4) for two-wheel drive versions with synchronized PTO (a):
– twin gear (5) for all-wheel drive versions, with synchronized PTO and front axle drive output (a_1).

Tighten nut (M) of tool fully and gauge the distance (H_1) using depth gauge.

Disassemble, lubricate bearings with engine oil and refit tool to housing.

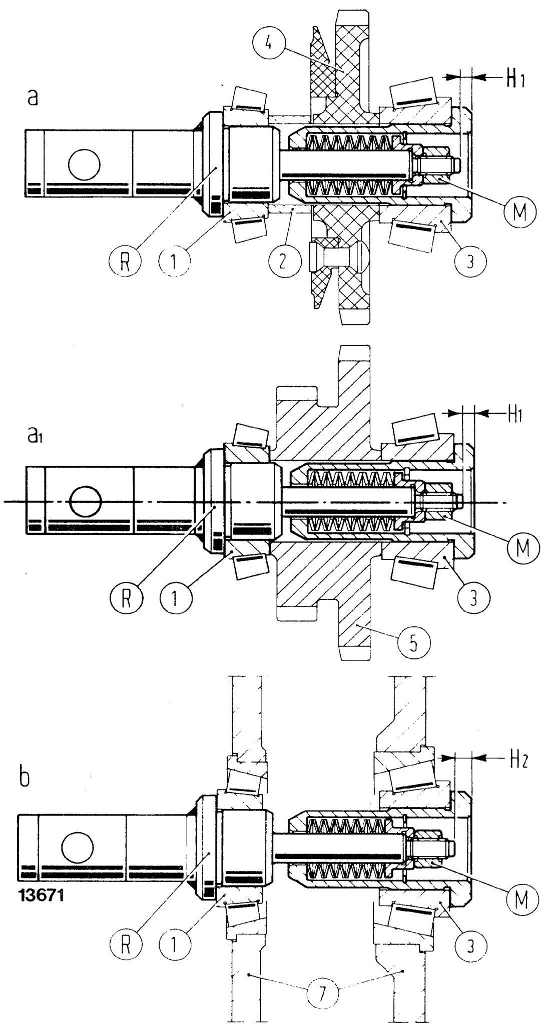
Again tighten nut (M) to its limit turning the tool at the same time to seat the bearings.

Measure distance (H_2, fig. b).

The required thickness of the shims (Sp, page 2) is given by:

$$Sp = H_2 - H_1 + 0.05$$

where:



Establishing shims (Sp, page 2) for bevel pinion shaft bearing for two-wheel drive version with synchronized PTO (a), and on all-wheel drive version with synchronized PTO and power output to front axle (a_1) using special tool 293101/1

H_1 and H_2. Distance to be gauged by depth gauge - M. nut locking tool - R. Gauge **293101/1** - 1 and 3. Bearing inboard races - 2. Spacer - 4. Synchronized PTO drive gear. 5. Twin drive gear for synchronized PTO and front axle power output - 7. Transmission housing.

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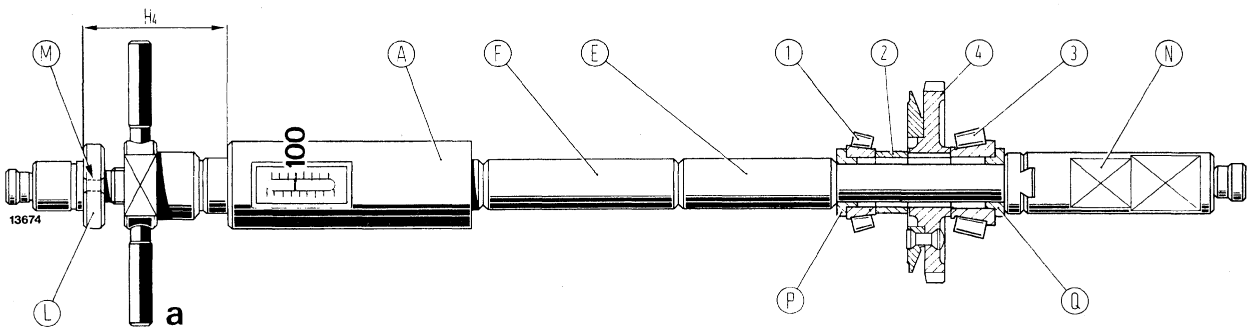

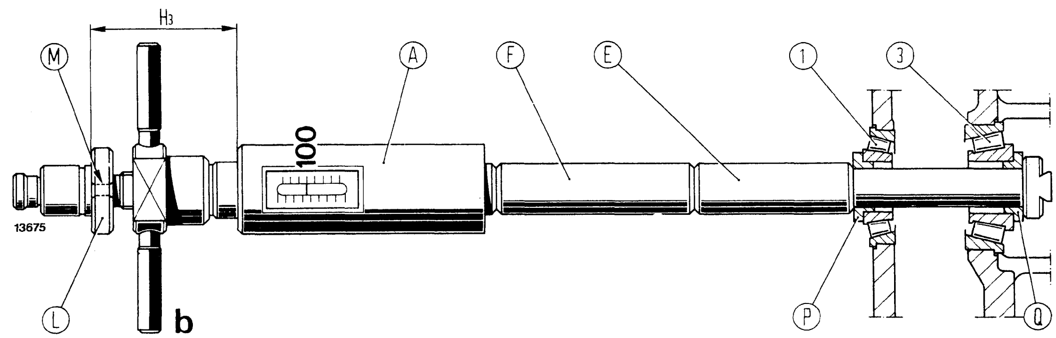

Shim requirement (Sp, page 2) for bevel pinion bearings using universal tool 293510.

a. Measuring distance H_3 - b. Measuring distance H_4 - A. Universal tool **293510** - E. Spacer **293619** - F. Spacer **293620** - H_4 and H_3. Distances measured by depth gauge - L. Adapter **293624** - M. Holes for adapter (L) - N. Connector for terminal **293617** - P. Bush **293632** - Q. Bush **293632** - 1 and 3. Bearing inboard races - 2. Spacer - 4. Synchronized PTO drive gear.

0.05 mm = oversize necessary to compensate bearing preloading by bearing pinion locking nut.

If necessary round off value (Sp) to 0.05 mm.

Note - On completion of gauging do not remove the tool from the transmission housing (also required for gauging installation of bevel pinion).

2. Adjusting bevel pinion shaft bearings and establishing shim (Sp, page 2) requirements using universal tool 293510 (figs. a, b).

Mount universal tool **293510** (A) bushing **293632** (P and Q) and spacers **293620** (F), **293619** (E).

Then fit item **293617** (N) for vicing the tool and inserting the internal races (1 and 3) of the pinion bearings, spacer (2) and synchronize PTO drive gear (4) arranged as shown in fig. a.

Turn the handwheel on the tool and gradually load the bearings up to a scale reading of 100 kg.

Fit universal tool (A) with adapter **293624** (L) so that the holes (M) correspond with the mating surfaces of the handwheel boss.

Using a depth gauge establish the resulting depth (H_4).

Disassemble the arrangement, lubricate the bearings with engine oil and refit the tool complete with bushes (P and Q) and spacers (F and E) in the transmission housing as shown in fig. b.

Gradually preload the bearings until the scale reading is 100 kg, turning the tool at the same time

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to seat the bearings, and establish distance (H_3, page 4).

The thickness of the shims (Sp) required is given by:

$$Sp = H_4 - H_3 + 0.05$$

where:

0.05 mm = oversize necessary to compensate pre-loading of the bearings resulting from tightening the bevel pinion locking nut.

If necessary round off value (Sp) to 0.05 mm.

Note — On completion of gauging do not remove the tool from the transmission housing (also required for gauging installation of bevel pinion).

3. Adjusting for proper installation of bevel pinion and establishing shim (S, page 2) requirement.

Fit tool (D) **293400/1** to the seats of the differential supports as shown in the figures c and d below.

Tighten or back off the two cones (1) to bring the stylus (2) of the micrometer (4) into contact with the bearing (3) of the bevel pinion shaft.

Note — Use stylus identified 125 to 150.

Turn cones (1) by hand or use locking ring **293446** and lightly lock the tool in the seats in the housing to eliminate any play.

Lock the micrometer and stylus by means of screw (5).

Bring stylus (2) of micrometer into contact with bearing (3) and distance (H_5).

Establish correct nominal distance (H_6) between, ring gear center-line and back of pinion:

$$H_6 = H \pm C$$

where:

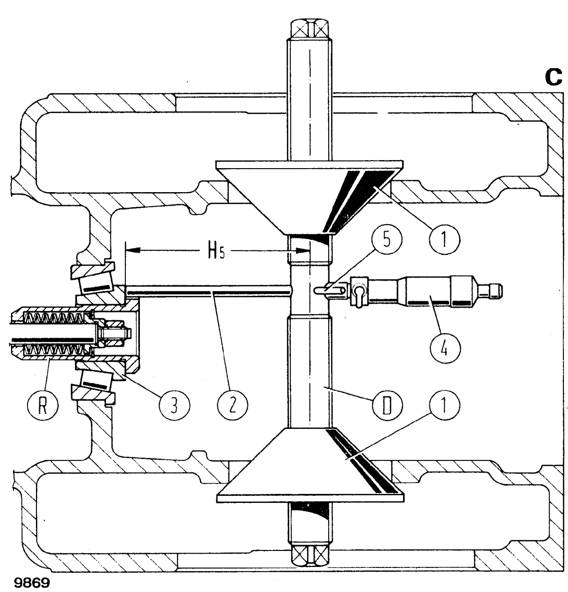
H = 128 mm nominal dimension between ring gear center-line and back of pinion.

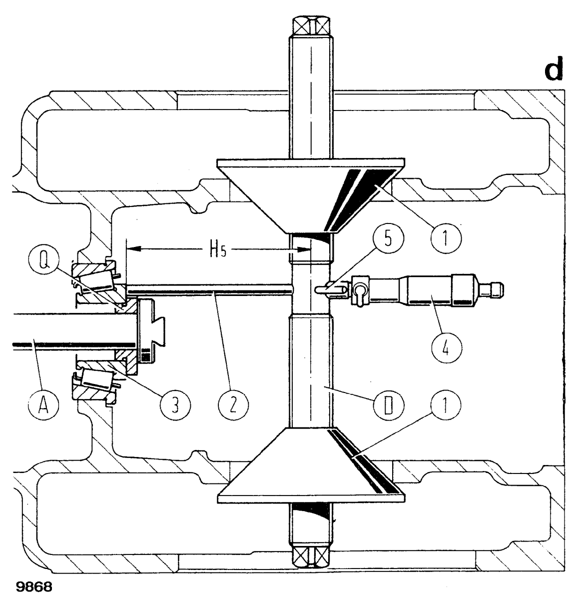
C = Correction factor stamped on pinion expressed in mm and preceded by + or –, if different from 0, to be added or subtracted from nominal dimension (H) according to the sign.

Thickness of required shim (S) is given by:

$$S = H_5 - H_6$$

where:





Installation schematics for bevel pinion position checking tool

c. Measuring distance (H_5) using universal tool (D) and special tool (R) - d. Measuring distance (H_5) using universal tools (A and D) - A. Universal tool **293510** - D. Universal tool **293400/1** - Q. Bushing **293632** - R. Special tool **293101/1** - 1. Centering cones - 2. Micrometer stylus - 3. Inboard race of bevel pinion bearing - 4. Micrometer gauge - 5. Micrometer screw.

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where:

H_5 = distance measured by micrometer;

H_6 = corrected nominal dimension between ring gear center-line and back of pinion.

Example

Dimension measured by mcrometer $H_5 = 132$ mm.

Corrected nominal distance between ring gear center-line and back of pinion H = 128 mm.

Correction factor C = + 0.2 mm.

Corrected nominal dimension $H_6 = 128 + 0.2 = 128.2$ mm.

Required shim thickness:

S = 132 − 128.2 = 3.8 mm.

Correction factor C = − 0.2 mm.

Corrected nominal dimension $H_6 = 128 - 0.2 = 127.8$ mm.

Required shim thickness:

S = 132 − 127.8 = 4.2 mm.

Correction factor C = 0 mm.

Corrected nominal dimension H_6 = H = 128 mm.

Required shim thickness:
S = 132 − 128 = 4 mm.

4. Adjusting taper roller bearings of ring gear and establishing shim (S_C) requirements (fig. e, f, g).

With the bevel pinion removed, install the differential assy complete with the ring gear and bearings adequately lubricated.

Mount RH support (6, see fig. e) inserting package of shims (S_1) to thickness of 1 mm and tighten only three cap screws (C_4) to 59 Nm (6 kgm).

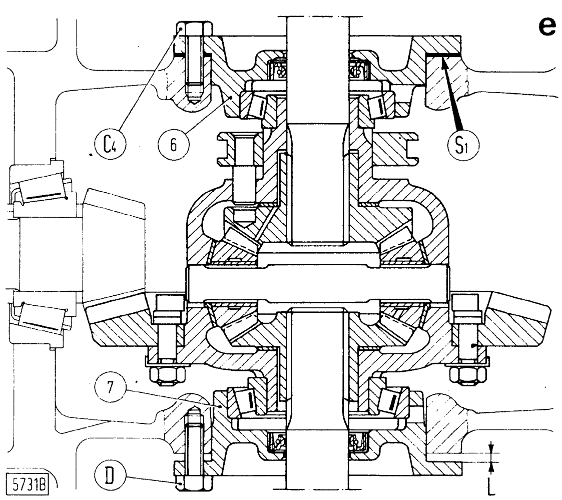
Fit the LH support (7) without the shims, using three cap screws (D) lubricated and disposed 120°. from each other.

Gradually tighten the cap screws (D) using torque wrench **293512** (P, fig, f) to obtain a torque of 6 Nm (0.6 kgm) turning the ring gear at the same time to seat the bearings.

Make sure that the friction torque necessary for turning the ring gear assy is in the range 1,5 to 2 Nm (0.15 to 0.20 kgm) making the measurement with the spring balance and pull cord attached to the flange of the differential housing (fig. h, page 7) and making sure that the differential lock fork does not conflict in its seat. The prescribed friction torque is obtained by a spring balance reading of 20 − 24.5 N (2 − 2.5 kg).

Measure gap (L, fig. e) between transmission housing and LH support using a feeler gauge at three locations disposed 120° symmetrically to each other with respect to the adjusting bolts (D, fig. g).

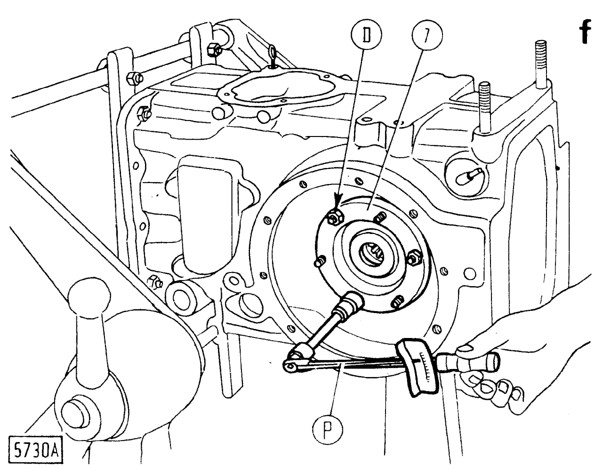
e



Adjusting taper roller bearings of differential ring gear.

C_4. Cap screws for support (6) - D. Cap screws for checking setting - L. Daylight between transmission housing and lefthand support (7) - S_1 = approx. 1 mm. Shim package on RH support - 6. RH support - 7. LH support

f



Tightening cap screws (D) using spring balance torque wrench (P) to check adjustment of ring gear taper roller bearing.

P. Torque wrench **293512** - 7. LH support.

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locations disposed 120° symmetrically to each other with respect to the adjusting bolts (D, fig. g).

Calculate the values as before and add 0.05 mm to the result.

The required shim (S_C) value is then given by:

$$S_C = S_1 + L + 0.05$$

where:

S_1 = total thickness of shims inserted in RH support;

L = daylight previously gauged;

0.05 mm = oversize necessary to eliminate axial preloading resulting from tightening bolts (D).

Example

Total thickness of shims (S_1) in RH support. . . . . 0.95 mm

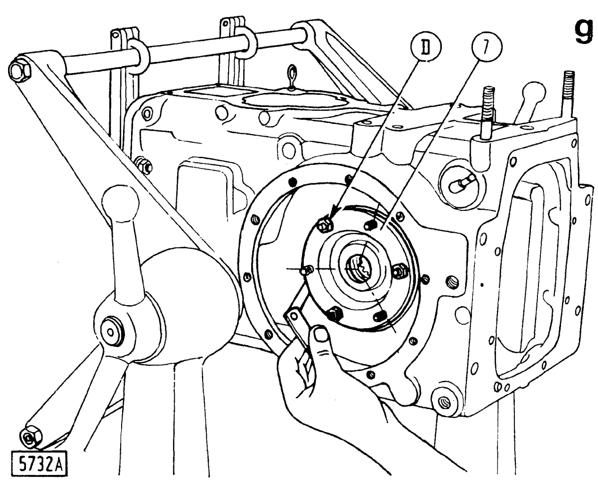
Measurement of daylight (L). . .2.70-2.70-2.65 mm

= average daylight =

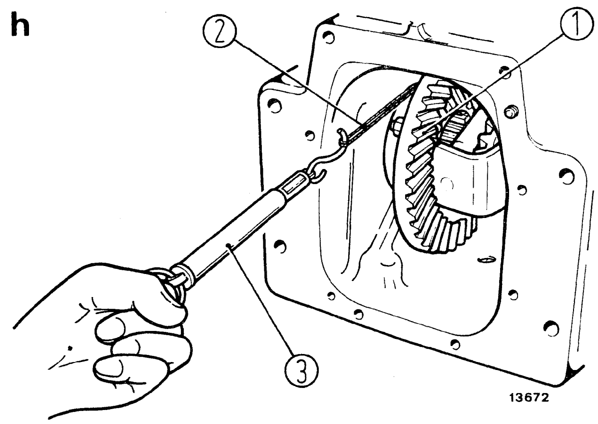
$$= \frac{2.70 + 2.70 + 2.65}{3} = 2.683 \text{ mm}$$

S_C = S_1 + L + 0.05 = 0.95 + 2.683 + 0.05 = 3.683 mm, rounding off in excess of 3.70 mm.

Note – Always round off the result to the second decimal place in increments of 0,05 mm.



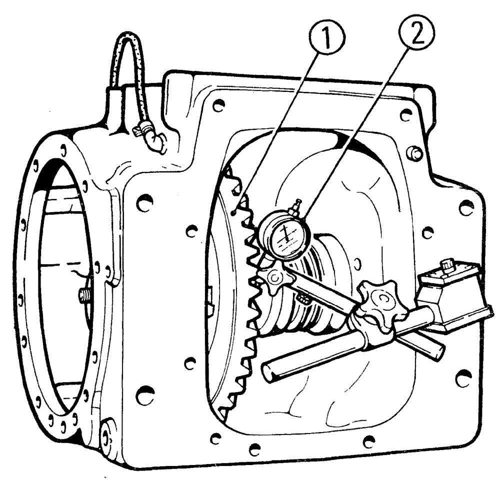
Measuring daylight (L, fig. e, page 6) using feeler gauge.
D. Adjusting bolts - 7. LH support.



Checking friction torque of differential ring gear bearing support.
1. Ring gear - 2. Cord - 3. Spring balance.

Disassemble differential ring gear assy, mount pinion in housing, adding shims as established and torquing nut (C_3, page 2) to 294 Nm (30 kgm) rotating the bevel pinion shaft to facilitate seating the bearings.

The necessary friction torque for turning the pinion shaft must be in the range 0.69 - 1.37 Nm (0.07 - 0.14 kgm) corresponding to a spring balance reading of 24.5 - 49 N (2.5 - 5 kg) obtained with the cord wrapped around the spacer of the bevel pinion shaft.



Checking backlash of bevel pinion assy (must be in range 0.15 - 0.20 mm).
1. Ring gear - 2. Dial gauge.

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Note – Should the established friction torque markedly deviate from the required value add or reduce the number of shims (Sp).

---

5. Checking backlash and differential bearing adjustment (C) obtained in paragraph 4 by shims (Sd and Ss, page 2).

Mount the ring gear in the housing, shimming the RH support with shims (1) to 0.95 mm and the LH support to 2.75 mm (the sum of both shim thicknesses must be equal to S_C as determined in paragraph 4) and then gauge the backlash using a dial gauge located perpendicular to the outer edge of one tooth of the ring gear (fig. i, page 7).

Note – It is good practice to repeat the measurement in two further positions of the ring gear, disposed 120° in averaging the result.

Determine end float (Z) of the ring gear by multiplying the coefficient 1.4 (fixed ratio between normal clearance and end float of ring gear) by the difference between the measured clearance (G) and the normal backlash (0.15 - 0.20 mm, i.e. 0.18 average) provided for proper functioning of the bevel drive assy.

$$Z = (G - 0.18) \times 1.4$$

where:

G = backlash, as measured;

0.18 mm = clearance provided for correct functioning of bevel drive assy.

1.4 = fixed ratio between normal clearance and end float of ring gear.

Total shim thickness (Sd and Ss, page 2) required in the supports is then:

$$Sd = S_1 + Z$$

$$Ss = S_C - Sd$$

where:

S_1 = shim thickness in RH support

Z = end float of ring gear previously determined;

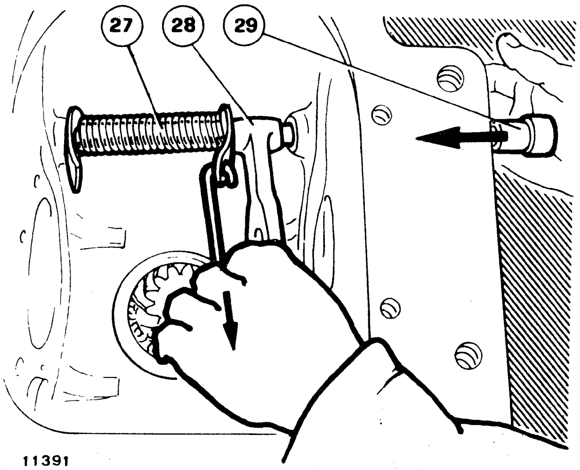
Sc = total shim thickness as establish in paragraph 4.

Example: G = 0.92 mm
$Z = (G - 0.18) \times 1.4 = (0.92 - 0{,}18) \times 1.4 = 1.04$ mm rounded off by 1.05 mm.
$Sd = S_1 + Z = 0.95 + 1.05 = 2$ mm.
$SS = S_C - Sd = 3.70 - 2 = 1.7$ mm.

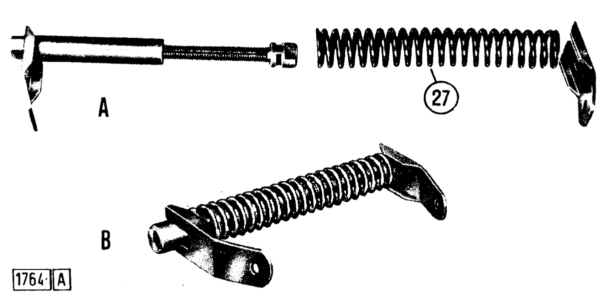
Shims (Sd and Ss) the supports and torque cap screws (C_4, page 2) as required.

INSTALLING DIFFERENTIAL LOCK

Use tool **290870** and proceed as shown in the following figures:



Fitting return spring (27) to spindle (29) of differential lock fork (28) using tool 290870.



Fitting differential lock return spring (27) to tool 290870.
A. Spring before fitting – B. Spring fitted on tool.

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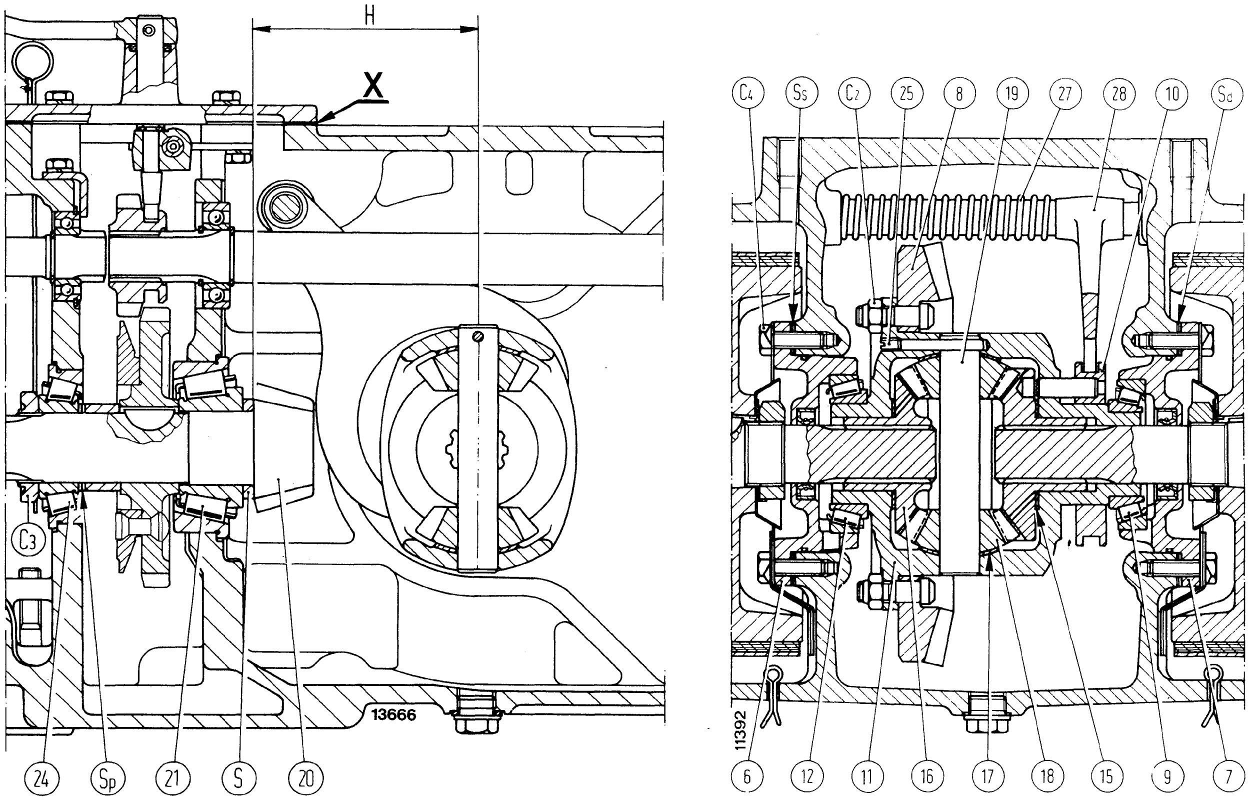

BEVEL AND DIFFERENTIAL LONGITUDINAL AND CROSS-SECTIONS

C_2. Nut for bolts securing ring gear - C_3. Nut locking bevel pinion shaft - C_4. Bolt securing ring gear supports - H = 128 mm. Nominal distance between center-line of ring gear and back of bevel pinion - S. Bevel pinion shim - Sd and Ss. Ring gear bearing and backlash shims - Sp. Pinion bearing shims - 6 and 7. Differential support - 8. Ring gear - 9 and 12. Taper roller bearings - 10. Differential lock sliding sleeve - 11. Differential housing - 15 and 17. Baulk rings - 16. Side gear - 18. Differential pinion - 19. Differential journal - 20. Bevel pinion - 21 and 24. Taper roller bearings - 25. Cap screws securing differential (19) - 27. Spring - 28. Differential lock shift fork.

Note — On assembly, thoroughly clean and degrease mating surfaces X and apply one of the jointing compounds indicated on page 5, section A.

DIFFERENTIAL PINION AND SIDE GEAR BACKLASH ADJUSTMENT

Fit the two side gears (16, see fig. above) in the differential carrier without the baulk rings (15).

Install differential pinions (18) complete with baulk rings (17) and journal (19) and tighten bolt (25) a few turns to prevent journal work out.

Bring LH side gear into full contact with differential pinion.

Using a depth gauge measure dimension (H_1, page 10) at two dimetrically opposed points and average the two readings.

Then push side gear into contact with differential carrier and measure dimension (H_2).

Repeat the same operations on RH side gear.

End float of each side gear without the baulk ring must be:

$$Gs \text{ or } Gd = H_1 - H_2$$

where:

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POWER TRAIN: Bevel drive and differential

Gs = LH side gear end float;

Gd = RH side gear end float;

H_1 and H_2 = Dimensions measured on LH or LH side gears.

Normal differential pinion and side gear backlash is 0.15 mm.

Note that the average ratio normal backlash to the equivalent side gear end float is 1 to 1.7.

Side gear end float corresponding to normal backlash will be:

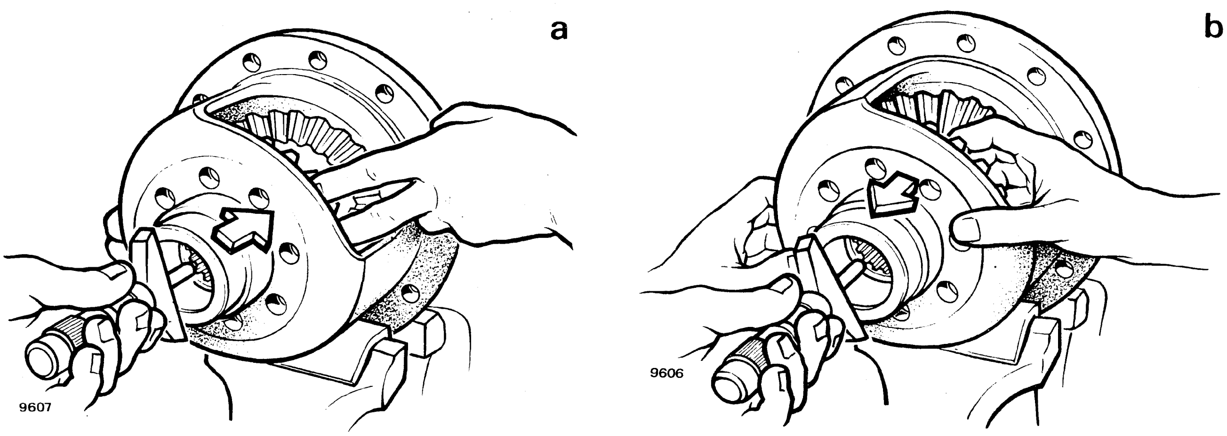
$0.15 \times 1.7 = 0.25$ mm

Consequently the baulk ring thickness required in the differential carrier is given by:

Ss = Gs − 0.25 (for LH side gear)

Sd = Gd − 0.25 (for RH side gear)

Available shims are 1.5 and 1.6 mm; install closest to calculated thickness.



Determining side gear shim thickness (15, page 9).
a. Measuring dimension (H_1) - b. Measuring dimension (H_2).

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SERVICE BRAKE ASSY REMOVAL – INSTALLATION

To remove brake assy components or to remove the complete final drives follow the corresponding instructions as given and proceed as follows:

- remove pedal return spring (2) and detach the fork (3) from the outer control lever (6);
- remove bottom cover and via the transmission housing sump undo the cap screws (C_2) and remove control lever (6);
- remove the hinge pins (10) and then remove brake band complete (8) and the inner lever (9).

INSPECTIONS

Check the friction segments for wear, noting that replacements are not provided separately but only with the brake band complete with the segments, the latter bonded to the brake band.

During disassembly note that the brake bands and other internal items must show no signs of oil, otherwise check for halfshaft leakage.

Check brake drum surface in contact with the brake bands, dressing surface as necessary to a depth which must not exceed 0.5 mm, however.

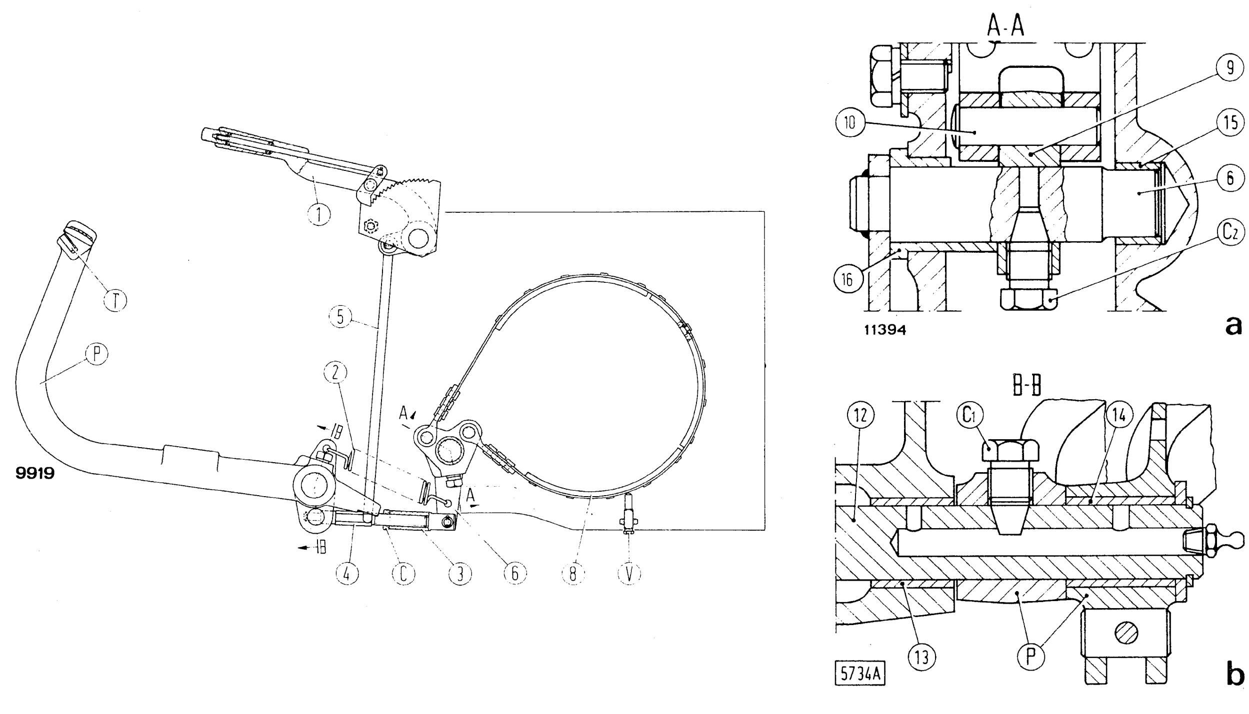
Then check condition of the bushings.

Refit cap screws (C_2) with the head facing the bottom of the tractor and torque as prescribed.

SETTING BRAKE CONTROLS

As the brake band friction segments wear out, the idle travel of the pedals will increase.

Travel must not exceed 60 - 70 mm and must be equal for both pedals to produce simultaneous braking with equal intensity when connected by the corresponding crosslink (T).



Brake assy components

a. Section through hingeing arrangement of inner lever (9) - B. Section through hingeing arrangement of shaft (12) of pedals (P) - C. Locknut for fork (3) - C_1. LH brake pedal cap screw - C_2. Inner lever cap screw (9) P. Brake pedals - T. Cross link - V. Brake band centering bolt - 1. Brake lever - 2. Return spring - 3 and 4. Brake pedal travel fork and plunger - 5. Lever link (1) - 6. Pin for outer brake lever - 8. Brake band - 9. Inner brake band lever - 10. Brake band hinge pins - 12. LH brake control shaft - 13, 14 and 15. Bushes - 16. Support.

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When travel is up to the maximum permissible value, reset as follows:

- first make sure that the brake lever (1, page 1) is not ON;
- tighten cap screws (V) for centering the brake bands fully, then back off 1/2 turn and lock in this position with the corresponding locknuts;
- tighten locknuts (C) and back off the plungers (4) until the required pedal idle travel is zero;
- then tighten plungers (4) by two turns to obtain an idle travel of approx. 50 mm for both pedals;
- lock nuts (C).

REMOVING–INSTALLING PARKING BRAKE ON POWER TRAIN

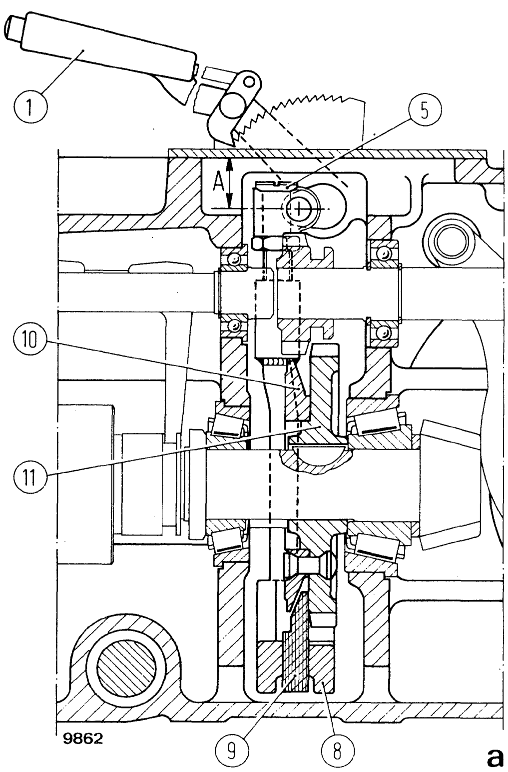
(Two-wheel drive models only)

To disassemble the brake assys or simply to replace a worn friction segment (9, fig. a) it is necessary to remove the final drives, PTO and to separate the rear transmission housing from the front transmission housing, see the corresponding instructions in the relative chapters.

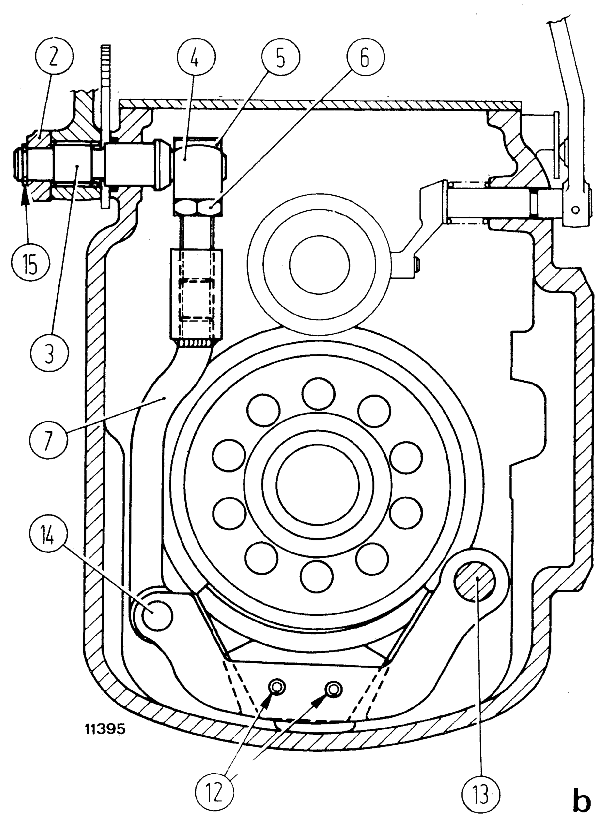
Note – prior to removing the brake lever (1) mark the lever and the hinge pin (3) to facilitate later correct reassembly.

Then proceed as follows:

- remove differential ring gear assy and bevel pinion as described on pages 1 and 3 of Section 204 for disassembling the rear transmission;
- back off the locknut (6, fig. b) and fully release the adjusting bolt (5) to release the corresponding hub (4) of the brake lever pin (3).



a



b

Longitudinal (a) and cross (b) section drawings of parking brake on transmission

A = 26 – 29 mm. Brake lever hinge pin setting - 1. Brake lever - 2. Lever bracket (1) - 3. Eccentric pin - 4. Hub for bolt (5) 5. Adjusting bolt - 6. Locknut - 7. Linkage - 8. Lever for segment (9) - 9. Friction segment - 10. Friction disk solid with gear (11) - 11. Synchronized PTO drive gear - 12. Roll pin - 13. Hinge pin for lever (8) - 14. Pin connecting lever (8) to linkage (7) - 15. Circlip.

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– remove circlip (15, fig. b, page 2) eccentric pin (3) from inside transmission housing and then brake lever (1);

– remove cap screw and retaining plate of pin (13), remove the latter and then remove lever (8) complete with friction segment (9) together with linkage (7) and synchronized PTO drive gear (11).

Check friction segment (9) for wear and check the taper surfaces of the PTO drive gear fillet (11).

Then check the hinge pins (13 and 14) and their seats.

When refitting the brake lever (1, page 2) to the corresponding pin (3) make sure the two marks made on disassembly agree.

Should this not be possible or should one of the two parts have to be changed mate lever (1) to the pin (3) as follows:

– with the supporting bracket (2) removed, position the brake lever (1) fully to the bottom of the segment;

– then insert the pin (3) without the hub (4) and adjusting bolt (5) in the transmission housing, turning it at the same time to bring the eccentric portion facing the front of tractor so that its spindle is at a distance (A, fig. a, page 2) of 26 - 29 mm with respect to the top of the transmission housing;

– keeping the pin (3) at the distance (A) as formerly established, connect the pin to the brake lever (1) and fit the supporting bracket (2) and circlip (15);

– then fit the hub (4), tighten bolt (5) in linkage (7) using locknut (6) and make adjustment as follows:

ADJUSTING PARKING BRAKE ON POWER TRAIN

To fully lock the tractor braked, the brake lever (1) must travel three or four detents on the toothed segment, from the released position.

When this travel exceeds 7 detents reset the brake as follows:

– back off locknut (6);

– loosen or tighten, depending on whether the travel needs increasing or decreasing, the adjusting bolt (5) to obtain the required travel.

– then lock the bolt (5) using the corresponding locknut (6).

Note – Note that roughly every half turn of the adjusting bolt corresponds to one detent on the toothed segment.

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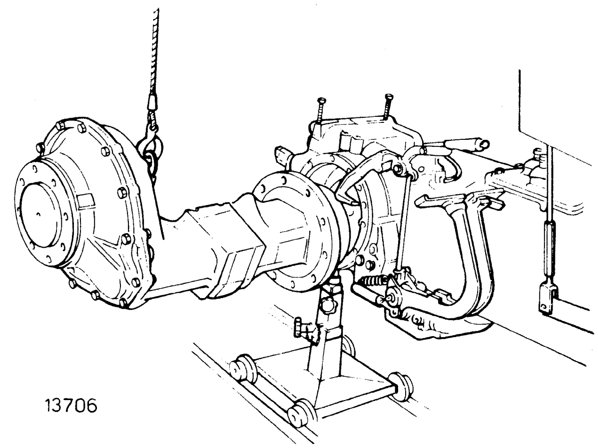
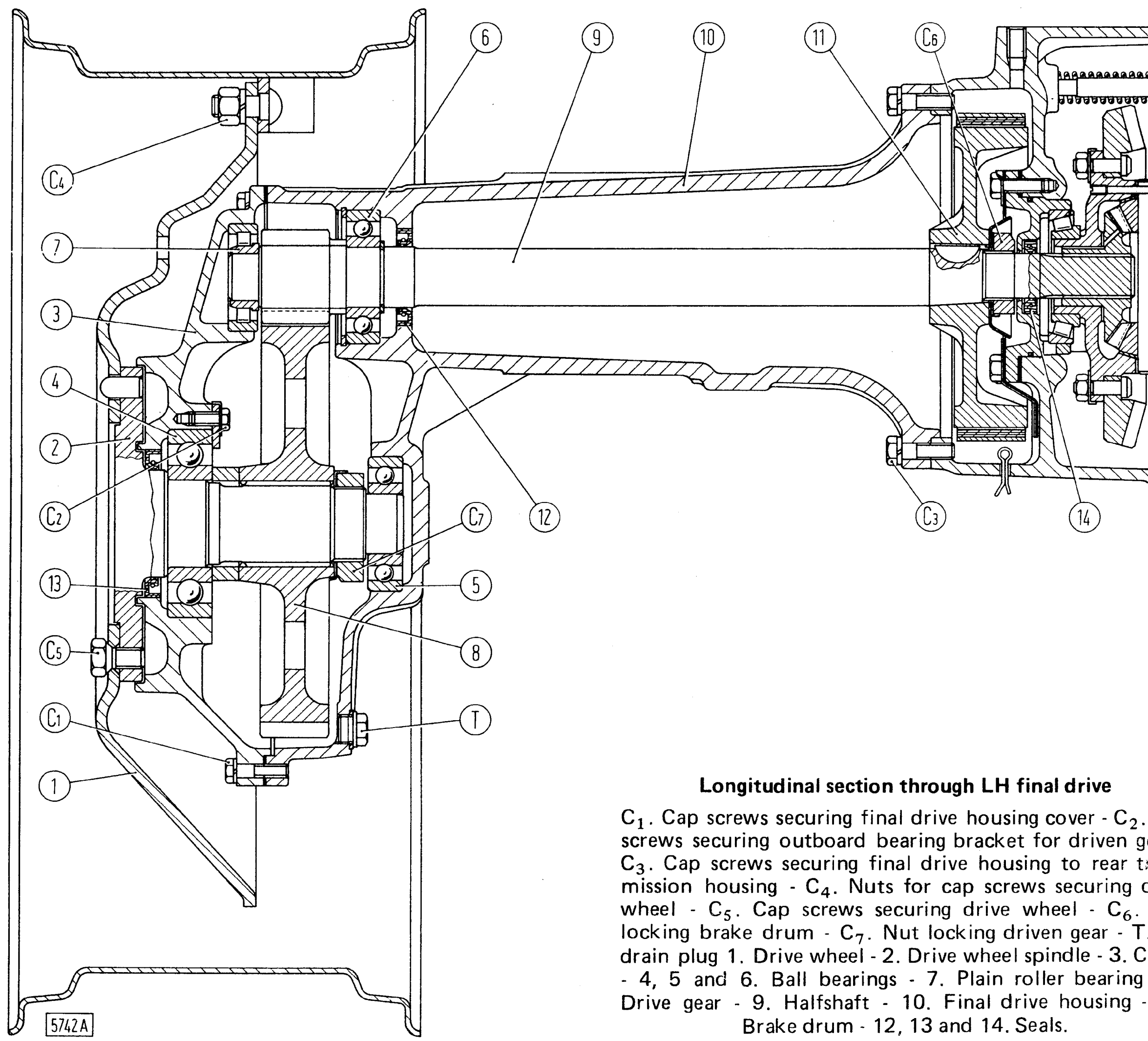
REMOVAL

- Tilt hood, disconnect negative battery pole, drain oil from final drive housing using corresponding drain plug (T, see figure below);
- remove ROPS frame, place a jack stand under the rear transmission housing and remove the rear wheel of the final drive in question followed by the fender and then the footboard;
- connect the final drive housing to the hook of the lifting tackle **291517** and remove the case complete after having removed the corresponding cap screws (C_3);
- back off nut (C_6, page 1) and remove brake drum (11) using outer puller **292904**;



Removing/installing final drive housing complete.
C_1. Cap screws securing housing cover.



Longitudinal section through LH final drive

C_1. Cap screws securing final drive housing cover - C_2. Cap screws securing outboard bearing bracket for driven gear - C_3. Cap screws securing final drive housing to rear transmission housing - C_4. Nuts for cap screws securing drive wheel - C_5. Cap screws securing drive wheel - C_6. Nut locking brake drum - C_7. Nut locking driven gear - T. Oil drain plug 1. Drive wheel - 2. Drive wheel spindle - 3. Cover - 4, 5 and 6. Ball bearings - 7. Plain roller bearing - 8. Drive gear - 9. Halfshaft - 10. Final drive housing - 11. Brake drum - 12, 13 and 14. Seals.

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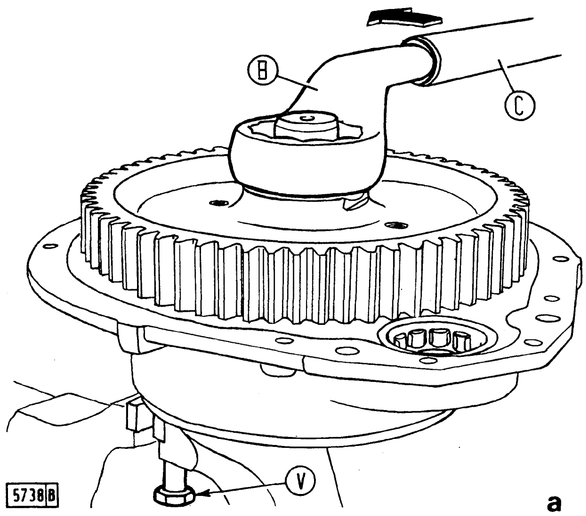
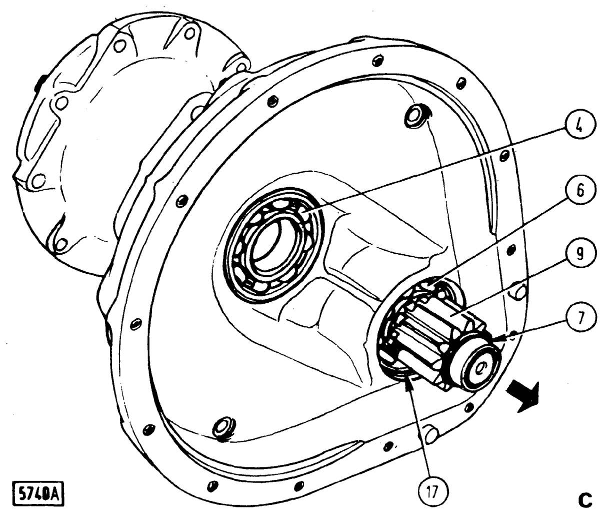


Disassembling nut securing driven gear

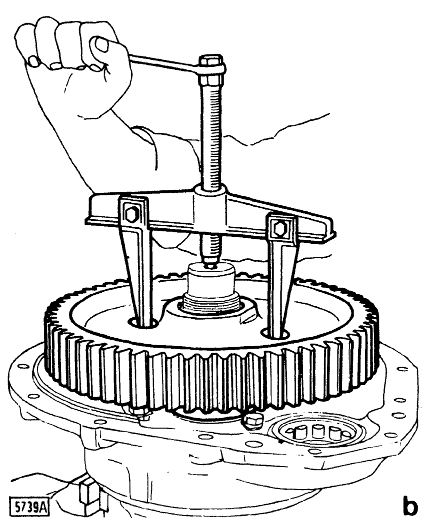
B. Angle wrench **290061** - C. Extension for wrench **290240** - V. M 16 x 1.5 cap screw securing cover to vice.



Final drive housing (mods. 480 - 500 S - S 540 S).

[Arrow indicates direction for removing halfshaft (9)]. 4 and 6. Ball bearings - 7. Inboard race of plain roller bearing - 9. Halfshaft - 17. Circlip for bearing (6).

- remove cover from final drive housing complete with driven gear and clamp in vice using M 16 x 1.5 capscrew formally used for removal;
- back off nuts (C_7, fig. a) after having removed ball bearing 5, page 1).



Disassembling driven gear using puller series 292904.

Back off nut (C_7, fig. a) after having removed driven gear (8, page 1) from drive wheel spindle (2) using **292904** series puller as shown in fig. (b), removing spacer and tapping out the drive wheel spindle with a lead mallet as indicated by arrow in fig. (e);

- remove circlip (17, fig. c) remove halfshaft complete with bearing (6) as shown by arrow in the same figure;
- remove internal race of roller bearing (7) from halfshaft, using series **292911** puller/separator as shown in fig. (d);
- then remove bearing (4, fig. e) from cover, after having removed the corresponding mounting bracket (19) and ball bearing (6, page 1) from halfshaft (9) after having removed circlip.

Replace damaged bearings using universal puller and suitable drifts.

Make sure the lip-type seals (12, 13 and 14, page 1) are in good condition and replace, if necessary, to ensure proper seal.

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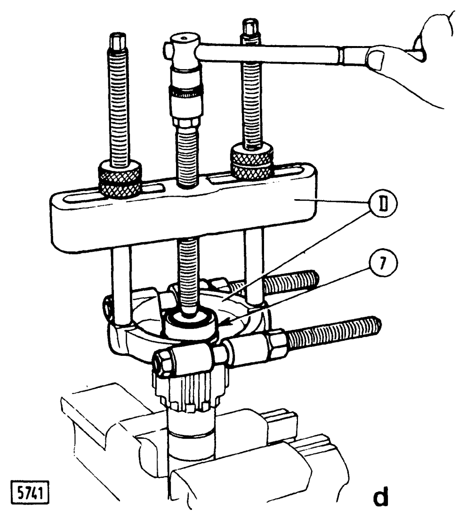
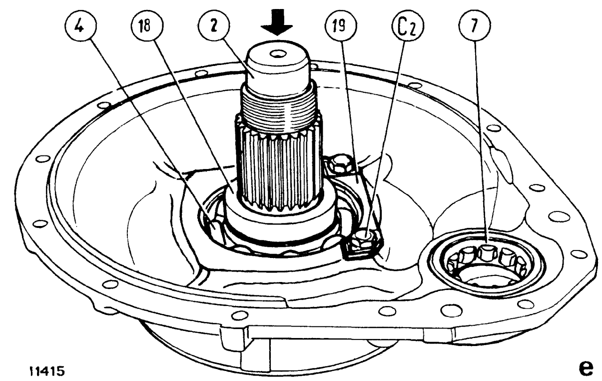


Removing internal race of plain roller bearing (7) from halfshaft.

D. **292911** series puller/extractor.



Installation (disassembly) drivel wheel spindle.
(Arrow indicates direction of removal).

C_2. Capscrews securing bearing bracket (19) - 4. Ball bearing - 7. External race of roller bearing - 18. Distance ring - 19. Ball race bearing bracket.

INSTALLATION

Install in the following sequence:

– fit the halfshaft to the drive wheel shaft taking care not to damage the seals (12, 13 and 14, page 1);

– install internal race of plain roller bearing (7, fig. c) to halfshaft after heating it up in oil to 80 - 90° C;

– seat external race of plain roller bearing (7, fig. e) in final drive housing cover so that the maker's logo faces outwards;

– where replaced, orient the seals (12, 13 and 14) as shown in the figure on page 1;

– tighten nut (C_7, page 1) locking the driven gear using angle wrench (B, fig. a, page 2) and an extension (C) formerly used for disassembly.

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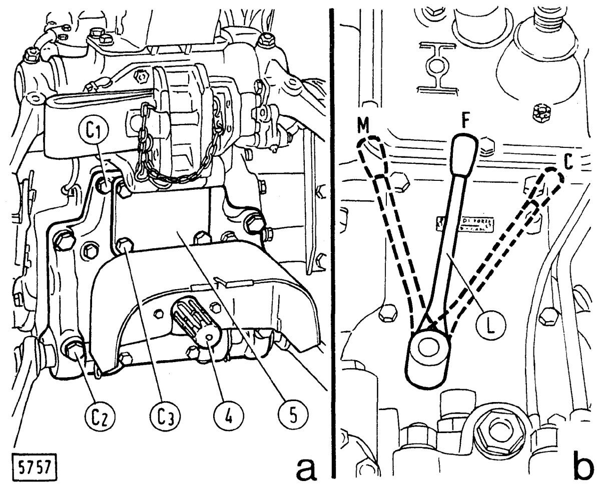
REMOVAL–INSTALLATION

To remove the PTO assy proceed as follows:

– drain oil from front and rear transmission housings;

– position lever (L, fig. b) to position (M) to prevent the gear (1, page 2) from dropping when removing the PTO cover complete with the corresponding drive shaft (2);

– undo capscrews (C_1 and C_2, page 2) securing rear cover (9) and remove cover from rear transmission housing complete with PTO.



PTO location on tractor

a. View showing PTO assy incorporated in rear cover of transmission housing - b. View showing PTO engagement - C. Engaged position on transmission case - C_1 and C_2. Capscrews securing rear cover of transmission housing - C_3. Capscrews securing cover (5) - F. PTO OFF position - L. PTO lever - M. Engaged position with engine - 4. Driven shaft with standard spline - 5. Cover on power output and for applying powered pulley.

For correct disassembly install PTO housing on rotary stand (see fig, c) and refer to longitudinal section as shown in fig. 2.

Remove top cover from transmission housing to permit removal of sliding gear (1, page 2) and PTO engagement.

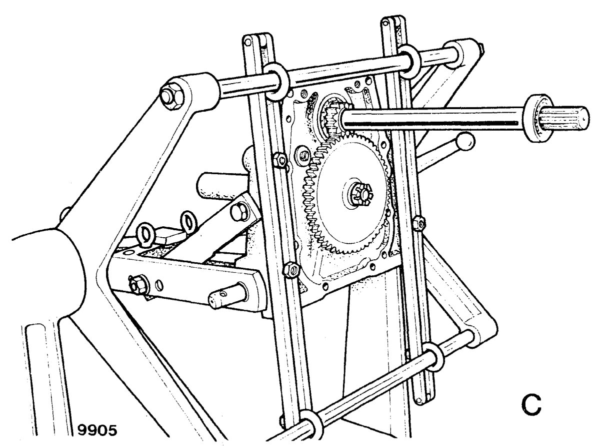
Replace any damaged bearings using universal extractor and suitable drifts.

Use new gasket (6, page 2) as necessary.

Note – Prior to refitting the PTO cover to the rear transmission housing carefully clean and grease the coupling surface and apply one of the jointing compounds as recommended on page 5, Section A.

When refitting the PTO items refer to the longitudinal section of the assy on page 2 and keep to the locking torques as listed on page 9 of Section 20.

In reassembling the assy manoeuver the slined end of the driven shaft to facilitate splining the drive shaft (2, page 2) with the sliding gear (1).



PTO assy mounted in rotary stand 290086.

(Assy shown complete with drawbar).

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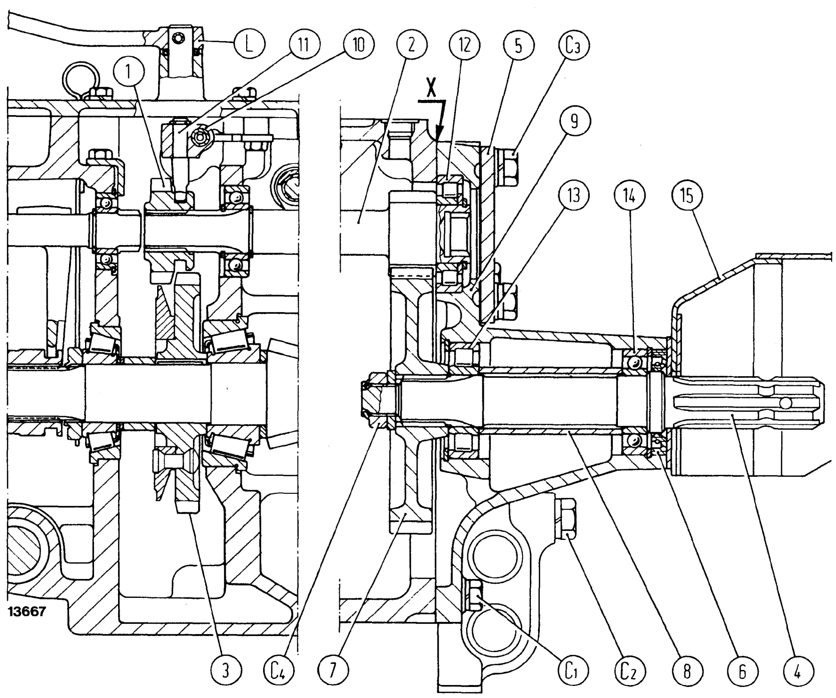
POWER TRAIN: Power take-off



LONGITUDINAL SECTION THROUGH PTO

C_1 and C_2. Capscrews securing cover to rear transmission housing - C_3. Capscrews securing cover (5) - C_4. Nut locking driven shaft gear - L. PTO lever - 1. Sliding gear for PTO engagement - 2. Drive shaft - 3. Drive gear for PTO synchronized to transmission - 4. Driven shaft - 5. Cover for power output and powered pulley - 6. Seal - 7. PTO driven gear - 8. Spacer - 9. Cover of rear transmission - 10. PTO release lever - 11. Pad for lever (10) - 12 and 13. Plain roller bearing - 14. Ball bearing - 15. PTO shaft guard

Note - Apply jointing compound as recommended (see page 5, Section A) to mating surfaces X.

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FRONT AXLE

Type	inverted U, telescoping, centre pivotting
Tracks (six)	1400-1500-1600-1700-1800-1900 mm (56-60-64-68-72-76 in)
Camber .... Toe-in	2°, equivalent to 15 mm (0.590 in) for 16 in rims, 17 mm (0.669 in) for 18 mm (0.706 in) for 20 in rims at outermost edge of rim 0 to 5 mm (0 to 0.197 in)
Steering Knuckle Articulation King pin journal dia. (2, page 2, Section 301) .... Bushing fitted I.D. (3) .... King pin clearance in bushings	 37.961 to 38.000 mm (1.4945 to 1.4961 in) 38.050 to 38.140 mm (1) (1.4980 to 1.5016 in) 0.050 to 0.179 mm (0.0020 to 0.0047 in)
Bronze thrust washer thickness (5, page 1, Section 301) .... Steel washer thickness (12)	3.935 to 4.065 mm (0.1574 to 1626 in) 3.925 to 4.000 mm (0.1545 to 0.1575 in)
Axle Pivot Pivot dia. (10, page 1, Section 301) .... Bushing fitted I.D. (11) .... Pivot clearance in bushing	 37.961 to 38.000 mm (1.4945 to 1.4961 in) 38.050 to 38.140 mm (1) (1.4980 to 1.5016 in) 0.050 to 0.179 mm (0.0020 to 0.0047 in)

MANUAL STEERING

Steering Box	
Type	ball recirculation
Make	GRAZIANO
Reduction ratio (lever at centre)	33.25 to 1
Steering column bearings	two, ball

(1) Not reamed.

(follows)

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FRONT AXLE - STEERING: Specification and Data

MANUAL STEERING

(continued)

Steering shaft bushings	two white metal lined steel shells
Worm gear bearing adjustment	see page 2, Section 302
Rocker shaft end play adjustment	see page 2, Section 302
Worm bearing shim thickness (S, page 1, Section 302)	2.10-2.15-2.20-2.25-2.30-2.35-2.40-2.45-2.50-2.55-2.60-2.65-2.70-2.75 mm (0.0827-0.0846-0.0866-0.0886-0.0905-0.0925-0.0945-0.0965-0.0984-0.1004-0.1024-0.1043-0.1063-0.1083 in)
Top cover gasket thickness (12)	0.15 mm (0.0060 in)
Rocker shaft shim thickness (S_1)	0.20 to 0.25 mm (0.0079 to 0.0100 in)
Side cover gasket thickness (10)	0.20 to 0.25 mm (0.0079 to 0.0100 in)
Rocker shaft journal diameter (8, page 1, Section 302)	37.984 to 38.000 mm (1.5193 to 1.5200 in)
Rocker shaft bushing fitted I.D. (15)	38.030 to 38.070 mm (1.5212 to 1.5228 in)
Rocker shaft clearance in bushings	0.030 to 0.086 mm (0.0012 to 0.0034 in)
Bushing interference fit	0.050 to 0.118 mm (0.0020 to 0.0046 in)
Upper worm cam journal diameter (2, page 1, Section 302)	25.360 to 25.400 mm (0.9984 to 1.0000 in)
Sintered bushing fitted I.D. (14)	25.425 to 25.464 mm (1) (1.0010 to 0.0025 in)
Worm cam journal clearance in bushing	0.025 to 0.104 mm (0.0010 to 0.0041 in)

(1) Not reamed.

POWER STEERING

Type	hydrostatic
Make	DANFOSS
Hydraulic circuit	independent, separate pump
Oil reservoir	transparent plastic on RH side of engine
Oil filter	in oil reservoir, gauze

(cont.)

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POWER STEERING *(continued)*

Hydraulic Pump	
Type	gear
Model	A 18 X
Make	FIAT
Drive	from engine valve gear
Rotation (seen from drive side)	counterclockwise
Drive ratio	0.910 to 1
Rated speed (at engine governed speed)	2366 rpm
Rated output at maximum rated speed	19.4 l/min (34 pints/min)
On-bench output at 1450 rpm and 68.5 bar ($70\ kg/cm^2$, 993 psi):	
– new or reconditioned pump	11.1 l/min (19 pints/min)
– used pump	7.70 l/min (13 pints/min)
– test oil temperature	55° to 65°C
– test oil viscosity	SAE 20
Drive/driven gear journal diameter	17.400 to 17.424 mm (0.6850 to 0.6860 in)
Bearing bore diameter	17.450 to 17.470 mm (0.6870 to 0.6878 in)
Gear journal clearance in bearing	0.026 to 0.070 mm (0.0010 to 0.0027 in)
Maximum wear clearance	0.1 mm (0.004 in)
Gear clearance in pump body	37.270 to 37.294 mm (1.4908 to 1.4917 in)
Maximum pump body wear, suction side opposite gears	0.1 mm (0.004 in)
Bearing width	16.863 to 16.878 mm (0.6639 to 0.6645 in)
Gear width	13.190 to 13.215 mm (0.5193 to 0.5203 in)
Pump body width	47.070 to 47.120 mm (1.8531 to 1.8551 in)
Bearing and gear end clearance in pump body (to be restored on overhaul)	0.1 to 0.2 mm (0.004 to 0.008 in)
Control Valve	DANFOSS
Type	with steering column operated rotary valve (permitting steering also in case of pump failure)

(cont.)

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POWER STEERING

(continued)

Outfit code:	
– DANFOSS (with valves in control valve)	OSPC 100
Relief valve crack-off setting (all outfits)	100 bar (102 kg/cm^2, 1471.77 psi)
Power cylinder overload valve crack-off setting	200 bar (204 kg/cm^2, 2903.53 psi)
Power Cylinder:	
Type	Double acting, located behind front axle
Make	WEBER or SIMA or ERBER
Cylinder bore diameter (all models)	48 mm (1.89 in)
Piston rod diameter (all models)	22 mm (0.866 in)
Maximum piston stroke:	
– mod. 446 with cylinder { WEBER or ERBER	215 (8.464 in)
– mod. 446 with cylinder { SIMA	214 mm (8.425 in)
– mode. 446 DT with cylinder { WEBER or ERBER	200 mm (7.874 in)
– mode. 446 DT with cylinder { SIMA	194 mm (7.638 in)

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TIGHTENING TORQUE FIGURES

DESCRIPTION	Thread Size	Torque		
		Nm-N	kgm	ft lb
Front Axle, Section 301 Capscrew, front axle carrier to engine (C_3, page 1) ..	M 18x1.5	314	32	231.5
Capscrew, axle pivot (C_4)	M 10x1.25	59	6	43
Nut, axle end	M 16x1.5	221	22.5	163
Capscrew, wheel to hub (C_2)	M 18x1.5	314	32	231
Nut, track rod ball joint	M 14x1.5	98	10	72
Nut, RH and LH levers on knuckles (C_1)	M 14x1.5	147	15	108
Manual Steering, Section 302 Capscrew, steering box to tractor	M 16x1.5	142	14.5	105
Nut, steering wheel to post (C_1, page 1)	M 18x1.5	69	7	50
Capscrew, top cover to steering box (C_5)...........	M 10x1.5	49	5	36
Capscrew, side cover to steering box (C_3)	M 8x1.25	28	2.8	20
Nut, side cover to steering box (C_2)	M 8x1.25	28	2.8	20
Nut, swing lever (C_4)	M 24x2	245	25	181
Power Steering, Section 303 Capscrew, control valve support	M 16x1.5	147	15	108
Capscrew, control valve to tractor	3/8"-16 UNC	44	4.5	32
Capscrew, cover to control valve (C_1, page 11)	M 8x1	34	3.5	25
Nut, power cylinder pivot pin (C_4, page 2)	M 18x1.5	294	30	217
Nut, power cylinder piston rod to steering arm (C_1) .	M 16x1.5	206	21	151.2
Nut, piston to rod { ERBER cylinder or SIMA (C_2)	M 16x1.5	98	10	72
Nut, piston to rod { WEBER cylinder (C_2)	M 16x1.5	83	8.5	61
Capscrew, steering pump to engine (C_1, page 3)	M 6x1	8	0.8	6
Nut, cover to pump body (C_4)	M 10x1.25	49	5	6
Nut, drive sleeve to pump drive shaft (C_3)	7/16"-20 UNF-2B	28	2.8	20

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AXLE REMOVAL-INSTALLATION

CAUTION – Handle all parts with care. Do not put hands or fingers between parts. Wear safety items such as goggles, safety shoes and gloves.

Remove front axle assy from tractor as follows:

– apply parking brake, chock rear wheels and remove front ballast weights and associated support;
– for models with mechanical steering, separate levers on knuckles from track rods. For models with power steering, remove power cylinder from axle;
– position stand under axle support, raise tractor and remove front wheels;
– remove capscrew (C_4) and withdraw axle pivot (10) using slide hammer puller **292927** with adapter **290793.** Remove axle assy and install on a suitable axle overhaul stand.

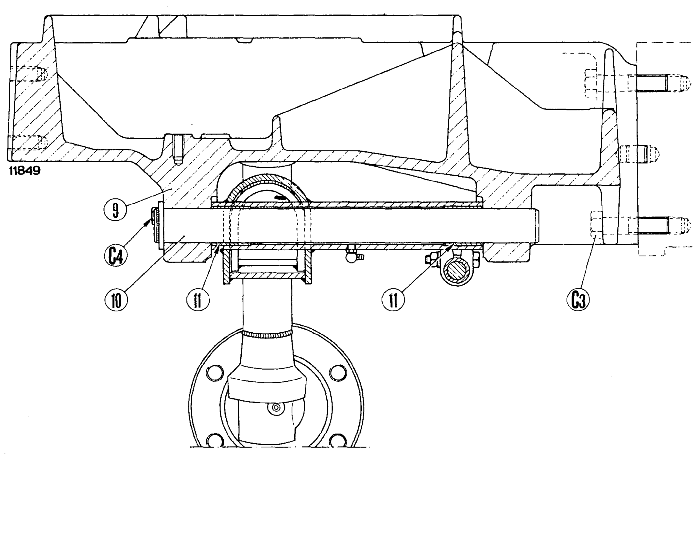
Replace axle pivot bushings (11) if worn, using suitable pullers and drivers.
When refitting axle grease axle pivot with **grassofiat TUTELA G9** by means of lubricators provided.

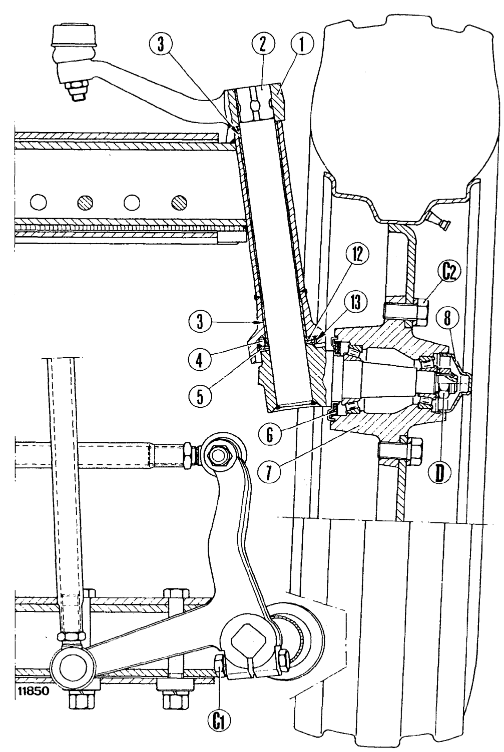
STEERING KNUCKLE OVERHAUL

Steering knuckles and hubs may also be disassembled without removing axle from tractor. Proceed as follows for each wheel:

– remove hub cap (8) and slacken adjusting nut (D);
– slacken wheel hub capscrews (C_2);
– apply parking brake, chock rear wheels, jack up the front of the tractor and support front axle on two stands;
– remove front wheel;
– remove nut (C_1) and withdraw steering knuckle together with wheel hub from below. Disassemble on bench.

Replace inefficient seals, worn bushings and bearings using suitable pullers and drivers.
When refitting steering knuckles grease the bushings with **grassofiat TUTELA G9** by means of lubricators provided.





Section through front axle pivot and steering knuckle.

C_1. Steering arm (1) nut - C_2. Wheel hub capscrew - C_3. Axle support capscrew - C_4. Axle pivot capscrew - D. Bearing adjusting nut - 1. Steering arm - 2. King pin - 3. Bushings - 4. Dowel - 5. Bronze thrust waster - 6. Seal - 7. Wheel hub - 8. Hub cap - 9. Axle support - 10. Axle pivot - 11. Axle pivot bushings - 12. Steel washer - 13. Cup.

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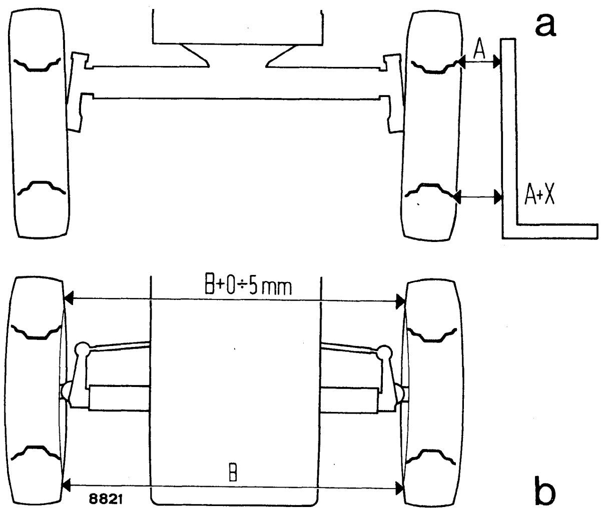
FRONT AXLE - STEERING: Front axle



Front wheel geometry.

a. Wheel camber check - b. Front toe-in check - X = Approx. 15 mm (0.59 in) for 16 in rims.

On reassembly, pack wheel hub with **grassofiat TUTELA G9** grease and adjust taper roller bearings as follows:

– tighten nut (D, page 1) to a torque of 68 Nm (kgm or 50.6 ft lb) while simultaneously rotating wheel hub (6) to settle the bearings;

– slacken nut, then tighten to a torque of 9.8 Nm (1 kgm or 7.2 ft lb) while simultaneously rotating wheel hub;

Note - Scrap and replace nut (D) at every adjustment.

– Stake nut in place.

AXLE CHECKS

Check the steering geometry as follows:

– with the wheels in straight-ahead driving position, camber should be 2 deg., equivalent to approx. 15 mm (0.59 in) for 16 in rims, between rim edges (a) and parallel to tractor longitudinal centerline. Toe-in should be up to 5 mm (0.19 in) as measured on the inside between rims (b);

– to adjust toe-in, turn the adjustable ends of tracks rods.

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STEERING BOX OVERHAUL

To remove steering box proceed as follows:

- remove rear control panel;
- remove steering wheel, hand throttle cable and PTO clutch link from associated lever on clutch housing;
- detach drag link from swing lever and swing lever from rocker shaft;
- take off capscrews and remove steering box together with steering column.

Disassamble steering box as follows:

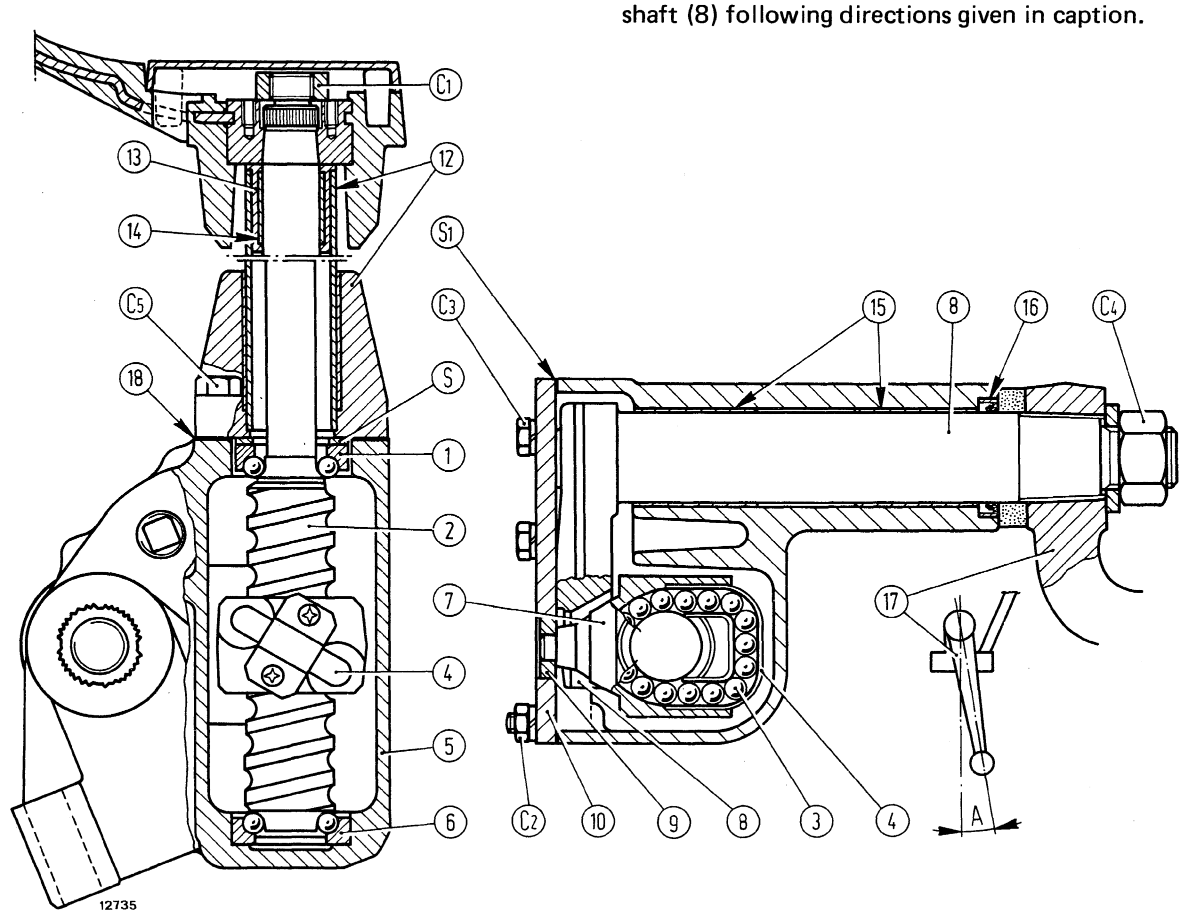
- take off side cover (10) and shims (S_1) and remove rocker shaft (8);
- remove cover (12) and associated shim (S). Turn worm (2) slowly counterclockwise to remove.

Remove balls and collar (7) from steering box.

Replace damaged bushings and seals using suitable pullers and drivers.

Check worm (2) and collar (7) for wear and signs of seizure along ball seats. Replace worm, balls and collar, if necessary.

Reassemble steering box referring to figures below and carry out the following adjustments. After adjustment, install steering swing lever (17) on rocker shaft (8) following directions given in caption.



Sections through steering box.

A. Install swing lever (17) on rocker (8) in such a way that, with steering wheels in straight-ahead driving position, lever is 10° backwards with respect to the vertical - C_1. Nut securing steering wheel column - C_2 and C_3. Side cover nut and capscrew - C_4. Nut securing swing lever to associated shaft. - C_5. Top cover capscrew - S and S_1. Shims - 1 and 6. Top ball and bottom bearings - 2. Worm - 3. Balls - 4. Ball transfer pipe - 5. Steering box - 7. Ball retaining collar - 8. Rocker shaft 9. Roller - 10. Side cover - 12 . Top cover - 13. Outer bushing - 14. Lubricated-for life bushing - 15. Rocker shaft bushings - 16. Seal - 17. Swing lever - 18. Gasket.

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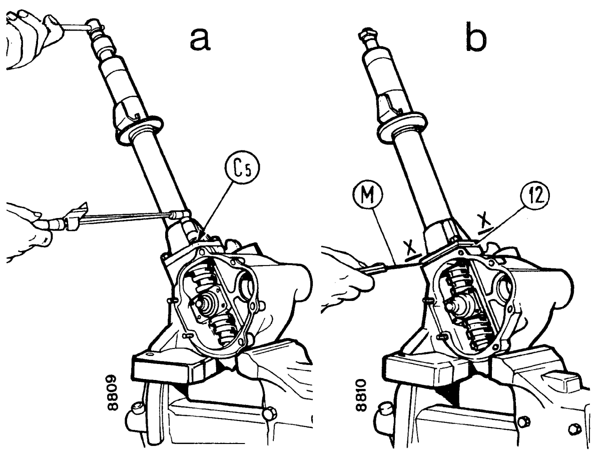

Adjusting worm bearings.

a. Tighten two screws C_5 (for tightening torque, see text) - b. Measuring top cover gap using feeler gauge M - X-X. Plane of gap measurement - 12. Top cover.

Worm installation and ball bearing adjustment

Pack bottom bearing race (6, page 1) with **grasso-fiat TUTELA G9** grease, install the balls in position and place the race assembly in the steering box.
Position collar (7) over the worm together with the balls embedded in grease to prevent them from falling, and insert the worm in the casing through the side cover aperture pushing upwards as far as possible.
Pack the top bearing race (1) integral with the worm, embed the balls on the race, insert the outer race through the top cover aperture and push the assembly downwards, ensuring that the top and bottom bearing balls do not come off their seats.
Fit a 2.75 mm (0.108 in) shim.
Install top cover (12), without gasket (18) and secure to the casing using two of the four capscrews (C_5) positioned diagonally and lubricated with engine oil.
Progressively tighten the two screws (C_5) in alternating fashion until a 5 Nm (0.5 kgm or 3.6 ft lb) torque is obtained, while simultaneously turning the worm cam (a) to settle the bearings.
Measure the gap between top cover (12) and steering box face, using a suitable feeler gauge, at two diametrically opposed points along plane X-X (b) and arithmetically average the readings.

Remove top cover (12) and interpose a shim of thickness equal to shim previously mounted (s = **2.75 mm or 0.108 in**), plus minus gap reading and plus 0.10 mm (0.004 in), which is the thickness of gasket (18, page 1).
Reinstall top cover and tighten capscrews to the torque indicated in table on page 5, Section 30.
Check that worm cam rotating torque (2, page 1) is 0.40 to 0.78 Nm (0.04 to 0.08 kgm or 0.29 to 0.58 ft lb). To adjust, change thickness of shim (S) as necessary.

Rocker shaft end float adjustment (8, page 1)

Insert shaft (8) in the steering box, paying particular attention to prevent damaging seal (16).
Interpose a pack of shims (S_1) and gasket between side cover and steering box so as to obtain a rocker shaft end play of 0.1 mm (0.004 in), with steering wheel in straight-ahead driving position and with a tightened cover.
Finally, tighten the cover capscrews and nuts to the torque given in the table on page 5, section 30.
With housing installed and lever at the centre, check that worm cam rotating torque (2, page 1) is 1.13 to 2.82 Nm (0.11 to 0.28 kgm or to 0.80 to 2.02 ft lb).

STEERING LINKAGE

Ensure that the levers and actuating links are free from distortion; if distortion is detected, straighten as necessary and, prior to reassembly, check that the straightening operation has not weakened the parts involved replacing any suspect component without hesitation.

Ensure that the ball joints are not affected by excessive play and check the pins and seals for damage.

In case of damage, scrap and replace the entire ball joint assemblies; loose joint parts are not available.

Check the wheel alignment and adjust the front wheel toe-in as necessary, according to the instructions given on page 2, Section 301.

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POWER STEERING OVERHAUL

Hydraulic power steering system components and their operation are illustrated in the general diagram on pages 10 and 11, Section 303.

Removal

Remove the unit from the tractor as follows:

– Drain oil from power steering reservoir.

– Remove rear control panel.

– Disconnect hose and the three pipes from power steering unit.

– Remove power steering unit after removing capscrews securing unit to steering column and support.

Disassembly

Disassemble power steering unit as follows:

NOTE – When removing and refitting sleeve (6, page 11, Section 303) and rotary valve (5) make sure pin (1) is fitted horizontally to prevent it from fouling the neck of the power steering body thus impeding emergence of the unit.

– Remove the capscrews (C_1) that hold the cover to the body (3) and remove the cover, cam ring (8) with attached rotor (9), thrust ring (10), spacer (12), rotor shaft (7), sleeve (6) with rotary valve (5) and pin (1) and thrust bearing (29) in that order.

– Upend the steering unit and retrieve check valve ball (4), after removing the threaded stop.

Assembly

Reverse the disassembly sequence and note the following points:

– Scrap and replace power steering seals every time unit is disassembled.

– Install seal (31, page 11, Section 303) between power steering unit and rotary valve (5) using tool **293388.**

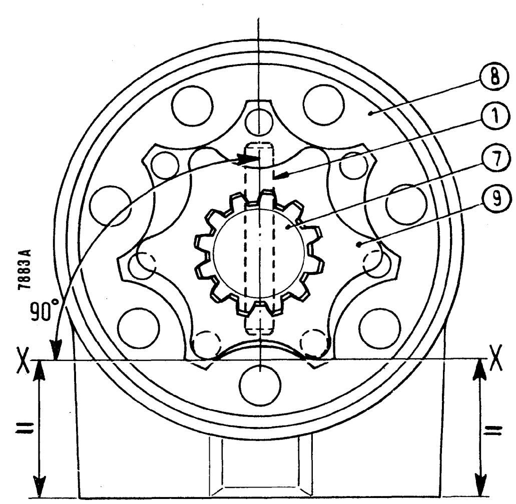
– If spring (2) is to be replaced, use tool **293389.**

– Whenever the steering unit is disassembled, turn the rotor over (9) to make full use of spline life.

– Install check valve ball (4) in its seat, keeping the steering unit (3) vertical or upended relative to its normal operating position on the tractor, and fully tighten the screw to prevent the ball from falling in the recesses between steering unit pushrod.

– Insert rotor (9) into cam ring (8) as shown in figure and using tool **293390**, couple shaft (7) to pin (1) so that the latter lies at right angles to plane X-X.

– Tighten capscrews (C_1, page 11, Section 303) retaining cover to steering unit to the specified torque.



Timing power steering unit

X-X. Reference line for pin assembly (1) - 1. Drive pin - 7. Rotor shaft - 8. Cam ring - 9. Rotor.

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FRONT AXLE - STEERING: Power steering

HYDRAULIC CYLINDER OVERHAUL

The steering power cylinder installed in production may be either WEBER, SIMA or ERBER.
WEBER and ERBER cylinders may be disassembled, whereas on SIMA cylinder it is only possible to remove the piston rod, dust excluder and O-ring with its retainer.

WEBER cylinder disassembly.

Remove lockring (3), push guide (7) inwards and withdraw retaining ring (5) from cylinder.
Subsequently, withdraw the piston rod assembly from the cylinder, back off nut (C_2) and withdraw guide (7) from piston (10).

SIMA piston rod removal.

Push the piston rod fully in, apply 40 mm long M14x1.5 screw to fluid inlet port, ensuring that the end of the screw locks on one flat of piston nut (C_2).

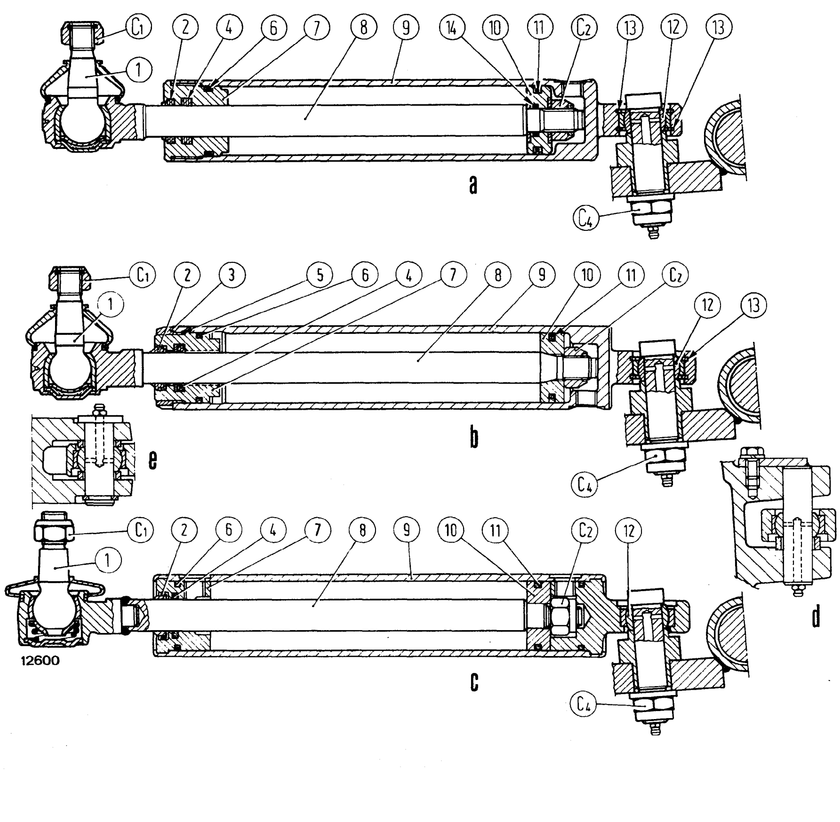
Back off the rod, withdraw from the cover and take off dust excluder (2) and O-ring (4).
Replace the spherical joint on the cylinder end using a suitable press and subsequently peening the edge of the seat in three points.

ERBER cylinder disassembly.

Remove guide (7) and withdraw piston rod assy from cylinder, back off nut (C_2) and withdraw guide (7) and piston (10). Scrap and replace worn seals and O-rings.

WEBER, SIMA and ERBER cylinder assembly.

Suitably lubricate parts, and reassemble by reversing the sequence given for disassembly. Refer to the illustrations below and note the following points:



Section through power cylinders.

a. Section through ERBER cylinder - b. Section through WEBER cylinder - c. Section through SIMA cylinder - d. Section through cylinder connection to front axle - e. Section cylinder connection to steering arm - C_1. Steering arm nut - C_2. Piston nut - C_4. Pivot pin nut - 1. Ball joint - 2. Dust excluder - 3. Lockring - 4. Seal - 5. Retaining ring - 6. O-ring - 7. Guide - 8. Piston rod - 9. Cylinder - 10. Piston - 11. Piston gland - 12. Spherical joint - 13. Retaining ring - 14. Piston seal.

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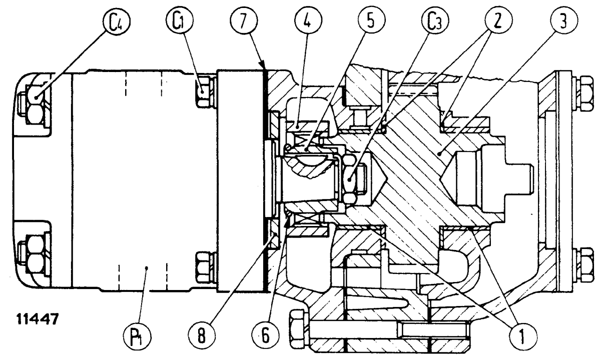
– Tighten nuts (C_2, page 2) retaining pistons to piston rods to the specified torque.

– Insert piston rods in their respective guides (7) paying the utmost attention to prevent distortion or damage to the seals.

– Check for piston rod seal leakage for pressurizing the cylinder chamber on the piston rod side.



Section through steering pump drive.

C_1. Pump capscrews - C_3. Sleeve nut - C_4. Cover nut - P_1. Hydraulic pump - 1. Gear bushings - 2. Shims - 3. Pump drive gear - 4. Drive collar - 5. Drive sleeve - 6. Retaining ring - 7. Gasket - 8. Centraliser.

Steering pump and reservoir overhaul.

For steering pump overhaul and testing, proceed as directed on page 1, Section 502, for lift pump.

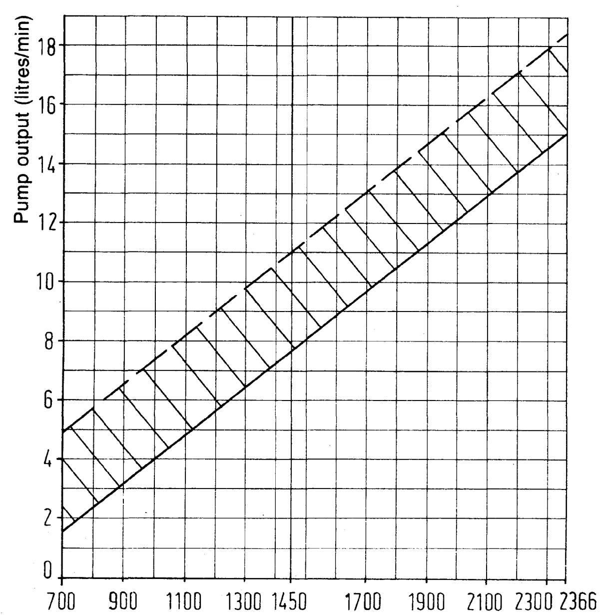
Moreover, note the following points:

– Steering pump drive is shown alongside.

– Pump assembly and performance data A18X are given in table on page 3, section 30, whereas the speed/output diagrams are shown below.

When removing hydraulic fluid reservoir (T, page 10, Section 303), clean thoroughly and check for:

– Oil leakage, replacing reservoir as necessary,



Power steering pump output-speed curve.

Test pressure . . . . 70 bar (71 kg/cm² or 1,015 psi)
Fluid temperature . . . . 55 to 65°C

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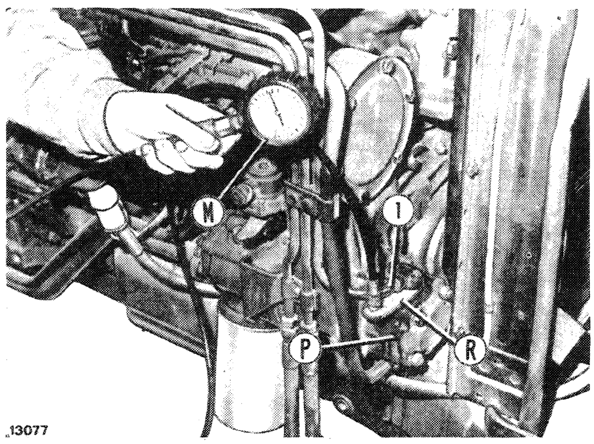


Checking power steering relief valve with control valve installed on tractor.

M. Pressure gauge of kit **293300** - P. Power steering pump - R. Connector **293160** for power steering relief valve check on tractor - 1. Oil delivery line to control valve.

since repair is not possible.
- Inefficiency of gauze filter element, container and spring;

After assembly, refill the system in several stages, each time operating the steering system to fill parts of the circuit.

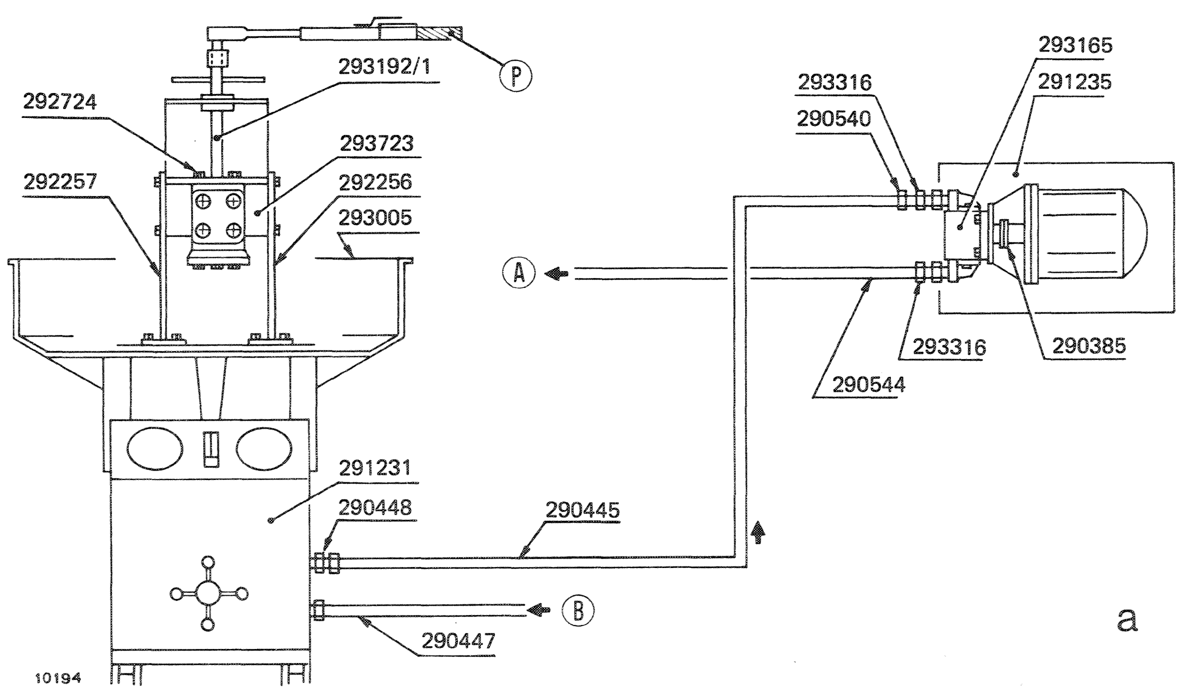
Hydraulic system bleeding

To eliminate any air from the hydraulic system, simply steer lock to lock several times and top up if necessary.

On-tractor relief valve adjustment.

Start the engine and steer the tractor from lock to lock several times to bring steering fluid temperature to approximately 50°C.

Proceed as follows:
- Stop the engine;
- fit connector **293160** (R) between oil delivery pipe (1) and hydraulic pump (P) and connect 0 to 150 kg/cm² pressure gauge (M) of kit **293300**;
- start engine and accelerate to approx. 1,850 rpm and steer to one lock. In this condition, relief



Test set-up for checking rotary valve and seal and calibration of relief valve and cylinder safety valves.

A. Delivery - B. Restriction - P. Torque wrench.

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– If the crack off pressure is found to be considerably different, adjust through screw (36, page 11).

POWER STEERING BENCH TEST CONDITIONS

Oil type .... **oliofiat IDRAULICAR AP 51**

Oil viscosity .... SAE 20 W

Oil temperature .... 60°C

Output of hydraulic
pump **293165** . 12 l/min (dm³/min) (21 pints/min)

Speed of motor **291235** .... 1450 rpm

1. ROTARY VALVE WEAR CHECK

Connect as shown in diagram of fig. a, page 4, and complete circuit as in fig. b. Using tool **293192/1**, keep unit in steering position (right or left).

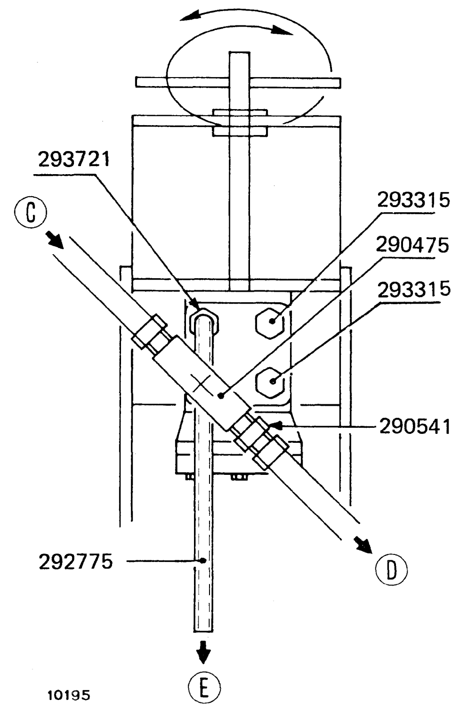
Simultaneously turn handwheel of apparatus **291231** to increase circuit pressure to a value immediately below the crack-off setting of relief valve (24, page 10).

Apply torque wrench to tool **293192/1** and, operating with a torque of 34 Nm (3.5 kgm or 25.3 ft lb), check that time required to turn rotary valve (5, page 10) through one complete revolution exceeds 10 seconds.

If the above conditions are not met, replace rotary valve and associated sleeve (6).

2. RETURN TO NEUTRAL CHECK

In the same conditions as those of test No. 1, check that rotary valve (5) returns automatically to neutral after each simulated steering manoeuvre, with tool **293192/1** free.



b

Checking rotary valve for wear.

C. From delivery - D. To restriction - E. Exhaust.

3. SEAL CHECK

In the same conditions as those of test No. 1, keep rotary valve (5, page 10) in steering position using tool **293192/1** for approx. three minutes and check seals for leakage.

4. RELIEF VALVE CALIBRATION

Connect as show in diagram of fig. a, page 4 and complete circuit as in fig. b. Using tool **293192/1**, simulate steering (to right of left) to cut off oil flow to exhaust.
Gradually increase pressure in circuit by turning handwheel of apparatus **291231** and check on pressure gauge that relief valve (24, page 10) cracks off at the specified pressure (100 bar - 102 kg/cm² - 1,450 psi). To adjust crack off setting, tighten or back off adjusting screw (36, page 11).

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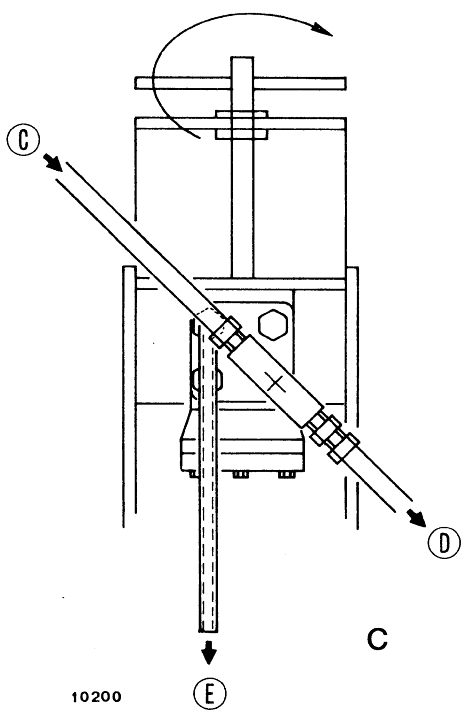
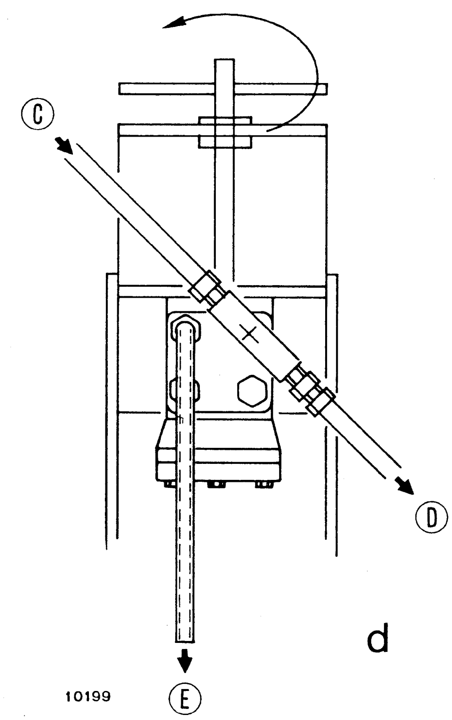


Adjusting L.H. steer cylinder safety valves.
C. From delivery - D. To restriction - E. Exhaust.



Adjusting R.H. steer safety valves.
C. From delivery - D. To restriction - E. Exhaust.

5. CYLINDER SAFETY VALVE ADJUSTMENT

c - L.H. steer safety valve.

Connect as shown in fig. a, page 4 and complete circuit as in fig. c.

Using tool **293192/1**, simulate L.H. steering (counterclockwise) to cut off fluid flow to exhaust.

Gradually increase pressure by turning handwheel and check on pressure gauge that safety valve (33, page 10) cracks off at the specified pressure (200 bar - 204 kg/cm^2 - 2,900 psi).

If not, adjust through screw (38, page 11). Tighten screw to increase or back off to decrease crack off setting.

d. R.H. steer safety valve.

Connect as shown in fig. a, page 4 and complete circuit as in fig. d.

Proceed as described for L.H. steer safety valve, turning tool **293192/1** clockwise.

Note - Cylinder safety valves (33, page 10) incorporated in valve blocks DANFOSS OSPC 100 control valve body are adjusted using the screw associated with each valve.

On OSPC 100 control valves, the two safety valves are separate and are each equipped with their own spring and adjusting screw. Valves must be adjusted separately for each direction of steering.

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POWER STEERING CONTROL VALVE OVERHAUL

Installation of seal (31, fig. a) and ring (39) using tool 293388 (for DANFOSS control valves type OSPC 100).

Lubricate O-ring (31) and anti-extrusion ring (39) (as shown in figure) with grease and apply to lower end of tool plug (1).

Fully insert tool sleeve (2) in seat (3).

Insert tool plug (1) in sleeve (2) and, when tool plug can no longer be slid in easily, rotate slightly and push fully in. Withdraw plug (1) from sleeve (2) by a few millimeters and then remove complete tool **293388.**

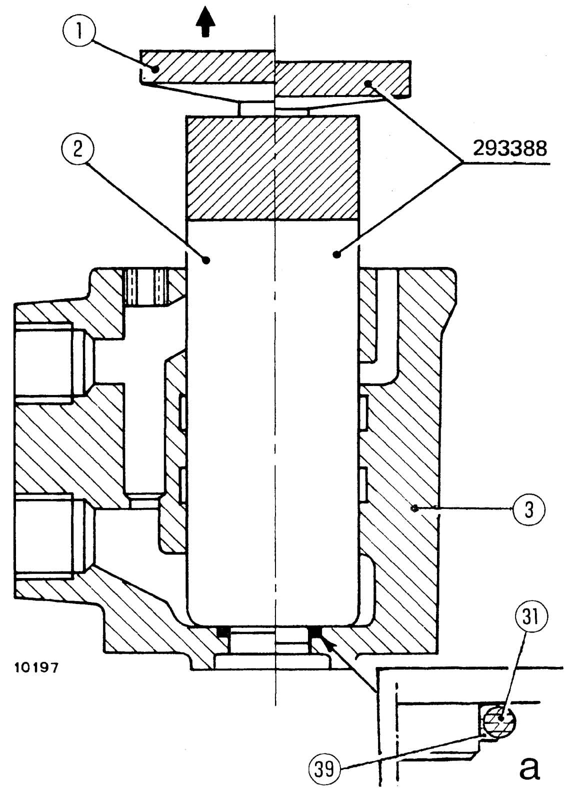
Check that seal (31) and associated ring (39) are correctly positioned.

Installation of return springs (2) using tool 293389 (figs. b, c).

Couple rotary valve (5) and associated sleeve (6), aligning the return spring seats.
Insert tool **293389** (see fig. c). Then insert springs (2), arranged as shown in fig. b, in tool.
Squeeze springs together and push into seat while withdrawing tool.

Installation of shaft (7, page 11) using lever 293390 (fig. d)

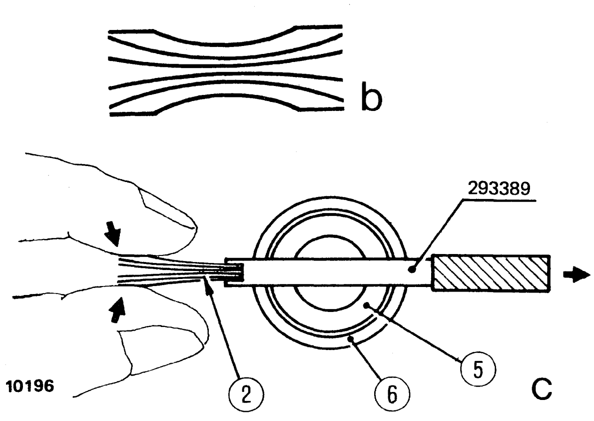
Insert rotor shaft (7) for rotor (9, page 11) in body (3) with slot parallel to pin (1).



Installing seal (31) and ring (39) using tool 293388 (for DANFOSS control valves type OSPC 100).

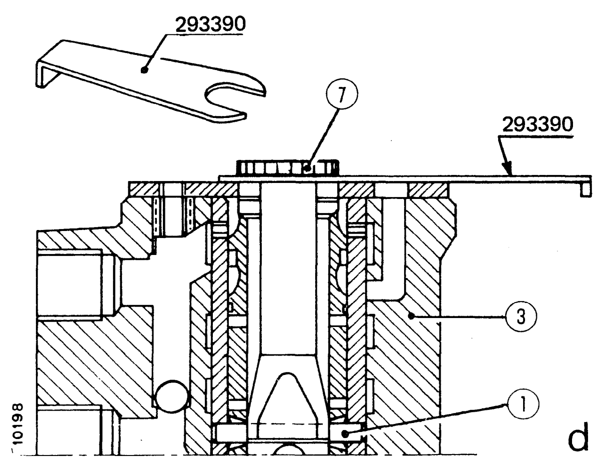
1. Tool plug - 2. Sleeve - 3. Seat.

Insert tool **293390** as shown in figure to facilitate power steering unit timing (see page 1) when rotor and associated cam ring (8) are installed.



Installing return springs (fig. b) using tool 293389 (fig. c).

2, 5 and 6 See text.



Installing rotor shaft with lever 293390.

1, 3 and 7 See text.

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TROUBLE SHOOTING

Fault	Cause	Remedy
1. Control unit leakage from: **a.** Control side. **b.** Cover side.	**a.** Faulty O-ring (31, page 11).	Replace O-ring and associated anti-extrusion ring using tool **293388.**
	b_1. Loose screws (C_1).	Tighten screws to specified torque.
	b_2. Faulty lock washers (25) or O-ring (35).	Replace washers or seals.
2. Heavy steering.	**a.** Faulty hydraulic pump.	Overhaul pump.
	b. Check valve (4) stuck open or ball missing.	Clean valve or filter. Insert new ball, if necessary.
	c. Relief valve (24) out of adjustment.	Adjust crack off pressure (100 bar - 102 kg/cm^2 - 1,450 psi).
	d. Relief valve (24) stuck or open.	Remove foreign matter and clean filter (E, page 10). If trouble persists, replace entire control valve.
	e. Steering column binding in bush owing to rusting, pick-up, etc.	Remedy as necessary.
3. Loose steering.	**a.** Excessive clearance between steering column and rotary valve (5, page 11).	Replace worn parts.
	b. Excessive clearance between shaft (7) and drive pin (1).	Replace worn parts.
	c. Excessive clearance between shaft (7) and rotor (9).	Replace worn parts.
	d. Build-up of above clearances.	Replace worn parts.
	e. Broken or weakened leaf springs (2).	Replace springs.
4. Steering wheel rotates normally but steering response is:	**a.** Leakage through power cylinder piston gland (H, page 10).	Replace gland.
a. Slow, or.	**b_1.** Failed power cylinder piston rod (H).	Replace damaged part.
b. Zero.	**b_2.** Failed rotor shaft (7, page 11) or pin (1).	Replace damaged part.
5. Engine off, no steering.	**a.** Excessive wear between rotor (9) and cam ring (8).	Replace worn parts.
	b. Damaged check valve (23, page 10).	Replace entire control valve OSPC 100.

(continued)

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TROUBLE SHOOTING

(continued)

Fault	Cause	Remedy
	c. Power cylinder safety valves (33, page 10) stuck open or damaged.	Remove foreign particles and clean filter or replace entire control valve OSPC 100.
6. Steering wheel snatch or steering in opposite direction.	**a.** Timing out of adjustment.	Reset as directed on page 1.
	b. Interchanged connecting pipes between control unit and power cylinder.	Reverse connection.
7. Impossible to hold tractor on course, continuous correction needed.	**a.** Low oil level in hydraulic circuit tank.	Top up and bleed air from circuit as directed on page 4.
	b. Worn power cylinder piston gland.	Replace gland.
	c. Power cylinder safety valves (33, page 10) or make-up valves (34) stuck open.	Remove foreign particles and clean filter or replace entire control OSPC 100.
	d. Worn control valve.	Replace control valve (D_1).
8. Impossible to hold straightahead position; steering wheel may tend to move upon discontinuing manual control and steering action continues slowly in the direction of initial steering, necessitating continuous correction to maintain trajectory.	**a.** Failed or weakened leaf springs (2).	Replace leaf springs.
	b. Sleeve (6) and rotary valve (5) stuck with delivery ports open.	Remove foreign particles and clean filter.
	c. Sleeve (6) stuck to rotary valve (5) owing to excessive pressure.	Check relief valve (24, page 10) crack-off setting.
9. Front wheel shimmy.	**a.** Air in power cylinder.	Bleed system as directed on page 4 and eliminate causes of possible leakage.
	b. Worn steering linkage points.	Replace worn parts.
	c. Power cylinder safety valves (33) or make-up valves (34) stuck open.	Remove foreign matter and clean filter or renew entire control valve OSPC 100.
10. Steering difficult in one or both directions.	**a.** Low pressure.	Check hydraulic pump (P) and relief valve setting (24, page 10).
	b. Excessive leakage inside control valve.	Replace control valve (D_1).
	c. Power cylinder safety valves (33) out of adjustment or inefficient owing to the penetration of foreign matter.	Remove foreign matter and clean filter or replace entire control valve for OSPC 100.

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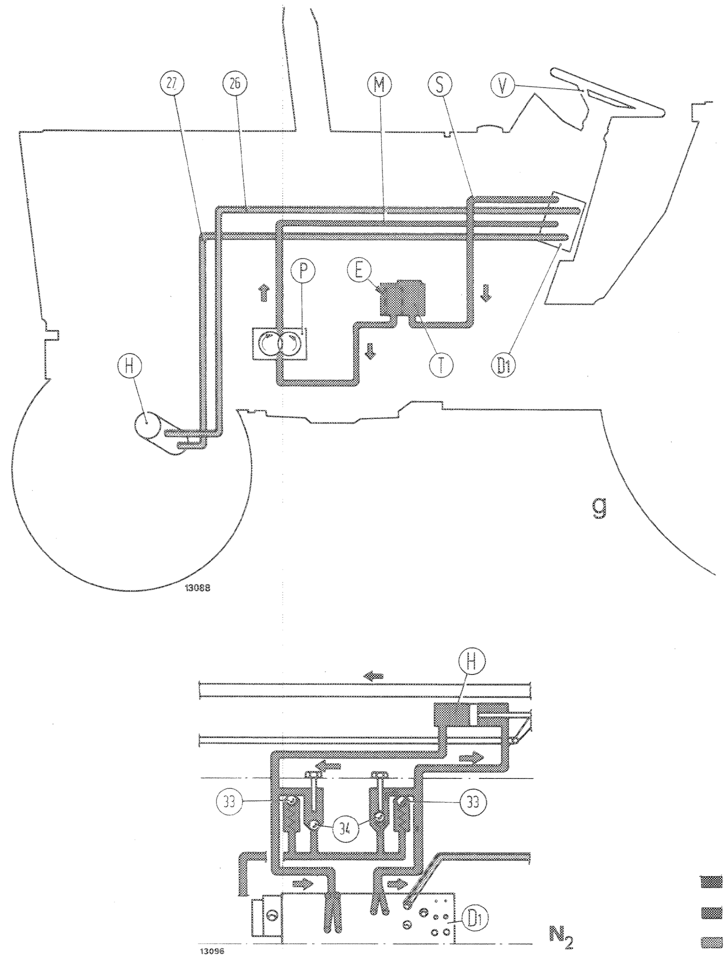
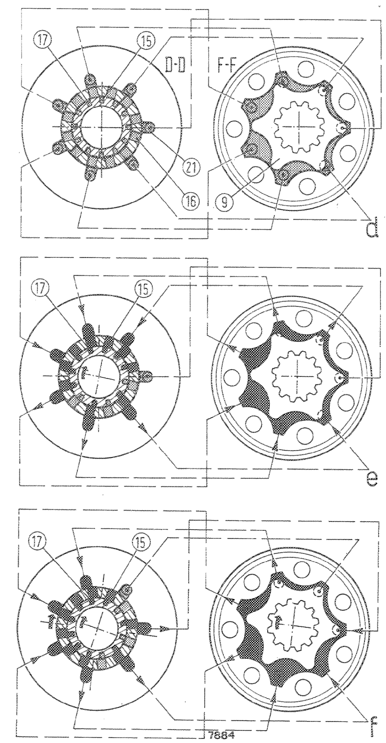
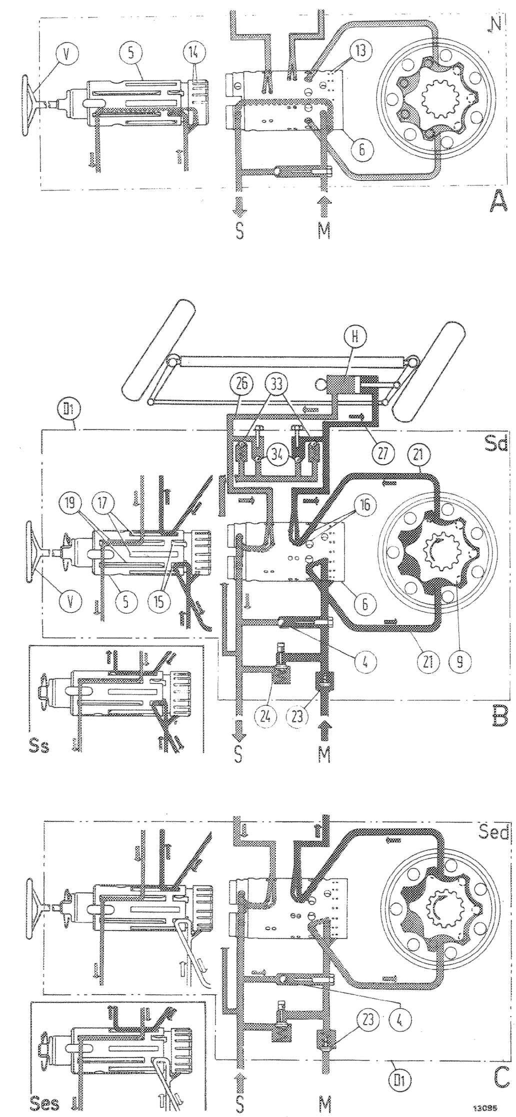


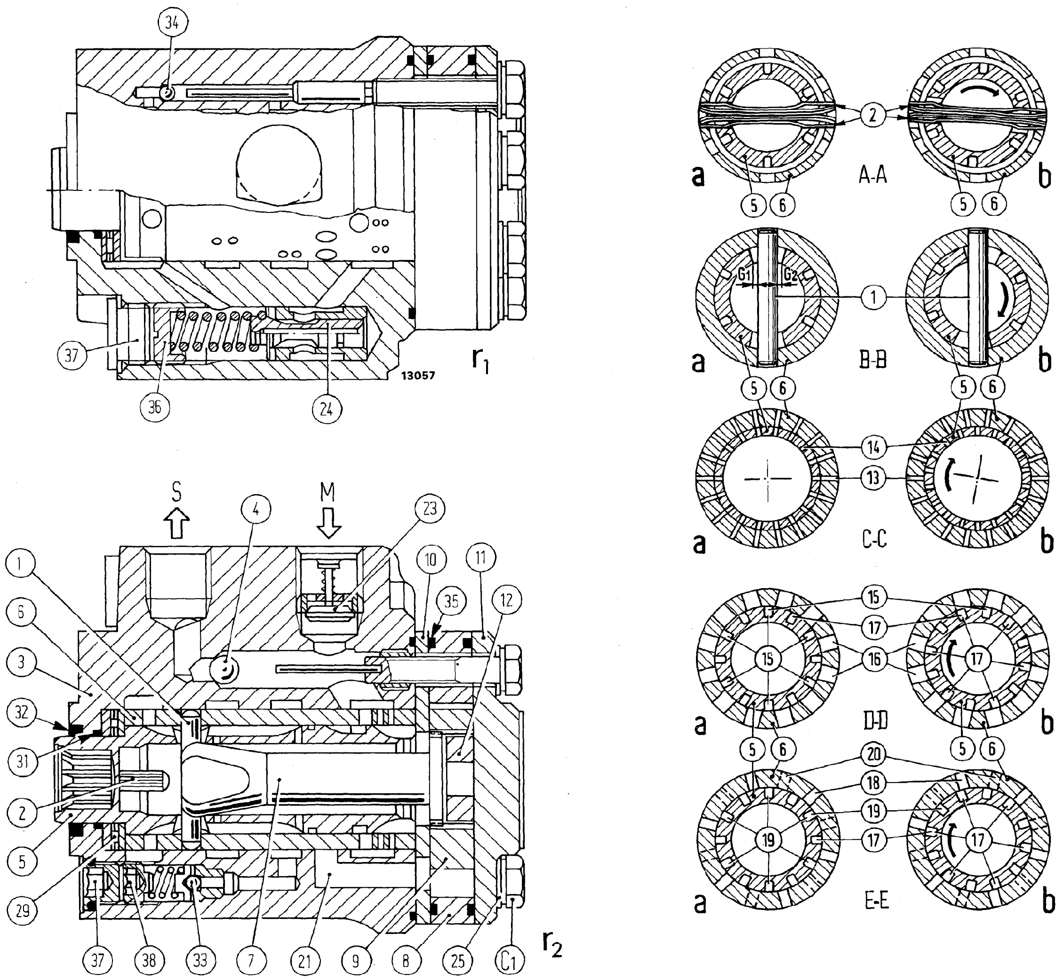




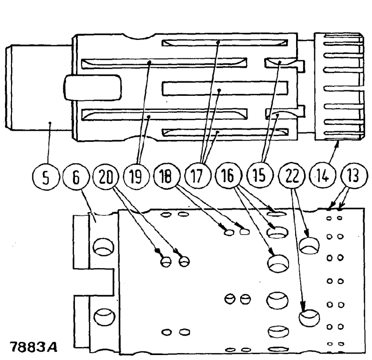
- Oil pressure to power cylinder.
- Oil pressure to rotor.
- Inlet, low pressure or return oil.
- Trapped oil.

Operation diagram
(For missing references see the caption on page 11)

A. Operation in straight-ahead driving position - B. R.H. (Sd) and L.H. (Ss) steer - C. R.H. and L.H. emergency steer (S e d and S e s) - d. Operation diagram for straight-ahead driving (Section D-D and F-F) - D_1. DANFOSS OSPC 100 control valve - e, f. Operation diagram for two-stage R.H. steering (D.D. and F.F.) - E. Filter cartridge - g. Steering system schematics - H. Power cylinder - M. Pump outlet line - N_2. Operation diagrams of make-up valve (34) with control valve (D_1) in straight-ahead driving position and cylinder piston (H) subject to external action (shown by black arrow) - P. Hydraulic pump - S. Return to tank - T. Reservoir - V. Steering wheel - 23. Check valve - 24. Relief valve (set to 100 bar - 102 kg/cm² - 1,450 psi) - 33. Power cylinder safety valves (set to 200 bar - 204 kg/cm² - 2,900 psi) - 34. Make-up valves.



Sections through hydraulic control unit.



a. Section through control unit with valve (5) in neutral - b. Sections through control unit with valve (5) in R.H. steer position (for L.H. steer, valve rotation is symmetrical in opposite direction) - C_1. Cover capscrews - G_1, G_2. Gap between pin (1) and rotary valve (5) - r_1, r_2. Sections through DANFOSS OSPC 100 control valve - 1. Drive pin - 2. Sleeve return springs - 3. Control valve body - 4. Check valve - 5. Rotary valve - 6. Valve seat sleeve - 7. Rotor drive shaft - 8. Rotor cam ring - 9. Rotor - 10. Thrust ring - 11. Cover - 12. Spacer - 13 and 14. Oil ports - 15. Rotor inlet passages (6 off) - 16. Connecting port (12 off) communicating with passages (15 and 17) alternatively - 17. Pressure passages (6 off) to power cylinder communicating with the rotor recesses and ports (18 and 20) - 18. R.H. power cylinder chamber outlet or exhaust ports (6 pairs) - 19. Power cylinder exhaust passages (6 off) communicating with ports (18 and 20) - 20. L.H. power cylinder chamber outlet or exhaust ports (6 off) - 21. Oil passage from ports (16) to rotor recesses - 22. Supply ports for passages (15) - 23. Check valve - 24. Relief valve - 25. Washer - 26. Oil passage to L.H. power cylinder chamber - 27. Oil passage to R.H. cylinder chamber, piston rod side - 29. Thrust bearing - 31. Seals - 32. Dust excluder - 33. Cylinder safety valves - 34. Make-up valves - 35. O-rings - 36. Valve adjusting screw - 37. Plugs - 38. Valve adjusting screw.

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OPERATION

Straight-ahead Driving (A, a, d).

With steering wheel (V) stationary, rotary valve (5) takes neutral position relative to sleeve (6). This position is maintained through the action of springs (2, section A-A) and the following conditions exist:

- Pin (1, section B-B) is central in the valve (5) aperture.
- Ports (13 and 14) are in alignment (Section C-C) and the oil pressure from pump (P) is returned to tank.
- Passages (15, 17 and 19) on the valve (Sections D-D and E-E) are off register relative to ports (16, 18 and 20) on the sleeve (i.e. all ports in communication with the power cylinder remain closed).

RH Steer (B, Sd, b, e, f).

Upon turning steering wheel (V) clockwise, springs (2, Section A-A) deflect allowing valve (5) to rotate relative to sleeve (6) until gap (G_1, section B-B) is taken up.
Thus:
- Ports (13 and 14, Section C-C) go out of alignment to discontinue oil return.
- Six passages (15, Section D-D) line up with an equal number of ports (16) connected instant by instant with the rotor recesses during the inlet phase.
- Six pressure passages (17, Section E-E) line up with ports (18) communicating with the power cylinder. Moreover, the oil pressure passages communicate with the remaining ports (16, Section D-D) connected instant by instant with the rotor recesses during the actuation phase.
- Six exhaust passages (19) line up with ports (20, Section E-E) communicating with the power cylinder.

Once the gap (G_1) is eliminated, valve (5) positively transmits steering wheel input to both sleeve (6) and rotor (9) through pin (1) and shaft (7). Diagrams (e and f) show the principle of operation at start of RH steer and after a certain amount of wheel rotation.
The flow of oil pressure from pump to rotor during inlet, and from rotor to power cylinder line during the power actuation phase, is provided instant by instant.

LH Steer (B, Ss).

Upon turning the steering wheel anti-clockwise, a reversal of the above sequence is obtained and delivery passages (17, Section E-E) supply ports (20) to bring about LH steering.

Emergency Hydraulic Steer (C, Sed, Ses).

Steering is possible even in cases of loss of hydraulic pressure. Upon turning the steering wheel, valve (5) takes up the normal operating position, whilst the rotor functions as a hand pump directing oil pressure to the power cylinder.
Check valve (4) opens, thereby permitting the flow of oil from tank to rotor by-passing the pump.
Valve (23) remains closed preventing leakage in connecting line between pump and control unit.

Power Cylinder Safety and Make-up Valves (N_2).

As of safety valves open (33), pressure created by piston (H) is exhausted in one cylinder chamber under the action of strong external stresses on wheels. Simultaneously, vacuum in the opposite chamber is compensated by oil flow through the opening of the associated make up valve (34). Pressure in one cylinder chamber deriving from small external stresses which are not sufficient to open cylinder safety valve, is exhausted through normal leakage past control valve (D_1), while vacuum in the opposite chamber is compensated through make-up (34), as shown in detail N_2, for DANFOSS OSPC 100 control valve.
Operation of the above valves eliminates continuous steering wheel correction and prevents front wheel shimmy, hydraulic circuit failure and damage to the steering linkage.

LIVE FRONT AXLE

Type	Steering, full-floating, center pivotting
Bevel Drive and Differential	
Bevel drive ratio	9/38 = 1 to 4.2
Bevel drive backlash	0.15 to 0.20 mm
Bevel pinion bearing shim thickness (S_1, page 3, Section 402)	2.5-2.6-2.7-2.8-2.9-3-3.1-3.2-3.3-3.4-3.5-3.6-3.7 mm (0.098-0.102-0.106.0.110-0.114-0.118-0.122-0.126-0.130-0.134-0.138-0.142-0.146 in)
Bevel pinion shim thickness (S_2)	2.5-2.6-2.7-2.8-2.9-3.0-3.1-3.2-3.3-3.4-3.5-3.6-3.7 mm (0.098-0.102-0.106-0.110-0.114-0.118-0.122-0.126-0.130-0.134-0.138-0.142-0.146 in)
Differential pinion and side gear backlash	0.15 mm (0.006 in)
Side gear thrust washer thickness (7, page 3, Section 402)	1.470 to 1.530 mm (0.0579 to 0.0602 in)
Differential pinion thrust washer thickness (6)	1.50-1.60 mm (0.0590-0.0630 in)
Differential pinion journal dia.	21.939 to 21.960 mm (0.0864 to 0.865 in)
Differential pinion bore dia.	22.040 to 22.061 mm (0.868 to 0.869 in)
Differential pinion journal clearance in pinion bore	0.080 to 0.122 mm (0.003 to 0.005 in)
Side gear spigot diameter	37.961 to 38.000 mm (1.494 to 1.496 in)
Side gear spigot bore diameter in differential case	38.080 to 38.119 mm (1.499 to 1.501 in)
Side gear spigot clearance in differential case	0.080 to 0.158 mm (0.003 to 0.005 in)
Axle Shafts and Joints	
Axle shaft journal diameter (5, page 3, Section 402) at axle bushing (14)	29.914 to 29.935 mm (1.178 to 1.179 in)
Axle bushing fitted I.D. (14)	30.050 to 30.105 mm (1.183 to 1.185 in) (1)
Axle shaft running clearance in bushing	0.115 to 0.191 mm (0.004 to 0.007 in)
Bushing interference fit in housing	0.064 to 0.129 mm (0.003 to 0.005 in)
King pin bearing shim thickness (S_3, page 3, Section 402)	0.10-0.15-0.20-0.25-0.30 mm (0.004-0.006-0.008-0.010-0.012 in)
Planetary Final Drives	
Reduction ratio	15:(15 +54) = 1:4.6
Driven gear thrust washer thickness (18, page 3, Section 402)	0.77 to 0.83 mm (0.030 to 0.033 in)

(1) Not reamed.

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FRONT WHEEL DRIVE: Specification and Data

LIVE FRONT AXLE

Centre Pivot Pivoting angle (on either side)	11°
Centre pivot diameter .... Centre pivot front bushing fitted I.D. (21) .... Centre pivot working clearance in bushing	52.652 to 52.671 mm (2.0729 to 2.0737 in) 52.720 to 52.790 (1) mm (2.0756 to 2.0783 in) 0.049 to 0.138 mm (0.0019 to 0.0054 in)
Rear bevel pinion carrier spigot O.D. .... Rear bushing fitted I.D. (24) .... Spigot fitted clearance in bushing	99.040 to 99.072 mm (3.8992 to 3.9005 in) 99.146 to 99.221 (1) mm (3.9033 to 3.9063 in) 0.074 to 0.181 mm (0.0029 to 0.0071 in)
Axle front and rear thrust washer thickness (22 and 23, page 3, Section 402)	4.95 to 5.00 mm (0.1949 to 0.1968 in)
Turning radius: – Live axle in and brakes off	4300 mm (169.42 in)

(1) Not reamed

AXLE DRIVE

Reduction ratio .... Relay lever pad width .... Pad seat width in driven gear .... Pad clearance in seat	35/24x24/31 = 1 to 0.885 7.910 to 8.000 mm (3.116 to 3.152 in) 8.280 to 8.370 mm (0.3260 to 0.3295 in) 0.280 to 0.460 mm (0.0110 in)
Relay lever pivot diameter .... Pivot housing bore in casing .... Pivot clearance in housing	15.973 to 16.000 mm (0.6288 to 0.6299 in) 16.016 to 16.059 mm (0.6305 to 0.6322 in) 0.016 to 0.086 mm (0.0006 to 0.0034 in)
Relay lever detent spring length: – Free .... – Under 178.2 to 197.8 N (18.17 to 20.17 kg or 40 to 44 lb)	 24.5 mm (0.9646 in) 19.3 mm (0.7598 in)

DRIVE SHAFT

Front drive sleeve adjustment .... Front drive sleeve shim thickness (S_5, page 3, Section 402)	See page 1, Section 402 2.2-2.5-2.8-3-3.3-3.7-4-4.3 mm (0.086-0.100-0.110-0.118-0.130-0.146-0.158-0.170 in)

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TIGHTENING TORQUE FIGURES

DESCRIPTION	Thread Size	Torque		
		Nm	kgm	ft lb
Front Axle - Section 402 Lock ring, bevel pinion (C_1, page 3)	M 35 x 1.5	294	30	217
Capscrew, differential case to axle casing (C_2)	M 12 x 1.25	113	11.5	83
Capscrew, ring gear to differential case (C_3)	M 12 x 1.25	127	13	83
Capscrew, king pin (C_4)	M 10 x 1.25	64	6.5	47
Capscrew, steering knuckle (C_5)	M 12 x 1.25	113	11.5	83
Lock ring, wheel bearing (C_6)	M 45 x 1.5	98	10	–
Capscrew, planetary final drive housing (C_7)	M 10 x 1.25	64	6.5	47
Capscrew, wheel disc to hub (C_8)	M 16 x 1.5	260	26.5	192
Nut, rim to wheel disc	M 14 x 1.5	216	22	159
Capscrew, front and rear axle case support (C_9) ...	M 18 x 1.5	265	27	–
Capscrew, differential cap (C_{10})	M 12 x 1.25	113	11.5	83
Capscrew, front axle carrier to engine (C_{11})	M 18 x 1.5	314	32	231
Drive Shafts - Axle Drive - Section 402 Capscrew, centre bearing (C_{12}, page 3)	M 12 x 1.5	98	10	72
Capscrew, axle drive housing to tractor (C_{13}, page 3)	M 12 x 1.25	98	10	72

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REMOVAL

Proceed as follows:

- remove drive shaft guard, back off drive shaft centre bearing capscrews (C_{12}, Section 402, page 3), remove retaining rings (28 and 31) from seats and withdraw drive shaft (30) with centre bearing (56), moving splined sleeves (27 and 32) inwards;
- remove power steering cylinder and hinge pins; place a hydraulic jack centrally under case and remove wheels;
- place a stand under engine sump at front, remove front and rear axle pivots and, lowering jack, separate assy from tractor;
- secure axle assy to universal stand **293460** remove track rod and drain oil from axle case and final drives.

DISASSEMBLY

Final drive, hub and steering knuckle overhaul.

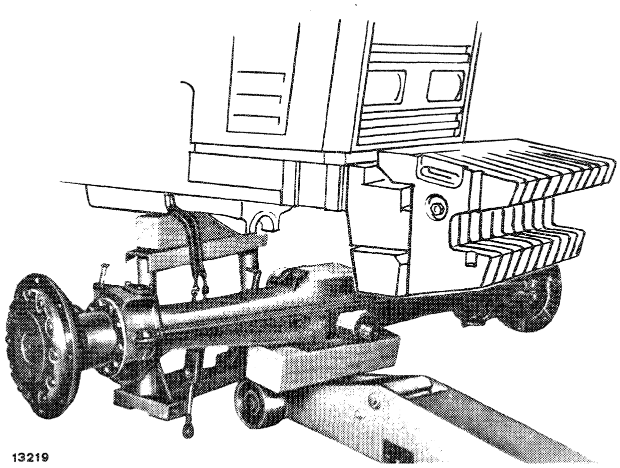
Overhaul may also be carried out with axle installed on tractor.
In this case, lock parking brake and place a stand at the center of axle case.
Disassemble parts in the following order:

1. Planetary final drive housing (1, a, page 2) with planet wheels.

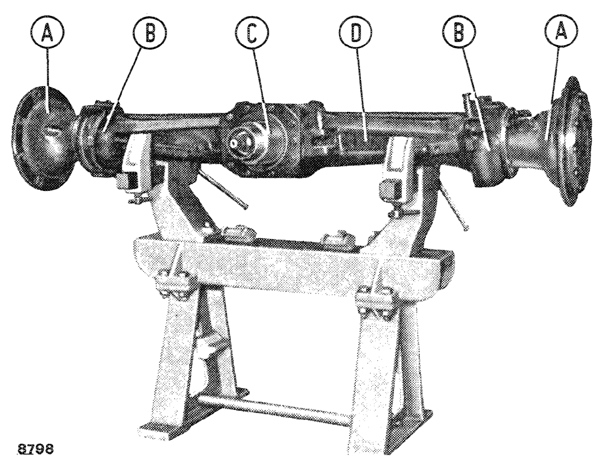
Note – To facilitate final drive housing removal from hub, back off 8 capscrews and slacken the remaining two capscrews. Remove oil filler plug, install a slide hammer puller in its place and remove housing.

2. Sun gear (2, a, page 2).
3. Planetary final drive ring gear-fixed gear unit (3 and 4, fig. b, page 2), slackening lock ring (C_6, section 402, page 3) using wrench **293837** and removing assy from knuckle.
4. Wheel hub (6, fig. c, page 2) with taper roller bearing cups (7) and associated seal. Be careful to prevent seal damage.
5. Steering knuckle (10, fig. d, page 2) with wheel hub support.
6. Articulated axle shaft (9, page 2) with bearing housing (11). Back off capscrew (9, Section 402, page 3) before withdrawing axle shaft.
7. Knuckle carrier (8, page 2).

Proceed as follows:
- Remove capscrews (C_4, Section 402, page 3) securing king pin bearings (11);



Removing front axle assy, compl. from tractor.



Front axle assy installed on universal stand.

A. Wheel hubs with planetary final drives - B. Steering knuckle - C. Differential carrier - D. Axle case.

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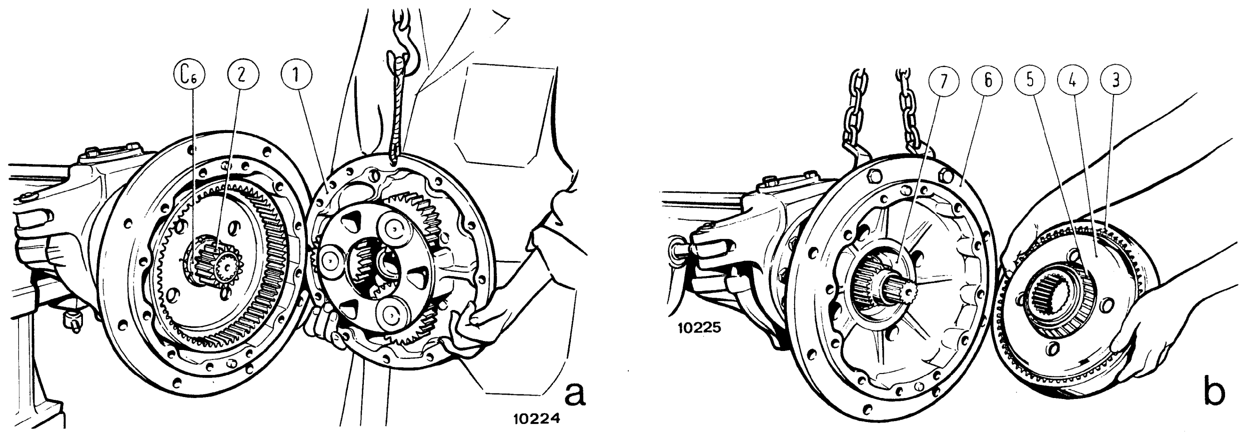
FRONT WHEEL DRIVE: Front Axle



Removing/installing final drive housing (a) and fixed gear/ring gear assy (b).

C_6. Wheel hub bearing lockring - 1. Final drive housing - 2. Sun gear - 3 and 4. Fixed gear/ring gear assy - 5. Taper roller bearing cone - 6. Wheel hub - 7. Taper roller bearing cup.

- remove lubricators from the bearings;

- fit the three column bolts (V, fig. e, page 3) of tool **293857**, tightening them by the same amount;

- fit plate (P) of the tool and secure it to the three column bolts by means of nuts (D);

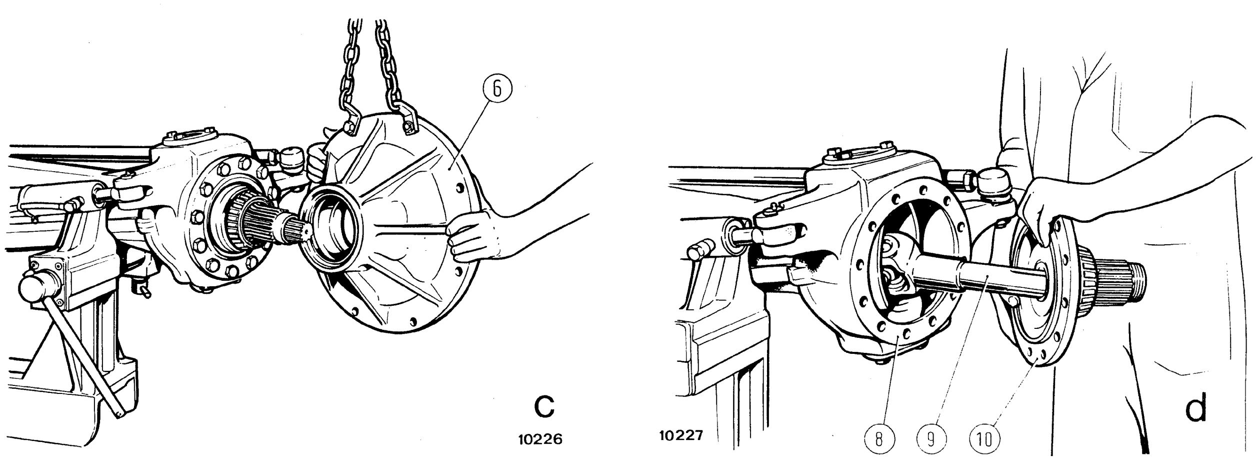
- fit linkage (T), tighten it completely in the seat of the lubricator on the pin (11);

- tighten nut (D_1) until pin (11) releases.

Replace worn-out bearings and bushes using suitable drifts and universal pullers. Make sure seals are in good condition.

Install front axle items so that the reference marks made in figure on page 3, Section 402 agree and note the following:

- prior to fitting the final drive housing (1) coat the gasket surfaces with one of the jointing compounds recommended on page 5, Section A;
- prior to fitting the knuckle carrier (8, d) locate the axle shaft (9) in the axle housing;
- preload the steering knuckle bearings as described in the corresponding chapter;
- preload the wheel hub bearings as described in the corresponding chapter;
- refill the wheel hub and bevel differential housings with the prescribed oil.



Removing/installing wheel hub (c) and steering knuckle (d)

6. Wheel hub - 8. Knuckle carrier - 9. Axle shaft with universal joint - 10. Steering knuckle.

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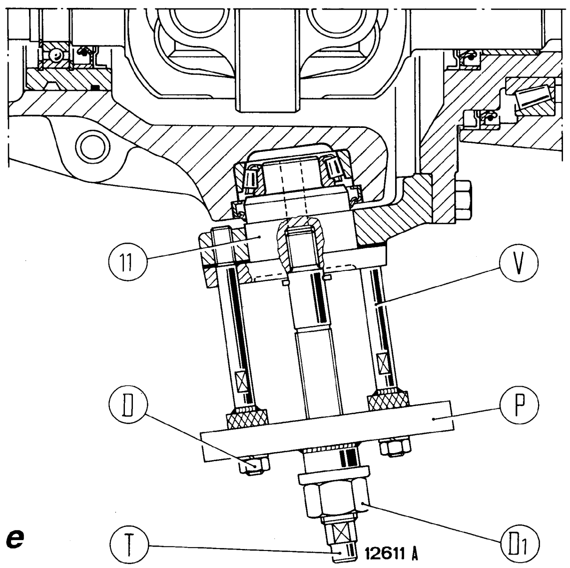


e

Removing king pin bearings using puller 293857.
D, D1, P, T, V. Parts of puller **293857** - 11. King pin bearings.

King pin bearing adjustment (fig. f)

Proceed as follows:

— check bearing outer races in axle case and associated seals for wear and pack with **Fiat TUTELA G9 grease;**

— having removed the lubricator, fit the top cover (1, fig. f) without shims and torque capscrews to 64 Nm (6.5 kgm, 47 ft lb);

— having removed the lubricator, fit the bottom cover (2) without shims using three capscrews lubricated with engine oil;

— tighten bottom capscrews alternatively in increments of 0.98 Nm (0.1 kgm, 0.72 ft lb) until 2.9 Nm (0.3 kgm, 2.17 ft lb) is reached, swinging the carrier while doing so to settle the bearings;

— using a feeler gauge, measure gap (H, fig. f) between bottom cover and carrier alongside the capscrews;

— the thickness of the shims (S_3, page 3 sect. 402) to install under the bottom cover is given by the arithmetical average of the readings.

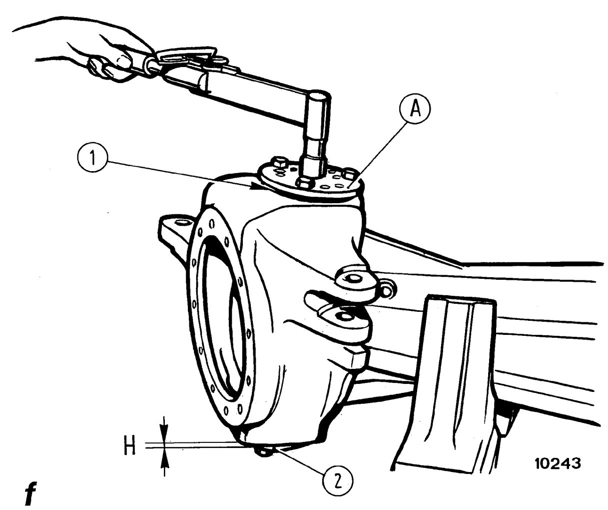
If necessary round off downwards to the nearest 0.05 mm (0.002").

Partially slacken bottom cover capscrews, insert shims and tighten capscrews to a torque of 64 Nm (6.5 kgm or 47 ft lb).

Swing carrier several times to settle and, using a torque wrench with tool **292220/3**, check that the torque required to swing the carrier is 2.9 to 7.8 Nm (0.3 to 0.8 kgm, 2,17 to 5.79 ft lb).

If the torque is excessive add shims; if it is too low, remove some.

Install the lubricators in the top and bottom covers and lubricate.



f

Determining king pin pre-load shim thickness (S_3, page 3, sect. 402).
A. Tool **292220/3** for knuckle carrier swing torque check
H. Gap between carrier and bottom cover - 1. Top cover
2. Bottom cover.

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Wheel hub bearing adjustment.

Proceed as follows:

— install wheel hub (6 fig. C, page 2) and fixed gear unit (3 and 4, fig b) on steering knuckle;
— using a torque wrench and lock ring wrench **293837**, progressively tighten lock ring (C_6, sect. 402, page 3) to 147-196 Nm (15-20 kgm or 108.5-145 ft lb), rotating the hub to settle the bearings while doing so;
— fully slacken lock ring and retighten to 59 Nm (6 kgm or 43.5 ft lb) while rotating hub;
— secure lock ring by bending over a lock washer tab (if necessary, tighten lock ring further to align with tab);
— check, by hand, that the hub turns without play or sticking.

Bevel drive-differential unit overhaul

Remove final drive assemblies, consisting of final drives, wheel hubs and knuckle carriers (fig. a); remove the bearing capscrews (9) which retain axle shaft carriers to axle case and withdraw axle shafts with universal joints (fig. b).

Remove the bevel drive-differential unit, clamp in vice using support **293743** and disassemble as follows:

— back off bevel pinion lock ring (C_1, sect. 402, page 3) using wrench **293520/2;**

— separate bevel ring gear-differential assy, from pinion carrier, removing the lock rings and caps (1, fig. c, page 5); check that caps are marked to ensure correct positioning when reassembling;

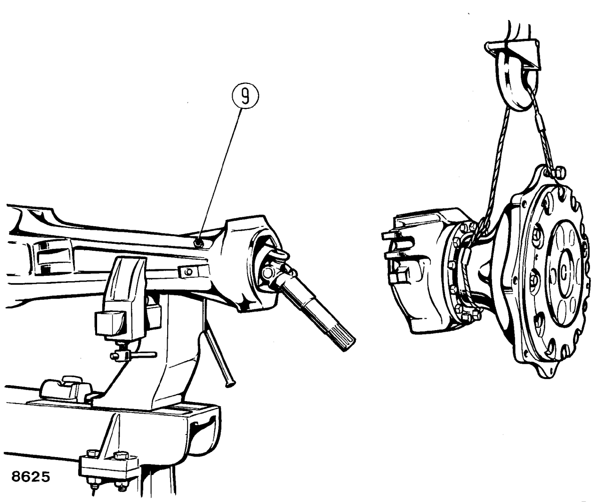
— remove ring gear capscrews (C_3, sect. 402, page 3) and differential pinion journal capscrews (8); disassemble differential.

Check differential components for wear (see table, sect. 40).

Replace worn bearings and seals using suitable punches and pullers.

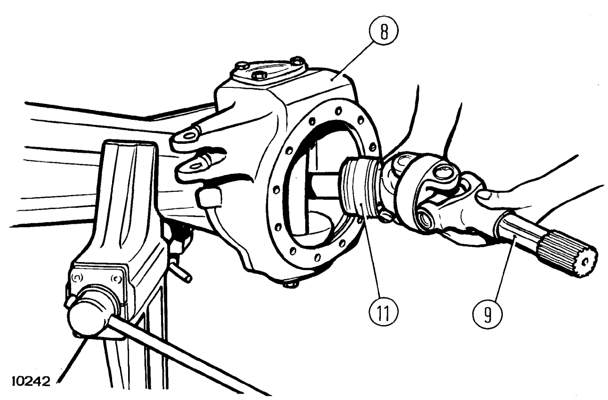
When reassembling, install differential bearing caps, aligning reference marks, and adjust bevel drive-differential as described here below.

Reassemble bevel drive-differential and final drive units by reversing the disassembly procedure. Secure differential carrier to axle case, applying jointing compound (see page 5, section A) to the mating surface. Top up axle using the oil specified.



a

Removing (installing) final drive with hub and knuckle carrier.
9. Bearing carrier capscrew.



b

Removing (installing) axle shaft with universal joint.
8. Knuckle carrier - 9. Axle shaft with universal joint - 11. Bearing case

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Torque and differential adjustment.

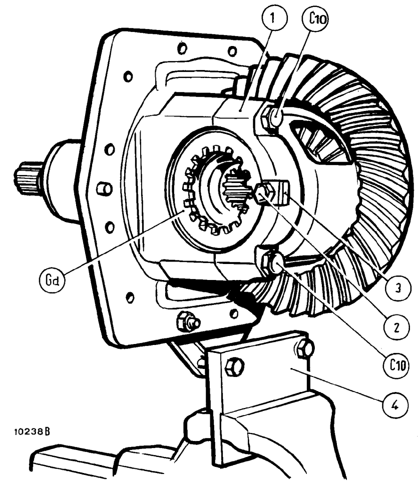
1. Bevel pinion bearing adjustment and shim thickness determination using special purpose tool (figs. d, e).

Proceed as follows:

— install bevel pinion bearing cones (7 and 9) with spacer (8) on tool **293438/2** (E);
— fully tighten tool nut (M);
— mesure distance (H_4) between tool pin end and top face;
— remove bearing cones and spacer from tool, lubricate bearings with engine oil and reinstall on tool, inserting differential carrier (10) with bearing cups, without spacer (8);
— fully tighten tool nut (M) while rotating differential carrier through ten revolutions to settle the bearings;
— now measure distance (H_3) on tool in this condition;
— thickness of shims (S_1) will be found by:

$$S_1 = H_3 - H_4 + 0{,}1 \text{ mm } (0.004")$$

If necessary, the result (S_1) may be rounded off upwards to the nearest 0.05 mm ((0.002").

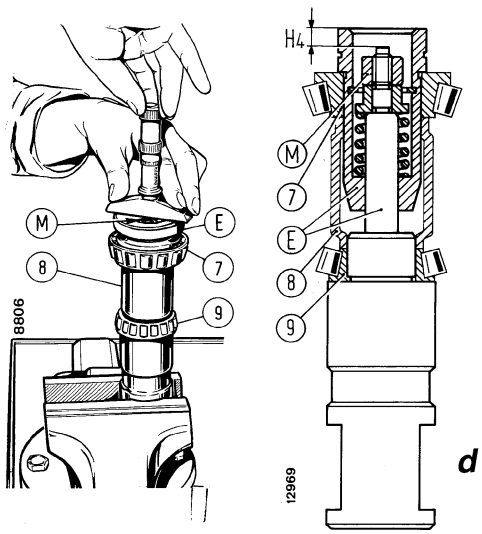


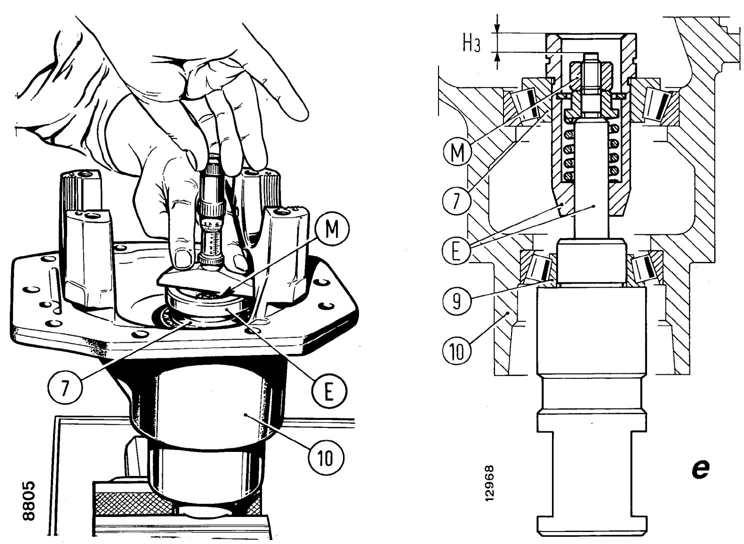
c

Bevel drive-differential unit.

C_{10}. Differential ap capscrews - Gd. RH lock ring - 1. Differential cap - 2. Lock ring plate capscrews - 3. Lock ring plates - 4. Support **293743** for bevel drive-differential housing.

Note: On completion of adjustment, do not remove tool from carrier as it will be used for subsequent bevel pinion position adjustment.





Determining bevel pinion bearing shim thickness (S_1, page 3, sect. 402)

d. Measuring distance (H_4) - e. Measuring distance (H_3) - Tool **293438/2** - H_3, H_4. Distances to be measured between tool pin end and top face - M. Tool nut - 7, 9. Bearing cones - 8. Spacer - 10. Differential carrier

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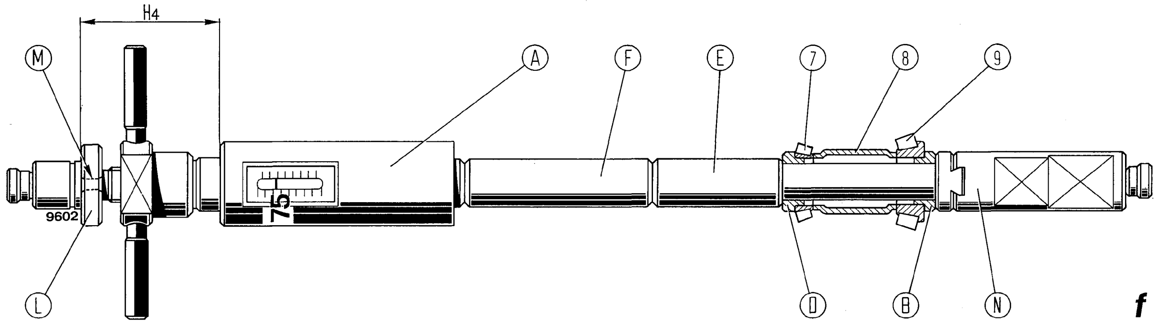
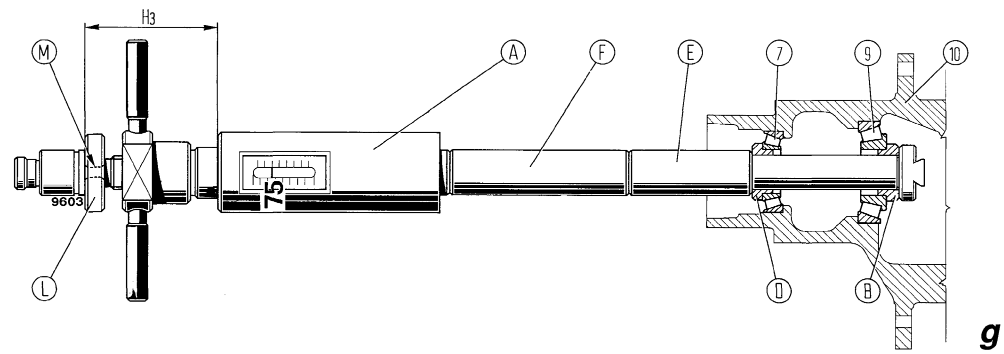


f



g

Determining bevel pinioin bearing shim thickness (S_1, page 3, sect. 402) using universal gauge 293510.

f. Measuring distance H_4 - g. Measuring distance H_3 - A. Universal gauge **293510** - B. Bushing **293632** - D. Bushing **293633** - E. Spacer **293619** - F. Spacer **293620** - H_3, H_4. Distances to be measured using depth gauge - L. Register **293624** - M. Register holes - N. Vice adapter **293617** - 7 and 9. Bearing cones - 8. Spacer - 10. Differential carrier.

2. Bevel pinion bearing adjustment and shim thickness determination using universal gauge 293510 (figs. f, g).

Proceed as follows:

- fit the bushings **293632** (B) and **293633** (D), and the spacers **293619** (E) and **293620** (F) on the universal gauge **293510** (A);
- install part **293617** (N) to secure gauge in vice and insert pinion bearing cones (7 and 9) and spacer (8) positioned as shown in fig. f.
- turn gauge handwheel to bring pointer gradually to 75 kg (165 lb);
- install register **293624** (L) on universal gauge (A), positioning holes (M) in line with flats on handwheel hub;
- measure dimension (H_4) using a depth gauge;
- disassemble the unit, lubricate the bearings with engine oil and reassemble gauge with bushings (B and D) and spacers (E and F) in differential carrier (10) as shown in fig. g;
- gradually bring pointer to 75 kg (165 lb) on gradua ted scale, rotating tool at the same time to settle the bearings; measure dimension (H_3) as described above;
- thickness of shims (S_1 page 3, sect. 402) will be found by:

$$\mathbf{S_1 = H_4 - H_3 + 0.1\ mm\ (0.004'')}$$

If necessary, the result (S_1) may be rounded off upwards to the nearest 0.05 mm (0.002'').

Note: On completion of adjustment, do not remove tool from carrier as it will be used for subsequent bevel pinion position adjustment.

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3. Bevel pinion position shim thickness determination (figs. h, i, l).

Proceed as follows:

- position differential bearings cups on shaft (P) of tool **293400/1** with cones (R) and install cups in differential carrier, tightening capscrews (C_{10}) to 113 Nm (11.5 kgm or 83 ft lb).
- tighten or back off tool cones (R) to position 100 mm (3.9") spindle (L) in the direction of bearing cone (11) and eliminate clearance between cones (R) and differential bearing cups.
- turn depth gauge (N) to bring spindle (L) into contact with bearing cone (11) and measure distance (H_5).
- establish normal distance (H_7) from ring gear centerline to back of pinion:

$$H_7 = H_6 \pm C$$

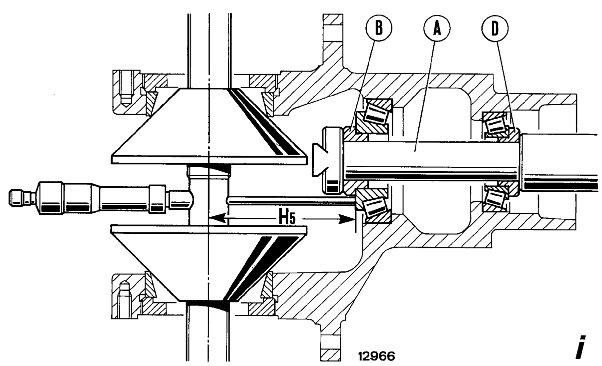
where:
H_6 = nominal distance from ring gear centerline to back of pinion: 100 mm;
C = correction factory marked on pinion and preceded by + or — if if different from 0, to be added to or subtracted from nominal dimension (H_6), depending on the sign indicated.
Shim thickness (S_2, page 3, sect. 402) will be given by:

$$S_2 = H_5 - H_7$$

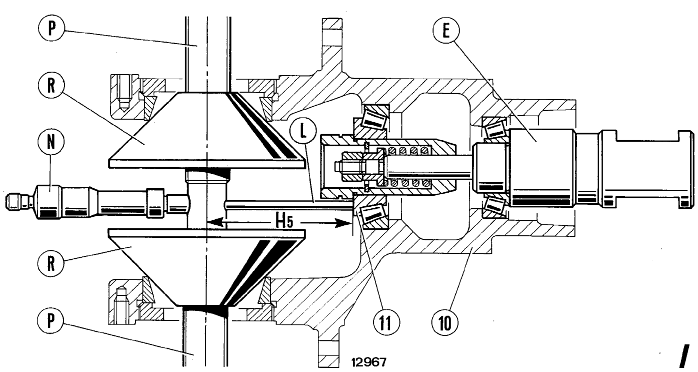
where:
H_5 = distance measured using depth gauge.
H_7 = corrected nominal distance from ring gear centerline to back of pinion.

Example

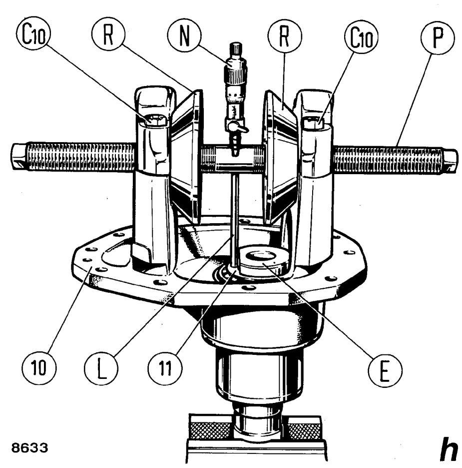
Distance measured using depth gauge H_5 = 103.3 mm.
Nominal distance from ring gear centerline to back of pinion H_6 = 100 mm.
Correction factor C = + 0,2 mm.
Corrected nominal distance H_7 = 100 + 0.2 mm = 100.2 mm.
Shim thickness S_2 = 103.3 — 100.2 = 3.1 mm.
Correction factor C = — 0.2 mm.
Corrected nominal distance H_7 = 100 — 0.2 = 99.8 mm.
Shim thickness S_2 = 103.3 — 99.8 = 3.5 mm.
Correction factor C = 0 mm.
Corrected nominal distance H_7 = H_6 = 100 mm.
Shim thickness S_2 = 103.3 — 100 = 3.3



i



l



h

Determining bevel pinion position shim thickness (S_2, page 3, sect. 402).

i. Measuring distance H_5 using universal gauge **293510** — l. Measuring distance H_5 using tool **293438/2** - A. Universal gauge **293510** - B. Bushing **293632** - D. Bushing **293633** - E. Tool **293438/2** - L,N,P,R. Tool 293400/1 - C_{10} - Differential bearing cap capscrews - 10. Differential carrier - 11. Front taper roller bearing.

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4. Differential bearing adjustment and bevel drive backlash check.

Proceed as follows:

— install bevel pinion with all parts, including shims (S_1 and S_2, page 3, sect. 402) as determined above, in differential carrier. Lubricate bearings with engine oil and tighten lock ring (C_1, page 3, sect. 402) to 294 Nm (30 kgm or 217 ft lb) using wrench **293520/2**;

Alter lock ring wrench **293520/2** by drilling and tapping three holes as specified in drawing below and adding three M8 x 1.25 x 40 (R 50) screws (1) as shown in figure.

— lock modified wrench **293530/2** on pinion shaft by means of the associated screws (1) and check that torque required to rotate shaft is 0-0.2 kgm or 0-0,145 ft lb); measure torque using torque wrench **293512** (C) without taking starting torque into account;

Note - The rotating torque indicated above applies to pinion shaft installed without seal. If the seal is installed, rotating torque should be ⩽ 0.5 Nm (0.05 kgm or 0.362 ft lb).
This torque can be measured with the torque wrench and wire wrapped around lock ring wrench **293520/2** and corresponds to a torque wrench force of (0-0.6 kg or 0-1.323 ft lb) for pinions installed without seal or ⩽ 16 N (1.6 kg or 3.527 ft lb) for pinion fitted with seal.

— to adjust rotating torque, change bearing shim thickness (S_1, page 3, sect. 402). Remove shims to increase torque or add shims to reduce it;

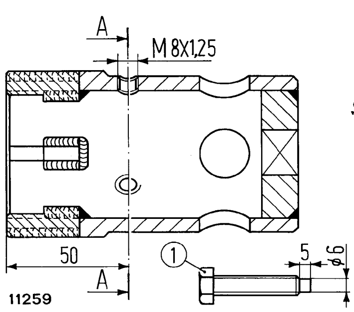
— install differential unit in carrier ensuring that ring gear does not force on pinion, tighten capscrews (C_{10}, fig. o, page 9) to 59 Nm (6 kgm or 43.4 ft lb); then slacken and re-tighhten to 20 Nm (2 kgm or 14.5 ft lb);

— lubricate ring gear bearings, rotate bevel drive and tighten LH lock ring (Gs, sect. 402, page 3) at the same time using wrench **293544** to obtain torque of 39 to 59 Nm (4-6 kgm or 29-43 ft lb) to establish the specified axial pre-load;

— measure bevel drive backlash using a dial gauge positioned at right angles on the outside of a bevel gear toothy;

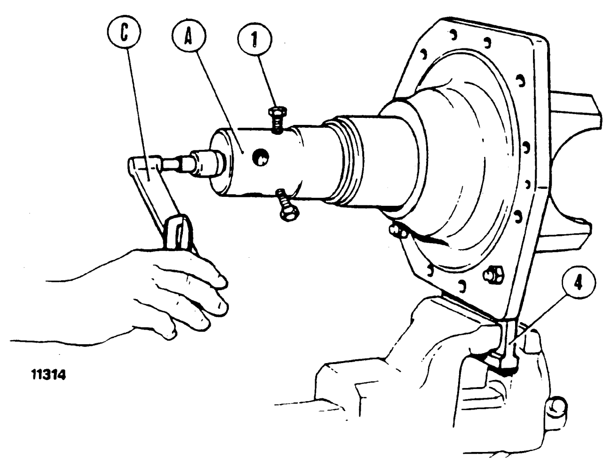
— repeat measurement at another two equidistant points staggered at 120° and compare the average of the three readings with specified backlash: 0.15 to 0;20 mm (0.006 to 0.008"), average 0.18 mm (0.007");

If backlash is out of the specified range, back off one lock ring and tighten the other by the same amount to restore axial pre-load and obtain specified backlash;



m

Modifying lock ring wrench 293520/2 for bevel pinion rotating torque measurement (dimensions in mm).
1. M8 x 1.25 x 40 screw (R 50) to be modified as shown in figure.



n

Bevel pinion rotating torque check
A. Wrench for ring **293520/2** - C. Torque wrench **293512** - 1. Screws retaining wrench **293520/2** to bevel pinion - 4. Differential bevel gear cage support **293743**

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— in these conditions, pinion and differential bearing rotating torque, measured in the same conditions as pinion torque, must be:

A_2 = A_1 + 1 to 1.5 Nm (0.1-0.15 kgm or 0.72-1.08 ft lb)

where:

A_2 = Ring gear and pinion rotating torque.
A_1 = Pinion rotating torque as previously measured, i.e.:

• 0-0.2 Nm (0-0.02 kgm or 0-0.145 ft lb) with pinion installed without seal;

• ⩽ 0.5 Nm (0.05 kgm or 0.362 ft lb) with pinion installed with seal;

• 1-1.5 Nm (0.1-0.15 kgm or 0.72-1.08 ft lb) rotating torque of ring gear only measured at end pinion using wrench **293520/2** and torque wrench **293512**.

Note - To measure ring gear and pinion rotating torque with the torque wrench and wire wrapped around lockring wrench **293520/2** la torque wrench force must be:

$$F_2 = F_1 + F_3$$

where:

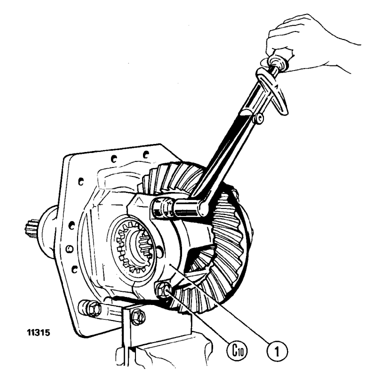
F_2 = ring gear and pinion rotating torque measured with torque wrench and wire;

F_1 = rotating torque of pinion only previously measured with torque wrench and wire, i.e.:

- 0-0.6 Nm (0-0.6 kg or 1.323 ft lb) for pinions installed without seal;
- ⩽ 16 N (1.6 kg or 3.527 ft lb) for pinion fitted with seal;

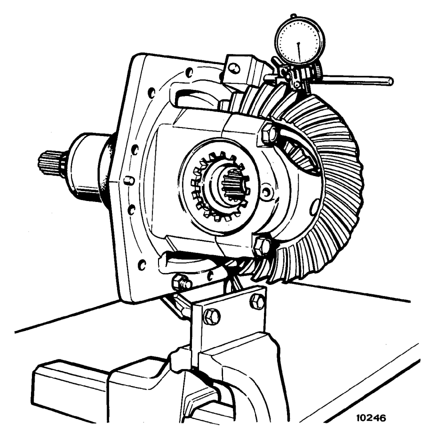
F_3 29-43 N (2.9-4.3 kg or 6.39-9.48 lb) = rotating torque of ring gear only, measured at end of pinion using torque wrench and wire.

— finally, block cap retaining screws (c_{10}) to 113 Nm (11.5 kgm or 83 ft lb) and secure lockring by means of associated lock plates. If plate does not correspond to notch, tighten lock ring further.



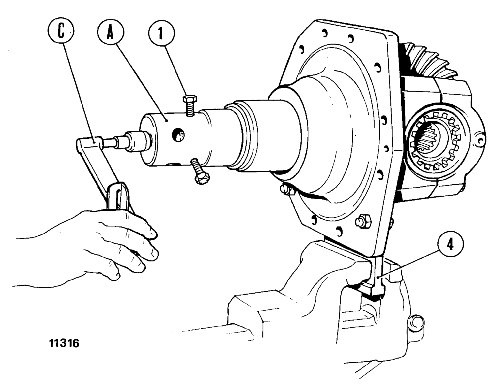
o

Installing differential bearing caps (1).
c_{10} - Self-locking capscrews retaining differential carrier caps.



p

Checking normal bevel drive backlash.



q

Checking ring gear and bevel pinion rotating torque
A. Lockring wrench **293520/2** - C. Torque wrench **293512** - 1. Screws retaining wrench **293520/2** to bevel pinion - 4. Support **293743** for differential carrier.

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Differential gear backlash adjustment.

Install two side gears (60 and 61, section 402, page 3) on differential cage without shims (6).

Insert differential pinions (62) with washers (7) and journal (63) and tighten capscrew (8) through a few turns to prevent journal from slipping.

Bring LH side gear into contact with differential pinion as shown on page 10, sect. 204 and, using a depth gauge, measure distance (H_1) in two diametrically opposite points for average reading.

Push side gear in contact with differential cage as shown on page 10, section 204 and measure distance (H_2).

Repeat the same operations on RH side gear. Axial displacement of each side gear without shim will be given by:

$$Gs \text{ or } Gd = H_1 - H_2$$

where:

Gs = LH side gear axial displacement;

Gd = RH side gear axial displacement;

H_1 and H_2 = Distances measured on LH and RH side gear.

Normal differential pinion and side gear backlash is 0.15 mm (0.006").

Note that average ratio of backlash to equivalent side gear displacement is **1 to 1.7.**

Side gear displacement corresponding to normal backlash: 0.15 x 1.7 = **0.25 mm (0.01").**

Thickness of shims to install on differential cage will thus be given by:

Ss = Gs - 0.25 (LH side gear)

Sd = Gd - 0.25 (RH side gear).

Fit the shim which is closer to the calculated value, remembering that shims are available in thicknesses of 1.5 and 1.6 mm (0.059 and 0.063").

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DRIVE SHAFT

Removal.

To remove drive shaft, proceed as follows:

– remove shaft guard, back off cap screws (C_{12}, page 3) from the center mounting bracket, unseat the retaining rings (28 and 31) and widthdraw drive shaft (30) complete with center mounting bracket (33) moving the splined sleeves (27 and 32) inwards.

Carefully inspect the splines of the shaft and the associated sleeves and check condition of bore bearing accommodated in the center mounting bracket (33).

Installation.

Reinstall shaft in reverse sequence to the above, and then adjust as follows:

– bring front spline sleeve (27, page 3) up against retaining ring (28). Use feeler gauge to gauge daylight between the sleeve and the retaining ring (26) and add shim (S_5) of suitable thickness to obtain a sleeve (27) play (L) of 1 to 1.5 mm.

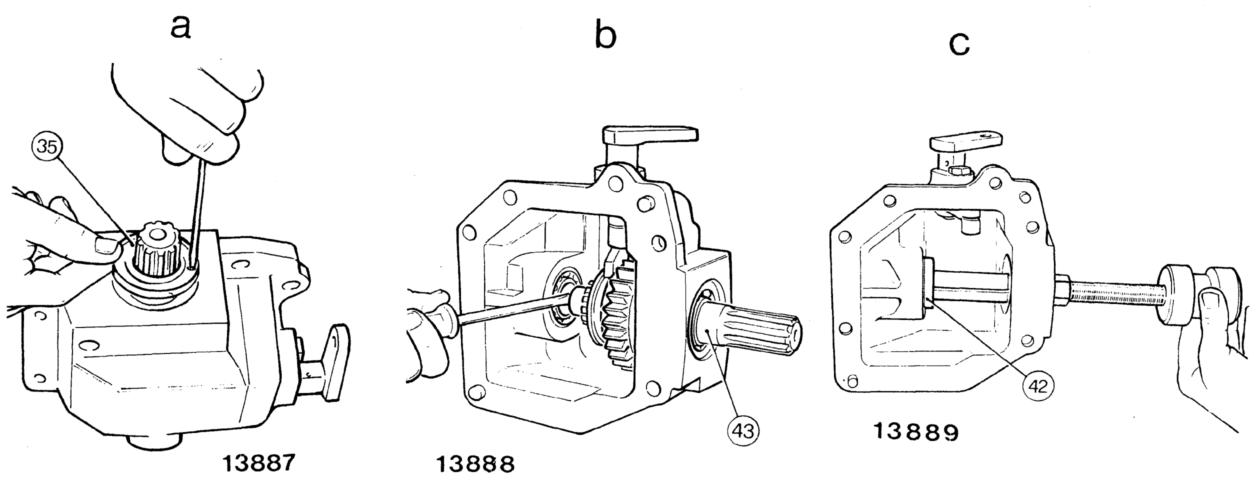
POWER TAKE OFF

Disassembly.

To remove PTO from the tractor proceed as follows: remove drive shaft and the shaft guard as already described above, drain oil from the transmission case, detach the lift rod (54, page 3) from the outer lever (53), removing cap screws (C_{13}) and removing the PTO unit complete.

Disassemble PTO unit as follows:

– remove retaining disk of seal (35) from PTO housing as shown in (a) together with seal (36, page 3) retaining ring (37) and remove driven shaft (41) as shown in (b) complete with ball bearing (38), oil baffle (39).



Disassembling PTO unit using universal impact puller

a. Removing seal retaining disk (35) - b. Removing driven shaft (43) - c. Removing bearing cup of ball bearing (42).

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- remove the driven gear casing (40), unscrew plug (51), remove plunger spring (50), plunger (49) and extract inner relay lever (48), having first removed relative spring plug;
- if necessary, remove rear ball bearing (42) of the intermediate PTO housing using a universal extractor tool as indicated in (c page 1);
- if it should be necessary to remove the intermediate gear (45 page 3) including the roller bearing.

Assembly

Reassemble the parts following the reverse order of dismantling, referring to figure on page 3.

Mount the new seal retaining disc (35) taking care not to distort.

When refitting the PTO housing tighten the screws on the coupling as prescribed on page 3, see 40. Check the transmission shaft as described in the relative chapter.

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Longitudinal section through front axle, pivot, axle drive and drive shaft.

Note - On assembly thoroughly clean and degrease surfaces X and apply one of jointing compounds listed on page 5, Section A.

a. Section through axle drive control - b. Correct bushing installation in front axle pivot support (split arrowed) - C. Correct bushing installation in rear axle pivot support (split arrowed) - C_1. Bevel pinion locking ring - C_2. Differential carrier capscrew - C_3. Ring gear capscrew - C_4. King-pin bearing capscrews - C_5. Steering knuckle capscrew - C_6. Wheel hub bearing lock ring - C_7. Final drive housing capscrew - C_8. Wheel capscrew - C_9. Axle pivot support capscrew - C_{10}. Differential bearing cap bolt - C_{11}. Capscrew securing front axle support to engine - C_{12}. Drive shaft center bearing cap screw - C_{13}. Axle drive housing capscrew - Gd and Gs. Rh and LH differential bearing lock rings- S_1. Bevel pinion bearing shim - S_2. Bevel pinion position bearing shim - S_2. Bevel pinion position shim - S_3. King pin bearing shims - S_5. Sleeve (27) position shim - T. Oil drain plug - 1. Bevel pinion-2. Seal - 3. Bevel pinion bearing spacer - 4. Ring gear - 5. Axle shaft with universal joint - 6. Side gear washers - 7. Differential pinion washers - 8. Differential pinion journal capscrew - 9. Bearing carrier capscrew - 10. Seal - 11. King pin bearing - 12 and 13. Seals - 14. Axle shaft bushing - 16. Thrust washer - 17. Planetary wheel journal - 18. Planetary wheel shim - 19. Sun gear - 20. Front axle pivot support - 21. Front bushing - 22. Front thrust washer - 23. Rear thrust washer - 24. Rear bushing - 25. Rear axle pivot support - 26, 28, 31, 34 and 37. Retaining rings - 27. Front splined sleeve - 29. Drive shaft guard - 30. Drive shaft - 32. Rear spline sleeve - 33. Center support complete with ball bearing - 35. Seal disc - 36. Seal - 38. Ball bearing - 39. Dust excluder - 40. Driven gear - 41. Splined driven shaft - 42. Ball bearing - 43. Intermediate shaft - 44. Roller bearing - 45. Intermediate gear - 46. Drive gear keyed on bevel pinion - 47. Pad - 48. Inner relay lever - 49. Plunger - 50. Plunger spring - 51. Plug - 52. O-ring - 53. Axle drive control lever - 54. Vertical link - 55. Hand lever hingepin - 56. Hand lever - 60 and 61. Side gears - 62. Differential pinion - 63. Differential pinion journal.

H = 1 mm. Recess of front bushing (21) fully fitted.

L = End float daylight (1 - 1.5 mm) between sleeve (27) and retaining ring (26).

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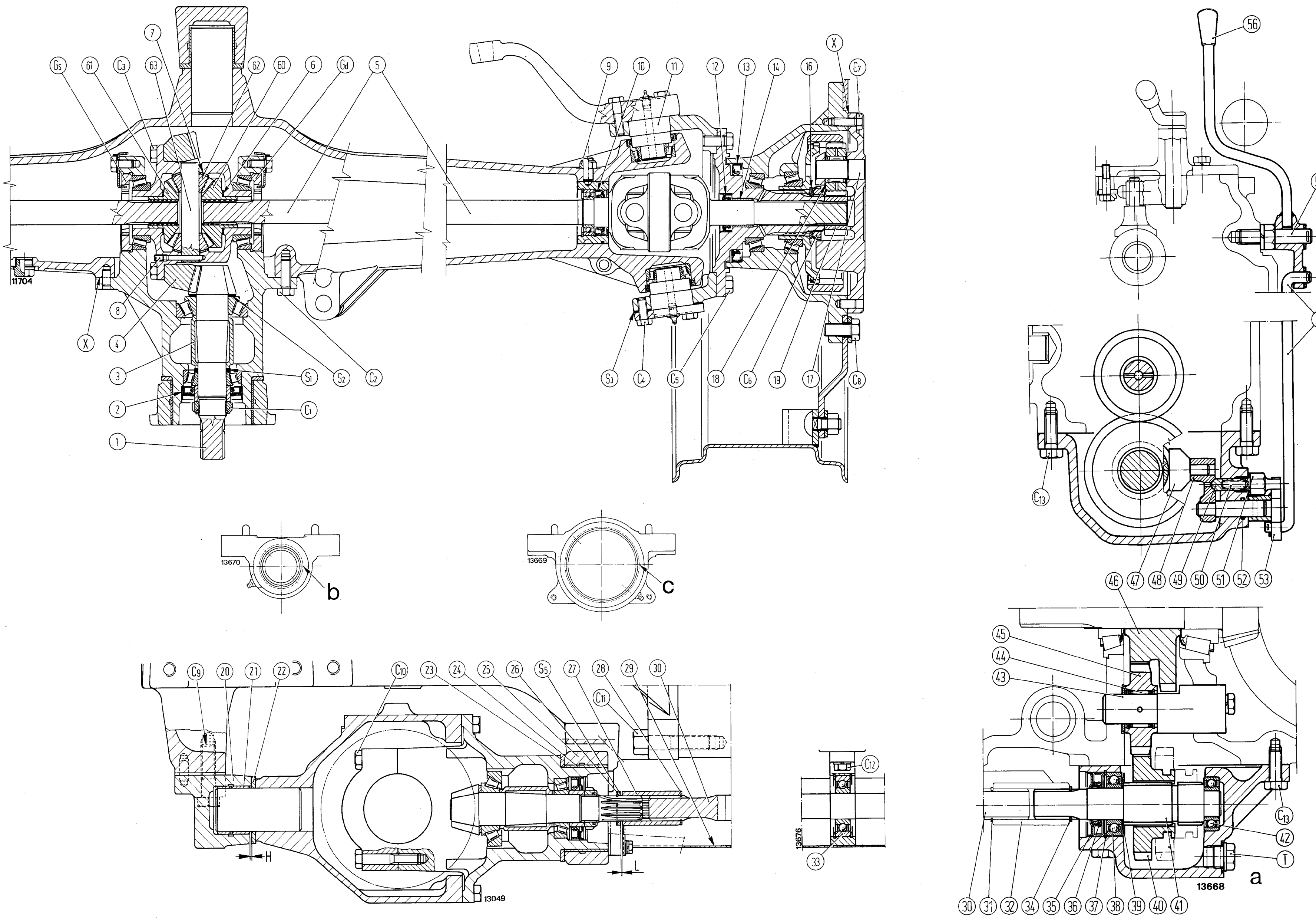
11704
13670
b
13669
c
13049
H
L
13676
13668
a
X
T

LIFT

Type	Position and draught control
Control	two independent levers
Sensitivity adjustment	control valve-mounted lever
Single-acting cylinder:	
— bore x stroke	90 x 96.5 (3.600x3.8600 in)
— displacement	613 cm^3
Relief valve crack-off setting	142 to 152 bar (145 to 155 kg/cm^2)
Safety valve crack-off setting	196 to 206 bar (200 to 210 kg/cm^2)
Design lift capacity	9025 Nm (920 kgm)
Lift piston dia.	89.980 to 90.000 mm (3.5992 to 3.6000 in)
Lift cylinder bore dia.	90.036 to 90.071 mm (3.6014 to 3.6028 in)
Piston working clearance in bore	0.036 to 0.091 mm (0.0014 to 0.0036 in)
Cross shaft journal dia:	
— RH	54.970 to 55.000 mm (2.1642 to 2.1653 in)
— LH	46.975 to 47.000 mm (1.8979 to 1.8800 in)
Bushing fitted ID in lift body:	
— RH	55.100 to 55.170 (1) (2.2040 to 2.2068 in)
— LH	47.100 to 47.170 (1) (1.8840 to 1.8868 in)
Cross shaft working clearance in bushings:	
— RH	0.100 to 0.200 mm (0.0040 to 0.0080 in)
— LH	0.100 to 0.195 mm (0.0040 to 0.0078 in)
RH bushing interference fit in housing	0.046 to 0.102 mm (0.0018 to 0.0040 in)
LH bushing interference fit in housing	0.046 to 0.102 mm (0.0018 to 0.0040 in)
Cross shaft end float with lift arms in position	0.1 to 0.3 mm (0.0040 to 0.0120 in)
Control shaft OD	24.948 to 25.000 mm (0.9979 to 1 in)
Shaft bushing bore (fitted)	25.020 to 25.072 mm (1.0008 to 1.0028 in)
Shaft clearance in bushing	0.020 to 0.124 mm (0.0008 to 0.0049 in)
Bushing interference fit in cover	0.050 to 0.120 mm (0.0020 to 0.0048 in)

(1) Not reamed.

(cont.)

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HYDRAULIC LIFT UNIT: Specification and Data

LIFT

(cont.)

Valve spool (6, page 3, Section 501) clearance in body .... Lift valve (2) clearance in control valve body	0.025 to 0.035 mm (1) (0.0009 to 0.0013 in) 0.025 to 0.035 mm (1) (0.0009 to 0.0013 in)
Cylinder (5) oil admission valve return spring length: – free .... – loaded 4.1 to 5.1 N (0.42 to 0.52 kg)	 9.5 mm (0.37 in) 4.6 mm (0.18 in)
Dump valve (4) return spring: – free .... – loaded 40.2 to 44.1 N (4.1 to 4.5 kg)	 31 mm (1.22 in) 21 mm (0.82 in)
Control valve (2) return spring length: – free .... – loaded 17.6 to 21.6 N (1.8 to 2.2 kg)	 46 mm (1.81 in) 20 mm (0.78 in)
Pressure relief valve (1) spring length: – free .... – loaded 280 to 310 N (28.6 to 31.6 kg)	 39 mm (1.53 in) 30.5 mm (1.20 in)

REMOTE CONTROL VALVES

Type	spool
Application	for single or double-acting cylinder remote control
Location	secured to lift control valve, requiring removal of corresponding cover
Control	independent hand levers
Pressure relief valve	same as provided on lift control valve body
Pressure relief valve crack-off setting	142 to 152 bar (145 to 155 kg/cm^2)
Spool clearance in remote control valve body	0.007 to 0.015 mm (1) (0.0003 to 0.0006 in)

(1) spools to be selected accordingly and rubbed with emery cloth to obtain the prescribed clearance.

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LIFT PUMP

Filter	
Type	metal strainer cartridge
Location	suction side, on pump body
Pump	
Type	gear, drawing from rear transmission case
Location	before transmission cover
Model	C25X
Make	FIAT
Drive	valve timing gear driven
Rotation (seen from drive end)	clockwise
Drive ratio	0,910 to 1
Max. rated speed (engine at governed speed)	2366 rpm
Max. rated output	26.8 dm^3
Output at 1450 rpm and pressure (see diagram, page 2, section 502):	
– new or reconditioned	15.3 dm^3
– used	10.7 dm^3
– test oil temperature	55 to 65°C (131 to 151°F)
– test oil grade	SAE 20
Pump gear journal dia.	17.400 to 17.424 mm (0.6850 to 0.6860 in)
Journal housing bore dia. in bearing	17.450 to 17.470 mm (0.6870 to 0.6878 in)
Journal clearance in bearing	0.026 to 0.070 mm (0.0010 to 0.0028 in)
– max wear clearance	0.220 mm (0.0088 in)
Gear in pump body	0.020 to 0.064 mm (0.0008 to 0.0025 in)
Max. pump body wear on suction side	0.1 mm (0.0040 in)
Gear flank width	18.323 to 18.348 mm (0.7329 to 0.7339 in)

(cont.)

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HYDRAULIC LIFT UNIT: Specification and Data

LIFT PUMP

(continued)

Bearing width	19.796 to 19.812 mm (0.7793 to 0.7799 in)
Pump body width	58.072 to 58.122 mm 2.2862 to 2.2882 in)
Gear and bearing end float (applicable to new and reconditioned pumps)	0.1 to 0.2 mm (0.003937 to 0.007874 in)

IMPLEMENT ATTACHMENT

Type	3-point linkage
Category	one and two
Draught control	through third point
Max lower link end travel:	
— lifting rods out and coupled to front mounting holes	720 mm (28.8 in)
— lifting rods out and coupled to rear mounting holes	595 mm (23.8 in)
Max. lift capacity, starting with lower links horizontal (Top link coupled to center hole):	
— at lower link swivel bushing	1400 kg (3.087 lb)
— center of gravity 600 mm from lower link swivel bushings	1000 kg (220.55 lb)
— center of gravity 1000 mm from lower link swivel bushings	860 kg 1.896 lb)

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TRAILER BRAKE VALVE

Type	spool valve incorporating pressure relief valve
Location	on separate mounting bracket, bolted to RH final drive housing
Clearance, rod and remote control valve body (appropriate selected items adapted by rubbing with emery cloth)	0.007 to 0.012 mm (0.0003 to 0.0005 in)
Governor valve setting (4 and 5, page 2, Section 503) . .	142 ± 4.9 (145 ± 5 kg/cm²) bar
Shim availability for pressure relief valve (8)	0.2 - 0.5 mm (0.0078 - 0.197 in)

SPRING CHARACTERISTICS	Length, free mm	Length loaded mm	Checking load N
Spring for pressure relief valve	28.2	24.6	265 ± 13 (27 ± 1.35 kg)
Rod return spring	30.5	20	29 ± 5 (3 ± 0.5 kg)

TIGHTENING TORQUE FIGURES

DESCRIPTION	Thread size	Torque			
		Nm	kgm	in	ft/lbs
Lift - Section 501					
Cap screw, end of suction pipe to transmission case .	M 12 x 1.5	98	10	5.97	72
Nuts, studs securing spool valve to lift body (C_1, C_4, page 2)	M 10 x 1.25 M 14 x 1.5	59 152	6 15.5	3.60 9.27	43.4 112
Cap screws, or nuts for stud, securing lift to transmission case (C_5)	M 14 x 1.5	152	15.5	9.27	112
Nut, studs securing rear cover to lift body	M 12 x 1.5	137	14	8.35	101

(continued)

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HYDRAULIC LIFT UNIT: Specification and Data

TIGHTENING TORQUE FIGURES

(cont.)

DESCRIPTION	Thread	Torque Nm	kgm	in	ft lb
Capscrew (79, page 6), max. arm raise stop lever (80)	M 10 x 1.25	41	4.2	2.5	30
Capscrew, lever to spool of control valve (49, page 3)	M 10 x 1.25	41	4.2	2.5	30
Capscrew, sensing bar bracket shaft (55, Fig. a, page 2) ...	M 16 x 1.5	196	20	11.95	144.7
Plug, locking dump valve (C_6, page 3)	M 24 x 1.5	64	6.5	3.90	47
Safety valve, cylinder (3)	M 24 x 1.5	59	6	3.59	43
Capscrew, return spring to rear cover of lift unit and sensing bar bracket (C_2, page 2)	M 12 x 1.5	74	7.5		54
Capscrew lift arm to corresponding shaft (C_3, page 6) ...	M 14 x 1.5	147	15	8.82	108.5
Capscrew, sensing bar bracket locking wedge (29, page 2) .	M 12 x 1.5	123	12.5	7.55	90.5
Nut, roller pin (19, Fig. i, page 9)	M 8 x 1.25	37	3.8	2.26	27.5
Capscrew, control valve cover to control valve	M 10 x 1.25	59	6	3.59	43
Lift pump - Section 502					
Capscrew, pump to control valve cover (C_1, page 2)	M 6 x 1	8	0.8	0.48	5.8
Nuts, cap screws securing pump covers (C_4, page 2)	M 10 x 1.25	49	5	2.99	36
Nut, pump control shaft sleeve (C_3)	7/16"20 UNF-2B	28	2.3	1.7	16.6
Implement attachment and towing devices					
Capscrew, top towing crossbar	M 20 x 1.5	333	34	20	246
Nut, capscrew, bottom towing crossbar	M 20 x 1.5	333	34	20	246
Nut, capscrew end of rear towbar	M 18 x 1.5	368	37.5	22.44	271

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LIFT TROUBLE SHOOTING CHART

FAULTS	CAUSE	REMEDY
1. Lift fails to operate.	*a.* Low oil level in transmission housing.	Top up.
	b. Lift governor valve stuck open.	Remove foreign particles and check filter.
	c. Inefficient pump.	Remove and inspect pump.
2. Erratic lift movement during raising.	*a.* Low oil level in transmission housing.	Top up.
	b. Clogged oil filter.	Inspect filter and replace cartridge as necessary.
	c. Intake of air in pump suction line.	Check for faulty connections and seals.
3. Lift fails to hold the load in raised position. Continuous pitching motion (with engine running. Upon stopping engine, load is lowered).	*a.* Wrong sensitivity setting of valve spool.	Check sensitivity setting.
	b. Seal leakage and exhaust valve stuck open. Seal damaged.	Dismantle, check seals, clean and replace damaged items. Inspect filter.
	c. Oil inlet valve seal (in cylinder) leaking.	Dismantle, check and clean items concerned.
	d. Leakage past lift piston gland or lift cylinder seal.	Change gland, seal.
	e. Safety valve leakage or incorrect setting.	Replace valve.
4. Relief valve cracks off with lift arms in maximum raise position.	Lift arm travel out of adjustment.	Adjust travel.
5. Inadequate lifting power.	*a.* Incorrect relief valve setting.	Replace valve.
	b. Incorrect safety setting.	Replace valve.
	c. Poor pump performance (usually accompanied by increased raise time).	Check pump performance and overhaul or replace as necessary.

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DESCRIPTION

The lift provides the following three modes of operation: position control, float and draught control, each of which can be selected appropriate to the type of work in hand, implement and soil condition.

a. Position control

Position control keeps implement positions steady either sunk in ground or on surface depending on position of lever (A). Implement height is proportional to the position of the lever on the quadrant. Position control operation requires lever (B) to be positioned fully forward.
When working, keep the stop knob (finger guide) (29) in place between the sensing bar support and the rear cover of the lift to prevent excessive, detrimental actuation of the return spring and ensure that the actuator (30) is located in the lowest hole of the corresponding bracket.

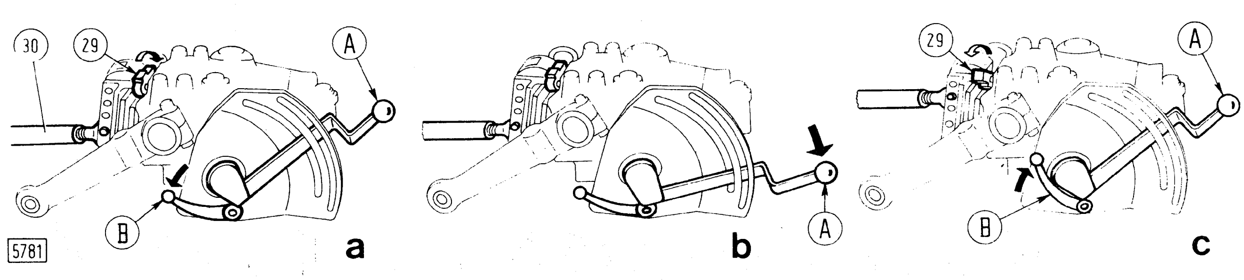
b. Float

When lift is in the float mode, the lifting arms can swing freely to allow the implement to follow the ground contour.
This mode is used to simply allow the implement to ride on the ground and follow the profile or for semi-supported implements carrying surface working implements.
Lift and lower implement using position control lever (A) only.

c. Draught control

In draught control, the lift automatically keeps tractive effort constant by allowing implement working depth to vary within limits.
In soil which is sufficiently homogeneous, varying the working depth thus depends on the position control lever in position correspondingly forward or reversed on the quadrant (in the zone U of the quadrant, fig. g, page 9).
Should working depth not be sufficient although the control lever is positioned fully to the rear of zone (U) on the segment, the implement hitch sensing bar must be shifted a hole further down on the reaction support, (see detail fig. a, page 2). To fully lift the implement shift the control lever fully upwards (zone V on the quadrant, fig. g, page 9).
To select draught control it is sufficient to position the control lever (B) upwards and to disengage the stop control (29) for the sensing bar bracket.
When working, set the "sensitivity" of the lift for maximum possible effect to prevent the implement from being subject to repeated, damaging jolting. To enhance sensitivity turn lever (18, fig. of page 2) clockwise - and vice versa.

Note — To move the mode selection lever (B) when changing the lift system first lift the arms to prevent bending of the spool valve levers.



Lift positions for position control (a), float (b) and draught control (c)

A. Lift control lever - B. Mode selector lever - 29. Sensing bar stop control - 30. Implement hitch sensing bar.

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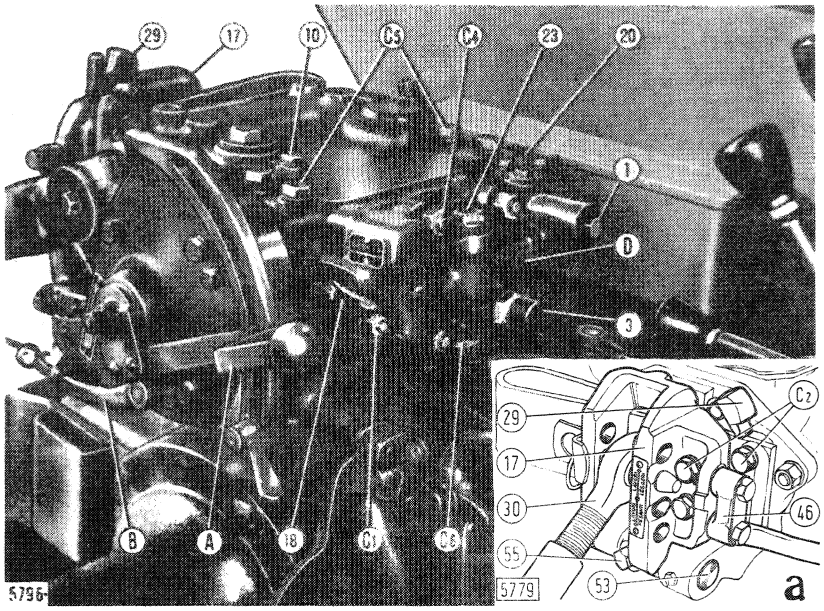
HYDRAULIC LIFT UNIT: Lift



Hydraulic lift fitted to tractor

(a. Detail showing rear view of sensing bar supporting brackets and relative hitching holes).

A. Lift control lever - B. Mode selector lever - C_1 and C_4. Nuts for studs securing lift control valve - C_2. Capscrews securing sensing bar supporting bracket spring and lift rear cover - C_5. Capscrews securing lift to transmission housing - C_6. Plug securing dump valve - D. Control valve - 1. System pressure release valve - 3. Cylinder safety valve - 10. Max. arm height adjusting bolt - 17. Sensing bar mounting bracket - 18. Sensivity control lever (increase sensitivity by moving towards + and vice versa) - 20. Oil delivery line from hydraulic pump - 23. Plug retaining lift control valve - 29. Stop control for sensing bar mounting bracket - 30. Implement hitch sensing bar - 46. Draught control outer pin - 55. Bolts securing actuator bracket hinge pin.

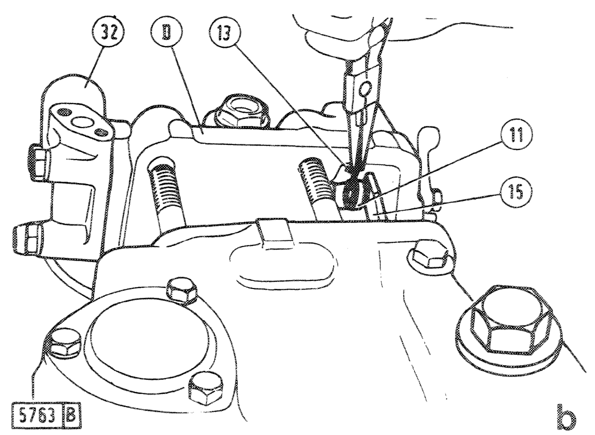
REMOVAL

To remove the lift from the tractor see as follows:

- separate lifting arms from hitch and remove the operator's seat complete with mounting bracket;
- disconnect the breather pipe from the lift body and the delivery line to the lift;
- unbolt transmission housing and remove from the rear using chain and lifting tackle.

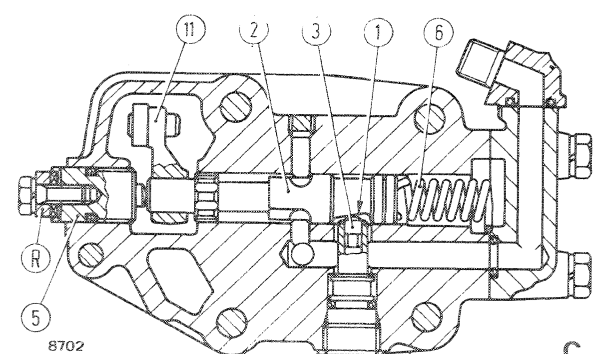
DISASSEMBLY

Place the lift assy on the bench and proceed



Removing/installing control valve assy

D. Control valve - 11. Control valve spool lever, inner - 13. Cotter securing linkage (15) to spool lever (11) - 15. Linkage - 32. Cover mounting pressure relief valve.



Section through control valve spool

R. Sensitivity setting lever - 1. Dump valve control cam - 2. Spool - 3. Dump valve sensing bar - 5. Plug for setting sensitivity - 6. Spool return spring - 11. Spool control lever.

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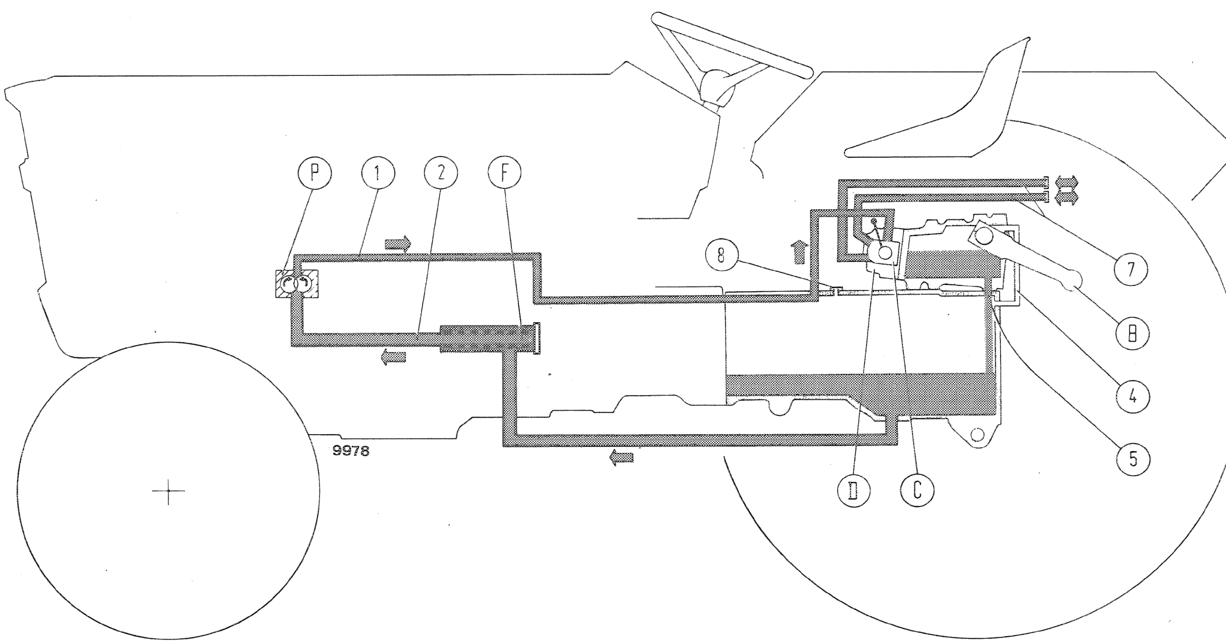
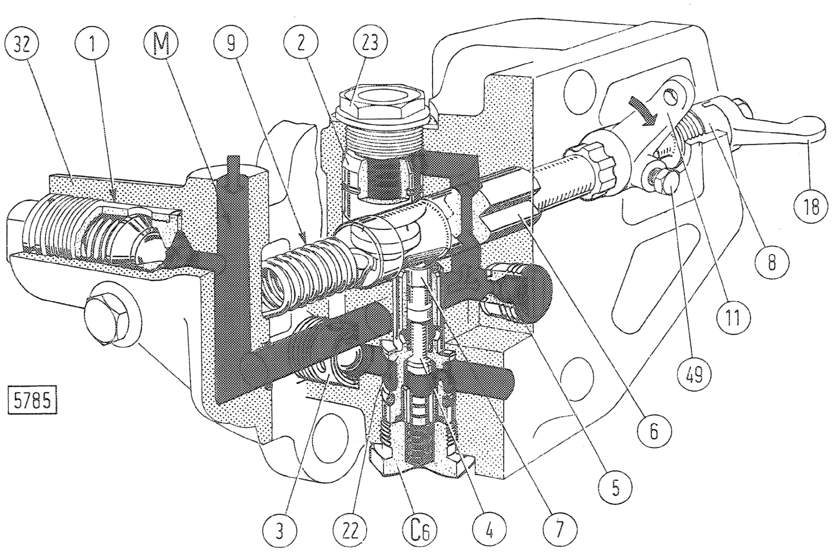


LIFT SYSTEM AND CONTROL VALVE SYSTEM SCHEMATIC

B. Lift arm - C. Single or double acting control valve - D. Control valve - F. Gauze oil filter - P. Engine valve gear driven hydraulic pump - 1. Delivery line to control valve - 2. Suction line from transmission housing - 4. Oil level pipe in lift body - 5. Oil drain pipe from lift body in transmission housing - 7. Delivery line single or double-acting cylinder - 8. Breather.



Hydraulic control valve section schematic

(Black arrow indicates torsion action of spring 9 on spool control lever 11. Oil flow is as in the arm lifting phase as shown on the following page).

C_6. Plug locking dump valve - M. Oil inlet passage for pump delivery - 1. Pressure relief valve - 2. Lift control valve - 3. Cylinder safety valve - 4. Dump valve - 5. Cylinder oil intake valve - 6. Spool - 7. Dump valve actuator (in contact with cam of spool) - 8. Sensitivity setting plug - 9. Spool return spring - 11. Spool control lever - 18. Sensitivity control lever - 22. Dump valve seat - 23. Plug of valve (2) - 32. Valve mounting cover - 49. Capscrew securing lever (11) to spool.

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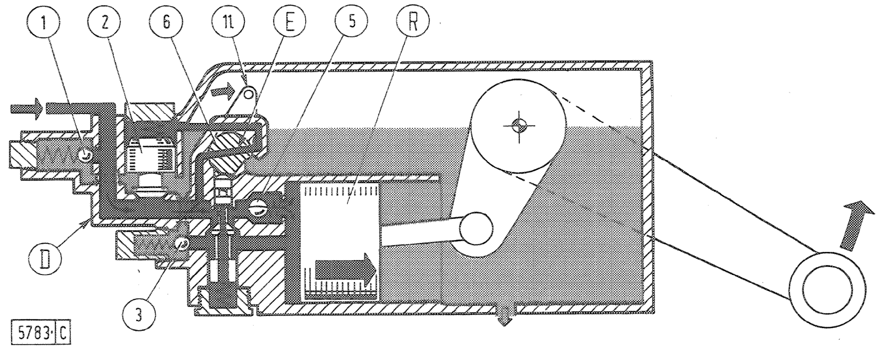
High pressure oil

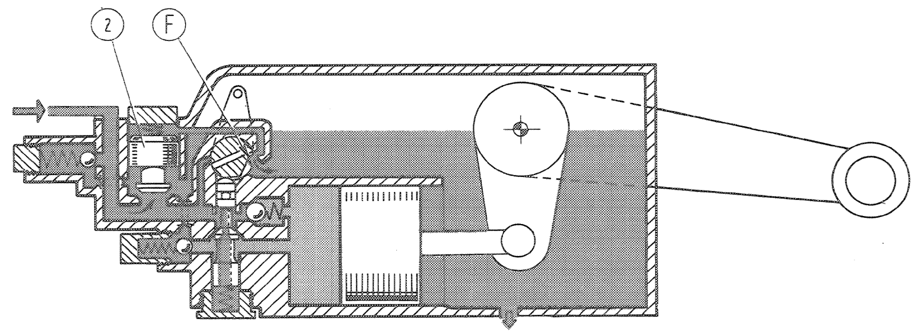
Inlet, pump and exhaust oil

Trapped oil



S. Oil Flow when Raising.

As spool (6) turns incoming oil pressure is directed to the upper chamber of governor (2) through cross drilling (E). As the upper area of the governor is larger than that on the lower side, that valve is kept closed.
Oil pressure is thus directed to the lift cylinder through valve (5).

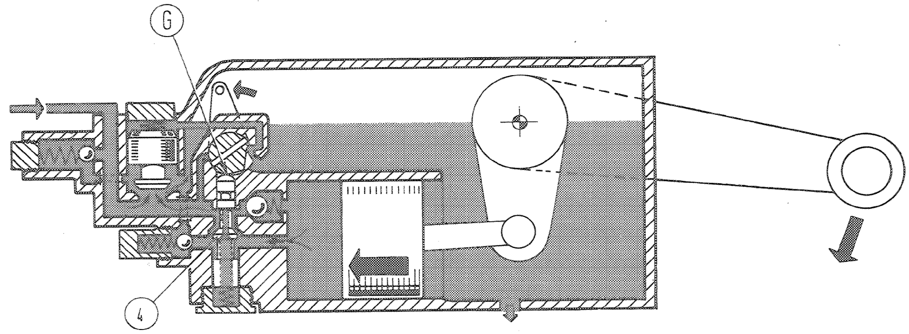


N. Oil Flow in Neutral.

Spool position is such that oil pressure from governor valve (2) is exhausted through slot (F). Thus, pump oil pressure displaces the governor upwards and the power is directed to the lift body.

LIFT SYSTEM OPERATION DIAGRAM

D. Control valve - E. Spool cross drilling - F. Spool slot - G. Spool cam - R. Lift piston - 1. Relief valve - 2. Governor valve - 3. Safety valve - 4. Unload valve - 5. Inlet valve - 6. Spool - 11. Spool lever.



A. Oil Flow when Lowering.

Spool cam (G) caused valve (4) to open, thereby connecting the cylinder to exhaust.

OPERATION

X. Position control

Positioning the mode selection lever (B) down, takes the roller (64) out of contact with the outer lever 62 and 63 and rotates the cam (65) upwards into contact with the lever 63.
The outer linkage for the draught control function (diagram Y) remains unaffected.
Shifting the control lever A forwards on the quadrant results in the linkage being moved in the direction of the black arrows allowing the spool 6 to move in the delivery direction due to the action of spring 9.
As soon as the plunger moves lever 39 connecting the inner arm moves the rocker 66 in the direction of the white arrows to bring the spool into the neutral position.
This can only happen, however, when the lift arms have reached the prefixed position of lever A on the control lever quadrant.
The reversed happens when the lever A is moved downwards to lower the implement.
Maximum lift of the arms is limited by adjusting bolt 10 relay lever 80, which is solid with the rocker 66 to bring the spool 6 into the neutral position before the plunger reaches full stroke (see page 7 for setting full arm stroke).

Y. Draught control

Moving the mode selector lever B upwards disengages cam 65 from lever 63 and inserts roller 64 between levers 62 and 63 making them solid and bringing roller 19 into contact with cam 34. Changes in load of the implement introduced into the system by plunger 30 thus acts on the return spring 94 resulting in the spool acting on lever A.
After having moved lever A on the quadrant to the desired draught, the force of the implement acting on the lower arms will tend to increase when the implement encounters harder soil.
This increases the thrust of the plunger 30 on the return spring 94 which determines rotation of the spool 6 in delivery through the action of the levers 46, 63, 92, 69, 80 and 66 as indicated by the black arrows.
The arms lift until the subsequent reduction of force F on the neutral position, arresting arm lift.
Should the thrust of the actuator still increases or reduce, the movement of the above levers is reversed and the spool discharges the pressure to subsequently lower the arms.
Since in draught control the spool is required to only react to change in the length of the return spring 94 the movement is indicated by the white arrows, transmitted to the rocker 66 from lever 39 zeros the movement in the opposite sense caused by sliding of the roller 19 on cam 34 (shaded arrows).

Note — The black, white and shaded arrows refer to movements of the linkage in the lifting phase. The white-black arrows indicate movement of the plunger and arm lifting. When the arms are lowered the movements occur in the opposite direction.

A. Lift control lever - A. Mode selection lever - F. Reaction of actuator caused by resistance felt by implement. - 6. Spool - 9. Spool spring - 10. Adjusting bolt for setting max. arm lift - 11. Spool control lever - 19. Roller - 30. Hitch actuator - 34. Cam solid with RH lifting arm - 35. RH lifting arm - 39. Inner arm connecting lever - 46. Lever connecting sensing bar bracket - 62. Roller mounting lever - 63. Outer relay lever - 64. Selection roller - 65. Cam solid with mode selector lever - 66. Rocker - 69. Rocker control lever (solid with lever 80) - 80. Rocker relay control lever (stopping upward movements of arms when in contact with adjusting bolts 10)- 81. Spring connecting levers (62 and 63) - 91. Rocker control roller (always in contact with lever 92 for actuating spool spring 9) - 92. Roller support lever - 94. Return spring.

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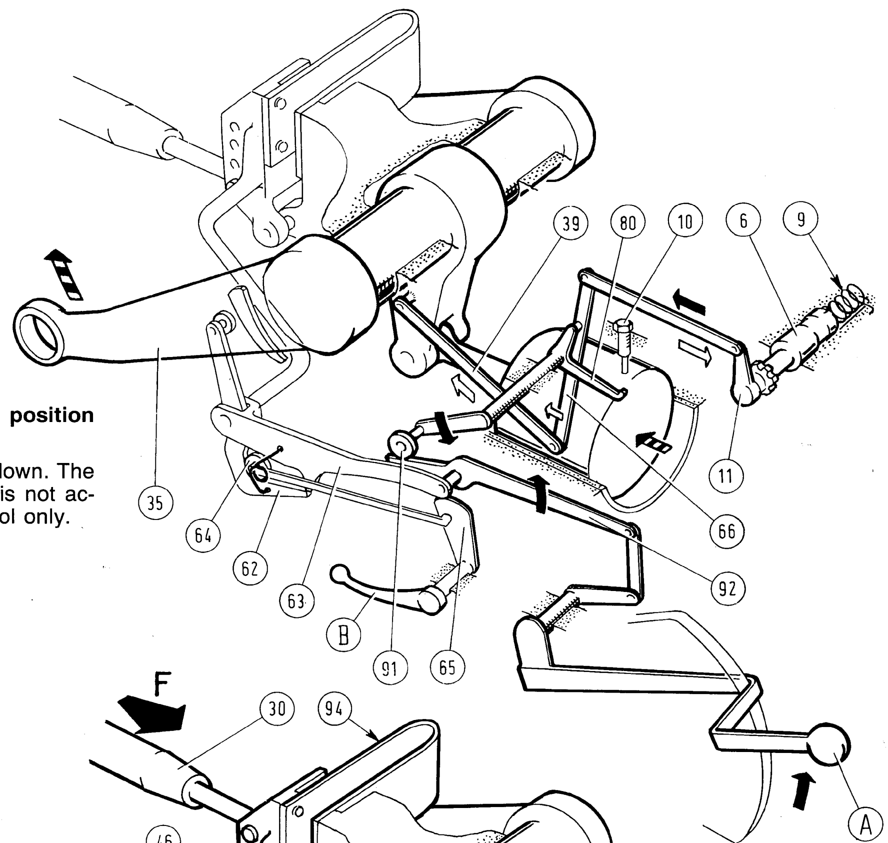
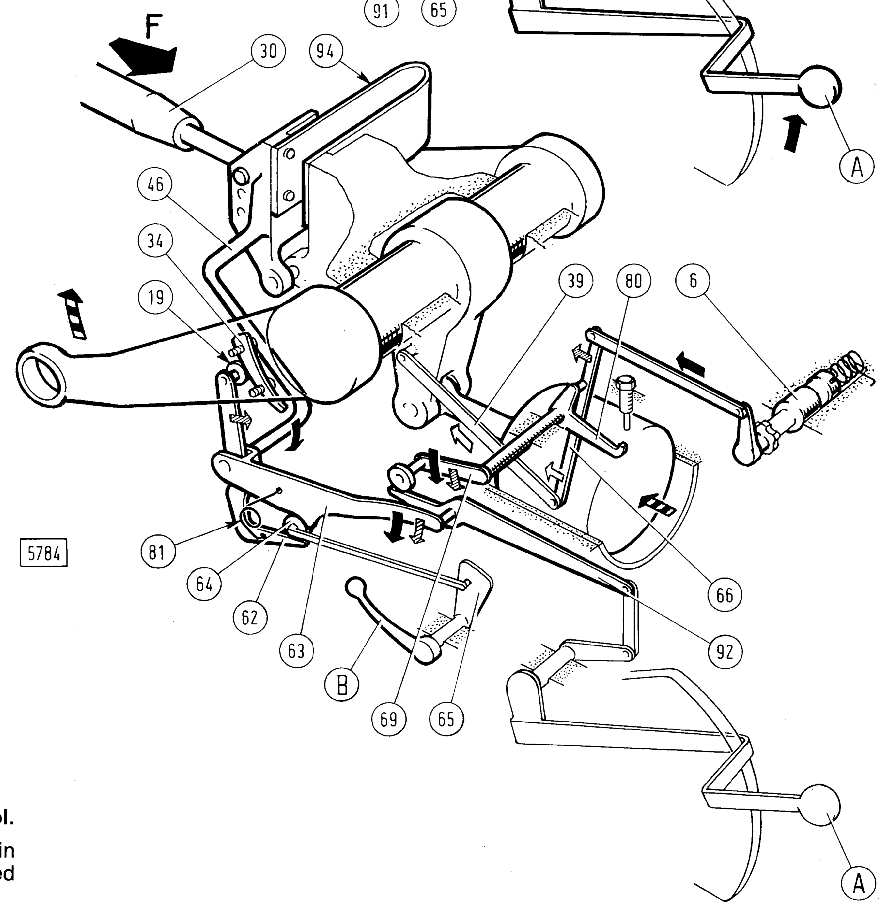
LIFT CONTROL LINKAGE SCHEMATICS



X. Implement raising in position control.

Move selector lever B fully down. The thin line section of linkage is not activated, affecting draft control only.

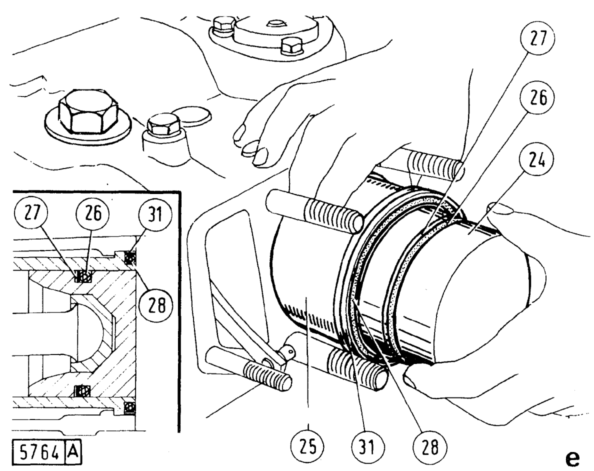


Y. Implement raising in draft control.

Move selector lever B fully up. The thin line section of linkage is not activated affecting position control only.

disassemble as follows:
Remove complete control valve, (D, page 2) undoing nuts and releasing the linkage pivot pin (15) from the spool control lever, (11), after having removed the cotter (13).
Unbolt the pressure relief valve assy (1, page 3) and the cylinder safety valve (3), remove plunge (23 and C_6) disassemble respectively the lift control valve and the dump valve. If necessary, remove oil inlet valve (5, page 3) to the cylinder by undoing the corresponding plug using wrench **291259.**;
To disassemble the spool (6, page 3) remove lever (18) and the sensing adjuster plug (8), the cover mounting the pressure relief valve and the control lever (11), having released the corresponding locking screw (49).
Removing plunger (24, fig. e) and the cylinder (25) complete with the seals is possible after having removed the complete control valve.
To remove the lifting arms it is sufficient to release the capscrews securing the retaining plates.
Detach the outer lever (46, page 2) for draught control from the sensing bar (17) bracket and then remove the latter complete with the return spring after having removed capscrews (55) to release the corresponding hinge pin and capscrews (C_2) for detaching the spring from the rear cover of the lift.
Remove the rear cover, the capscrews securing the inner arm (40, fig. d) from the lifting arm shaft (45) and then remove the latter as indicated by the arrow, extracting the inner arm complete with the sensing valve plunger.

Note — To avoid damaging the seal (44) on the left hand end of the lifting arm shaft, first shift the shaft in the opposite direction to that of removal until the seal is exposed in its seat, then remove seal using guard **290817 (A).**



e

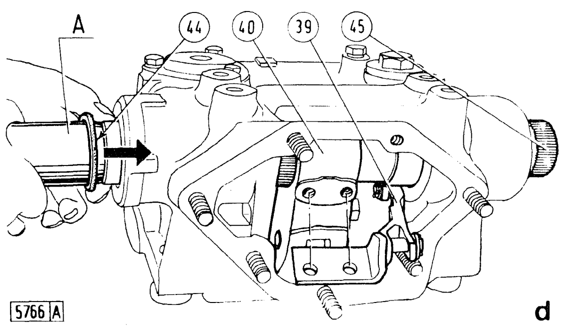
Disassembling (assembling) plunger and cylinder sleeve from lift cylinder body.

24. Plunger - 25. Cylinder sleeve - 26. Plunger seal - 27. Hold-back ring for plunger seal (plastic) - 28. Sleeve seal - 31. Hold-back ring for sleeve seal (brass).

Remove outer lever assy complete with the hand lever, removing the capscrews securing the latter to the lift.
Then remove the inner levers, first undoing capscrews (79, page 6) via the top hole in the lift after having removed the corresponding plug and then removing the roller carrier lever (69) together with the seal (67) and spacer (68) to the outside.
Remove bushes (51 and 52, page 6) from the inside of the lift unit body using suitable drifts.

INSPECTIONS

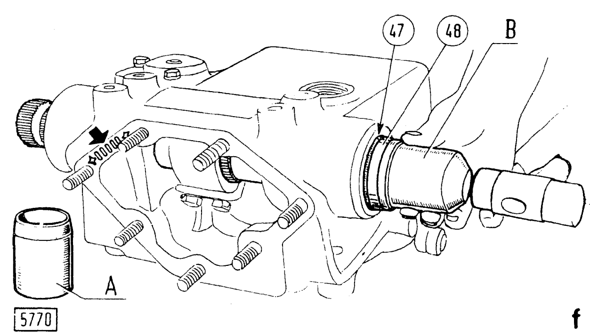
— Refer to the tabulated requirements on pages 1 and 2, Section 50.



d

Disassembling lifting arm shaft

(Arrow indicates direction for removing shaft).
A. Guard **290817** to protect seal - 39. Lever connecting inner arm - 40. Inner arm - 44. Shaft seal - 45. Lifiting shaft.



f

Fitting out lifting arm shaft with seals using guard 290817 (A) and drift 290818 (B).

47. Seal - 48. Spacer.

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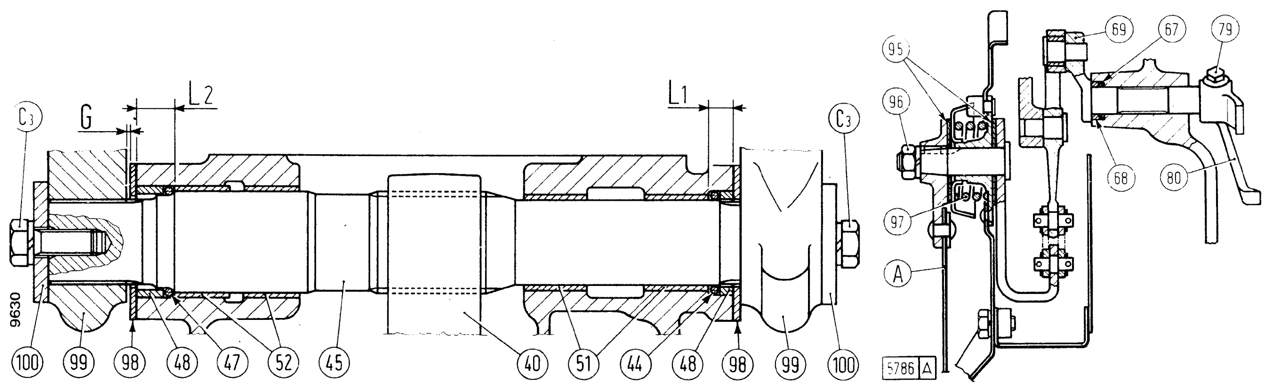
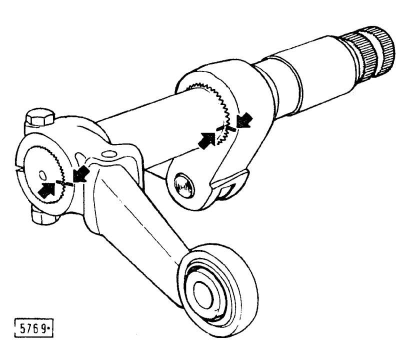
HYDRAULIC LIFT UNIT: Lift



Section through lifting cross shaft and inner and outer control levers.

A. Lift lever - C_3. Capscrew securing lift arm stop plate - G = 0.1 - 0.3 mm shaft and float - L_1 = 13.5 - 13.8 mm. Recess of LH outer shaft from lift body surface - L_2 = 20.5 - 20.7 mm recess of RH outer bush from lift body surface - 40. Inner arm - 44. LH seal - 45. Lift arm control shaft - 47. RH seal. -48. Spacer - 51. LH bushes - 52. RH bushes - 67. Seal - 68 Spacer - 69. Rocker control roller lever - 79. Capscrew securing lever (80) - 80. Lift arm limit lever - 95. Clutch disks - 96. Nut - 97. Spring - 98. Washer - 99. Lifter arms - 100. Arm stop plate.

- Carefully check the seals and use new seals, when necessary.
- Check wear of spool, noting that a replacement is only available together with new control valve body compatible from production.
- Check setting of pressure relief valves (1, page 3) and safety cylinder (3) as directed in corresponding paragraph of page 10. No separate spare parts are available for these valves which must be replaced as complete assys.
- Check discharge valve for leakage as described on page 10 noting that the replacement items (4, 22 and 56, page 10) are only available as complete assys.
- Check lift control valve plugs (2, page 3) for leakage make sure they are neither scored nor dented (also only available as a complete unit with a new control valve body).



Reference marks to assist correct installation of inner arm and lift arm on control shaft.

ASSEMBLY

Reassemble in reverse sequence to disassembly, noting the following requirements:

- When using new bushes on the cross shaft locate the bushes from the outside inwards in the lift body to obtain distances L_1 and L_2 (see fig. above).
  On completion of installation these bushes require no dressing for final seating.
- Locate inner arm and lifter arms on the shaft so that the reference marks line up (see figure below).
- Shaft seals are best installed by first applying guard **290817** (A) to prevent the inner lip from being damaged by arm splines and use drift **290818** (B, see fig. d, f page 5) to correctly seat the seals.
- On completion of assembly check that the end float the cross shaft is in the range 0.1 to 0.3 mm (G, see page fig. above). If exceeded, insert a spacer of suitable thickness between the lift valve body and the outer arm.
- Orient lever (11, page 3) for control valve spool controls so that on completed assembly the corresponding locking bolt (49) faces the piston.
- Locate the return spring (9, page 3) so that it biases the spool (6) in the lift position, i.e. so that the corresponding control lever (11) is turned towards the piston.

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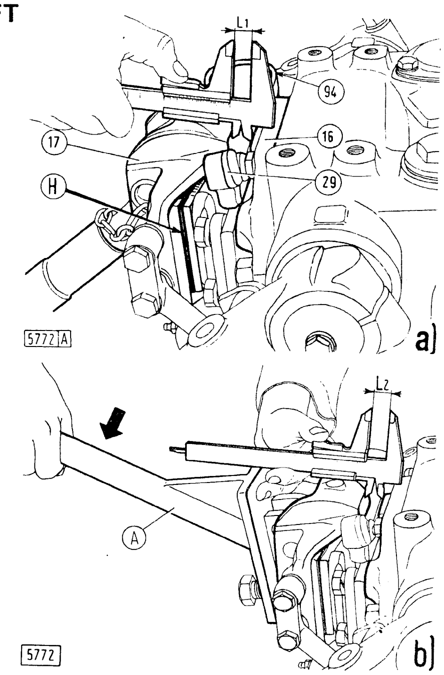
ADJUSTING LIFT

Keep to the following sequence in adjusting the lift (fitted to the tractor) otherwise difficulties will be experienced in correct lift functioning.

1. Setting return spring movement (figs. a, b).

– Disengage the stop knob (29) and with the return spring (94) free, check that the distance (L_1) between the top stop of the sensing bar bracket (17) and the rear cover (16) is between 14.8 and 15.1 mm. If necessary vary the shim (H) between the spring and the sensing bar bracket (17) to obtain the required distance.

– Fully compress the spring using special tool **290819** (A) applied to the sensing bar bracket and check that the distance (L_2) is between 22-23 mm; a major discrepancy can be due to the bottom stop surfaces of the sensing bar bracket being pitted, requiring filling by arc welding.



Setting return spring

a. Checking (L_1) of spring, released - b. Checking distance (L_2) with spring fully depressed by lever **290819** (A) - A. Lever **290819** connecting holes in sensing bar bracket for tensioning the return spring (lever down) - H. Shims for setting (L_1) - L_1. (= 14.8 - 15.1 mm) - L_2. (= 19 - 20 mm) - 16. Rear cover - 17. Sensing bar bracket - 29. Stop knob for spring travel - 94. Return spring.

2. Setting lift response (figs. e, f).

Conditions for testing:

– Apply a weight of roughly 100 kg to the lower arm disks of the sensing bar;

– Fill system with oil at a temperature of 50 - 60°C.

– Run engine at a speed of 1200 - 1500 rpm.

– Position mode selection lever (B, page 8) to the position control (lever down) position.

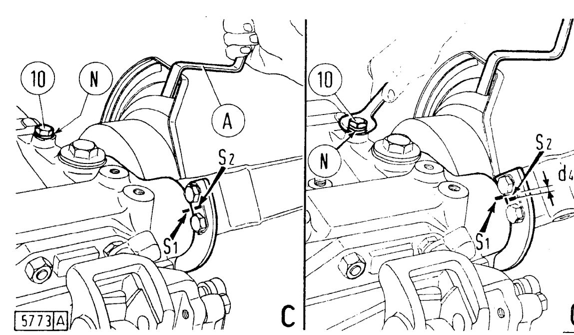
Adjust as follows:

– Shift lift lever (A, fig. c) through at least five complete lift cycles.

– Bring the lever in a single movement to half travel of the quadrant, starting from the top of the quadrant.

– Remove the sensing lever (18, fig. f) by removing the corresponding bolt.

– Tighten the setting plug (8) until the lift "gallops".



Setting minimum travel of lifting arms

C. Position of arms on intervention of pressure relief valve - d. Position of arms fully up after having adjusted d_4 = 2 - 2.5 mm, distance between reference marks S_1 and S_2 (remaining travel of arms) - S_1. Reference mark on lift body - S_2. Reference mark on cam solid with RH arm - A. Lift lever-N. Shim - 10. Bolt adjusting max. arm lift.

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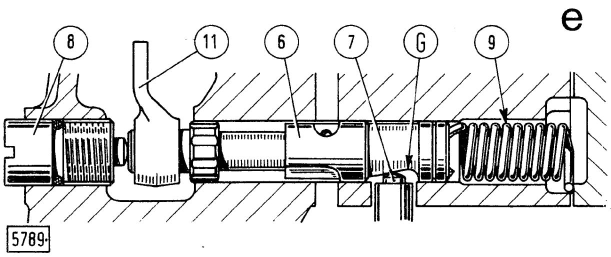
HYDRAULIC LIFT UNIT: Lift Adjustment



Section through spool

G. Cam - 6. Spool - 7. Dump valve actuating pad - 8. Sensitivity adjusting plug (not including outer lever) - 9. Spool return valve (two-way valve) - 11. Inner spool control lever.

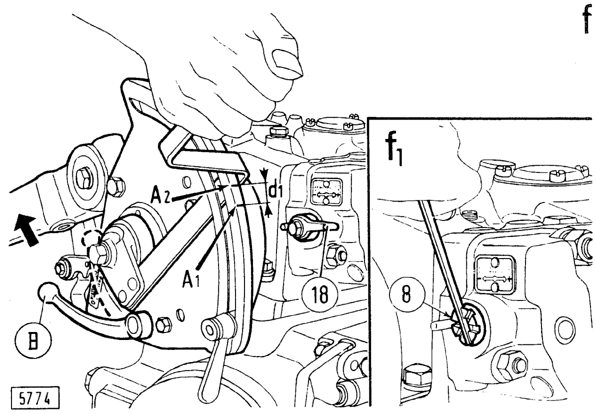
Note - "Galloping" means abnormal functioning of the lift with intermittent intervention of the lift arms in intervals of less than two minutes.

- Back-off adjusting plug (8) until the lift ceases "galloping".
- Back-off adjusting plug (8) a final **half-turn.**
- Refit lever (18) in horizontal position and secure with corresponding cap screw.

3. Adjusting maximum lift arm travel (figs. c. d).

Carry out this adjustment under the same test conditions as for paragraph 2 proceeding as follows:

- bring the lift control lever (A) into the top position on the segment with a single movement;
- gradually release the adjusting bolt (10) for adjusting maximum lift arm travel until the pressure relief valve is actuated (end of mechanical stroke);
- in this position make two reference marks corresponding to S_1 on the piston body and S_2 on the cam fixed to the RH arm;
- gradually tighten the adjusting bolt (10) until, with the arms lowering, the distance (d_4) between the two reference marks made previously is 2 - 2.5 mm;
- if this distance is exceeded increase the number of washers (N), if less reduce the number.



Checking spool sensitivity.

f_1. Detail showing setting of sensitivity - A_1. Starting reference position for control lever - A_2. Reference position of control lever for start of arm lift - B. Mode selection lever positioned for "position control (down)" - d_1. (= 7 - 10 mm) distance between reference marks measured on the periphery of the quadrant - 8. Sensitivity adjustment plug - 18. Lever on sensitivity adjustment plug.

Note - The mode selection lever (B) must be in the fully down position throughout full adjustment.

---

4. Adjusting start of lift with position control (figs. g, h, i, page 9)

The distance (d_3) separating the roller (19) from the cam (34) determines the zone for 'position control" (U, fig. g) on the control lever quadrant.

To make the adjustment proceed as follows:

- apply a load of at least 100 kg to the lift arms;
- start the engine and run it at medium speed;
- position the lift control lever (A, fig. c, page 7) fully up and bring the mode selection lever (B) into the "position control" position i.e. up;

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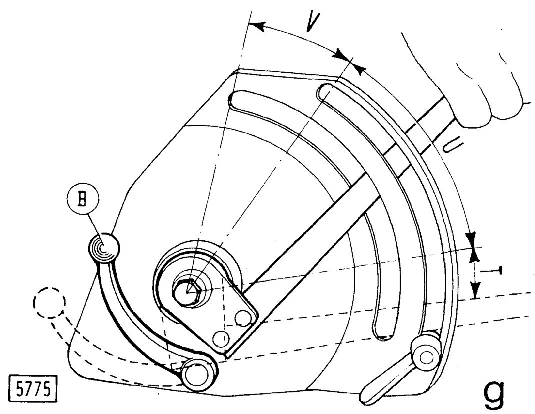
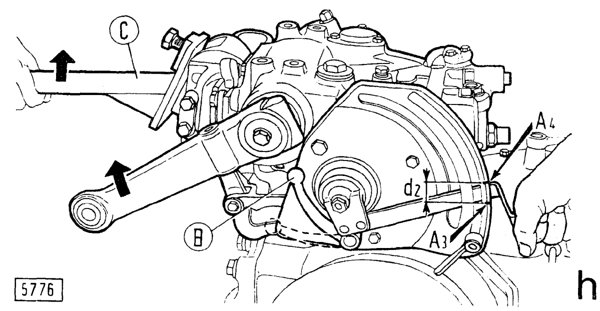


Zone for "position control" on control lever quadrant

B. Mode selection lever positioned for "position control" (up) T. Neutral zone: Corresponding arc measured on the periphery of the quadrant must not exceed 5 mm - U. "Position control" zone - V. Lift zone.

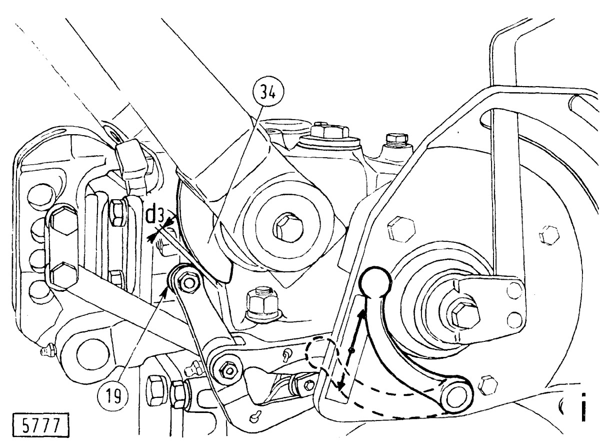


Checking effective range of "draught control".

A_3. Reference mark for position of lift control lever down fully - A_4. Reference mark for control lever for commencement of arm lift - B. Mode selection lever in "draught control" position (up) - C. **290819** lever connected to holes of sensing bar bracket for compressing return spring (pushing lever up) - d_2. ($\leqslant$ 5 mm) - Distance between reference marks A_3 and A_4 measured on the periphery of the quadrant.

- position the lift control lever down fully and make a mark (A_3, fig. h) on the periphery of the quadrant corresponding to the top profile of the lever;
- fit special tool **290819** (C) to the sensing bar and keep fully lifted to zero play (L_1, fig. a, page 7); in this condition the arms must not lift, otherwise reduce the distance (d_3, fig. i) between the roller (19) and the cam (34) by means of the corresponding eccentric pin;
- with the return spring fully compressed, gradually shift the lever (A, fig. c, page 7) up, stopping the movement as soon as the arms start lifting;
- mark the new position (A_4, fig. h) of the lever on the quadrant and check that the distance (d_2) between the reference marks (A_3 and A_4) is less than 5 mm; if more than 5 mm, increase the distance (d_3) between roller (19) and cam (34, fig. i);
- push the tool (C) down for full stroke of the return spring and check that the arms lift fully, bringing lever (A, fig. c, page 7) up fully on the quadrant. If otherwise, reduce distance (d_2) between (A_3) and (A_4) as already described.

On completion of adjustment, torque the eccentric pin of the roller (19) as specified.



Adjusting effective range of draught control.

d_3. Distance between roller and cam with arms lifted (1.5 mm) - 19. Roller with eccentric pin for adjusting distance between the roller itself and cam (34) - Cam solid with RH lift arm.

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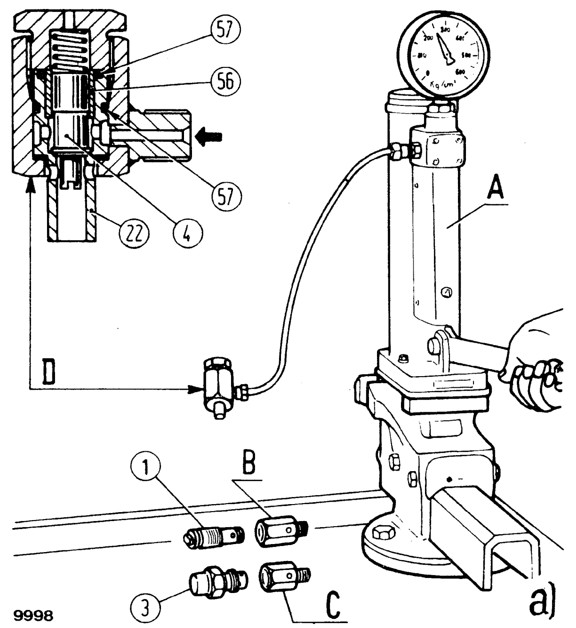
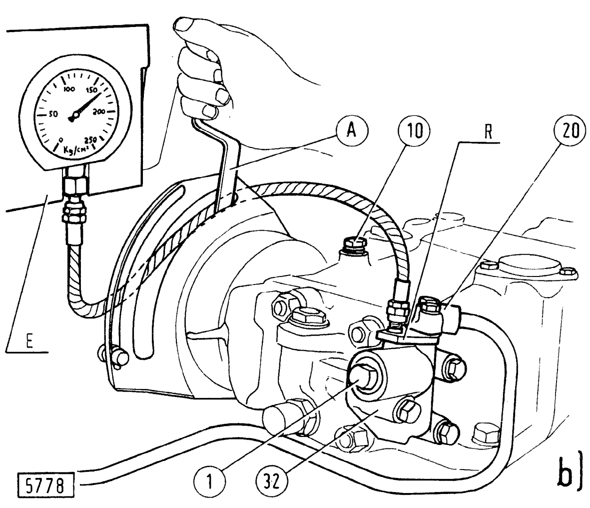
HYDRAULIC LIFT UNIT: Lift Adjustment



Test equipment for pressure relief valve (1), cylinder safety valve (3) and dump valve (4) leakage.

A. Hand pump **290284** - B. Relief valve fitting **290824** - C. Cylinder safety valve fitting **290826** - D. Discharge valve fitting **290834/1** - 22. Discharge valve seat - 56. Valve sleeve - 57. O-rings.



Checking maximum operating pressure of lift control hydraulics (adjusting pressure relief valves setting).

A. Lift control lever into full up position on quadrant - E. Universal kit **293300** (291314) for checking hydraulic system pressure - R. Fitting **291326** for universal kit - 1. Pressure relief valve - 10. Maximum arm lift adjusting bolt - 20. Oil delivery line from pump to control valve - 32. Cover mounting valve.

VALVE CHECK

Relief and cylinder safety valve setting check (figs. a, b).

Checking the setting of the pressure relief valve (1, page 3) and the cylinder safety valve (3) can be done by means of the hand pump **290284** (A, fig. a) fitted out with the corresponding valve fittings **290824** (B) and **290826** (C). Relief valve should crack off at approx. 147 bar (150 kg/cm^2) while safety valve crack-off pressure should be 196 - 206 bar (200 - 210 kg/cm^2).

It should be noted, however, that these values only apply when the valves are replaced as complete units since the component items are not available as single replacements. The setting of the pressure-relief valves can also be checked with the lift unit fitted on the tractor by proceeding as follows:
- connect delivery fitting (20) and the cover mounting the valve (32) with adapter **291326** (R, fig. b) and connect pressure gauge with a scale of 0 - 250 kg/cm^2 to fitting **293300** (E);
- run engine until the hydraulic fluid has obtained a temperature of approx. 50°C;
- position the lift control lever (A) up fully on the quadrant and gradually loosen the adjusting bolt (10) for maximum arm travel until the pressure relief valve (1) cracks-off;
- with the engine running at a speed of 1800 rpm the pressure should be of 142 - 152 bar (145 - 155 kg/cm^2).

Checking discharge valve leakage

To check discharge valve leakage proceed as follows:
- fit the valve complete with O-rings to adapter fitting **290834/1** (D, fig. a) for connecting hand pump **290284** (A);
- actuate the pump until the pressure gauge indicates a pressure of 245 - 294 bar (250 - 300 kg/cm^2);
- then clock the time required for the pressure to drop from 196 to 98 bar (from 200 to 100 kg/cm^2) which must be more than six seconds. If less, use new O-rings (57) and recheck valve leakage. Should the trouble persist, it will be necessary to replace the complete valve.

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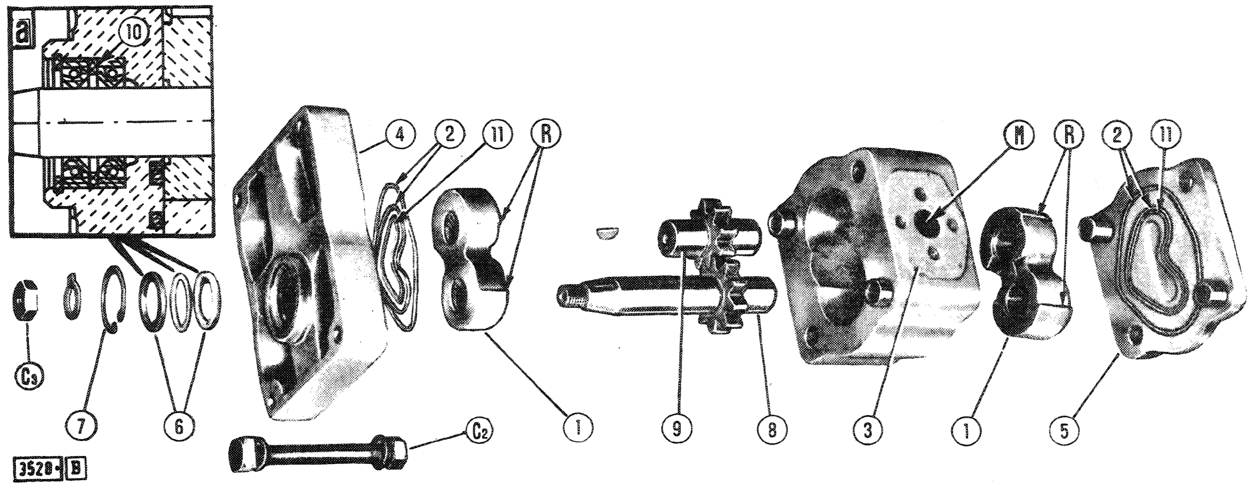


Lift pump components.

a. Seal assembly detail - C_2. Cover capscrews - C_3. Drive shaft sleeve nut - M. Pump delivery port - R. Gear bearing fillets (delivery side) - 1. Gear bearings - 2. Cover seals - 3. Pump body - 4. Rear cover - 5. Front cover - 6. Drive shaft seals - 7. Seal retaining ring - 8. Drive gear shaft - 9. Driven gear shaft - 10. Spacer - 11. Anti-extrusion rings.

HYDRAULIC PUMP

Pump is driven by the valve gear through a dog clutch.

To gain access to drive gear, remove valve gear cover.

Oil circulating in pump automatically lubricates and restores gear end float.

Overhaul.

Refer to figure above when disassembling pump.

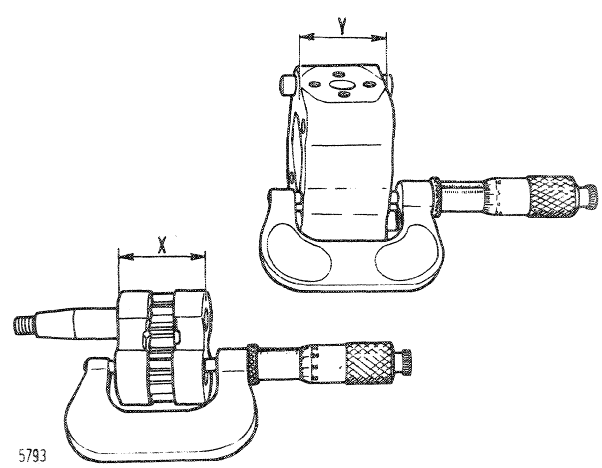
Mark the position of internal parts in order to replace them in their original position on assembly.

Check gear shaft and bearings for wear, comparing the readings to the data given in the table on page 3, Section 50.

Check gear side face flatness and squareness relative to bearings, smearing the surfaces in question with carbon black.
Small defects may be rectified using wet zero-grade emery cloth.

- Check gear end clearance in the pump body with bearings in position. The correct end float is 0.1 to 0.2 mm. Any pump body face dressing, with a view to restoring the specified end clearance, should be carried out using wet zero-grade emery cloth, removing as little material as possible.

Liberally lubricate all pump parts using the same grade of hydraulic lift oil, then assemble noting the following points:
- ensure that reference marks applied on disassembly are in register;
- position plastic anti-extrusion ring (11) inside center O-ring (2);



Checking gear end clearance in pump body.

Note - Dimension **X** to be smaller than dimension **Y** by 0.1 mm to 0.2 mm

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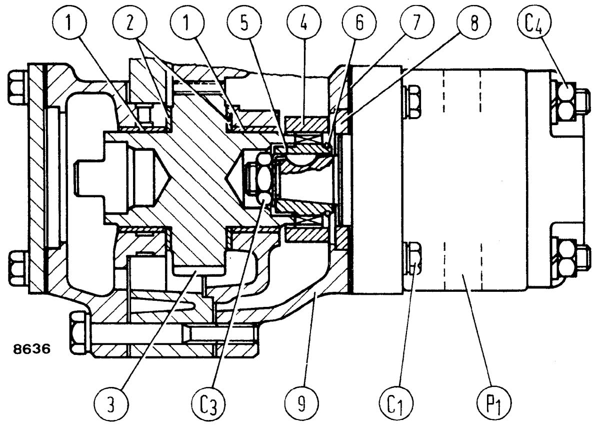
HYDRAULIC LIFT UNIT:
Lift Pump



Section through steering pump drive

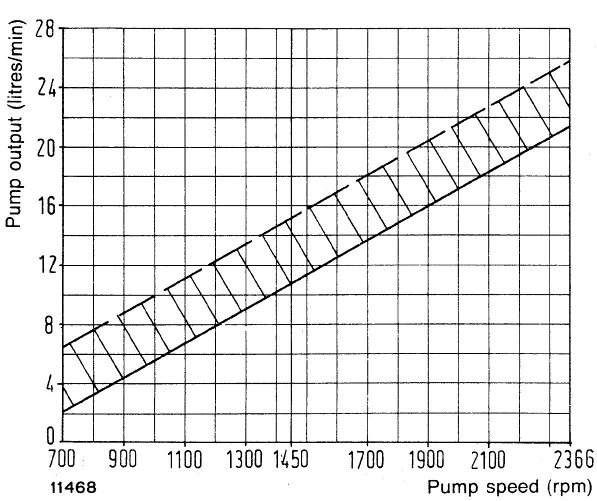
C_1. Pump capscrews - C_3. Sleeve nut - C_4. Cover nut - P_1. Hydraulic pump - 1. Gear bushings - 2. Shims - 3. Pump drive gear - 4. Drive collar - 5. Drive sleeve - 6. Retaining ring - 7. Gasket - 8. Centralizer - 9. Pump support.

— the bearings, which should slide into position by hand, must be introduced so that fillets (R, page 1) face toward outlet port (M) and with slotted frontal surfaces abutting the gears;

— fit rotary shaft seals (6, page 1) to rear cover (4) with attached spacer (10) as shown in detail (a, page 1) and pack the lip cavity with **grasso-fiat TUTELA G9** or other approved grease;

— progressively tighten the cover nuts and bolts to the pump body adopting the specified tightening torques;

When installing pump to tractor, fill both suction pipe and the pump body with **oliofiat AF87** or other approved oil to facilitate priming and prevent seizure during initial service.



Speed-output chart of lift pump A31X or A31XP.

Test pressure 132 bar or 135 kg/cm^2 - Oil temperature 55° to 65°C - Pump drive ratio 0.910 to 1.

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Ouput test

Couple the pump to the drive motor and connect to output test machine using the equipment shown in the figure below.

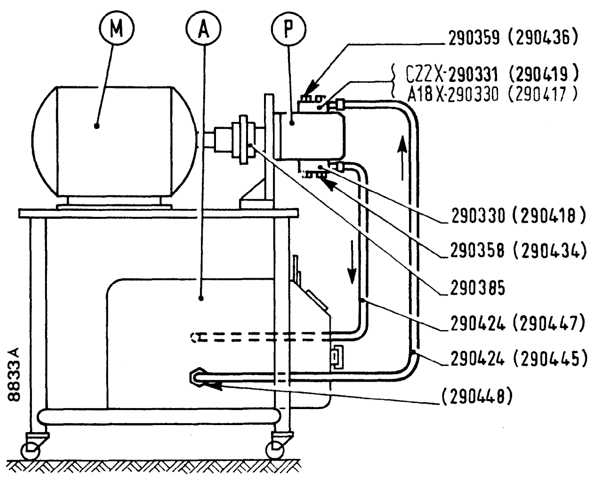
Use **olio Fiat idraulico AP51** (SAE 20) hydraulic fluid supplied with the test machine and carry out the output test at the specified temperature and pressure settings.

Compare the output figures obtained with the values of the chart noting the following:

– output ratings of new or reconditioned pumps should be fairly close to the dotted line;

– output rating of used pumps are acceptable if included in the shaded area of the chart.

If the pump rating is very near to, or lower than, the continuous line, the pump in question should be overhauled or replaced.



Lift pump output test machine

Note – Bracketed items refer to tester **291231**.

A. Small output tester **292574** (or large tester **291231**) - M. Motor **291235** - P. Pump under test.

OIL FILTER

The lift hydraulics control circuit filter is located in the suction pipe of the pump.

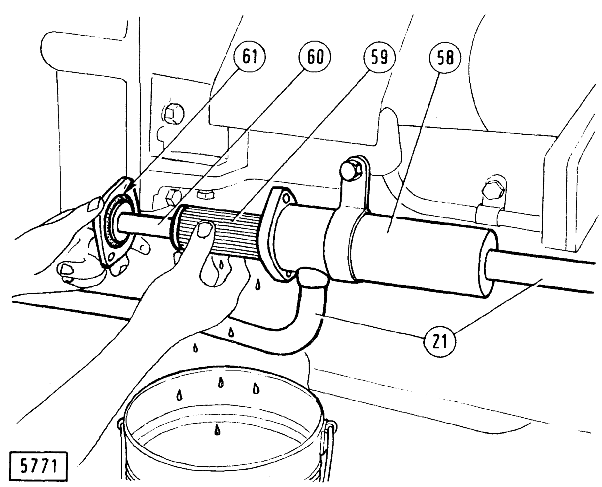
This is a gauze cartridge filter incorporating a magnetic metal particle plug.

Disassemble filter for cleaning every 200 hours of operation.

To do so, simply unbolt the cover of the container and remove the magnetic plug (60) which is solid with the cover itself, prior to removing the filter cartridge (59), collecting the oil emerging from the top suction pipe, using a suitable vessel.

Carefully clean items in kerosine and clean the inside of the filter shell.

Make sure the cover seal (61) is in good condition and then refit the items after drying.



Checking and proper handling of lift oil filter

21. Pump suction pipe - 58. Filter shell - 59. Filter cartridge - 60. Magnetic plug - 61. Filter cover seal.

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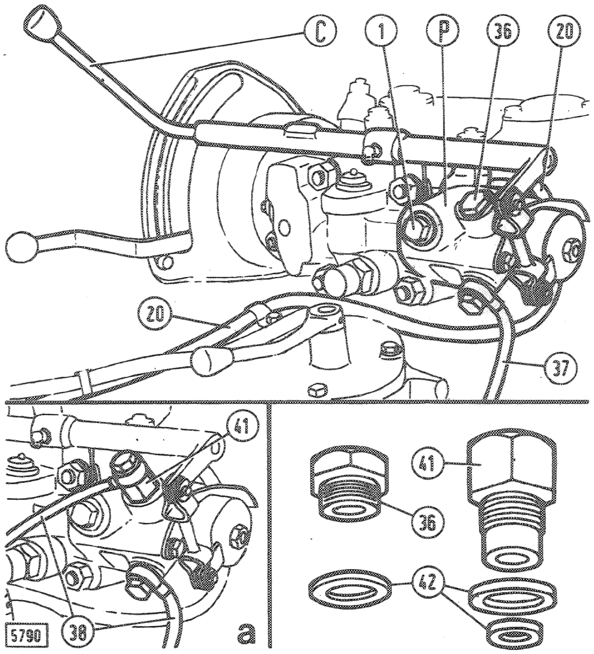
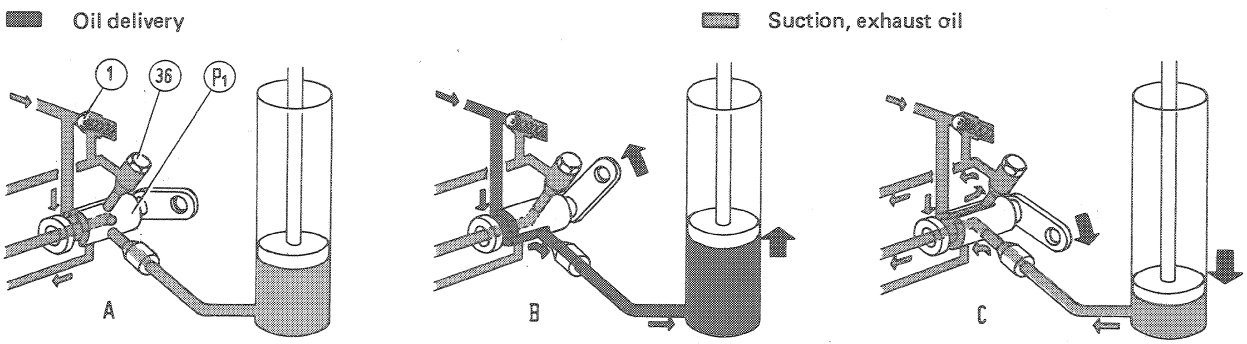


REMOTE CONTROL VALVE (P) ON HYDRAULIC LIFT UNIT FOR SINGLE AND DOUBLE-ACTING CYLINDER CONTROL (a)

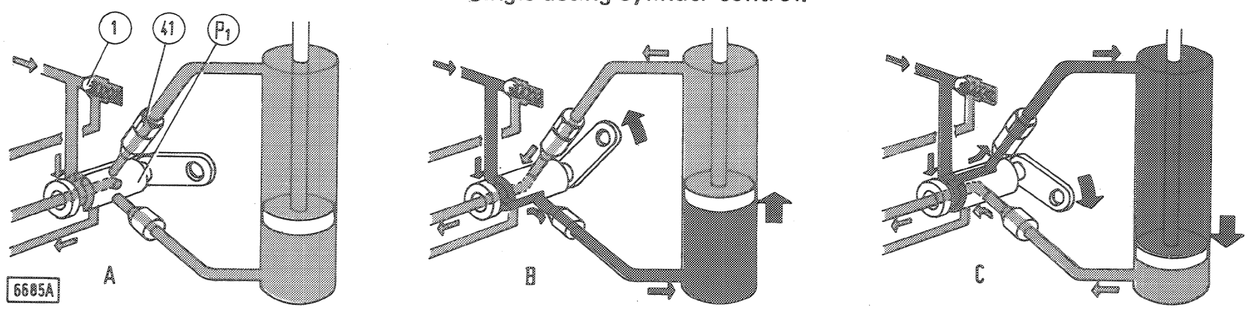
C. Control lever for spool (P) - 1. Pressure relief valve - 20. Oil delivery line from pump - 36. Plug for double-acting cylinder control line port - 37. Single-acting cylinder control line - 38. Double-acting cylinder control lines - 41. Fitting - 42. Seals.

Notes — The remote control valve is involved in changing cover (32, see page 3, Section 501) taking care to remove the valve (1) from the cover itself for refitting on the remote control valve.

— The remote control valve uses the same hydraulic fluid as the hydraulic lift unit, but is operated independently by means of the hand lever (C). It is not possible, however, to operate the remote control valve and the hydraulic lift unit simultaneously.



Single-acting cylinder control.



Double-acting cylinder control.

HYDRAULIC CIRCUIT ARRANGEMENT OF REMOTE CONTROL VALVE FOR SINGLE AND DOUBLE-ACTING CYLINDER CONTROL

A. Stop - B. Lift - C. Lower - P_1. Remote control valve spool - 1. Pressure relief valve - 36. Plug for double-acting cylinder control line port - 41. Adapter for double-acting cylinder control.

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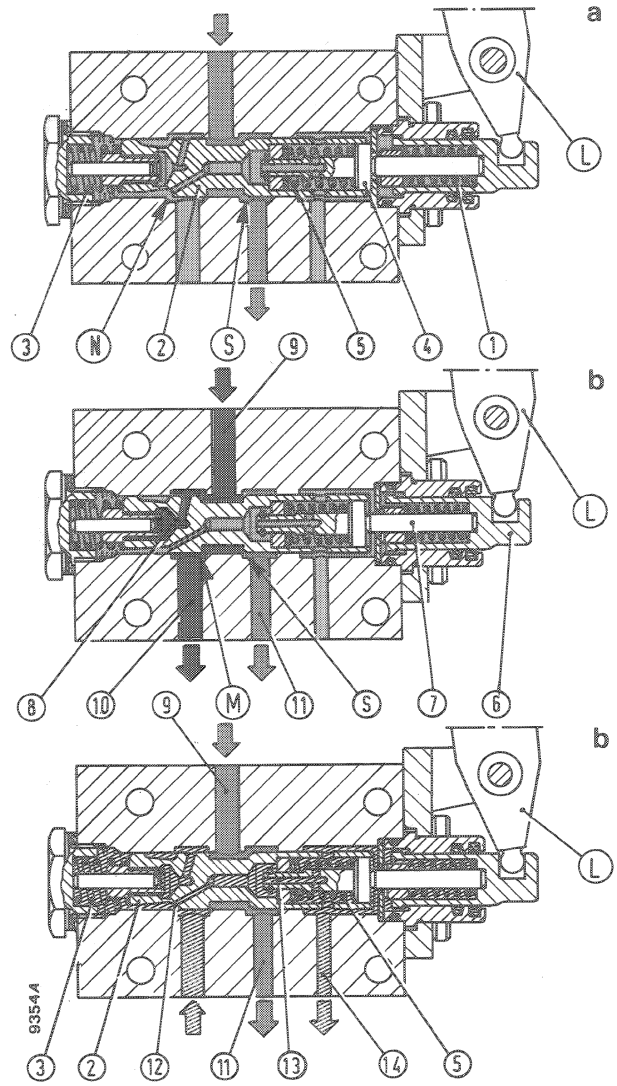


Trailer brake control valve circuit diagram.

L. Control valve hand lever - M. Delivery port to brake circuit - N. Exhaust port from brake circuit - S. Delivery port to remote control valve circuit and hydraulic lift - 1. Return spring for lever (L) - 2. Control valve rod - 3. Rod return spring - 4 and 5. Brake control pin and spring - 6 and 7. Sleeve and actuator for control of rod (2) - 8. Pressure chamber - 9. Delivery duct from lift pump - 11. Delivery duct to remote control valve and lift - 12, 13 and 14. Exhaust ducts.

Brake pressure oil.

Oil delivery (low pressure).

Brake circuit exhaust oil.

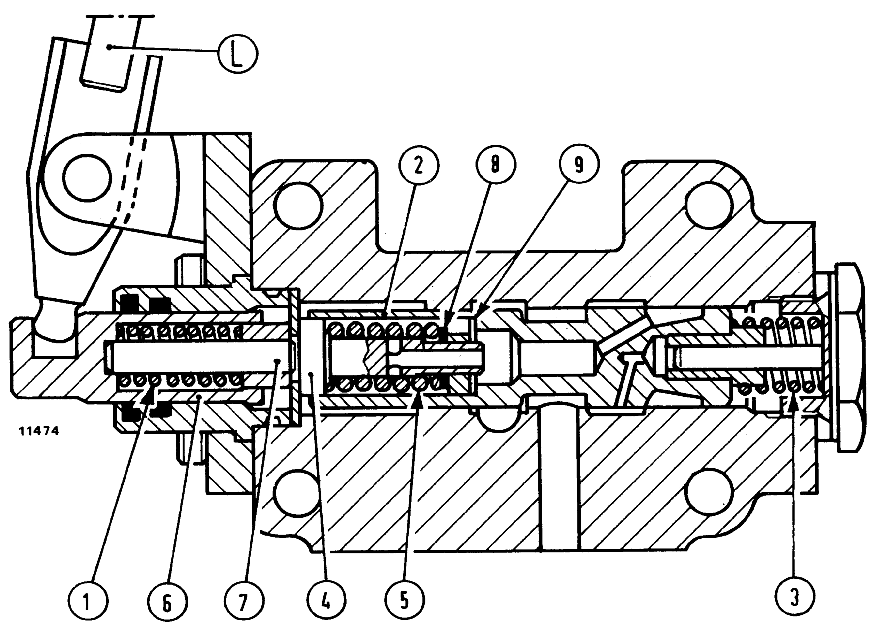
Trapped or exhaust oil.

FUNCTION

a. **Neutral** — The rod of the control valve (2) is kept in the neutral position by spring (3).
Oil supplied by the pump circulates as shown by the arrows and flows to the remote control valve and then to the lift.

b. **Braking** — Actuating the hand lever (L) shifts the rod (2) to the left via sleeve (6) and actuator (7). This closes off the exhaust port (N) for the oil from the trailer brake circuit, opening the port (M) communicating pump delivery to the brake cylinder and restricting port (S) communicating with the lift oil drilling (11) resulting in an increasing pressure in the trailer brake circuit and thus producing brake application.

This increasing pressure is also felt by the chamber (8) forcing the rod (2) to the right against the action of the spring (5).
The rod (2) shifting to the right compresses the spring (5) and closes off the port (M) for oil delivery from the pump to the trailer brake circuit, isolating it from all variations in pressure which could result in the lift circuit.
At the same time all oil delivered by the pump is used to actuate the remote control valve or the hydraulic lift via duct (11).
As soon as the hand lever (L) is released, the rod (2) forces the return spring (3) in the neutral position and the pressure flow of the trailer brake circuit is exhausted via the ducts (12, 13 and 14).



Longitudinal section through trailer brake control valve.

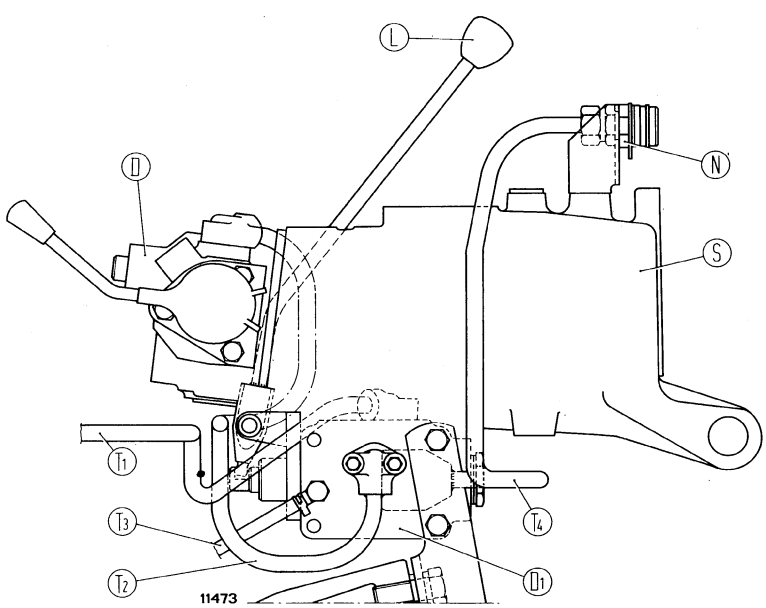
L. Trailer brake control valve lever - 1. Return spring for lever (L) - 2. Rod - 3. Rod return spring - 4 and 5. Brake setting pin and spring - 6 and 7. Control sleeve and plunge of rod (2) - 8. Shims for spring (5) - 9. Circlip.

CHECKING OPERATING PRESSURE

Proceed as follows:

- connect 0 - 245 bar (250 kg/cm^2) pressure gauge of universal kit **293300** to the male coupling (N) of the hydraulic trailer brake;
- start engine and run at medium speed, shifting hand lever (L) fully forward and check that the pressure indicated by the pressure gauge is 142 ± 4.9 bar (145 ± 5 kg/cm^2).

If not, increase or reduce the number of shims (8) accordingly depending on whether the pressure is too low or too high.



Arrangement of trailer brake control valve on tractor.

D. Hydraulic lift control valve - D_1. Trailer brake control valve - L. Control valve hand lever - N. Male coupling for hydraulic trailer brake - S. Hydraulic lift - T_1. Delivery line connecting hydraulic pump to trailer brake control valve (D_1) - T_2. Delivery line connecting control valve (D_1) to control valve (D) - T_3. Flexible hose breather line connecting lift body - T_4. Delivery line to trailer brake cylinder.

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CHARGING SYSTEM

Alternator		
Type (three-phase, self-rectifying)		BOSCH G1-14V-33A27 MARELLI AA108-14V-33A-1 ISKRA AGG-1104-14V-33A LUCAS 18ACR-14V-40A
Rated voltage	V	14
Rotation (seen from pulley side)		Clockwise
Cut-in speed at 12 V and 25°C	rpm	1050 to 1150
Output at 14 V across battery after warm-up (°):		
— at 5000 rpm (BOSCH)	Amps	34
— at 7000 rpm (MARELLI or ISKRA)	Amps	33
— at 6000 rpm (LUCAS)	Amps	45
Rotor winding resistance between both collector rings (20°C) — BOSCH or ISKRA	Ohm	3.4 to 3.74
— MARELLI	Ohm	3.4 to 3.8
— LUCAS	Ohm	3.04 to 3.36
On-machine alternator speed (at engine governed speed)	rpm	5180
Drive ratio		1 to 1.992
Torque requirement for nut securing alternator pulley	Nm	41 (4.2 kgm)
Voltage Regulator		
Type integral transistor		BOSCH-EE 14 V 3 MARELLI-RTT 110 AT ISKRA-AER 1402 LUCAS-37657
Alternator-test speed	rpm	4000
Voltage setting — BOSCH or ISKRA	V	13.7 to 14.5
— MARELLI	V	13.6 to 14
— LUCAS	V	14.2 to 14.5

(°) Applicable to fully bedded-in brushes

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MARELLI STARTER

Type		MARELLI MT 71 AA
Voltage rating	V	12
Rated output	kW	2.5
Rotation (seen from pinion end)		Clockwise
Starter drive ratio		9/110
No. of poles		4
Field winding		Series
Control		Freewheel
Operation		Through solenoid
Bench Test Data		
Running torque at 20°C:		
– current	Amp	⩽ 500
– torque	Nm	16.6 (12.3 ft. lb., 1.7 kgm)
– speed	rpm	1300
– voltage	V	8.3
Lock torque at 20°C:		
– current	Amp	⩽ 950
– voltage	V	4.8
– torque	Nm	⩾ 36 (26.7 ft. lb., 3.7 kgm)
– overall internal resistance	Ohm	0.005 ± 0.0005
Light running torque at 20°C:		
– current	Amp	⩽ 60
– voltage	V	11.6
– speed	rpm	8.500
Mechanical Data		
Brush spring load (not worn)	N	12.2 to 15.2 N (1.25 to 1.55 kg, 2.75 to 3.4 lb)
Mica undercut depth	mm	1 (0.040 in)
Clutch slip torque (pinion rotating torque)	kgcm	6 to 8 (0.4 to 0.6 lb ft)
Commutator dia.	mm	44.840 to 45.000 (1.7653 to 1.7716 in)
– maximum wear limit	mm	43.5 (1.7126 in)
– maximum ovality	mm	0.08 (0.0031 in)
– armature end float	mm	0.1 to 0.4 (0.004 to 0.016 in)
Solenoid		
Winding resistance at 20°C	Ohm	0.22 ± 0.02
Current consumption at 12 V	Amp	54
Activation voltage	V	⩽ 5.5
Moving contact travel	mm	3 (0.118 in)
Plunger stroke	mm	13.8 to 14.9 (0.5433 to 0.5866 in)
End of stroke plunger load at 12 V	N	⩽ 392 (40 kg. 88 lb)
Fitting Data		
Pole shoe I.D.	mm	75.830 to 76.000 (2.9854 to 2.9921 in)
Armature O.D.	mm	74.900 to 74.950 (2.9488 to 2.9508 in)
Drive end bushing I.D.	mm	12.475 to 12.502 (0.4911 to 0.4922 in)
Pinion journal dia.	mm	12.425 to 12.440 (0.4892 to 0.4900 in)
Pinion clearance in bushing	mm	0.035 to 0.077 (0.0014 to 0.0030 in)
Intermediate bushing I.D.	mm	20.200 to 20.264 (0.7953 to 0.7978 in)
Shaft journal dia.	mm	19.967 to 20.000 (0.7861 to 0.7874 in)

(continued)

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MARELLI STARTER

Shaft clearance in bushing	mm	0.200 to 0.297 (0.0080 to 0.0117 in)
Commutator end bushing I.D.	mm	14.000 to 14.270 (0.5512 to 0.5618 in)
Shaft journal dia..	mm	13.975 to 13.984 (0.5495 to 0.5505 in)
Shaft clearance in bushing	mm	0.016 to 0.313 (0.0006 to 0.0123 in)
Lubrication Data		
Starter drive helical groove (during overhaul)		grassofiat TUTELA MR 3
Commutator end thrust washer		

BOSCH STARTER

Type		BOSCH JF 12V 0.001.362.039
Voltage rating	V	12
Rated output	kW	1.8
Rotation (seen from pinion end)		Clockwise
Starter drive ratio		9/110
No. of poles		4
Field winding		Series
Control		Sliding
Operation		Solenoid
Bench Test Data		
Running torque at 20°C:		
– current	Amp	735 to 765
– torque	Nm	24.5 (2.5 kgm, 18.1 ft. lb)
– speed	rpm	950 to 1250
– voltage	V	9
Lock torque at 20°C:		
– current	Amp	700 to 880
– voltage	V	4.5
– torque	Nm	0
– overall internal resistance	Ohm	0.00573
Light running torque at 20°C:		
– current	Amp	65 to 95
– voltage	V	11.5
– speed	rpm	6500 to 8500
Mechanical Data		
Brush spring load (not worn)	N	11.3 to 12.7 (1.15 to 1.3 kg. 2.5 to 2.9 lb)
Armature end play	mm	0.1 to 0.3 (0.004 to 0.012 in)
Mica undercut depth	mm	0.5 to 0.8 (0.020 to 0.032 in)
Commutator diameter	mm	42 (1.65 in)
– wear limit	mm	39.5 (1.55 in)
– maximum ovality of lamination pack	mm	0.05 (0.0020 in)
– maximum ovality of commutator	mm	0.03 (0.0012 in)

(cont.)

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ELECTRICAL SYSTEM: Specification and Data

BOSCH STARTER

Solenoid		
Resistance at 20°C — holding coil	Ohm	1.05
Resistance at 20°C — actuating coil	Ohm	0.25
Current consumption at 12V	Amp	60
Activation voltage (minimal)	V	7.5
Plunger stroke	mm	12 to 14 (0.472 to 0.551 in)
Fitting Data		
Pole shoe I.D.	mm	75.85 to 75.98 (2.986 to 2.991 in)
Armature O.D.	mm	73 (2.874 in)
Armature bushing fitted I.D:		
— pinion	mm	12.475 to 12.502 (0.491 to 0.492 in)
— intermediate	mm	19.020 to 19.072 (0.749 to 0.751 in)
— commutator	mm	12.475 to 12.502 (0.491 to 0.492 in)
Armature shaft journal dia.:		
— pinion	mm	12.425 to 12.440 (0.489 to 0.490 in)
— intermediate	mm	18.927 to 18.960 (0.745 to 0.746 in)
— commutator	mm	12.425 to 12.440 (0.489 to 0.490 in)
Armature shaft clearance in bushing:		
— pinion	mm	0.035 to 0.077 (0.0014 to 0.0030 in)
— intermediate	mm	0.060 to 0.145 (0.0023 to 0.0057 in)
— commutator	mm	0.035 to 0.077 (0.0014 to 0.0030 in)
Pinion bushing fitted I.D.	mm	14.245 to 14.272 (0.561 to 0.562 in)
Armature shaft journal dia. over pinion bushing	mm	14.123 to 14.150 (0.556 to 0.557 in)
Armature shaft clearance in pinion bushing	mm	0.095 to 0.149 (0.0037 to 0.0059 in)
Lubrication Data (during overhaul)		
Starter drive helical groove		**grassofiat TUTELA MR 3**

LUCAS STARTER

Type		LUCAS M45 G
Voltage rating	V	12
Rated output	kW	2.5
Rotation (seen from pinion end)		Clockwise
Starter drive ratio		9/110
No. of poles		4
Field winding		Compound
Control		Sprag clutch
Operation		Pre-engagement
Bench Test Data		
Running torque at 20°C:		
— current	Amp	$\leqslant$ 600
— torque	Nm	22.5 (2.3 kgm, 16.6 ft. lb.)
— speed	rpm	$\geqslant$ 1000
— voltage	V	8.9

(cont.)

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LUCAS STARTER

Light running torque at 20°C:		
— current	Amp	⩽ 100
— voltage	V	12
— speed	rpm	5000 to 7000
Overall internal resistance at 20°C	Ohm	0.0078
Mechanical Data		
Brush spring load (not worn)	N	14.7 to 19.6 (1.5 to 2 kg, 3.3 to 4.4 lb)
Armature end play	mm	0.025 to 1.420 (0.0009 to 0.0559 in)
Commutator dia.	mm	41.150 to 41.400 (1.620 to 1.629 in)
— wear limit	mm	38.89 (1.53 in)
— maximum ovality	mm	0.076 (0.003 in)
Solenoid		
Resistance at 20°C — holding coil	Ohm	0.46 to 0.56
Resistance at 20°C — actuating coil	Ohm	0.145 to 0.165
Current consumption at 12 V — holding coil	Ohm	21.5 to 26.1
Current consumption at 12 V — actuating coil	Ohm	73 to 83
Activation voltage	V	8
Plunger stroke	mm	0.585 (0.023 in)
Fitting Data		
Pole shoe I.D.	mm	75.38 to 75.74 (2.967 to 2.982 in)
Armature O.D.	mm	74.40 to 74.47 (2.929 to 2.932 in)
Armature bushing fitted I.D.		
— pinion	mm	14.287 to 14.313 (0.562 to 0.563 in)
— intermediate	mm	28.500 to 28.530 (1.122 to 1.123 in)
— commutator	mm	12.700 to 12.725 (0.499 to 0.501 in)
Armature shaft journal dia.		
— pinion	mm	14.20 to 14.22 (0.559 to 0.560 in)
— intermediate	mm	28.356 to 28.433 (1.116 to 1.119 in)
— commutator	mm	12.65 to 12.67 (0.498 to 0.499 in)
Armature shaft clearance in bushing		
— pinion	mm	0.067 to 0.113 (0.0026 to 0.0044 in)
— intermediate	mm	0.067 to 0.174 (0.0026 to 0.0068 in)
— commutator	mm	0.03 to 0.075 (0.0012 to 0.0029 in)
Pinion bushing fitted I.D.	mm	14.26 to 14.29 (0.561 to 0.562 in)
Armature shaft journal dia. over pinion bushing	mm	14.20 to 14.22 (0.559 to 0.560 in)
Armature shaft clearance in pinion bushing	mm	0.04 to 0.09 (0.0015 to 0.0035 in)
Lubrication Data (during overhaul)		
Starter drive helical groove		grassofiat TUTELA MR 3

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ELECTRICAL SYSTEM: Specification and Data

BATTERY

Type	Voltage	Nominal capacity (20 h discharge rate)	Current rating (for discharge $18^\circ \times 3'$)	Max. dimensions (length x width x height)	Weight (net)
MARELLI 5080286	V 12	Ah 88	A 395	mm 381 x 175 x 190	–
SCAINI 59270	V 12	Ah 92	A 385	mm 329 x 175 x 224	–
MARELLI 6ATM25Z–A	V 12	Ah 110	A 490	mm 508 x 174 x 205	kg 36
SCAINI 62072	V 12	Ah 120	A 500	mm 508 x 174 x 205	–

FUSES

Six 8 Amp and two 16 Amp fuses, housed in box.

Fuses	PROTECTED CIRCUITS	Amp
1	Thermostarter (optional).	16
2	Hazard warning indicator and flasher, power point.	16
3	High beam and indicator.	8
4	Low beam.	8
5	Front LH parking light, rear RH parking light, trailer RH parking light flood-light, instrument panel light.	8
6	Front RH parking light, rear LH parking light, license plate light, trailer LH parking light, parking light indicator.	8
7	Turn signal and stop lights (tractor and trailer) with indicators, water temperature gauge, fuel gauge, air cleaner restriction indicator, battery charge indicator, low engine oil pressure indicator, parking brake indicator and sending unit.	8
8	Horn.	8

Unprotected circuits: starter circuit and battery charger.

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LIGHTING - SIGNALS - ACCESSORIES

Headlamps asymmetric, high and low beam, 45/40 W, double filament, white or yellow.
Front lights, i.e: — parking, 5 W, white lens; — turn signal, 21 W, orange lens;
Rear lights, i.e: — parking light, 5 W, red lens; LH doubles as license plate light; — turn signal, 21 W, orange lens; — stop, 21 W, red lens;
Reflex reflectors on either side.
Floodlight, integral switch, 35 W, white.
Indicators, 3 W: — battery charge (red); — low engine oil pressure (red); — air cleaner restriction (red), optional; — parking brake (red); — spare; — parking lights (green); — high beam (blue); — tractor turn signal lights (green); — first trailer turn signal lights (green); — second trailer turn signal lights (green); — water temp. gauge; — fuel gauge;
Thermostater

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STARTER SWITCH

CO BO Type, 4-position, 50 A.	
Positions	**CIRCUIT COMPLETED**
Position 0 30	Off (○).
Position 1 30-15/54 57-58/57	Lighting switch - Fuel gauge - Water temp. gauge - Battery charge indicator - Low engine oil pressure indicator - Turn signal lights and indicators - Parking brake indicator - Tractor and trailer stop lights - Prefitted for thermostarter.
Position 2 30-15/54-50 57-58/57	Lighting switch - Fuel gauge - Water temp. gauge - Battery charge indicator - Low engine oil pressure indicator - Turn signal lights and indicators - Parking brake indicator - Tractor and trailer stop lights - Starter - Prefitted for thermo-starter.
Position 3 30-57	Front RH and rear LH parking lights - Front LH and rear RH parking light - Parking lights indicator - Instrument panel lights.

(○) Key removable

LIGHTING SWITCH (Integral Horn Push)

CO BO Type, 4-position.	
Positions	**CIRCUITS COMPLETED (*)**
Position 0 30 49-49a	Horn.
Position 1 30-58/57 49-49a	Front RH and rear LH parking lights - Front LH and rear RH parking lights - Instrument panel light - Parking lights indicator - Horn - Rear floodlight auxi-liary.
Position 2 30-58/57-56 b 49-49a	Front RH and rear LH parking lights - Front LH and rear RH parking lights - Instrument panel light - Parking lights indicator - Low beam - Horn - Rear auxiliary.
Position 3 30-58/57-56 a 49-49a	Front R.H and rear L H parking lights - Front L H and rear R H parking lights - Instrument panel light - Parking lights indicator - High beam - Horn - Rear auxiliary floodlight.

TURN SIGNAL SWITCH (*)

CO BO Type, 3-position.	
Positions	**CIRCUIT COMPLETED**
Position 0 (centre) 54	Off
Position 1 (right) 54 1	Right-hand turn signal (tractor and trailers)
Position 2 (left) 54 2	Left-hand turn signal (tractor and trailers)

(*) The dipswitch and turn signal switch can be activated with the ignition switch in position 1.

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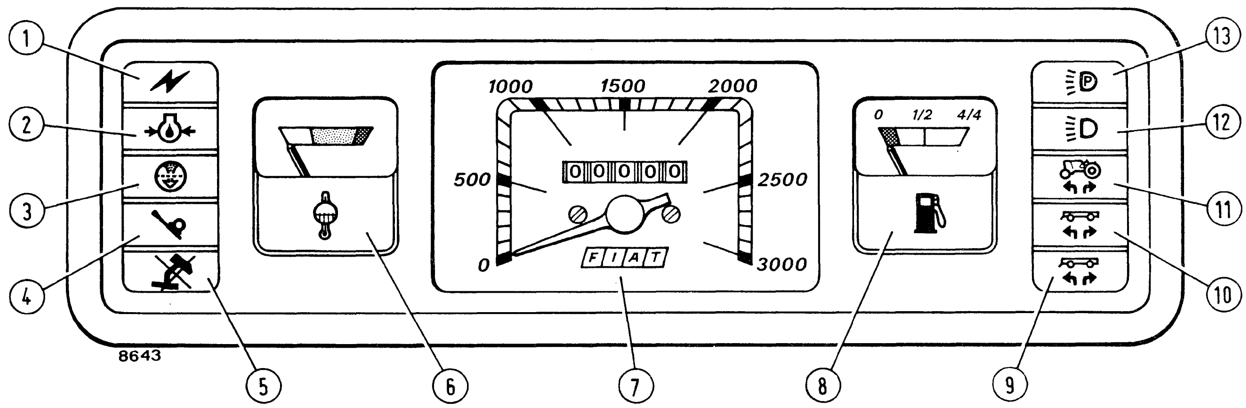
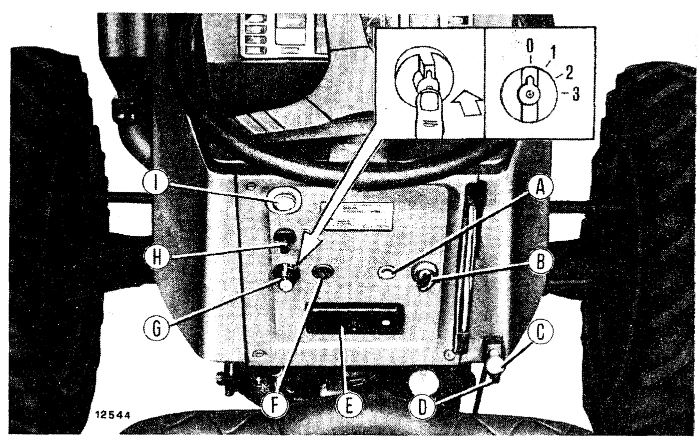
CONTROLS AND INSTRUMENTS



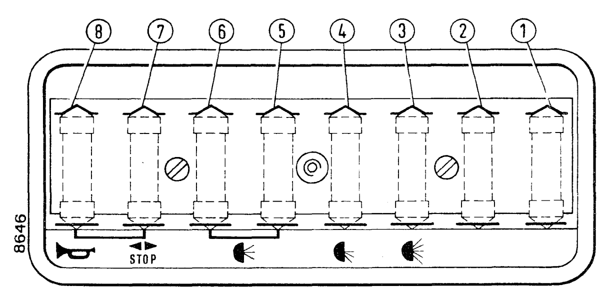
Instrument Panel.

1. Battery charge indicator (red) - 2. Low engine oil pressure indicator (red) - 3. Air cleaner restriction indicator (red) - 4. Parking brake flashing indicator (red) - 5. Spare - 6. Engine coolant temperature gauge - 7. Tractor meter - 8. Fuel gauge - 9. 2nd trailer turn signal indicator (green) - 10. 1st trailer turn signal indicator (green) - 11. Tractor turn signal indicator (green) - 12. High beam indicator (blue) - 13. Parking lights indicator (green).



Control Board.

A. Single-conductor power point - B. Starter switch - C. Shut-off control - D. Shut-off deftent - E. Fuse box - F. Start-pilot or thermostarter control - G. Lighting switch and horn push - H. Turn signal switch - I Hazard warning switch with indicator.



Fuse Unit.

(For references see page 6).

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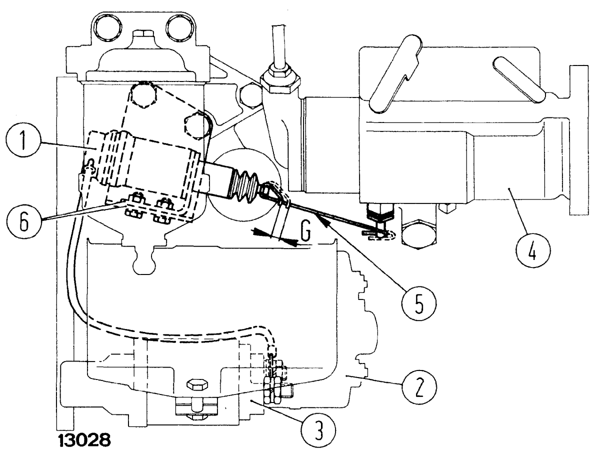

C.A.V. Injection Pump Start-retard device.

G = 1 to 2 mm (0.04 to 0.08 in), link (5) free travel - 1. Start-retard solenoid - 2. Starter - 3. Starter solenoid - 4. C.A.V. injection pump - 5. Link - 6. Solenoid brackets.

C.A.V. INJECTION PUMP START-RETARD DEVICE

Control solenoid is supplied by the same terminal clamps as that of starter field and is connected to C.A.V. injection pump start-retard lever through link (5).

On assembly, position solenoid by using the elongated holes provided in brackets (6), to obtain a link (5) free travel of 1 or 2 mm (0.04 to 0.08 in).

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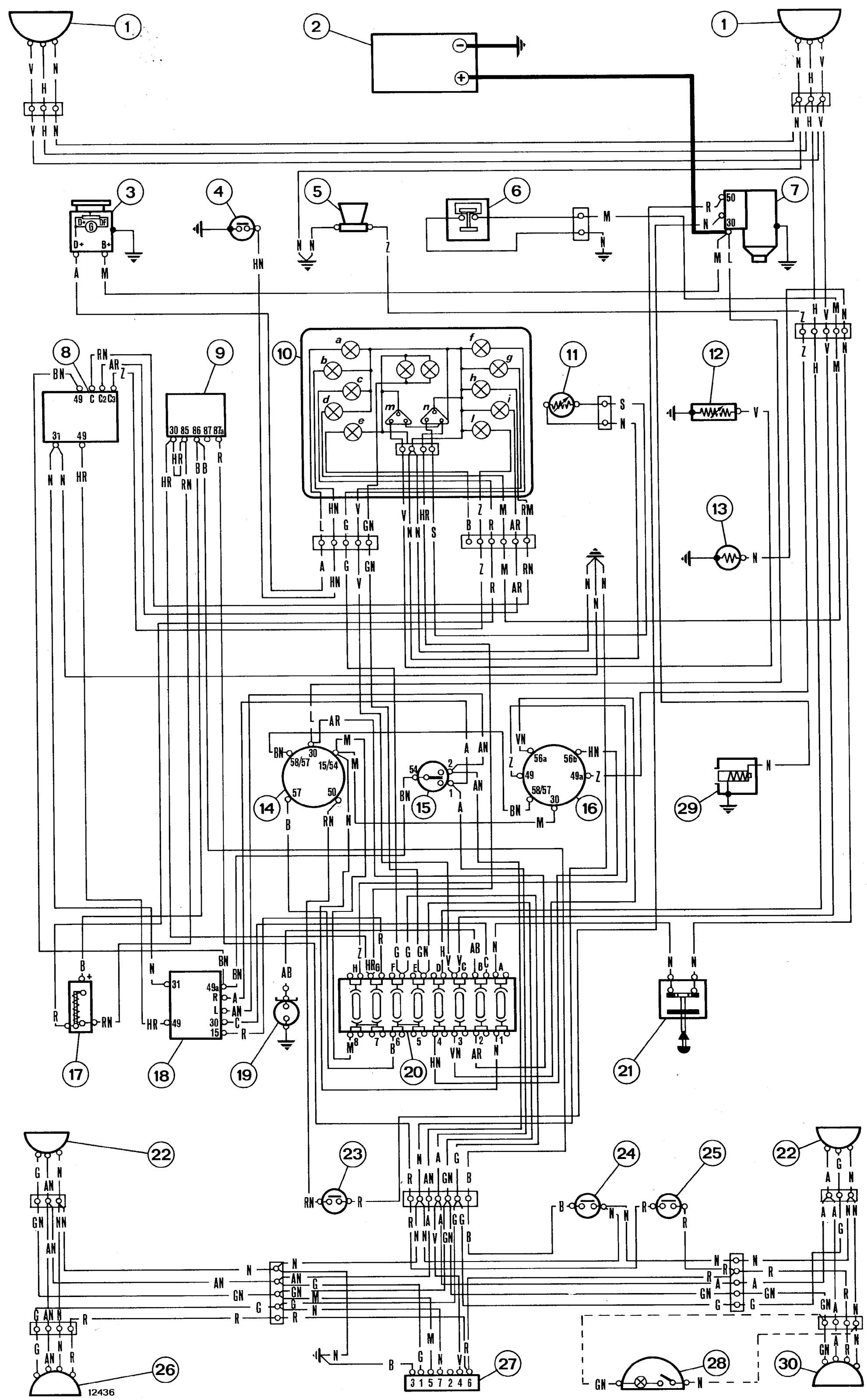

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Wiring diagram.

1. Headlamps, high/low beam.
2. Battery.
3. Alternator.
4. Low engine oil pressure transmitter unit.
5. Horn.
6. Air cleaner restriction transmitter unit (optional).
7. Starter.
8. Hazard warning light flasher.
9. Parking brake and stop light switch.
10. Instrument panel:
    - **a.** battery charge indicator (red);
    - **b.** low engine oil pressure indicator (red);
    - **c.** air cleaner restriction indicator (red, optional);
    - **d.** parking brake indicator (red);
    - **e.** spare;
    - **f.** parking lights indicator (green);
    - **g.** high beam indicator (blue);
    - **h.** tractor turn signal indicator (green);
    - **i.** 1st trailer turn signal indicator (green);
    - **l.** 2nd trailer turn signal indicator (green);
    - **m.** water temperature gauge;
    - **n.** fuel gauge;
11. Fuel gauge transmitter unit.
12. Water temperature transmitter unit.
13. Thermostart (optional).
14. Starter switch.
15. Turn signal switch.
16. Lighting switch and horn button.
17. Parking brake flasher.
18. Hazard warning pushbutton and indicator.
19. Single-conductor power point.
20. Fuse box.
21. Thermostarter pushbutton (optional).
22. Front parking and turn signal lights.
23. Starter inhibitor switch.
24. Parking brake indicator transmitter unit.
25. Stop light switch.
26. Rear LH parking, turn signal, stop and license plate lights.
27. Seven-conductor power point.
28. Floodlight and switch.
29. CAV inj. pump start-retard device.
30. Rear RH parking, turn signal and stop lights.

CABLE COLOUR CODE

A = Light blue	**H** = Grey	**R** = Red
B = White	**L** = Dark blue	**S** = Pink
C = Orange	**M** = Brown	**V** = Green
G = Yellow	**N** = Black	**Z** = Mauve

10 - ENGINE

Removal - Installation - Bench test.

290740/1 Hook, lift

293002/1 Bracket, universal, use with rotary stand **290090.**

293050/1 Bracket, universal, use with rotary stand **290086.**

291310 Tester, compression (kit **291309**).

292631 **293499** Compression tester tool and mounting bracket for injector mounting.

Engine block - Cylinder head.

292507 Plate, cylinder liner removal.

291501 Plate, cylinder liner installation.

A390363 (293269) Reamer, camshaft bush.

292103 **A360383** Drift for camshaft bush removal/installation.

291046/1 Drift for valve guide removal/installation.

291177 Reamer, valve guide.

292913 Lathe fixture for valve seat dressing.

293784 Puller, injector sleeve.

293742/1 Set, dressing tools for injector seat.

293386/1 Roller for dressing injector sleeve.

291780 Bush, valve guide insertion.

Valve gear

291883 Wrench, valve clearance.

Crank gear

291504 Puller, crankshaft pulley hub.

Fuel system.

290752 Plate, injection pump to rotary stand **290239.**

293761 Set wrenches for injector removal/installation.

293671 Cleaners, injectors.

290898 Support, injector removal/installation (FIAT - OMAP).

293760 Support, injector removal/installation (BOSCH - CAV - OMAP).

293401 Kit, on tractor distributor pump diagnosis.

On-bench injection pump test equipment.

293530 (formerly 290761) Test assy (comprising 1 pressure gauge 0 to 10 kg/cm^2, 1 pressure gauge 0 to 1.5 kg/cm^2, 1 vacuum gauge 0 to 760 mm Hg and graduated flask).

290763 Support for bench test pump.

292133 Drive coupling.

290765 Delivery lines (test A) (dimensions 6x2x845 mm).

293786 (A352120) Wrench, delivery line connections.

BOSCH injection pump

290766 Removal-replacer, rotor.

290774 Gauge, distributing rotor stroke.

290778 Spacer, rotor spring preload check.

290779 Installer, O-ring.

290780 Removal, O-ring.

292548 Protector, O-ring.

292551 Extension, M 14.5x2 (for use with **290774**).

292553 Removal, pressure regulating valve retaining ring.

292554 Protector, cam ring.

292555/1 Remover/replacer, pump shaft.

292556 Wrench, shuttle and metering valve.

292557/1 Compressor, pressure regulating valve.

292558 Centralizer, hydraulic head.

292817/1 Tester, advance and feed pressure.

293378 Remover/installer pump shaft (use with **292555/1** and **293392**).

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293387 Spacer, advance check (use with **292817/1**).

293392 Screw, pump shaft removal/installation (use with **292555/1** and **293378**).

C.A.V. **injection pump**

290741 Guide, throttle lever spindle removal.

290742 Guide, throttle and shut-off lever O-ring installation.

290743 Tester, advance.

290744 Remover/replacer, transfer pump rotor (use with torque wrench).

290745 Guide, start-retard O-ring replacer.

290746 Guide, advance plug O-ring replacer.

290747 Wrench, distributor rotor flange.

290748 Plug, pump leakage test.

290749 Connector, transfer pump outlet pressure test.

290750 Connector, fuel drain line.

290751 Connector, fuel inlet line.

290753 Connector, pump leakage test.

290754 Wrench, fueling adjusting screw.

290755 Connector, relief valve, pump roller check.

290756 Coupling, pump drive.

290757 Gauge, timing, pump flange.

290758 Remover/replacer, cam ring pin.

290759 Replacer, pump shaft.

290764 Connector, drain.

Colling system

291182/1 Puller, water pump impeller.

291979 Digital thermometer for checking temperature.

20 - POWER TRAIN

201 - Clutch

293650 Kit, universal, overhaul.

291184 Centralizer/adjuster, with register, on tractor.

293763 Wrenches, PTO. Clutch release lever adjuster screw.

292176 Compressor, release lever test.

202 - Transmission and splitter

290086 Rotary stand.

290092 Vee bracket.

291517 Hook, lift.

293335 Guard for installing primary shaft gasket.

292888 Guide pins, clutch housing removal/installation.

204 - Bevel drive and differential

293400/1 Gauge, bevel pinion position (use with **293510** or **293101/1**.

293510 or 293101/1 Universal tool or specific tool for setting bevel pinion bearing.

291525 Installer, differential supports.

290870 Installer for differential lock fork spring.

293342/1 Wrench, bevel pinion locking nut.

291517 Hook, lift, differential supports.

291525 Installer, differential supports.

30 - FRONT AXLE - STEERING

301 - Axle

292927
290793 Puller, slide hammer, with king pin adapter (M12x1.25).

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303 - Power steering

293388	Installer, O-ring.
293389	Installer, rotary valve spring.
293290	Retainer, rotor.
293300	Kit, pressure gauge (use with **293160**).

Steering hydraulic test equipment.

291231	Tester, pump output.
293005	Tank.
291235 or	Electric motor (6-10 HP).
292150	Electric motor (9-15 HP).
290385	Union.
293165	Hydraulic pump.
293723	Support.
292256 **292257**	Brackets, (use with **293723**).
292724	Screw (2 off).
293192/1	Wrench, rotary valve.
290445	Pipe, suction.
290448 **290540**	Adapter, suction pipe.
293316	Adapter (2 off), suction and delivery pipes.
290544	Pipe, delivery.
290475	Connector, 3-way.
290541	Adapter.
290447	Pipe, return.
293315	Plug (2 off).
293721	Connection, oil drain.
292775	Pipe, oil drain.

40 - ALL-WHEEL DRIVE

401 - Front axle

293460	Stand, front axle overhaul.
293743 (291707/1)	Support, differential bevel pinion housing.
293836	Guard, axle drive seal installation.
293510	Gauge, bevel pinion bearing setting.
293837	Wrench, wheel bearing lock ring.
293400/1 or **292502/1**	Gauge, bevel pinion position (use with **293438/2** or **293510**).
293544	Wrench, differential bearing lockring.
292161	Puller, bearing cup.
292220/3	Tester, bearing rotating torque.
293438/2	Adjuster, bevel pinion bearing.
293520/2	Wrench, front pinion lockring and rotating torque check.
293857	Removal, kingpin.
291525	Pin, for planetary reduction gear cover.

50 - LIFT UNIT

501 - Lift

290284	Pump, hand valve adjustment.
293300 **(291314)**	Tester, pressure, universal (pressure gauges and connectors)
290817 **290818**	Protector/installer, lift cross shaft seal.
291259	Wrench, oil intake valve plug on cylinder.
290826	Adapter, safety valve adjustment.
290824	Adapter, pressure relief valve adjustment.
290831	Adapter for checking oil intake valve leakage on cylinder.
290834/1	Adapter for checking exhaust valve leakage.
290819	Lift spring checking lever.
291326	Adapter, pressure relief valve adjustment with lift unit on tractor.
291863	Wrench for locking ring of lift pressure valve adjustment.

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502 Lift pump type C25X and power steering pump type A18X.

293600 Stand, rotary, pump overhaul (to clamp in vice).

291231 Tester, output, large, complete with:

290417 – union, inlet (A18X pump);

290419 – union, inlet (C25X pump);

290418 – union, outlet (for A18X and C25X pumps);

290448 – adapter, inlet (for A18X and C25X pumps);

290445 – pipe, inlet (for A18X and C25X pumps);

290447 – pipe, delivery (for A18X and C25X pumps);

290436 – screw, inlet union (for C25X pump);

290434 – screw, delivery union (for A18X, C25X pumps) and inlet union (A18X pump);

291233 Engine, diesel, pump drive.

291235 Motor, electric, pump drive complete with:

290385 – coupling (for A18X and C25X pumps);

292574 – test set - portable, small comprising;

290331 – union, inlet (for C25X pump);

290330 – union, outlet (for A18X and C25X pumps) and inlet (for A18X pump);

290424 – piping, inlet and delivery (for A18X and C25X pumps);

290359 – screw, inlet union (for C25X pump);

290358 – screw, delivery union (for A18X, C25X pumps) and inlet (A18X pump).

60 - ELECTRICAL SYSTEM

292307 Connector for starter friction torque tester.

290973 Tool for dressing starter commutator.

293489 Support, alternator bench test.

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FIAT

55-46
55-46 DT
65-46
65-46 DT

WORKSHOP MANUAL

CONTENTS

S E R V I Z I   T E C N I C I   D I   A S S I S T E N Z A

INTRODUCTORY NOTE

- These pages update the Workshop Manual of model 446 to the recent production of new Series 46 including models 55-46 and 65-46 (for export).

- This updating assembles all the technical data of the new parts associated with the power units and the new mechanical and hydraulic units fitted to the present Series 46 together with the modifications made to the preceding mechanical units equipping the preceding Series.

- For the parts which instead have remain unchanged it is necessary to look up (as stated in contents and in the text) the preceding Manual covering the 446 Model.

- For the purpose, it should be borne in mind that:

  – Model 55-46 replaces Model 446

  – Model 65-46 does not replace any model of earlier production and is fitted a 4-cylinder engine.

FIATGEOTECH S.p.A. – Viale delle Nazioni,55 – 41100 Modena – Italia
FIATAGRI – Direzione Commerciale – Servizi Tecnici di Assistenza – Pubblicazioni Tecniche
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CONTENTS

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GENERAL: Contents

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Print no. **603.54.239.01** - IX - 1987

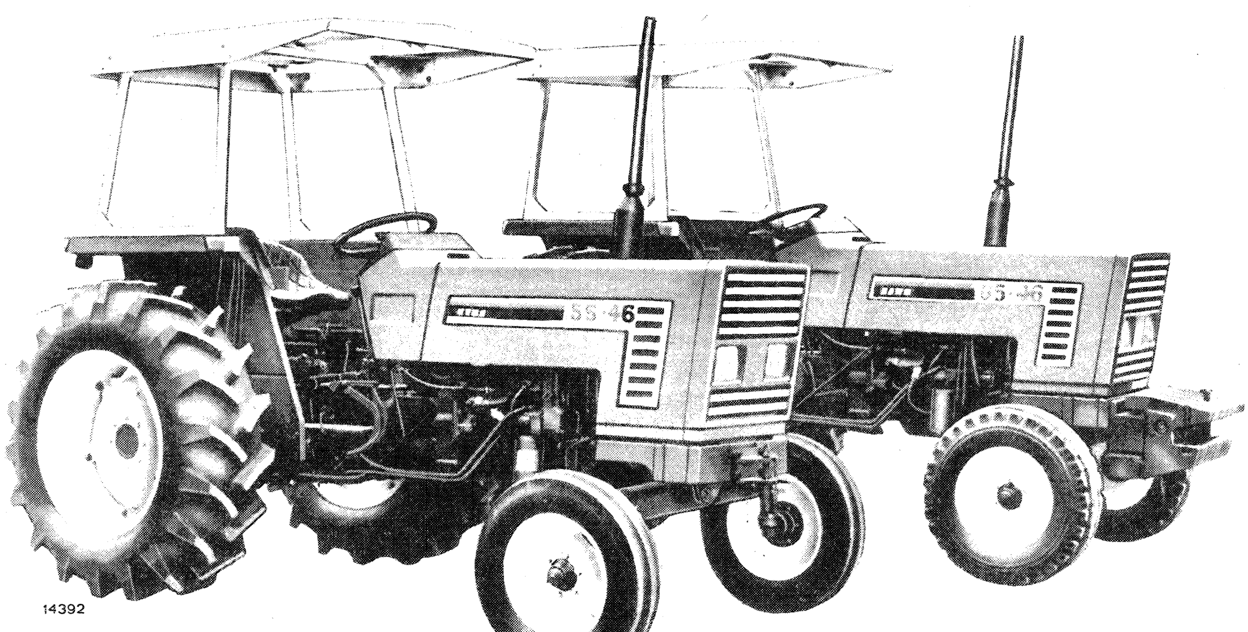
SPECIFICATION

Marketing code:		
— Two-wheel drive	55 - 46	65 - 46
— All-wheel drive	55 - 46 DT	65 - 46 DT
Engineering code:		
8-speed, two-wheel drive	673.100.000	673.500.000
12-speed, two-wheel drive	673.100.000 var. 720.111	673.500.000 var. 720.111
8-speed, all-wheel drive	673.127.000	673.527.000
12-speed, all-wheel drive	673.127.000 var. 720.111	673.527.000 var. 720.111
FIAT engine type, same on all four versions — with BOSCH pump	8035.06.206	8045.06.220
FIAT engine type, same on all four versions — with C.A.V. pump	8035.06.306	8045.06.320
Clutch type	LUK or OMG 11"/11"	

WEIGHTS

	55 - 46	55 - 46 DT	65 - 46	65 - 46 DT
Operating weight: lift, implement attachment, front hook, swinging drawbar and ROPS frame ... kg	2010(*)	2220(*)	2100(*)	2350(*)
... tons	1.98	2.17	2.00	2.3
Same as above, with front ballasting (10 plates) and 6 ballast rings or rear wheels ... kg	2750(*)	2960(*)	2840(*)	3090(*)
... tons	2.7	2.9	2.8	3.00

(*) Weight increases by 10 kg (26.8 lbs) on models with 12-speed transmission.



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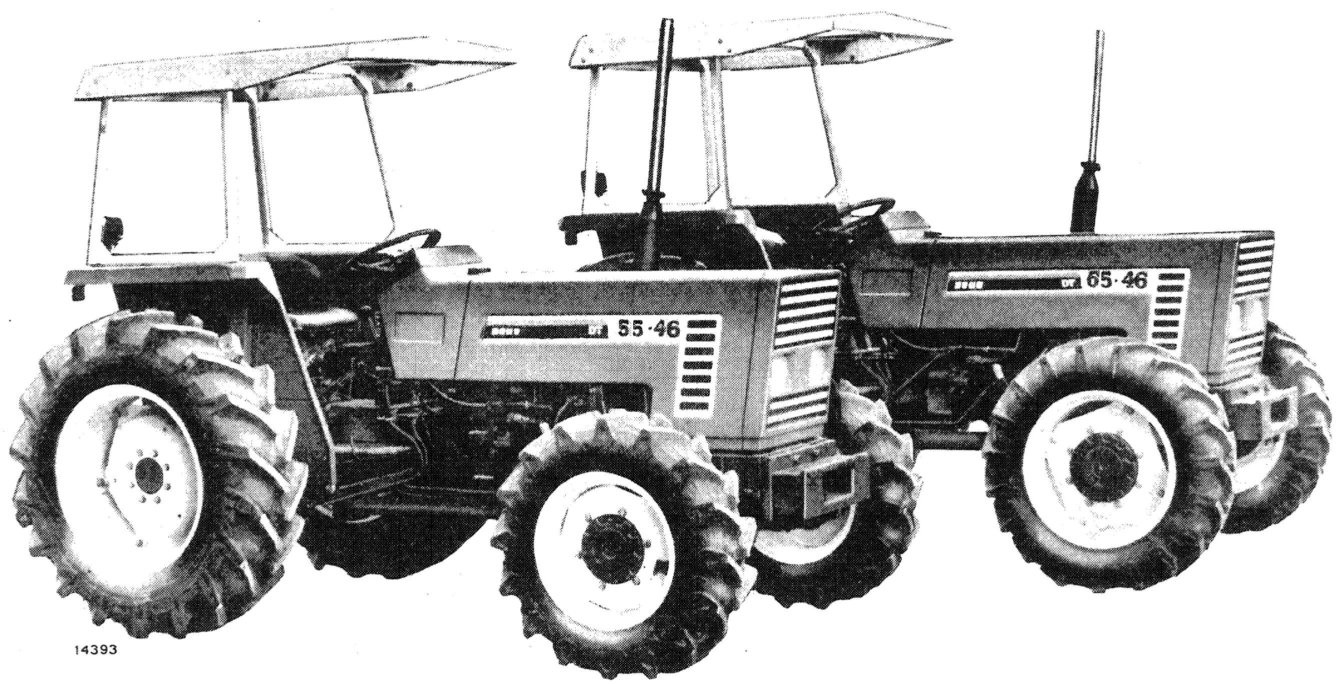
SPECIFICATION

ENGINE

	55 - 46 55 - 46 DT	65 - 46 65 - 46 DT
Diesel	4-stroke, naturally aspirated	
Injection	direct	
Number of cylinders	3	4
Cylinder liners	dry, pressed on engine bloc	
Bore and stroke mm	100 × 115 (4 × 4.5 in)	
Displacement cm^3	2710	3613
Compression ratio	17 : 1	
Max. horse power DGM/DIN kW	40,5 (55 CV)	47,8 (65 CV)
At speed rpm	2500	
Max torque speed rpm	1500	
Main bearings	4	5
Sump	Cast iron	
Dynamic balancer	—	with countrar-otating weights in sump
Valve gear	OH valves, push rod/crankshaft operated	
Inlet opens: BTDC	3°	
Inlet closes: ABDC	23°	
Exhaust opens: BTDC	48° 30'	
Exhaust closes: ATDC	6°	
Valve clearance for timing check	0.45 mm (0.18 in)	
Normal (irrespective of whether engine hot or cold) inlet	0.25 mm (0.01 in)	
Normal (irrespective of whether engine hot or cold) exhaust	0.35 mm (0.013 in)	

(continued)



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ENGINE

(contd)

	55 - 46 55 - 46 DT	65 - 46 65 - 46 DT
Fuel system		
Air cleaner	Oil bath or dry, both with automatic drain centrifugal precleaner	
Fuel filters on feed pump delivery	For 55-46 models single filter incorporating cartridge with water separator For 65-46 two in-line paper cartridge rechangeable filters, (water separator integral with first filter)	
Feed pump	Double diaphragm	
– Operation	Cam	
Injection pump	Rotary distributor incorporating controller and advance device	
Type – BOSCH	VE3/11 F 1250 L163-1 4794587 - 4800682	VE4/11F 1250 L164-2 4804869
or		
Type – C.A.V.	DPS8522A 010A 4797414	DPS8520A 140A 4806880
All-speed governor incorporated in pump	With centrifugal masses	
Advance device incorporated in pump	Hydraulic	
– Pump timing, BTDC – BOSCH	6° ± 1°	4° ± 1°
– Pump timing, BTDC – C.A.V.	0° ± 1°	0° ± 1°
Injectors, with nozzle	4-orifice	
– Type	See page 8, Section 10	
– Calibration pressure	230-238 bar (235-243 kg/cm^2) (3342-3455 psi)	
Firing orger	1 - 2 - 3	1 - 3 - 4 - 2
Lubrication	Forced feed by gear pump	
Pump drive	Camshaft	
Oil filters	Strainer on pump inlet and full flow cartridge on outlet	
Relief valve	In pump body	
– Oil pressure at maximum speed	2.9 to 3.9 bar (3 to 4 kg/cm^2) (42.6 - 56.8 psi)	
Cooling system	Water, by centrifugal pump	
Radiator	3 deep core vertical tube with steel fins	
Fan, water pump-pulley mounted	Suction sheet steel, four-bladed	
Temperature control	Wax thermostat	
Tractor meter	On instrument panel	
– Drive	Motor oil pump gear	
– Hour meter activation speed	1800 rpm	
– Meter drive ratio	1 : 2	

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SPECIFICATION

POWER TRAIN

Clutch

Twin, dry single plate type LUK or O.M.G. 11 in. with separate controls: pedal for transmission and manual lever for PTO.

Plate material for both transmission and PTO plates is organic.

Transmission

Constant mesh, spur gear type.
Planetary gear splitter box for 8 forward speeds and 2 reverse speeds, with total of 12 forward speeds and 3 reverse speeds on version using crawler box (series with splitter box).
Gear box and splitter/crawler with separate control levers.

Bevel drive on differential with differing ratios on two-wheel or all-wheel drive.

Two pinion differential with pedal-control differential lock.

Final drives of single reduction planetary type.

BRAKES

Service
Drive brake bands acting on wheel drums fitted to halfshafts of differential with separate pedal control with pedals latched for simultaneous road speed braking.

Parking/emergency
Independent, acting on service brakes, operated by manual lever.

STEERING

Steering wheel system with circulating ball steering box or with power steering optional.

Linkage joints sealed permanently.
Turning radius (without brakes)

– Mod. 55-46	3400 mm 11′1″
55-46 DT with front axle out	5300 mm 17′3″
– Mod. 65-46	3550 mm 11′6″
65-46 DT with front axle out	5300 mm 17′4″

FRONT AXLE

Inverted U, telescoping, center pivoting with track adjustment by sliding axle ends .... 6 off.

LIVE FRONT AXLE

Fully floating, center pivoting unjointed drive shaft (without universal joints) and articulations on tractor centerline.
Two-pinion differential with planetary final drives.
Five disc/rim/hub repositioning.

REAR WHEELS

Disc/rim/hub repositioning: .... 7 off.

POWER TAKE-OFF

Fully independent (540 rpm)

Shaft .... 1 . 3/8″ – 6 splines
Control .... mechanical by manual lever.
Engine speed with PTO at standard speed of 540 rpm .... 2160 rpm.
Rotation: Clockwise (tractor seen from rear).

Synchronized PTO
Drive shaft and rotation same as for fully independent PTO.

Speed of spline shaft (12/47 bevel drive) per rear wheel turn:

– Mod. 55-46 .... 13.78 rpm

– Mod. 65-46 .... 15.1 rpm

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HYDRAULIC LIFT

Hydraulic, draught and position control with manual sensitivity adjustment. Draught control by three-point attachment.
Gear-type pump with engine valve gear drive.
Hydraulic fluid taken from gearbox.
Design lift capacity, max. lift capacity and max. lift stroke at end of arms (see Section 50, pages 1 and 4 for 446 model).
Three-point category I and II implement attachments, with normal arms or extra-long, reinforced arms optional.

Remote control valves

Single remote control valve (for right - or left-hand control) for remote single and double-acting cylinder control.
Trailer power braking remote control valve with extra remote control valve for double-acting remote control with left-hand control).

TOWING ATTACHMENTS

Rear:

- Swing over sector drawbar;
- Cross member drilled for implement attachment;
- Tow hook;
- Rockinger jaw hook: designed to rotate on its own longitudinal axis and equipped with an automatic device for tow pin coupling/locking.

Front:

- Fixed hook (cannot be installed with front ballasting).

BALLASTING

Front axle

Comprising support of 80 kg (176 lb) for mountting total of 6 or 10 plates of 33 kg (73 lb) each for a total weight of 278 kg or 410 kg.

Rear wheels

Comprising 4 or 6 rings secured to the wheels rims, each weighing 55 kg (110 lb) to provide a total weight of 220 kg (484 lbs) or 330 kg (726 lbs).

BODY

Forward-tilt hood for complete accessibility to engine and other units such as radiator, battery, air cleaner, engine oil filter, fuel filters, fuel pump, injection pump and power steering tank (optional).
Partial wrap-around rear fenders with ROPS frame mounts, with or without roof.
Sheet metal fuel tank located in front of dashboard.
Operator seat padded, with parallelogram suspension, adjustable for horizontal position and springing.

ELECTRICAL SYSTEM

Voltage .... 12 V
33 A alternator with integral electronic voltage regulator.
- Bosch: GI ⟶ 14 V - 33A27;
- Marelli: AA 108 - 14 V - 33A - 1
- ISKRA: AAG1104 - 14 V - 33A;
- LUKAS: 18 A CR - 14 V - 40A.

Starter:

– Marelli – Bosch	55-46 – 65-46 models
– Lucas	only 55-46 model

Battery located in front of radiator, capacity 88 Ah.
Alternatively sealed, no maintenance battery.

Lighting

Twin, high and asymmetric low beam headlamps, 45/40 W.
Two front lights comprising:
- parking (5 W bulb);
- turn signal (21 W bulb);

Two tail lights comprising:
- parking (5 W bulb);
- turn signal (21 W bulb);
- stop (21 W bulb);
- licence plate (doubles as LH parking lights).

Instruments and accessories

Multi-function instrument panel (see Section 60, p.8).
Dashboard (see Section 60, p.8)
Rear floodlight (35 W bulb).
Rear power socket, DIN, 7-pole.
Dash power socket, single-pole.
Horn.
Thermostarter.
Fuses: max. 8 off (see Section 60, page 7).
Tractor and trailer hazard warning lights.

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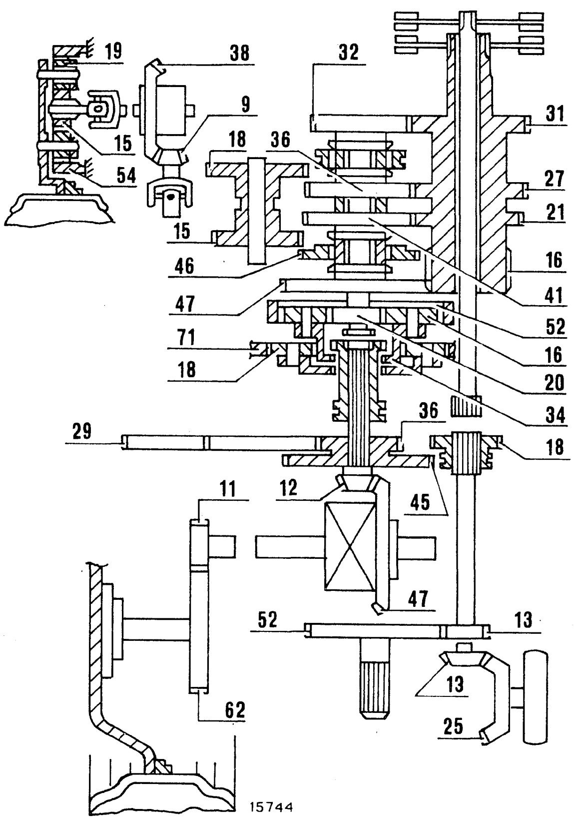
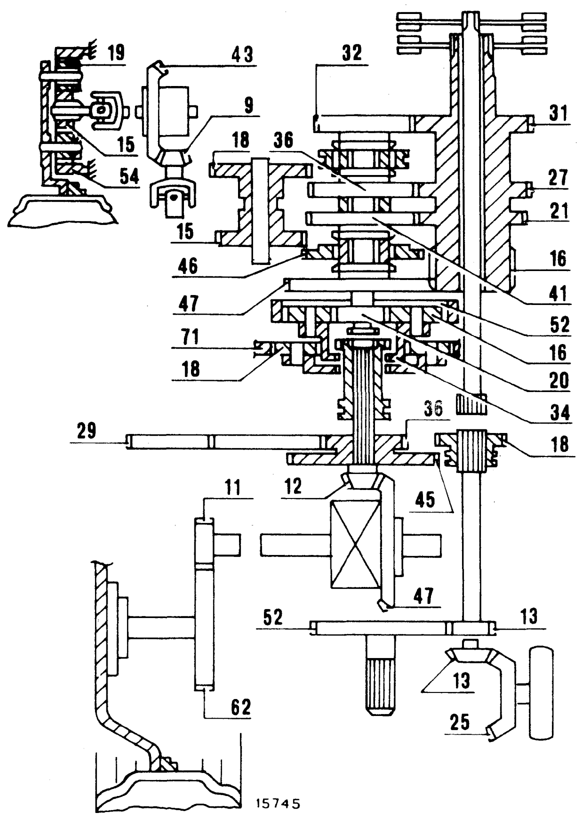
POWER TRAIN SCHEMATIC

Mod. 55-46 DT 12-speed version



Mod. 65-46 DT 12-speed version



(*) Only with 12 gear changing

Tractor speed, at max. engine speed, with 8 and 12-speed transmission in km/h (mph)

GEARS		Mod. 55-46 with rear tyres:			Mod. 65-46 with rear tyres:		
		13.6/12-28	14.9/13-28	12.4/11-32	16.9/14-30	12.4/11-36	14.9/13-30
Low (*)	1st	0.8 (0.5)	0.8 (0.5)	0.8 (0.5)	0.8 (0.5)	0.8 (0.5)	0.8 (0.5)
	2nd	1.2 (0.7)	1.3 (0.8)	1.3 (0.8)	1.2 (0.7)	1.2 (0.7)	1.2 (0.7)
	3rd	1.8 (1.1)	1.8 (1.1)	1.8 (1.1)	1.8 (1.1)	1.8 (1.1)	1.7 (1.1)
	4th	2.3 (1.4)	2.4 (1.5)	2.4 (1.5)	2.3 (1.4)	2.3 (1.4)	2.2 (1.4)
	RM	1.1 (0.6)	1.2 (0.7)	1.2 (0.7)	1.2 (0.7)	1.2 (0.7)	1.1 (0.6)
Normal	1st	2.5 (1.5)	2.6 (1.6)	2.6 (1.6)	2.5 (1.5)	2.6 (1.6)	2.4 (1.5)
	2nd	3.7 (2.3)	3.9 (2.4)	3.9 (2.4)	3.8 (2.4)	3.8 (2.4)	3.6 (2.2)
	3rd	5.2 (3.2)	5.7 (3.6)	5.7 (3.6)	5.6 (3.5)	5.6 (3.5)	5.3 (3.3)
	4th	7.0 (4.3)	7.4 (4.6)	7.4 (4.6)	7.2 (4.5)	7.3 (4.5)	6.9 (4.3)
	Reverse	3.5 (2.2)	3.7 (2.3)	3.7 (2.3)	3.6 (2.2)	3.6 (2.2)	3.5 (2.2)
High	1st	8.9 (5.5)	9.3 (5.8)	9.3 (5.8)	9.1 (5.7)	9.2 (5.7)	8.7(5.4)
	2nd	13.4 (8.4)	14.0 (8.7)	14.0 (8.7)	13.7 (8.5)	13.8 (9.8)	13.1 (8.2)
	3rd	19.5 (12.2)	20.5 (12.8)	20.5 (12.8)	20.1 (12.6)	20.3 (12.7)	19.3 (12.1)
	4th	25.2 (15.7)	26.5 (16.6)	26.5 (16.6)	26.0 (16.2)	26.2 (16.4)	24.9 (15.6)
	Reverse	12.7 (7.9)	13.4 (8.4)	13.4 (8.4)	13.1 (8.2)	13.2 (8.2)	12.6 (7.9)

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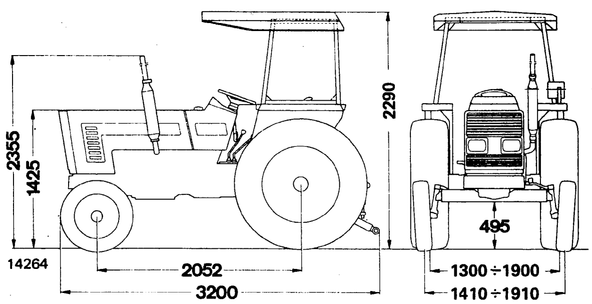
MAIN DIMENSIONS (in mm)



Mod. 55 - 46

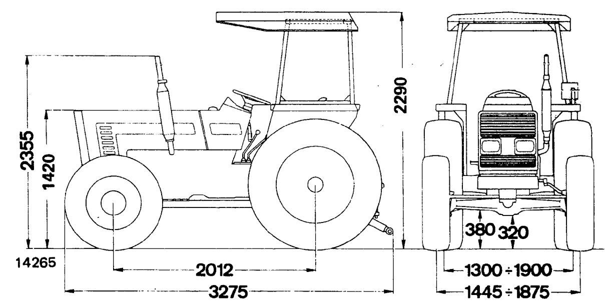
Recommended combinations	
Front tyres	Rear tyres
6.00-16	13.6/12-28
6.00-16	14.9/13-28(*)
6.00-16	12.4/11-32
7.50-16	12.4/11-32

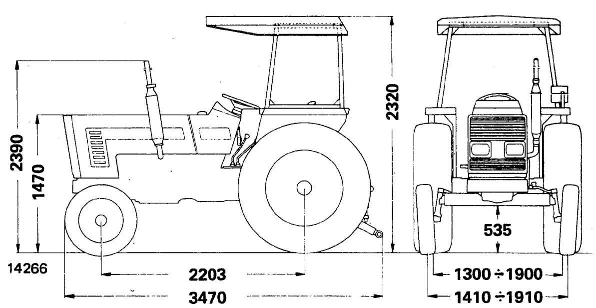
(*) Standard combination

Mod. 55 - 46 DT

Recommended combinations	
Front tyres	Rear tyres
8.00-20	13.6/12-28
9.5/9-20	13.6/12-28
11.2/10-20	14.9/13-28(*)
11.2/10-20	12.4/11-32
8.3/8-24	12.4/11-32

(*)Standard combination





Mod. 65-46

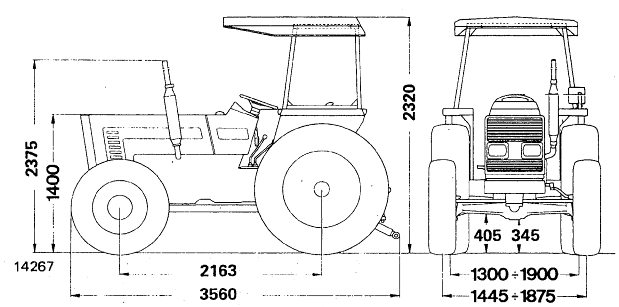
Recommended combinations	
Front tyres	Rear tyres
7.50-16	16.9/14-30
7.50-16	12.4/11-36
7.50-16	14.9/13.30(*)

(*)Standard combination

Mod. 65 - 46 DT

Recommended combinations	
Front tyres	Rear tyres
9.5/ 9-24	14.9/13-30(*)
11.2/10-24	16.9/14-30
11.2/10-24	12.4/11-36

(*)Standard combination



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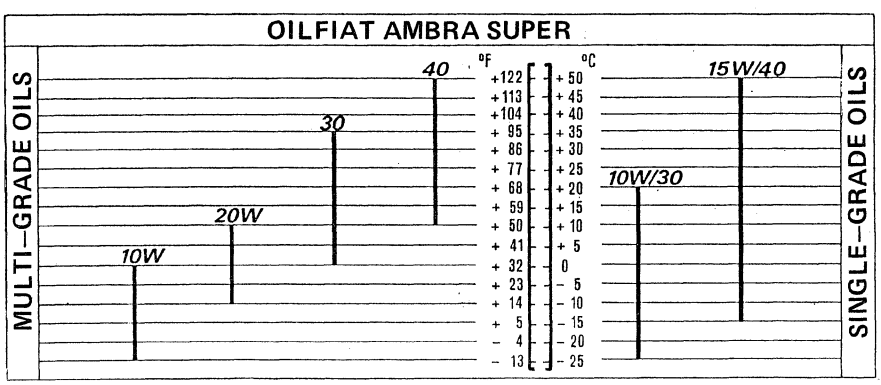
SPECIFICATION

CAPACITIES

DESCRIPTION	LIQUIDS AND LUBRICANTS: FIAT RECOMMENDED PRODUCTS	QUANTITY 55 - 46 / 55 - 46 DT dm³	55 - 46 / 55 - 46 DT pints	65 - 46 / 65 - 46 DT dm³	65 - 46 / 65 - 46 DT pints	International designation
Sump and filter oil	oil Fiat AMBRA SUPER	7.3	12.8	11.7	20.5	Diesel engine oil to MIL-L-2104D and service API CD
Sump oil		6.7	11.8	10.5	18.5	
Air cleaner oil (2)		0.55	1	0.55	1	
Transmission system, rear axle and lift:	oil Fiat TUTELA MULTI F					Transmission, oil bath brakes and lift oil corresponds to Massey Ferguson MF 1135 and Ford M2C 86A
— 2-wheel drive		17.8	31.3	17.8	31.3	
— All-wheel drive		18.6	32.7	18.6	32.7	
Steering unit		0.5	0.88	0.4	0.7	
Power steering		1.8	3.2	1.8	3.2	
Final drives (each)		1.7	3	4.4	7.7	
Front axle:						
— Axle cases		4.3	7.5	6.1	10.7	Service API GL5
— Planetary drives (each)		0.8	1.4	1.2	2.1	SAE 20 W/30
Front wheel hubs	grease Fiat TUTELA G 9	—		—		Lithium-calcium grease to NLGI2
Pressure lubricator						
		dm³ (liters)				
Coolant — without cab	Water and FIAT 'PARAFLU 11" (3)	12	21glls.	14	21glls	
Coolant — with cab		14	24.6	16	28.1	—
Screenwasher tank	Water and FIAT "DPI" (1)	2	3.5	2	3.5	—
Fuel tank	Diesel fuel decanted & filtered	61	107	61	107	—

(1) Detergent & non-freeze liquid down do −10°C (+14°F) with only 50% of FIAT-DPI. For temperatures below −10°C (+14°F) fill with only DPI.
(2) Change filter oil when dirt level is approx. 1 cm thick.
(3) See 446 mod., page 1, Section 106.



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ENGINE BLOCK

Engine Block	
Cylinder bore diameter in engine block	102.850 to 102.900 mm (4.011 to 4.013 in)
Sleeve OD	103.020 to 103.050 mm (4.017 to 4.018 in)
Sleeve interference fit in block	0.120 to 0.200 mm (0.005 to 0.008 in)
Sleeve diameter oversize	0.2 mm (0.008 in)
Sleeve bore diameter	100.000 to 100.024 mm(1) (3.9370 to 3.9379 in)
Maximum ovality and taper due to wear (2)	0.12 mm (0.0047 in)
Sleeve bore oversize	0.4 to 0.8 mm (0.0159 to 0.0314 in)
Housing bore diameter:	
— camshaft bushings: front	54.780 to 54.805 mm (2.1566 to 2.157[illegible] in)
— camshaft bushings: intermediate	54.280 to 54.305 mm (2.1370 to 2.1379 in)
— camshaft bushings: rear	53.780 to 53.805 mm (2.1173 to 2.1183 in)
Tappet housing bore diameter	15.000 to 15.018 mm (1) 0.5906 to 0.5912 in)
Tappet oversize	0.1 - 0.2 - 0.3 mm (0.00394 - 0.0078 - 0.0118 in)
Main bearing housing bore diameter	84.200 to 84.230 mm (3.314 to 3.316 in)

CYLINDER HEAD

Valve guide housing bore diameter in head	13.950 to 13.983 mm (0.5492 to 0.5505 in)
Valve guide oversize	0.2 mm (0.0078 in)
Valve seat dimensions	Section 101, page 2
Valve stand-in	0.7 to 1.0 mm (0.5492 to 0.5505 in)
— maximum seating allowed	1.3 mm (0.0078 in)
Injector projection	0.05 to 0.7 mm (0.0019 to 0.0275 in)
— maximum stand-out allowed	1.0 mm (0.0397 in)
Cylinder head height	92 mm (3.622 in)
Maximum head skimming depth	0.5 mm (0.0196 in)

CRANKSHAFT

Crankshaft - Bearings	
Main journal diameter	79.791 to 79.810(3) (3.1414 to 3.1421 in)
Main journal undersize	0.254-0.508-0.762-1.016 mm (0.0099-0.0199-0.0299-0.0399 in)
Main bearing wall thickness	2.168 to 2.178 mm (0.0853 to 0.0857 in)
Main bearing undersize	0.254-0.508-0.762-1.016 mm (0.0099-0.0199-0.0299-0.0399 in)
Main journal clearance in bearings	0.034 to 0.113 mm (0.0133 to 0.0044 in)
— maximum wear clearance	0.180 mm (0.0070 in)

(cont.)

(1) Value to be obtained when fitted after reaming.
(2) Measurements to be taken in working zone of spring rings parallel and perpendicular to engine axis.
(3) 0.1 mm undersize crankpin and main journal crankshafts may be fitted in production coupled to corresponding undersize bearings.

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CRANK GEAR

(continued)

Crankpin diameter	63.725 to 63.744 mm(1) (2.5088 to 2.5096 in)
Crankpin undersize	0.254-0.508-0.762-1.016 mm (0.0099-0.0199-0.0299-0.0399 in)
Big end bearing wall thickness	1.805 to 1.815 mm (0.0710 to 0.0714 in)
Big end bearing undersize	0.254-0.508-0.762-1.016 mm (0.0099-0.0199-0.0299-0.0399 in)
Crankpin clearance in big end bearing	0.033 to 0.087 mm (0.00129 to 0.0034 in)
– maximum wear clearance	0.180 mm (0.0070 in)
Crankshaft thrust washer thickness	3.378 to 3.429 mm (0.1329 to 0.1349 in)
Thrust washer oversize	0.127-0.254-0.508 mm (0.0049-0.0099-0.0199 in)
Width of main bearing housing over thrust washers	31.766 to 31.918 mm (1.2506 to 1.2566 in)
Length of corresponding main journal	32.000 to 32.100 mm (1.2598 to 1.2638 in)
Crankshaft end float	0.082 to 0.334 mm (0.0032 to 0.0131 in)
– maximum wear end float	0.40 mm (0.0157 in)
Maximum main journal and crankpin ovality or taper after grinding	0.01 mm (0.0004 in)
Maximum main journal and crankpin ovality or taper due to wear	0.05 mm (0.0019 in)
Maximum main journal misalignment with crankshaft resting on end journals	0.10 mm (0.0039 in)
Maximum misalignment of crankpins (mod. 55-46) or each pair of crankpins (mod. 65-46) referred to main journals (in either direction)	0.25 mm (0.0098 in)
Maximum tolerance on distance from outer crankpin edge	±0.10 mm (±0.0039 in)
Maximum crankshaft flange run-out with stylus in A, (Section 103, page 2) over 108 mm (4.25 in) diameter, T.I.R.	0.025 mm (0.00098 in)
Maximum flywheel seat eccentricity relative to main journals (See B, section 103, page 2) T.I.R.	0.04 mm (0.0016 in)
Connecting Rods	
Small end bore diameter	41.846 to 41.884 mm (1.6474 to 1.6489 in)
Small end bushing OD	41.979 to 42.017 mm (1.6527 to 1.6542 in)
Bushing interference fit in small end	0.095 to 0.171 mm (0.0037 to 0.0067 in)
Small end bushing fitted ID	38.004 to 38.014 mm (1.4962 to 1.4966 in)

(1) 0.1 mm (0.00393 in) undersize crankpin and main journal crankshafts may be fitted in production coupled to corresponding undersize bearings.

(cont.)

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PISTONS *(continued)*

Big end bore diameter	67.407 to 67.422 mm (2.6538 to 2.6544 in)
Maximum connecting rod axis misalignment at 125 mm (5 in)	±0.007 mm (± 0.0027 in)
Maximum connecting rod weight difference over a complete set of the same engine	25 grams (0.088 oz.)
Pistons	
Piston diameter 57 mm (2.25 in) from base of skirt, at right angles to pin	99.827 to 99.841 mm (3.9301 to 3.9307 in)
Piston clearance in sleeve	0.159 to 0.197 mm (0.0062 to 0.0077 in)
— maximum wear clearance	0.30 mm (0.0118 in)
Piston oversize range	0.4 - 0.8 mm (0.0157 to 0.0315 in)
Piston stand-out	0.355 to 0.761 mm (0.01397 to 0.0302 in)
Piston pin diameter	37.983 to 37.990 mm (1.4953 to 1.4957 in)
Piston pin housing bore in piston	37.993 to 38.000 mm (1.4957 to 1.4960 in)
Piston pin clearance in piston	0.003 to 0.017 mm (0.00012 to 0.00066 in)
Piston pin clearance in small end bushing	0.014 to 0.031 mm (0.00055 to 0.00122 in)
— maximum wear clearance	0.06 mm (0.0023 in)
Maximum weight difference over a complete set of pistons	20 grams (2/3 oz.)
Piston ring clearance in groove vertically:	
— Top	0.090 to 0.122 mm (0.0035 to 0.0048 in)
— 2nd	0.060 to 0.092 mm (0.0023 to 0.0036 in)
— 3rd	0.040 to 0.075 mm (0.0016 to 0.0029 in)
Maximum wear clearance:	
— Top	0.50 mm (0.0196 in)
— 2nd and 3rd	0.20 mm (0.0078 in)
Piston ring gap:	
— Top	0.35 to 0.55 mm (0.0138 to 0.0216 in)
— 2nd	0.30 to 0.45 mm (0.0118 to 0.0177 in)
— 3rd	0.30 to 0.60 mm (0.0118 to 0.0236 in)
Maximum wear gap	1.20 mm (0.0472 in)

(cont.)

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CRANK GEAR

(contd)

Contrarotating mass balancer (Mod. 65-46)	
Idler gear pin (19, page 3 - Section 103) clearance in bushings(1)	0.050 to 0.100 mm (0.0019 to 0.0039 in)
Mass drive gear shaft (11) clearance in front bushing(1)	0.050 to 0.100 mm (0.0019 to 0.0039 in)
Drive gear shaft (18) clearance in bushings(1)	0.050 to 0.100 mm (0.0019 to 0.0039 in)
Sides of splines of coupling (13) connecting drive gear (18) and mass drive gear (11) backlash	0.038 to 0.106 mm (0.0014 to 0.0042 in)
Mass drive gear shaft end (11) float in rear bushing(2)	0.013 to 0.061 mm (0.0005 to 0.0024 in)
Pin (26) and mass bushing (27) clearance	0.020 to 0.073 mm (0.0008 to 0.0028 in)
Mass bushing interference fit in housing	0.040 to 0.100 mm (0.0016 to 0.0039 in)
Mass drive idler gear pins (34) clearance in bushing(2)	0.013 to 0.061 mm (0.0005 to 0.0024 in)
Coupled gear teeth sides clearance	0.080 mm (0.0031 in)
Contrarotating mass timing	See page 3, Sections 103 Mod. 65-46

(1) Bushing interference fit in housing: 0.063 to 0.140 mm (0.0024 to 0.0055 in)
(2) Bushing interference fit in housing: 0.037 to 0.101 mm (0.0014 to 0.0039 in)

VALVE GEAR

Valve Timing Gears	
Timing gear backlash	0.160 mm (0.0062 in)
Idler gear jack shaft diameter	36.975 to 37.000 mm (1.4557 to 1.4567 in)
Idler gear bushing fitted I.D. after reaming	37.050 to 37.075 mm (1.4586 to 1.4596 in)
Jack shaft journal clearance in bushing	0.050 to 0.100 mm (0.0019 to 0.0039 in)
— maximum wear clearance	0.15 mm (0.0059 in)
Bushing interference fit in idler gear	0.063 to 0.140 mm (0.0024 to 0.0055 in)
Lift and power steering pump drive gear shaft diameter	36.975 to 37.000 (1.4557 to 1.4567 in)
Bushing fitted I.D. after reaming	37.050 to 37.075 mm 1.4586 to 1.4596 in)
Shaft clearance in bushing	0.050 to 0.100 mm (0.0019 to 0.0039 in)
Bushing interference fit in housing	0.063 to 0.140 mm (0.0024 to 0.0055 in)
Pump drive gear thrust washer thickness	1.45 to 1.50 mm (0.0571 to 0.0590 in)

(cont)

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VALVE GEAR *(contd)*

Camshaft	
Camshaft bushing O.D.:	
– front	54.875 to 54.930 mm (2.1604 to 2.1626 in)
– intermediate	54.375 to 54.430 mm (2.1407 to 2.1429 in)
– rear	53.875 to 53.930 mm (2.1206 to 2.1232 in)
Bushing interference fit in housing	0.070 to 0.150 mm (0.0027 to 0.0059 in)
Camshaft bushing fitted I.D. after reaming:	
– front	51.080 to 51.130 mm (2.0110 to 2.0129 in)
– intermediate	50.580 to 50.630 mm (1.9913 to 1.9933 in)
– rear	50.080 to 50.130 mm (1.9716 to 1.9736 in)
Camshaft journal diameter:	
– front	50.970 to 51.000 mm (2.0067 to 2.0078 in)
– intermediate	50.470 to 50.500 mm (1.9870 to 0.2165 in)
– rear	49.970 to 50.000 mm (1.9673 to 1.9685 in)
Camshaft journal clearance in bushing	0.080 to 0.160 mm (0.0031 to 0.0062 in)
Maximum wear clearance	0.20 mm (0.0079 in)
Camshaft end float (thrust plate to associated seat in camshaft)	0.070 to 0.220 mm (0.0027 to 0.0086 in)
Tappets	
Tappet O.D.	14.950 to 14.970 mm (0.5886 to 0.5894 in)
Tappet clearance in housing on engine block	0.030 to 0.068 mm (0.0012 to 0.0027 in)
– maximum wear clearance	0.15 mm (0.0059 in)
Tappet oversize	0.1-0.2-0.3 mm (0.0039-0.0078-0.0118 in)
Rockers	
Rocker bushing O.D.	21.006 to 21.031 mm (0.8270 to 0.8279 in)
Rocker bore diameter	20.939 to 20.972 mm (0.8243 to 0.8257 in)
Bushing interference fit in rocker	0.034 to 0.092 mm (0.0013 to 0.0036 in)
Rocker bracket bore diameter	18.016 to 18.034 mm (0.7093 to 0.7099 in)
Rocker shaft diameter	17.982 to 18.000 mm (0.7079 to 0.7086 in)
Rocker shaft clearance in bracket	0.016 to 0.052 mm (0.0006 to 0.0020 in)
– maximum wear clearance	0.15 mm (0.0059 in)
Rocker spacer spring length:	
– free	59.5 mm (2.3425 in)
– load 46 to 52 N (4.7 to 5.3 kg, 10.4 to 11.7 lb)	44 mm (1.7322 in)

(cont.)

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VALVE GEAR

(contd)

Valves, Guides and Springs		
Valve head diameter	inlet	45.300 to 45.500 mm (1.7834 to 1.7913 in)
	exhaust	37.500 to 37.750 mm (1.4763 to 1.4862 in)
Valve stem diameter		7.985 to 8.00 mm (0.3143 to 0.3149 in)
Valve face angle	inlet	60°30′ ± 7′
	exhaust	45°30′ ± 7′
Valve clearance	Timing check	0.45 mm (0.0177 in)
	Normal (cold or warm) — inlet	0.25 mm (0.0098 in)
	Normal (cold or warm) — exhaust	0.35 mm (0.0138 in)
Cam lift	Inlet	5.250 mm (0.2066 in)
	Exhaust	5.677 mm (0.2235 in)
Valve lift	Inlet	9.31 mm (0.3665 in)
	Exhaust	10.06 mm (0.3960 in)
Valve guide O.D.		13.993 to 14.016 mm (0.5509 to 0.5518 in)
Valve guide oversize		0.2 mm (0.0079 in)
Valve guide interference fit in housing on cylinder head		0.005 to 0.050 mm (0.0002 to 0.0019 in)
Valve guide fitted I.D. after reaming		8.023 to 8.038 mm (0.3158 to 0.3164 in)
Valve stem clearance in guide		0.023 to 0.058 mm (0.0009 to 0.0023 in)
– maximum wear clearance		0.13 mm (0.0051 in)
Maximum valve stem eccentricity over one revolution with stylus on centre of sealing face		0.03 mm (0.0012 in)
Inlet and exhaust valve spring length:		
– free		44.6 mm (1.755 in)
– valve closed, load 256-284 N (26.1-28.9 kg)		34 mm (1.338 in)
– valve open, load 502-554 N (51.2-56.5 kg)		23.8 mm (0.937 in)

LUBRICATION SYSTEM

Refer to table page 6, Section 10 for model **446**.

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COOLING SYSTEM

Water Pump	centrifugal, vane
Water pump drive ratio	1.403 to 1
Shaft interference fit in impeller	0.017 to 0.059 mm (0.0007 to 0.0023 in)
Shaft interference fit in fan hub	0.024 to 0.058 mm (0.0009 to 0.0023 in)
Face sealing bushing interference fit in impeller	0.012 to 0.058 mm (0.0005 to 0.0023 in)
Thermostat	
Type	WAX
Opening temperature	79 ± 2°C (175°F ± 2)
Fully open at	94°C (200°F)
Minimum valve travel when fully open	7.5 mm (0.2952 in)
Radiator	3-core (mod. 55-46) 4-core vertical tube and steel fins (mod. 65-46)
Fan	suction, steel, 4-bladed
Water Temperature Gauge	three coloured sectors
Temperature range:	
— white sector	30 to 65°C (85 to 150°F)
— green sector	65 to 105°C (150 to 220°F)
— red sector	105 to 115°C (220 to 240°F)

FUEL SYSTEM

Feed Pump	double diaphragm
Operation	engine driven
Minimum fuel flow at 1.600 rpm shaft	100 litre/hour (22 Gall/hour)
Drive shaft eccentricity	3 mm (0.118 in)
Feed Pump drive	
Shaft journal diameter	31.975 to 32.000 mm (1.2588 to 1.2598 in)
Bushing fitted I.D. after reaming	32.050 to 32.075 mm (1.2618 to 1.2628 in)
Shaft clearance in bushing	0.050 to 0.100 mm (0.0020 to 0.0040 in)
Bushing interference fit in housing	0.063 to 0.140 mm (0.0025 to 0.0055 in)
Inner washer thickness	1.450 to 1.500 mm (0.0025 to 0.0055 in)
Outer washer thickness	2.930 to 3.000 mm (0.1153 to 0.1181 in)

(continued)

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FUEL SYSTEM

(cont.)

Injection pump	distributor, integral governor and advance device
– BOSCH mod. 55 - 46	VE 3/11 F 1250 L163-1-4794587
– BOSCH mod. 65 - 46	VE 4/11 F 1250 L164-2 - 4804869
– CAV mod. 55 - 46	DPS 8522 A 010 A - 4797414
– CAV mod. 65 - 46	DPS 8520 A 140 A - 4806880
Direction of rotation	anticlockwise
Firing order mod. 55 - 46	1 - 2 - 3
Firing order mod. 65 - 46	1 - 3 - 4 - 2
Fuel injectors:	
Type WALTECNA	4802391
Type BOSCH	4792442
Type O.M.A.P.	4800032
WALTECNA nozzle holder	KBEL 83S1W200 - 4802392
WALTECNA spray nozzle	DLL 124S500W - 4802393
BOSCH nozzle holder	KBEL 83S35 - 4791124
BOSCH spray nozzle	DLLA 124S1001 - 4792443
O.M.A.P. nozzle holder	OKLL 83S3392 - 4796644
O.M.A.P. spray nozzle	OLL 124S3990 - 4792447
Number of spray orifices	4
Spray orifice diameter	0.31 mm (0.012 in)
Release pressure bar	230 to 238 (235 to 243 kg/cm^2) (3337 to 3450 psi)
Delivery pipes for mod. 55-46 with BOSCH pump	
– type	4797507
– pipe size	6 x 1.5 x 475 mm (0.23 x 0.06 x 18.7 in)
Delivery pipes for mod. 55-46 with CAV pump	
– type	4797512
– pipe size	6 x 2 x 475 mm (0.23 x 0.08 x 18.7 in)
Delivery pipes for mod. 65-46 with BOSCH pump	
– type	4797517
– pipe size	6 x 1.5 x 530 mm (0.23 x 0.06 x 20.9 in)
Delivery pipes for mod. 65-46 with CAV pump	
– type	4797523
– pipe size	6 x 2 x 530 mm (0.23 x 0.06 x 20.9 in)

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**MODEL 55-46 - CALIBRATION DATA - BOSCH INJECTION PUMP
TYPE VE 3/11F 1250 L 163-1-4794587 - 4800682 (Provisional data)**

ASSEMBLY DATA

Pump rotation (drive end) .... Anti-clockwise
Firing order 1-2-3

Rotor stroke to spill cut-off .... 0.2 ± 0.02
Pump timing: 6° ± 1° B.T.D.C., cylinder no. 1 in compression stroke.

Delivery connection of cylinder No. 1 marked with letter A.

TEST PLAN

Test bench in accordance with ISO 4008 standard.
Injectors in accordance with ISO 4010 standard: 1688901020 with 1680103096 pad.
Injector release pressure 172 : 175 bar.
Fuel pressure .... (2.8 psi) ... 0.2 bar (kg/cm²).
Pipes (in accordance with ISO 4093.2 standards) .... (0.2x0.07x33in) mm 6x2x840.
Burette draining time .... 30 sec.
Calibration fluid: ISO 4113 at 40° ± 2°C temperature. (104 ± 2°F)

REGULATION VALUES

Operation description	rpm	Advance piston stroke mm/in	Fuel internal pressure bar (kg/cm^2)	Injector delivery cm^3/1000 shots	Fuel pressure bar (kg/cm^2)	Delivery spead cm^3/1000 shots
Full load delivery	800	0.8 to 1.2 (0.03x0.4in)	3.8 to 4.4 (54 to 62 psi)	64.5 to 65.5 3.9 to 4 cu.in)	0.2 (2.8 psi)	3.5 (0.2 cu in)
Minimum speed limitation	350	–	–	21 to 25 (1.3 to 1.5 cu.in)	0.2 (2.8 psi)	3 (0.18 cu in)
Starting delivery	150	–	–	100 to 120 (6.1 to 7.3 cu.in)	0.2 (2.8 psi)	–
Maximum speed limitation	1350	–	–	32 to 38 (1.9 to 2.3 cu.in)	0.2 (2.8 psi)	–

TEST VALUES

Automatic advance device control	rpm	mm	Internal fuel pressure control	rpm	bar (kg/cm^2)	Back leakage	rpm	cm^3/100 shots
	600	0 to 0.6		600	3.0 to 3.6 (42 to 51 psi)			
	800	0.8 to 1.2			2.8 to 3.8 (40 to 54 psi)			
	1200	4.4 to 5.2		800	3.8 to 4.4 (54 to 62 psi)			
				1200	5.6 to 6.2 (80 to 88 psi)			

DELIVERY CONTROL

Maximum speed stop	rpm	Injector delivery cm^3/1000 shots	Fuel pressure bar (kg/cm^2)	Minimum speed stop	rpm	Injector delivery cm^3/1000 shots	Fuel pressure bar (kg/cm^2)
	1400 to 1460	0 (0 cu.in)	0.2 (2.8 psi)				
	1350	32 to 38 (2 to 2.3 cu.in)	0.2 (2.8 psi)		475	≤ 2 (0.1 cu.in)	0.2 (2.8 psi)
	1250	62.5 to 65.5 3.8 to 4 cu.in)	0.2 (2.8 psi)		425	4 to 10 (0.2 to 0.6 cu.in)	0.2 (2.8 psi)
	800	64.5 to 65.5 (3.9 to 4 cu.in)	0.2 (2.8 psi)		350	21 to 25 (1.3 to 1.5 cu.in)	0.2 (2.8 psi)
	500	56.5 to 59.5 (3.4 to 3.6 cu.in)	0.2 (2.8 psi)				
	250	≤55 (≤ 3.4 cu.in)	0.2 (2.8 psi)				

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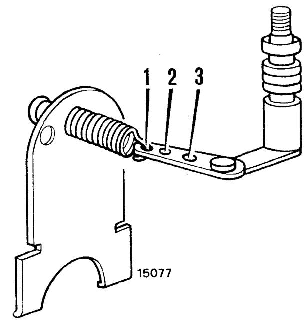
MODEL 55-46 - CALIBRATION DATA - CAV INJECTION PUMP TYPE DPS 8522 A 010A-4797414 (Provisional data)

ASSEMBLY DATA

Direction of rotation (drive end) . . . anticlockwise
Firing order 1-2-3
Governor control stud to metering valve lever pin . . . . mm 41 to 42 (1.61 to 1.65 in)
Pump timing: 0° ± 1° B.T.D.C., cylinder No. 1 in compression stroke.
Flange centering guide diameter . 50 mm (1.96 in)
Delivery connection ty cylinder No. 1: marked with letter U.

TEST PLAN

Test bench in accordance with ISO 4008 standard.
Injectors in accordance with ISO 4010 standard.
Injector release pressure 172:175 bar (175:178 kg/cm²; 2485:2527 psi).
Fuel pressure 0.1 bar (kg/cm² (1.42 psi).
Pipes (in accordance with ISO 4093.2 standards): mm 6x2x845 (0.23x0.08x33.3 in).
Burette draining time: 30 sec.
Calibration fluid: ISO 4113 at 40° ± 2°C (104± 2°F) temperature.
Position maximum delivery screw so that it projects 7.5 mm (0.3 in) from lock-nut.



Governor spring attachment hole: 2

Completely release transfer fuel pressure screw and rescrew by 3.5 turns.
Position notch fuel valve screw immediately below locknut surface.
Release completely maximum, minimum and idling screw.
In advance device, plug on spring side is fitted with a 2.5 mm (0.1 in) shim: no more are required.

Test No.	Throttle lever position	Speed rpm	Advance degrees	Fuel internal pressure bar (kg/cm²)	Injector delivery shots cm³/200	Delivery spread cm³/200	Back leakage cm³/100
1(1)		200	–	–	–	–	–
2(2)		1000	–	–	–	–	–
3		100	–	⩾0.4 (⩾2.8 psi)	–	–	–
4(+)		850	–	–	–	–	–
5(3)-6		900	3	4.2 : 5.2 (59.6:73.8 psi)	–	–	–
7(4)		1250	4.8:5.3	–	–	–	–
8-9	max	750	–	–	8.9:9.1 (0.54:0.55 cu.in)	⩾0.8 (0.05 cu.in)	40:80 (2.4:4.8 cu.in)
10(5)		1250	–	–	–	–	–
11 (6)		1420	–	–	1.5 : 2 (0.09 : 0.12 cu.in)	–	–
12(7)		1250	–	–	–	–	–
13 (8)		350	–	–	⩽12 (⩽0.73 cu.in)	–	–
14 (9)		250	0	–	⩾16 (⩾0.98 cu.in)	–	–
15 (10)		850	–	–	–	–	–
16 (11)		325	–	–	2 : 2.5 (0.12 : 0.15 cu.in)	–	–
17 (12)	min	325	–	–	⩽0.8 (⩽0.05 cu.in)	–	–
18 (13)		325	–	–	⩽0.5 (⩽ 0.03 cu.in)	–	–
19(14)		–	–	–	–	–	–

1) Delivery to all injectors.
2) Rotate pump 3 minutes.
3) Regulate fuel pressure screw to obtain advance specified, check that pressure is the specified one.
4) Stop test machine, remove transfer pressure gauge connection, assemble stopping device and activate it, restart test machine.
5) Measure mean delivery.
6) Regulate maximum speed screw and lock it.
7) Delivery must not be less than test No. 10. Less than 0.4 cm³/200 (0.02 cu.in/200) shots is permissible.
8) Before performing test bring test machine up to 100 RPM and stop it. Screw completely notch valve screw, restart test machine and release screw to obtain values specified.
9) Before performing test bring test machine up to 100 RPM, stop it and then restart it.
10) Adjust idling screw to obtain delivery of 2 to 3 cm³/2000 (0.12 to 0.18 cu.in/2000) shots, then lock.
11) Regulate minimum speed screw.
12) Stop lever closed.
13) With stopping device not activated and stop lever open, wait 5 sec. before performing test.
14) Connect U-connection outlet to injector tester and maintain 54 bar (766 psi) pressure, lock hydraulically with timing device, then set pump timing plat on +14°.
(●) Take reading after 15 sec. (○) Delivery 300 to 600 cm³/min (18 to 36 cu.in/min).
(+) Pump body pressure measured with pressure gauge connected to bleeding screw hole must be 0.1 to 0.3 bar (1.42 to 4.26 psi).

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MODEL 65-46 - CALIBRATION DATA - BOSCH INJECTION PUMP TYPE VE 4/11F 1250 L 164-2-4804869 (Provisional data)

ASSEMBLY DATA

Pump rotation (drive end) .... anti-clockwise
Firing order 1-2-3-4

Rotor stroke to spill cut-off .... mm 0.2 ± 0.5 .... (0.008 ± 0.002 in)
Pump timing: 4° ± 1° B.T.D.C., cylinder no. 1 in compression stroke.

Delivery connection of cylinder No. 1 marked with letter A.

TEST PLAN

Test bench in accordance with ISO 4008 standard.
Injectors in accordance with ISO 4010 standard: 1688901020 with 1 680 103 096 pad.
Injector release pressure .... 172:175 bar .... (175:178 kg/cm²; (2485 to 2527 psi).
Fuel pressure .... 0.2 bar (kg/cm² (2.8 psi).
Pipes (in accordance with ISO 4093.2 standards) .... mm 6x2x840 (0.2x0.07x33 in)
Burette draining time: .... 30 sec
Calibration fluid: ISO 4113 at 45° ± 1°C (113 ± 1°F) temperature.

REGULATION VALUES

Operation description	rpm	Advance piston stroke mm	Fuel internal pressure bar(kg/cm²)	Injector delivery cm³/1000 shots	Fuel pressure bar (kg/cm²)	Delivery spead cm³/1000 shots
Full load delivery	800	2.8 to 3.2 (0.11 to 0.12 in)	3.9 to 4.5 (55 to 64 psi)	62.5 to 63.5 (3.8 to 3.9 cu.in)	0.2 (2.8 psi)	3.5 (0.2 cu.in)
Minimum speed limitation	350	–	–	19 to 23 (1.2 to 1.4 cu.in)	0.2 (2.8 psi)	3 (0.18 cu.in)
Starting delivery	150	–	–	100 to 120 (6.1 to 7.3 cu.in)	0.2 (2.8 psi)	–
Maximum speed limitation	1350	–	–	32 to 38 (1.9 to 2.3 cu.in)	0.2 (2.8 psi)	–

TEST VALUES

Automatic advance device control	rpm	mm	Internal fuel pressure control	rpm	bar (kg/cm²)	Bock leakage	rpm	cm³/100 shots
	600	0.8 to 1.6 (0.03 to 0.06 in)		600	3.0 to 3.6 (42 to 51 psi)			
	800	2.8 to 3.2 (0.11 to 0.24 in)		800	3.9 to 4.5 (55 to 70psi)			
	1200	5.4 to 6.2 (0.21 to 0.24 in)		1250	6.0 to 6.6 (85 to 94 psi)			

DELIVERY CONTROL

Maximum speed stop	rpm	Injector delivery cm³/1000 shots	Fuel pressure bar (kg/cm²)	Minimum speed stop	rpm	Injector delivery cm³/1000 shots	Fuel pressure bar (kg/cm²)
	1375	11 to 17 (0.7 to 0.1 cu.in)	0.2 (2.8 psi)				
	1400	<2 (<0.1 cu.in)	0.2 (2.8 psi)				
	1350	32 to 38 (2 to 2.3 cu.in)	0.2 (2.8 psi)		450	⩽2 (⩽0.1 cu.in)	0.2 (2.8 psi)
	1250	54 to 57 (3.3 to 3.5 cu.in)	0.2 (2.8 psi)		400	6 to 12 (0.3 to 0.7 cu.in)	0.2 (2.8 psi)
	800	62.5 to 63.5 (3.8 to 3.9 cu.in)	0.2 (2.8 psi)		350	19 to 23 (1.2 to 1.4 cu.in)	0.2 (2.8 psi)
	600	59.5 to 62.5 (3.6 to 3.8 cu.in)	0.2 (2.8 psi)				
	250	⩽47 (⩽2.8)	0.2 (2.8 psi)				
	150	100 to 120 (6.1 to 7.3 cu.in)	0.2 (2.8 psi)				

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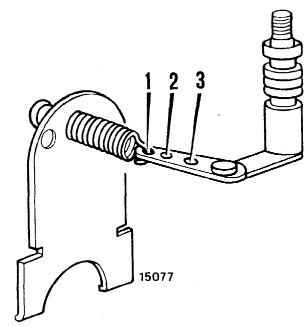
MODEL 65 - 46 - CALIBRATION DATA - CAV INJECTION PUMP TYPE DPS 8520 A 140 — 4806880 (Provisional data)

ASSEMBLY DATA

Direction of rotation (drive end) . . . anticlockwise
Firing order 1-3-4-2
Governor control stud to metering valve lever pin 41 - 42 mm. . . . . .(1.61 to 1.65 in)
Pump timing: 0° ± 1° B.T.D.C., cylinder No. 1 in compression stroke.
Flange centering guide diameter . 50 mm (1.97 in)
Delivery connection to cylinder No. 1: marked with letter U.

TEST PLAN

Test bench in accordance with ISO 4008 standard.
Injectors in accordance with ISO 4010 standard.
Injector release pressure 172 : 175 bar (175 : 178 kg/cm²; 2485 : 2527 psi).
Fuel pressure 0.1 bar (kg/cm² (1.42 psi).
Pipes (in accordance with ISO 4093.2 standards) mm 6x2x845 (0.23x0.007x33 in).
Burette draining time: 30 sec.
Calibration fluid: ISO 4113 at 40° ± 2°C temperature (104±2°F). Position maximum delivery screw so that it projects 9.5 mm (0.38 in) from lock-nut.



Governor spring attachment hole: 2

Completely release transfer fuel pressure screw and rescrew by 3.5 turns.
Position notch fuel valve screw immediately below locknut surface.
Release completely maximum, minimum and idling screw. In advance device, plug on spring side is fitted with a 3 mm (0.1 in) shim: no more is required.

Test No.	Throttle lever position	Speed rpm	Advance degrees	Fuel internal pressure bar (kg/cm²)	Injector delivery cm³/200 shots	Delivery spread cm³/200 shots	Back leakage cm³/100 shots
1(1)	max	200	–	–	–	–	–
2(2)		1000	–	–	–	–	–
3		100	–	⩾0.4 (5.7 psi)	–	–	–
4(3)-5		950	4.5	4.2 to 5.4 (60 to 77 psi)	–	–	–
6(4)		1250	6.8 to 7.8	–	–	–	–
7 - 8		750	–	–	8.4 to 8.6 (●) (0.51 to 0.52 cu.in)	⩽0.8 (0.05 cu.in)	40 to 80 (2.4 to 4.8 cu.in)
9(5)		1250	–	–	–	–	–
10(6)		1420	–	–	1.5 to 2 (0.09 to 0.12 cu.in)	–	–
11(7)		1250	–	–	–	–	–
12(8)		300	1.8 to 2.8	–	–	–	–
13(9)		250	0	–	⩾1.6 (0.09 cu.in)	–	–
14(10)	min	850	–	–	–	–	–
15(11)		350	–	–	2 to 2.5 (0.12 to 0.15 cu.in)	–	–
16(12)		350	–	–	⩽0.8 (0.05 cu.in)	–	–
17(13)		350	–	–	⩽0.5 (0.03 cu.in)	–	–
18(14)		–	–	–	–	–	–

1) Delivery to all injectors.
2) Rotate pump 3 minutes.
3) Regulate fuel pressure screw to obtain advance specified, check that pressure is the specified one.
4) Stop test machine, remove transfer pressure gauge connection, assemble stopping device and activate it. restart test machine.
5) Measure mean delivery.
6) Regulate maximum speed screw and lock it.
7) Delivery must not be less than test No. 10. Less than 0.4 cm³/200 shots (0.02 cu.in) is permissible.
8) Before performing test bring test machine up to 100 RPM and stop it. Screw completely notch valve screw, restart test machine and release screw to obtain values specified.
9) Before performing test bring test machine up to 100 RPM, stop it and then restart it.
10) Adjust idling screw to obtain delivery of 2 to 3 cm³/2000 shots, (0.12 to 0.18 cu.in) then lock.
11) Regulate minimum speed screw.
12) Stop lever closed.
13) With stopping device not activated and stop lever open, wait 5 sec. before performing test.
14) Connect U-connection outlet to injector tester and maintain 54 bar (766 psi) pressure, lock hydraulically with timing device, then set pump timing plate on +8,5°

(●) Take reading after 15 sec. (0). Delivery 300 to 600 cm³/min. (18 to 36 cu.in).

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TIGHTENING TORQUE ANGLES

DESCRIPTION	Thread size	Initial tightening torque			Angle
		Nm	kgm	ft. lbs	
Cylinder head capscrews (C_1, pp. 15 & 16) (*) .	M12 x 1.25	60	6.1	44	90° + 90°
Main bearing cap capscrews (C_2) (*)	M14 x 1.5	80	8.2	60	90°
Connecting rod caps capscrews (C_3) (*)	M11 x 1.5	40	4.1	30	60°
Flywheel capscrews (C_4) (*)	M12 x 1.25	40	4.1	30	60°

(*) In case of capscrew re-use, see drawings & notes page 14.

TIGHTENING TORQUES

DESCRIPTION	Thread size	Tightening torque		
		Nm	kgm	ft.lbs
Rocker bracket capscrews (C_5, pp 15 & 16)	M8 x 1.25	24	2.5	18
Crankshaft pulley hub nut (C_6)	M30 x 1.5	294	30	216
Additional weight capscrews (mod. 65-46)	M12 x 1.25	110	11.2	80

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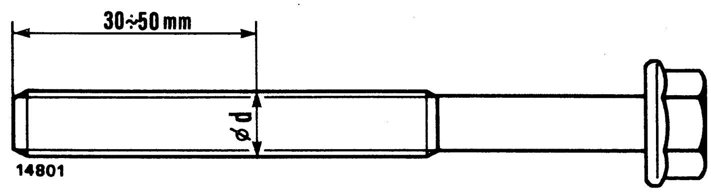
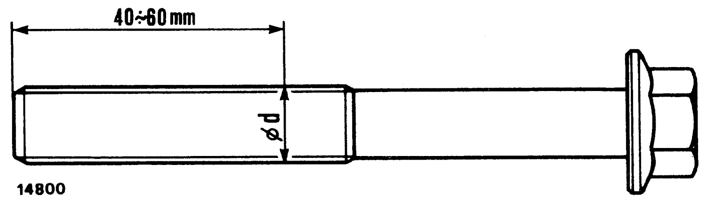


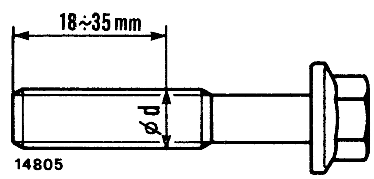
Cylinder head capscrews (C_1, pp 15 & 16)

In case of capscrew re-use, check that diameter **d** (measured as in above figure) is greater than 11.5 mm (0.45 in), otherwise reject capscrews.



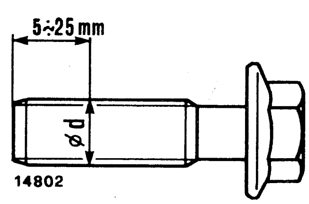
Main bearing cap capscrews (C_2, pp 15 & 16)

In case of capscrew re-use, check that diameter **d** (measured as in above figure) is greater than 13.5 mm (0.53 in), otherwise reject capscrews.



Connecting rod caps capscrews (C_3, pp 15 & 16)

In case of capscrew re-use, check that diameter **d** (measured as in above figure) is greater than 10.5 mm (0.41 in), otherwise reject capscrews.



Flywheel capscrews (C_4, pp 15 & 16)

In case of capscrew re-use, check that diameter **d** (measured as in above figure) is greater than 11.5 mm (0.45 in), otherwise reject capscrews.

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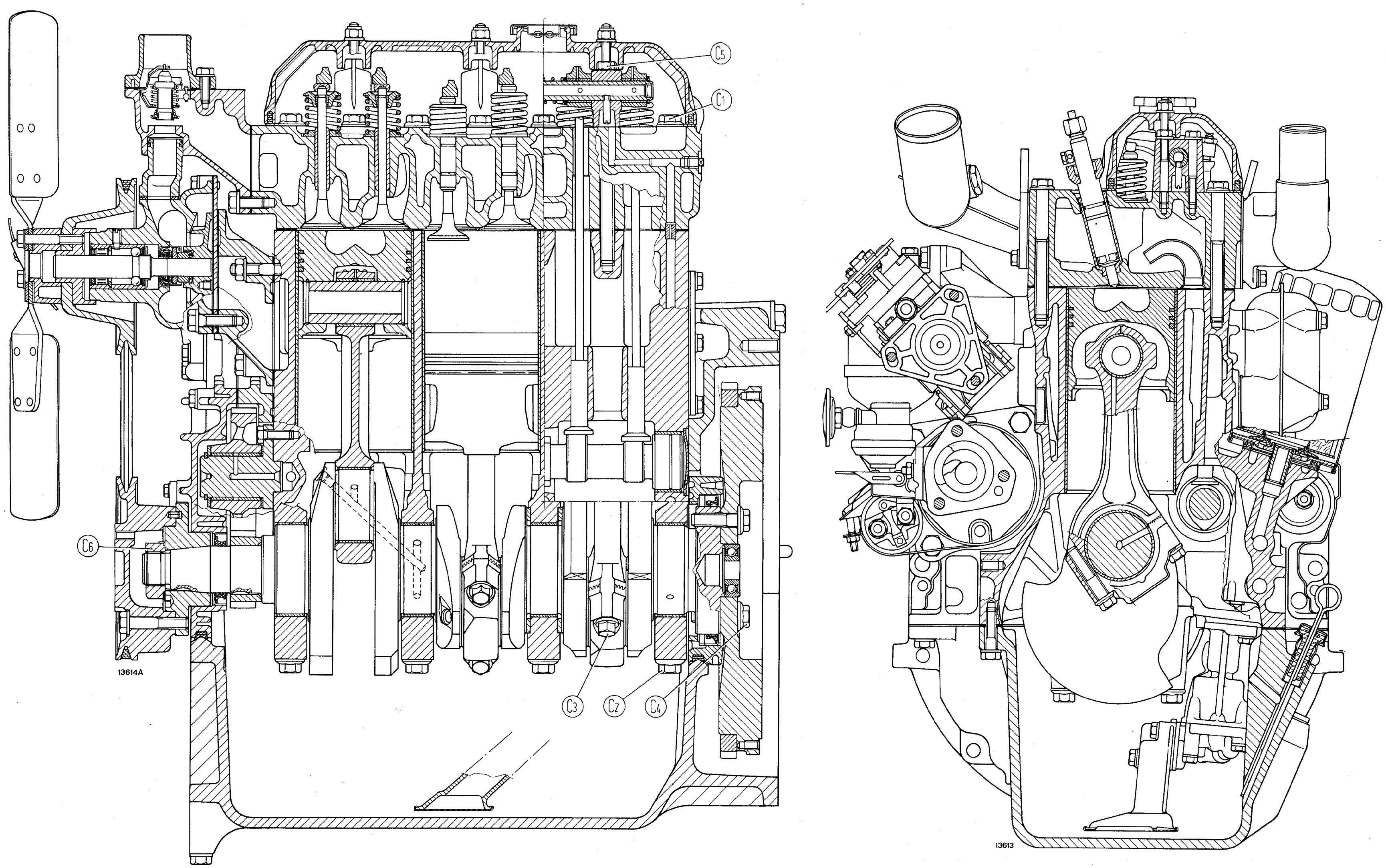

Longitudinal and cross-sections mod. 55 - 46

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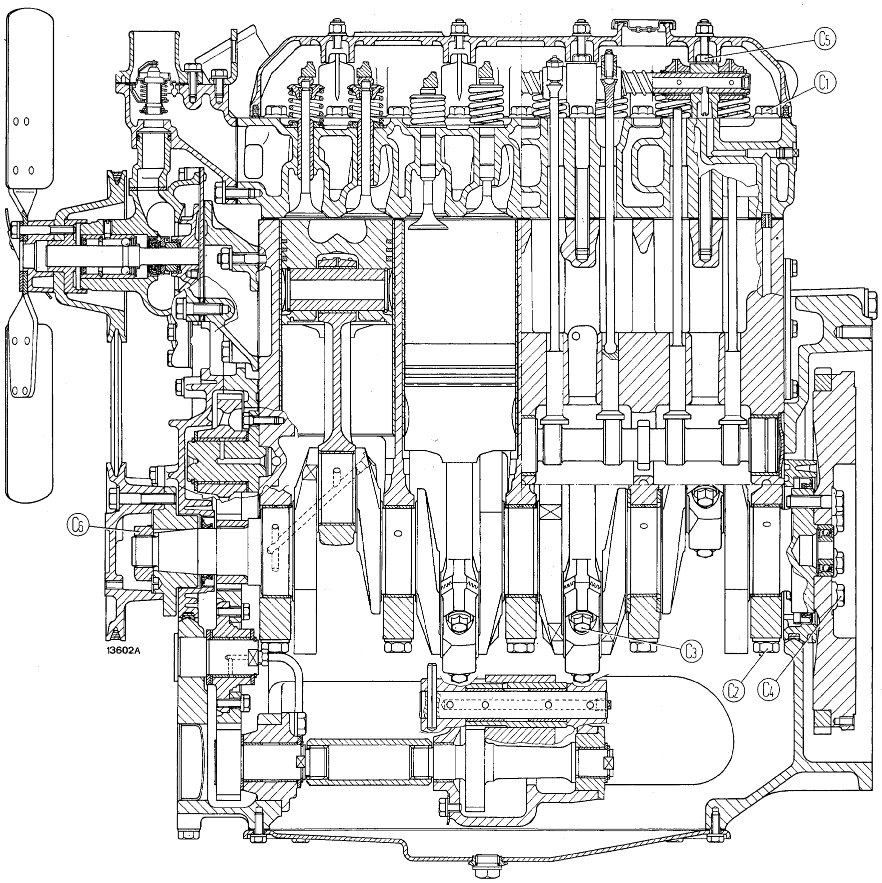

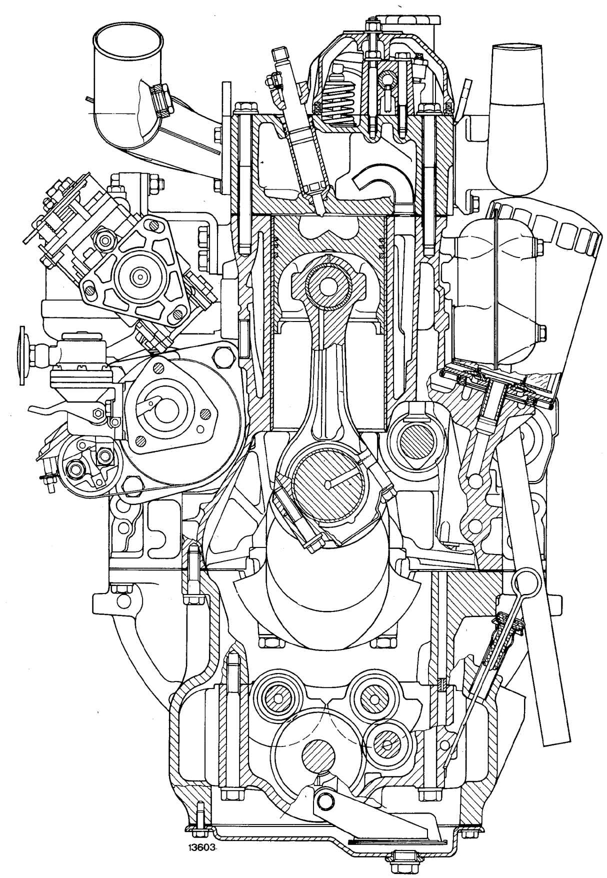

Longitudinal and cross-sections mod. 65 - 46

DESCRIPTION

FIAT engines installed on 55-46 & 65-46 models are high-speed, 4-stroke, direct injection, in-line Diesel units.

Engine block: Single iron casting, dry sleeve, crankshaft, camshaft and valve tappet seats.

Cylinder head: integral valve seats.

Valve gear: pushrod operated valves, helical gear driven camshaft.

Crank gear: crankshaft running on 4 bearings for mod. 55 - 46 and on 5 bearings for mod. 65 - 46, with 3-ring light alloy piston. (One compression ring and two oil scraper rings). A balancing device with reverse rotation weights in engine pump for 65 - 46 mod. reduces motor vibrations and those produced by it on other units.

Air induction system: Throught oil-bath or dry air cleaner.

Fuel system: Rotating distributor injection pump, four-orifice injectors.

Lubrication system: Forced-feed, gear pump, full-flow oil filter and pressure relief valve.

Cooling system: Water, centrifugal pump, wax thermostat.

Engine starting: 12 V, electromagnetically operated starter and thermostarter (if applicable).

ON-BENCH PERFORMANCE DATA

Test plan

Engine without fan, air cleaner and exhaust silencer.
Barometric pressure 740 ± 5 mm Hg at 239 metres (785 ft) above sea level.
Ambient temperature: 20 ± 3°C (68 ± 3°F).
R. H. 70% ± 5.

Fuel density, 830 ± 10 g/l.
Pump timing, B.T.D.C. cylinder No. 1 on compression stroke:

– 55-46 mod. BOSCH .... 6° ± 1°
– 55-46 mod. C.A.V. .... 0° ± 1°
– 65-46 mod. BOSCH .... 4° ± 1°
– 65-46 mod. C.A.V. .... 0° ± 1°

Mod. 55 - 46 – BOSCH injection pump

Throttle	rpm	kW		Fuel consumption
		2-hour run-in	50-hour run-in	kg/h
Maximum, full load	2500	36.7 (50 CV)	38.2 (52 CV)	9 to 9.4
Maximum, full torque	1500	25.6 (34.8 CV)	26.7 (36.3 CV)	5.8 to 6.2
Maximum, no-load	2750 to 2790	–	–	–
Minimum, no-load	625 to 675	–	–	–

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Mod. 55 - 46 — C.A.V. injection pump

Throttle	rpm	kW		Fuel consumption kg/h
		2-hour run-in	50-hour run-in	
Maximum, full load	2500	36.7 (50 CV)	38.2 (52 CV)	9 to 9.4
Maximum, full torque	1500	25.6 (34.8 CV)	26.7 (36.3 CV)	5.8 to 6.2
Maximum, no-load	2750 to 2790	—	—	—
Minimum, no-load	625 to 675	—	—	—

NOTE — Provisional values

Mod. 65 - 46 — BOSCH injection pump

Throttle	rpm	kW		Fuel consumption kg/h
		2-hour run-in	50-hour run-in	
Maximum, full load	2500	46.4 (63 CV) (*)	47.8 (65 CV)	11 to 11.4
Maximum, full torque	1500	31.6 (43 CV (*)	32.8 (44.6 CV)	7.1 to 7.6
Maximum, no-load	2750 to 2790	—	—	—
Minimum, no-load	625 to 675	—	—	—

NOTE — Provisional values
(*) Forecast values

Mod. 65 - 46 — C.A.V. injection pump

Throttle		kW		Fuel consumption kg/h
		2-hour run-in	50-hour run-in	
Maximum, full load	2500	46.4 (63 CV) (*)	47.8 (65 CV)	11 to 11.4
Maximum, full torque	1500	31.6 (43 CV) (*)	32.8 (44.6 CV)	7.1 to 7.6
Maximum, no-load	2750 to 2790	—	—	—
Minimum, no-load	625 to 675	—	—	—

NOTE-Provisional values
(*) Forecast values

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CYLINDER SLEEVES

To inspect for wear proceed as follows:

- measure the sleeve bore diameter over the swept area (X);
- the diameter reading should be taken in both the upper and lower part of the swept area in plane (a) parallel to the crankshaft and in plane (b) at right angles to it;
- compare the readings to establish the amount of sleeve ovality and taper.

To check the piston working clearance measure the liner bore diameter over (Z) in plane (b) only.

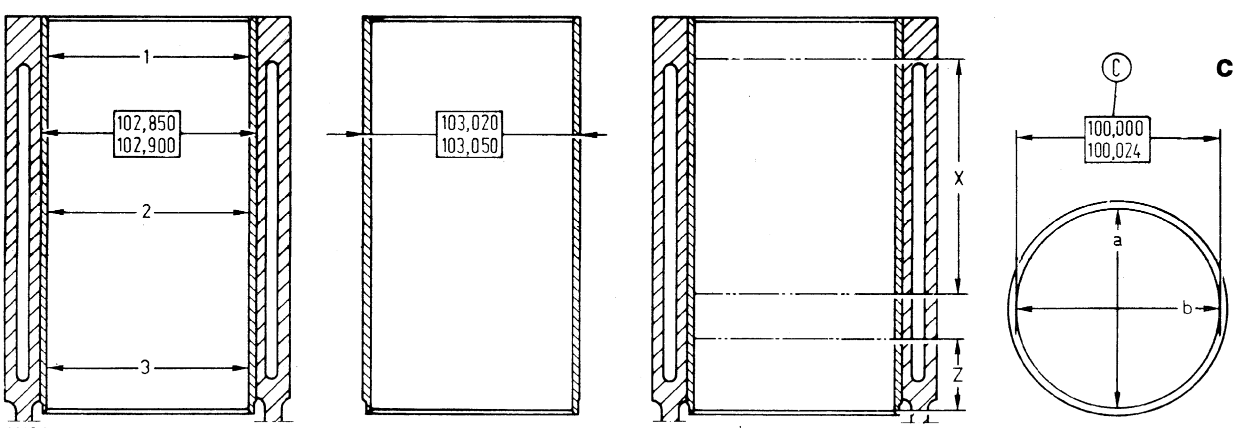
If ovality or taper in excess of 0.12 mm (0.0048 in), or piston working clearance in excess of 0.3 mm (0.12 in) is detected, rebore (or renew) the sleeves to the oversize values envisaged (see table on page 1, Section 10).

After machining, check the size by taking 2 dial gauge readings at rights angles (a and b, page 1) and at 3 depths (1, 2 and 3).

Subsequently, fit replacement pistons of suitable size and weight (see page 3, section 10).

For sleeve removal and installation, do not heat sleeves, use a suitable press and proceed as follows:

- withdraw the worn sleeve from the bottom of the engine block using plate **292507**;
- check engine block bore ovality and if necessary rebore to 0.2 mm (0.008 in) oversize;
- press a new sleeve (0.2 mm oversize if necessary) from the top of the block using plate **291501**;
- ream the sleeve to the specified diameter.



Sleeve and Block inspection Data

a, b. Sleeve bore measurements at right angles — C. Sleeve fitted bore diameter (see table, page 1, Section 10) — Z. Sleeve wear inspection length for assessment of piston fit on plane a at right angles to crankshaft - X. Sleeve wear inspection length (swept area) for assessments of ovality and taper on planes a and b — 1, 2, 3. New or re-bored sleeve bore measuring depth on planes a and b.

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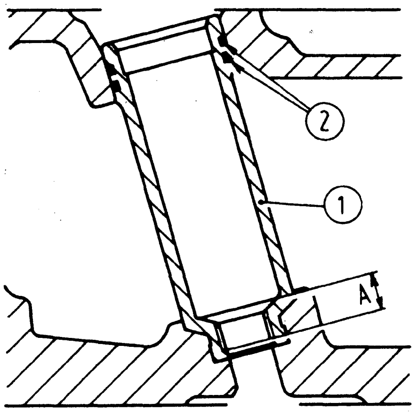
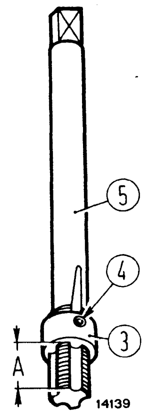
CYLINDER HEAD





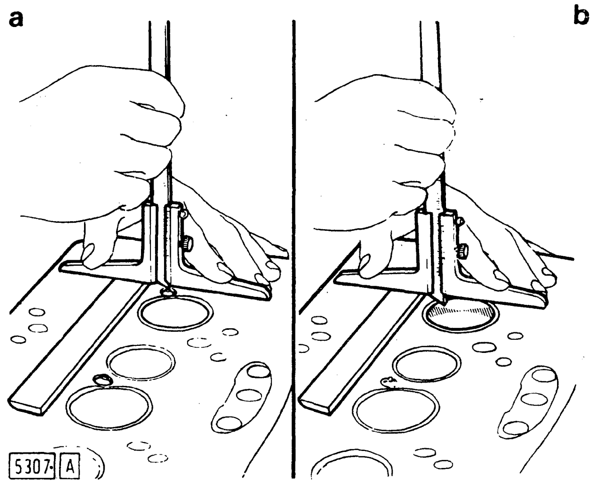
Injector sleeve threading on cylinder head with tool (5) 292240 (IVECO 390425).

A ≅ 9 mm (0.35 in). Depth of threaded hole (M12x1.75) for injector sleeve removal (1). - 1. Injector sleeve - 2. O-rings - 3. Ring nut - 4. Lock-screw.

The cylinder head face may be skimmed if necessary, removing not more than 0.5 mm (0.02 in).

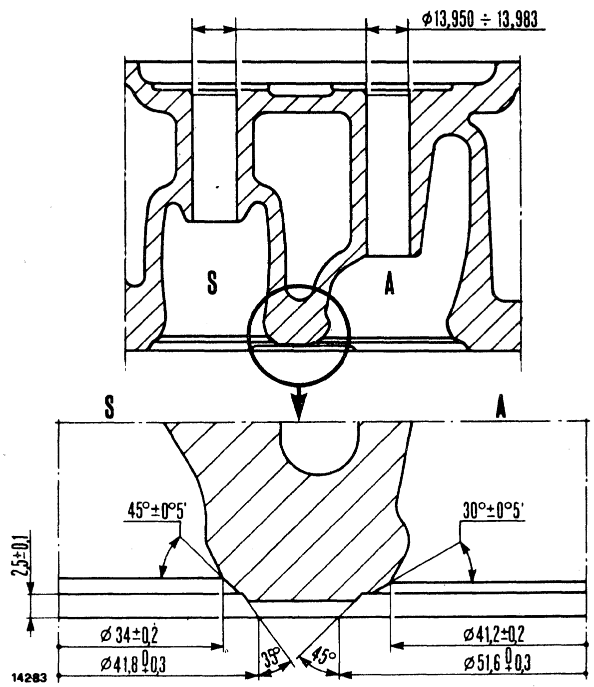
After skimming, check that fuel injector projection is as specified in the illustration. If projection is more than 1.0 mm (0.04 in) replace injector sleeve as follows:

– regulate dimension A on tool (5) **292240 IVECO 390425**) to 9 mm (0.35 in) with ring nut (3) and lock with lock-screw (4).



Checking injector stand-out and valve seating

a. Injector stand-out: 0.05 to 0.7 mm (0.0019 to 0.027 in) (max permissible stand-in: 1.3 mm (0.05 in) - b. Valve stand-in: 0.7 - 1.0 mm (0.027 to 0.04 in) (max permissible stand-in: 1.3 mm (0.05 in).



Valve seat and guide housing dimensions (mm)

A. Inlet - B. Outlet

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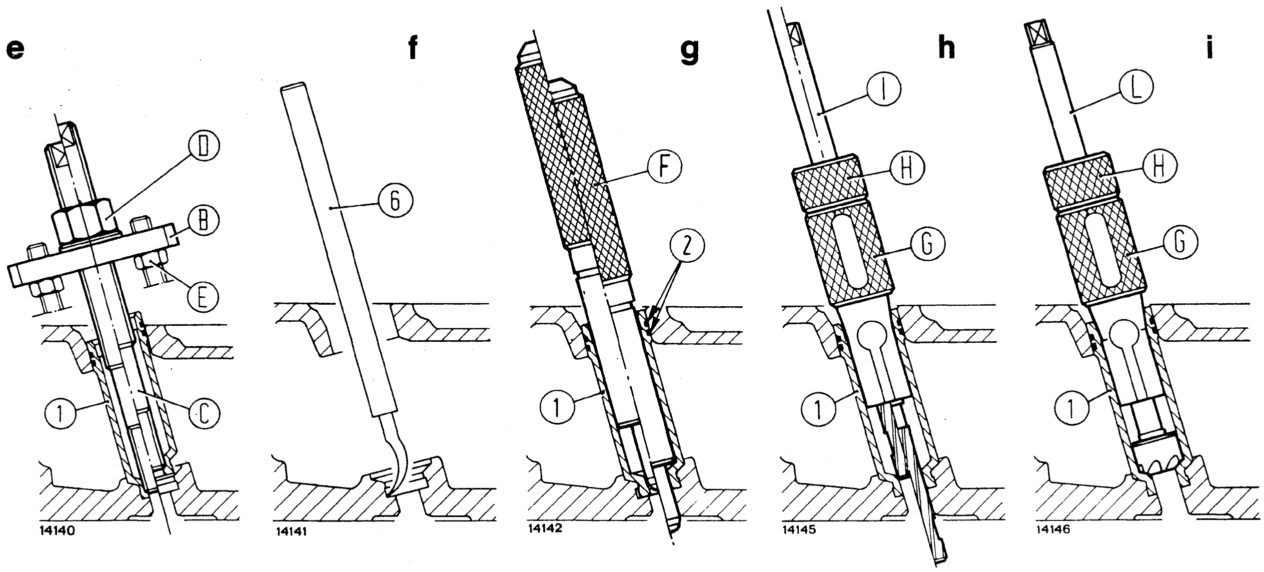


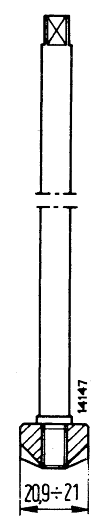
Disassembly (e), removal of material (f), assembly (g) and dressing (h, i) injector sleeve on cylinder head with set 293742/2

B, C, D. Sleeve puller **293784 (IVECO 342137)** - E. Injector nuts M8 x 1.25 - F. Burnisher **293861** - **G, H. Guide bushing 293746/1** - I. Dresser **293747** - L. Cutter **293790/1** - 1. Injector sleeve - 2. O-rings - 6. Material removal tool **292243 (IVECO 390771)**

- thread inside seat of injector sleeve with tap **292240 (IVECO 390425)** (M12 x 1.75) checking that threading is only on injector sleeve;
- secure sleeve puller (B, fig. e) **293784 (IVECO 342137)** to cylinder head screwing nuts (E) M8 x 1.25 on injector retaining studs;
- fully tighten on previously made thread assembly (C) and turn nut (D) so as to pull sleeve (1) from cylinder head;
- with tool (6) **292243 (IVECO 390771)** remove from cylinder head any material (of copper) left by sleeve pulled, as in fig. f;
- provide new sleeve to be assembled with gaskets (2, fig. g), fit in housing, ensure that lower part contacts seat in cylinder head and proceed to burnish with burnisher **293861** (F, fig. g);
- insert in new sleeve (1, fig. h) bushing (G) **293746/1**, fit in housing turning ring-nut (H) clockwise, insert dresser (I) **293747** in bushing (G) and dress sleeve lower part;
- disassemble dresser (I) and unscrew ring-nut (H) by about 10 mm.
- press by hand, or tap lightly with plastic head hammer, ring-nut (H) to release inside body of bushing (G) **293746/1**;
- disassemble bushing, fit cutter (L, fig. i) **293790/I** in bushing, place latter in sleeve (I) and fasten by screwing ring-nut (H) clockwise.

Modification to be made, by skimming, to cutter 293790 to transform into cutter 293790/1.

20.9 to 21 mm (0.822 to 0.826 in) = cutter **293790/1** dimension (for cutter **293790** this dimension was 21.9 to 22 mm (0.862 to 0.866 in).



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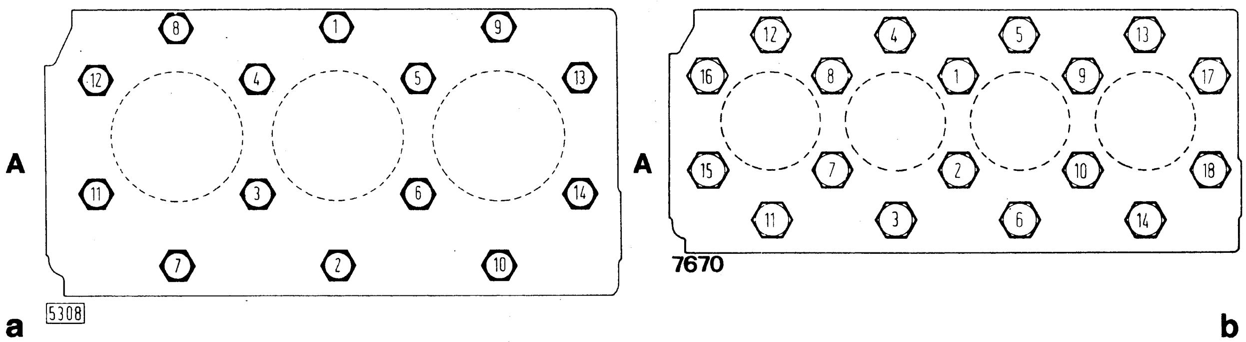
ENGINE: Cylinder Head



Cylinder head bolt tightening sequence
a. Mod. 55 - 46 - b. Mod. 65 - 46 - A = Fan end

- using cutter, remove material until seat is perfectly smooth and free from burrs or tool marks;
- when dressing is completed insert injector in sleeve (1, page 3) and check that stand-out is 0.05 to 0.07 mm (0.0019 to 0.0027 in) (fig. a page 2).

Note - To transform cutter **293790** (of **293742/1** set) into **293790/1** it must be skimmed until dimension shown in fig. a, p. 3 is 20.9 to 21 mm (0.82 to 0.83 in) (for cutter **293790** it was 21.9 to 22 mm) (0.8622 to 0.866 in).

To recut valve seats, use fixture **291113** and universal hand lathe **292913**.
On completion of this operation, check that valve seating stand-in from cylinder head plane does not exceed the one shown in fig. b on page 2.

When installing the cylinder head, thoroughly clean the mating surfaces and reposition the head gasket noting the following points: place the gasket on the block with the mark "ALTO" facing towards the cylinder head. Replace the cylinder head and tighten the retaining bolts to the correct torque in the order shown in figs. a & b.

Note - The required cylinder head capscrew tightening torque must be obtained in four stages (capscrew tightening with an initial torque of 60 Nm, 6,1 kgm - 44 ft lbs check of same, capscrew tightening through a tightening angle of 90°, further capscrew tightening through 90°) as shown in table below.

STAGE	1	2	3	4
All models	Initial tightening torque	Initial tightening torque check	Tightening angle angle	
	60 Nm (6.1 kgm) (44 ft lbs)	60 Nm (6.1 kgm) (44 ft lbs)	90°	90°

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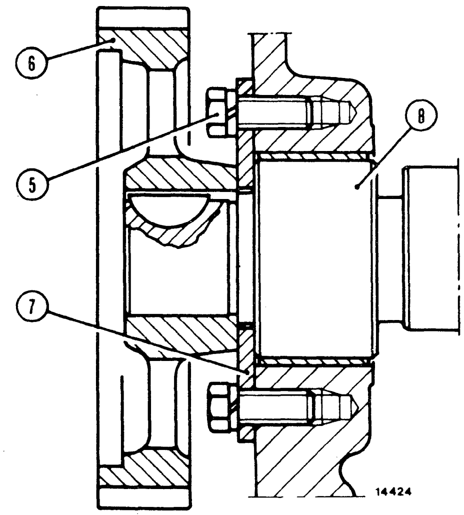
CAMSHAFT

Follow text and figures of p. 1, Section 102, for **446** Model.

Figure shown at side replaces the equivalent figure of p. 1, Section 102, concerning previous model.

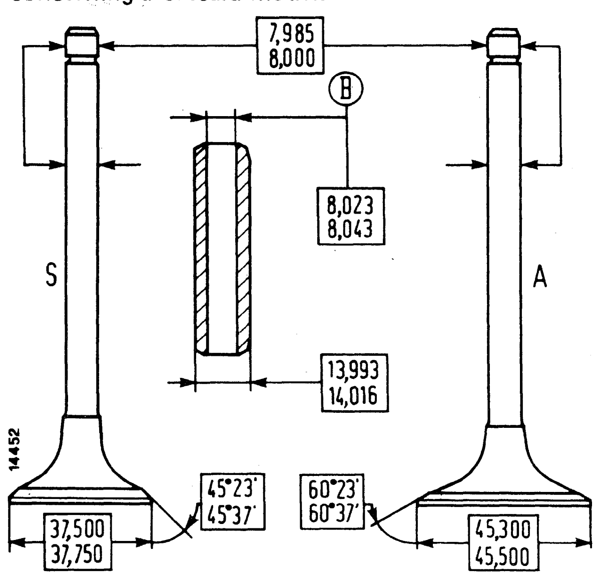


Section through Camshaft Drive

5. Retaining screw for plate (7) - 6. Drive gear - 7. Thrust plate - 8. Camshaft

VALVES, GUIDES AND SPRINGS

Follow descriptions of pp 1 & 2, Section 102, for **446** Model, apart from figure below which replaces the equivalent figure of p. 2, Section 102, concerning aforesaid model.



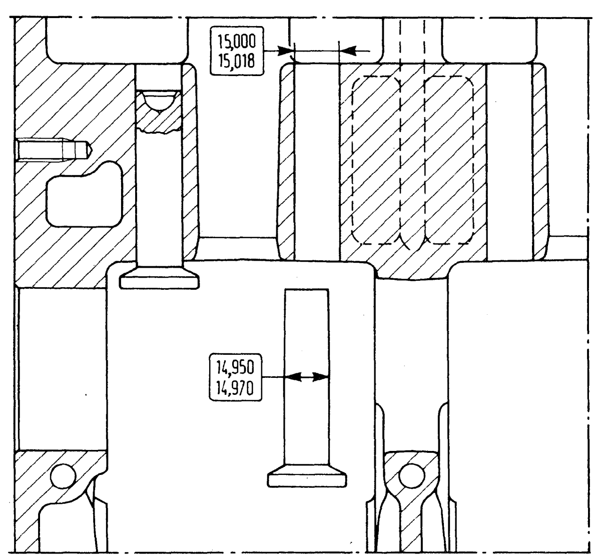
Valve and guide details (mm)

A. Inlet - B. Fitted diameter after reaming - S. Exhaust

TAPPETS, PUSHRODS AND ROCKERS

Follow text of p. 2, Section 102, for **446** Model.

Figure below replaces equivalent figure of p. 2, Section 102 of previous Model.



Tappet and housing details (mm)

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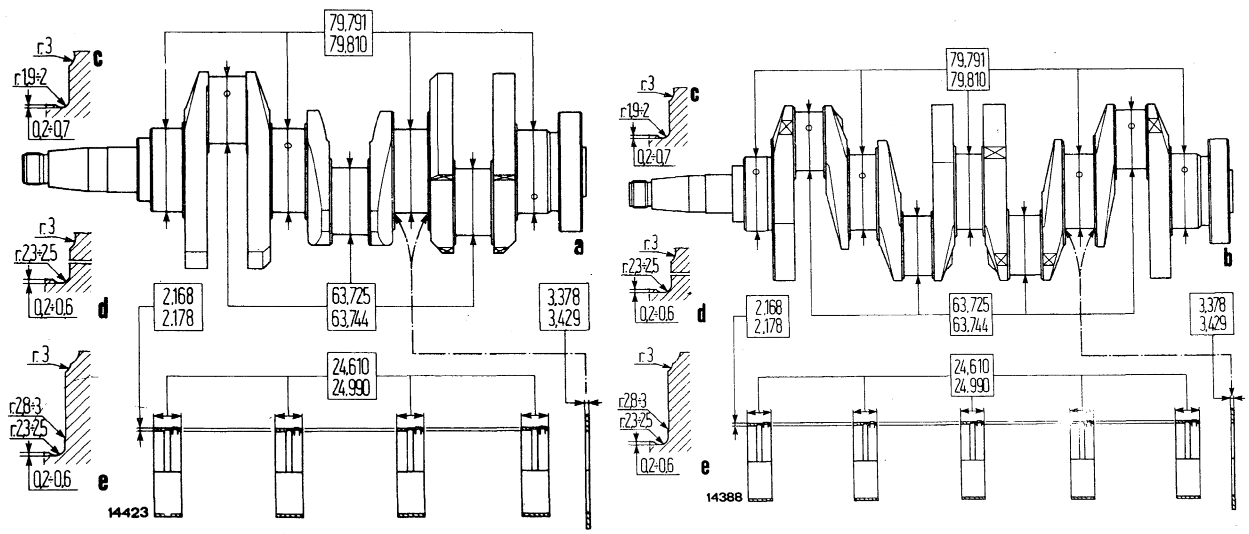
CRANKSHAFT

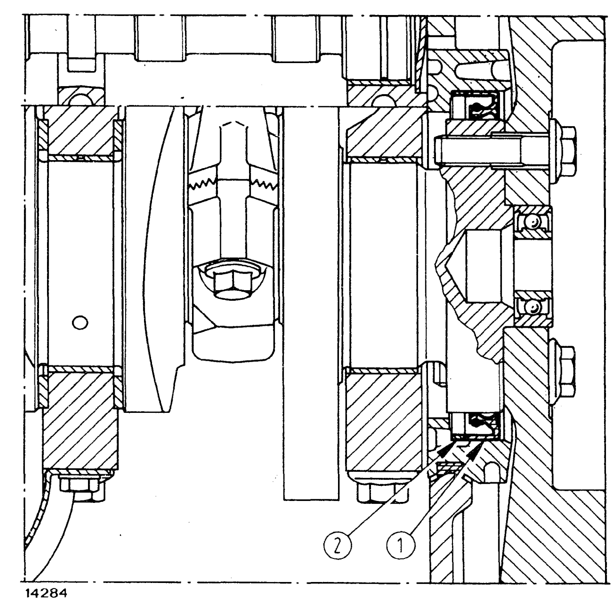
Follow descriptions of pp 1 & 2, Section 103 of **446** Model, apart from figure below.



Normal dimensions (mm) of crankshaft journals, main bearings and of thrust washers

a. Mod. 55 - 46 - b. Mod. 65 - 46 - c. Crankpin fillet radii detail - d. Main journal fillet radii detail - e. Main journal fillet radii with thrust washer detail

Note - In case of replacement of sealing gasket (1), spacer (2) has to be disassembled too. The new gasket must then be fitted without the spacer (2), to prevent it from working in the same position of the previous gasket.



Replacement of crankshaft sealing gasket (1)
1. Spacer

PISTONS AND PISTON RINGS

Follow descriptions in pp 2 & 3, Section 103 for **446** Model, apart from figure of next page. For the new models, piston diameter is measured 57 mm (2.24 in) from skirt base and no longer 50 mm (2.36 in) as for the previous models.

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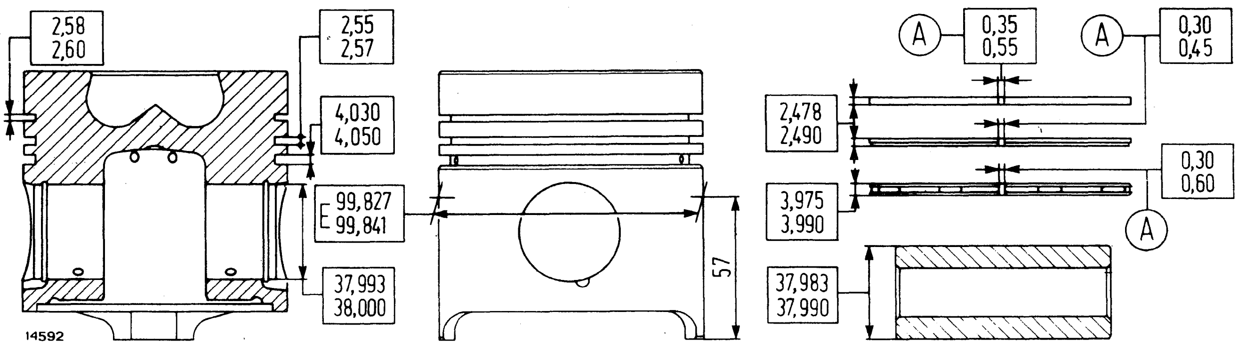
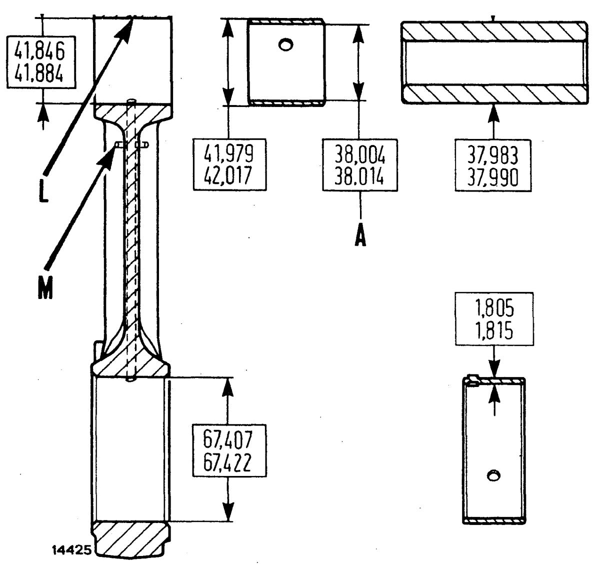


Dimensions (mm) of normal pistons, pins and rings

A. Dimension to be measured with rings in sleeves - E. Piston diameter measured 57 mm (2.24 in) from skirt base



CONNECTING RODS

Follow descriptions in pp 3 & 4, Section 103, for **446** Model, apart from figure at side and it should be noted that oversize crankpins are no longer supplied.

Connecting rod, bearing, bush and piston pin normal dimensions (mm)

A. Dressed requirement with bushes fitted - L. M. Drilled oilways

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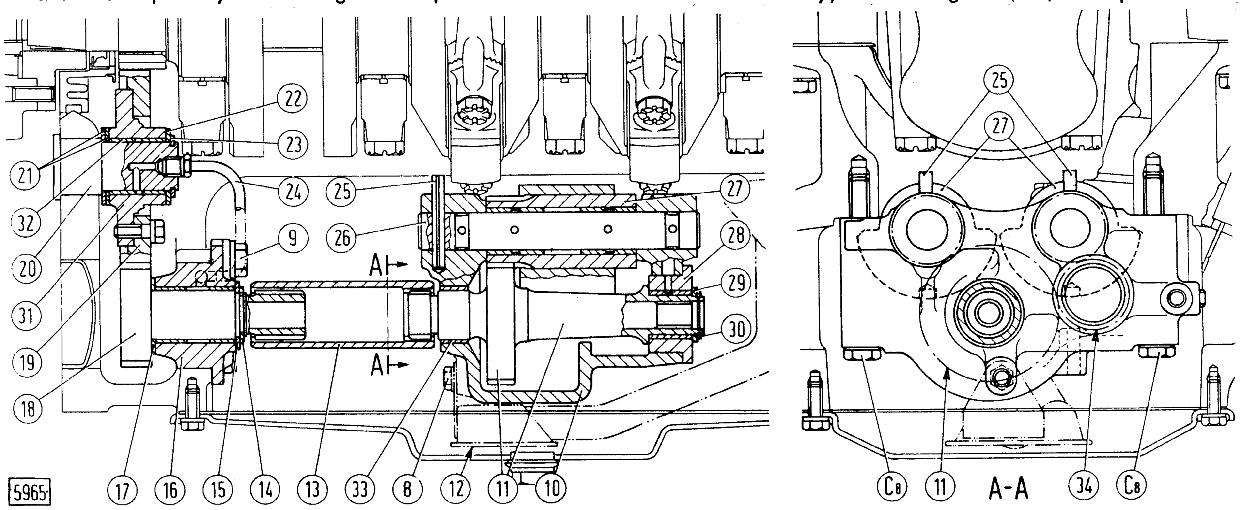
CONTRAROTATING MASS BALANCER

Balancer overhaul (Mod. 65 - 46)

To remove unit, proceed as follows:

– drain completely oil in engine sump and remove lower cap;
– remove oil pump rose, remove screws (C_8) and remove contrarotating mass unit;
– if necessary, remove gear (18) complete with

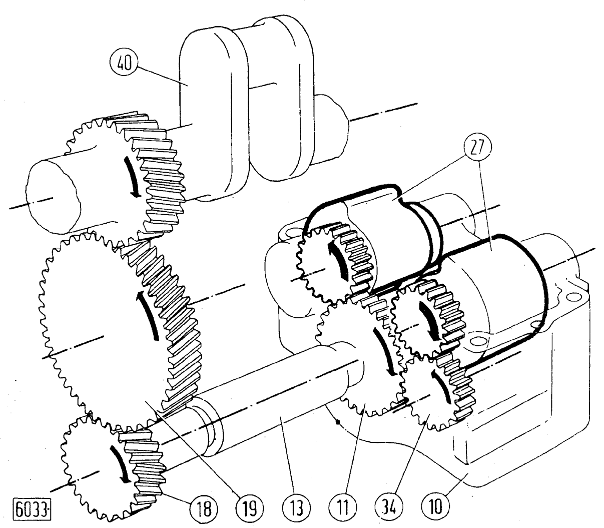


Balancing unit cross section (Mod. 65 - 46)

C_8 - Screws securing mass case to sump - 8. Screws securing rose to mass case (10) - 9. Screws securing housing (16) to sump - 10. Mass case - 11. Mass drive gear - 12. Rose - 13. Stiff connection coupling - 14. Spring retaining ring - 15. Thrust bearing - 16. Gear (18) housing - 17. Thrust bearing - 18. Gear with mass power drive - 19. Idler gear - 20. Gear (19) shaft - 21. Thrust bearings - 22. Thrust bearings - 23. Spring retaining ring - 24. Bush (32) lubrication tube - 25. Mass shaft (26) spring pin - 26. Mass shaft - 27. Masses - 28. Mass drive gear (11) housing - 29. Thrust bearing - 30. Spring retaining ring - 31. Gear (19) housing - 32. Bushes - 33. Bushes - 34. Mass drive idler gear

Operating schematic of contrarotating mass balancer (Mod. 65 - 46)

10. Mass case - 11. Mass drive gear - 13. Stiff coupling - 18. Gear with mass power drive - 19. Idler gear - 27. Masses - 34. Mass drive idler gear - 40. Drive shaft



– Take off the suction scoop, remove screws (C_8) and take off flyweight assembly.

If necessary, remove gear (18) with attached flange (16) withdrawing oil pipe (24) and capscrews (9).

Disassemble contrarotating mass unit as follows:

– withdraw spring pins (25) and disassemble mass shafts by punch blows;

– disassemble drive gear (11), removing spring ring (30), page 4 and screws (7), page 4 securing housing;

– disassemble idler gear (34) removing spring ring (36) page 4.

Check wear of parts, replacing damages ones and dress inside of bushes replaced using expanding blade dressers **290001 & 291242.**

Mass bushes must be fitted in their housing after heating masses in oil at 140-160°C (285 to 320°F).

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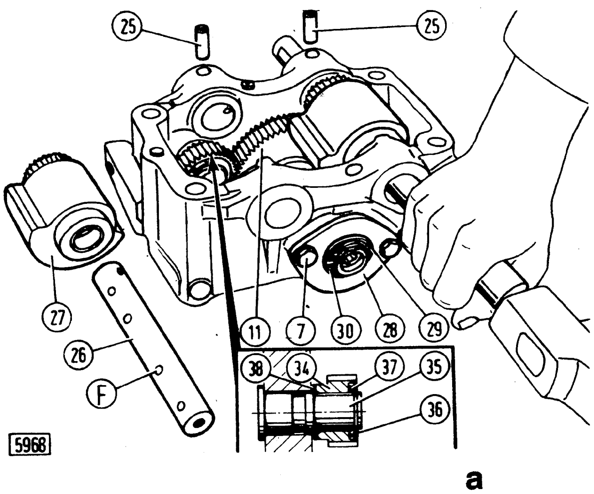
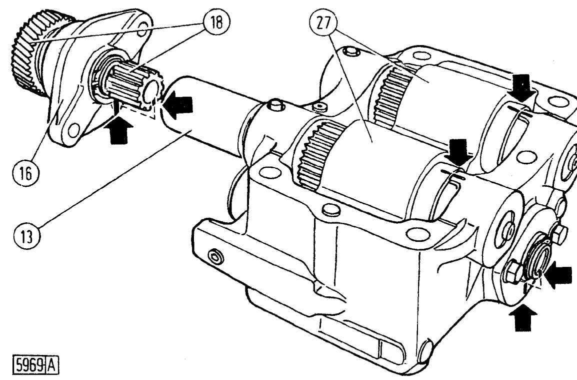


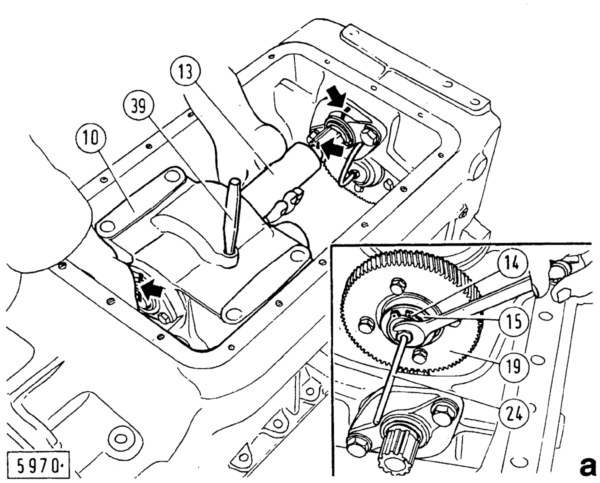
Balancing mass shaft pulling (Mod. 65 - 46)

a. Section on mass drive idler gear (34) - F. Oilway holes - 7. Housing (28) securing screws - 11. Mass drive gear - 25. Split pins - 26. Mass shaft - 27. Mass - 28. Gear (11) housing - 29. Thrust bearing - 30. Spring retaining ring - 35. Gear (34) shaft - 36. Spring retaining ring - 37 & 38. Thrust bearings.



Layout and matching of reference marks for timing of balancing unit with piston No. 1 on T.D.C. (Mod 65 - 46)

13. Stiff coupling - 16. Housing - 18. Gear with mass power drive - 27. Masses



Assembling of mass balancing unit (10) case complete with coupling (13) in sump (Mod. 65 - 46).

(Arrows denote position of reference marks for timing purposes)

a. Installation of lubrication tube (24) - 14. Spring retaining ring - 15. Thrust bearing - 19. Idler gear - 39. Pin to lock mass position during assembly

When re-assemblying parts, gear (11 p. 3) and masses (27) must be positioned so as to observe matching of marks shown by arrows. Refer to figures and note that:

– mass drive idler gear (34) must have longer part of hub facing case wall;

– holes for the pins made on the shafts (26) must be aligned with corresponding holes on case.

When refitting contrarotating mass unit, timing is undertaken as follows:

– position piston No. 1 at T.D.C.;

– secure power drive (18), matching reference marks as shown in figure;

– lock masses in correct installation position with pin (39), checking match of reference marks;

– fit drive coupling (13) and lock assembly tightening screws to torque specified.

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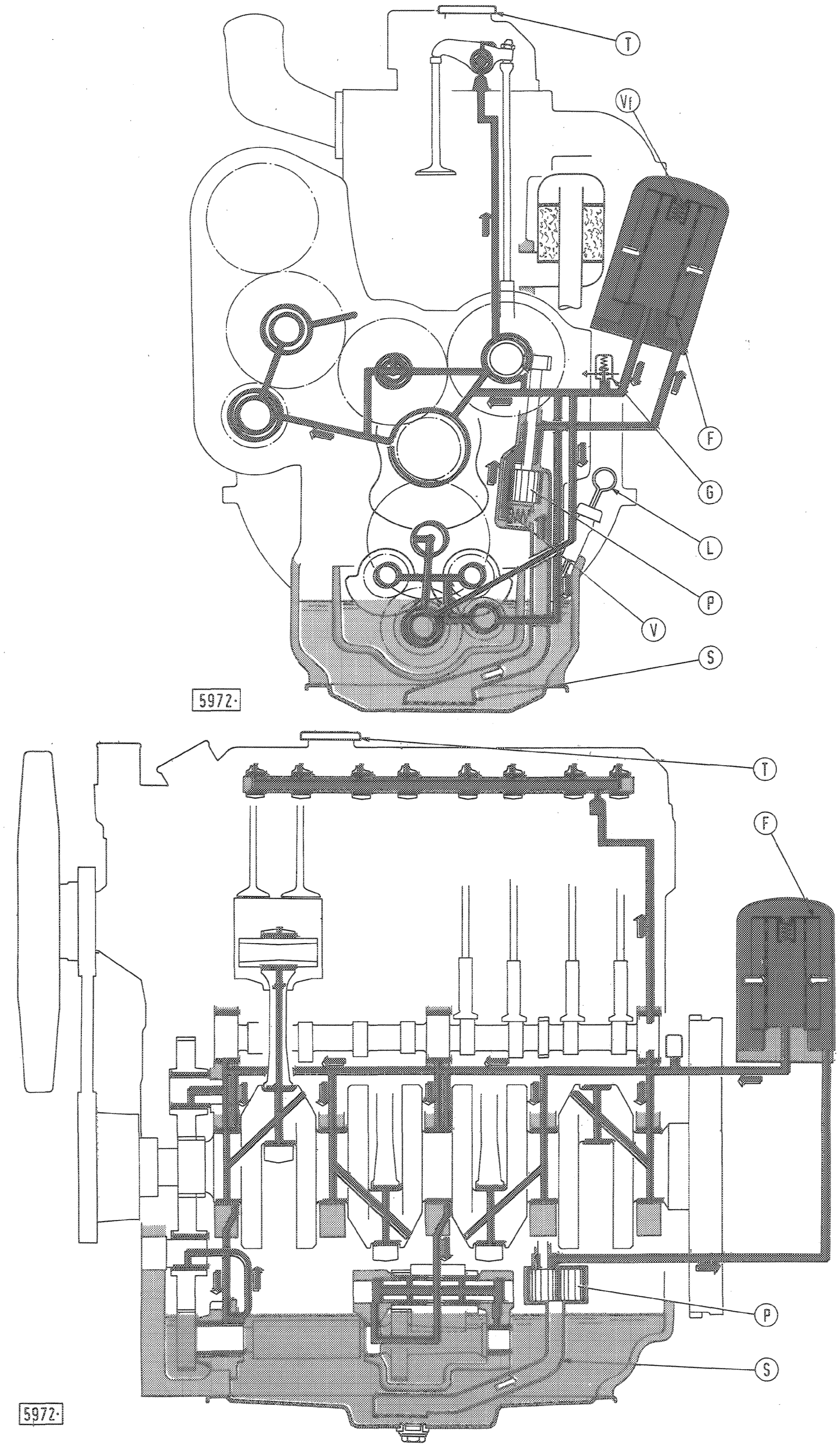

Lubrication System Diagram

F. Filter - G. Oil pressure transmitter unit switch (on dashboard) - L. Dipstick - P. Pump - S. Mesh suction filter - T. Oil filler cap - V. Relief valve - Vf. By-pass valve (cuts in when inlet pressure is 1.5 to 1.7 bar (kg/cm^2) or 22 to 25 psi higher than outlet pressure)

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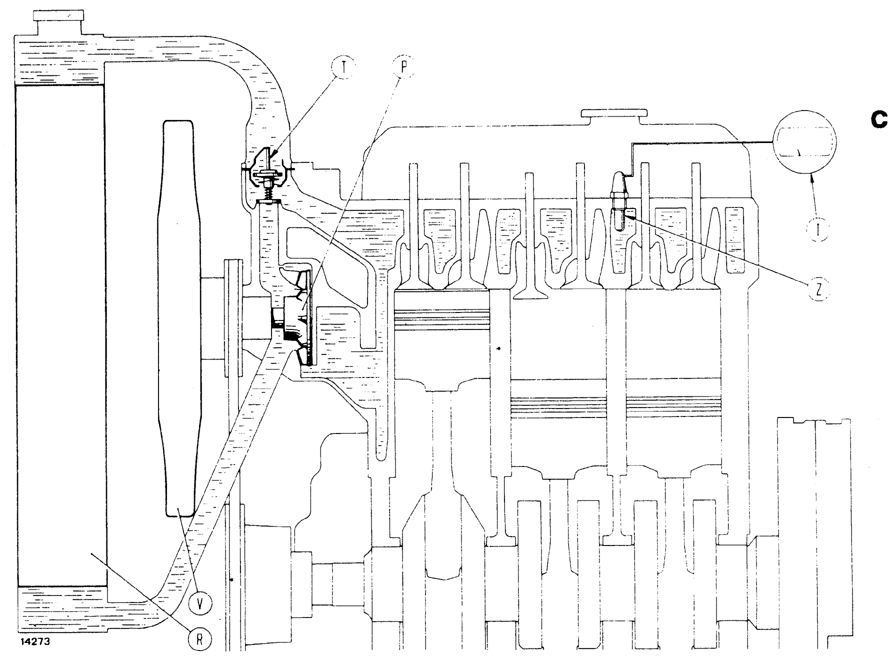

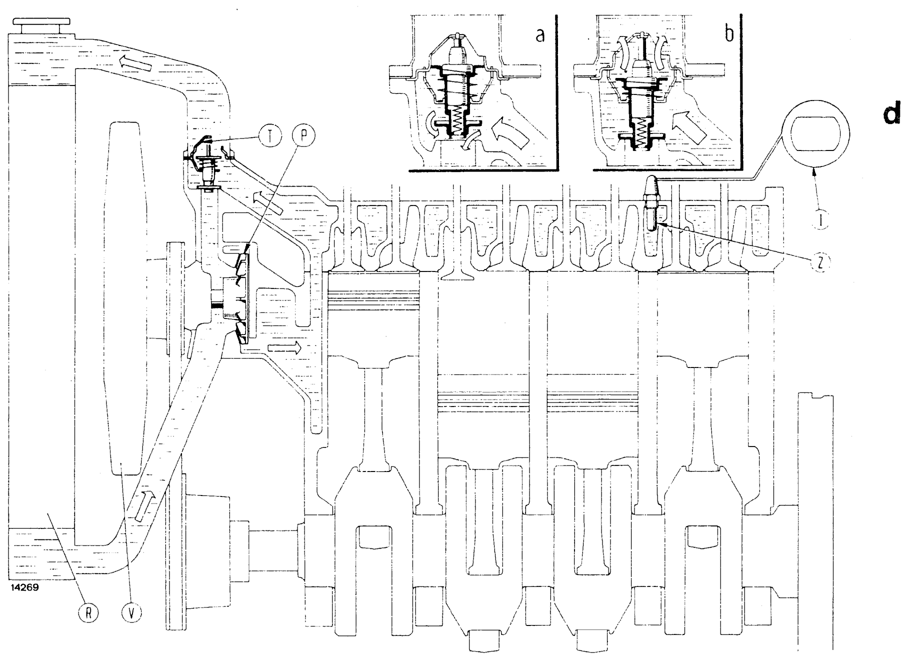

Cooling System Diagram

a. Thermostat closed - b. Thermostat open - c. Mod. 55 - 46 - d. Mod. 65 - 46 - I. Water temperature electric gauge - P. Pump - R. Radiator - T. Thermostat - V. Fan - Z. Transmitter unit

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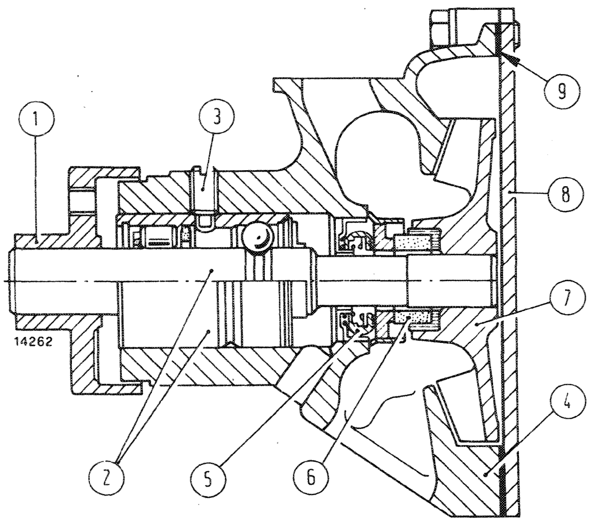
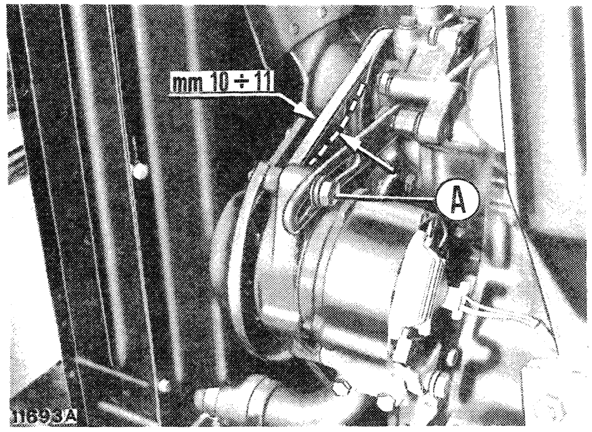


Water pump section

1. Pump and fan hub drive - 2. Drive shaft assembly with sealed bearing - 3. Shaft bearing retaining capscrew - 4. Pump body - 5. Seal - 6. Bushing front seal - 7. Impeller - 8. Cover - 9. Seal



Adjusting fan, Water pump and Alternator drive belt tension

A. Alternator nut on belt tensioner

WATER PUMP

To overhaul pump proceed as follows:

– remove cover (8) and shaft-bearing (2) retaining screw (3);

– tap end of shaft (2) lightly to break the film of oxide between shaft and impeller using puller **291182/1**;

– using a suitable punch, withdraw shaft complete with bearing and fan hub.

Remove seal (5) only if replacement is necessary, i.e. when graphitized surface in contact with impeller bushing is no longer sufficiently smooth to prevent leakage.

Re-assemble parts noting the following:

– bearing (2) requires no lubrication, as it is sealed;

– impeller (7) must be installed flush with end of drive shaft.

BELT TENSION ADJUSTMENT

To check tension of fan, water pump and alternator drive belt, apply a 78 to 98 N (8 to 10 kg) (17 to 22 lbs) load on belt section between alternator and water pump pulley. Belt should deflect by 10 to 11 mm (0.4 to 0.43 in).

If necessary, adjust as follows:

– slacken nut (A) securing alternator to belt tensioner;

– move alternator along bracket to obtain the required tension and tighten nut (A).

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CLUTCH (LUK or O.M.G.)

For Mod. 446, data on p. 1, Section 20, apply, apart from those below.

Transmission pedal requirements	
Pedal pin diameter	35.961 to 36.000 mm (1.415 to 1.417 in)
Transmission case and pedal supporting bush internal diameter (fitted, non-dressed)	36.064 to 36.161 mm ((1.419 to 1.423 in)
Shaft bush play	0.064 to 0.200 mm (0.002 to 0.008 in)
Bush internal diameter (pedal & transmission case)	40.000 to 40.025 mm (1.5748 to 1.5757 in)
Bush outer diameter	39.928 to 40.097 mm (1.5719 to 1.5786 in)
Maximum clearance between bushes and housing	0.97 mm (0.038 in)
Pedal bracket/bush interference fit	0.97 mm (0.038 in)

TRANSMISSION AND SPLITTER – For Mod. 446, data on p. 2 & 3, Section 20, apply.

CREEPER – For Mod. 446, data on p. 2, Section 20, apply.

REAL BEVEL DRIVE AND DIFFERENTIAL

For Mod. 446, data on p. 4, Section 20, apply, apart from those below.

Bevel drive ratio	12/47 = 1 : 3.9
Bevel drive backlash	0.15 to 0.20 mm (0.0059 to 0.0078 in)
Differential	2-pinion
Differential lock	pedal-controlled

BRAKES

Type:	
– Service	dry brake drum band, differential half-shaft splined
– parking	acting on service brakes
Control:	
– service brake	mechanical, independent pedals, with latching capability
– parking and transmission emergency	mechanical, manual lever
Brake band thickness (7, page 1, Section 205)	6 mm (0.236 in)
– critical wear thickness	3.5 mm (0.1377 in)
Brake band width	55 mm (2.165 in)
Brake drum outer dia	225 mm (8.858 in)
– critical wear dia	224 mm (8.818 in)

(continued)

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POWER TRAIN: Specification and Data

BRAKES

(contd)

Brake band pin dia. (10, page 1, Section 205)	bush end	23.948 to 24.000 mm (0.9428 to 0.9448 in)
	bracket end	26.948 to 27.000 mm (1.0609 to 1.0629 in)
Pin bore dia	in bush (16)	24.040 to 24.092 mm([1]) (0.9464 to 0.9485 in)
	in bracket (18)	27.040 to 27.092 mm (1.0645 to 1.0666 in)
Clearance between brake band lever/bracket and bushing		0.040 to 0.144 mm (0010 to 0.0056 in)
Interference fit of brake band control lever pin bushing		0.037 to 0.091 mm (0.0014 to 0.0036 in)
Brake pedal shaft dia. (14, page 1, Section 205)		35.961 to 36.000 mm (1.4157 to 1.4173 in)
Brake pedal shaft bushing ID in transmission case and RH brake pedal (15 and 17)		36.064 to 36.101 mm([1]) (1.4198 to 1.4212 in)
Maximum clearance between brake pedal shaft and bushing		0.064 to 0.140 mm (0.0025 to 0.0055 in)
Maximum clearance between bushing and bore (17, page 1, Section 205)		0.097 mm (0.0038 in)
Maximum interference fit between bushing and bore (17, page 1, Section 205)		0.097 mm (0.0038 in)
Service brake control adjustment		see page 2, Section 205
Transmission parking brake control adjustment		see page 2, Section 205

([1])After fitting, without reaming.

PARKING AND EMERGENCY TRANSMISSION BRAKE

Hand brake lever pin diameter (12, page 1, Section 205)	21.948 to 22.000 mm (0.8641 to 0.8661 in)
Transmission housing pin bone diameter	22.000 to 22.072 mm (0.8661 to 0.8689 in)
Pin/bore clearance	0.020 to 0.124 mm (0.0008 to 0.0048 in)
Hand brake lever 21 & 23 pin diameters (22, page 1, Section 205)	9.985 to 10.000 mm (0.3931 to 0.3937 in)
Lever pin bore diameters	9.959 to 9.981 mm (0.3921 to 0.3929 in)
Pin/Bore pin interference fit	0.004 to 0.141 mm (0.0002 to 0.0055 in)
Parking brake idler shaft (22, page 1, Section 205) diameter	21.967 to 22.000 mm (0.8648 to 0.8661 in)
RH ID (23, page 1, Section 205)	22.000 to 22.072 mm (0.8661 to 0.8689 in)
LH ID (21, page 1, Section 205)	21.939 to 21.972 mm (0.8637 to 0.8650 in)
Shaft (22) & lever (23) clearance	0.020 to 0.105 mm (0.0008 to 0.0041 in)
Shaft (22) & lever (21) maximum clearance	0.005 mm (0.0002 in)
Shaft (22) & lever (21) maximum interference	0.061 mm (0.0024 in)

FINAL DRIVE – For Mod. 446, data on page 6, Section 20, apply

POWER TAKE-OFF

For Mod. 446, data on page 7, Section 10, apply, apart from those below

PTO speed with engine at top speed	625 rpm
Splined shaft speed with PTO synchronized to transmission: shaft revs per rev. of rear wheel (all tyres):	
– 55 - 46	13.79
– 65 - 46	15.5

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TIGHTENING TORQUE FIGURES

For Mod. 446, data on pp. 8 & 9, Section 20, apply, apart from those below.

Description	Thread size	Torque		
		Nm	kgm	ft. lbs.
Clutch - Section 201 Capscrews, release fork (C_3, page 7, Mod. 446)	M 16 x 1.5	157	16	115
Capscrews, transmission housing to engine (C_4, page 3, Mod. 446	M 12 x 1.25	98	10	72
Transmission and splitter - Section 202 Nut, driven gear shaft (C_{13}, page 3, Mod. 446)	M 32 x 1.5	294	30	216
Nuts on studs securing transmission housing to gear housing (C_{10}, page 3, Mod. 446)	M 12 x 1.5	98	10	72
Nuts for studs securing transmission shaft bearing cover (C_2, page 3, Mod. 446)	M 8 x 1.25	17	1.7	12
Capscrews securing planetary reduction fixed gear ...	M 12 x 60	98	10	72
Bevel drive and differential - Section 204 Self-locking nuts for capscrews securing ring gear (C_2, page 9, Mod. 446)	M 12 x 1.25	113	11.5	82
Brakes - Section 205 Capscrew securing LH brake pedal (C_1, page 1)	M 16 x 1.5	117	12	86
Final drive - Section 206 Capscrews securing final drive housing to transmission housing (C_3, page 1, Mod. 446)	M 12 x 1.5	98	10	72
Capscrews securing disc (C_5, page 1, Mod. 446)	M 18 x 1.5	338	34.5	250
Nut securing final drive driven gear to disc spindle (C_7, page 1, Mod. 446)	M 55 x 1.5	882	90	650
Power take-off - Section 207 Capscrews, final drive cover (C_3, page 1, Mod. 446) ..	M 14 x 1.5	147	15	108
Capscrews, securing transmission housing rear cover (C_2, page 2, Mod. 446)	M 16 x 1.5	221	22.5	163

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SERVICE BRAKE ASSY REMOVAL – INSPECTION – INSTALLATION

To disassemble brake assy components, remove the complete final drive, following the instructions given in the corresponding chapter, and proceed as follows:
- remove pedal return spring (2) and detach the fork (3) from the outer control lever (10);
- remove bottom cover and via the transmission housing sump undo the cap screws (C) and remove control lever (10);
- remove the hinge pins (9) and then remove brake band complete (7) and the inner lever (8).

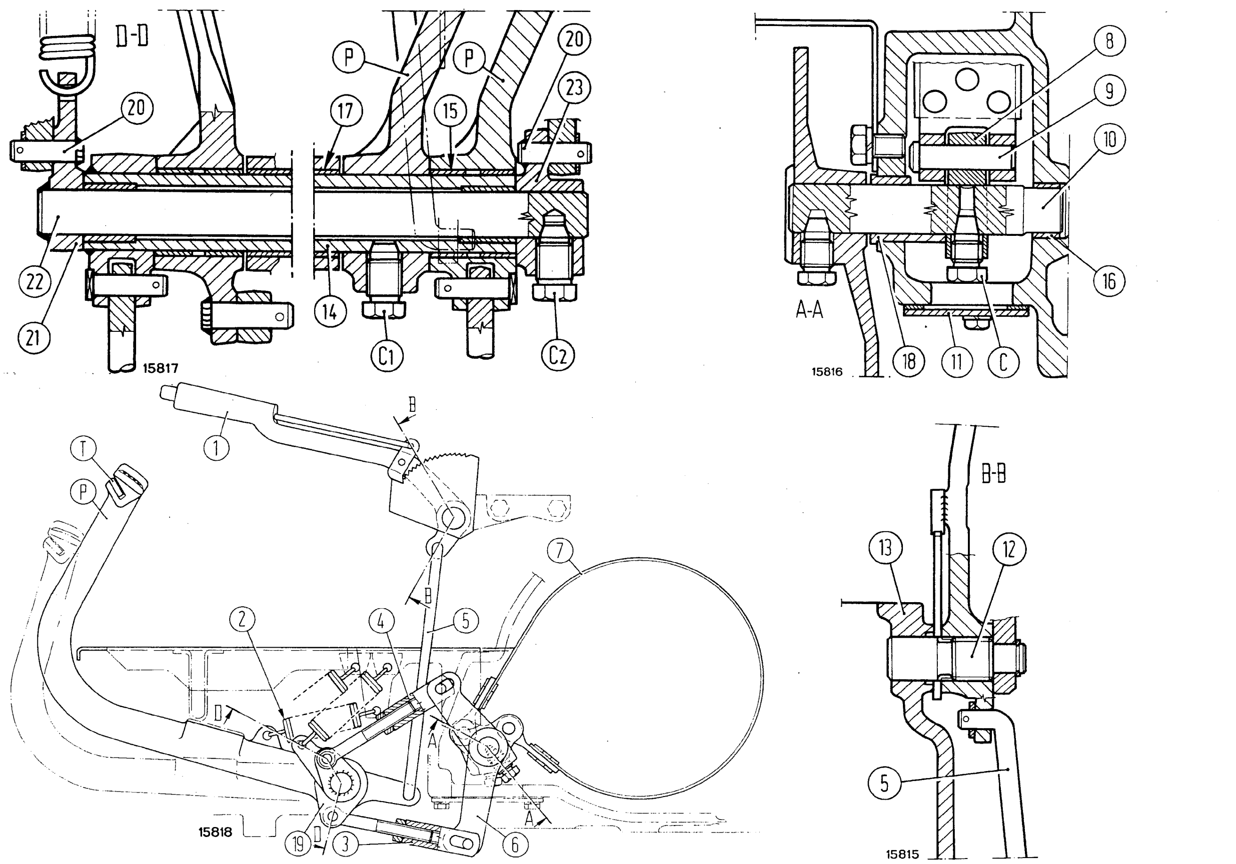
Check the friction segments for wear, noting that replacements are not provided separately, but only with the brake band complete with the segments, the latter bonded to the brake band.

During disassembly, note that the brake bands and other internal items must show no signs of oil, otherwise check for halfshaft gasket leakage.

Check brake drum surface in contact with the brake bands, dressing surface as necessary to a depth which must not exceed 0.05 mm (0.002 in).

Then check bushing wear.

Refit cap screws (C_1) with the head facing the bottom of the tractor and torque as prescribed.



Brake assy components and controls

A. Section through hingeing arrangement of inner lever (8) - D. Section through hingeing arrangement of shaft (14) of pedals (P) - B. Section through brake lever (1) housing hingeing arrangement - C. Inner lever (8) cap screw - C_1. LH brake pedal cap screw - C_2. Brake control lever cap screw - P. Brake pedals - T. Cross link for pedals (P) - 1. Brake lever - 2. Return spring - 3. Brake pedal travel fork and plunger - 4. Brake lever (1) travel fork and plunger - 5. Lever link (1) - 6. Outer brake lever - 7. Brake band - 8. Inner brake band lever - 9. Brake band hinge pins - 10. Pin for outer lever - 11. Access cover to screw (C) - 12. Lever (1) to housing hinge pin - 13. Transmission housing - 14. LH brake control shaft - 15-16 and 17. Bushes - 18. Support - 19. Service brake control lever - 20. Parking brake LH relay lever hinge pin - 21. Parking brake LH relay lever - 22. Parking brake relay shaft - 23. Parking brake RH relay lever.

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SETTING BRAKE CONTROLS

As the brake band friction segments wear out, the idle travel (A) of the pedals will increase.

Travel must not however exceed 85 mm (3.4 in) and must be equal for both pedals to produce simultaneous braking with equal intensity when connected by the corresponding crosslink (T).
When travel is up to the maximum permissible value, reset as follows:

- first make sure that the brake lever (1) is not released (fully down);
- remove plungers (3) from lever (4), and loosen until idle travel (A) of pedals (2) is eliminated;
- tighten plungers (3) 2 to 3 turns one after the other, and reinstall to check that travel (A) obtained is about 50 mm (2 in) on each pedal;
- after the final setting screw home the plungers (3).

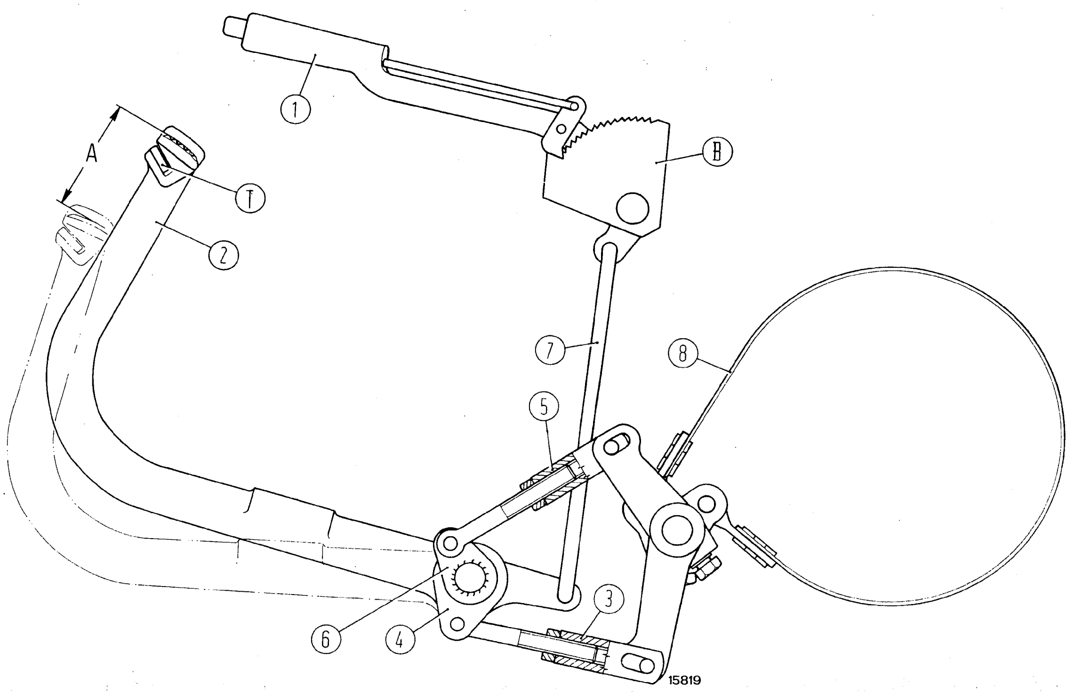
MANUAL BRAKE CONTROL LEVER SETTING

To immobilize the tractor when parked, the manual control (1), starting from neutral position (fully down) must pass through the equivalent of 4 notches on the toothed quadrant (B).

If this exceeds 7 notches, perform lever (1) setting as follows:

- check that idle travel (A) is about 50 mm (2 in);
- remove plugner (5) from lever (6);
- tighten or loosen, depending on whether lever (1) travel is more or less than 4 notches as specified;
- reinstall plunger (5) and check that lever (1) is locked at the fourth notch on the toothed quadrant (B).

Note — It may be assumed that a half turn of the plunger (5) corresponds approximately to one notch advance of the pawl on the toothed quadrant (B).



Brake control setting components

A. Idle travel of brake pedal - B. Toothed quadrant for lever (1) - 1. Manual brake control lever - 2. Brake pedal - 3. Pedal (2) plunger - 4. Plunger (3) control lever - 5. Hand brake plunger - 6. Plunger control lever - 7. Hand brake control link - 8. Brake Band

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FRONT AXLE

Refer to data given in table on p. 1 of section 30 for model 446, except as listed below.

		55 - 46	65 - 46
Type		inverted U. telescoping centre pivoting	
Tracks (six)	6.00 - 16 mm	1410-1510-1610 (55.5-60-63.4 in) 1710-1810-1910 (67.3-71.3-75.2 in)	–
	7.50 - 16 mm	1430-1530-1630-1730-1830-1930 (56.3-60.2-64.2-68.1-72-76 in)	

MANUAL STEERING

Refer to data given in table on pp1 and 2 of Section 30 for model 446.

POWER STEERING

Refer to data given in table on pp 2, 3 and 4 of section 30 for model 446, except as shown below.

Hydraulic pump	
Type	gear
Model	C 25
Make	FIAT
Drive	from engine valve gear
Rotation (seen from rear)	clockwise
Ratio of motor revolutions to pump revolutions	1 to 0.931
Maximum rated rpm (at maximum engine speed)	2328 rpm
Rated output at maximum rated speed	26.4 dm³/min (0.93 cu. ft.)
On-bench output at 1450 rpm and 68.5 bar (70 kg/cm², 993 psi):	
– new or reconditioned pump	15.3 dm³/min (0.54 cu. ft.)
– used pump	10.7 dm³/min (0.34 cu. ft.)
– test oil temperature	55° to 65°C (130 to 150°F)
– test oil viscosity	SAE 20
Drive/driven gear shaft diameter	17.400 to 17.418 mm (0.6870 to 0.6877 in)
Diameter of shaft bore in bearings	17.450 to 17.470 mm (0.6870 to 0.6877 in)
Shaft-bearing clearance	0.032 to 0.070 mm (0.0012 to 0.0027 in)
Maximum wear clearance	0.1 mm (0.004 in)

(continued)

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POWER STEERING

(continued)

Gear radial clearance in pump body	0.020 to 0.064 mm (0.0008 to 0.0025 in)
Maximum pump body wear, suction side opposite gears	0.1 mm (0.004 in)
Bearing width	19.796 to 19.812 mm (0.7793 to 0.7799 in)
Gear width	18.323 to 18.348 mm (0.7213 to 0.7223 in)
Pump body width for seating of gears and bearings	58.072 to 58.122 mm (2.2863 to 2.2882 in)
Bearing — gear end clearance in pump body (to be restored on overhaul)	0.1 to 0.2 mm (0.004 to 0.008 in)
Pressure relief valve setting (all outfits):	
— front-wheel drive models	100 bar (102 kg/cm^2) (1450 psi)
— all-wheel drive models	125 bar (127 kg/cm^2) (1803 psi)
Power cylinder overload valve setting	200 bar (204 kg/cm^2) (2897 psi)

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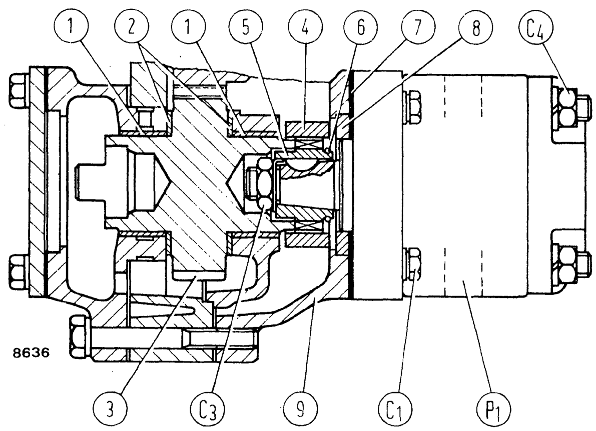
Refer to text and figures in Section 303 for Model 446, except as shown below.

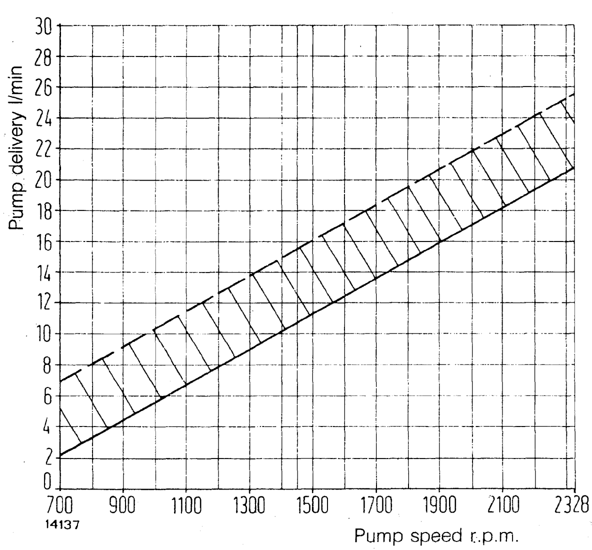
Steering pump and reservoir overhaul

Refer to the description on p. 3, Section 303 for Model 446, except as shown below.



Section through steering pump drive

C_1. Pump capscrews - C_3. Sleeve nut - C_4. Cover mounting screw nut - P_1. Hydraulic pump - 1. Gear bushings - 2. Shims - 3. Pump drive gear - 4. Drive collar - 5. Drive sleeve - 6. Retaining ring for collar (4) - 7. Gasket - 8. Centraliser - 9. Pump bearing



C25 **Power steering pump output-speed curve**

Test pressure 100 bar (102 kg/cm^2) (1450 psi) - Oil temperature 55 to 65°C (130 to 150°F)

Checking power steering relief valve with control valve installed on tractor

Refer to description on pp. 4 and 5, Section 303 for model 446.

The only difference with respect to the description on the aforementioned page concerns the calibration of the pressure relief valve. This remains 100 bar (102 kg/cm^2) (1450 psi) for the front-wheel drive models 55 - 46 and 65 - 46, but changes to 125 bar (127 kg/cm^2) (1803 psi) for models 55 - 46 DT and 65 - 46 DT. These values must be checked on both models with the engine turning at about 1.600 rpm.

Bench calibration of relief valve

Refer to description on p. 5 Section 303, for model 446.

The only difference with respect to the description on the aforementioned page concerns the calibration of the relief valve. This remains 100 bar (102 kg/cm^2) (1450 psi) for models 55 - 46 and 65 - 46, but changes to 125 bar (127 kg/cm^2) (1803 psi) for models 55 - 46 DT and 65 - 46 DT.

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LIVE FRONT AXLE

	mm	
	55 - 46	65 - 46
Type	steering, full floating, center pivoting	
Bevel Drive and Differential		
Bevel drive ratio	9/38=1 to 4.2	9/43=1 to 4.8
Bevel drive rated backlash	0.15 to 0.20 mm (0.0059 to 0.0078 in)	
Bevel pinion bearing shim thickness (S_1, page 1, Section 402)	2.50-2.55-2.60-2.65-2.70-2.75-2.80-2.85-2.90-2.95-3-3.05-3.10 3.15-3.20-3.25-3.30-3.35-3.40-3.45-3.50-3.55-3.60-3.65-3.70 (0.098-0.1-0.102-0.104-0.106-0.108-0.110-0.112-0.114-0.116-0.118-0.12-0.122-0.124-0.126-0.128-0.13-0.132-0.134-0.136-0.138-0.14-0.142-0.144-0.146 in)	
Bevel pinion shim thickness (S_2)	2.5-2.6-2.7-2.8-2.9-3.0-3.1-3.2-3.3-3.4-3.5-3.6-3.7 (0.098-0.102-0.106-0.110-0.114-0.118-0.122-0.126-0.13-0.134-0.138-0.142-0.146 in)	
Differential pinion and side gear backlash	0.15 (0.0059 in)	
Side gear thrust washer thickness (7, page 3, Section 402)	1.470 to 1.530 (0.058 to 0.060 in)	
Differential pinion thrust washer thickness (6)	1.50 to 1.60 (0.059 to 0.062 in)	
Differential pinion journal dia	21.939 to 21.960 (0.8637 to 0.8645 in)	
Differential pinion bore dia	22.040 to 22.061 (0.8677 to 0.8685 in)	
Differential pinion journal clearance in pinion bore	0.080 to 0.122 (0.003 to 0.004 in)	
Side gear spigot diameter	37.961 to 38.000 (1.4945 to 1.4960 in)	
Side gear spigot bore diameter in differential case	38.080 to 38.119 (1.4992 to 1.5007 in)	
Side gear clearance in differential case	0.080 to 0.158 (0.003 to 0.004 in)	
Axle Shafts and Joints		
Axle shaft diameter (5, page 3, Section 402) at axle bushing (14)	29.914 to 29.935 (1.1777 to 1.1785 in)	
Axle bushing fitted I.D. (14)	30.050 to 30.105(1) (1.1830 to 1.1852 in)	
Axle shaft running clearance in bushing	0.115 to 0.191 (0.0045 to 0.0075 in)	
Bushing interference fit in housing	0.064 to 0.129 (0.0025 to 0.0050 in)	
King pin bearing shim thickness (S_3, page 3, Section 402)	0.10-0.15-0.20-0.25-0.30 (0.0039-0.0059-0.0078-0.0098-0.0118 in)	
Planetary Final Drives		
Reduction ratio	15 : (19 + 54) = 1 : 4.87	
Driven gear shim thickness (18, page 3, Section 402)	0.77 to 0.83 (0.0303 to 0.326 in)	

(1) Not reamed.

(continued)

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LIVE FRONT AXLE

(contd)

	mm
Centre Pivot Pivoting angle (on either side) . . . . End clearance on axle-support pivot . . . . Maximum wear clearance	 11° 0.3 to 1.1 (0.12 to 0.043 in) 2 (0.078 in)
Front axle pivot support diameter . . . . I.D. with front bushing fitted . . . . Pivot fitted clearance in bushing	52.652 to 52.671 (2.0729 to 2.0736 in) 52.720 to 52.790(1) (2.0755 to 2.0783 in) 0.049 to 0.138 (0.002 to 0.005 in)
Rear bevel pinion carrier spigot O.D. . . . . I.D. with rear bushing fitted (24) . . . . Spigot fitted clearance in bushing	99.040 to 99.072 (3.899 to 3.900 in) 99.146 to 99.221(1) (3.903 to 3.906 in) 0.074 to 0.181 (0.003 to 0.007 in)
Axle support front and rear thrust washer thickness (22 and 23, page 1, Section 402)	4.95 to 5.00 (0.1948 to 0.1968 in)
Minimum turning radius, drive disengaged, brakes off	5300 (17'4")

(1) Not reamed

AXLE DRIVE

Reduction ratio . . . . Relay lever pad width . . . . Pad seat width in driven gear . . . . Pad clearance in seat	36/29 x 29/29 = 1 : 0.805 7.910 to 8.000 (0.3114 to 0.3149 in) 8.280 to 8.370 (0.3259 to 0.3295 in) 0.280 to 0.460 (0.011 to 0.018 in)
Relay lever pivot diameter . . . . Pivot housing diameter in casing . . . . Pivot clearance in housing	15.973 to 16.000 (0.6288 to 0.6299 in) 16.016 to 16.059 (0.6305 to 0.6322 in) 0.016 to 0.086 (0.0006 to 0.0034 in)
Relay lever detent spring length: — Free . . . . — Under 134.3 to 150 N (13.7 to 15.3 kg)	 24.3 (0.957 in) 17.8 (0.7 in)

DRIVE SHAFT

Refer to data given in table on page 2, Section 40, concerning model 446 DT.

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TIGHTENING TORQUE FIGURES

DESCRIPTION	Thread Size	Torque		
		Nm	kgm	ft.lbs
Front Axle – Section 402				
Lock ring, bevel pinion (C_1, p. 1)	M 35 x 1.5	294	30	217
Capscrew, differential carrier to axle casing (C_2)	M 12 x 1.25	113	11.5	83
Capscrew, ring gear to differential case (C_3)	M 12 x 1.25	127	13	94
Capscrew (C_4)	M 10 x 1.25	64	6.5	47
Capscrew, steering knuckle (C_5)	M 10 x 1.25	64	6.5	47
Lock ring, wheel hub bearing (C_6)	M 45 x 1.5	118	12	87
Capscrew, planetary final drive housing (C_7)	M 10 x 1.25	64	6.5	47
Capscrew, wheel disc to hub (C_8)	M 16 x 1.5	255	26	188
Nut, rim to wheel disc capscrew	M 16 x 1.5	245	25	180
Capscrew, front and rear axle pivot support (C_9)	M 18 x 1.5	392	40	290
Capscrew, differential bearing cap (C_{10})	M 12 x 1.25	113	11.5	83
Capscrew, front axle support to engine (C_{11})	M 18 x 1.5	314	32	231
Drive Shaft – Axle Drive – Section 402				
Capscrew, drive shaft centre bearing (C_{12}, page 1)	M 16 x 1.5	220	22.5	163
Capscrew, axle drive housing to tractor (C_{13}, page 1) ...	M 12 x 1.25	98	10	72

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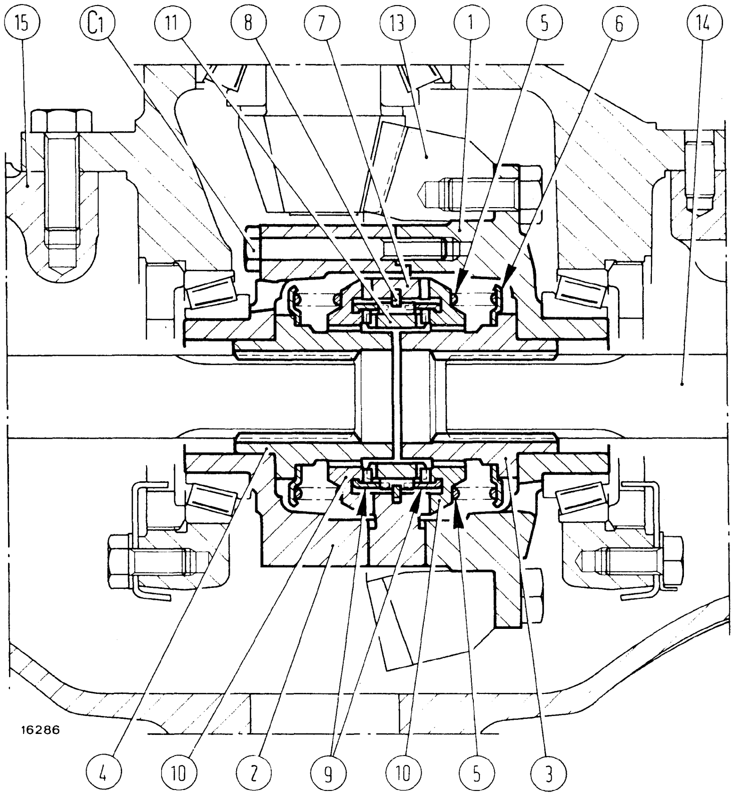
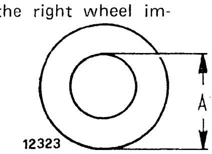
NO-SPIN UNIT (optional on all-wheel drive models)



CAUTION

To check no-spin unit operation, proceed as follows:
- with the engine shut down, engage a gear and front-wheel drive, block the hand brake and raise the front end of the tractor;
- roll the two front wheels forward to eliminate play, immobilize the left wheel and turn the right backward. The NO-SPIN unit will disengage, allowing it to turn freely with a metallic clicking noise;
- stop the right wheel and roll it slightly forward, the NO-SPIN unit will disengage and immobilize the wheel;
- turn both wheels backward to eliminate the play, immobilize the left wheel and roll the right forward, the NO-SPIN unit will disengage, allowing it to turn freely with a metallic clicking noise;
- stop the right wheel and roll it slightly backward; the NO-SPIN unit will re-engage and immobilize the wheel;
- repeat the operations described above, with the right wheel immobilized.



b

Section through complete differential of NO-SPIN unit (for all-wheel drive models)

C_1. Capscrew for 2 half-cases; tightening torque 56÷62 Nm (5.7÷6.3 kg/m) (41.2÷45.5 ft.lbs) - 1. Ring gear half-case - 2. Closing half-case - 3 and 4. Transmission sleeves to half-shafts (14) - 5. Retaining springs - 6. Spring (5) retainers - 7. Central toothed quadrant - 8. Elastic washer - 9. Toothed washers - 10. Drive transmission flanges (also for uncoupling of other wheel) - 11. Central cam - 13. Ring gear - 14. Transmission half-shafts - 15. Front live axle housing.

OPERATION

The **NO-SPIN** unit ensures the following important functions:
- permits utilization of the traction power available on the live axle;
- prevents loss of traction on one wheel from limiting or eliminating the traction power generated by the opposite wheel still exercising draught;
- allows the wheels to revolve at different speeds to accomodate the difference in distance they have to cover on bends or rough ground.

When the tractor is moving along a straight line, the NO-SPIN unit holds the two wheels locked with the ring gear, and enables the live axle to generate traction power to impart the same speed to both wheels. As soon as a wheel that has to negotiate an obstacle), it activates the NO-SPIN unit, disconnects its own half-shaft, and spins. If one of the two wheels loses adherence, the other wheel on the axle continues to exercise the same force of traction as it previously transmitted.

DEFLECTION

In the event of a deflection, e.g. to the left, the right wheel will increase speed, the shaft (14) will transmit this increase to the sleeve (3), which in its turn will transmit it to the flange (10) and the related toothed washer (9).
As soon as the right wheel applies a braking force in excess of a given value, the washer (9) and the flange (10) overcome the load on the spring (5), enabling them to uncouple from the central cam (11) and remain in that position until the completion of the curve.

NOTE — Correct operation of the NO-SPIN unit is directly related to the circumference of the two tyres on the axle, which must be equal exactly or to within a few millimetres. For minor adjustments, the tyre inflation pressure may be slightly varied.
This check may be performed as shown in detail b. above: the distance A must be equal on both wheels.

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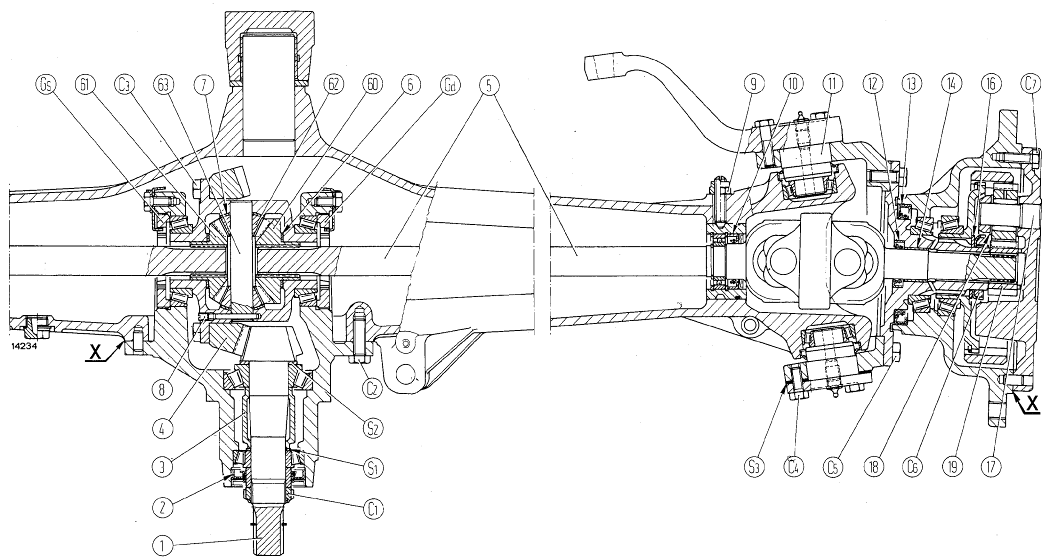
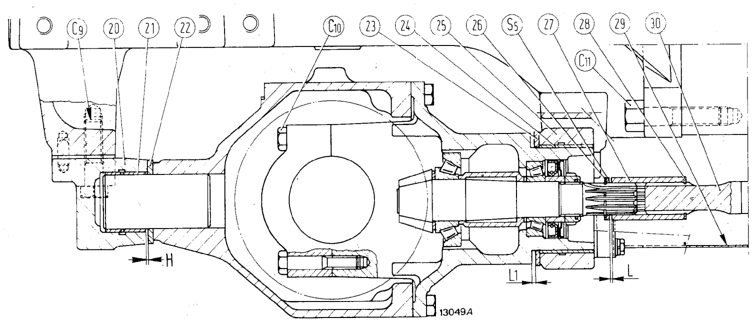
Longitudinal section through front axle, pivot, axle drive and drive shaft.

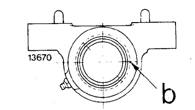
Note — On assembly, thouroughly clean and degrease surfaces X to be coupled and apply one of jointing compounds listed on page 5, Section A.

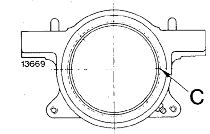
a. Section through axle drive control - b. Correct bushing installation in front axle pivot support (split arrowed) - C. Correct bushing installation in rear axle pivot support (split arrowed) - C_1. Bevel pinion locking ring - C_2 Differential carrier capscrew - C_3. Ring gear capscrew - C_4. King-pin bearing capscrew - C_5. Steering knuckle capscrew - C_6. Wheel hub bearing lock ring - C_7. Final drive housing capscrew - C_8. Wheel capscrew - C_9. Axle pivot support capscrew - C_{10}. Differential bearing cap bolt - C_{11}. Capscrew securing front axle support to engine - C_{12}. Drive shaft center bearing capscrew - C_{13}. Axle drive housing capscrew - Gd and Gs. RH and LH differential bearing lock rings - S_1. Bevel pinion bearing shims - S_2. Bevel pinion position shim - S_3. King pin bearing shims - S_5. Sleeve (27) end play shim - T. Oil drain plug - 1. Bevel pinion - 2. Seal - 3. Bevel pinion bearing spacer - 4. Ring gear - 5. Axle shaft complete with universal joint - 6. Side gear washers - 7. Differential pinion washers - 8. Differential pinion journal capscrew - 9. Bearing carrier housing capscrew 10. Seal - 11. King pin pivot bearing - 12 and 13. Seals - 14. Axle shaft bushing - 16. Thrust washer - 17. Planetary wheel journals - 18. Planetary wheel shims - 19. Sun gear - 20. Front axle pivot support - 21. Front bushing - 22. Front thrust washer - 23. Rear thrust washer - 24. Rear bushing - 25. Rear axle pivot support - 26, 28, 31, 34 and 37. Retaining rings - 27. Front splined sleeve - 29. Drive shaft guard - 30. Drive shaft - 32. Rear splined sleeve - 33. Center support complete with ball bearing - 35. Seal disc - 36. Seal - 38. Ball bearing - 39. Oil excluder - 40. Driven gear - 41. Splined driven shaft - 42. Ball bearing - 43. Intermediate shaft - 44. Roller bearing - 45. Intermediate gear - 46. Drive gear keyed on bevel pinion shaft - 47. Pad - 48. Inner relay lever - 49. Pawl - 50. Pawl spring - 51. Plug - 52. 0-ring - 53. Axle drive outer control lever - 54. Vertical link - 55. Hand lever hingepin - 56. Hand lever - 60 and 61 Side gears - 62. Differential pinion - 63. Differential pinion journal.

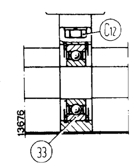
H = 1 mm. Recess of front bushing (21) fully fitted.
L_1 = End play (0.3 - 1.1 mm) (0.012 to 0.043 in) on pivot between axle and carrier.

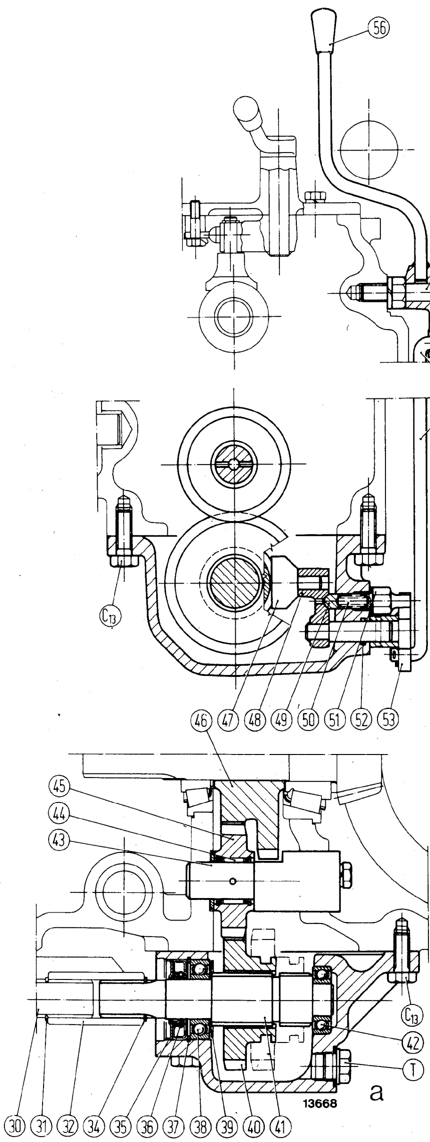












Refer to the text on page 1 Section 402 for model 446, except as below.

Installation:

Reinstall shaft in housing and perform the following adjustment:

place axle in full contact with rear pivot support (25, p. 1) to eliminate axle end play, and position front splined sleeve (27) against retaining ring (28). Use feeler gauge to measure clearance between sleeve and retaining ring (26), and install a shim (S_5) of suitable thickness to allow sleeve (27) play (L) of 1 to 1.5 mm (0.039 to 0.059 in).

LIFT

Refer to data given in table on pp. 1 and 2, Section 50 for model 446, except as below.

Unit pressure relief valve crack-off setting	186 to 191 bar (190 to 195 kg/cm²) (2700 to 2770 psi)
Safety valve setting	225.5 to 235.3 bar (230 to 240 kg/cm²) (3266 to 3408 psi)

REMOTE CONTROL VALVES

Refer to data given in table on p. 2, Section 50 for model 446, except as shown below.

Pressure relief valve crack-off setting	186 to 191 bar (190 to 195 kg/cm²) (2700 to 2770 psi)

LIFT PUMP

Refer to data given in table on pp. 3 and 4, Section 50 for model 446, except as shown below.

Filter	
Type	gauze strainer cartridge
Location	on pump body suction side
Pump	
Model	A 25
Rotation (seen from drive side)	counter clockwise
Ratio of motor revolutions to pump revolutions	1 to 0.931
Max. rated rpm at maximum engine speed	2328
Corresponding rated output	26.4 dm³ (0.93 cu. ft.)

IMPLEMENT ATTACHMENT

	55 - 46	65 - 46
Type	3-point linkage	
Category	one and two	
Draught control	through third point	

(continued)

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IMPLEMENT ATTACHMENT

(contd.)

	55 - 46	65 - 46
Max lower link end travel:		
– with vertical rods fully extended	745 mm (29.3 in)	
– with vertical rods fully retracted	610 mm (24.0 in)	
Max. lift capacity, starting with lower links horizontal, for full lifting travel, with sensing bar hitched to top hole on support:		
– at lower link swivel bushing	1920 kg (4225 lbs)	1940 kg (4270 lbs)
– centre of gravity 610 mm from lower link	1580 kg (1730 lbs)	1730 kg (3800 lbs)
– centre of gravity 1050 mm from lower link swivel bushings (55 - 46)	1460 kg (3210 lbs)	–
– centre of gravity 1130 mm from lower link swivel bushings (65 - 46)	–	1560 kg (3430 lbs)

TRAILER BRAKE VALVE

Type	spool valve incorporating pressure relief valve
Location	on separatè mounting bracket, bolted to RH final drive housing
Fitted clearance between rod and remote control valve body (selected components adjusted by rubbing with emery cloth)	0.007 to 0.012 mm (0.0003 to 0.0004 in)
Brake control valve setting (4 and 5, page 2, Section 503)	142 ± 4.2 bar (145 ± 5 kg/cm^2) (2060 ± 70 psi)
Shim thickness for pressure relief valve (8)	0.2 to 0.5 mm (0.008 to 0.02 in)

TIGHTENING TORQUE FIGURES

Refer to table on pp. 5 and 6, Section 50, for model 446, except as shown below.

Description	Thread size	Torque		
		Nm	kgm	ft.lbs.
Nuts for captive screws securing control valve to lift body (C_2, C_4, page 2)	M 10 x 1.25 M 14 x 1.5	59 147	6 15	44 108
Cap screws, or nuts for captive screw, securing lift to transmission case (C_5)	M 14 x 1.5	147	15	108
Capscrew, return spring to rear cover of lift unit and sensing bar bracket (C_2, page 2)	M 12 x 1.5	71.5	7.3	53
Implement attachment and towing devices				
Capscrew, top towing crossbar	M 20 x 1.5	470	48	347
Nut, capscrew, bottom towing crossbar	M 20 x 1.5	392	40	290
Nut, capscrew end of rear towbar	M 18 x 1.5	343	35	253

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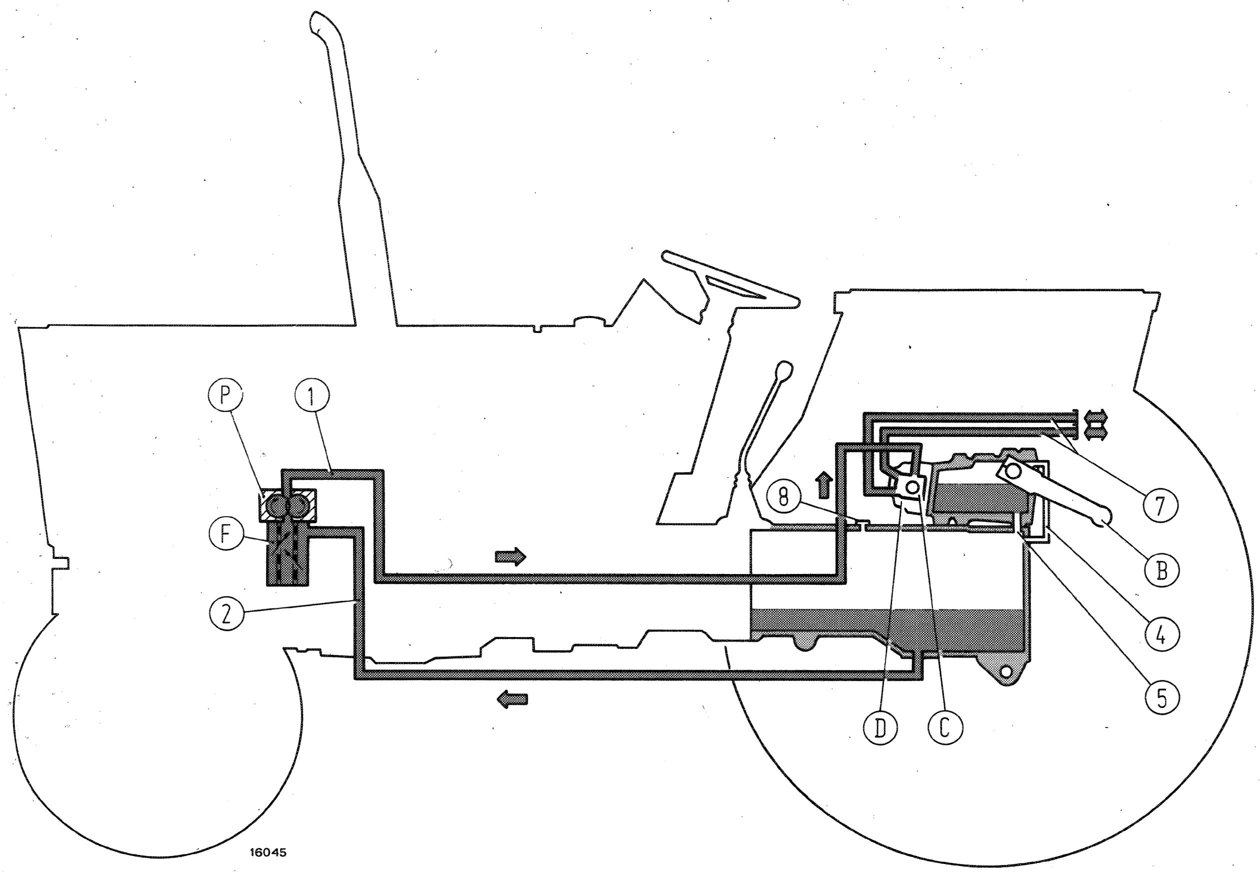
Refer to text and installations in Section 501 for model 446, except for schematic below and controls on p. 2.



LIFT CONTROL HYDRAULIC CIRCUIT AND REMOTE CONTROL VALVE SCHEMATIC

B. Lift arm - C. Single or double acting remote control valve - D. Control valve - F. Gauze oil filter - P. Engine valve gear driven hydraulic pump - 1. Delivery line to control valve - 2. Suction line from transmission housing - 4. Pressure equalizing pipe in lift body and in transmission housing - 5. Oil drain pipe from lift body in transmission housing - 7. Single or double-acting cylinder delivery line - 8. Breather.

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HYDRAULIC LIFT UNIT: Lift

Bench check of pressure relief valve setting (1, p. 1, Section 503, Model 446)

Set up the remote control valve to be checked and the testing equipment as shown in schematic (a), bearing in mind that the control valve oil return line **290447** must be attached to the control valve by means of the adaptor **293551**, the adjustable coupling **293553**, and the second adaptor **290541**.

Place the control lever (C) in lifting position, and hold it there, start up the pump drive motor, and operate the handwheel **291231** to regulate the delivery pressure at about 88 bar (90 kg/cm^2) (1280 psi). Wait until the temperature of the test oil in the system reaches 50° ÷ 60° C (120 ÷ 140° F), then operate the handwheel again, and check on the test equipment pressure gauge that the valve (1) crack-off pressure is 181 – 191 bar (185 – 195 kg/cm^2) (2630 ÷ 2770 psi). If the pressure as checked is different from the specified value, replace the complete pressure relief valve.

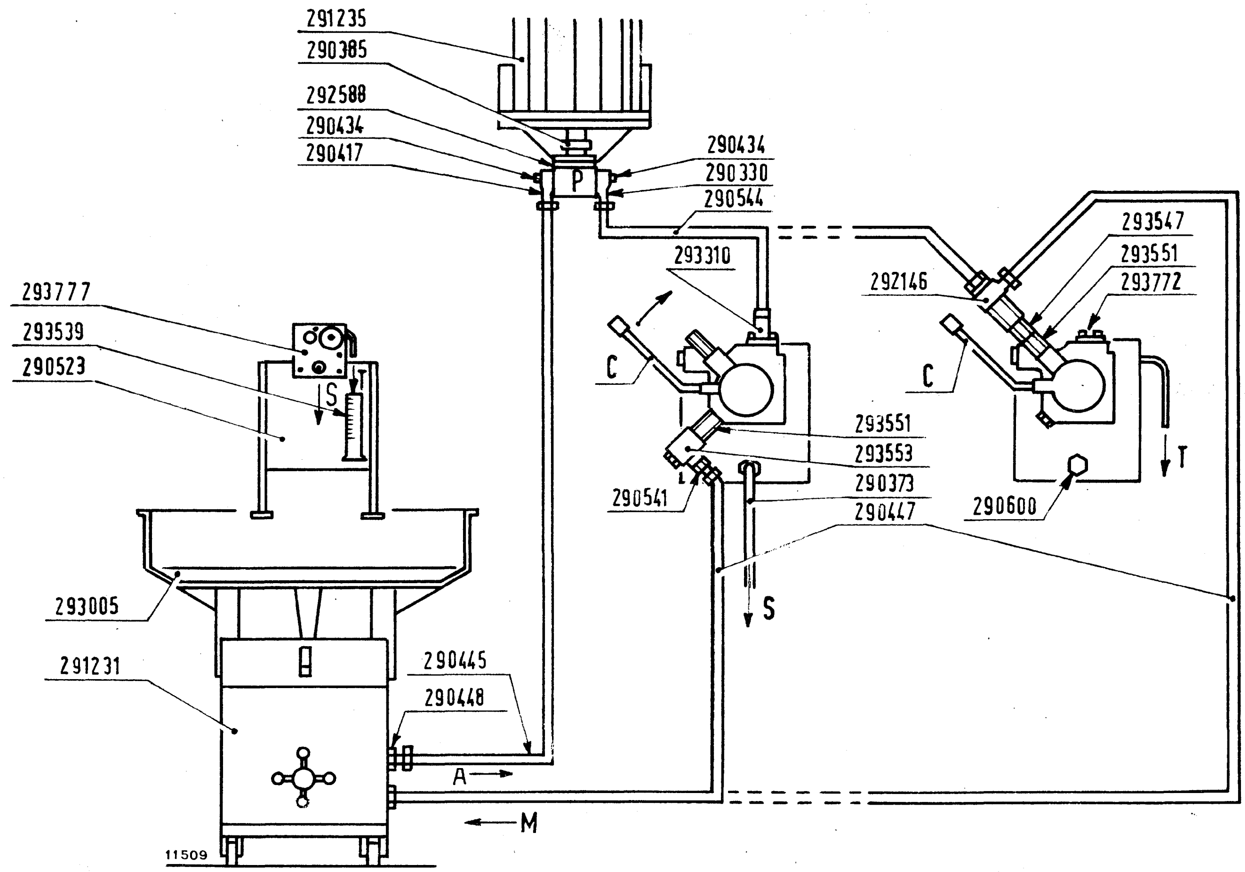
Blow-by check of control valve

Set up the remote control valve to be checked and the test equipment as shown in schematic (b), bearing in mind that the threeway coupling **292146** must be attached to the control valve by means of adaptors **293551** and **293547**.

With the control lever (C) in neutral position, perform the test as follows:

– switch on the hydraulic pump, gradually increasing the pressure by operating the handwheel of the testing equipment **291231**, and check on the test equipment pressure gauge that the pressure reaches 147 bar (150kg/cm^2) (2130 psi);

– collect the blown-by oil draining from the coupling **293550** in the drain tube **293539** provided for the purpose, for one minute exactly, and check that it does not exceed 25 cm^3 (1.5 cu.in) per minute.



Schematics of the set up of the equipment for the pressure relief valve check (a) and the control valve blow-by check (b)

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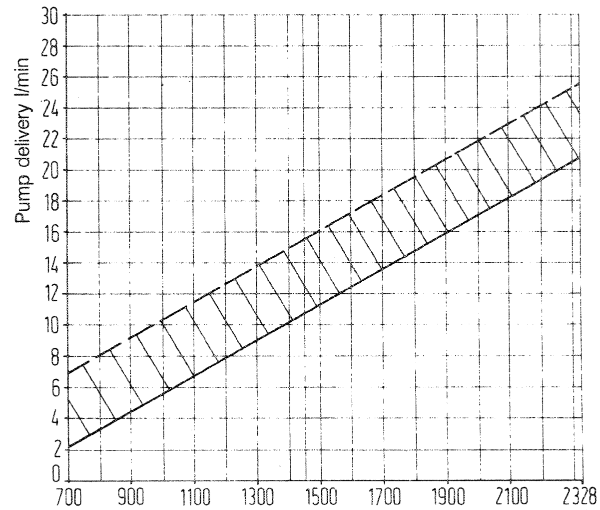
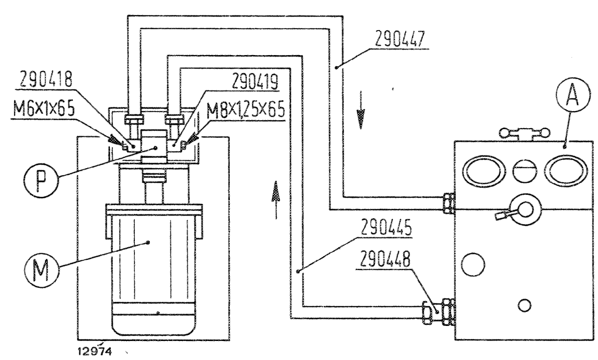
HYDRAULIC PUMP

Refer to text and figures on pp. 1, 2 and 3, Section 502, for model 446, except as shown on this page.



Speed-output curve of power steering control pump A 25

Test pressure 166 bar (170 kg/cm^2) (2415 psi) - Oil temperature 55° to 65°C (130 - 150°F)



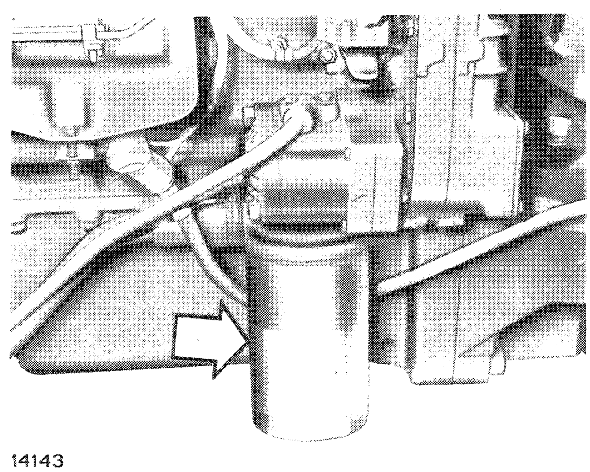
Lift pump output test schematic

A. Large output tester **291231** - M. Electric motor **291235** - P. Pump under test A25

LIFT UNIT OIL FILTER

The lift hydraulics control circuit oil cleaning filter is located on the suction pipe of the pump.

The filter element is a gauze cartridge, which is to be replaced after every 400 hours of operation.



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CHARGING SYSTEM

The values given in the table on p. 1, Section 60, for model 446 are valid, except as shown below.

Alternator	
Type (3-phase, self-rectifying)	BOSCH G1-14V-33A27 MARELLI AA108-14V-33A-1 ISKRA AAG-1104-14V-33A LUCAS 18ACR-14V-40A
Output at 14 V across battery after warm-up (°):	
— at 5000 rpm (BOSCH or ISKRA)	34 Amp
— at 7000 rpm (MARELLI)	33 Amp
— at 6000 rpm (LUCAS)	45 Amp

(°) Applicable to fully bedded-in brushes.

MARELLI STARTER FOR MODEL 55 - 46 — Refer to data on Marelli starter on pp. 2 and 3, Section 60. for model 446.

BOSCH STARTER FOR MODEL 55 - 46 — Refer to data on Bosch starter given on pp. 3 and 4, Section 60, for model 446, except as shown below.

Rated output	2.5 kW

LUCAS STARTER (Model 55 - 46)

Type	LUCAS 2M113
Voltage rating	12 V
Rated output	2.5 kW
Rotation (seen from pinion end)	Clockwise
Starter drive ratio	9/110
No. of poles	4
Field winding	Series and parallel
Control	Freewheel with rollers
Operation	Pre-engagement
Bench Test Data	
Running test at 20°C:	
— current	⩽ 600 Amp
— torque	22.5 Nm (2.3 kgm) (16 ft.lbs)
— speed	⩾ 1 000 rpm
— voltage	8.9 V
Light running test at 20°C:	
— current	⩽ 100 Amp
— voltage	12 V
— speed	5000 to 7000 rpm
Overall internal lock resistance at 20°C	0.0078 Ohm

(continued)

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LUCAS STARTER (Model 446) *(continued)*

Mechanical Data	
Brush spring load (not worn)	14.7 to 19.6 N (1.5 to 2 kg) (3.3 to 4.4 lbs)
Armature shaft end play	0.025 to 1.420 mm (0.001 to 0.056 in)
Commutator diameter	41.150 to 41.400 mm (1.620 to 1.629 in)
– wear limit	38.89 mm (1.531 in)
– maximum ovality	0.076 mm (0.003 in)
Solenoid	
Resistance at 20°C – holding coil	0.46 to 0.56 Ohm
Resistance at 20°C – actuating coil	0.145 to 0.165 Ohm
Current consumption at 12 V – holding coil	21.5 to 26.1 A
Current consumption at 12 V – actuating coil	73 to 83 A
Activation voltage (min.)	8 V
Plunger stroke	0.585 mm (0.023 in)
Fitting Data	
Pole shoe ID	75.38 to 75.74 mm (2.967 to 2.981 in)
Armature OD	74.40 to 74.47 mm (2.929 to 2.931 in)
Armature bushings ID (when fitted):	
– pinion	14.287 to 14.313 mm (0.562 to 0.563 in)
– intermediate	28.500 to 28.530 mm (1.122 to 1.123 in)
– commutator	12.700 to 12.725 mm (0.499 to 0.501 in)
Armature shaft journal diameter at:	
– pinion	14.20 to 14.22 mm (0.5590 to 0.5598 in)
– intermediate	28.356 to 28.433 mm (1.116 to 1.119 in)
– commutator	12.65 to 12.67 mm (0.4980 to 0.4988 in)
Armature shaft clearance in bushing:	
– pinion	0.067 to 0.113 mm (0.0026 to 0.0044 in)
– intermediate	0.067 to 0.174 mm (0.0026 to 0.0068 in)
– commutator	0.03 to 0.075 mm (0.001 to 0.003 in)
Pinion bushing ID (when fitted)	14.26 to 14.29 mm (0.561 to 0.562 in)
– Armature shaft journal diameter over pinion bushing	14.20 to 14.22 mm (0.5590 to 0.5598 in)
– Armature shaft clearance in pinion bushing	0.04 to 0.09 mm (0.0010 to 0.0035 in)
Lubrication Data (during overhaul)	
Starter drive helical groove	**grassofiat MR3**

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MARELLI STARTER (Model 65 - 46)

Type	MARELLI MT 68 AC
Voltage rating	12 V
Rated output	3.5 kW
Rotation (seen from pinion end)	Clockwise
Starter drive ratio	9/110
No. of poles	4
Field winding	Series
Control	Freewheel, with lever
Operation	Solenoid
Bench Test Data	
Running test at 20°C:	
— current	⩽ 700 Amp
— torque	19.6 Nm (2 kgm) (14 ft. lbs)
— speed	1400 ÷ 1800 rpm
— voltage	9 V
Lock test at 20°C:	
— current	⩽ 1400 Amp
— voltage	5 V
— torque	⩽ 49 Nm (5 kgm) (36 ft. lbs)
— overall internal resistance	0.004 ± 0.0004 Ohm
Light running test at 20°C:	
— current	⩽ 85 Amp
— voltage	12 V
— speed	7.000 ÷ 10.000 rpm
Main series inductance winding resistance (at 20°C)	0.002 ± 0.0002 Ohm
Mechanical Data	
Brush spring load (not worn)	14.7 ÷ 17.4 N (1.5 ÷ 1.8 kg) (3.3 ÷ 4 lbs)
Mica undercut depth	1 mm (0.04 in)
Clutch slip torque (pinion rotating torque)	6 ÷ 8 kgcm

(continued)

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MARELLI STARTER (Model 65 - 46)

(continued)

Commutator dia	44.840 to 45.000 mm (1.765 to 1.77 in)
— wear limit	43.5 mm (1.712 in)
— maximum ovality	0.08 mm (0.003 in)
— armature end play	0.1 ÷ 0.4 mm (0.004 to 0.016 in)
Solenoid	
Winding resistance at 20°C (68°F)	0.22 ± 0.02 Ohm
Current consumption at 12 V	54 Amp
Activation voltage	⩽ 5.5 V
Moving contact travel	3 mm (0.118 in)
Plunger stroke	13.8 to 14.9 mm (0.543 to 0.586 in)
End of stroke plunger load at 12 V	⩽ 392 N (40 kg) (88 lbs)
Fitting Data	
Pole shoe I.D.	75.830 to 76.000 mm (2.985 to 2.992 in)
Armature O.D.	74.900 to 74.950 mm (2.948 to 2.950 in)
Drive end bushing I.D.	12.475 to 12.502 mm (0.491 to 0.492 in)
Pinion journal O.D.	12.425 to 12.440 mm (0.4891 to 0.4897 in)
Pinion clearance in bushing	0.035 to 0.077 mm (0.0013 to 0.0030 in)
Intermediate bushing I.D.	20.200 to 20.264 mm (0.7952 to 0.7977 in)
Shaft journal dia	19.677 to 20.000 mm (0.7747 to 0.7874 in)
Shaft clearance in bushing	0.200 to 0.587 mm (0.0078 to 0.0231 in)
Commutator end bushing I.D.	14.000 to 14.022 mm (0.5511 to 0.5520 in)
Shaft journal dia	13.957 to 13.984 mm (0.5494 to 0.5505 in)
Shaft clearance in bushing	0.016 to 0.065 mm (0.0006 to 0.0025 in)
Lubrication Data	
Starter drive helical groove (to be lubricated during overhaul)	grassofiat TUTELA MR 3
Commutator end thrust washer	grassofiat TUTELA MR 3

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BOSCH STARTER (Model 65 - 46)

Type BOSCH	JF 12 V 0.001.367.028	
Voltage rating	12 V	
Rated output	3.0 kW	
Rotation (seen from pinion end)	Clockwise	
Starter drive ratio	9/110	
No. of poles	4	
Field winding	Series and parallel	
Control	Freewheel, with lever	
Operation	Solenoid	
Bench Test Data		
Short circuit test (at 20°C) (68°F):	(*)	(°)
— current	760 to 900 Amp	650 to 800 Amp
— torque	45 Nm (4.6 kgm) (33 ft.lbs)	38 Nm (3.9 kgm) (28 ft.lbs)
— voltage	4 V	3.5 V
Light running test at 20°C (68°F):		
— current	60÷90 Amp	
— voltage	11.5 V	
— speed	4800 to 6800 rpm	
Mechanical Data		
Brush spring load (not worn)	25.5 to 27.4 Nm (2.6 to 2.8 kg) (5.8 to 6.1 lbs)	
Armature end play	0.1 to 0.3 mm (0.004 to 0.012 in)	
Mica undercut depth	0.5 to 0.8 mm (0.02 to 0.03 in)	
Commutator diameter	42 mm (1.65 in)	
— wear limit	39.5 mm (1.5 in)	
— maximum ovality of lamination pack	0.05 mm (0.002 in)	
— maximum ovality of commutator	0.03 mm (0.0012 in)	

(continued)

(*) Battery charged (°) Battery not charged

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BOSCH STARTER (Model 65 - 46)

(continued)

Solenoid	
Resistance at 20° C (68° F) — holding coil	1.05 Ohm
Resistance at 20° C (68° F) — actuating coil	0.25 Ohm
Current consumption at 12 V — holding coil	11.04 Amp
Current consumption at 12 V — actuating coil	50 Amp
Activation voltage (minimal)	8 V
Plunger stroke	12 to 14 mm (0.47 to 0.55 in)
Fitting Data	
Pole shoe I.D.	75.85 to 75.98 mm (2.986 to 2.991 in)
Armature O.D.	73 mm (2.88 in)
Armature bushings ID (when fitted):	
— pinion	12.475 to 12.502 mm (0.491 to 0.492 in)
— intermediate	19.020 to 19.072 mm (0.7488 to 0.7508 in)
— commutator	14.000 to 14.018 mm (0.5512 to 0.5518 in)
Armature shaft journal dia:	
— pinion	12.425 to 12.440 mm (0.4891 to 0.4897 in)
— intermediate	18.777 to 18.910 mm (0.7392 to 0.7444 in)
— commutator	13.932 to 13.950 mm (0.5485 to 0.5492 in)
Armature shaft clearance in bushing:	
— pinion	0.035 to 0.077 mm (0.0013 to 0.0030 in)
— intermediate	0.110 to 0.195 mm (0.0043 to 0.0076 in)
— commutator	0.050 to 0.086 mm (0.0019 to 0.0033 in)
Pinion bushing ID (when fitted)	14.245 to 14.272 mm (0.5608 to 0.5618 in)
Armature shaft journal dia, over pinion bushing	14.123 to 14.150 mm (0.5560 to 0.5570 in)
Armature shaft clearance in pinion bushing	0.095 to 0.149 mm (0.0037 to 0.0058 in)
Lubrication Data (during overhaul)	
Starter drive helical groove	grassofiat TUTELA MR 3

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BATTERY

Make	Rated voltage	Nominal capacity (20h discharge rate)	Current rating (discharge 18° x 3)	Max. dimensions (1 x w x h)	Weight with electrolyte
MARELLI	12 V	88 Ah	395 A	373x175x190 mm (14.7x6.8x7.5 in)	–
FIAT	12 V	100 Ah	460 A	330x174x240 mm (13 x 6.8 x 9.5 in)	–
MARELLI	12 V	100 Ah	470 A	353x175x190 mm (13.9 x 6.8 x 7.5 in)	–

FUSES

Refer to table on page 6, Section 60, for Model 446, except as shown below.

Fuses	Protected circuits	Amperes
6	Front RH parking light, rear LH parking light, trailer LH parking light, parking light indicator.	8
7	Turn signal and stop lights (tractor and trailers) with indicators, water temperature gauge, fuel gauge, air cleaner restriction indicator (optional), alternator charge indicator, low engine oil pressure indicator, parking brake indicator and switch, horn.	8
8	Engine shut down solenoid.	8

STARTER SWITCH

4-position, 50-Amp	
Positions	CIRCUIT COMPLETED
Position 0 30	Off (key removable).
Position 1 30-15/54 57-58/57	Lighting switch with integral horn push, fuel gauge, water temp. gauge, alternator charge indicator, low engine oil pressure indicator, turn signal lights and indicators, parking brake indicator, tractor and trailer stop lights, prefitted for thermostart, engine shut down solenoid.
Position 2 30-15/54-50 57-58/57	Lighting switch with integral horn push, fuel gauge, water temp. gauge, alternator charge indicator, low engine oil pressure indicator, turn signal lights and indicators, parking brake indicator, tractor and trailer stop lights, starter, prefitted for thermostart.
Position 3 30-57	Front RH and rear LH parking lights, front LH and rear RH parking lights, parking lights indicator, instrument panel lights.

LIGHTING, SIGNALS AND ACCESSORIES

Refer to data given on p. 7, Section 60, for Model 446, and add (fuel filter restriction indicator).

LIGHTING SWITCH (with integral horn push)

Refer to data given on p. 8, Section 60, for Model 446.

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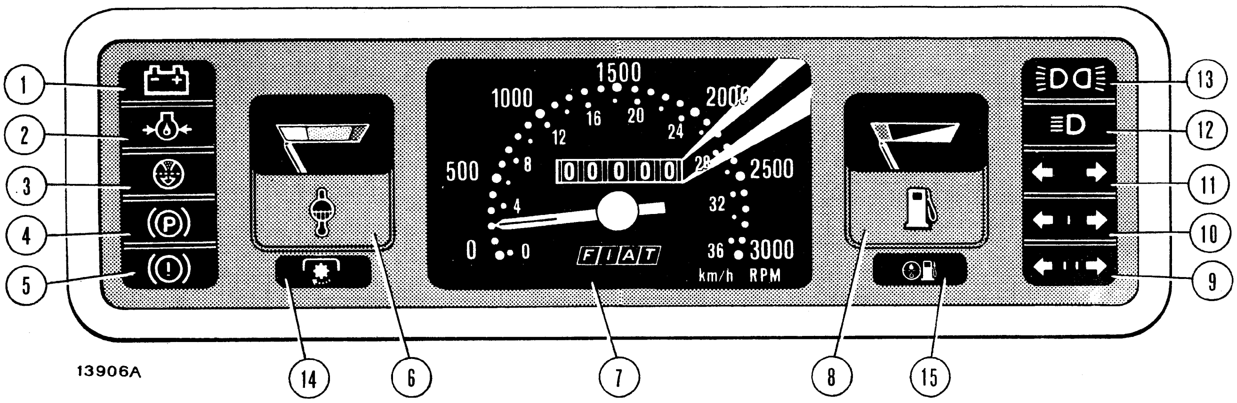
TRACTOR AND TRAILERS TURN SIGNAL SWITCH

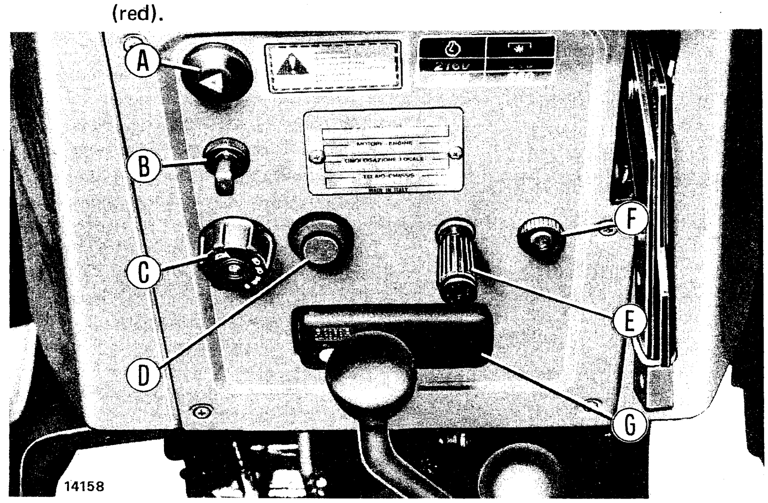
Refer to data given on p. 8, Section 60, for Model 446.

CONTROLS AND INSTRUMENTS



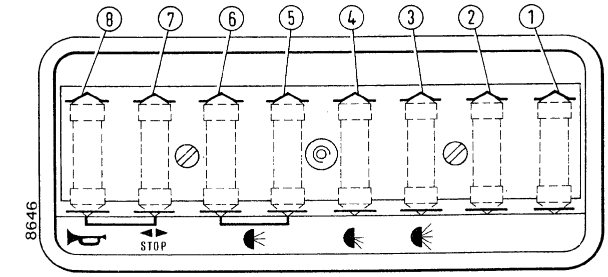
Instrument Panel

1. Battery charger malfunction indicator (red) - 2. Low engine oil pressure indicator (red) - 3. Air cleaner restriction indicator (red) - 4. Hand brake flashing indicator (red) - 5. Spare - 6. Engine cooling water temperature gauge - 7. Tractor meter - 8. Fuel gauge - 9. Second trailer turn signal indicator (green) - 10. First trailer turn signal indicator (green) - 11. Tractor turn signal indicator (green) - 12. High beam indicator (blue) - 13. Parking light indicator (green) - 14. Spare - 15. Fuel filter indicator (red).



Control Board

A. Hazard warning switch with indicator.
B. Turn signal switch.
C. Lighting switch and horn push.
D. Thermostart control.
E. Single-pole power point.
F. Starter switch.
G. Fuse box.



Fuse Box.
(For reference, see page 7, Section 60).

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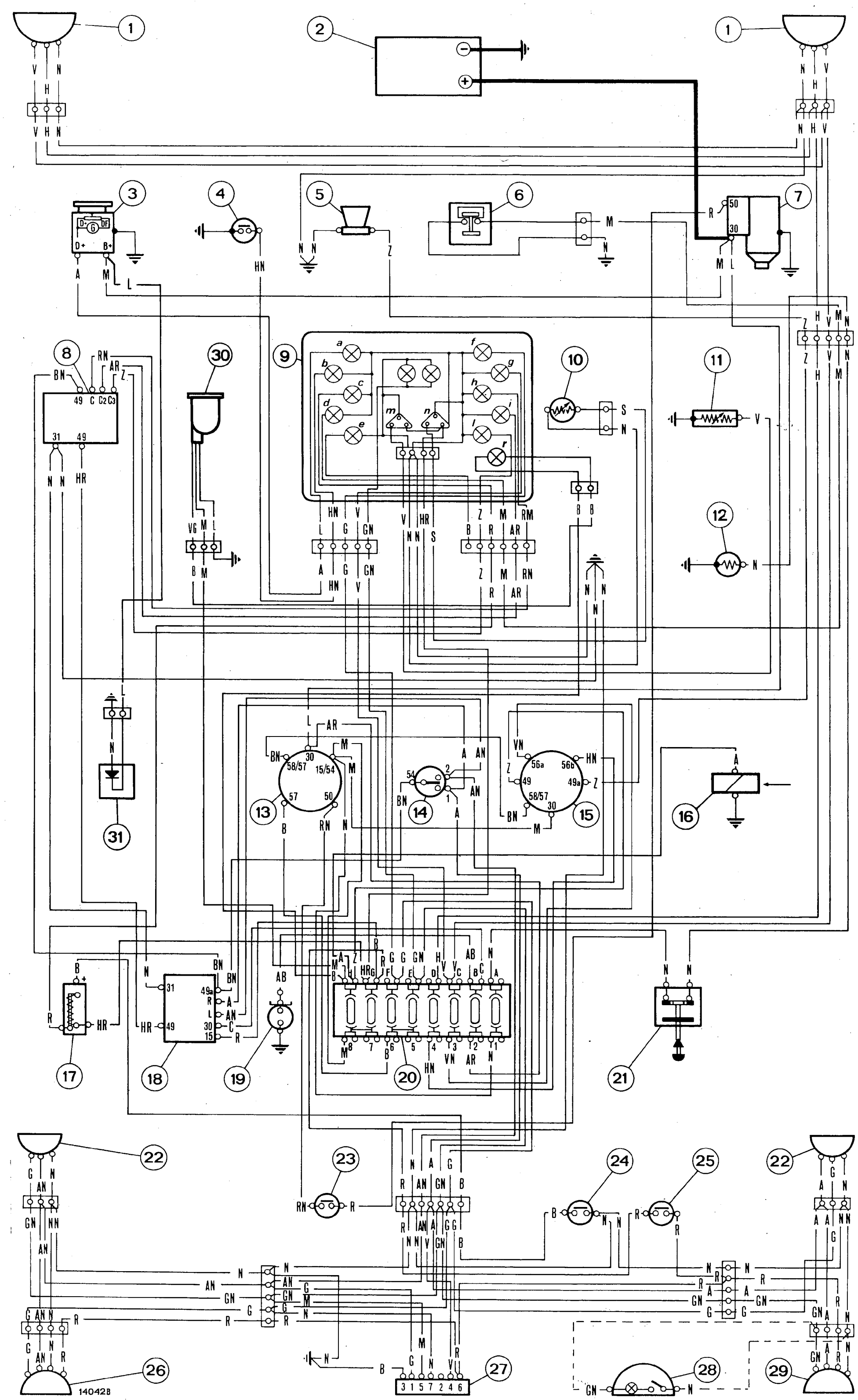

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Wiring Diagram

1. Headlamps, asymmetric, high/low beam.
2. Battery.
3. Alternator.
4. Low engine oil pressure indicator switch.
5. Horn.
6. Aircleaner restriction indicator switch (optional).
7. Starter.
8. Hazard warning light flasher.
9. Multipurpose instrument panel comprising:
   a. battery charger malfunction indicator (red);
   b. low engine oil pressure indicator (red);
   c. aircleaner restriction indicator (red. optional);
   d. parking brake indicator (red);
   e. spare;
   f. parking lights indicator (green);
   g. high beam indicator (blue);
   h. tractor turn signal indicator (green);
   i. first trailer turn signal indicator (green);
   l. second trailer turn signal indicator (green);
   m. water temperature gauge;
   n. fuel gauge;
   r. fuel filter restriction indicator (red, optional).
10. Fuel gauge indicator control.
11. Engine cooling water temperature transmitter unit.
12. Thermostart (optional).
13. Starter switch.
14. Turn signal switch.
15. Lighting switch and integral horn push.
16. Engine shutdown solenoid.
17. Parking brake flasher.
18. Hazard warning indicator pushbutton.
19. Single-pole power point.
20. Fuse box.
21. Thermostart pushbutton (optional).
22. Front parking and turn signal lights.
23. Starter inhibitor switch.
24. Parking brake indicator switch.
25. Stop light switch.
26. Rear LH parking, turn signal and stop lights.
27. Seven-pole power point.
28. Floodlight and integral switch.
29. Rear RH parking, turn signal and stop lights.
30. Fuel filter.
31. Excess voltage protection.

CABLE COLOUR CODE

A = Light blue	**H** = Grey	**R** = Red
B = White	**L** = Dark blue	**S** = Pink
C = Orange	**M** = Brown	**V** = Green
G = Yellow	**N** = Black	**Z** = Mauve

10 - ENGINE

100 - Removal - Installation - Bench Test

290740/1	Engine lifting hook.
290090	Rotary stand for engine overhaul.
293860	Set of brackets for rotary stand **290090.**
291309/1	Compression tester, complete with dummy injector **293862**).

101 - Engine Block - Cylinder Head

292507	Plate for cylinder liner removal.
291501	Plate for cylinder liner removal.
292240 (390425)	Tap (M 12 x 1.75) for injector sleeve threading.
292243 (390771)	Tool for removal of injector sleeve fragments from cylinder head.
293784 (242137)	Puller for injector sleeve.
293742/2	Set of dressing tools for injector seat.
293861	Roller for injector sleeve.
291113	Cylinder head support.
292248	Graduated device for angular tightening of cylinder head screws.
292913	Lathe fixture for valve seat dressing.

102 - Valve gear

293269 (390363)	Valve gear shaft bushing polishing tool.
292103 (360383)	Set of punches for removal/installation of valve gear shaft bushings, for use with **292208 (370008).**
292208 (370008)	Handle.
291046/1 (360409/1)	Punch for removal of engine valve guide.
291177 (390310)	Engine valve guide polishing tool.
291780 (360409/3)	Sleeve for assembly of intake and discharge valve guide (for use with **291046/1**).
290064	Pneumatic valve grinder.
291050	Press for removal/installation of valve springs.
291112	Valves support.
291883 (350108)	Valve clearance adjustment wrench.

103 - Crank gear

291504	Puller for crankshaft pulley hub.
291160	Pliers for elastic piston rings.
291048	Strap for piston installation in cylinder.

104 - Fuel System

290284	Hand pump with stand and couplings for injector tests.
293780	Hand pump for injector setting test.
293671	Injector cleaning set.
290898	Injector removal/installation support (FIAT-OMAP).
293760	Injector removal/installation support (BOSCH-CAV-OMAP).
293761	Set of wrenches for injector removal/installation.
293786	Wrench for injection pump pressure coupling adjustment.

On-bench injection pump test equipment

290239	Adjustable support for overhaul of pumps.
290756	Drive union.
290765	Injector delivery lines (test A, 6x2x 850 mm) (0.2x0.08x33.5 in).
290752	Pump support plate.
293149	Injection pump test bench.
292197	Comparator (1/100 mm, travel 5 mm, (0.2 in), dia. 60 mm (2.36 in).
291754	Comparator (1/100 mm, travel 5 mm, (0.2 in), dia. 40 mm (1.6 in).
291755	Gauge for injection pump assembly to motor.
293401	Injection pump inspection kit (on tractor).

BOSCH distributor injection pump

290664 (365149)	Case for removal/installation of transfer pump rotor.
290774	Distributing rotor stroke gauge.
290779	O-ring installation sleeve.

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290780	0-ring removal hook.
292548	0-ring protector.
291750	Extension with M 8 x 1 thread (for
292553	use with **290774**).
292553	Tool for removal of pressure regulat-
(342141)	ing valve pin.
292554	Cam ring protector.
292555/1	Pump shaft removal/installation tool.
292557/1	Pressure regulating valve compressor.
291747	Regulation shaft attachment and set-
(352142)	ting wrench.
291748	Distributor access plug wrench.
(352140)	
291912	Wrench for regulator support triangular
(352141)	head screw.
291751	Automatic ignition advance gauge.
292239	0-ring installation sleeve.
291749	Wrench for pressure regulating valve.
(352139)	
292823	Wrench for recessed head screw (TORX)

C.A.V. distributor injection pump

290741	Throttle spindle removal guide.
290744	Transfer pump rotor removal/installation tool (for use with torque wrench).
290745	Start-retard 0-ring replacer guide.
290746	Advance plug 0-ring replacer guide.
290757	Pump flange timing gauge.
(365092)	
290758	Cam ring pin removal/installation sleeve.
290742	Guide for throttle and shutoff lever 0-ring installation.
292249	Advance grade tester (with pins).
292251	Recess wrench (TORX 15).
292252	Recess wrench (TORX 20).
292253	Recess wrench (TORX 25).
292254	Drive shaft gasket installation guide.
290755	Set of couplings for outside milling (with hand pump **290284**).
292397	Transfer pressure coupling.
292411	Timing pin.
292414	Transfer pressure adjustment tool.
292415	Recovery and intake coupling.
292439	Injection pump body pressure check coupling (Model 55 - 46).
292794	Pump tightness test plug, for use with **292249** (Model 65 - 46).
292821	Pump tightness test plug, for use with **292449** (Model 55 - 46).
293403	0-1.5 bar pressure gauge (kit **293401**), **for use with 292439.**
293405	Hose (kit **293401**) for use with **292439.**
292822	Wrench for hydraulic test capscrew.

105 -Lubrication

293300	Lubrication pressure checking kit.

106 - Cooling

291182/1	Water pump impeller puller.
291968	Engine cooling water temperature checking kit.

20 - POWER TRAIN

201 - Clutch

292320	Tractor disassembly stand.
291291/2	Clutch overhaul kit (pre-modification).
293650	Universal clutch overhaul kig (post-modification).
291184	Clutch centring and adjustment pin (on tractor), complete with register.
292176	Clutch lever release test compressor.
293763	PTO clutch release lever set screw wrenches.

202 - Gearbox and splitter

290086	Rotary stand.
290092	V-brackets.

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291517	Gearbox removal/installation hook.
292888	Engine-gearbox assembly guide pins.
292626 **(322228)**	Parallel brackets (for use with **290086**).

204 - Bevel drive and differential

293400/1	Bevel pinion position gauge (for use with **293510** or **293101/1**).
293510 **or** **293101/1**	Universal or specific tool for setting bevel pinion bearing.
291525	Differential supports installation pins.
290870	Differential lock fork spring press.
293342/2	Bevel pinion locking nut wrench.
291517	Final drive housing and cover lifting hook.
292313	M 10 x 1.25 adaptor for PTO relay journal removal (for use with **292927**).

206 - Final Drives

292400	Rear wheel lifting hook.
291517	Final drives housing and cover lifting hook.
291525	Final drives housing cover guide pins.

30 - FRONT AXLE - STEERING

301 - Axle

292927 **290793**	Slide hammer puller with kingpin adaptor (M 12 x 1.25).

303 - Power steering

293388	Tool for installing O-ring in power steering housing.
293389	Power steering rotary valve return spring installation pin.
292390	Power steering rotor retainer.
292870 **(formerly 293300)**	Universal set of pressure gauges for power steering pressure relief valve check on tractor (for use with coupling **293160**).

Power steering hydraulic test equipment

291231	Pump output tester.
293005	Tank.
291235	Electric motor (6-10 hp).
or	
292150	Electric motor (9-15 hp).
290385	Union.
293165	Hydraulic pump.
293723	Support.
292256 **292257**	Brackets for support **293723**.
293192/1	Wrench for rotary valve.
290445	Suction pipe.
290448 **290540**	Suction pipe adaptors.
293316	Adaptor (2 off) for suction and delivery pipes.
290544	Delivery pipe.
292146	Three-way connector.
290541	Return pipe adaptor.
290447	Return pipe.
293315	Plug (2 off).
293721	Drain connection.
292775	Plastic pipe for oil drainage.

40 - FRONT WHEEL DRIVE

401 - Live front axle

292116	Ballast support lifting hook.
293782	Front axle bevel pinion restraining wrench (for use with **293782**).
292220/3	Front axle bearing swivel torque checking tool.
292161	King pin pivot bearing cup puller.
293857	Kingpin puller.
293785	Wrench for bevel pinion lock ring (for use with **293782**).
291525	Pins for planetary drive installation.
293812	Pins for front wheel installation.

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293460 (Ar322215)	Stand for front axle overhaul.
293836	Axle drive seal installation guard.
293743	Differential bevel pinion housing housing support.
293520/2	Wrench for bevel pinion bearing lock ring and for swivel torque check.
293400/1	Bevel pinion position gauge (for use with **293438/2** or **293510**).
293510	Universal bevel pinion bearing setting gauge.
293438/2 (A293439)	Specific bevel pinion bearing setting gauge.
293544	Differential bearing lock ring **4966240** setting wrench.
293837	Front axle wheel hub shaft bearing lock ring wrench.

50 - HYDRAULIC LIFT UNIT

501 - Lift

290284	Valve adjustment hand pump.
293300	Universal set of pressure gauges and connectors for hydraulic circuit pressure test.
290817 290818	Lift cross shaft seal guard and punch for installation.
291259	Wrench for oil intake valve plug on cylinder.
290826	Safety valve adjustment adaptor (for use with **290824**).
290824	Pressure relief valve adjustment adaptor.
290831	Adaptor for checking oil intake valve leakage on cylinder (with **290284**).
290834/1	Adaptor for checking exhaust valve leakage (with **290284**).
290819	Lift spring checking lever.
291863	Wrench for lock ring of lift pressure valve adjustment.

Remote control valve

291231	Tester.
291235 or 292150	Motor.
293005	Tank.
293539	Drain tube.
290523	Support.
293777	Plate.
290385	Union.
292588	A 18 X pump.
290445	Suction pipe.
290417	Suction coupling.
290544	Delivery pipe.
290330	Delivery coupling.
290447	Return pipe.
292146	Three-way coupling.
290541	Return adaptor.
293547	Adaptor.
293551	Adaptor.
293772	Plug.
290373	Plug.
290448	Suction adaptor.
290600	Plug.
293553	Coupling.
293310	Delivery coupling.

502 - Lift pump, type A 25, and power steering control pump, type C 25

291231	Large output tester, equipped with:
290419	– suction coupling (for pumps A 25 and C 25);
290418	– delivery coupling (for pumps A 25 and C 25);
290448	– suction adaptor (for pumps A 25 and C 25);
290445	– suction pipe (for pumps A 25 and C 25);
290447	– delivery pipe (for pumps A 25 and C 25);
291235	Pump drive motor, equipped with:
290385	– drive union (for pumps A 25 and C 25).

60 - ELECTRICAL SYSTEM

291352	60 Amp and 4-40 V ammeter; 500 Ohm ohmeter.
290708	12 V lamp tester.
290049 or 291994	6 - 12 V battery tester.
290050	Densimeter for battery.
291929	4-metre cables with clips.
291763	Electric equipment test bench.
293599	Support for bench test of alternators.

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FIAT

55-46 Special
55-46 DT Special
60-46 Special
60-46 DT Special
65-46 Special
65-46 DT Special

WORKSHOP MANUAL

QUICK REFERENCE INDEX

S E R V I Z I   T E C N I C I   D I   A S S I S T E N Z A

FOREWORD

- The attached section updates the Workshop Manual for Mods. 55-46 and 65-46 with front wheel drive, including Moc 55-46/60-46/65-46 Special with rear or four-wheel drive.

- For the sections which have remained unchanged, consult section A (GENERAL)) of the index which will refer to the sections already dealt with for previous models.

The imperial weights and measures are given for operator's convenience and though the closest approximation is sought, they are normally rounded off for practical reasons. In case of discrepancies, only the metric units should be considered.

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See mods. 55-56/60-56/65-56

102 - Valve gear

See mods. 55-56/60-56/65-56

103 - Crankgear

See mods. 55-46 and 65-46

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See mods. 55-46 and 65-46

Injection pump bench test

See mods. 55-46 and 65-46

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See mods. 55-46 and 65-46

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See mods. 55-46 and 65-46

50 - HYDRAULIC LIFT UNIT

501 - Lift

See mods. 55-46 and 65-46

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See mods. 55-46 and 65-46

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FIAT

55-56 55-56 DT
60-56 60-56 DT
65-56 65-56 DT
70-56 70-56 DT

QUICK REFERENCE INDEX

WORKSHOP MANUAL

S E R V I Z I   T E C N I C I   D I   A S S I S T E N Z A

FOREWORD

- The attached sections complete the Workshop Manual for model 446 and mods. 55-46 and 65-46 with rear and four-wheel drive with insertion of the Rew Series 56, including mods. 55-56, 60-56, 65-56 and 70-56 with rear or front wheel drive.

- This revision contains all the information required for servicing the models which make up the New Series 56.

- For the sections in common with the other models, consult section A (GENERAL) of the index which will refer to the sections already dealt with for previous models.

The imperial weights and measures are given for operator's convenience and though the closest approximation is sought, they are normally rounded off for practical reasons. In case of discrepancies, only the metric units should be considered.

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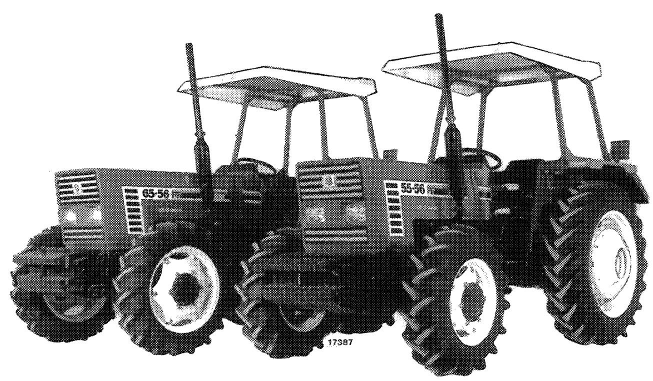
SPECIFICATION

Marketing code:				
— Two wheel drive	55-56	60-56	65-56	70-56
— Four wheel drive	55-56 DT	60-56 DT	65-56 DT	70-56 DT
Engineering code:				
— 8-speed, two wheel drive	673.200.000	673.200.001	673.600.000	673.700.000
— 12-speed, two wheel drive	673.200.000 Var. 720.111	673.200.001 Var. 720.111	673.600.000 Var. 720.111	673.700.000 Var. 720.111
— 8-speed, four wheel drive	673.227.000	673.227.001	673.627.000	673.727.000
— 12-speed, four wheel drive	673.227.000 Var. 720.111	673.227.001 Var. 720.111	673.627.000 Var. 720.111	673.727.000 Var. 720.111
Engine type (all versions)	FIAT 8035.06.307 (C.A.V. pump) 8035.06.206 (BOSCH pump)	FIAT 8035.05.307 (C.A.V. pump) 8035.05.206 (BOSCH pump)	FIAT 8045.06.320 (C.A.V. pump) 8045.06.220 (BOSCH pump)	FIAT 8045.06.307 (C.A.V. pump) 8045.06.206 (BOSCH pump)
Weights				
Operating weight with lift, implement attachment, tow hook and ROPS frame.				
— Two wheel drive .... kg	2010 kg 4431 lb	2100 kg 4630 lb	2360 kg 5203 lb	2440 kg 5379 lb
— Four wheel drive .... kg	2220 kg 4894 lb	2320 kg 5115 lb	2600 kg 5732 lb	2700 kg 5952 lb



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SPECIFICATION

ENGINE	55-56 55-56 DT	60-56 60-56 DT	65-56 65-56 DT	70-56 70-56 DT
Type	4-stroke diesel, naturally aspirated			
Injection	Direct			
Number of cylinders	3		4	
Sleeves	Dry, pressed on engine block			
Bore and stroke ... mm	100 x 115 3.94 x 4.52"	104 x 115 4.09 x 4.53"	100 x 115 3.94 x 4.52"	100 x 115 3.94 x 4.52
Displacement ... cm^3	2710	2931	3613	3613
Compression ratio	17 to 1			
Max. horsepower DGM/DIN ... kW	40.5 (55 HP)	44 (60 HP)	47.8 (65 HP)	55.5 (70 HP)
Max. output speed ... rpm	2500	2500	2500	2500
Max. torque speed ... rpm	1500	1500	1500	1500
Main bearings	4		5	
Sump	bearing, in cast iron			
Balancer	—		bearing, in cast iron Flyweight, engine sump	
Valve gear	OH valves, pushrod operated			
Inlet — Opens: BTDC	3°			
Inlet — Closes: ABDC	23°			
Exhaust — Opens: BBDC	48° 30'			
Exhaust — Closes: ATDC	6°			
Valve clearance — for timing check ... mm	0.45			
— normal inlet ... mm	0.25			
scarico ... mm	0.35			
Fuel system				
Air cleaner	Oil bath, or dry double cartridge, with centrifugal pre-cleaner and automatic dust discharge.			
Fuel filter (on feed pump delivery)	Strainer in fuel pump. — Mods. 65-56 and 70-56: two further disposable paper filters (the first with water separator) — Mods. 55-56 and 60-56: single integral cartridge filter with incorporated water separator			
Fuel pump	Double diaphragm			
— operation	Cam			
Injection pump	Rotary distributor with incorporated governor and spark advance variator			
— type BOSCH	VE 3/11F 1250 L 163-1- 4800682	VE 3/11F 1250 L 163 4794586	VE 4/11F 1250 L 164-2- 4804869	VE 4/11F 1250 L 164-1 4794589
— type C.A.V.	DPS8522A 010A 4797414	DPS8522A 000A 4797413	DPS8520A 140A 4806880	DPS8520A 100A 4797416

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	55-56 55-56 DT	60-56 60-56 DT	65-56 65-56 DT	70-56 70-56 DT
Integral all-speed governor:				
— BOSCH	Centrifugal			
— C.A.V.	Centrifugal			
Integral advance device:				
— BOSCH	Hydraulic			
— C.A.V.	Hydraulic			
Pump timing, BTDC:				
— BOSCH	6° ± 1°	6° ± 1°	4° ± 1°	4° ± 1°
— C.A.V.	0° ± 1°	0° ± 1°	0° ± 1°	0° ± 1°
Injectors	4-orifice	3-orifice	4-orifice	4-orifice
— Type	see page 10, section 10			
— Release pressure ... bar	230-238 (235-243 kg/cm² or 3342-3456 psi)			
Firing order	1-2-3		1-3-4-2	
Lubrication system	Forced feed, gear pump			
Pump drive	From camshaft			
Oil filter	Strainer on pump inlet and full flow cartridge on outlet			
Relief valve	In pump body			
— Oil pressure at governed speed ... bar	2.9-3.9 (3-4kg/cm² or 42.6-56.9 psi)			
Cooling system	Water, centrifugal pump			
Radiator	3 or 4 deep core vertical tube			
Fan, water pump pulley mounted	Suction, steel			
Temperature control	Wax thermostat			
Tractor meter	On instrument panel			
— Drive	Oil pump gear			
— Hour-meter activation speed ... rpm	1800			
— Meter drive ratio	1 to 2			

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POWER TRAIN

Clutch

Twin, dry, single plate LUK or O.M.G. 11" type with separate controls: a pedal for the transmission and lever hand for the PTO.

Transmission and PTO clutch plate material: organic.

Transmission

Constant mesh, straight-toothed.
Epicyclic type splitter, 8 forward and 2 reverse speeds.
In version with creeper (in series with splitter), 12 forward and 3 reverse speeds.
Two separate levers for transmission, splitter and creeper control.

Bevel drive: central on differential.

Differential: two-pinion with pedal-controlled lock.

Final drives: pinion drive, single reduction

BRAKES

Service

Disc, oil-bath, axle shaft mounted. Mechanically operated with separate (latched) pedals.

Parking/Emergency

Acting on service brakes. Mechanical hand lever operated.

STEERING

Circulating ball steering wheel, or power-steering optional.
Life-sealed control linkage.

Turning radius (without brakes):

For mods. 55-56/60-56/65-56/70-56:

— two-wheel drive .... m 3.4 (11 ft 2 in)
— four-wheel drive .... m 4.1 (16 ft 1 in)

FRONT AXLE

Inverted U, centre pivoting. Track adjustment by sliding axle ends.

— Track widths ....7 off

LIVE FRONT AXLE

Full floating, centre pivoting, unjointed drive shaft and articulations on tractor centreline.
Two-pinion differential with epicyclic reduction gear in wheel hubs. Five track widths obtained by varying disc/rim/hum positioning.

REAR WHEELS

Seven track widths obtained by varying disc/rim/hub positioning.
— Track widths ....7 off

POWER TAKE-OFF

Fully independent (540 rpm)

Shaft ....1 3/8", six-spline
Control .... manual lever
Engine speed with PTO at standard speed
(540 rpm) .... 1967 rpm
Rotation: clockwise (tractor seen from rear).

Ground speed PTO

Drive shaft and rotation sense as independent PTO.

Splined-shaft speed (with bevel gear 12/47) per revolution of rear wheels:
— mods. 55-56/60-56/65-56 .... 15.2 revs.
— mod. 70-56 .... 14.2 revs.

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LIFT

— Draught and position control with manual sensitivity control.
— Draught control through spring installed below top link.
— Device for arm lift with automatic return to working position (LIFT O MATIC).
— Gear pump, engine valve gear driven.
— Hydraulic fluid from rear transmission oil.
— Max. lift capacity and stroke: see section 50, page 5.
— Implement attachment, 1st and 2nd category three-point linkage, normal arms (extended reinforced arms optional).

Remote control valves

One or two convertible remote control valves and a trailer power braking valve can be fitted as optionals.

TOWING ATTACHMENTS

— Drilled cross member
— Drawbar swinging over sector
— Adjustable height tow hook
— Front pull hook.

BALLASTING

Front axle

80 kg (178 lb) support on which six or ten 33 kg (73 lb) plates can be fitted - total weight 278 kg (612 lb) or 410 kg (904 lb).

Rear wheel

Four or six 55 kg (121 lb) rings - total weight 220 kg (485 lb) or 330 kg (728 lb) - wheel disc mounted.

BODY

Forward tilting hood for total access to engine and associated components such as radiator, battery, air cleaner, oil filter, fuel filters, feed pump, injection pump and power steering reservoir (if installed).

Partial wrap-around rear fenders with ROPS frame mounts.
Steel plate fuel tank in front of instrument panel.
Padded seat, parallelogram suspension, adjustable reach and ride.

ELECTRICAL SYSTEM

Voltage .... V 12

Alternator

Max. power at top engine speed ..... approx. 400 W
Integral electronic voltage regulator.

Battery

Maintenance-free 12 V; capacity 90/100 Ah (mods. 55-56/60-56) or 100 Ah (mods. 65-56/70-56).

Starter

2.5 kW, electromagnetic engagement.

Lighting

Twin headlamps, asymmetric beams, 45/40 W lamps (white or yellow).
Twin front lights comprising:
— parking light (5 W), transparent;
— turn signal (21 W) orange.
Two tail lights comprising:
— parking light (5 W), red;
— turn signal (21 W), orange;
— stop (21 W), red;
— licence plate.
— rear red reflectors

Instruments and accessories

— Multiple function control panel.
— Power point, DIN 7-pole.
— Single-pole power point.
— Cold starting device
— Flasher for tractor and trailer emergency lights.
— Front floodlight (35 W).

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SPECIFICATION

Speed with engine at top speed (8-speed transmission)

GEAR	Rear Tyres									
	55-56				60-56					
	13.6-28		12.4-32		16.9-28		12.4-36		12.4-32 14.9-28	
	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph
1st slow	2.5	1.6	2.6	1.6	2.7	1.7	2.8	1.7	2.6	1.6
2nd slow	3.7	0	3.9	2.4	4.1	2.5	4.2	2.6	3.9	2.4
3rd slow	5.4	3.4	5.7	3.5	5.9	3.7	6.1	3.8	5.7	3.5
4th slow	7,0	4.3	7.4	4.6	7.7	4.8	7.9	4.9	7.4	48.1
1st fast	8.9	5.5	9.3	5.8	9.7	6.0	10.0	6.2	9.3	5.8
2nd fast	13.3	8.3	14,0	8.7	14.6	9.1	15.1	9.4	14.0	8.7
3rd fast	19.5	12.1	20.5	12.7	21.4	13.3	22.1	13.7	20.5	12.7
4th fast	25.2	15.7	26.5	16.5	27.7	17.2	28.5	17.7	26.5	16.5
1st REV slow	3.5	2.2	3.7	2.3	3.9	2.4	4.0	2.5	3.7	2.3
2nd REV fast	12.7	7.9	13.4	8.3	14.0	8.7	14.4	8.9	13.4	8.3

GEAR	Rear Tyres									
	65-56				70-56					
	14.9-30		12.4-36		16.9-30		12.4-36		14.9-30	
	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph
1st slow	2.7	1.7	2.8	1.7	2.9	1.8	3.0	1.9	3.0	1.9
2nd slow	4.0	0	4.2	2.6	4.3	2.7	4.5	2.8	4.5	2.8
3rd slow	5.9	3.7	6.1	3.8	6.3	3.9	6.5	4.0	6.6	4.1
4th slow	7.6	4.7	7.9	4.9	8.1	5.0	8.4	5.2	8.5	5.3
1st fast	9.7	6.0	10.0	6.2	10.3	6.4	10.7	6.6	10.7	6.6
2nd fast	14.5	9.0	15.1	9.4	15.5	9.6	16.0	9.9	16.2	10.1
3rd fast	21.3	13.3	22.1	13.7	22.6	14.0	23.5	14.6	23.7	14.7
4th fast	27.5	17.1	28.5	17.7	29.3	18.2	30.4	18.9	30.6	19.0
1st REV slow	3.9	2.4	4.0	2.5	4.1	2.5	4.3	2.7	4.3	2.7
2nd REV fast	13.9	8.6	14.4	8.9	14.8	9.2	15.3	9.5	15.4	9.6

Speed with engine at top speed (12-speed transmission)

GEAR	Rear Tyres									
	55-56				60-56					
	13.6-28		12.4-32		16.9-28		12.4-36		12.4-32 14.9-28	
	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph
1st very slow	0.8	0.5	0.8	0.5	0.9	0.6	0.9	0.6	0.8	0.5
2nd very slow	1.2	0.7	1.3	0.8	1.3	0.8	1.4	0.9	1.3	0.8
3rd very slow	1.8	1.1	1.8	1.1	1.9	1.2	2.0	1.2	1.8	1.1
4th very slow	2.3	1.4	2.4	1.5	2.5	1.6	2.6	1.6	2.4	1.5
1st slow	2.5	1.6	2.6	1.6	2.7	1.7	2.8	1.7	2.6	1.6
2nd slow	3.7	0	3.9	2.4	4.1	2.5	4.2	2.6	3.9	2.4
3rd slow	5.4	3.4	5.7	3.5	5.9	3.7	6.1	3.8	5.7	3.5
4th slow	7.0	4.3	7.4	4.6	7.7	4.8	7.9	4.9	7.4	48.1
1st fast	8.9	5.5	9.3	5.8	9.7	6.0	10.0	6.2	9.3	5.8
2nd fast	13.3	8.3	14.0	8.7	14.6	9.1	15.1	9.4	14.0	8.7
3rd fast	19.5	12.1	20.5	12.7	21.4	13.3	22.1	13.7	20.5	12.7
4th fast	25.2	15.7	26.5	16.5	27.7	17.2	28.5	17.7	26.5	16.5
1st REV very slow	1.1	0.7	1.2	0.7	1.2	0.7	1.3	0.8	1.2	0.7
2nd REV slow	3.5	2.2	3.7	2.3	3.9	2.4	4.0	2.5	3.7	2.3
3rd REV fast	12.7	7.9	13.3	8.3	14.0	8.7	14.4	8.9	13.4	8.3

GEAR	Rear Tyres									
	65-56				70-56					
	14.9-30		12.4-36		16.9-30		12.4-36		14.9-30	
	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph
1st very slow	0.9	0.6	0.9	0.6	0.9	0.6	1.0	0.6	1.0	0.6
2nd very slow	1.3	0	1.4	0	1.4	0	1.4	0	1.4	0.9
3rd very slow	1.9	1.2	2.0	1.2	2.0	1.2	2.1	1.3	2.1	1.3
4th very slow	2.5	1.6	2.6	1.6	2.6	1.6	2.7	1.7	2.7	1.7
1st slow	2.7	1.7	2.8	1.7	2.9	1.8	3.0	1.9	3.0	1.9
2nd slow	4.0	0	4.2	2.6	4.3	2.7	4.5	2.8	4.5	2.8
3rd slow	5.9	3.7	6.1	3.8	6.3	3.9	6.5	4.0	6.6	4.1
4th slow	7.6	4.7	7.9	4.9	8.1	5.0	8.4	5.2	8.5	5.3
1st fast	9.7	6.0	10.0	6.2	10.3	6.4	10.7	6.6	10.7	6.6
2nd fast	14.5	9.0	15.1	9.4	15.5	9.6	16.0	9.9	16.2	10.1
3rd fast	21.3	13.3	22.1	13.7	22.6	14.0	23.5	14.6	23.7	14.7
4th fast	27.5	17.1	28.5	17.7	29.3	18.2	30.4	18.9	30.6	19.0
1st REV very slow	1.2	0.7	1.3	0.8	1.3	0.8	1.4	0.9	1.4	0.9
2nd REV slow	3.9	2.4	4.0	2.5	4.1	2.5	4.3	2.7	4.3	2.7
3rd REV fast	13.9	8.6	14.4	8.9	14.8	9.2	15.3	9.5	15.4	9.6

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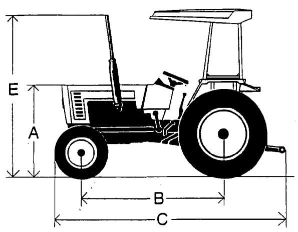
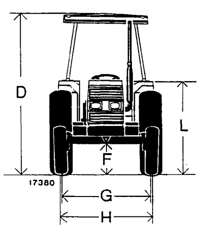
Standard tyre sizes	Models			
	55-56	60-56	65-56	70-56
front	6.00-16	7.50-16	7.50-16	7.50-16
rear	12.4-32	16.9-28	14.9-30	16.9-30

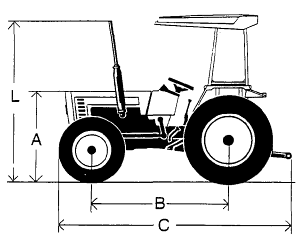


Operating weights	Models			
	55-56	60-56	65-56	70-56
With ballast kg	2010	2100	2360	2440
With ballast lb	4431	4630	5203	5379
Without ballast kg	2750	2840	3100	3180
Without ballast lb	6063	6261	6834	7011

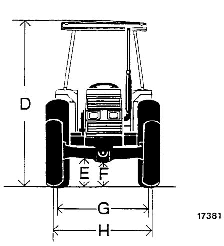


Dimensions	55-56		60-56		65-56		70-56	
	mm	in	mm	in	mm	in	mm	in
A	1430	56.3	1430	56.3	1470	57.9	1470	57.9
B	2052	80.8	2052	80.8	2167	85.3	2203	86.7
C	3200	126.0	3200	126.0	3435	135.2	3470	136.6
D	2290	90.2	2290	90.2	2320	91.3	2320	91.3
E	2360	92.9	2360	92.9	2390	94.1	2390	94.1
F	495	19.5	495	19.5	535	21.1	535	21.1
G	1315-1915	51.8-74.4	1315-1915	51.8-74.4	1415-1915	55.7-74.4	1415-1915	55.7-74.4
H	1400-2000	55.1-78.7	1400-2000	55.1-78.7	1400-2000	55.1-78.7	1400÷2000	55.1-78.7
L	1465	57.7	1465	57.7	1495	58.9	1495	58.9

Standard tyre sizes	Models			
	55-56 DT	60-56 DT	65-56 DT	70-56 DT
front	11.2-20	9.5-24	9.5-24	11.2-24
rear	12.4-32	16.9-28	14.9-30	16.9-30



Operating weights	Models			
	55-56 DT	60-56 DT	65-56 DT	70-56 DT
With ballast kg	2220	2320	2600	2700
With ballast lb	4894	5115	5732	5953
Without ballast kg	2960	3060	3340	3440
Without ballast lb	6526	6746	7364	7584



Dimensions	55-56 DT		60-56 DT		65-56 DT		70-56 DT	
	mm	in	mm	in	mm	in	mm	in
A	1420	55.9	1420	55.9	1445	56.9	1445	56.9
B	2012	79.2	2012	79.2	2127	83.7	2163	85.2
C	3275	128.9	3275	128.9	3525	138.8	3560	140.2
D	2290	90.2	2290	90.2	2320	91.3	2320	91.3
E	380	15.0	380	15.0	405	15.9	405	15.9
F	320	12.6	320	12.6	345	13.6	345	13.6
G	1315-1915	51.8-74.4	1315-1915	51.8-74.4	1415-1915	55.7-74.4	1415-1915	55.7-74.4
H	1445-1875	56.9-73.8	1445-1875	56.9-73.8	1445-1875	56.9-73.8	1445-1875	56.9-73.8
L	2350	92.5	2350	92.5	2375	93.5	2375	93.5

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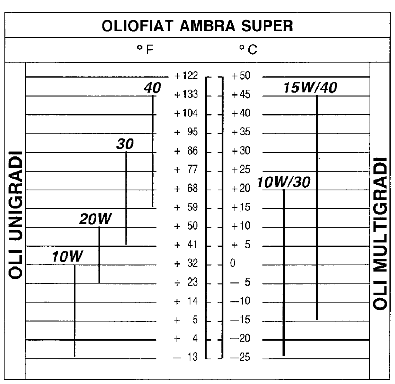
CAPACITIES

DESCRIPTION	LIQUIDS AND LUBRICANTS							
	CAPACITY						FIAT RECOMMENDED PRODUCTS	INTERNATIONAL DESIGNATION
	dm³ (litres)		gallons		kg			
	55-56 60-56	65-56 70-56	55-56 60-56	65-56 70-56	55-56 60-56	65-56 70-56		
Cooling system: without cab	12	14	2.64	3.08	—	—	Water and FIAT ***«PARAFLU 11»***	—
Cooling system: with cab	14	16	3.08	3.52	—	—		
Fuel tank	61	61	13.43	13.43	—	—	Diesel oil	—
Windshield washer	2	2	.44	.44	—	—	Water and FIAT «DP1» (1)	—
Sump and filter oil	7.3	11.7	1.61	2.58	6.60	10.50	**oil Fiat AMBRA SUPER**	Oil MIL-L-2104D and service API CD.
Sump oil only	6.7	10.5	1.47	2.31	6.00	9.50		
Air cleaner oil	1.0	1.0	.22	.22	.90	.90		
Power steering	1.70	2.0	.37	.44	1.50	1.80	**oil Fiat TUTELA MULTI F**	Oil for transmissions, oil bath brakes and lift to Massey Ferguson MF1135 and Ford M2 C86A Meets service API GL 4. Viscosity SAE 20W/30
Steering unit oil	1.0	1.0	.22	.22	.90	.90		
Live front axle: axle casing	5.5	5.5	1.21	1.21	5.00	5.00		
Live front axle: planetary drives- (each)	1.25	1.25	.28	.28	1.10	1.10		
Rear transmission (transmission, bevel drive and hydraulic lift oil								
— 2-wheel drive	32	32	7.04	7.04	28.80	28.80		
— 4-wheel drive	33	34	7.26	7.48	30.60	30.60		
Final drives (each)	1.7	4.0	.37	.88	1.50	3.60		
Front wheel hubs	—	—	—	—	—	—	**grease Fiat TUTELA G9**	Lithium-calcium grease to NLGI2
Pressure lubricators	—	—	—	—	—	—		

(1) Non-freeze and detergent liquid to -10°C (14°F) with 50% Fiat DPI. At temperatures below -10°C (14°F) use DP1 liquid only.



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ENGINE BLOCK - CYLINDER HEAD

	mm	
	55-56/65-56/70-56	60-56
ENGINE BLOCK		
Cylinder liner seat diameter in engine block	102.850-102.900 mm (4.0492-4.0512")	106.850-106.900 mm (4.2067-4.2086")
Cylinder sleeve O.D.	103.020-103.050 mm (4.0559-4.0571")	107.020-107.050 (4.2134-4.2146")
Interference between liners and seats in block..............................	0.120-0,200 mm (0.0047-0.0079")	
Liner O.D. oversize	0.2 mm (0.0079")	
Cylinder liner inner diameter	100.00-100.024 mm(1) (3.9370-3.9379 (1)	104.000-104.024 mm(1) (4.0945-4.0954) (1)
Maximum ovality and taper due to wear (2).....................................	0.12 mm (0.0047")	
Liner inner diameter oversize	0.4 - 0.8 mm (0.0157-0.0315")	
Camshaft bush seat diameters:		
— front	54.780-54.805 (2.1567-2.1577")	
— intermediate	54.280-54.305 mm (2.1370-2.1380")	
— rear	53.780-53.805 mm (2.1173-2.1183")	
Tappet seat bore diameter	15.000-15.018 mm (0.5906-0.5913")	
Tappet oversize	0.1 - 0.2 - 0.3 mm (0.0039-0.0079-0.0118")	
Main bearing seat bore diameter	84.200-84.230 mm (3.3149-3.3161")	
Cylinder head		
Valve guide seat bore diameter in head	13.950-13.983 mm (0.5492-0.5505")	
Valve guide oversize	0.2 mm (0.0079")	
Valve seat dimensions	See page 2, section 101	
Valve stand-in	0.7-1.0 mm (0.0276-0.0394")	
— maximum stand-in permitted	1.3 mm (0.0512")	
Injector stand-out	0.05-0.7 mm (0.002-0.0276")	
— max. stand-out permitted	1.0 mm (0.0394")	
Original cylinder head height	92 mm (3.622")	
Maximum head dressing allowed	0.5 mm (0.0197")	

(1) Value obtained after driving by means of reboring.

(2) Measure in piston ring working area in parallel sense and perpendicular to engine axis.

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CRANK GEAR

	mm
Crankshaft - Bearings	
Main journal diameter	79.791-79.810 mm (1) (3.1414-3.1421") (1)
Main journal undersize	0.254-0.508-0.762-1.016 mm (0.01-0.02-0.03-0.04")
Main bearing wall thickness	2.168-2.178 (0.0854-0.0857")
Main bearing undersize	0.254-0.508-0.762-1.016 mm (0.01-0.02-0.03-0.04")
Main journal clearance in bearings	0.034-0.103 mm (0.0013-0.004")
— maximum wear clearance	0.180 mm (0.0071")
Crankpin diameter	63.725-63.744 mm (1) (2.5088-2.5096") (1)
Crankpin undersize	0.254-0.508-0.762-1.016 mm (0.01-0.02-0.03-0.04")
Big end bearing wall thickness	1.805-1.815 mm (0.0710-0.0715")
Big end bearing undersize	0.254-0.508-0.762-1.016 mm (0.01-0.02-0.03-0.04")
Crankpin clearance in big end bearing	0.033-0.087 mm (0.0013-0.0034"
— maximum wear clearance	0.180 mm (0.0071")
Crankshaft thrust washer thickness	3.378-3.429 mm (0.133-0.135")
Thrust washer oversize	0.127-0.254-0.508 mm (0.005-0.01-0.02")
Width of main bearing housing over thrust washers	31.766-31.918 mm (1.2506-1.2638")
Length of corresponding main journal	32.000-32.100 mm (1.2598-1.2638")
Crankshaft end float	0.082-0.334 mm (0.0032-0.0131")
— maximum wear end float	0.40 mm (0.016")
Maximum main journal and crankpin ovality or taper after grinding	0.01 mm (0.0004")
Maximum main journal and crankpin ovality or taper due to wear .	0.05 mm (0.0019")

(cont.)

(1) mm undersize crankpin and main journal crankshafts may be fitted in production marched with corresponding undersize bearings.

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CRANK GEAR

(continued)

	mm
Maximum main journal misalignment crankshaft resting on end journals	0.10 mm (0.0039")
Maximum misalignment of crankpins (mods. 55-56/60-56) or of every pair of crankpins (mods. 65-56/70-56) relative to main journals (in either direction)	0.25 mm (0.0098")
Maximum tolerance in distance from outer crankpin edge to crankshaft centerline	±0.10 mm (± 00.39")
Maximum crankshaft flange run-out with gauge stylus in A, page 2, section 103, over 108 mm (4.25") diameter (total gauge reading)	0.025 mm (0.001")
Maximum flywheel seat eccentricity relative to main journals (B, page 2, sect. 103) (total gauge reading)	0.04 mm (0.0016")
Connecting rods	
Small end bore diameter	41.846-41.884 mm (1.6475-1.649")
Small end bushing outer diameter	41.979-42.017 mm (1.6527-1.6542")
Bushing interference fit in small end	0.095-0.171 mm (0.0037-0.0067")
Small end bushing fitted I.D.	38.004-38.014 mm (1.4962-1.4966")
Big end bore diameter	67.407-67.422 mm (2.6538-2.6544")
Maximum connecting rod axis misalignment at 125 mm	±0.07 mm (± 0.003")
Maximum connecting rod weight difference over a complete set from the same engine	25 grams (0.88 oz.)

(cont.)

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CRANK GEAR

(continued)

	mm	
	55-56/65-56/70-56	**60-56**
Pistons		
Piston diameter: measured at 57 mm (2.244") from base of skirt and right angles to pin	99.827-99.841 mm (3.9302-3.9307")	103.812-103.826 mm (4.0871-4.0876)
Piston clearance in liner	0.159-0.197 mm (0.0063-0.0077")	0.174-0.212 mm (0.0068-0.0083")
— max. wear clearance	0.30 mm (0.012")	
Piston oversize range	0.4-0.8 mm (0.016-0.032")	
Piston stand-out with respect to head at T.O.C.	0.355-0.761 mm (0.014-0.03")	
Piston pin diameter	37.983-37.990 mm (1.4954-1.4957")	
Piston pin seat bore in piston	37.993-38.000 mm (1.4958-1.4961")	
Piston pin clearance in piston	0.003-0.017 mm (0.0001-0.0007")	
Piston pin clearance in small end bushing	0.014-0.031 mm (0.0006-0.0012")	
— maximum wear clearance	0.06 mm (0.0024")	
Maximum weight difference between pistons on same engine	20 grams (2/3 oz.)	
Piston ring clearance in groove:		
— Top	0.090-0.122 mm (0.0035-0.0048")	
— 2nd	0.060-0.092 mm (0.0024-0.0036")	
— 3rd	0.040-0.075 mm (0.0016-0.0029")	
Maximum wear clearance:		
— Top	0.50 mm (0.008")	
— 2nd and 3rd	0.20 mm (0.019")	
Piston ring gap:		
— Top	0.35-0.55 mm (0.0138-0.0216")	0.40-0.65 mm (0.0157-0.0256")
— 2nd	0.30-0.45 mm (0.118-0.0177")	0.30-0.55 mm (0.0118-0.0216")
— 3rd	0.30-0.60 mm	(0.0118-0.0236")
Maximum wear gap	1.20 mm (0.047")	

(cont.)

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CRANK GEAR

(continued)

	mm
Dynamic balancer (mods. 65-56 and 70-56)	
Idler gear jack shaft clearance in gear bushing (see 19, page 3, sect. 103 - mods. 55-46/65-46) (1)	0.050-0.100 mm (0.002-0.004")
Flyweight gear shaft (11) clearance in front bushing (1)	0.050-0.100 mm (0.002-0.004")
Drive pinion (18) clearance in bushings (1)	0.050-0.100 mm (0.002-0.004")
Connecting sleeve (13) spline, PTO gear connection (18) and flyweight drive gear backlash	0.038-0.106 mm (0.0015-0.0042")
Flyweight gear shaft (11) clearance in rear bushing (2) (2)	0.013-0.061 mm (0.0005-0.0024")
Pivot (26) clearance in flyweight bushings (27)	0.020-0.073 mm (0.0008-0.0029")
Flyweight bushing interference fit in housing	0.040-0.100 mm (0.0016-0.0040")
Idler gear jack shaft (34) clearance in bushing (2)	0.013-0.061 mm (0.0005-0.0024") 0.080 (0.0031")
Flyweight balancer timing	See page 3, sect. 103 - Mods. 55-46/65-46

(1) Bushing interference fit in housing: 0.063-0.140 mm (0.0025-0.0055")

(2) Bushing interference fit in housing: 0.037-0.101 mm (0.0014-0.0040")

VALVE GEAR

	mm
Valve timing gears	
Timing gear backlash	0.160 mm (0.0093")
Idler gear jack shaft diameter	36.975-37.000 mm (1.4557-1.4567")
Idler gear bushing fitted I.D. after reaming	37.050-37.075 mm (1.4587-1.4596")
Jack shaft journal clearance in bushing	0.050-0.100 mm (0.002-0.004")
— max. wear clearance	0.15 (0.0059")
Bushing interference fit in idler gear	0.063-0.140 mm (0.0025-0.0055")
Lift and power steering pump drive gear shaft diameter	36.975-37.000 (1.4557-1.4567")
Bushing fitted I.D. after reaming	37.050-37.075 mm (1.4587-1.4596")
Shaft clearance in bushing	0.050-0.100 mm (0.002-0.004")
Bushing interference fit in housing	0.063-0.140 (0.0025-0.0055")
Pump drive gear thrust washer thickness	1.45-1.50 (0.0571-0.0591")

(cont.)

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VALVE GEAR

(continued)

	mm
Camshaft:	
Camshaft bushing O.D.:	
— front	54.875-54.930 mm (2.1604-2.1626")
— intermediate	54.375-54.430 mm (2.1407-2.1429")
— rear	53.875-53.930 mm (2.1210-2.1232")
Bushing interference fit in housing	0.070-0.150 mm (0.0028-0.0059")
Camshaft bushing fitted I.D. after reaming:	
— front	51.080-51.130 mm (2.011-2.013")
— intermediate	50.580-50.630 mm (1.9913-1.9933")
— rear	50.080-50.130 mm (1.9716-1.9736")
Camshaft journal diameter:	
— front	50.970-51.000 mm (2.0067-2.0079")
— intermediate	50.470-50.500 mm (1.9870-1.9882")
— rear	49.970-50.000 mm (1.9673-1.9685")
Camshaft journal clearance in bushing	0.080-0.160 mm (0.0031-0.0063")
Maximum wear clearance	0.20 mm (0.0079")
Camshaft end flat (thrust plate to associated seat in camshaft)	0.070-0.220 mm (0.0028-0.0087")
Tappets	
Tappet O.D.	14.950-14.970 mm (0.5886-0.5894")
Tappet clearance in housing on engine block	0.030-0.068 mm (0.0012-0.0027")
— maximum wear clearance	0.15 mm (0.0059")
Tappet oversize	0.1-0.2-0.3 mm (0.004-0.008-0.0012)
Rockers	
Rocker bushing O.D.	21.006-21.031 mm (0.8270-0.8280")
Rocker bore diameter	20.939-20.972 mm (0.8244-0.7902")
Bushing interference fit in rocker	0.034-0.092 mm (0.0013-0.0036")
Rocker bracket bore diameter	18.016-18.034 mm (0.7093-0.7100")
Rocker shaft diameter	17.982-18.000 mm (0.7070-0.7087")
Rocker shaft clearance in bracket	0.016-0.052 mm (0.0006-0.0020")
— maximum wear clearance	0.15 mm (0.006")

(cont.)

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VALVE GEAR

(continued)

	mm
Rocker spacer spring length:	
— free	59.5 mm (2.3425")
— under: 46-52 N (4.7-5.3 kg or 10.4-11.7 lb)	44 mm (1.7323")
Valves, guides and springs	
Valve head diameter — inlet	45.300-45.500 mm (1.7835-1.7913")
Valve head diameter — exhaust	37.500-37.750 mm (1.4764-1.4862")
Valve stem diameter	7.985-8.000 mm (0.3144-0.3150")
Valve face angle: inlet	60° 30' ± 7'
Valve face angle: exhaust	45° 30' ± 7'
Valve clearance: timing check	0.45 mm (0.0177")
Valve clearance: engine (warm or cold) — inlet	0.25 mm (0.0010")
Valve clearance: engine (warm or cold) — exhaust	0.35 mm (0.0138")
Cam lift: inlet	5.250 mm (0.2067")
Cam lift: exhaust	5.677 mm (0.2235")
Valve lift: inlet	9.31 mm (0.3665")
Valve lift: exhaust	10.06 mm (0.3961")
Valve guide O.D.	13.933-14.016 mm (0.5485-0.5518")
Valve guide oversize	0.2 mm (0.0079")
Valve guide interference fit in housing on cylinder head	0.005-0.050 mm (0.0002-0.0020")
Valve guide fitted I.D. after reaming	8.023-8.043 mm (0.3159-0.3166")
Valve stem clearance in guide	0.023-0.058 mm (0.0009-0.0029")
— maximum wear clearance	0.13 mm (0.0051")
Maximum valve stem eccentricity over one revolution with stylus on sealing face	0.03 mm (0.0012")
Inlet and exhaust valve spring length:	
— free	44.6 mm (1.756")
— with load of 256-284 N (26.1-28.9 kg or 57.5-63.7 lb)	34 mm (1.3386")
— with load of 502-554 N (51.2-56.5 kg or 112.9-124.6 lb)	23.8 mm (0.937")

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LUBRICATION

	mm
Oil pump	Gear, camshaft driven
Oil pump drive ratio	2 to 1
Oil pressure, warm at governed speed	2.9-3.9 bar (3-4 kg/cm², 42.6-56.9 psi)
Relief valve crack-off setting	3.5 bar (3.6 kg/cm², 51.2 psi)
Shaft clearance in bushing	0.016-0.055 mm (0.0006-0.0022")
Shaft clearance in driven gear	0.033-0.066 mm (0.0013-0.0026")
Gear backlash	0.100 mm (0.0039")
Gear clearance in pump body	0.060-0.170 mm (0.0024-0.0067")
Drive and driven gear width	40.961-41.000 mm (1.6126-1.6142")
Gear housing depth in pump body	41.025-41.087 mm (1.6152-1.6176")
Drive and driven gear end float	0.025-0.126 mm (0.0009-0.0049")
Relief valve spring length:	
— free	45 mm (1.77")
— loaded: 88-94 N (9-9.6 kg or 19.8-21 lb)	30.5 mm (1.2")
Oil filter	Mesh on suction and cartridge on delivery

COOLING SYSTEM

	mm
Water pump	Centrifugal, vane
Water pump drive ratio	1.403 to 1
Shaft interference fit in impeller	0.017-0.059 mm (0.0007-0.0023")
Shaft interference fit in fan hub	0.024-0.058 mm (0.0009-0.0023")
Face sealing bushing interference fit in impeller	0.012-0.058 mm (0.0005-0.0023")

(cont.)

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COOLING SYSTEM

(continued)

	mm
Thermostat	
Type	Wax
Opening temperature	79±2°C
Close off temperature	94°C
Valve travel when fully open	7.5 mm (0.295")
Radiator	Vertical tube and steel fins, 3 (mods. 55-56, 60-56) or 4 (mods. 65-56, 70-56)
Fan	Suction, steel, 4 blades
Water temperature gauge	Three coloured sectors
Temperature range for each sector:	
— white sector	30-65°C
— green sector	65-105°C
— red sector	105-115°C

FUEL SYSTEM

Fuel pump	Double diaphragm
Operation	Engine driven
Minimum fuel flow at 1600 rpm shaft speed	100 litres/h (22 gall/h)
Drive shaft eccentricity	3 mm (0.118")
Fuel pump drive	
Shaft journal dia.	31.975-32.000 mm (1.2588-1.2598")
Bushing fitted I.D. after reaming	32.050-32.075 mm (1.2618-1.2628")
Shaft clearance in bushing	0.050-0.100 mm (0.0020-0.0040")
Bushing interference fit in housing	0.063-0.140 mm (0.0025-0.0055")
Inner washer thickness	1.45-1.50 mm (0.0570-0.0590")
Outer washer thickness	2.93-3.00 mm (0.1153-0.1181")

(cont.)

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FUEL SYSTEM

(continued)

Injection pump		Distributor, integral governor and advance device	
— BOSCH	mod. 55-56	VE 3/11 F 1250 L163-1 4800682	
	mod. 60-56	VE 3/11 F 1250 L163 - 4794586	
	mod. 65-56	VE 4/11 F 1250 L164-2 - 4804869	
	mod. 70-56	VE 4/11 F 1250 L164-1-4794589	
— CAV	mod. 55-56	DPS 8522A 010A - 4797414	
	mod. 60-56	DPS 8522A 000A - 4797413	
	mod. 65-56	DPS 8520A 140A - 4806880	
	mod. 70-56	DPS 8520A 100A - 4797416	
Rotation direction		anti-clockwise	
Firing order:	mods. 55-56/60-56	1-2-3	
	mods. 65-56/70-56	1-3-4-2	
Injectors:		55-56/65-56/70-56	60-56
- type	W ALTECNA	4802391	4802394
	BOSCH	4792442	4800029
	O.M.A.P.	4800032	4800031
— W ALTECNA	nozzle holder	KBEL 83S1W200-4802392	KBEL 83S1W200-4802392
	spray nozzle	DLL 124S500W-4802393	DLL 136S501W-4802395
— BOSCH	nozzle holder	KBEL 83S35-4791124	KBEL 83S35-4791124
	spray nozzle	DLLA 124S1001-4792443	DLLA 136S1000-4800030
— O.M.A.P.	nozzle holder	OKLL 83S3392-4796644	OKLL 83S3392-4796644
	spray nozzle	OLL 124S3990-4792447	OLL 136S9119-4776715
Number of spray orifices		4	3
Spray orifice diameter	mm	0.31 mm (0.0122")	0.35 mm (0.0138")
Pressure setting		230-238 bar (235-243 Kg/cm², 3342-3456 psi)	
Delivery pipes for mods. 55-56 and 60-56 with BOSCH pump:			
— type		4797506	
— pipe dimensions		6x1.5x475 mm	
Delivery pipes for mods. 55-56 and 60-56 with C.A.V. pump:			
— type		4797511	
— pipe dimensions		6x2x475 mm	
Delivery pipes for mods. 65-56 and 70-56 with BOSCH pump:			
— type		4797516	
— pipe dimensions	mm	6x1.5x530	
Delivery pipes for mods. 65-56 and 70-56 with C.A.V. pump:			
— type		4797522	
— pipe dimensions		6x2x530	

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Mods. 55-56 - CALIBRATION DATA - BOSCH INJECTION PUMP
TYPE VE 3/11F 1250 L 163-1-4800682

ASSEMBLY DATA

Pump rotation (drive end): .... anticlockwise

Firing order 1-2-3

Piston lift to spill cut-off .... 0.2±0.02 mm (0.0079 ± 0.0008")

Pump timing, cylinder no. 1 in compression stroke, 6°±1° B.T.D.C.

Delivery connection of cylinder no. 1: marked with letter A.

TEST DATA

ISO 4008/1.../2 standard test machine.
ISO 7440 standard injectors: 1688901020 with 1680103096 pins.
Injector setting: 172-175 bar (175-178 kg/cm², 2489-2532 psi).
Feed pressure .... 0.2 bar (kg/cm², 2.85 psi).
Pipes: 6 x 2 x 840 mm (in conformity with ISO 4093.2)
Graduate drain time: 30"
Test liquid: ISO 4113 at a temperature of 40°±2°C.

SETTING VALUES

Operation	rpm	Advance piston stroke mm	Transfer pressure bar (kg./cm²)	Injector delivery cm³/1000 shots	Transfer pressure bar (kg/cm²)	Delivery deviation cm³/1000 shots
Full load output	800	0.8-1.2	3.8-4.4	64.5-65.5	0.2	3.5
Idling speed limitation	350	—	—	21-25	0.2	3
Starting delivery	150	—	—	100-120	0.2	—
Top speed limitation	1350	—	—	32-38	0.2	—

TEST VALUES

Avance device control	rpm	mm	Transfer pressure control	rpm	bar (kg/cm²)	Back leakage	rpm	cm³/100 shots
	600	0 ÷ 0.6		600	3.0 ÷ 3.6			
	800	0.8 ÷ 1.2			(2.8 ÷ 3.8)			
	1200	4.4 ÷ 5.2		800	(3.8 ÷ 4.4)			
				1200	5.6 ÷ 6.2			

DELIVERY CONTROL

Top speed stop		Injector delivery cm³/1000 shots	Transfer pressure bar (kg/cm²)	Idling speed stop	rpm	Injector delivery cm³/1000 shots	Transfer pressure bar (kg/cm²)
	1400-1460	0	0.2				
	1350	32-38	0.2		475	⩽2	0.2
	1350	62.5-65.5	0.2		425	4-10	0.2
	800	64.5-65.5	0.2		350	21-25	0.2
	500	56.5-59.5	0.2				
	250	⩽55	0.2				

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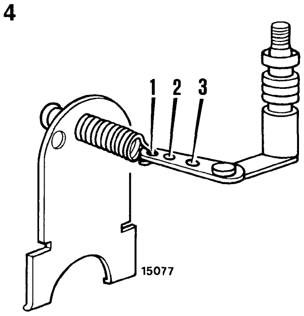
MODS. 55-56 - CALIBRATION DATA - C.A.V. INJECTION PUMP TYPE DPS 8522 A 010A-4797414

ASSEMBLY DATA

Pump rotation (drive end): .... anticlockwise
Firing order 1-2-3
Governor control stud to metering valve lever pin: 41-42 mm (1.61-1.65")
Pump timing, cylinder no. 1 in compression stroke, 0° ± 1° B.T.D.C.
Flange centering guide diameter: 50 mm (1.97")
Delivery connection of cylinder no. 1: marked with letter **U.**

TEST DATA

ISO 4008./1.../2 standard test machine.
ISO 7440 A11 standard injectors: 1688 901000
Test liquid: ISO 4113 at a temperature 40 ± 2°C.
Feed pressure: 0.1 bar (0.1 kg/cm², 1:42 psi).
Injector setting: 172-175 bar (175-178 kg/cm², 2489-2532 psi).
Pipes: 6x2x845 mm (in conformity with ISO 4093.2).
Position the max. speed setting screw so that it protrudes 7.5 mm (0.3") from the face of its own locknut.



Governor spring attachment hole: 2

Completely back off the transfer pressure setting screw and then screw in 3.5 turns.
Position the adjusting screw just below the face of its locknut.
Completely unscrew the top and idling speed setting screws, and the anti-stall screw.
A 2.5 mm (0.1") spacer is fitted in the advance device on the spring side plug: no others are required.

Test No.	Throttle lever position	Speed rpm	Advance degrees	Transfer pressure bar (kg/cm²)	Injector delivery cm³/200 shots	Delivery cm³/200 shots	Back leakage cm³/100 shots
1 (1)		200	—	—	—	—	—
2 (2)		1000	—	—	—	—	—
3		100	—	≤0.4	—	—	—
4 (+)		850	—	—	—	—	—
5 (3)-6		900	3 (2.4 mm)	4.2-5.2	—	—	—
7 (4)		1250	4.8-5.3 (3.8-4.2 mm)	—	—	—	—
8 -9	max	750	—	—	8.9-9.1 (●)	≤0.8	40-80 (○)
10 (5)		1250	—	—	—	—	—
11 (6)		1420	—	—	1.5-2	—	—
12 (7)		1250	—	—	—	—	—
13 (8)		350	—	—	≤12	—	—
14 (9)		250	0	—	≥16	—	—
15 (10)		850	—	—	—	—	—
16 (11)		325	—	—	2-2.5	—	—
17 (12)	min	325	—	—	≤0.8	—	—
18 (13)		325	—	—	≤0.5	—	—
19 (14)		—	—	—	—	—	—

1) Delivery to all injectors.
2) Turn pump 3'.
3) Adjust pressure setting screw to obtain advance specified; check that pressure is as specified.
4) Stop the test machine, detach the transfer pressure gauge, fit the stop device and power it, and start up the test machine.
5) Measure the average delivery.
6) Adjust the max. speed screw and tighten it.
7) Delivery must not exceed that of test no. 10. 0.4 cm³/200 shots less is acceptable.
8) Before carrying out test, bring test machine speed to 100 rpm and stop it. Completely tighten the adjusting screw, restart the test machine and unscrew the screw until specified values are obtained.
9) Before carrying out test, bring test machine speed to 100 rpm, stop it and restart.
10) Adjust anti-stall screw to get delivery of 2-3 cm³/2000 shots and block it.
11) Adjust idling screw.
12) Stop lever closed.
13) With stop device off and stop lever open, wait 5" before carrying out test.
14) Connect the "U"outlet fitting to the injector test and maintain a pressure of 54 bar; using the timing tool obtain hydraulic blockage and then position the pump timing plate at +14°.
(●) Take reading after 15".
(○) Flow: 300-600 cm³/min.
(+) Pump body position measured with pressure gauge connected to bleed screw aperture must be 0.1-0.3 bar (0.1-0.3 kg/cm², 1.42-4.47 psi).

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Mods. 60-56 - CALIBRATION DATA - BOSCH INJECTION PUMP TYPE VE 3/11F 1250 L 163-1-4794586

ASSEMBLY DATA

Pump rotation (drive end): .... anticlockwise

Firing order 1-2-3

Piston lift to spill cutt-off 0.2±0.02 mm (0.0079 ±0.0008")

Pump timing, cylinder no. 1 in compression stroke, 6°±1° B.T.D.C.

Delivery connection of cylinder no. 1: marked with letter A.

TEST DATA

ISO 4008/1.../2 standard test machine.
ISO 7440: standard injectors: 1688901020 with 1 680 103 096 pins.
Injector setting: 172-175 bar (175-178 kg/cm², 2489-2532 psi).
Feed pressure: 0.2 bar (0.2 kg/cm², 2.85 psi).
Pipes: 6×2×840 mm (in conformity with ISO 4093.2)
Graduate drain time: 30''
Test liquid: ISO 4113 at temperature of 40°±2°C.

SETTING VALVES

Operation	rpm	Advance piston stroke mm	Transfer pressure bar (kg/cm²)	Injector delivery cm³/1000 shots	Injector pressure bar (kg/cm²)	Transfer deviation cm³/1000 shots
Governed speed delivery	800	2.3-2.7	3.4-4.0	72-73	0.2	3.5
Idling speed limitation	350	—	—	19-23	0.2	3
Starting delivery	150	—	—	100-120	0.2	—
Top speed limitation	1350	—	—	41-47	0.2	—

TEST VALVES

Advance device control	rpm	mm	Transfer pressure control	rpm	bar (kg/cm²)	Back leakage	rpm	cm³/100 shots
	600	0.2-0.8		600	2.4-3.0			
	800	2.3-2.7		800	3.4-4.0			
	1200	6.1-6.9		1200	5.7-6.5			

DELIVERY CONTROL

Top speed stop	rpm	Injector delivery cm³/1000 shots	Transfer pressure bar (kg/cm²)	Idling speed stp	rpm	Injector delivery cm³/1000 shots	Transfer pressure bar (kg/cm²)
	1400-1460	0	0.2		475	⩽2	0.2
	1350	41-47	0.2		350	19-23	0.2
	1250	69.5-72.5	0.2				
	800	72-73	0.2				
	500	62.5-65.5	0.2				

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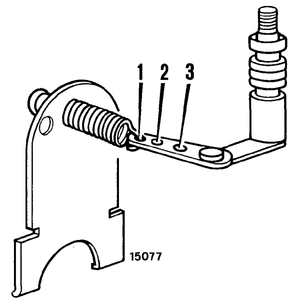
MODS. 60-56 - CALIBRATION DATA - C.A.V. INJECTION PUMP
TYPE DPS 8522 A 000A-4797413

ASSEMBLY DATA

Pump rotation (drive end): anticlockwise
Firing order 1-2-3
Governor control stud to metering valve lever pin: 40.5-41.5 mm (1.59-1.63")
Pump timing, cylinder no. 1 in compression stroke, 0° ± 1° B.T.D.C.
Flange centering guide diameter: 50 mm (1.97")
Delivery connection of cylinder no. 1: marked with letter **U.**

TEST DATA

ISO 4008./1.../2 standard test machine.
ISO 7440 A11 standard injectors: 1688 901000
Test liquid: ISO 4113 at a temperature of 40° ± 2°C.
Feed pressure: 0.1 bar (kg/cm^2, 1.42 psi).
Graduate drain time: 30".
Injector setting: 172-175 bar (175-178 kg/cm^2, 2489-2532 psi).
Pipes: mm 6x2x845 mm (in conformity with ISO 4093.2).
Position the max. speed setting screw so that it protrudes 9.5 (0.37") from the face of its own locknut.



Governor spring attachment hole: 2

Completely back off the transfer pressure setting screw and then screw in 3.5 turns.
Position the adjusting screw just below the face of its locknut.
Completely unscrew the top and idling speed setting screws, and the anti-stall screw.
A 2.5 mm (0.1") spacer is fitted in the advance device on the spring side plug: no others are required.

Test No.	Throttle lever position	Speed	Advance	Transfer pressure	Injector delivery	Delivery	Back leakage
		rpm	degrees	bar (kg/cm^2)	cm^3/200 shots	cm^3/200 shots	cm^3/100 shots
1 (1)		200	—	—	—	—	—
2 (2)		1000	—	—	—	—	—
3		100	—	⩽0.4	—	—	—
4 (+)		850	—	—	—	—	—
5 (3)-6		850	5.5 (4.4 mm)	3.8-4.8	—	—	—
7 (4)		1250	6.8-7.8 (5.4-6.2 mm)	—	—	—	—
8 -9	max	750	—	—	10.3-10.5 (●)	⩽0.8	40-80 (○)
10 (5)		1250	—	—	—	—	—
11 (6)		1420	—	—	1.5-2	—	—
12 (7)		1250	—	—	—	—	—
13 (8)		300	1.8-2.8(1.4-2.2 mm)	—	—	—	—
14 (9)		250	0	—	⩾16	—	—
15 (10)		850	—	—	—	—	—
16 (11)		325	—	—	2-2.5	—	—
17 (12)	min	325	—	—	⩽0.8	—	—
18 (13)		325	—	—	⩽0.5	—	—
19 (14)		—	—	—	—	—	—

1) Delivery to all injectors.
2) Turn pump 3'.
3) Adjust pressure setting screw to obtain advance specified; check that pressure is as specified.
4) Stop the test machine, detach the transfer pressure gauge, fit the stop device and power it, and start up the test machine.
5) Measure the average delivery.
6) Adjust the max. speed screw and tighten it.
7) Delivery must not exceed that of test no. 10. 0.4 cm^2/200 shots less is acceptable.
8) Before carrying out test, bring test machine speed to 100 rpm and stop it. Completely tighten the adjusting screw, restart the test machine and unscrew the screw until specified values are obtained.
9) Before carrying out test, bring test machine speed to 100 rpm, stop it and restart.
10) Adjust anti-stall screw to get delivery of 2-3 cm^3 2000 shots and block it.
11) Adjust idling screw.
12) Stop lever closed.
13) With stop device off and stop lever open, wait 5" before carrying out test.
14) Connect the "U" outlet fitting to the injector test and maintain a pressure of 54 bar; using the timing tool obtain hydraulic blockage and then positio the pump timing plate at + 12.5°.
(●) Take reading after 15".
(○) Flow: 300-600 cm^3/min.
(+) Pump body position measured with pressure gauge connected to bleed screw aperture must be 0.1-0.3 bar (0.1-0.3 (kg/cm^2, 1.42-4.47 psi).

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**Mods. 65-56 - CALLIBRATION DATA - BOSCH INJECTION PUMP
TYPE VE 4/11F 1250 L 164-2-4804869**

ASSEMBLY DATA

Pump rotation (drive end): anticlockwise

Firing order 1-3-4-2

Piston lift to spill cut-off 0.2 ± 0.05 mm (0.0079 ~ 0.002")

Pump timing, cylinder no. 1 in compression stroke, 4° ± 1° B.T.D.C.

Delivery connection of cylinder no. 1: marked with letter A.

TEST DATA

ISO 4008/1.../2 standard test machine.
ISO 7440 standard injectors: 1688901020 with 1 680 103 096 pins.
Injector setting: 172-175 bar (175-178 kg/cm², 2489-2532 psi).
Feed pressure: 0.2 bar (0.2 kg/cm², 2.85 psi).
Pipes: 6 x 2 x 840 mm (in conformity with ISO 4093.2).
Graduate drain time: 30"
Test liquid: ISO 4113 at temperature of 40° ± 2°C.

SETTING VALUES

Operation		Advance piston stroke mm	Transfer pressure bar (kg/cm²)	Injector delivery cm³/1000 shots	Transfer pressure bar (kg/cm²)	Delivery deviation cm³/1000 shots
Governed speed delivery	800	2.8-3.2	3.9-4.5	62.5-63.5	0.2	3.5
Idling speed limitation	350	—	—	19-23	0.2	3
Starting delivery	150	—	—	100-120	0.2	—
Top speed limitation	1350	—	—	32-38	0.2	—

TEST VALUES

Advance device control	rpm	mm	Transfer pressure control	rpm	bar (kg/cm²)	Back leakage	rpm	cm³/100 shots
	600	0.8-1.6		600	3.0-3.6			
	800	2.8-3.2		800	3.9-4.5			
	1250	5.4-6.2		1200	6.0-6.6			

DELIVERY CONTROL

Top speed stop	rpm	Injector delivery cm³/1000 shots	Transfer pressure bar (kg/cm²)	Idling speed stop	rpm	Injector delivery cm³/1000 shots	Transfer pressure bar (kg/cm²)
	1375	11-17	0.2		450	⩽2	0.2
	1400	⩽2	0.2		400	6-12	0.2
	1350	32-38	0.2		350	19-23	0.2
	1250	54-57	0.2				
	800	62.5-63.5	0.2				
	600	59.5-62.5	0.2				
	250	⩽47	0.2				
	150	100-120	0.2				

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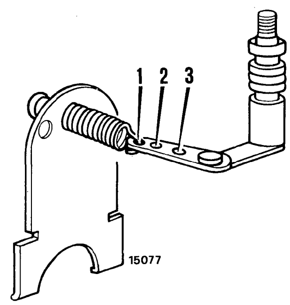
MODS. 65-56 - CALIBRATION DATA - C.A.V. INJECTION PUMP TYPE DPS 8520 A 140A-4806880

ASSEMBLY DATA

Pump rotation (drive end): anticlockwise
Firing order 1-3-4-2
Governor control stud to metering valve lever pin: 40.5-41.5 mm (1.59-1.63")
Pump timing, cylinder no. 1 in compression stroke, 0° ± 1° B.T.D.C.
Flange centering guide diameter: 50 mm (1.97").
Delivery connection of cylinder no. 1: marked with letter **U.**

TEST DATA

ISO 4008./1.../2 standard test machine.
ISO 7440 A11 standard injectors: 1688 901000.
Test liquid: ISO 4113 at a temperature of 40° ± 2°C.
Feed pressure 0.1 bar (0.1 kg/cm², 1.42 psi).
Graduate drain time: 30".
Injector setting: 172-175 bar (175-178 kg/cm², 2489-2532 psi).
Pipes: 6x2x845 mm (in conformity with ISO 4093.2).
Position the max. speed setting screw so that it protrudes 9.5 mm (0.37") from the face of its own locknut.



Governor spring attachment hole: 2

Completely back off the transfer pressure setting screw and than screw in 3.5 turns.
Position the adjusting screw just below the face of its locknut.
Completely unscrew the top and idling speed setting screws, and the anti-stall screw.
A 3 mm (0.118") spacer is fitted in the advance device on the spring side plug: no others are required.

Test No.	Throttle lever position	Speed	Advance degrees	Transfer pressure bar (kg/cm²)	Injector delivery cm³/200 shots	Delivery cm³/200 shots	Back leakage cm³/100 shots
1 (1)	max	200	—	—	—	—	—
2 (2)		1000	—	—	—	—	—
3		100	—	⩽0.4	—	—	—
4 (3) - 5		950	4.5 (3.6 mm)	4.2-5.4	—	—	—
6 (4)		1250	6.8-7.8 (5.4-6.2 mm)	—	—	—	—
7 - 8		750	—	—	8.4-8.6 (●)	⩽0.8	40-80 (O)
9 (5)		1250	—	—	—	—	—
10 (6)		1420	—	—	1.5-2	—	—
11 (7)		1250	—	—	—	—	—
12 (8)		300	1.8-2.8(1.4-2.2 mm)	—	—	—	—
13 (9)		250	0	—	⩾16	—	—
14 (10)	min	850	—	—	—	—	—
15 (11)		350	—	—	2-2.5	—	—
16 (12)		350	—	—	⩽0.8	—	—
17 (13)		350	—	—	⩽0.5	—	—
18 (14)		—	—	—	—	—	—

1) Delivery to all injectors.
2) Turn pump 3'.
3) Adjust pressure setting screw to obtain advance specified; check that pressure is as specified.
4) Stop the test machine, detach the transfer pressure gauge, fit thhe stop device and power it, and start up the test machine.
5) Measure the average delivery.
6) Adjust the max. speed screw and tighten it.
7) Delivery must not exceed that of test no. 9. 0.4 cm²/200 rpm and stop it.
8) Before carrying out test, bring test machine speed to 100 rpm and stop it.
Completely tighten the adjusting screw, restart the test machine and unscrew the screw until specified values are obtained.
9) Before carrying out test, bring test machine speed to 100 rpm, stop it and restart.
10) Adjust anti-stall screw to get delivery of 2-3 cm³/2000 shots and block it.
11) Adjust idling screw.
12) Stop lever closed.
13) With stop device off and stop lever open, wait 5" before carrying out test.
14) Connect the "U" outlet fitting ot the injector test and maintain a pressure of 54 bar; using the timing tool obtain hydraulic blockage and then position the pump timig plate at +8.5°.
(●) Take reading after 15".
(O) Flow: 300-600 cm³/min.

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Mods. 70-56 - CALIBRATION DATA - BOSCH INJECTION PUMP TYPE VE 4/11F 1250 L 164-1-4794589

ASSEMBLY DATA

Pump rotation (drive end): anticlockwise

Firing order 1-3-4-2

Piston lift to spill cut-off 0.2±0.02 mm (0.0079 ± 0.0008")

Pump timing, cylinder no. 1 in compression stroke, 4°±° 1 B.T.D.C.

Delivery connection of cylinder no. 1: marked with letter A.

TEST DATA

ISO 4008/1.../2 standard test machine.
ISO 7440 standard injectors: 1688901020 with 1 680 103 096 pins.
Injector setting: 172-175 bar (175-178 kg/cm², 2489-2532 psi).
Feed pressure: 0.2 bar (0.2 kg/cm², 2.85 psi).
Pipes: 6 x 2 x 840 mm (in conformity with ISO 4093.2).
Graduate drain time: 30".
Test liquid: ISO 4113 at a temperature of 40°±2°C.

SETTING VALUES

Operation	rpm	Advance piston stroke mm	Transfer pressure bar (kg/cm²)	Injector delivery cm³/1000 shots	Transfer pressure bar (kg/cm²)	Delivery deviation cm³/1000 shots
Governed speed delivery	800	2.0-2.4	3.8-4.4	67-68	0.2	3.5
Idling speed limitation	350	—	—	21-25	0.2	3
Starting delivery	150	—	—	100-120	0.2	—
Top speed limitation	1350	—	—	30-36	0.2	—

TEST VALUES

Advance device control	rpm	mm	Transfer pressure control	rpm	bar (kg/cm²)	Back leakage	rpm	cm³/100 shots
	600	0 -0.6		600	2.9-3.5			
	800	2.0-2.4		800	3.8-4.4			
	1250	5.3-6.1		1250	6.0-6.6			

DELIVERY CONTROL

Top speed stop	rpm	Injector delivery cm³/1000 shots	Transfer pressure bar (kg/cm²)	Idling speed stop	rpm	Injector delivery cm³/1000 shots	Transfer pressure bar (kg/cm²)
	1400-1460	0	0.2		475	⩽2	0.2
	1350	30-36	0.2		425	4-10	0.2
	1250	60-63	0.2		350	21-25	0.2
	800	67-68	0.2				
	250	⩽60	0.2				

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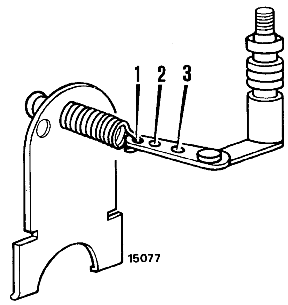
MODS. 70-56 - CALIBRATION DATA - C.A.V. INJECTION PUMP TYPE DPS 8520 A 100A-4797416

ASSEMBLY DATA

Pump rotation (drive end): anticlockwise
Firing order 1-3-4-2
Governor control stud to metering valve lever pin: 40.5-41.5 mm (1.59-1.63")
Pump timing, cylinder no. 1 in compression stroke, 0° ± 1° B.T.D.C.
Flange centering guide diameter: 50 mm (1.97").
Delivery connection of cylinder no. 1: marked with letter **U.**

TEST DATA

ISO 4008./1.../2 standard test machine.
ISO 7440 A11 standard injectors: 1688 901000.
Test liquid: ISO 4113 at a temperature of 40° ± 2°C.
Feed pressure: 0.1 bar (0.1 kg/cm², 1.42 psi).
Graduate drain time: 30".
Injector setting: 172-175 bar (175-178 kg/cm², 2489-2532 psi).
Pipes: 6x2x845 mm (in conformity with ISO 4093.2).
Position the max. speed setting screw so that it protrudes 9.5 mm (0.37") from the face of its own locknut.
Completely back off the transfer pressure setting screw and then screw in 3.5 turns.



Governor spring attachment hole:2

Position the adjusting screw just below the face of its locknut.
Completely unscrew the top and idling speed setting screws, and the anti-stall screw.
A 3 mm (0.118") spacer is fitted in the advance device on the spring side plug: no others are required.

Test No.	Throttle lever position	Speed rpm	Advance degrees	Transfer pressure bar (kg/cm²)	Injector delivery cm³/200 shots	Delivery cm³/200 shots	Back leakage cm³/100 shots
1 (1)		200	—	—	—	—	—
2 (2)		1000	—	—	—	—	—
3		100	—	⩾0,4	—	—	—
4 (3) - 5		950	4.5 (3.6 mm)	4.2-5.4	—	—	—
6 (4)		1250	6.8-7.8 (5.4-6.2 mm)	—	—	—	—
7 - 8	max	750	—	—	9.1-9.3 (●)	⩽0.8	40-80 (○)
9 (5)		1250	—	—	—	—	—
10 (6)		1420	—	—	1.5-2	—	—
11 (7)		1250	—	—	—	—	—
12 (8)		300	1.8-2.8(1.4-2.2 mm)	—	—	—	—
13 (9)		250	0	—	⩾16	—	—
14 (10)		850	—	—	—	—	—
15 (11)		350	—	—	2-2.5	—	—
16 (12)	min	350	—	—	⩽0.8	—	—
17 (13)		350	—	—	⩽0.5	—	—
18 (14)		—	—	—	—	—	—

1) Delivery to all injectors.
2) Turn pump 3'.
3) Adjust pressure setting screw to obtain advance specified; check that pressure is as specified.
4) Stop the test machine, detach the transfer pressure gauge, fit the stop device and power it, and start up the test machine.
5) Measure the average delivery.
6) Adjust the max. speed screw and tighten it.
7) Delivery must not exceed that of test no. 9. 0.4 cm²/200 shyots less is acceptable.
8) Before carrying out test, bring test machine speed to 100 rpm and stop it. Completely tighten the adjusting screw, restart the test machine and unscrew the screw until specified values are obtained.
9) Before carrying out test, bring test machine speed to 100 rpm, stop it and restart.
10) Adjust anti-stall screw to get delivery of 2-3 cm³/2000 shots and block it.
11) Adjust idling screw.
12) Stop lever closed.
13) With stsop device off and stop lever open, wait 5" before carrying out test.
14) Connect the "U" outlet fitting to the injector test and maintain a pressure of 54 bar; using the timing tool obtain hydraulic blockage and then position the pump timing plate at +8.5°.
(●) Take reading after 15".
(○) Flow: 300-600 cm³/min.

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ANGULAR TIGHTENING TORQUE DATA

DESCRIPTION	Thread size	Tightening torque data			Angle
		Nm	kgm	ft lb	
Capscrew, cylinder head (C_1, pages 15 and 16, sect. 10, mods. 55-46 and 65-46)	M12 × 1.25	60	6.1	44	90° + 90°
Capscrew, main bearing cap (C_2) (*)	M14 × 1.5	80	8.2	59	90°
Capscrew, connecting rod cap (C_3) (*)	M11 × 1.25	40	4.1	29.6	60°
Capscrew, flywheel (C_4) (*)	M12 × 1.25	40	4.1	29.6	60°

(*) Before re-using screws, see drawings and notes, page 20.

TIGHTENING TORQUE

DESCRIPTION	Thread size	Tightening torque data		
		Nm	kgm	ft lb
Capscrew, rocker shaft bracket (C_5, pages 15 and 16 sect. 10, mods. 55-46 and 65-46)	M8 × 1.25	24	2.5	18
Nut, crankshaft pulley hub (C_6) (*)	M30 × 1.5	294	30	217
Retaining screws, additional weights (mods. 65-56 and 70-56)	M12 × 1.25	110	11.2	81

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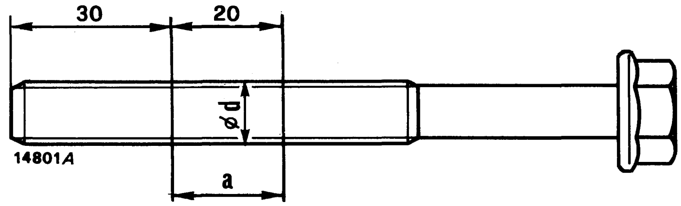
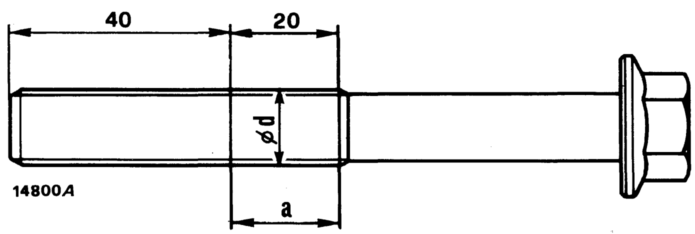
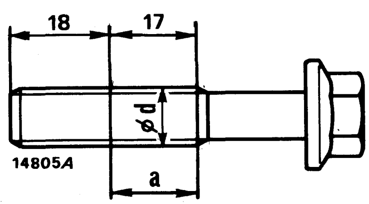


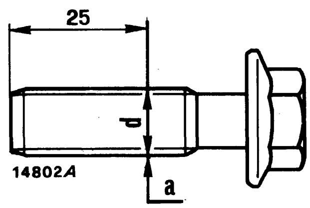
Cylinder head capscrew (C_1, pages 15 and 16 mods. 55-46 and 65-46)
Before reusing screws, check that diameter **d** (measured as shown above, zone a) exceeds 11.5 mm. If not, scrap screw.



Main bearing cap capscrew (C_2, pages 15 and 16 mods. 55-46 and 65-46)
Before reusing screws, check that diameter **d** (measured as shown above, zone a) exceeds 13.5 mm. If not, scrap screw.



Connecting rod cap head capscrew (C_3, pages 15 and 16 mods. 55-46 and 65-46)
Before reusing screws, check that diameter **d** (measured as shown above, zone a) exceeds 10.5 mm. If not, scrap screw.



Flywheel capscrew (C_4, pages 15 and 16 mods. 55-46 and 65-46)
Before reusing screws, check that diameter **d** (measured as shown above, zone a) exceeds 11.5 mm. If not, scrap screw.

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DESCRIPTION

Fiat engines installed on 55-56/60-56/65-56/70-56 model tractors are high-speed, 4-stroke, direct injection in-line Diesel units.

Engine block: single iron casting, dry sleeve, crankshaft, camshaft and valve tappet seats.

Cylinder heads: integral valve seats.

Valve gear: pushrod operated valves, helical gear driven camshafts.

Crank gear: crankshaft running on 4 bearings (mods. 55-56/60-56 or 5 bearings (65-56/70-56), 3-ring light alloy piston (one compression ring and two oil scraper rings).
A flyweight-type dynamic balancer in the engine sump (mods. 65-56/70-56) reduces engine and engine-induced vibrations.

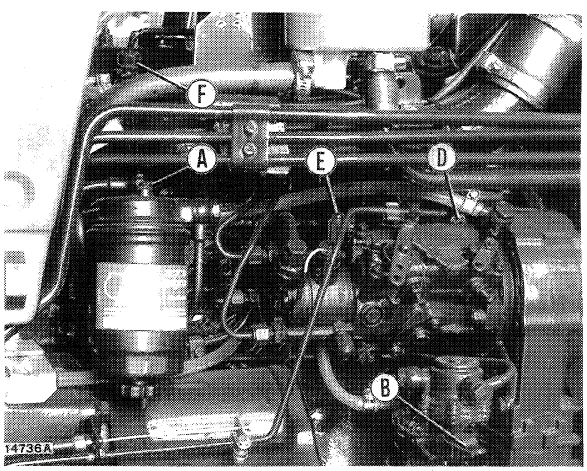
Air induction system: through oil-bath or dry air filter.

Fuel system: rotating distributor injection pump; 3-orifice injectors (60-56) or 4-orifice injectors (55-56/65-56/70-56).

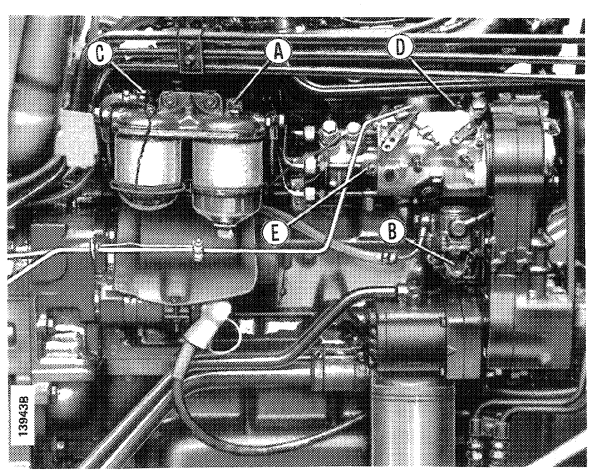
Lubrication system: forced feed, gear pump, full flow oil filter and pressure relief valve.

Cooling system: water, centrifugal pump, wax thermostat.

Engine starting: 12 volt electromagnetically operated starter and thermostarter (where applicable).



Engine with C.A.V. pump, mods. 55-56 and 60-56



Engine with C.A.V. pump, mods. 65-56 and 70-56

A and **C.** Fuel filter air bleed plugs - **D** and **E.** C.A.V. pump air bleed plugs - **B.** Fuel pump lever for filling system - **F.** Connection fitting for injector air discharge.

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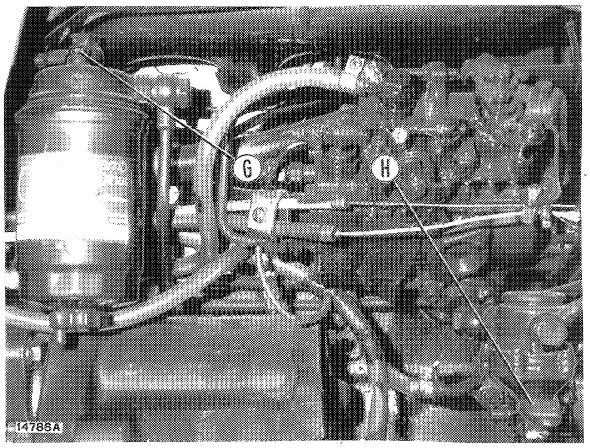
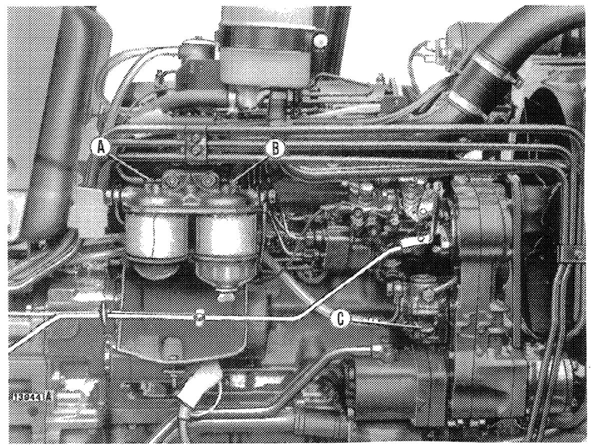


Engine with BOSCH pump, mods. 55-56 and 60-56



Engine with BOSCH pump, mods. 65-56 and 70-56

A - B - G. Fuel filter air bleed plugs - **C** and **H.** Fuel pump levers for filling system.

COMPRESSION TEST

If engine performance is found to be unsatisfactory, check the injection system (nozzle and injection pump overhaul) and the compression in each cylinder.

⚠ DANGER ⚠

Highly flammable fluids. Do not use matches, cigarette lighters or other naked flames as light sources.

Use tester **291309/1** as follows:
— remove the injectors;
— fit dummy injector **293862** in place of injector on the cylinder under test together with the associated copper washer;
— hold the injection pump in the shut-off position and take the readings, cranking the engine by means of the starter.

With perfectly efficient engines, 40°C (104°F) oil sump temperature, sea level atmospheric pressure (760 mm Hg) and the engine running at 200 to 280 rpm, the compression reading should be 25.5 to 27.5 bar, (26 to 28 kg/cm² or 370 to 398 psi).

The minimum acceptable compression in a worn engine is 21.6 bar, (22 kg/cm² or 313 psi).

The maximum pressure differential between cylinders must not exceed 3 kg/cm² (42.7).

For the purposes of the test, consider that every 100 metres 328 ft) of altitude corresponds to a pressure drop of about 1%.

Insufficient compression may be due to faulty valves and seats, pistons and piston rings, cylinder sleeves, or cylinder head gaskets.

Note— The purpose of the compression test is merely to assess the consistency of compression in the cylinders and obtain an indication of the degree of wear affecting the parts which help to seal the combustion chambers, and the results should not be taken as an absolute indication of engine efficiency.

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ON-BENCH PERFORMANCE DATA

Engine without fan, air cleaner and exhaust silencer.

Barometric pressure 740±5 mm Hg at 239 metres (785 feet) above sea level.

Environmental temperature 20±3°C.

RH 70% ±5.

Fuel density 830±10 g/l.

Pump timing, B.T.D.C. cylinder no. 1 on compression stroke:
- mod. 55-56 BOSCH injection pump .... 6°±1°
- mod. 55-56 C.A.V. injection pump .... 0°±1°
- mod. 60-56 BOSCH injection pump .... 6°±1°
- mod. 60-56 C.A.V. injection pump .... 0°±1°
- mod. 65-56 BOSCH injection pump .... 4°±1°
- mod. 65-56 C.A.V. injection pump .... 0°±1°
- mod. 70-56 BOSCH injection pump .... 4°±1°
- mod. 70-56 C.A.V. injection pump .... 0°±1°

55-56 - BOSCH INJECTION PUMP

Throttle	rpm	2 hour run-in kW	50 hour run-in kW	Fuel consumption kg/h
Maximum full load	2500	⩾36.7 (50 HP)	⩾38.2 (52 HP)	9 to 9.4
Maximum, full torque	1500	⩾25.6 (34.8 HP)	⩾ 26.7 (36.3 HP)	5.8-6.2
Maximum, no load	2750 to 2790	—	—	—
Maximum, no load	625 to 675	—	—	—

55-56 - C.A.V. INJECTION PUMP

Throttle	rpm	2 hour run-in kW	50 hour run-in kW	Fuel consumption kg/h
Maximum, full load	2500	⩾36.7 (50 HP)	⩾38.2 (52 HP)	9-9.4
Maximum, full torque	1500	⩾25.6 (34,8 HP)	⩾ 26.7 (36.3 HP)	5.8-6.2
Maximum, no load	2750 to 2790	—	—	—
Minimum, no load	625 to 675	—	—	—

60-56 - BOSCH INJECTION PUMP

Throttle	rpm	2 hour run-in kW	50 hour run-in kW	Fuel consumption kg/h
Maximum, full load	2500	⩾40.4 (55 HP)	⩾41.9 (57 HP)	9.7-10.2
Maximum, full torque	1500	⩾28.3 (38.5 HP)	⩾ 29.4 (40 HP)	6.4-6.8
Maximum, no load	2750 to 2790	—	—	—
Minimum, no load	625 to 675	—	—	—

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60-56 - C.A.V. INJECTION PUMP

Throttle	rpm	2 hour run-in kW	50 hour run-in kW	Fuel consumption kg/h
Maximum, full load	2500	⩾40.4 (55 HP)	⩾41.9 (57 HP)	9.7 to 10.2
Maximum, full torque	1500	⩽28.3 (38.5 HP)	⩽ 29.4 (40 HP)	6.4 to 6.8
Maximum, no load	2750 to 2790	—	—	—
Minimum, no load	625 to 675	—	—	—

65-56 - BOSCH INJECTION PUMP

Throttle	rpm	2 hour run-in kW	50 hour run-in kW	Fuel consumption kg/h
Maximum, full load	2500	⩾46.4 (63 HP)	⩾47.8 (65 HP)	11 to 11.4
Maximum, full torque	1500	⩾31.6 (43 HP)	⩾ 32.8 (44.6 HP)	7.1 to 7.6
Maximum, no load	2750 to 2790	—	—	—
Minimum, no load	625 to 675	—	—	—

65-56 - C.A.V. INJECTION PUMP

Throttle	rpm	2 hour run-in kW	50 hour run-in kW	Fuel consumption kg/h
Maximum, full load	2500	⩾46.4 (63 HP)	⩾47.8 (65 hp)	11 to 11.4
Maximum, full torque	1500	⩾31.6 (43 HP)	⩾ 32.8 (44.6 HP)	7.1 to 7.6
Maximum, no load	2750 to 2790	—	—	—
Minimum, no load	625 to 675	—	—	—

70-56 - BOSCH INJECTION PUMP

Throttle	rpm	2 hour run-in kW	50 hour run-in kW	Fuel consumption kg/h
Maximum, full load	2500	⩾49.6 (67.5 HP)	⩾51.5 (70 HP)	11.8 to 12.3
Maximum, full torque	1500	⩾34.5 (47 HP)	⩾ 35.7 (48.5 HP)	7.7 to 8.2
Maximum, no load	2750 to 2790	—	—	—
Minimum, no load	625 to 675	—	—	—

70-56 - C.A.V. INJECTION PUMP

Throttle	rpm	2 hour run-in kW	50 hour run-in kW	Fuel consumption kg/h
Maximum, full load	2500	⩾49.6 (67.5 HP)	⩾51.5 (70 HP)	11.8 to 12.3
Maximum, full torque	1500	⩽34.5 (47 HP)	⩽ 35.7 (48.5 HP)	7.7 to 8.2
Maximum, no load	2750 to 2790	—	—	—
Minimum, no load	625 to 675	—	—	—

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CYLINDER SLEEVES

To inspect for wear, proceed as follows:

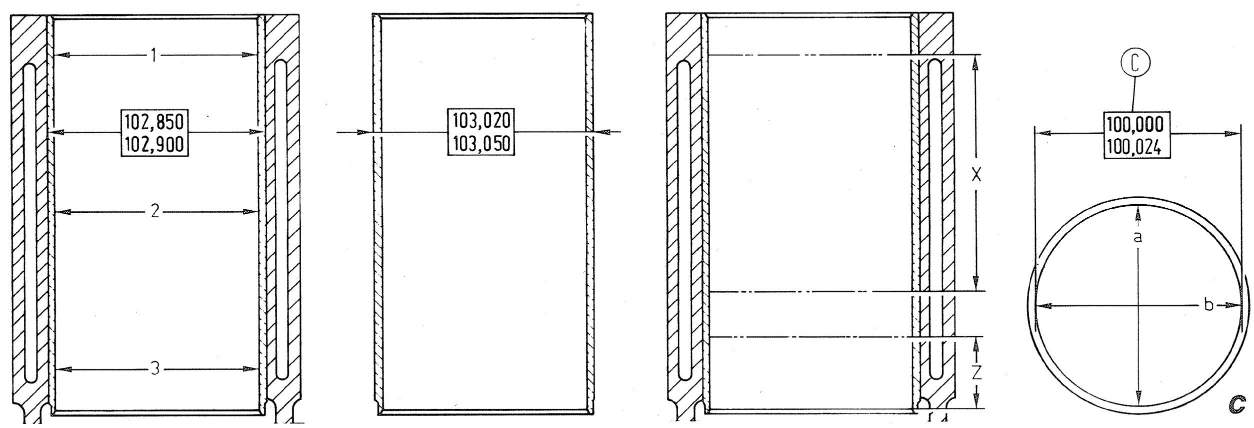
— measure the sleeve bore diameter over the swept area (X);

— the diameter reading should be taken in both the upper and lower part of the swept area in plane (a), parallel to the crankshaft and in plane (b) at right angles to it.

— compare the readings to establish the amount of sleeve ovality and taper.

To check the piston working clearance, measure the liner bore diameter (Z) in plane (b) only.

If ovality or taper in excess of .12 mm (.0047''), or piston working clearance in excess of .3 mm (.1181'') is detected, rebore (or replace) the sleeves to the oversize values envisaged (see table, page 1, section 10). After machining, check size by taking two dial gauge readings at right angles (a and b, page 1) and at three depths (1, 2 and 3).



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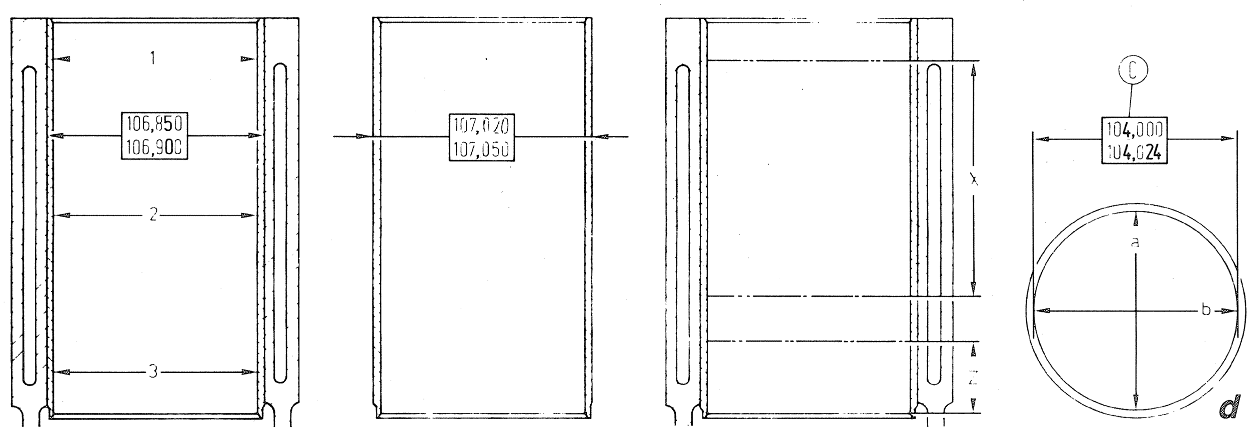

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Normal dimensions (mm) of cylinder sleeves and seats, and sleeve wear inspection.

a and b. Sleeve bore measurements at right angles - c. Models 55-56/65-56/70-56 - d. Mod. 60-56 - C. Sleeve fitted bore diameter - Z. Sleeve wear inspection length for assessment of piston fit on plane b at right angles to crankshaft - X. Sleeve wear inspection length (swept area) for assessment of ovality and taper on planes a and b - 1, 2 and 3. New or rebored sleeve bore measuring depths on planes a and b.

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Then fit replacement pistons of suitable size and weight (see page 4, section 10).

For sleeve removal and installation, do not heat sleeves; use a press and proceed as follows:

— withdraw the worn sleeve from the bottom of the engine block using plate **292507** for mods. 55-56/65-56/70-56 or plate **293864**for mod. 60-56;

— check engine block bore ovality and if necessary rebore to;

— press a new sleeve (2. mm oversize if necessary) from the top of the block using plate 291501.

— skim the sleeve to the specified diameter.

CYLINDER HEAD

Consult the text and illustrations on pages 2, 3 and 4, section 101 for mods. 55-46 and 60-46: note that the figure (a page 4) is used for cylinder heaad tightening for mods. 55-56 and 60-56 while the figure (b) is used for mods. 65-56 and 70-56.

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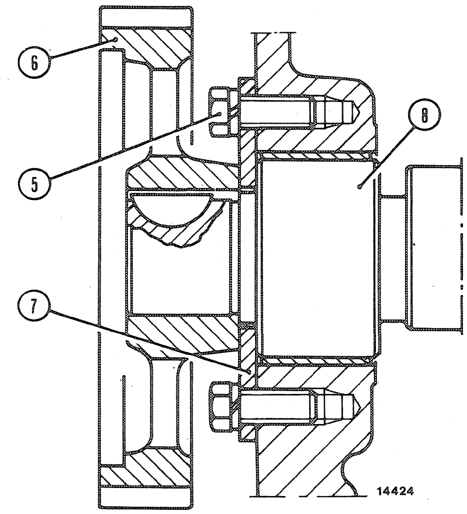


Section throught camshaft drive.
5. Plate (7) - 6. Retaining screw - 7. Thrust plate - 8. Camshaft.

CAMSHAFT

To remove camshaft, back off screws (5) retaining thrust plate (7).

To inspect, place the camshaft over V-block and check, using a suitable dial gauge that journal eccentricity does not exceed .02 mm (.0008'')

Straighten camshaft with press for distortion up to .2 mm (.0008''). If distortion exceeds .2 mm (.0008''), replace camshaft.

Replace worn bushing using appropriate pullers and installers.

After installation, the new bushing must be reamed to sizes specified in the figure.

VALVES, GUIDES AND SPRINGS

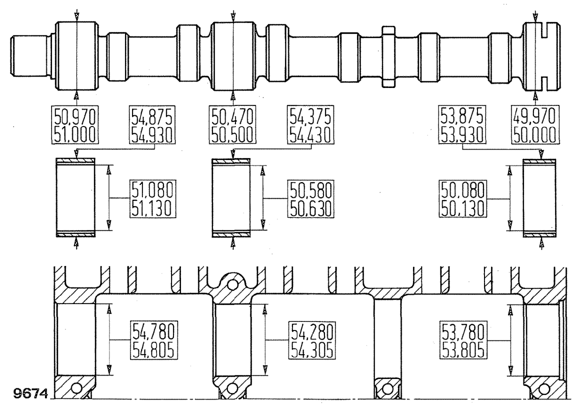
To remove and install valves use tool **291050.**

To eliminate slight seal defects, grind valves together with seats using air grinder **290064.** Whith greater defects, re-cut the valve seats as directed and grind the valves (page 2).

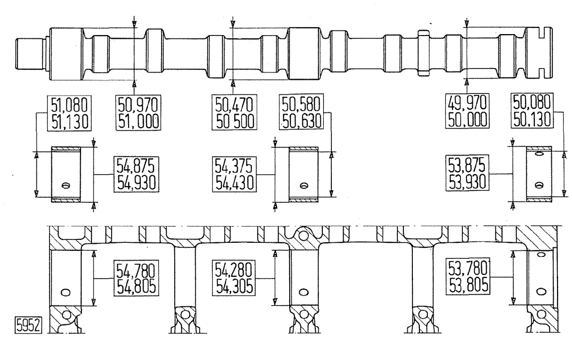
After grinding, check that the minimum land below valve head chamfer is not less than .5 mm (.0197'').

To remove and install the valve guides, use driver **291046/1** as shown on page 2, together with socket **293231 (99360293).**

Valve guides should be a drive fit in their housing. If loose, they should be replaced using oversize guides.



a



b

Camshaft, Journal and Housing dimensions (mm).
Note - Bushing fitted I.D. given - a. Mods. 55-56 and 60-56 - b. Mods. 65-56 and 70-56.

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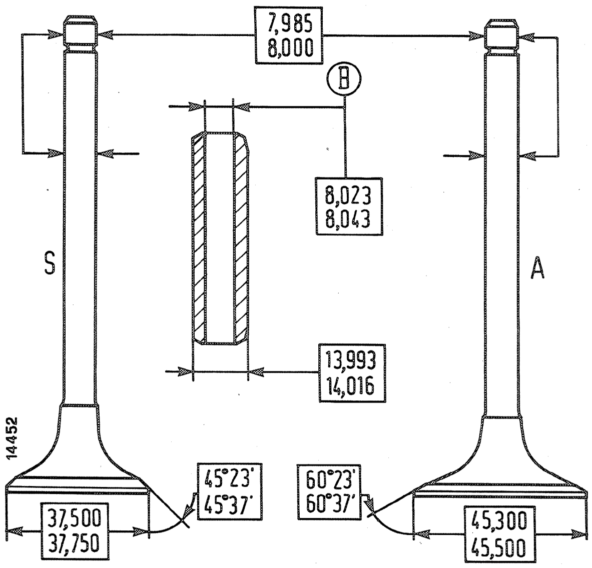


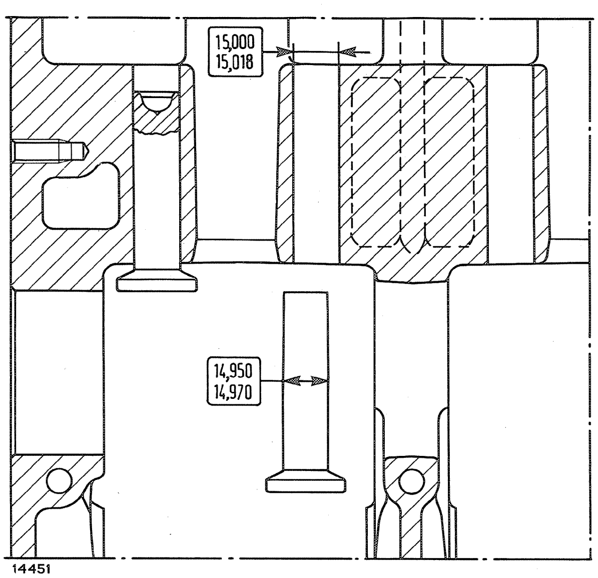
Valve and guide dimensions (mm).
A. Intake - B. Fitted diameter after reaming - S. Exhaust.

After installation, each valve should be reamed as shown with tool **291177**.

TAPPETS, PUSHRODS AND ROCKERS

Ensure that the tappets slide smoothly in their housing without excessive clearance.

If excessive tappet clearance is detected, replace with oversize tappets and open out the associated housing bores.



Tappet and Housing dimensions (mm)

The pushrods should be perfectly straight and the rocker screw seat should not show signs of pick-up or undue wear

Prior to removing the rocker and brackets, take off the screw securing bracket to shaft.

When dressing of the rocker and screw working surfaces becomes necessary, remove as little material as possible.

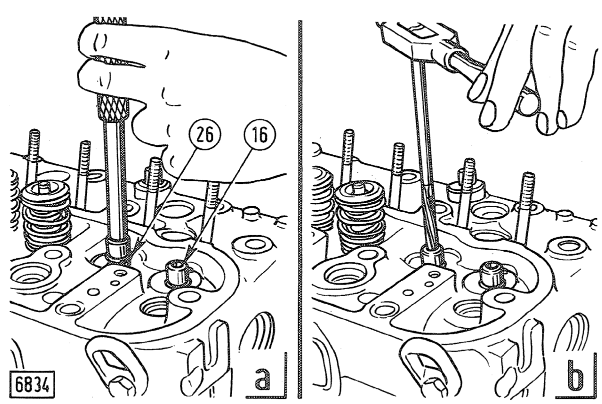
Vlave clearance adjustment.

To adjust, use feeler gauge and wrench **291883 (99350108)**; the correct clearances are given on page 7, section 10.

To adjust on models 55-56 and 60-56, proceed as follows:

— turn the crankshaft to bring piston no. 1 to T.D.C. position (intake) as shown by the flywheel timing mark.

— turn the crankshaft through a complete rotation and check that valve clearance is as shown on table (page 7, section 10).



Installing and remaing valve guide (16).
a. Pressing using driver **291046/1** - b. Dressing guide bore using dresser **291177** - 26. Valve guide retaining ring.

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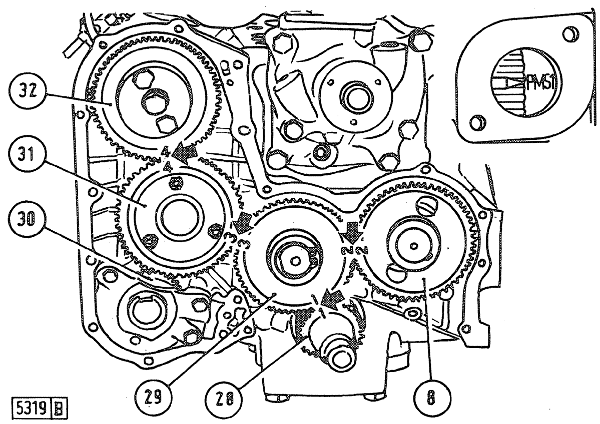
Valve timing

Nota — Arrows point to timing marks to line up with piston no. 1 at T.D.C. on compression stroke (insert a).

a. Valve timing mark (PMS1) and pointer - 8. Camshaft drive gear - 28. Crankshaft drive pinion - 29. Idler gear - 30. Lift pump drive gear - 31. Fuel pump drive gear - 32. injection pump drive gear.



— adjust the other valves, bearing in mind that the mark (PMS) is not valid for pistons 2 and 3; therefore, when the valves are balanced, make a mark on the flywheel or pulley.

Then adjust valve clearance as shown on page 2, section 00.

Models 65-56 and 70-56: check clearance with valves of matching cylinder in balanced condition. Matching cylinders are 1-4 and 2-3.

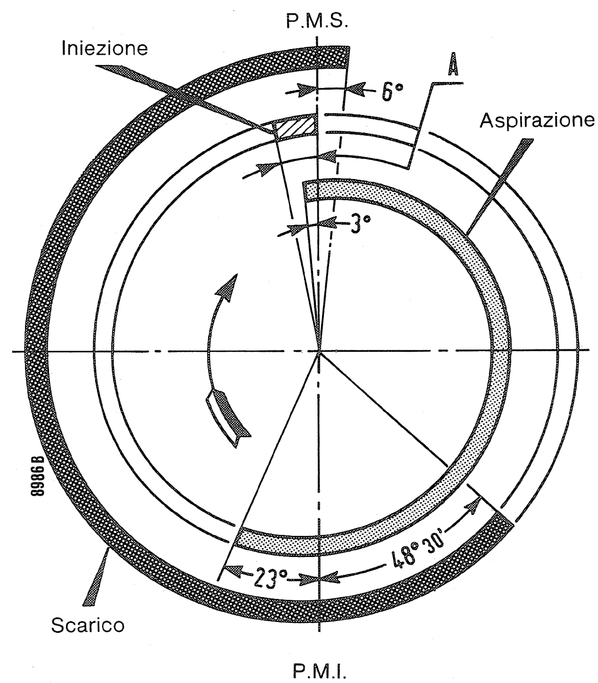
VALVE TIMING GEAR TRAIN

For valve timing, proceed as follows:

— turn the crankshaft to bring piston no. 1 to T.D.C. position on compressor stroke;

— install the drive gears and align as indicated.

To check valve timing after overhaul, adjust valve clearance provisionally to 45 mm (.018). Turn the crankshaft and, using an angle gauge, check that valve opening and closing angels are as specified in the diagram.



Valve timing diagram

A. Static advance depending on injection pump type and tractor models (see page 3, section 100).

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CRANKSHAFT

Remove the pulley hub using tool **291504.**

Carefully inspect the crankshaft. Even the slightest crack makes replacement necessary.

Ceck both main journals and crankpins for the following:

— pick-up and scratch marks may be remedied using extra-fine emery paper;

— score marks, ovality and taper in excess of .05 mm (.002) mm necessitate journal dressing to the nearest undersize dimension (see table, page 2, sect. 10).

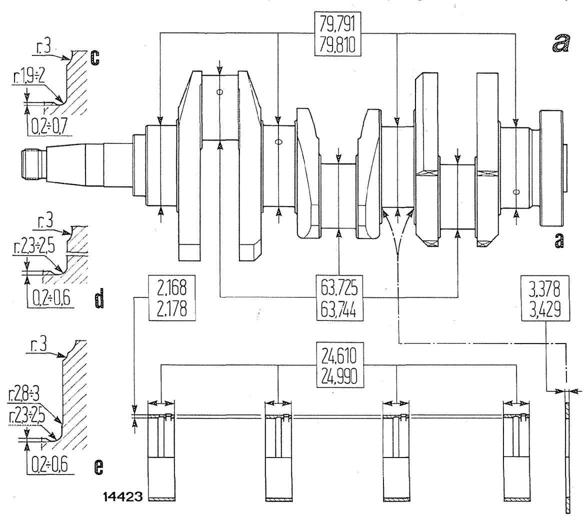
After dressing, blend the journal fillet radii as shown in figs. (a) and (b) and inspect the crankshaft to ensure that:

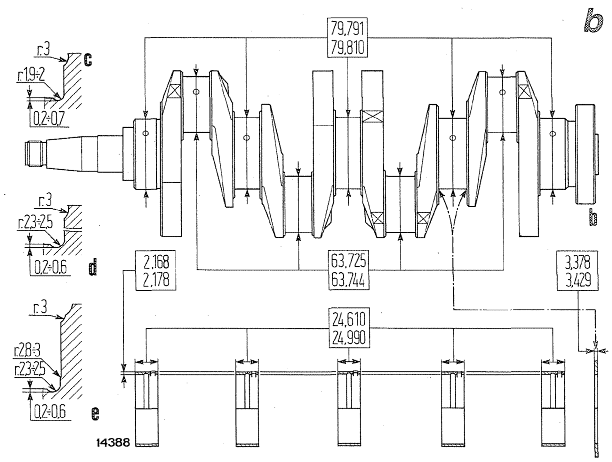
— journal ovality dies not exceed .008 mm (.0003");

— journal taper does not exceed .01 mm (.0004);

— maximum main journal alignement with shaft over V-blocks does not exceed .1 mm (.0394") (D. fig. page 2);

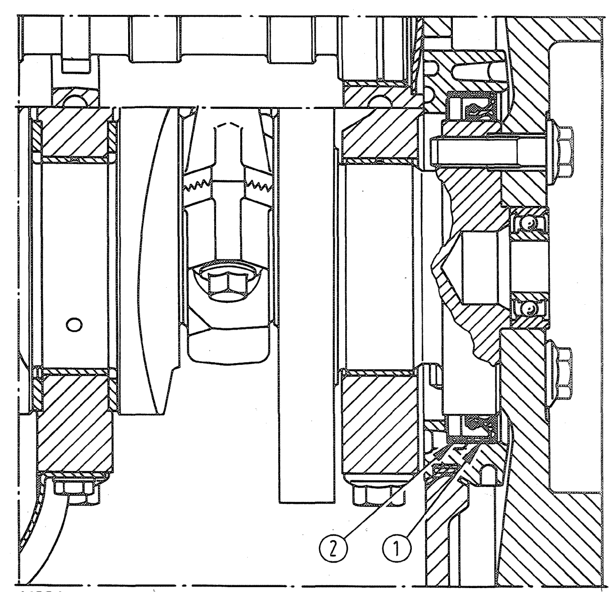
— maximum misalignment of crankpin centerlines (mods. 55-56 and 60-56) or each pair of crankpins (mods. 65-56 and 70-56) with respect to main journals does not exceed ±.25 mm(± .01") (a, b).





Crankshaft bearing and thrust washers - Dimensions (mm)

a. Mods. 55-56 and 60-56 - b. 65-56 and 70-56 - c. Crankpin filled radius details - d. Standard main journal fillet radius - e. Main journal filled radius with thrust washer



Crankshaft seal (1) replacement.
2. Spacer.

Note - When replacing crankshaft seal (1), remove it together with the spacer (2). Install new seal without spacer (2) so as to provide new sealing face.

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— the distance from top of crankpin to crankshaft centerline does not exceed ±.1 mm (±.004");

— run-out and eccentricity as measured at the gaige stylus at (A) and (B) respectively does not exceed the limits specified in the table on page 3, section 10.

Check the core plugs for leakage at 14.7 bar (15 kg/cm² or 230 psi). If replacement is necessary, press fit the plugs and check for leakage again with the oil under pressure.

After installing the crankshaft and tightening the bearing caps, check the end float at the last cap but one. If play is excessive (see table), install oversize thrust washers.

Crankshaft front and rear seals

Check the metal-caged, double-lip, spring-loaded rubber seals (1, page 1).

When replacing the seals, note the following:

— wipe off all traces of oil and thoroughly clean the seal seat;

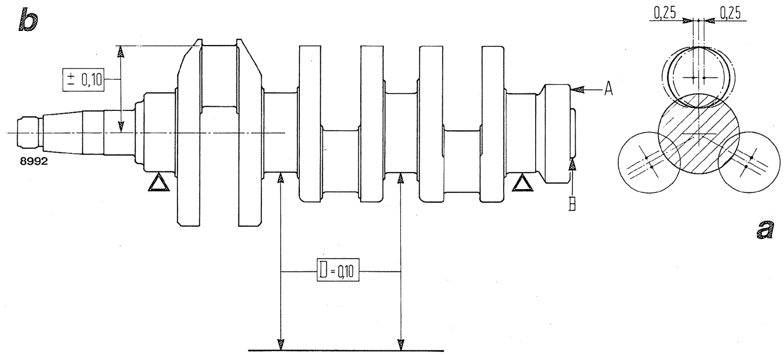
— soak tha seal in engine oil for thirty minutes and install, applying a steady even pressure all round using a suitable installer;

— smear the lips with a film of thick oil and pack the cavity with grease to prevent the seal from running dry when the engine is started for the first time.

MAIN AND BIG END BEARINGS AND CAPS

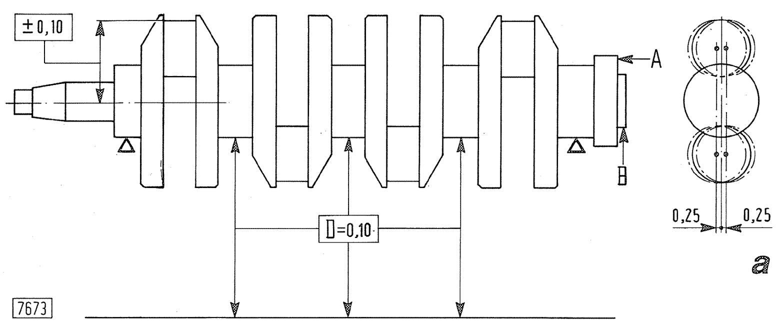
The bearings caps with attached thin shell bearing are numbered for correct installation.

b



a

c



a

Maximum main journal and crankpin misalignment with respect to the crankshaft and of the crankpins with respect to the main journals (a).

b. Mods. 55-56 and 60-56 - c. Mods. 65-56 and 70-56 - A and B. Stylus position for flange run-out and eccentricity check - D. Maximum main journal misalignment.

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The cap identification number should tally with that stamped on the engine block.

The crankshaft bearing running clearance may be checked using "Perfect Circle Plastigage". As shown in figure, for the relevant clearance setable on page 2, sect. 10.

PISTON AND RINGS.

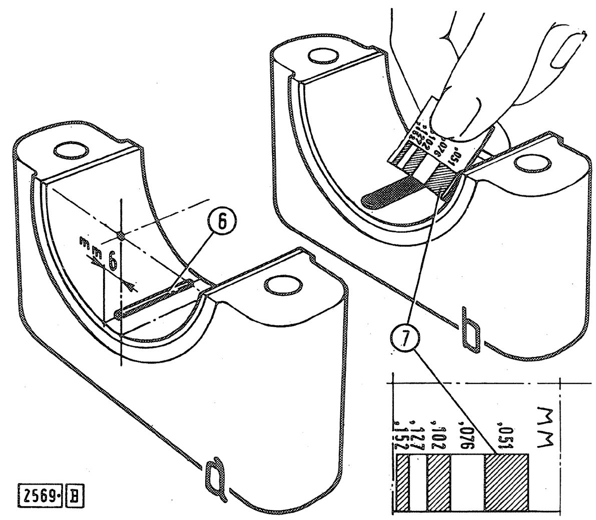
Access piston and sleeve wear as directed in the figures on this page, on page 1 sect. 101 and on page 4.

If clearance exceeds .30 mm (.012), rebore the sleeves and for oversize pistons and rings (see table, page 4, sect. 10).

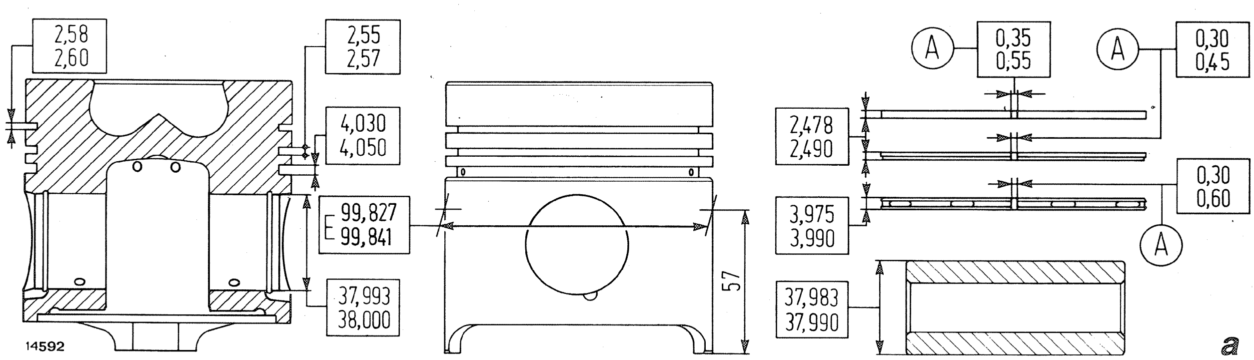
When replacing pistons, note that the weight difference between pistons of the same engine should not exceed 20 grams (2/3 oz.).

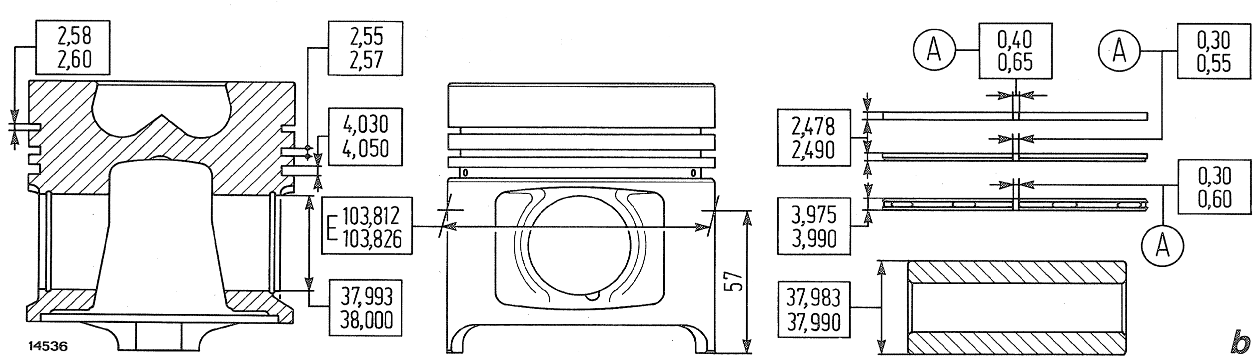
To remove and install piston rings, use tool **291160.**

Check that ring side clearance (b, page 4) and fitted gap (c) do not exceed specified limits.



Checking crankshaft journal running clearance.
a. Calibrated wire in position on bearing cap - b. Measuring width of compressed wire after cap removal - 6. Calibrated wire - 7. Graduated scale printed on wire container.





Normal piston, pin and ring dimensions (mm).
a. Mods. 55-56/60-56/70-56 - b. 60-56 - A. Piston ring gap - E. Piston diameter as measured 57 mm (24") from base of skirt.

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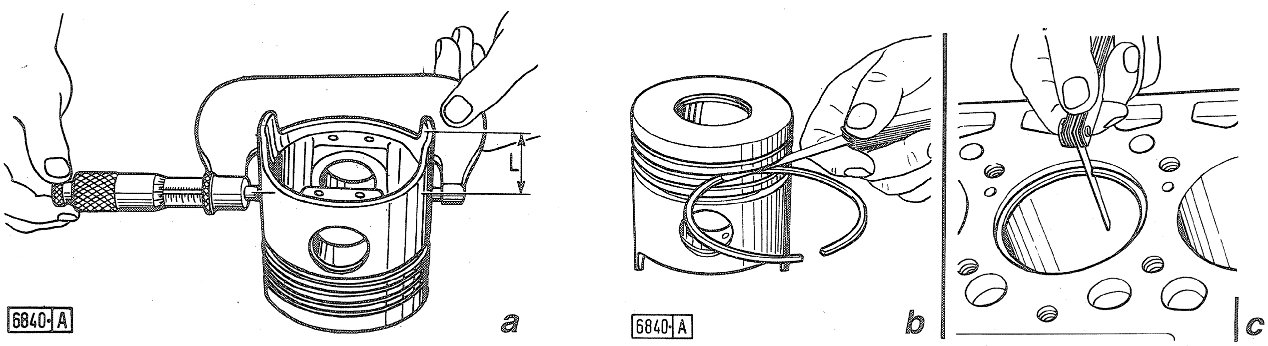


Inspecting pistons and rings

a. Measuring piston diameter at distance (L) from base of skirt - b. Measuring piston ring side clearance - c. Measuring piston ring gap L. Measuring distance from skirt base, 57 mm ($2^1/_4$").

If the ring gap is found to be less than specified, grind the ring ends as necessary.

install the rings in the order shown in figure (page 3).

When inserting the piston in the cylinder sleeves, ensure that the ring gaps are staggered at 180° from one another.

Connecting rod/piston installation.

Insert the pistons with attached rings and connecting rods into the associated sleeves, preferably using ring compressor **291048** and positioning each assembly so that the reference mark on the connecting rod faces towards the side opposite the camshaft.

Installed piston T.D.C. stand-out from engine block should be as specified on page 4, section 10.

CONNECTING RODS

Check the small end bushing for looseness and displacement. They should be flush with connecting rod sides.

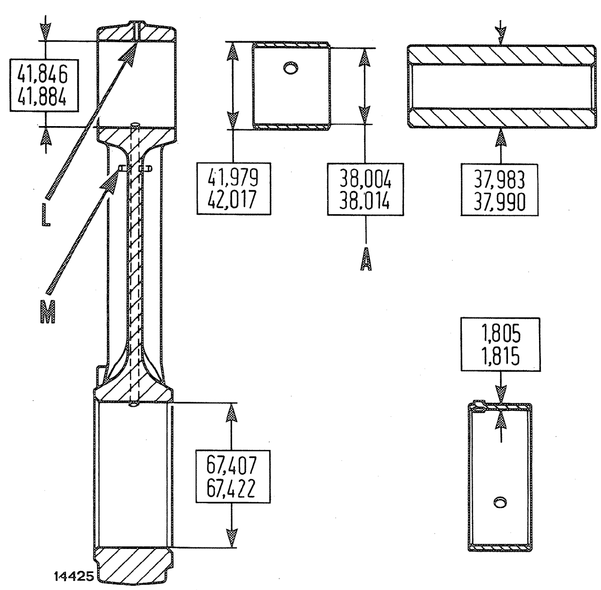
Replace piston pin and small end bushing if clearance exceeds .06 mm (.0024") (see page 4, sect. 10).

Use gauge **293459** to check connecting rod axis alignement. Maximum misalignment of big and small end axis at 125 mm (4.9") from the rod centerline should be as specified in the table. Any slight distortion may be remedied using a suitable press. If distortion is serious, however, replace the connecting rod.

Replacement rods should be stamped with the reference numbers of the cylinder to which they belong. Also ensure that the weight difference between rods of the same engine does not exceed 25 grams (1 oz.).

Ensure that the connecting rod lubrificating ports (L and M) are unobstructed.

Note - When connecting rods have been disassembled, scrap and replace the cap capscrews.



Connecting rod, associated bearing, bushing and normal pin dimensions (mm)

A. Distance to obtain by reaming after fitting bushings - L.M. Lubrification orifices.

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BOSCH (TYPE VE) INJECTION PUMP PROVAL, INSTALLATION AND TIMING ON ENGINE

To remove pump, proceed as follows:

— close cock on fuel intake line;

— remove injection pump drive gear front cover;

— disconnect fuel intake and return lines, high pressure lines to injectors, throttle control linkage and solenoid connection from the pump;

— if necessary, disconnect the fuel pump and filters;

— unscrew pump retaining screws (C_1)and nut securing pump shaft to drive gear and lift off injection pump.

To install, process as follows:

— place the flat gasket between the pump flange and the spacer (4);

— fit shaft to drive gear, locking by means of provided nut and insert pump retaining nuts (C_1) without tightening;

— turn the pump body to align reference marks (A_2) on the pump and spacer (4);

— tighten the pump retaining nuts (C_1) reconnect the various fuel lines, fuel pump and filters;

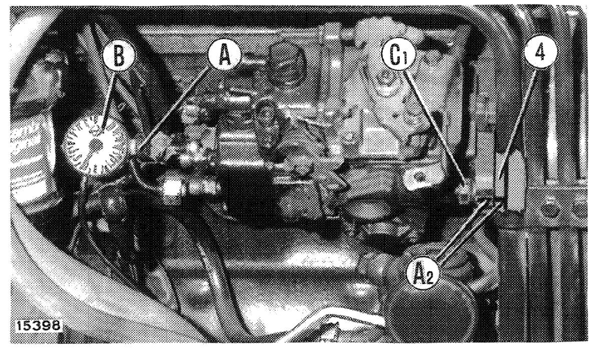
— finally vent the circuit.

If there are no reference marks (A_2) or if they are not reliable, timing must be carried out as follows:

— bring cylinder no. 1 piston in compression stage to T.D.C. (valves closed), turn the flywheel anticlockwise (as seen from fan side) until the reference mark is aligned with the inscription INIEZ. BOSCH.

— with the pump reinstalled, remove the plug (1), fit the tool **291755** (A) complete with gauge **291754** (B) and with feeler preloaded by about 2.5 mm (.1");

— turn again slowly backwards until the pumping element to B.D.C. in start of delivery position (the gauge will stop dropping);



BOSCH pump timing on engine.
A. Tool **291755** - A_2 Reference marks - B. Gauge **291754** - C_1 Pump retaining nuts - 4. Spacer.

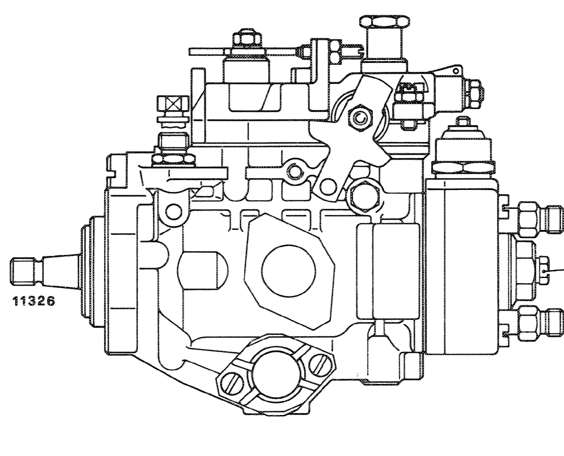
— set gauge to zero and turn flywheel clockwise until reference marks is aligned with the inscription INIEZ. BOSCH;

— check the gauge to ensure that the pumping element stroke is 1 mm (.04"). If not, slacken the pump retaining nuts (C_1);

— if the stroke is too short, turn the pump clockwise (as seen from drive side). If it is too long, turn anticlockwise;

— check that a pumping element stroke of 1 mm (.04") has been obtained, and repeat above operations as required;

— tighten the pump retaining nuts and cut reference marks into the pump flange and spacer.



View of injection pump complete with plug (1).

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— remove gauge (B, page 1), tool (A) and fit plug (1), tightening to 8 ÷ 10 Nm (0.8 ÷ 1 kgm or 5.8 ÷ 7.2 ft lb);

— reconnect the fuel lines, the fuel pump and filters;

— vent the circuit

C.A.V. (TYPE DPS) INJECTION PUMP REMOVAL, INSTALLATION AND TIMING ON ENGINE.

To remove pump, proceed as follows:

— close cock on fuel intake line;

— remove injection pump drive gear front cover;

— disconnect fuel intake and return lines, high pressure lines to injectors, throttle control linkage and solenoid connection fron the pump;

— if necessary, disconnect the fuel pump;

— unscrew pump retaining screws (C_1) and nut securing pump shaft to drive gear and lift off injection pump.

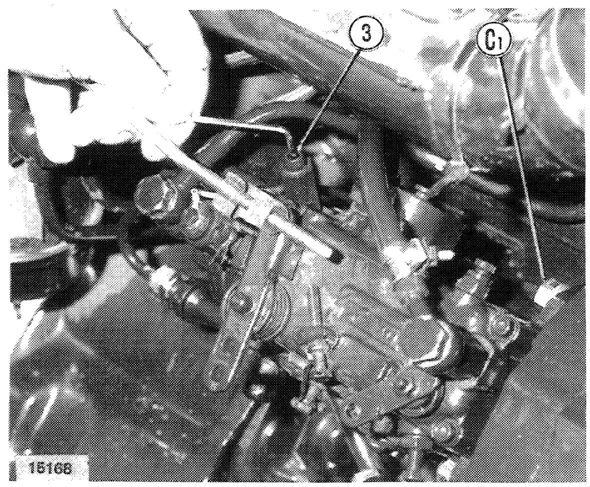
To install, proceed as follows:

— place the flat gasket between the pump flange and the spacer (4);

— fit shaft to drive gear, locking by means of provided nut and insert pump retaining nuts (C_1) without tightening;

— turn the pump body to align reference marks (A) on the pump and spacer (4);

— tighten the pump retaining nuts (C_1), reconnect the various fuel lines, fuel pump and filters and finally vent the circuit.



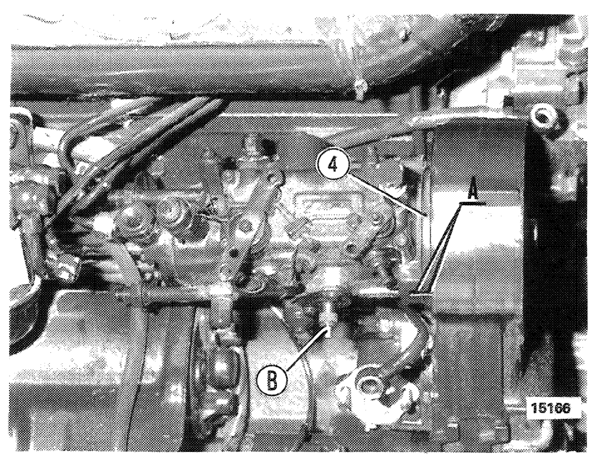
View of pump installed on engine.
C_1 Retaining nuts - 3. Socket head bleed scew.

If there are no reference marks (A) or if they are not reliable, timing must be carried out as follows:

— bring cylinder no. 1 piston in compression stage to T.D.C. (valves closed), corresponding to the inscription INIEZ. BOSCH.;

— remove the plug (1, page 3) from the side cover and fit timing tool **292411** (B);

— fit shaft to drive gear, locking by means of provided nut and insert pump retaining nuts (C_1) without tightening;



Timing C.A.V. (DPS) injection pump.

A. Reference marks - B. Timing tool **292411** - 4. Spacer

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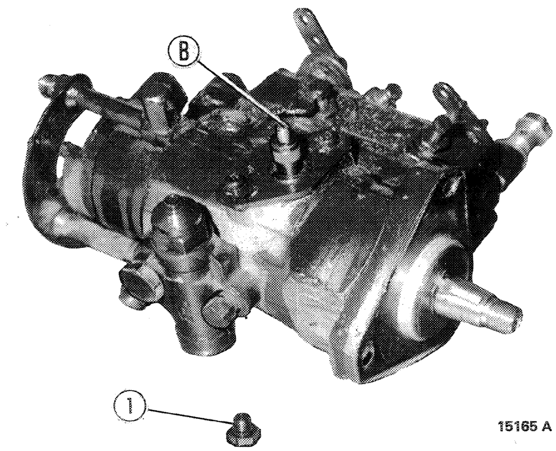
— turn the pump body until the pin on tool **292411** (B) enters the notch in the pump shaft; this occurs when the pin comes back towards the pump;

— tighten the pump retaining nuts (C_1 pag. 2) and cut reference marks (A) into the pump flange and spacer (4); install the fuel pump;

— remove tool **292411** (B) from hole in cover and fit plug (1) tightening to 4.5 nM (0.45 kgm or 3.25 ft lb);

— reconnect the fuel lines and vent the circuit.



Fitting timing tool 292411 (B) on .C.A.V. (DPS) injection pump.

1. Plug

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DESCRIPTION

The cooling system installed on mods. 55-56/60-56/65-56/70-56 tractors is filled with a mixture of water and Fiat "**PARAFLU 11**" (50% by volume) anti-freeze, effective down to:

Degrees C°	— 8	— 15	— 25	— 35
Degrees C°	17.6	5	— 13	— 30
% by volume "**PARAFLU 11**"	20	30	40	50

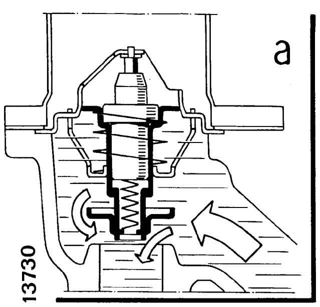
Futhermore, this mixture has oxidation, corrosion, foam and scale control properties to ensure long life protection to the system.

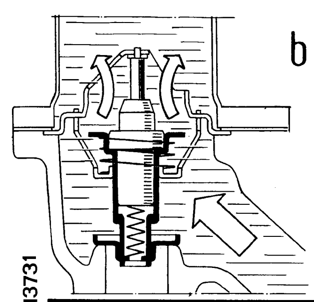
Vapour inside radiator is exhausted through a plastic pipe (12, page 3) connected to a hole on filler neck.

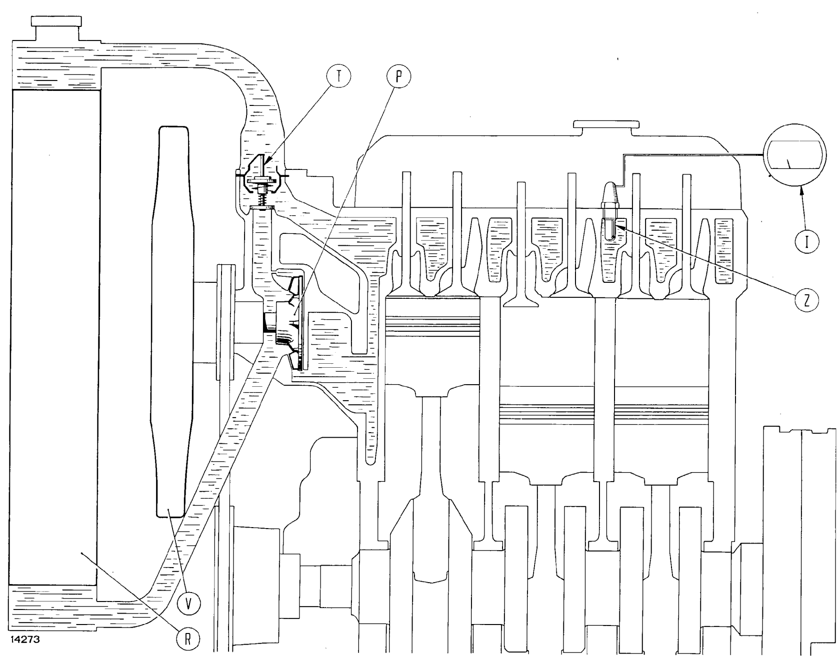
Periodically check that coolant level is about 3 cm (1.2") from top of filler neck.

When topping up the radiator, allow engine to cool down before removing cap.

The coolant is effective for a period of **two years** or **1600 hours**, after which the system should be drained, flushed and filled with fresh coolant.







Coolant circuit diagram. Mods. 55-56 and 60-56
a. Water circulation and thermostat closed - b. Water circulation and thermostat open - I. Engine water temperature gauge - P. Pump - R. Radiator - T. Thermostat - V. Fan - Z. Sending unit.

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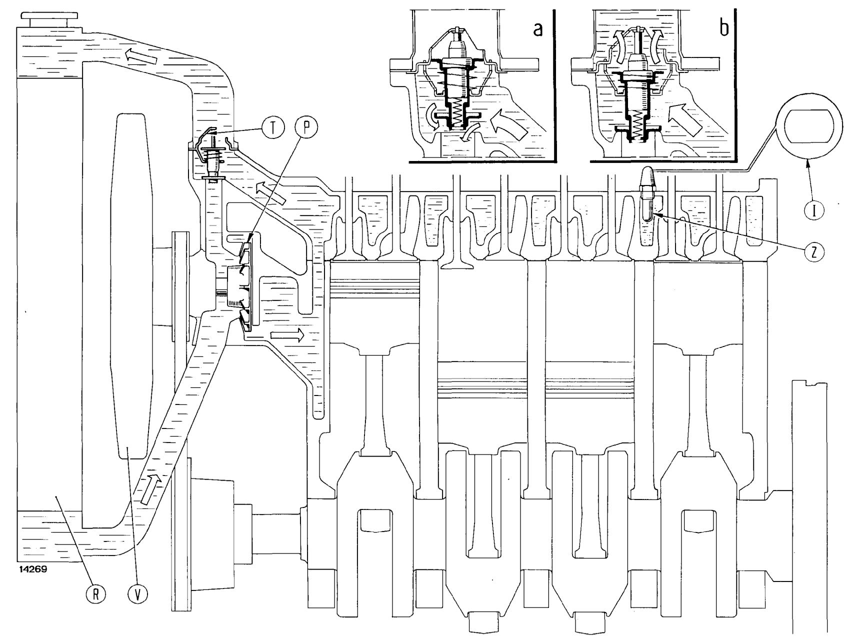


Coolant circuit diagram. Mods. 65-56 and 70-56

a. Water circulation and thermostat closed - b. Water circulation and thermostat open - I. Engine water temperature gauge - P. Pump - R. Radiator - T. Thermostat - V. Fan - Z. Sending unit.

WATER PUMP

— The overhaul water pump, proceed as follows:

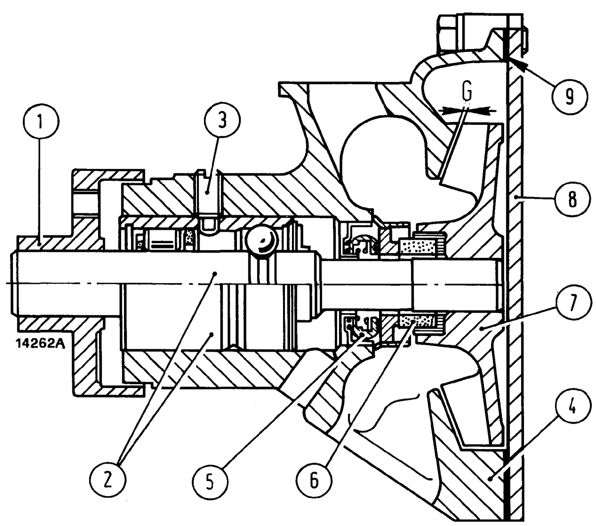
— remove cover (8) and retaining screw (3) form shaft bearing (2);

— tap end of shaft lightly to break oxide film between shaft and impeller and remove impeller using puller **291182/1** (page 2);

— using a suitable puller, withdraw shaft complete with bearing and fun hub.

Remove seal (5) only if replacement is necessary, i.e., when graphitized surface in contact with impeller bushing is no longer sufficiently smooth to prevent leakage.

Reassemble bearing in mind the following:



Section through water pump

1. Pump and fun drive hub - 2. Drive shaft assembly with bearing - 3. Shaft retaining screw - 4. Pump body - 6. Bushing - 7. Impeller - 8. Cover - 9. Seal - G. Operating clearance = .5 to .7 mm (.02 to .027").

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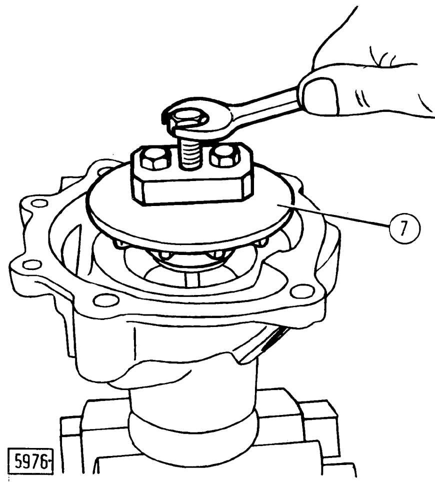
— the bearing (2 page 2) requires no lubrification;

— the impeller (7) must be fitted flush with end of drive shaft.



Water pump impeller removal using puller 291182/1.

7. Girante.

RADIATOR

The radiator cap incorporates two valves: a pressure relief valve (13) set at .7 bar (.7 kg/cm² or 10 psi) and a vacuum relief valve (14). Periodically check that valves operate correctly.

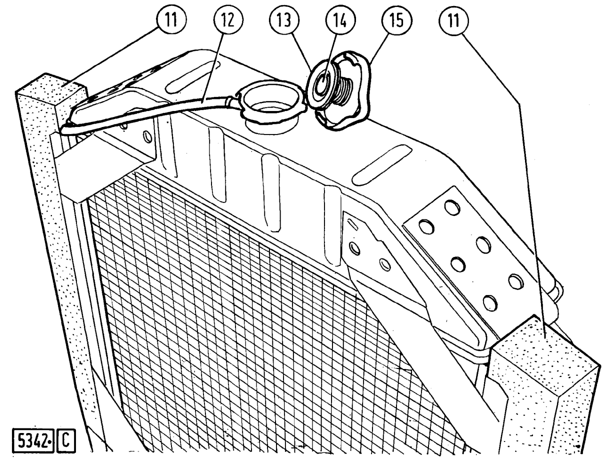
On overhaul, eliminate scale in radiator as follows::

— prepare a solution of warm water and sodium bicardonate (30 grams/litre) or use **Fiat flushing solution**, in quality indicated on container;

— pour solution into radiator, drain and rinse with abundant water.

To check for radiator leakage, submerge radiator in a tank of water at 30 ± 10 °C (86 ± 18°F) and apply air at .98 bar (1 kg/cm² or 14.22 psi) for two minutes. Repeat the test at least three times.

When flushing the radiator, also flush the rest of the cooling system using the solution and procedures indicated above. Operate tractor for about 1 hour before draining solution with the tractor off.

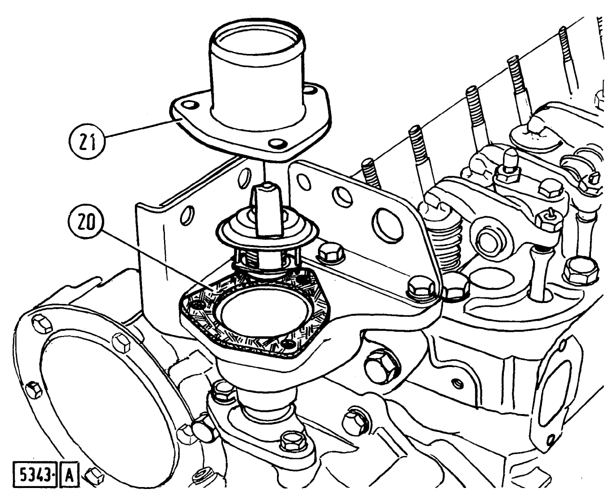


Radiator.

11. Sealing strips - 12. Vapor dischage pipe - 13. Pressure relief valve (set at .5 bar, .5 kg/cm² or 7 psi) - 14. Vacum relief valve - 15. Radiator cap.

THERMOSTAT

Thermostat (T, pae 1) is installed in cylinder head water outlet pipe.
Since adjustment is not possible, replace thermostat unit when temperature data specified in table are not met.



Thermostat removal (installation).

20. Seal - 21. Cover.

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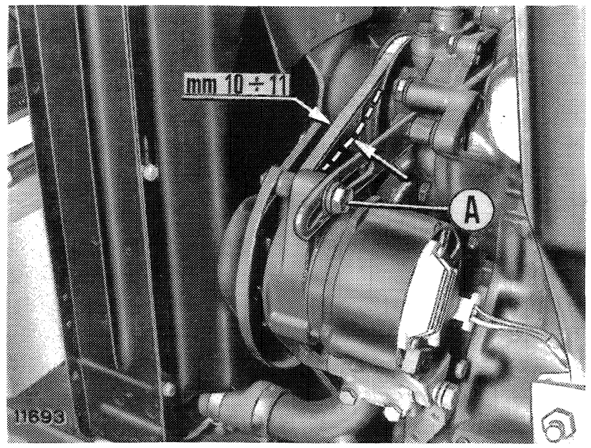
WATER TEMPERATURE GAUGE

The water temperature gauge is divided into three coloured sectors corresponding to the following temperature ranges:

— white sector .... 30 to 65 °C (86 to 149 °F)
— green sector .... 65 to 105 °C (149 to 222 °F)
— red sector .... 105 to 115 °C (222 to 239 °F)

In normal conditions, pointer should be in green sector.

In case of doubt, test instrument be immersing bulb in water and check scale with reference thermometer **291979;** repeat test several times.



Fan, water pump and alternator drive belt tension.
A. Nut sesecuring alternator to belt tensioner

BELT TENSION ADJUSTEMENT

To check fan, water pump and alternator drive belt, apply a load of 78 to 98 N (8 to 10 kg or 18 to 22 lb) on belt section between alternator and water pump pulleys: the belt should deflect 10 to 11 mm (.394 to .433").

If necessary, adjust as follows:

— slacken nut (A) securing alternator to belt tensioner;

— move alternator on tensioner bracket to obtain desired tension; then tighten nut (A).

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BEVEL DRIVE AND DIFFERENTIAL

With the exception of the following, the data given on page 4, sect. 20, mod. 446 is valid.

Bevel drive ratio for mods. 55-56 60-56/65-56	12/47 = 1 to 3.9
Bevel drive ratio for mod. 70-56	14/47 = 1 to 3.35

BRAKES

Type:	
— service	Disc, oil bath, axle shaft mounted
— parking	Same discs as service brakes
Control:	
— service	Mechanical, latched pedals
— parking	Mechanical, hand lever
Discs per brake:	
— mods. 55-56/60-56/65-56	3
— mods. 70-56	4
— Disc thickness	4.65 to 4.8 mm (0.183 to 0.189")
Disc material	Organic compound
Brake pedal support	
RH pedal I.D.	40.000 ÷ 40.025 mm (1.5748 ÷ 1.5758")
Bushing thickness	1.968 ÷ 1.932 mm (0.0775 ÷ 0.0761")
RH pedal bushing fitted I.D. (without reaming)	36.064 ÷ 36.161 mm (1.4198 ÷ 1.4236")
RH pedal bushing/housing clearance	0.097 mm (0.0038") max.
RH pedal bushing/housing interference	0.097 mm (0.0038") max.
LH pedal shaft diameter	36.000 - 35.961 mm (1.4173 ÷ 1.4158")
Clearance between LH pedal shaft and RH pedal bushing fitted	0.103 ÷ 0.161 mm (0.004 ÷ 0.0063")
LH pedal I.D.	36.025 ÷ 36.087 mm (1.4183 ÷ 1.4207")
Clearance between LH pedal shaft and housing	0.064 ÷ 0.087 mm (0.0025 ÷ 0.0034")
LH brake shaft bushing fitted I.D. (without reaming)	22.052 ÷ 22.137 mm (0.8682 ÷ 0.8715")
LH brake bushing fitted	25.000 ÷ 25.021 mm (0.9842 ÷ 0.9851)
Bushing thickness	1.442 ÷ 1.474 mm (0.0568 ÷ 0.058")
LH pedal bushing/housing clearance	0.064 mm (0.0025") max
LH pedal bushing/housing interference	0.085 mm (0.0033") max.
Handbrake shaft diameter	21.967 ÷ 22.000 mm (0.8648 ÷ 0.8661")
LH brake bushings	0.052 ÷ 0.170 mm (0.002 ÷ 0.0067")

(cont.)

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BRAKES

(continued)

Diameter of bushing housing in transmission casing	40.000 ÷ 40.025 mm (1.578 ÷ 1.5758'')
I.D. of LH brake shaft support bushing in transmission casing (without reaming)	36.064 ÷ 36.161 mm (1.4198 ÷ 1.4236'')
Bushing thickness	1.932 ÷ 1.968 mm (0.0761 ÷ 0.0775'')
Clearance between bushings and transmission casing .	0.097 mm (0.0038'') max
Interference between bushings and transmission casing	0.103 ÷ 0.161 mm (0.004 ÷ 0.0063'')

FINAL DRIVES

With the exception of the following, the data given on page 6, sect. 20, mod. 446 is valid.

Reduction ratio:	
- mods. 55-56/60-56 e 65-56	11/62 = 1 to 5.636
- mods. 70-56	11/68 = 1 to 6.18

POWER TAKE-OFF

Type	Ground speed or indipendent
Control	Hand lever
Output shaft clutch control	Hand lever on transmission casing cover
Rotation (as viewed from rear)	clockwise
Engine speed with PTO at 540 rpm	1967 rpm
PTO speed with full load engine rpm	686 rpm
Output shaft diameter (4, page 2, sect. 207)	1 3/8'' (6 spline)
Output shaft speed/ground speed ratio; Shaft rpm per rear wheel rev with any tyre:	
— mods. 55-56/60-56/65-56 (bevel gear 12/47)	15.2
— mods. 70-56 (bevel gear 14/47)	14.2

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TIGHTENING TORQUE DATA

With the exception of the following, the data given on page 6, sect. 20, mod. 446 is valid.

DESCRIPTION	Thread size	Tightening torque data		
		Nm	kgm	Ft lb
Clutch - Section 201 Capscrew, withdrawal fork (C_3, page 3, mod. 446)	M 16×1.5	157	16	116
Capscrew, clutch housing to engine (C_4, page 3, mod. 446) .	M 12×1,25	98	10	72
Transmission and splitter - Section 202 Locknut, driven gear shaft (C_{13}, page 3, mod. 446)	M 32×1,5	294	30	217
Nut, transmission housing to clutch housing (C_{10}, page 3, mod. 446)	M 12×1,5	98	10	72
Nut, transmission shaft bearing cover studs (C_2, page 3, mod. 446)	M 8×1,25	17	1,7	12
Capscrew, splitter fixed gear	M 12×60	98	10	72
Bevel drive and differential - Section 204 Nuts, self-locking for ring gear retaining screws (C_2, page 9, mod. 446)	M 12×1,25	113	11,5	83
FInal drives - Section 206 Capscrew, final drive housing to transmission casing (C_3, page 1, mod. 446)	M 12×1,5	98	10	72
Nuts for bolts securing disc (C_4, page 1, mod. 446)	M 16×1.5	245	25	180
Capscrew, wheel disc (C_5, page 1, mod. 446)	M 16×1,5	255	26	188
Locknut, driven gear to wheel shaft (C_7, page 1, mod. 446) ..	M 55×1,5	882	90	650
Power take-off - Section 207 Capscrew, PTO cover (C_3, page 1, mod. 446)	M 14×1,5	147	15	108
Capscrew, transmission housing rear cover (C_2, page 2, mod. 446)	M 12×1,5	98	10	72

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BEVEL DRIVE ADJUSTMENT

1. Bevel pinion bearing adjustment and shim thickness calculation (Sp. fig. b1) using tool (R) 293101/1 (fig. a, $a_1$and b).

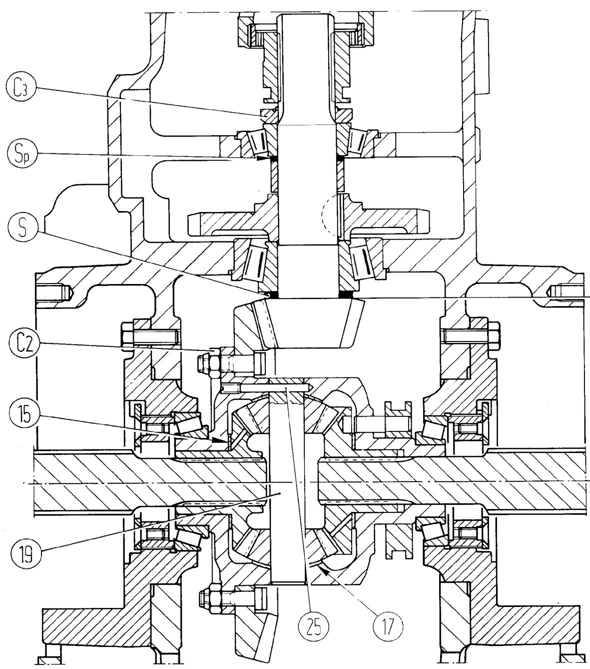
Fit the bearing inners rings (1 and 3) on tool 293101/1 (R) followed by:

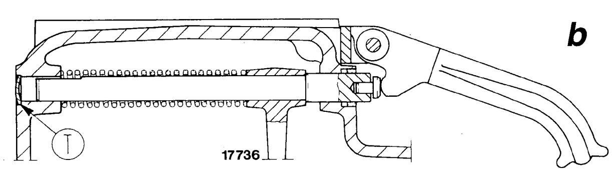
— the spacer (2) and gear (4) on 2-wheel drive tractors with ground-speed PTO (a);;

— double gear (5) for 4-wheel drive tractors with ground-speed PTO and live front axle drive (a_1).

Tighten the nut (M) on the tool and take the reading (H_1) using a depth gauge.

Disassemble, lubricate the bearing with engine oil and fit the tool in the housing.





Sections through bevel drive.

b1. Section through differential lock control - C^2. Bevel ring gear retaining screw nuts - C^3. Bevel pinion shaft nut - H = 128 mm (5''). Nominal distance between ring gear centerline and back of pinion - S. Bevel pinion positioning shim - Sp. Bevel pinion bearing shims - T. Plug - 15 and 17. Thrust washers - 19. Side gear journal - 25. Journal (19) retaining screw.

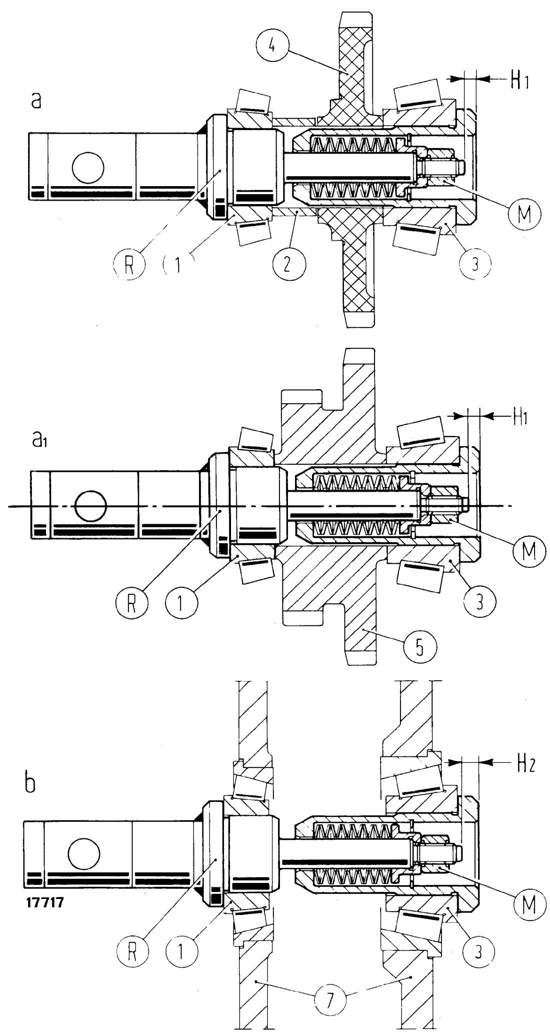
Tighten nut (M) once more, turning the tool at the same time to settle the bearings.

Take the reading (H_2, fig. b).

Shim thickness (Sp. fig. b_1) will be given by:

$$Sp = H_2 - H_1 + 0.05 \text{ mm } (.002'')$$

where:



Bevel pinion taper bearing adjustment and shim thickness calculation (SP, page 2) using tool (R) 293101/1 on 2-wheel drive tractors with ground speed PTO (a), and 4-wheel drive tractors with ground speed PTO and live front axle drive (a_1).

H_1 and H_2. Distance to measure using depth gauge - M. Tool lock nut - R. Adjustment tool **293101/1** - 1 and 3. Bearing inner rings - 2. Spacer - 4. PTO drive gear - 5. PTO and live front axle drive double drive gear - 7. Transmission housing

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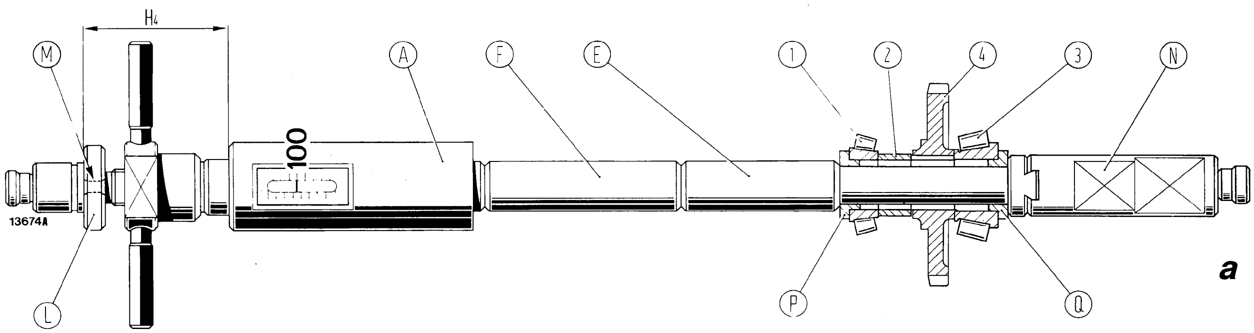
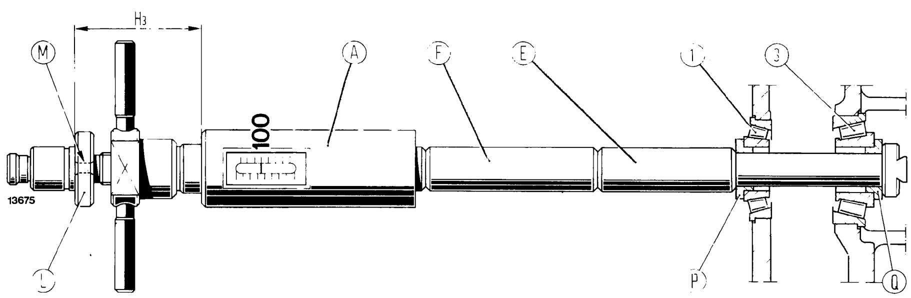


a



b

Pinion shaft bearing shim thickness calculation with universal tool 293510.

a. measurement of H_3 - b. Measurement of H_4 - A. Universsal tool **293510** - E. Spacer **293619** - F. Spacer **293620** - H_3 e H_4. Distance to measure using depth gauge - L. Register **293624** - M. Register (L) holes - N. Attachment for vice **293617** - P. Bushing **293632** - Q. Bushing **293632** - 1 and 3. Bearing inner rings - 2. Spacer - 4. PTO drive gear.

.05 mm = correcting required to compensate increased preload on bearings caused by tightening pinion shaft lock nut.

If necessary, round off Sp upwards to nearest **.05 mm** (.002").

Note — On completion of adjustment, do not remove tool from housing so as to carry out bevel pinion position adjustment.

---

2. Bevel pinion bearing adjustment and shim thickness calculation (SP, page 2) using universal tool 293510 (figs. a and b)

Fit the bushings **293632** (P and Q), and spacers **293620** (F) and **293619** (E) on universal tool **293510** (A).

Also fit attachment **293617** (N) for blocking the tool in a vice and fit the pinion bearing inner rings (1 and 3), the spacer (2) and the ground speed PTO drive gear (4) turned as in fig. a.

Turn the tool handwheel to bring the pointer gradually to 100 kg on graduated scale.

Fit universal tool (A) and register **293624** (L) so that the holes (M) correspond with the flats on the handwheel hub.

Measure the distance (H_4) with a depth gauge.

Disassemble, lubricate the bearings with engine oil and re-assemble the tool complete with the bushings (P and Q) and the transmission housing spacers (F and E) as shwn in fig. b.

Progressively bring the pointer to 100 kg on the graduated scale, turning the tool at the same time to settle the

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bearings; measure the distance (H_3 page 2).

$$Sp = H_4 - H_3 + .05 \text{ mm } (.002'')$$

where:

.05 mm = correction required to compensate increased preload on bearings caused by tightening pinion shaft lock nut.

If necessary, round off (Sp) upwards to nearset .05 mm (.002'').

Note — On completion of adjustment, do not remove tool from housing so as to carry out bevel pinion assembly position adjustment.

---

3. Bevel pinion assembly position adjustment and associated shim thickness adjustment (S, page1).

Install tool (D) **293400/1** on differential supports as shown in figs. c and d below.

Tighten of slacken the two cones (1) to bring micrometer (4) feeler (2) to bevel pinion shaft bearing (3).

Note — Use feeler marked 125 ÷ 150.

Turn cones (1) by hand and tighten the tool slightly aganist bearing cups to eliminate tool end play.

Lock micrometer gauge with feeler means of screw (5).

Bring micrometer feeler (2) in contact with bearing (3) and take reading (H_5).

Establish correct nominal distance (H_6) between ring gear centerline and back of pinion:

$$H_6 = H \pm C$$

where:

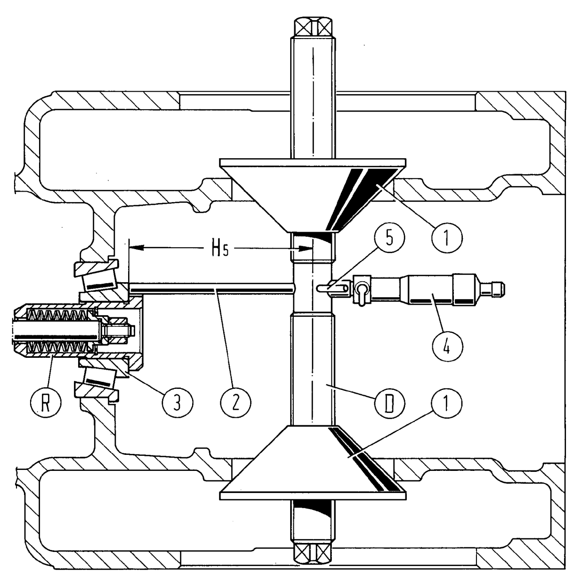
H = 128 mm (5''). Nominal distance between ring gear centerlineand back of pinion;

C = correction factor impressed on pinion, expressed in mm proceded by + or — sign, if other than 0, to be summed with or subtracted from the nominal value (H) depending on the sign indicated.

The shim thickness (S) will be given by:

$$S = H_5 - H_6$$

where:



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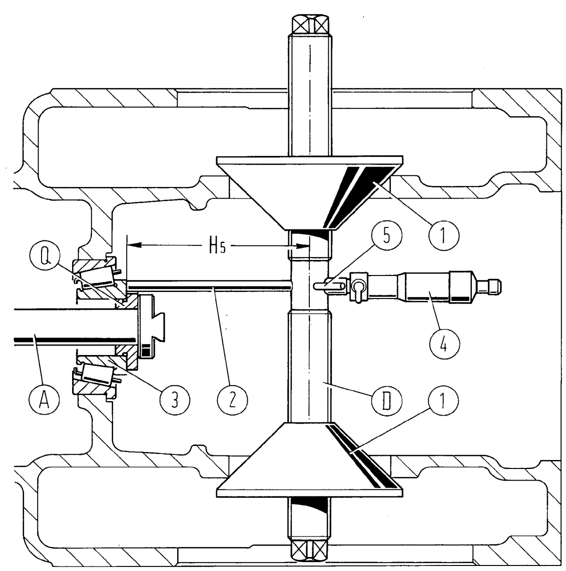

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Installation schematics for bevel pinion position check.

c. Measurement of distance (H_5) with universal tool (D) and specific tool (R) - d. Measurement of distances (H_5 with universal tools (A and D) - A. Universal tool **293510** - D. Universal tool **293400/1** - Q. Bushing **293632** - R. Specific tool **293101/1** - 1. Centering cones - 2. Micrometer feeler - 3. Bevel pinion bearing inner ring - 4. Micrometer gauge - 5. Micrometer screw.

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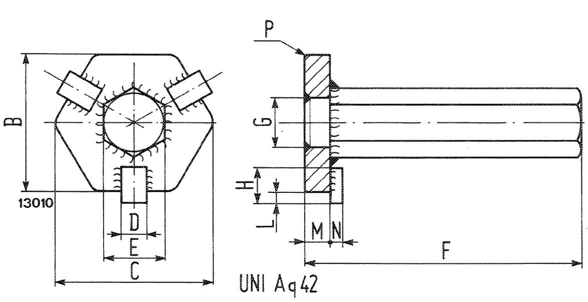
H_5 = distance measured by micrometer gauge
H_6 = corrected nominal distance betwen ring gear centerline and back of pinion.

Example

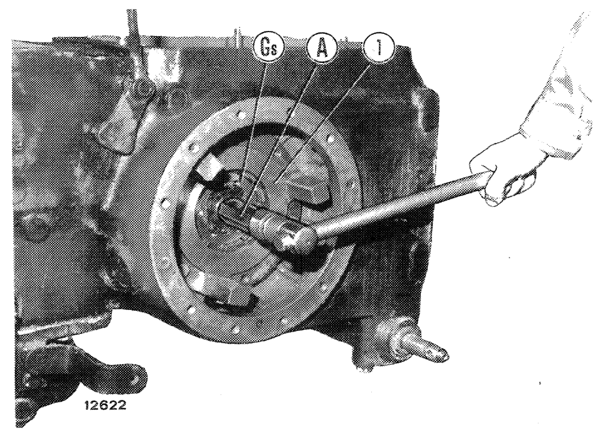
Micrometer reading H_5 = 132 mm.
Nominal distance between ring gear centerline and back of pinion H = 128 mm.
Correction factor C = + .2 mm.
Corrected nominal distance H_6 = 128 + .2 = 128.2 mm.
Shim thickness:
S = 132 — 128.2 = 3.8 mm.
Correction factor C = — 0.2 mm
Corrected nominal distance H_6 = 128 — .2 = 127.8 mm.
Shim thickness:
S = 132 — 127.8 = 4.2 mm.
Correction factor C = 0.
Corrected nominal distance H_6 = H = 128 mm.
Shim thickness:
S = 132 — 128 = 4 mm.

Ring gear bearing adjustment and bevel drive backlash check.

Note — To install lockrings, make tool as specified in drawing below.



Tool for ring gear-differential support bearing adjustment
B = 54.7 - 55 mm (2.15 - 2.16") - C = ∅62 mm (2.44") - D = 10 mm (.4") - E = 29.8 - 30 mm (1.17 - 1.2") - F = 110 mm (4.33") - G = ∅20 mm (.79") - H = 15 mm (.59") - L = 5 mm (.2") - M = 10 mm (.4") - N = 5 mm (.2") - P = cmafer 1 mm (.04") x 30°.

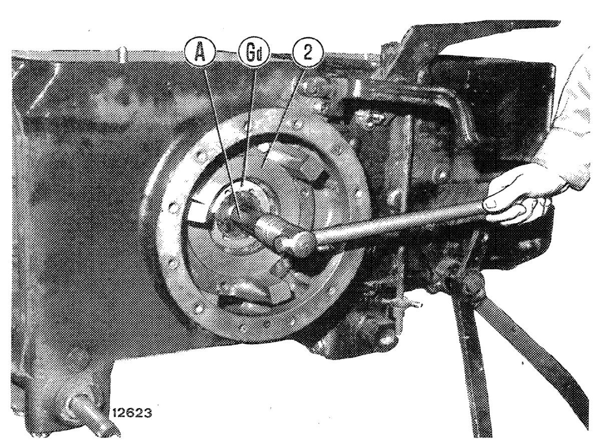


Installing LH lockring (Gs) for ring gear-differential support bearing adjustment.
A. Tool to make - 12. Lh support

— With bevel pinion installed, install the differential assy. with bevel ring gear (Fig. b1, page 1).

— Fit the LH lockring (Gs) and tighten to ensure minimum backlash of about 1 mm (.04") between the sides of the bevel gear teeth.

— Fit the RH bearing (Gd) and tighten to obtain pinion-ring gear assy. rolling torque of 9.8 to 14.7 Nm (1 to 1.5 Kgm or 7.2 to 12.3 ft lb). This torque is measured using a spring balance and cord wrapped around the differential carrier and corresponds to a spring balance pull of 98 to 147 N (10 to 15 kg or 22 to 33 lb).



Installing RH lockring (Gd) for ring gear-differential support bearing adjustment.
A. Tool to make - 2. RH support.

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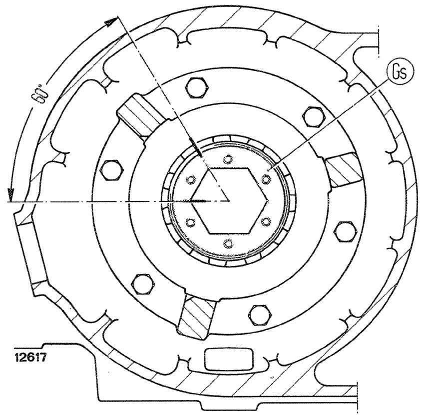
— Check bevel drive backlash (G) using a dial gauge, taking measurements at three equidistant points and comparing the average of the three readings to the backlash value envisaged: .18 to .23 mm, average .21 mm (.0007 to .009", average .0083").
To compensate excessive or insufficient backlash, note that the average ratio of normal backlash to equivalent ring gear displacement is 1 to 1.4.
Ring gear end play (Z) will therefore be:

$$Z = (G - .21) \times 1.4$$

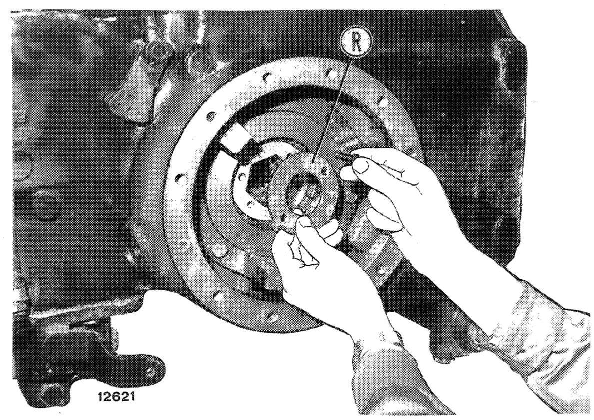
where:
G = bevel gear backlash as measured previously.

— Adjust the rings, first unscrewing the RH one and then screwing in the LH one to the same degree, until the specified backflah is obtai.

Note Note that one complete turn of the lockring corresponds to 2 mm (.08") ring gear axial displacement (Z).
Consequently a 60° turn of the lockring, equivalent to one side of the lockring hexagon, corresponds to .33 mm (.013") axial displacement.



Adjusting ring gear bearings
60° = lockring (Gs or Gd) rotation equivalent to one side of lockring hexagon corresponds to ring gear axial displacement of about .33 mm (.13").



Lock-washer installation (R).

— Fit lock-washer (R) on the lockrings so that the washer tab is aligned with a notch on differential support.

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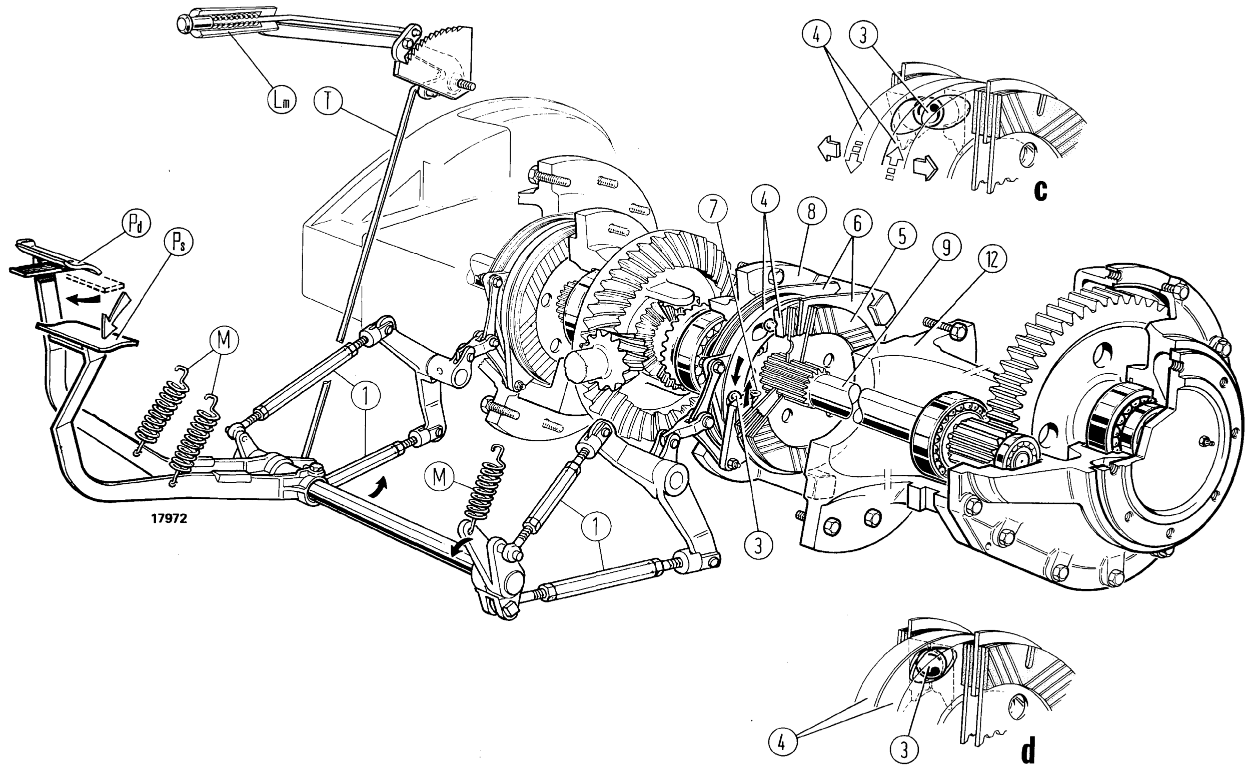

View of brakes and controls

c. Brakes applied - d. Brakes at rest - Lm. Parking brake hand lever - M. Brake pedal return springs - Pd. RH brake pedal - Ps. LH brake pedal - T. Parking brake control linkage - 1. Brake linkage - 3. Actuator (4) balls - 4. Brake actuator - 5. Brake disc - 6. Back-up disc - 7. Actuator (4) return spring - 8. Differential support - 9. Axle shaft - 12. Final drive housing.

BRAKE OPERATION

When LH brake pedal (Ps) is depressed, the linkage moves as shown by the arrows, thereby causing actuator discs (4) to move in opposite directions. As discs turn, balls (3) in taper seats force the discs apart as shown in detail (c).
These two simultaneous actions compress brake discs against differential support (8), back-up discs (6), actuator (4) and final drive housing (12).
Upon releasing the brake pedal, spring (7) and springs (M) immediately pull actuator (4) back into rest position (fig. d).
Operation is analogous when RH pedal (Pd) is depressed.

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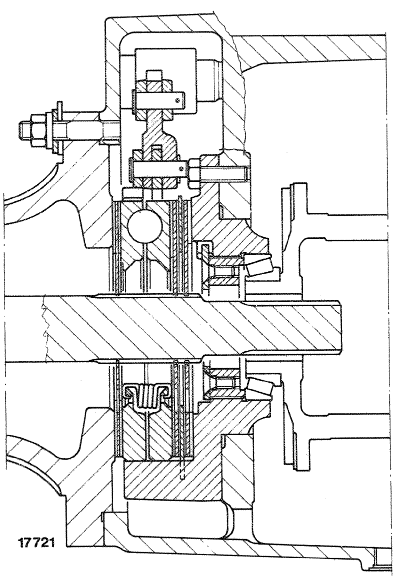
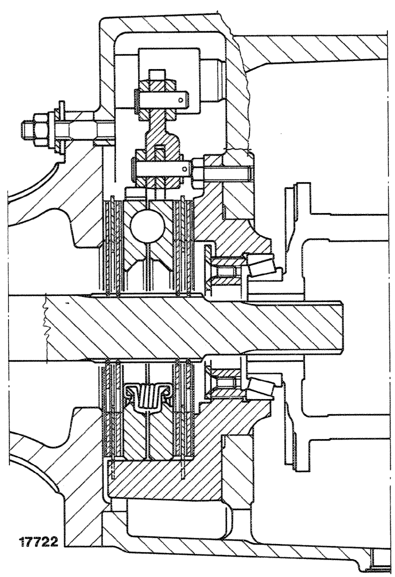
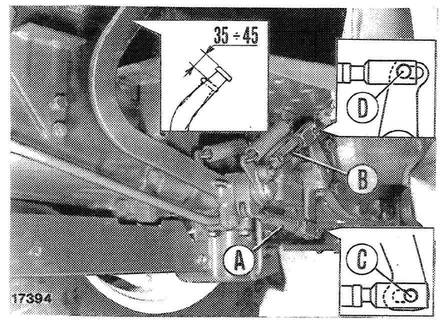
Important - New brake discs (5) must be soaked for at least 2 hours, and preferably for 5 to 6 hours, in Fiat TUTELA MULTI F oil before installation.



Sections through brake unit mods. 55-56/60-56/65-56



Section through brake unit mod. 70-56



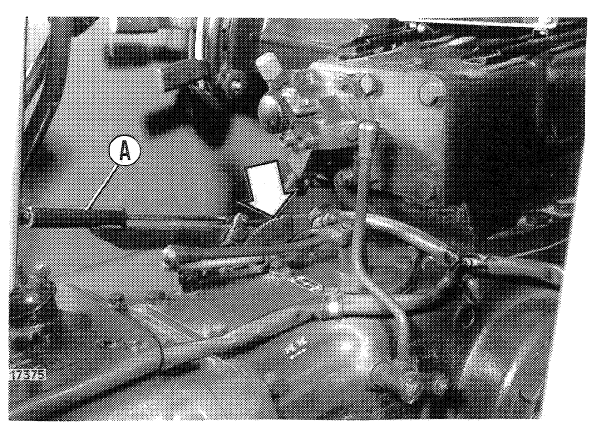
Brake pedal adjustment.
A and B. Sleeves - C and D. Pins

BRAKE PEDAL ADJUSTMENT

Check that the pedal free travel is the same for both pedals and does not exceed 45 to 50 mm (1.8 to 2''). Otherwise, adjust as follows:
— move handbrake lever downwards;
— tighten or slacken sleeve (A) to obtain free travel of 35 to 45 mm (1.4 to 1.8'');
— check that pin (C) is in contact with associated slot;
— screw or unscrew sleeve (B) until pin (D) is in contact with slot as shown.

PARKING BRAKE LEVER ADJUSTMENT

After adjusting brake pedal, check that lever (A) free travel corresponds to two to four ratchet teeth. Otherwise, check brake pedal adjustment as described above.



A. Parking brake lever

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REMOVAL

CAUTION

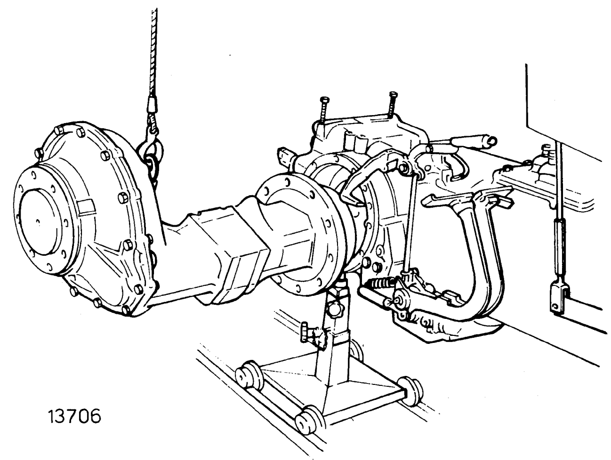
Raise and handle all heavy components using a suitable lift.
Ensure that units or parts are supported by suitable slings or hooks. Ensure that there is no one in the vicinity of the load to be lifted.

Remove final dives as follows:
— drain oil from rear transmission and final drive housings;
— position a support stand under transmission housing and remove ROPS frame, wheels, fenders and platform;
— take out capscrews (C_3) and remove final drive assy.

DISASSEMBLY (Cover)

CAUTION

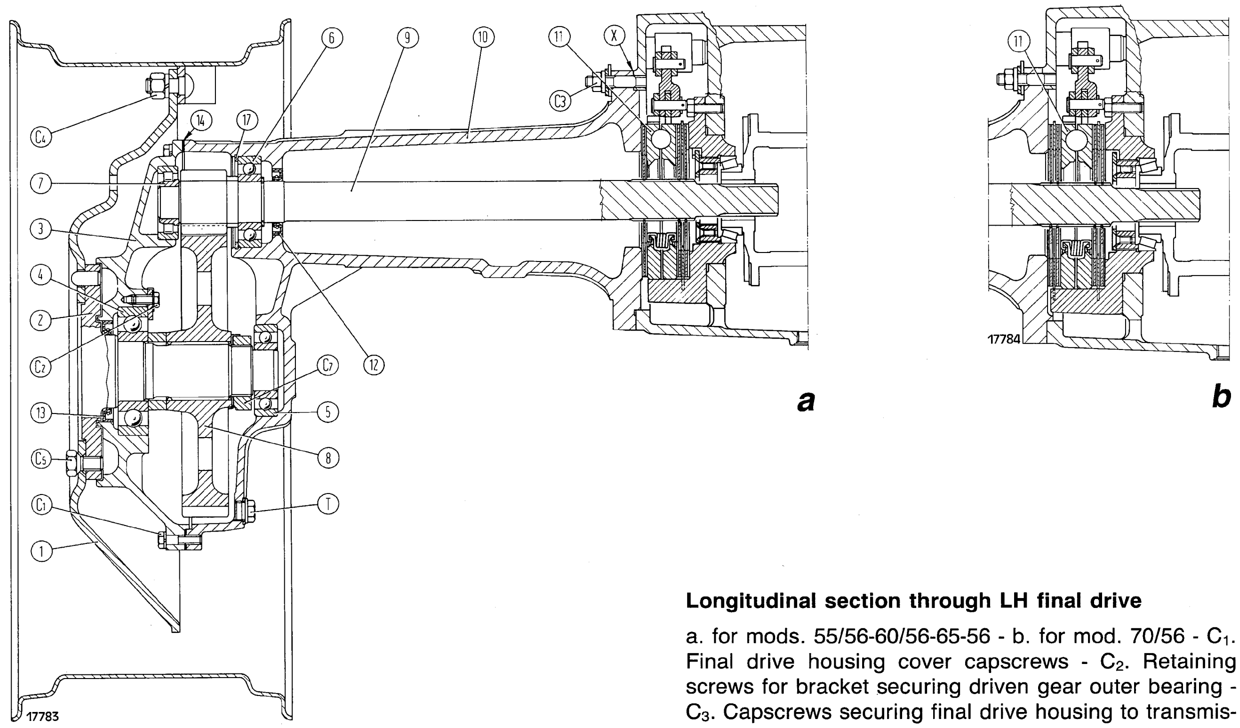
Handle all parts with care. Do not put hands and fingers between parts. Wear safety items such as goggles, gloves and safety shoes.



Final drive assy. removal (installation).

Disassemble as follows:

— take off capscrews (C_1) and remove final drive cover (3) with driven gear (8);



Longitudinal section through LH final drive

a. for mods. 55/56-60/56-65-56 - b. for mod. 70/56 - C_1. Final drive housing cover capscrews - C_2. Retaining screws for bracket securing driven gear outer bearing - C_3. Capscrews securing final drive housing to transmission housing - C_4. Wheel rim retaining screws - C_5. Wheel disc retaining screws - C_7. Driven gear locknut - T. Drain plug - 1. Wheel disc - 2. Wheel shaft - 3. Cover - 4, 5 and 6. Ball bearings - 7. Roller bearing - 8. Final drive driven gear - 9. Axle shaft - 10. Final drive - 11. Disc brakes - 12, 13 and 14. Seals - 17 Retaining ring.

Note: when reassembling, apply jointing compound on surfaces × as indicated on page 5, sect. A, mods. 446.

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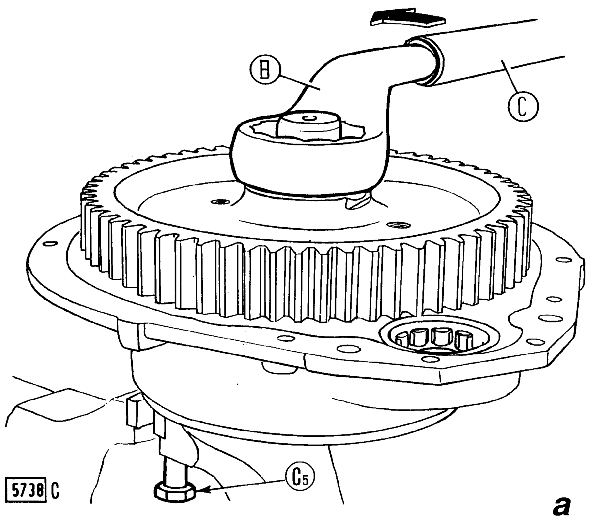
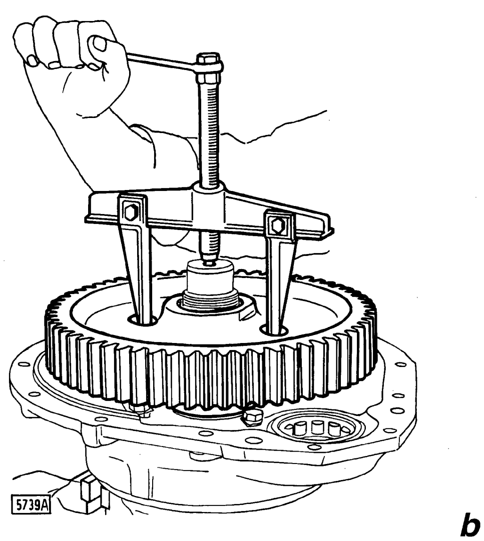


Driven gear retaining nut removal.
B. Wrench **290061** - C. Extension for wrench **290240** - C_5. M 16 × 1.5 screws for retaining cover in vice.

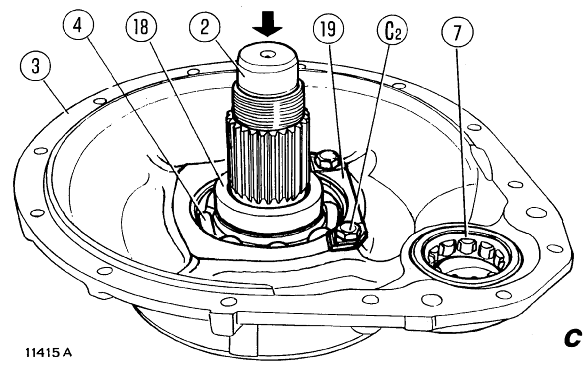
— tighten two M 16 × 1.5 screws (C5) into two of the wheel disc holes on hub and clamp wheel shaft in vice;

— unscrew nut (C_7 page 1 and fig. a.);

— withdraw driven gear (8, page 1) from wheel shaft (2) using puller from set **292904,** as shown in fig. (b);



Driven gear removal using puller from set 292904



Wheel shaft (2) removal (installation)
(Arrow indicates shaft removal direction).

C_2. Bracket (19) retaining screw - 3. Cover - 4. Ball bearing - 7. Roller bearing - 18. Spacer - 19. Bearing (4) retaining bracket.

— withdraw spacer (18), and knock out wheel shaft by beating with lead hammer in the direction shown by arrow in fig. (c.);

— use puller to withdraw outer ring (7) from cover (3);

— finally, withdraw the bearing (4) from cover, having first removed retaining bracket (19).

DISASSEMBLY (housing).

— remove the bearing (5) from the housing (10, fig. e page 3) using a suitable puller;

— remove retaining ring (17) and withdraw axle shaft (9) together with bearing (6), in the direction shown by the arrow;

— remove the roller bearing (7) internal ring from the axle shaft, using puller-separator from set **292911** as illustrated in fig. (d page 3) and the ball bearing (6, page 1) from the axle shaft (9), having first removed the lockring;

— check and replace damaged and worn parts;

— check lip seals (12 and 13, page 1) and replace if necessary; position as shown in fig.

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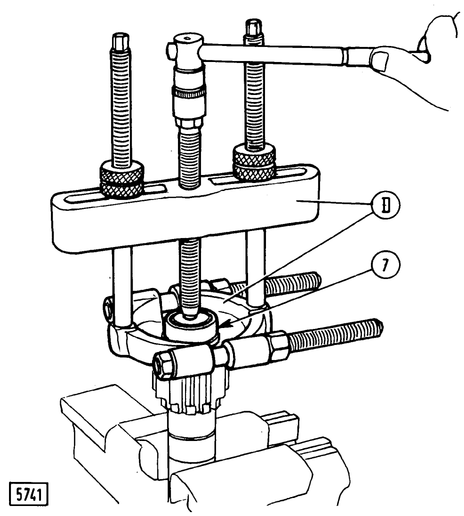
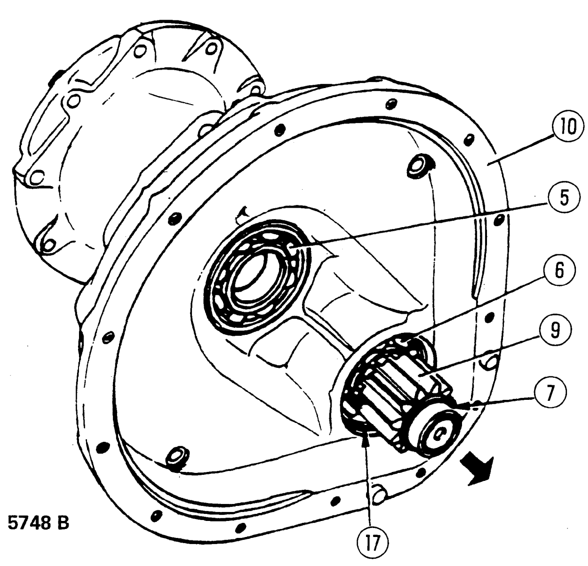


d

Roller bearing (7) internal ring removal from axle shaft.
D. Puller-separator from set **292911**.



e

Final drive housing
[Arrow indicators half shaft (9) removal direction].
5 and 6. Ball bearings - 7. Roller bearing internal ring - 9. Half shaft - 10. Final drive housing - 17. Bearing (6) retaining ring.

ASSEMBLY

Carry out the above operations in the inverse order, bearing in mind the following:

— place the roller bearing (7, fig. c) outer ring in its seat in the final drive cover with the mark on the outside;

— install the other bearings, using appropriate installers;

— fit the half shaft and wheel shaft, taking care not to damage the seals (12 and 13, page 1);

— fit the roller bearing internal ring (7, fig. e) on the half shaft (9) having heated it to oil to 80-90°C (176-194°F);

— tighten the gear locknut (C_7, page 1) using wrench (B, fig. a, page 2) and extension (C), previously used for disassembly;

— tighten all the nuts and screws to the torque values given on page 3, section 20;

— clean and grease the surfaces in contact between the housing (10, page 1) and the cover (3), inserting a new seal (14);

— throughly clean and grease the surfaces (×, page 1) applying jointing compound (see general instruction, page 5, section A).

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LIFT

Type	Position control, draught control and combined position/draught control
Control	Two independent levers
Variospeed (lift sensitivity adjustment)	External four-position lever on control valve
LIFT-O-MATIC	Permits rapid lift arm up/down movement by push button without operating draught or position control levers
Response adjustment	Knob on control valve
Single-acting cylinder:	
— bore × stroke	90 × 110 mm (3.54 × 3.94")
— displacement	700 cm^3 (42.7 in^3)
Relief valve crack-off setting	186-191 bar (190-195 kg/cm^2 or 2702-2773 psi)
Cylinder safety valve crack-off setting	210-215 bar (215-220 kg/cm^2 or 3058-3129 psi)
Lift piston diameter	89.980-90.000 mm (3.5425-3.5433")
Lift cylinder bore diameter	90.036-90.071 mm (3.5447-3.5461)
Piston working clearance	0.036-0.091 mm (0.0014-0.0036")
Cross shaft journal diameter	
— RH	47.975-48.000 mm (1.8888-1.8898")
— LH	54.970-55.000 mm (2.1642-2.1653")
Bushing fitted I.D. in lift body:	
— RH	48.100-48.184 mm (1.8937-1.8970") (1)
— LH	55.100-55.184 mm (2.1693-2.1726") (1)
Cross shaft working clearance in bushings:	
— RH	0.100-0.209 mm (0.0039-0.0082")
— LH	0.100-0.214 mm (0.0039-0.0084")
Rh bushing interference fit in housing	0.065-0.161 mm (0.0026-0.0063")
LH bushing interference fit in housing	0.065-0.161 mm (0.0026-0.0063")
Cross shaft end float with lift arms in position	0.200-1.400 mm (0.0079-0.0051")
Draught control shaft O.D.	21.967-22.000 mm (0.8648-0.8661")
Shaft housing bore dia. in lift body	22.020-22.072 mm (0.8669-0.8690")
Shaft clearance in body	0.020-0.105 mm (0.0008-0.0041")

(1) Not reamed

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HYDRAULIC LIFT UNIT: Specification and data

Position control shaft diameter .... Shaft housing bore dia. on draught control shaft .... Shaft clearance in body	13.973-14.000 mm (0.5501-0.5512") 14.016-14.059 mm (0.5553-0.5535") 0.016-0.086 mm (0.0006-0.0034")
Draught control lever pin and draught control inner lever hinge pin dia. at needle roller bearings .... Control valve link arm and draught control inner lever I.D. at needle roller bearings	13.973-14.000 mm (0.5501-0.5512") 19.985-20.006 mm (0.7868-0.7876")
Valve spool clearance in body .... Lift valve clearance in control valve body	0.008-0.012 mm (1) (0.0003-0.0005") 0.008-0.012 mm (1) (0.0003-0.0005")
Valve spool return spring length: — free .... — under 31.7-35 N (3.23-3.27 kg or 7.1-7.9 lb)	 50.5 mm (1.99") 34 mm (1.34")
Control valve return spring length: — free .... — under 103-114.7 N (10.5-11.7 kg or 23.1-25.8 lb)	 44 mm (1.73") 29 mm (1.14")
responde adjustment valve spring lenght: — free .... — under 1.7-2.3 N (0.17-0,23 kg or 0.4-0.5 lb)	 13 mm (0.51") 9.8 mm (0.38")
Sensitivity adjustment valve spring lenght: — free .... — under 15.8-17.6 N (1.61-1.79 kg or 3.5-3.9 lb)	 14.5 mm (0.57") 11 mm (0.43")
Check valve return spring length: — free .... — under 35.3-39.2 N (3.60-4 kg or 7.9-8.8 lb)	 23.5 mm (0.92") 18 mm (0.71")
Sensitivity adjustment pin lever outer spring lenght: — free .... — under 61.8-67.7 N (6.3-6.9 kg or 13.9-15.2 lb)	 20.5 mm (0.81") 13.8 mm (0.54")

(1) On assembly, spools and control valves are matched to obtained the specified clearance.

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REMOTE CONTROL VALVES

Remote control valves	
Type	Spool, automatic return to neutral
Make	KONTAK
Location	Up to two control valves on RH final drive
Control	Hand levers
Relief valve setting	186-191 bar (190-195 kg/cm²) or 2702-2773 psi)
Valve plunger clearance in body	0.003 ÷ 0.006 mm (0.0001-0.0002")
Relief valve spring length:	
— free	39.4 mm (1.551")
— under 294 ± 53 N (30 ± 5,4 kg or 66.2 ± 11.9 lb)	38.2 mm (1.504")
Valve plunger return spring length	42.8 mm (1.685")
Check valve spring length	15.9 mm (0.626")
Trailer brake valve	
Location	On transmission housing
Control	Tractor service brake pedals
Hydraulic fluid	Lift oil
Filter	Paper cartridge, used also for lift hydraulic
Pump	gear, used also for lift hydraulic circuit

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LIFT PUMP

Filter	
Type	Paper cartridge
Location	On pump body, suction side
Pump	
Type	Gear, drawing from rear transmiss-sion housing
Location	Behind timing cover
Model	A31
Make	FIAT
Drive	Valve timing gear driven
Rotation (seen from drive end	Anticlowise
Engine/pump drive ratio	1:0,931
Max. rated speed (engine at governed speed)	2328 rpm
Max. rated output	32.8 l/min (57.7 pints/min)
Output at 1450 rpm and 166 bar (170 kg/cm² or 2418 psi):	
— new or reconditioned	19 l/min (33.5 pints/min)
— used	13.3 l/min (23.4 pints/min)
— test oil temperature	55 ÷ 65 °C (131-149°F)
— test oil grade	SAE 20
Pump gear journal dia.	17.400-17.418 mm (0.6850-0.6857")
Journal hoursing bore dia. in bearing	17.450-17.470 mm (0.66870-0.6878")
Journal clearance in bearing	0.032-0.070 (0.0013-0.0028")
— Max. wear clearance	0.1 mm (0.0039")
Gear in pump body	0.020-0.064 mm (0.0008-0.0025")
Max pump body wear on suction side	0.1 mm (0.0039")
Gear flank width	24.000-24.015 mm (0.9449-0.9454")
Bearing width	24.490-24.510 mm (0.9642-0.965")
Pump body width	73.135-73.160 mm (2.8793-2.8803")
Gear and bearing end flot (applicable to new and reconditio-ned pumps	0.100-0.180 mm (0.0039-0.0071")

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IMPLEMENT ATTACHMENT

Type	3-point linkage
Category	1^{st} and 2^{nd}
Draught control	Through spring installed below top link
Max. lift capacity starting with lower links horizontal (top link coupled to top hole):	
— mods. 55-56 60-56 65-56 (at lower link swivel bushings)	1711 daN (1745 kg or 3847 ib)
— mod. 70-56 (at lower link swivel bushings)	2490 daN (2540 kg or 5600 lb)
— mods. 55-56, 60-56 and 65-56 (centre of gravity 610 mm from lower link swivel bushings	1314 daN (1340 kg or 2954 lb)
— mod. 70-56 (cente of gravity 610 mm from lower link swivel bushing	2138 daN (2180 kg or 4806 lb)
— mod. 55-56 (centre of gravity 1050 mm from lower link swivel bushings)	1167 daN (1190 kg or 2623 lb)
— mod. 60-56 (centre of gravity 1090 mm from lower link swivel bushings)	1157 daN (1180 kg or 2601 lb)
— mod. 65-56 (centre of gravity 1130 mm from lower link swivel bushings)	1142 daN (1165 kg or 2568 lb)
— mod. 70-56 (centre of gravity 1170 mm from lower link swivel 1170 mm from lower link swivel bushings)	1892 daN (1930 kg or 4255 lb)
Max. lower link end travel:	
— lifting rods fully out	~785 mm (30.9")
— lifting rods fully in	~645 mm (25.4")

TRAILER BRAKE VALVE TROUBLE SHOOTING CHART

Fault	Cause	Remedy
Jerky braking with more than two pulses/second.	Leakage past check valve (3, page 10, sect. 504).	Remove and clean check valve.
Valve does not brake.	Restriction (9) obstructed	Remove and clean output regulator (1)

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TORQUE DATA

Description	Thread size	Torque kgm	Torque Nm	Torque ft lb
Lift sect. - 501 Capscrew, lift to rear transmission housing (C_1, page 3)	M14 x 1.5	147	15	108.5
Capsrew, control valve body to lift (C_3, page 4)	M 8 x 1,25	26	2,7	19.5
Capscrew, lift arm plates (C_2, page 3)	M14 x 1.5	147	15	108.5
Plug, max. rise adjustment (T, page 9)	M12 x 1.25	103	10,5	76
Nut, position control shafts (26, page 3)	M10 x 1.25	15	1,5	10.8
Nut, lever bracket studs (C_4, page 3)	M 8 x 1.25	25	2.6	10.8
Capscrew, spring to top link support (27 page 3)	M14 x 1.5	215	22	159
Capscrew, spring to lift body (28, page 3)	M14 x 1.5	215	22	159
Capscrew, shaft to top link support	M16 x 1.5	196	20	145
Capscrew, suction connection	M12 x 1.25	98	10	72
Capscrew, delivery connection on lift control valve	M10 x 1.25	59	6	43
Hydraulic pump - sect. 502 Capscrew, pump (11, page 1)	M 6 x 1	8	0,8	5.8
Nut, pump cover (13 page 1 late models)	M10 x 1.25	41	4.2	30.4
Implement attachement and towing devices - sect. 503				
Nut, chain support	M14 x 1.5	147	15	108
Nut, chain rear arms	M18 x 1.5	313	32	231
Top retaining screw, towbar cross link	M20 x 1.5	470	48	347
Bottom retaining nut, towbar cross link	M20 x 1.5	392	40	289
Capscrew, rear cover and towbar support	M16 x 1.5	220	22,5	163
Capscrew, front tow fork to axle support	M16 x 1.5	220	22,5	163
Control valves - sect. 504 Nut, control valve stay bolts	—	20	2	14.5
Connection, oil outlet to lift	—	20	2	14.5
Plug, relief valve spring	—	20	2	14.5
Capscrew, control lever support	—	5.5	0.6	4.3
Capscrew, control lever support (8, page 4) and cover (4) ..	—	11	1.1	8
Plug, single/double acting changeover valve	—	20	2	14.5

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LIFT TROUBLE SHOOTING CHART

Fault	Cause	Remedy
1. Lift fails to operate	**a.** Governor blocked open	Remove foreign particles from drain holes (T_1, T_2, T_3, page 12 sect. 501) and inspect filter.
	b. Inefficient pump	Disassemble and inspect.
2. Erratic upward lift movement.	**a.** Clogged oil filter.	Inspect filter and replace cartridge if necessary.
	b. Air entering pump suction line	Check for faulty connections or seals.
3. Lift fails to hold load in raised position. (continuous pictching motion with engine running: - load is lowered when engine is stopped)	**a.** Oil leakage past spool seals (2 page 4 sect. 501).	Replace seals.
	b. Leakage past spool.	Remove, check for leakage, clean and replace damaged parts. Inspect filter.
	c. Check valve leakage	Remove, inspect and clean.
	d. Leakage past lift piston gland or lift cylinder seal (20, page 4, sect. 501).	Replace seals.
	e. Safety valve leakage or incorrect setting	Replace valve.
4. Relief valve cracks off with lift arms in max. raised position.	Lift arm travel adjustment error.	Adjust travel.
5. Insufficient or inaccurate lifting power.	**a.** Incorrect relief valve setting	Replace or installed on remote valves, adjust.
	b. Incorrect safety setting	Replace valve
	c. Poor pump performance (usually with increased)	Check pump performance and overhaul or replace as.

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DESCRIPTION

Lift senses loads on implement lower links through draught control spring and may be operated in the following ways:

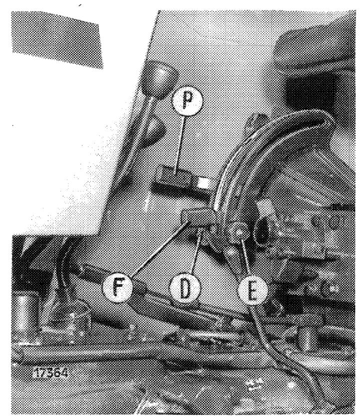
— position control;

— float;

— draught control;

— combined draught and position control.

Use the mode which is most appropriate to the type of work in hand, implement and soil condition.



Lift control levers
P. Position control lever - F. Draught control - D. and E. Position and draught control lever stop knobs.

Position control

Position control keeps implement position steady either sunk in ground or on surface, depending on position of lever (P).

When working, keep draught control lever (F) fully forward on quadrant.

At end of each pass, lift and lower using Lift-o-matic.

Float

With lift in float mode, lifting arms swing freely and implement follows ground contour.

Keep both (P and F) fully forward on quadrant.

Lift and lower the tool using Lift-o-matic.

Draught control

During draught control, the lift automatically keeps tractive effort constant by allowing implement working depth to vary within narrow limits.

Average working depth, and hence tractive effort, is controlled through lever (F), keeping position control lever (P) fully. forward on quadrant.

Lift and lower the tool using Lift-o-matic only.

Sensitivity

When working, lift sensitivity can be adjusted in four positions of the lever (25, page 9) so as to prevent continuous implement jolts.

— with the lever upwards (+), response times are longer (reduced sensitivity);

— with the level downwards (—), response times are shorter (greater sensitivity).

Combined draught and position control

Combined draught and position control is recommended when working in soil of uneven consistency to prevent implement from sinking excessively.

Proceed as follows:

— with position lever (P) fully forward, set the implement at the appropriate woking depth using draught control lever (F).

— gradually move position control lever (P) backwards until lift arms tend to rise.

Lift operates in draught control mode but at the same time prevents implement from sinking in loose soil and bringing unsuitable material to the surface.

Lift and lower the tool using Lift-o-matic only.

Do not move draught control lever (F) as this would change working depth.

Lift arm descent speed adjustment.

— descent speed is increased by screwing in the adjustment knob (29, page 9) (towards the (+) sign.;

— descent speed is reduced by unscrewing the adjustment knob (G) towards the (—) sign.

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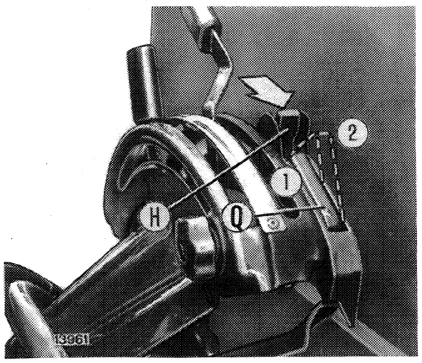


Lift-o-matic

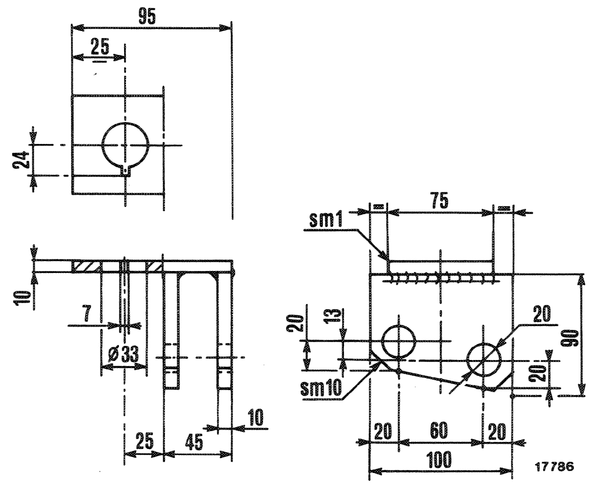
Q. Control lever for implement return to working position - H. Implement lift control lever - 1. Lever (Q) position with implement working - 2. Lever (Q) position with implement raised.

Lift-o-matic (botton for lifting and lowering lifting arms)

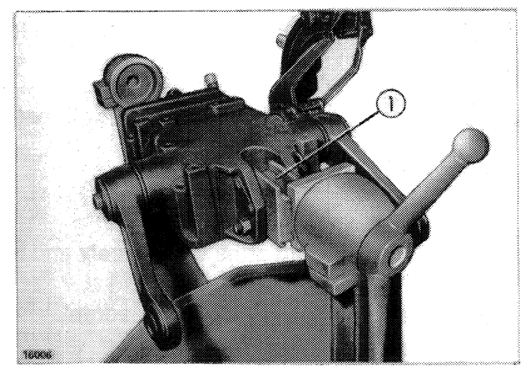
Position **1** = arms down;

Position **2** = arms up.

To lift the implement quickly without changing the position of levers (P and F, page 1) move lever (H) as shown by arrow; the lever (Q) will be released and will take up the position (2), beginning to lift. To return to the working position, press the lever (Q) until it engages.



Bracket for istalling lift on stand 290086: make in workshop and impress 50032. Measurements in mm.



Installing lift on rotary stand.
1. Bracket made in workshop (50032).

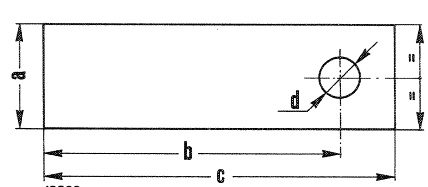
LIFT DISASSEMBLY

CAUTION

Handle all parts with care.
Do not put hands of fingers between one part and another. Wear suitable safety items such as glasses , gloves and safety shoes.

Before placing the lift on a rotary stand, the spring (A, page 3) must be removed. Make bracket **50032** following the instructions in the drawing on the right.

- take off capscrew and remove control valve assy. (B, page 3) from lift body;
- remove screw (C_2) and associated thrust plate (4);
- install tool for lift control lever spring removal, made according to drawing, and fit it to the arm shaft (2) by means of the screw (C_2) and thrust plate (4);
- remove nuts (C_4) and progressively slacken screw (C_2) so as ro remove quadrant bracket (21) and spring (22);
- remove nut on position control shaft and then the lever (P), the lever (F) and the clutch plates (23);
- take off lift front cover (20) and remove cylinder and piston;
- remove piston from cylinder;
- remove lift arm control shaft tapping on the RH end of the arm itself after removing parts (C_2), (4) and (3);



Lift control lever spring remover (make in workshop)
a = 40 mm, tool height - b ≃ 110 mm - c ≃ 130 mm, tool length - d = 15 mm, hole dia.
(Note - Implement thickness must be approx. 8 - 10 mm).

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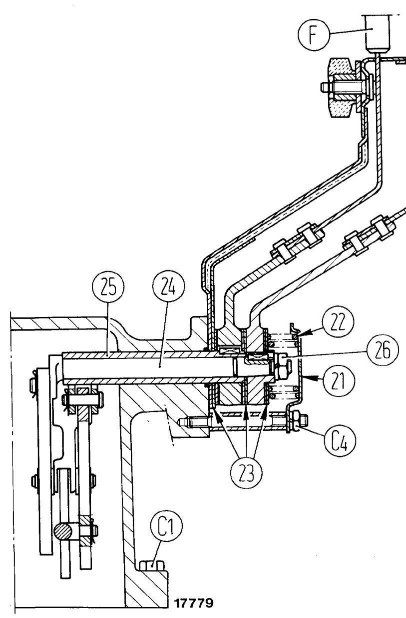


Section through lift levers and controls.

C_1. Lift capscrews - C_4. Lever quadrant bracket nuts - 21. Lever quadrant bracket - 22. Springs - 23. Clutch plates - 24. Position control lever pin - 25. Draught control lever inner shaft - P. Position control lever - F. Draught control lever - 26. Nut.

— remove pin (16), setscrew (19) and pivot (18) and take out lift body inner levers;
— on tractors without remote control valves, remove relief valve (17) from lift body.

Disassemble control valve as follows:

— remove cylinder safety valve (15, page 4), arm descent speed control valve (17) and pin (19) after removing knob (29);
— remove fitting (20), retrieving check valve (22) and associated seat (23);
— remove plug (3), retrieving valve spool (1), associated seat (2), spring (4) and ring (14);
— remove draught sensitivity control valve plug (13) and plug (7), retrieving plunger (5), spring (6), piston (9) and associated seat (8).

Remove retaining ring (30) and retrieve spring cup (10), spring (11) and draught sensitivity control valve.

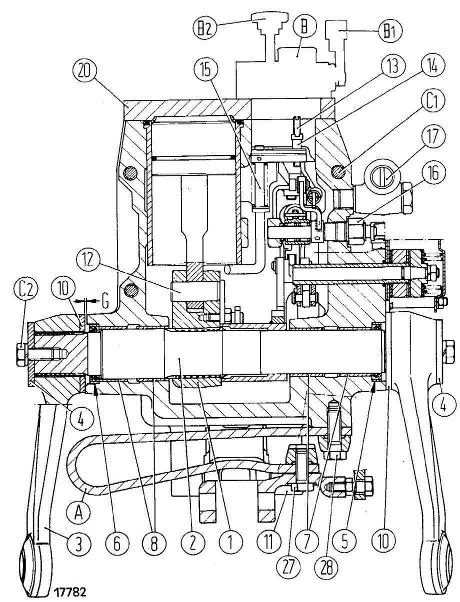
Unscrew plug (27), remove roll pin (31), and retrieve draught control valve pin (28).

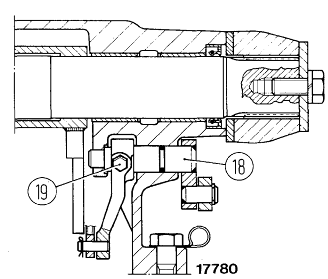
INSPECTION

Refer to tables 1 and 2, sect. 50, and inspect as follows:

— throughtly check seals, replacing if necessary;
— check valves for wear and clearance in associated seats.

In replacement is required, note that spare valve spools (1, page 4) are supplied together with associated seats (2) and that valve plunger (5) is supplied together with control valve doby.





Section through lift

A. Draught control spring - B. Control valve - B_1. Lift sensitivity adjustment lever - B_2. Arm descent speed adjustment knob - C_1. Lift retaining screw - C_2. Thrust plate retaining screw - G = 0,2 - 1.4 mm, shaft end float - 1. Inner arm - 2. Arm - 3. Lifting arms - 4. Arm thrust plates - 5. RH seal - 6. LH seal - 7. RH bushings - 8. LH seals - 10. Thrust washers - 11. Top link support - 12. Piston rod pin - 13. Travel limit adjusting screw - 14. Travel limit adjustment screw locknut - 15. Travel limit control rod - 16. Control valve link pin - 17. Lift relief valve (tractors without remote control valves) - 18. Draught control inner lever pivor - 19. Setscrew - 20. Front cover - 27. Screw retaining sping to top link support - 28. Screw retaining spring to lift body.

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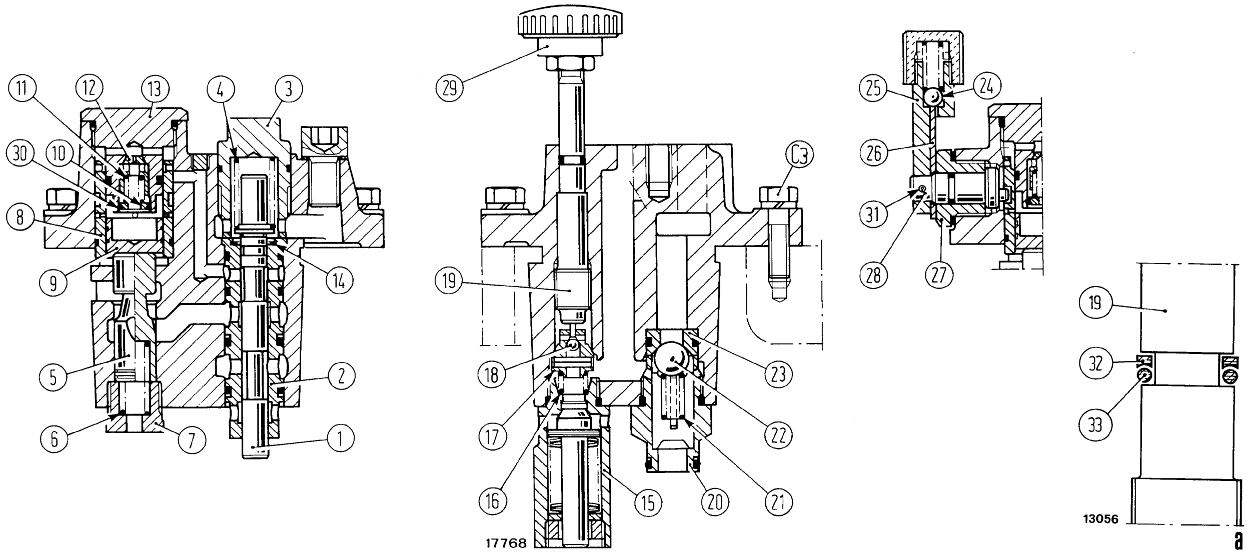


LIFT CONTROL VALVE SECTIONS

a. detail of o-ring (33) AND back-up ring (32) - 1. Valve spool - 2. Valve spool seat - 3. Plug - 4. Valve spool return spring - 5. Valve plunger - 6. Plunger spring - 7. Plug - 8. Piston seat - 9. Valve piston - 10. Spring cup - 11. Draught sensitivity adjusting valve spring - 12. Draught sensitivity adjusting valve - 13. Plug - 14. Spool seat ring - 15. Cylinder safety valve - 16. Arm descent speed adjusting valve spring - 17. Arm descent speed adjusting valve - 18. Ball - 19. Arm descent speed adjusting pin - 20. Delivery connection - 21. Check valve spring - 22. Check valve - 23. Check valve seat - 24. Detent ball - 25. Adjusting pin lever - 26. Sector - 27. Plug - 28. Adjusting pin - 29. Arm descent speed adjustment knob - 30. Retaining ring - 31. Roll Pin - 32. Pin (19) back-up ring - 33. O-ring - C_3. Cascrew.

Note - Install O-ring (33) and back-up ring (32) as shown in detail (a), using protector **293858** and heating ring (32) in oil at 50° (122°F). Take care to install ring (32) with flat surface upwards and concave surface facing O-ring (33).

Check cylinder safety and relief valve setting as described on pages 9-10. Valve may be integral with remote control valves or installed on lift body.

LIFT ASSEMBLY

Reverse disassembly procedures and note the following:

— should replacement be necessary, press-fit cross shaft bushings from outside to inside of lift body ensuring that dimensions(A, B, C) are as shown in figure. Bushings do not require reaming after installatio;

— couple shaft (2, page 3) to innere arm (1) and lift arms (3), lining up reference marks on parts;

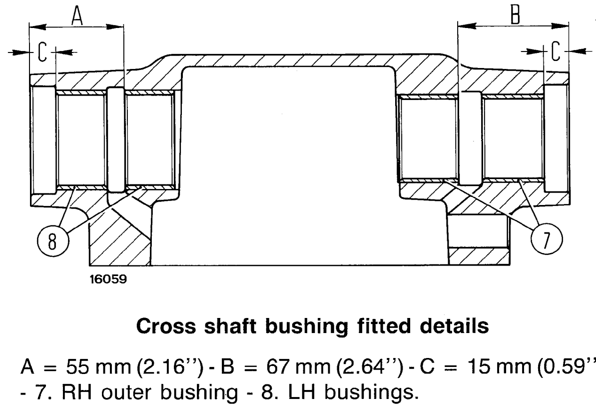
— remove LH seal (6) and, if replacement is necessary, also replace the RH seal (5);

— with cross shaft (2) installed, fit seals using driver **292535** to insert them correctly in seats;

— on completing assembly, check cross shaft end float is 0.2 to 1.4 mm (0.0079 to 0.055") (G);

— to prevent seal demage, install piston in cylinder using guide ring **292547**;

riassemble control linkage using driver **293839** to install roller bearing On control valve spool lever and driver **293838** to install roller bearings on draught control inner lever and control valve control link;



Cross shaft bushing fitted details

A = 55 mm (2.16") - B = 67 mm (2.64") - C = 15 mm (0.59") - 7. RH outer bushing - 8. LH bushings.

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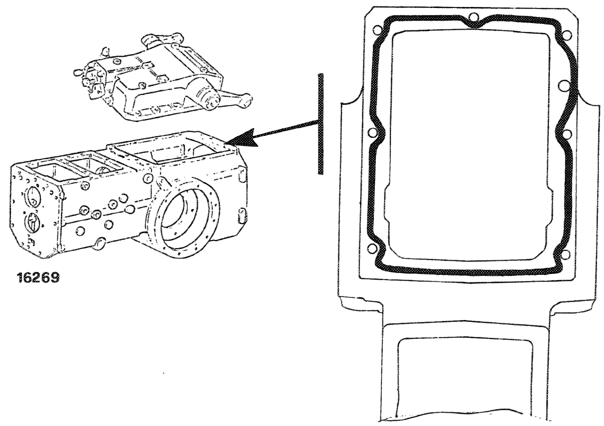


Applying jointing compound to rear transmission housing prior to installation

Jointing compound types are indicated on page 5, sect. A, mod. 446

— reassemble control valve as shown in figures and install the lift body only after carrying out the adjustments spoecified in points 1 - 2 - 3 - 4;

— before reassembly, check that mating surfaces are thoroughly clean and degreased and apply one of the jointing compounds specified on page 5, sect. A, mod. 446.

Note — On control valve reassembly, check efficiency of spool (1, page 4) as follows:

— install seat (2) with O-ring, ring (14) and spool (1) in connection fitting **293849** (R), checking that seals in bottom of seat prevent leakage through the connection fitting itself and connect the latter to hand pump **290284** (A);

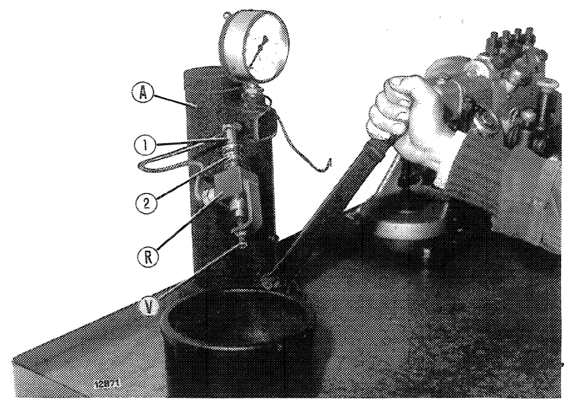
— push spool (1) into contact with associated seat (2);

— while operating hand pump, tighten screw (V) on connection fitting to discontinue oil flow through seat (2) outlet;

— tighten screw (V) two more turns;

— operate the pump to bring oil pressure in system to 250 kg/cm² (3556 psi) and check on pressure gauge that pressure takes more than 6 seconds to drop from 200 kg/cm² (2845 psi) to 100 kg/cm² (1422 psi);

— if necessary, replace spool; note that spare spools are provided together with associated seats.



Check valve spool (1) leakage.
A. hand pump **290284** - R. Connection fitting **293849** - V. Screw on fitting - 2. Control valve spool seat.

Note — Before installing lift, thoroughly clean and degrease mating surfaces and apply 2 mm (0.08") dia. bead of jointing compound on transmission housing as shown in figure. Jointing compound types are indicated on page /, sect. A, mod. 446

⚠ CAUTION ⚠

Use suitable tools for aligning holes.
DO NOT USE HANDS OR FINGERS.

LIFT ADJUSTMENT

The following adjustment refers to lift without hydraulic control valve, placed on work bench or secured to rotary stand by means of appropriate bracket.
Carry out adjustments in order listed below.
With lift installed on tractor, arm upward travel adjustment and minimum variators in draught control lever setting are possible.

Before carrying out adjustments, disconnect Lift-o-matic control, putting it in position 1, relative to lift arm lowering with lever (Q, page 2) engaged.

1. Position control adjustment

— disconnect draught control outer link (25, page 7);
— shift postion control lever (P, page 6) fully back on quadrant;
— rotate cross shaft (2, page 3), raising arms (3) so that inner arm (1) comes into contact with lift body. Make two, marks corresponding to this position, one (S_2 page 8) on the arm and the other (S_1) on the body;
— using wrench **293870** (C, page 6) slacken locknut (10) and unscrew travel adjusting screw (6) until it is no longer in contact with control valve lever (7).

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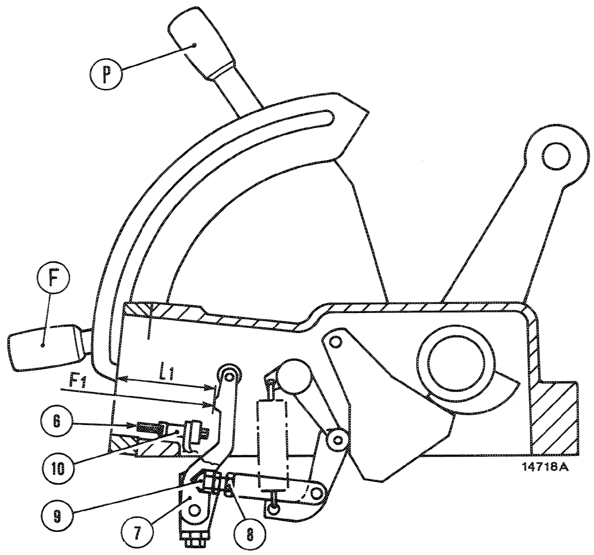
— Install tool **293846** (A) on lift body;

— using two wrenches, back off locknut (8) and tighten of slacken adjustable link road (9) so that the plunger (P_1) is aligned with outer register (R_1) of tool (A);

Note — this condition corresponds to a gap (L_1 page 7) of 82 - 82.1 mm (3.228 - 3.232") between lever end (7) and lift body front face measured applying a force (F_1) of 4 - 4.5 da N (kg) or 9 - 10 lb to lever end.

— tighten locknut (8);
— bring position control lever (P) fully forward on quadrant;
— rotate arm shaft to bring piston fully foreward and check that moving rod (P_1) of tool **293846** is no more than 1.3 to 1.7 mm (0.051 to 0.067") back from the inner register (R_2) of the tool.

Note — this condition corresponds to a gap (L_1) of 86.3 - 86.7 mm (3.398 - 3.413") between lever end (7) and lift body front face measured applying a force (F_1) of 4 - 4.5 N (kg) or 9 - 10 lb to lever end.



Adjusting position control.

F. - Draught control lever - F_1. = 4 ÷ 4.5 N (kg) or 9 - 10 lb, force applied to lever end (7) by tool **293846** - L_1. Distance between end of lever (7) and lift body front face. - P. Position control lever - 6. Travel adjustment screw - 7. Control valve lever - 8. Locknut - 9. Control valve lever cap - 10. Travel adjustment screw locknut.

Note — this condition corresponds to a gap (L_1) of 86.3 - 86.7 mm (3.398 - 3.413") between lever end lift body front face.

— block the locknut (10).

2. Maximum lift arm travel adjustment on bech.

Proceed as follows:

— with tool **293846** (A) installed on lift body, install connection fitting **293872** (D);

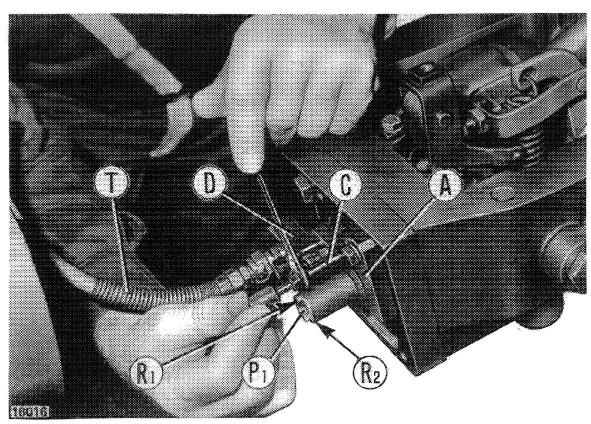
— put position control lever (P) fully back on quadrant;

— connect fitting **293872** (D_1) to the workshop compressed air supply (T);

— turn shaft (2, page 3) to raise arms until inner arm (1) comes into contact with lift body;

— through fitting **293872** (D), introduce air into cylinder so that piston moves through full lift stroke and maintain air pressure to hold this position;

— using wrench **293870** (C), tighten screw (6) until plunger (P_1) stand-in is not more than 1.3 to 1.7 mm(0.051 to 0.067") from the inner register (R_2) of the tool **293846** (A);



Adjusting maximum lift arm travel on bench.

A. Tool **293846** - C.Wrench **293870** - D. Fitting **293872** P_1. Plunger of tool **293846** - R_1. Tool **293846** outer register - R_2. Tool **293846** inner register - T. Compressed air line.

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3. Draught control spring travel adjustment (fig. a, b).

— install stop block (29) and with draught control spring (94) free, check that distance (L_2) between plate (16) and spring (94) is 12.7 - 13 mm (0.5 - 0.51''). If necessary, adjust shim (H_1) thickness, reducing them if it is lower and adding to them if it is higher.

— put spring completely under traction using tool **290819** (A) applied to top link support and check that distance (L_3) between plate (16) and spring (94) is in the 19.2 - 19.7 mm (0.756 - 0.776'') range. If it is lower, reduce the shims (H_2) between the spring and the top link support fork; if higher, increase them.

4. Draught control linkage adjustment

Having carried out the adjustments on the bench as described in points **1** and **2**, and the draught control spring as described in point 3, adjust draught control as follow:

— fit outer draught control link (25, page 8);

— put position control lever (P) fully forward on quadrant and pull back the draught control lever (F) 184 - 186 mm(7.24 - 7.32'') (L_2) measured from the beginning of the slot and the edge of the lever(F);

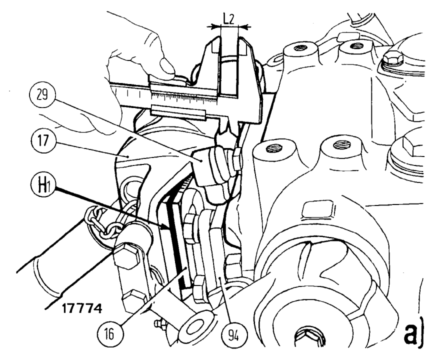
— adjust link (22) so that the distance between the centerlines of the fulcrums it is fitted on is 70 -.70.5 mm (2.76 - 2.77'') (L_3)

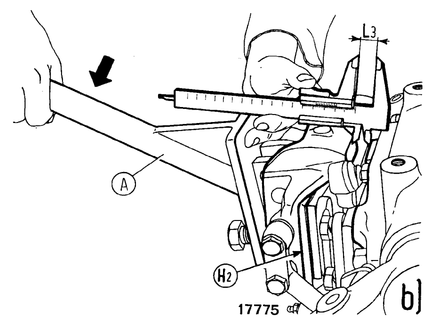
— adjust outer draught control link (25, page 8) so that the end (P_1 page 6) of tool **293846** (A) is on the same plane as the outer register (R_1);

Note — this condition corresponds to a gap (L_1) of 82-82.1 mm (3.228 - 23.232'') between lever end (7) and lift body front face measured applying a force (F_1) of 4-4.5 N (kg) or 9-10 lb to lever end.

— tighten the locknut (23, page 8);

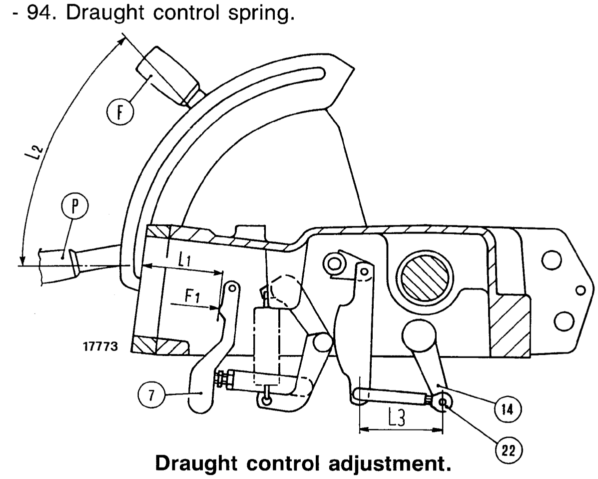
— install the control valve.





Draught control spring travel adjustment

a. Controlling distance (L_2) with spring free - b. controlling distance (L_3) with spring in total traction by means of tool **290819** (A) - A. Lever **290819** connected to the top link support holes to stretch control spring (push lever downwards) - H_1 and H_2. Shims for dimensions (L_2) and (L_3) - L_2 = 12.7 - 13 mm) (0.5 - 0.51'') - L_3 = 19.2 - 19.7 mm (0.756 - 0.776'') - 16. Plate - 17. Top Link support - 29. Spring travel stop block - 94. Draught control spring.



Draught control adjustment.

F. Draught control lever - F_1 = 4 - 4.5 N (kg) or 9 - 10 lb, forced exerted by tool **293846** on lever (7) - L_1 = 82 - 82.1 mm (3.228 - 3.232''), distance between end of lever (7) and front face of lift body - L_2 = 184 - 186 mm (7.24 - 7.32''), distance from beginning of slot and edge of lever (F) - L_3 = 70 - 70.5 mm (2.76 - 2.77''), distance between tie (22) fulcrum centerlines - P. Position control lever - 7. Control valve lever - 14. Draught control internal lever - 22. Draught control adjustable link.

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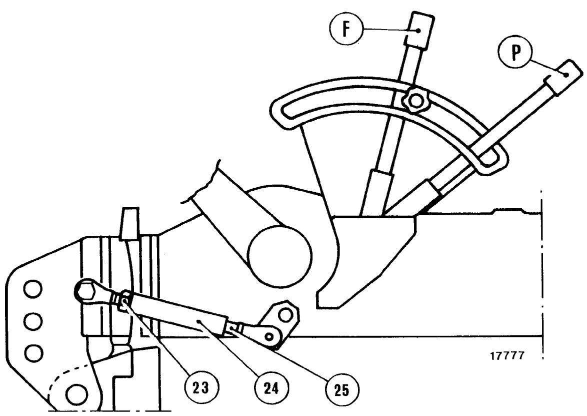


Draught control adjustment on tractor

23. Locknut - 24. Threaded sleeve - 25. Draught control link - F. Draught control lever -P. Position control lever

Adjustment and check with lift installed on tractor

A) Lift - o- matic device adjustment. Proceed as follows:

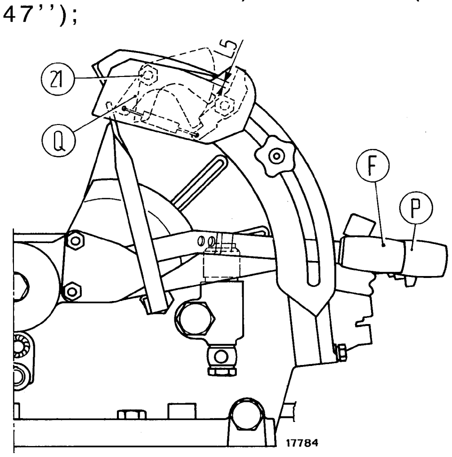
— apply a 50 kg 110 lb) load to lifting arm swivel bearings;

— run engione at medium speed (1200 - 1500 rpm);

— put position and draught control levers (P and F) fully forward on quadrant.

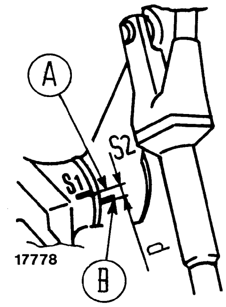
With engine at medium speed::

— adjust position of support together with LIFT-o-MATIC control levers on lift control support, securing it by screw (21) so that, when pressing button (Q), arm descent starts with free travel at the end of the button L_5) of 9 - 12 mm (0.35 - 0.47'');



Lift-o-matic device adjustment

F. Draught control lever - P. Position control lever - 21. Retaining screw - Q. Arm descent button.



Notches for arm top travel end copntrol.

A. With inner arm (1 page 3) in contact with lift body, notch position (S_2) corresponding to arm (3) top travel end.
B. Notch position (S_2) corresponding to maximum arm rise (L_1 page 6) = 86.3 - 86.7 mm (3.398 - 3.413").
d. distance between notches (S_1 and S_2) = 2 - 4 mm (0.079 - 0.16").

B) Top travel and control

— put postion and draught control levers (P and F) fully forward on quadrant;

— operative lift by means of LIFT o MATIC device and, after carrying out a few lift operations, check that distance between notches S_1 and S_2 is d = 2 to 4 mm (0.79 to 0.16");

— if this is not the case, remove plug (19), unscrew locknut (10) and turn setting screw (6) to obtain the distance specified above;

— tighten locknut (10);

— tighten plug (19).

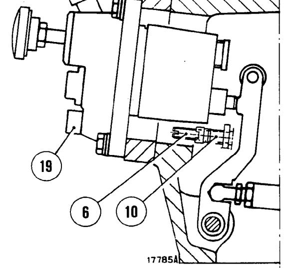
C) Start-to-lift check

— place position control lever (P, page 7) fully forward on quadrant;

— Place Lift o matic lever (Q, page 2) in position (1), relative to arm descent;

— check by means draught control lever (F, page 7) that lifts starts with lever 185 - 1 mm (7.28±0.04") from end of slot in quadrant;

— otherwise, adjust link (25) to obtain specified length and tighten locknut (23).



Top travel end adjustment.

6. Setting screw - 10. Locknut - 19. Plug

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VALVE CHECK

Relief any cylinder safety valve setting check.

Relief valve (installed on right of lift body or incorporated in remote control valve, where fitted)may be checked either on bench or on tractor, while cylinder safety valve setting check may only be carried out on bench.

To bench test cylinder safety valve (15, page 4) and relief valve incorporated in lift body (17, page 3 for tractors without remote contol valves only) use hand pump **290284** (A), with fittings **290828** (C) and **290824** (B).

Relief valve should crack off at 186 to 191 bar (190 to 195 kg/cm² or 2702 to 2775 psi), while safety valve crack-off pressure should be 210 to 215 bar (215 to 220 kg/cm² or 3058 top 3129 psi).

Note - In factory, on-bench adjustment of relief valve (1) installed on RH side of lift body is carried out using oil under pressure; consequently, the adjustment procedure using pump **290284** is provided for guidance only. Check valve setting with valve installed on tractor, as described here below, is recommended for tractor without remote control valves.

Note — If valve setting is not as specified, scrap and replace valves.
If necessary, valves may be adjusted through threaded plugs after raising the peened area, and using wrenches **291862** and **291863** for cylinder safety valve and relief valve respectively.

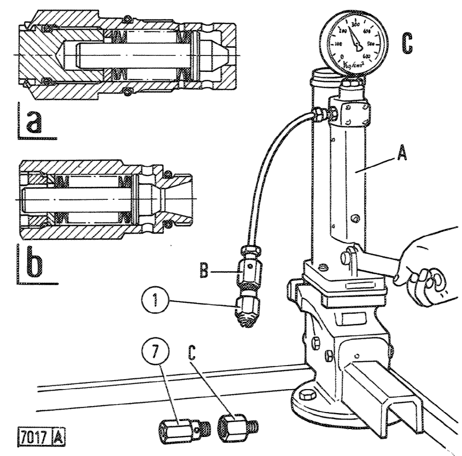
On-bench setting check of relief valve incorporated in remote control valves must be carried out as described on page 5, sect. 504.

Check relief valve setting on tractor as follows:

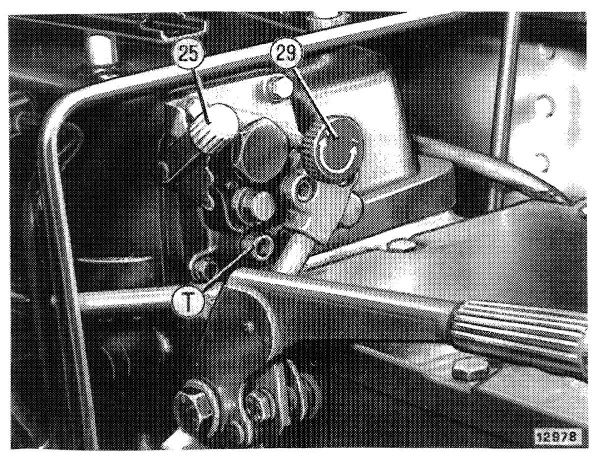
a. Tractor without remote control valves:

— run engine to bring hydraulic system oil to 50 ± 3 °C (122 ± 5.4 °F);

— shut off engine, wait approx. five minutes to allow oil in lift body to dischrage into transmission housing, remove plug (T) and insert wrench **293870** (C, page10) into aperture;



Cylinder safety and relief valve on-bench test equipment.
a. Section through relief valve - b. Section through cylinder safety valve - A. Hand pump **290284** - B. Safety valve fitting **290824** - C. Safety valve fitting **290828** - 1. Relief valve - 7. Cylinder safety valve.



Lift control valve front view

T. PLug to remove to adjust lifting arms max. lift with lift installed on tractor.
25. Lift sensitivity adjustment lever;
— upwards (+) = slow reaction (low sensitivity);
— downwards (—) = quick reaction (high sensitivity.
29. Arm descent adjustment knob:
— screw in (towards +) = high descent speed;
— unscrew (topwards —) = low descent speed.

CAUTION — when travelling on the rod with implements coupled, completely unscrew knob (29) to block implement in desired position.

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— place fitting **291326** (R) between oil delivery pipe (2) to lift control valve and hydraulic pump (P), and connect pressure gauge (M) with 0 - 250 kg/cm² (0-3556 psi) scale from kit **292870**

— run engine again;

— place position control lever (P, page 7) fully back on quadrant;

— using wrench **293870** (C) slacken locknut (10, page 6) and unscrew travel limit setting screw (6) until relief valve cracks off;

— with engine running at 1500 -1700 rpm, pressure gauge (M) show give reading of 186-191 bar (190-195 cm² or 2702 to 2775 psi). Optherwise scrap valve and replace or if necessary, adjust threaded plug using wrench **291863** .

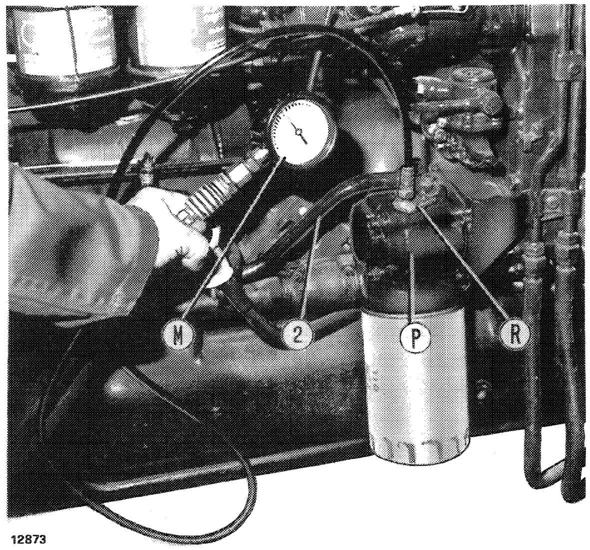
b. Tractor fitted with remote valves

— insert fitting **292449** (F) in a bayonet-type female half-coupling and connect to a pressure gauge (M) with 0-250 kg/cm² scale from kit **292870** (M);

— run the engine until oil temperature reaches 50 ± 3°C;

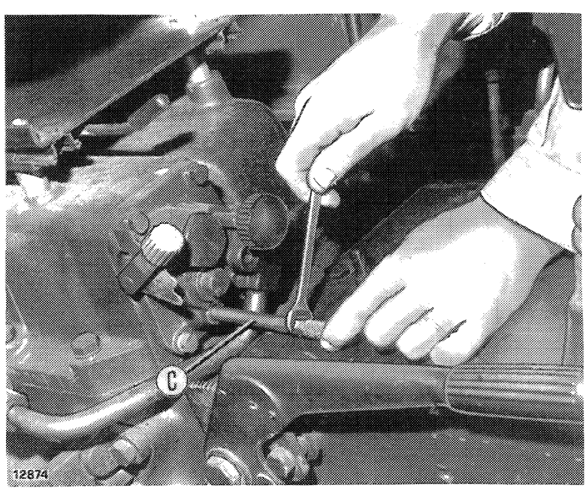
— actuate the valve lever associated with the half-coupling used until the relief valve is cracked off;

— with engine running at 1500-1700 rpm, pressure gauge (M) show give reading of 186-191 bar (190-195 kg/cm² or 2702 to 2775 psi). Otherwise scrap valve and remplace or adjust setting by varying shims (27, page 4, sect. 504), increasing them to increase set pressure, reducing them to reduce set pres.



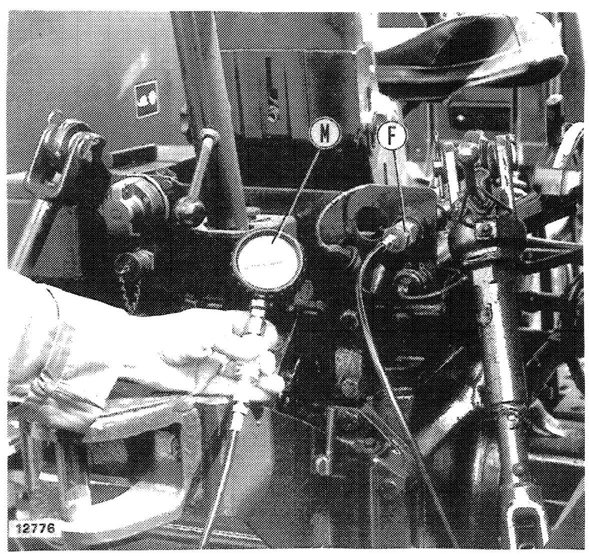
Checking lift relief valve setting (tractor without remote control valve)

M. Pressure gauge with 0 ÷ 250 kg/cm² (0-3556 psi) scale from kit **292870** - P. Hydraulic pump - R. Fitting **291326** - 2. Oil delivery pipe



Adjusting lifting arm lift.

C. Wrench **293870**



Checking lift relief valve setting (tractor without remote control valves).

F. Fitting **293449** - M. Pressure gauge with 0-250 kg/cm² (0-3556 psi) scale from kit **292870**.

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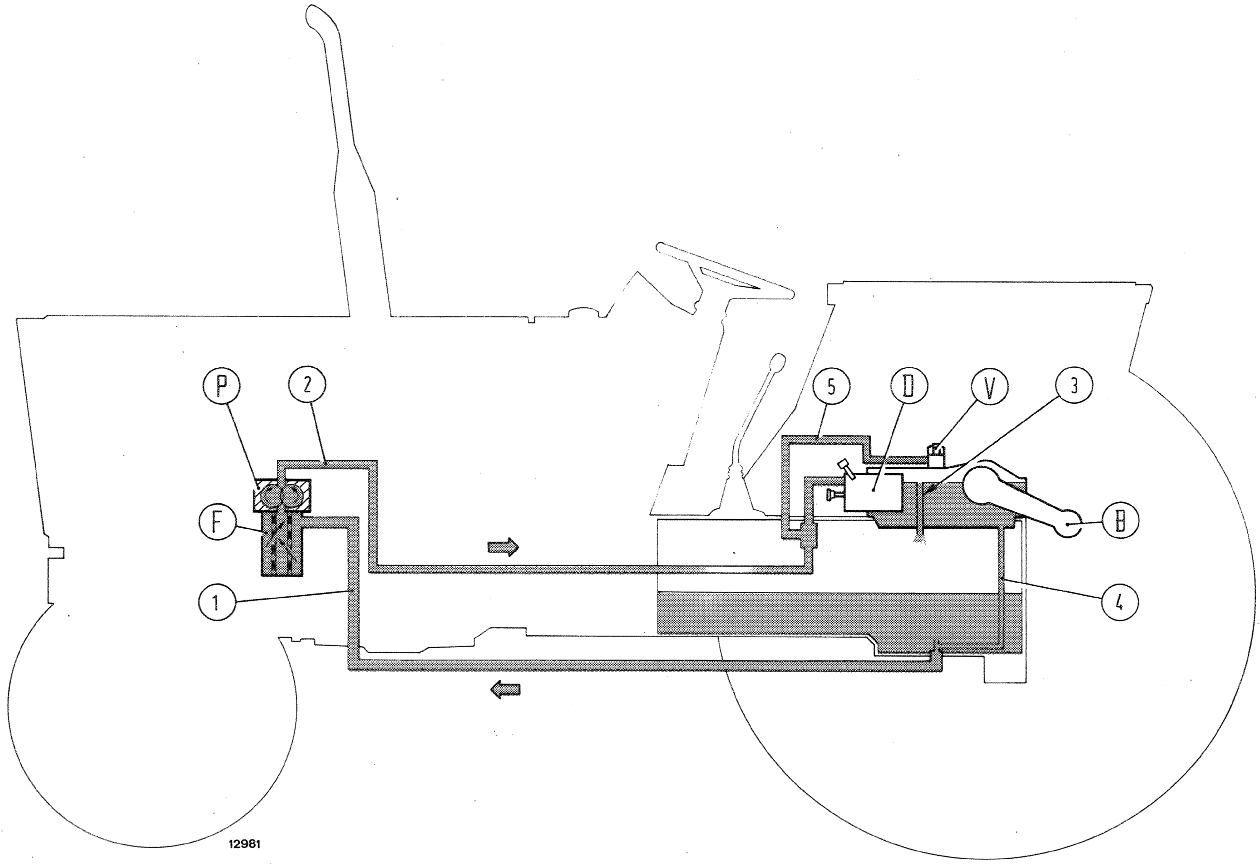
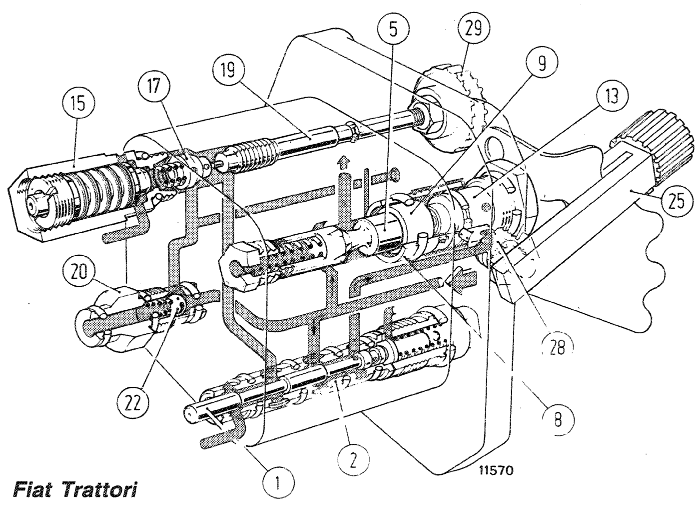


Lift hydraulic system schematics.

B. Lift arm - D. Control valve - F. Paper cartridge oil filter - P. Engine valve gear driven hydraulic pump - V. Relief valve fitted on lift body - 1. Suction line drawing from transmission housing - 2. Delivery line to control valve - 3. Oil level pipe in lift body - 4. Oil discharge pipe from lift body - 5. Connection line to relief valve.



Oil under pressure.
Inlet, delivery or discharge oil.
Tapped oil.

Hydraulic control valve schematics.

Note — Oil flow refers to neutral phase.

1. Spool - 2. Spool seat - 5. Control valve plunger - 8. Control valve piston seat - 9. Piston - 13. Plug - 15. Cylinder safety - 17. Arm descent adjusting valve - 19. Descent adjustment pin - 20. Oil delivery fitting to lift cylinder - 22. Check valve - 25. Sensitivity adjustment pin lever - 28. Sensitivity adjustment pin - 29. Arm descent adjusting pin knob.

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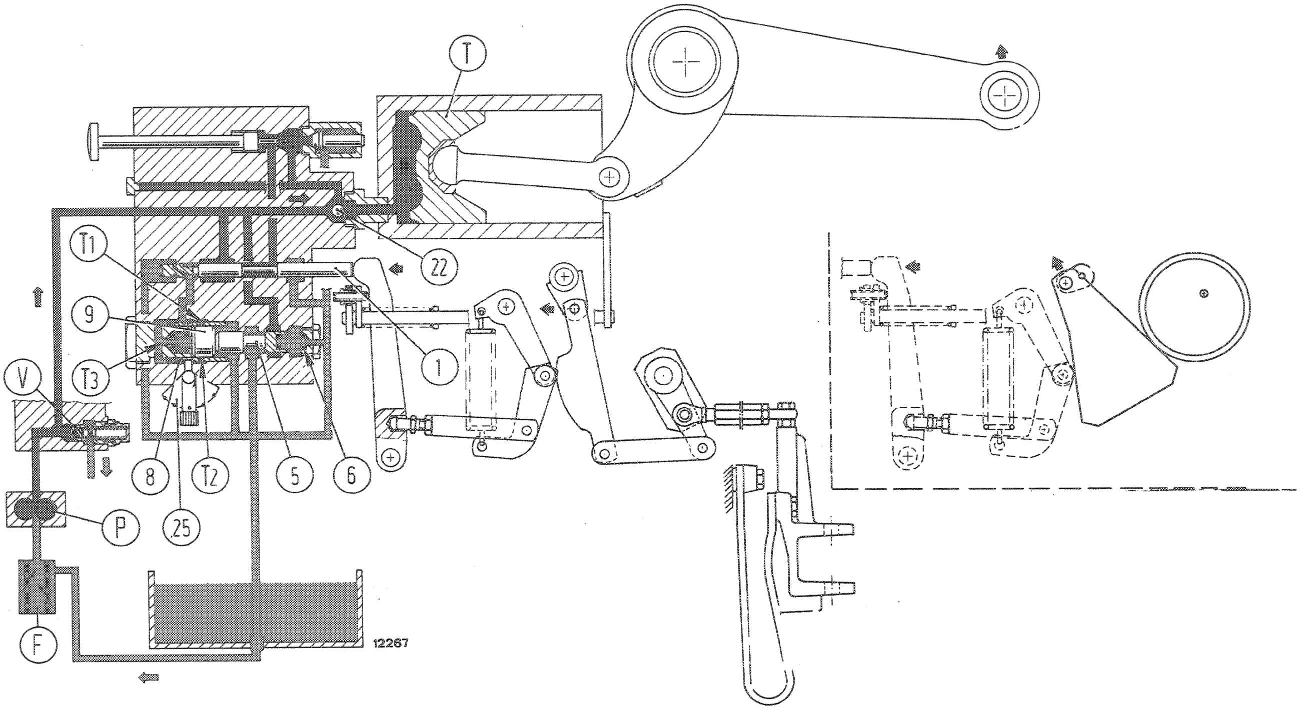
HYDRAULIC LIFT UNIT:
Lift



F. Filter - P. Hydraulic pump - T. Implement lift arm control piston - T_1 and T_2. Ports in control valve piston seat (8) - T_3. Draught sensitivity valve port - V. Relief valve (installed on lift body, or on remote control valves where applicable) - 1. Spool - 5. Control valve plunger - 6. Plunger spring - 8. Control valve piston seat - 9. Control valve piston - 22. Check valve - 25. Adjusting pin lever.

S. Arm lifting phase.

When valve spool (1) moves, oil flow to piston (9) is cut off and plunger (5) is forced to the left by spring (6), thus closing discharge port. Oil under pressure opens check valve (22) and operates piston (T) to raise arms.

Note — Draught sensitivity may be adjusted throught lever (25), which controls position of valve seat (8). When seat (8) is moved to the right, piston (9) covers ports (T_1 and T_2) and oil in valve may be discharged through port (T_3). Since discharge therey takes longer, lift reaction time increases with a consequent decrease in sensitivity. When seat (8) is moved to the left, ports, (T_1 and T_2) are free and oil may be discharaged quickly through all three ports (T_1, T_2 and T_3), with consequent short reaction time resulting in increased sensitivity.

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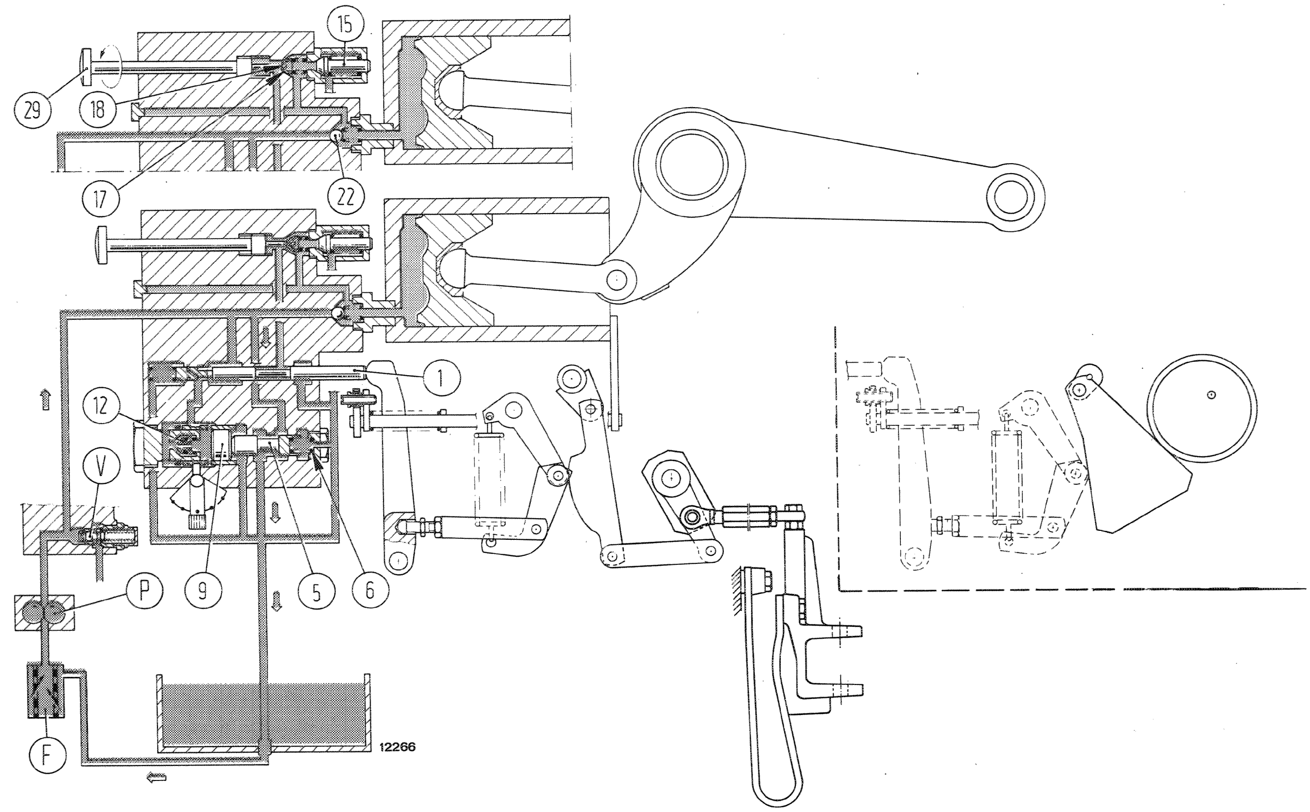

F. Filter - P. Hydraulic pump - V. Relief valve (instaslled on lift body or on remote control valves where applicable) - 1. Spool - 5. Control valve plunger - 6. Plunger spàring - 9. Control valve piston - 12. Sensitivity control valve - 15. Cylinder safety valve - 17. Arm descent adjustment valve - 18. Ball - 22. Check valve - 25. Adjusting pin lever.

N. Neutral phase.

With spool (1) in neutral position, oil is delivered throught sensitivity control valve (12) to piston (9) which overcomes spring (6) reaction and moves plunger (5) to the right, thus opening discharge port and conveying oil flow to tank in rear transmission housing rather than to cylinder.

Note — when travelling on the road with implements attached, fully unscrew knob (29) to block implement in desired positions; oil contained in cylinder remains trapped by check valve (22) and descent speed control valve (17). Arms therefore remain blocked, even if operator accidentally moves lift control levers. Cylinder safety valve (15) protects lift cylinder pressure circuit while relief valve (V) protects pump circuit.

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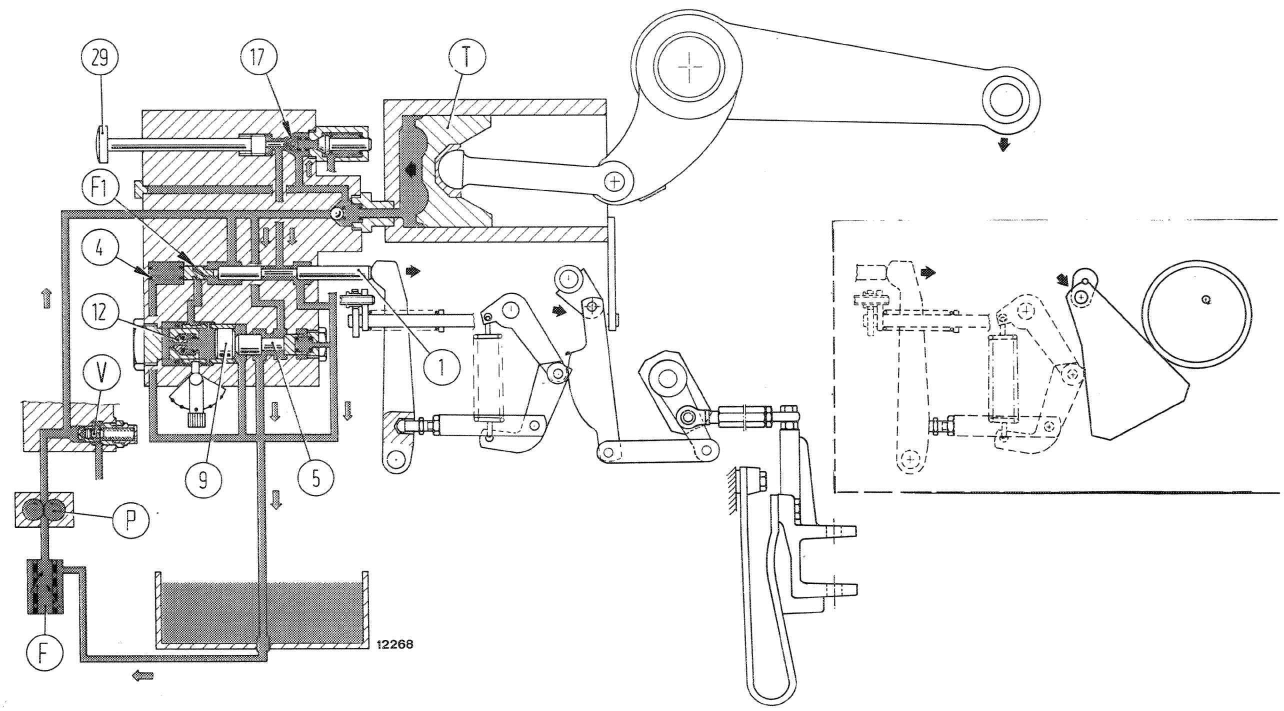
HYDRAULIC LIFT PUMP: Lift



F. Filter - F_1. Orifice in control valve spool (1) - P. Hydraulic pump - T. Implement Lift arm control piston - V. Relief valve (installed on lifft body, or on remote control valves where applicable) - 1. Spool - 4. Spool return spring - 5. Control valve plunger - 9. Piston - 12. Sensitivity control valve - 17. Arm descent adjsting valve - 29 Arm descent adjusting pin knob.

A. Arm descent phase.

When return spring (4) pulls spool (1) to the right, cylinder is discharged under piston pressure (T) through descent speed control knob (17) and the port uncovered by spool. Through spool port (F_1) and draught sensitivity valve (12), oil flows to piston (9) which holds plunger (5) in position shown, thus allowings pump delivery to be discharge past plunger (5).

Note — Arm lowering speed is determinated of knob (29). Slackening this knob restricts exhaust passage between valve (17) and control valve body, thus increasing the time taken to lower the implement (low response). Tightening knob (29) increases effective area of descharge port and the implement drops more quickly (high response).

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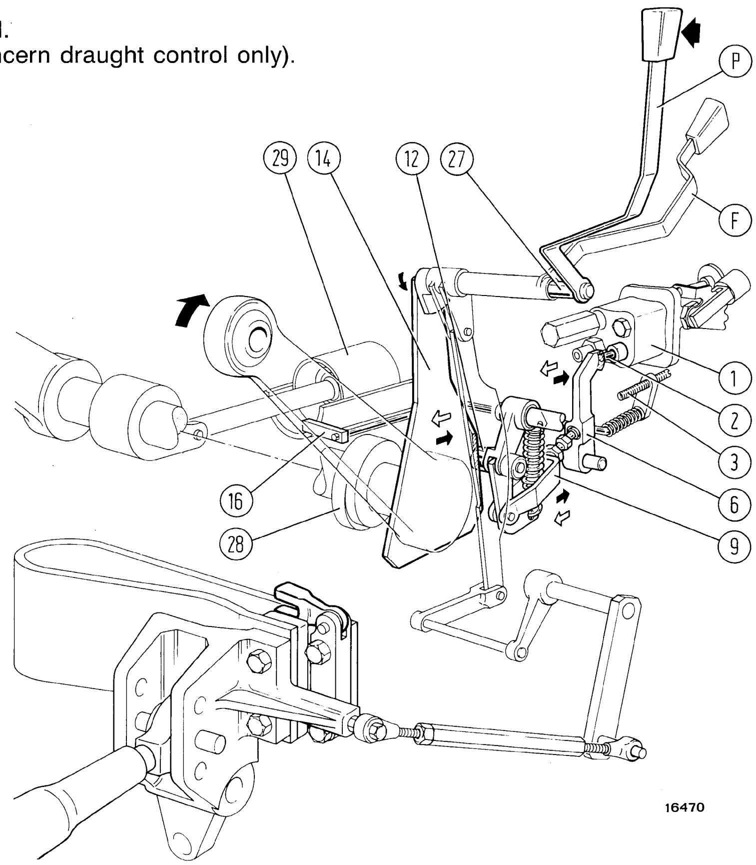
Raising implement in position control mode.

(Move draught control lever (F) fully forward.
Levers traced lightly to not operate and concern draught control only).



Control valve linkage operation in position control mode.

Note — Solid arrows indicate linkage movements in arm raising phase. During arm descent, linkage moves in opposite direction.

F. Draught control lever - P. Position control lever - 1. Lift control valve - 2. Spool - 3. Travel limit setting screw - 6. Control valve lever - 9. Control valve lever link - 12. Position control lever roller - 14. Position control inner lever - 16. Travel limit control rod - 27. Position control lever pin - 28. Cam ring - 29. Piston.

OPERATION

Position control

When lever (P) is moved back, cam on end of pin (27) moves lever (14), located between roller (12) and cam ring (28), upwards. As the cam ring (28) on arm shaft is stationary at the beginning of operation, lever (14) reacts against it and pushes roller (12) foreward. This moves link (9) and lever (6) in the direction indicated by the solid arrows to set control valve (1) in the arm lift position (S, pag. 12).
Arms rise until cam ring (28) turns far enough to permit lever (6), link (9) and lever (14) to move under the action of spool return spring (4, page 14) in the direction indicated by the clear arrows.
The control valve (1) therefore returns to neutra and the arms stop in the neutral phase N (page 13).

maximum arm upward travel is limited by road by rod (16). When rod (16) contacts piston (29), ther control valve is returned to neutral through adjusting screw (3) before the piston reaches mechanical travel limit stop. The same movements occur in reverse when lever (P) is moved forward to lower arms (A, page 14).

Float position

Whit position copntrol lever (P) and draught control lever (F) fully forward:

— the draught control linkage is not activated;

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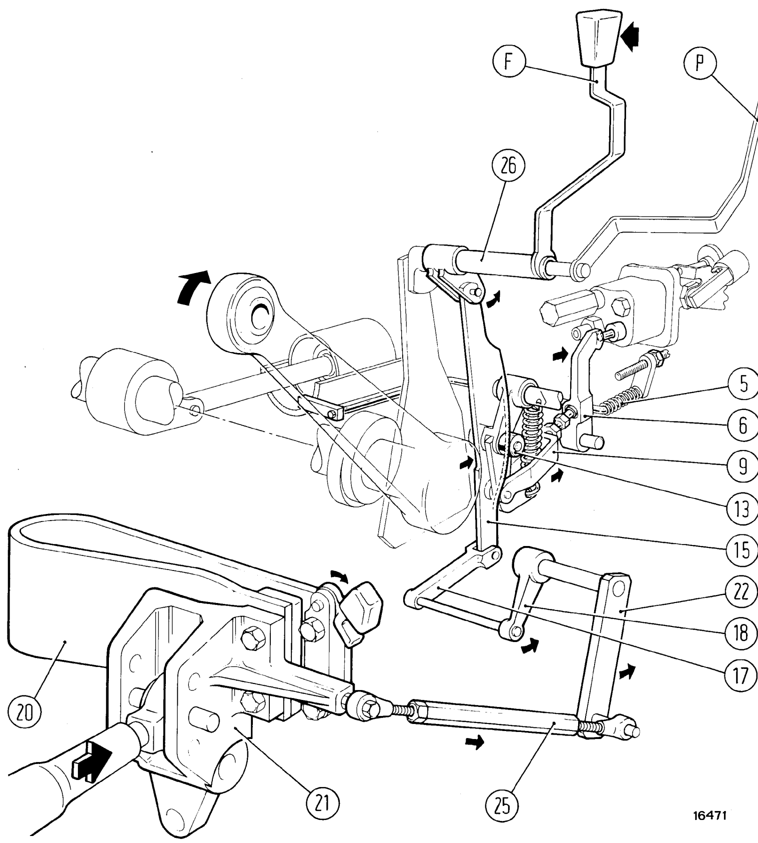

Raising implement in draught control mode.
(Move position control lever fully forward. Levers traced lightly to not operate and concern position control only.

Control valve linkage operation in draught control mode.

Note — Arrows indicate linkage movements in arm raising phase. During arm descent, linkage moves in opposite direction. F. Draught control lever - P. Position control lever - 5. Travel limit control rod spring - 6. Control valve lever - 9. Control valve lever Link - 13. Draught control lever roller - 15. Draught control inner lever - 17. Draught control link - 19. Lever - 20. Top link draught control spring - 21. Draught control spring support - 22. Draught control outer lever - 25. Draught control adjustable link - 26. Draught control hollow shaft.

— lever (14, page 15) link (9) and lever (6) are moved in the direction opposite to that indicated by the solid arrows, and control valve is held in lowered position (A, page 14), thereby letting arms swing freely and associated implement float on the surface of the soil.

Draught control

When the implement has been to the desired working depth by means of lever (F), and if the implement then hits a stretch of harder or more compact soil, its draught on the lower arms will tend to increade. This will then cause a greater top link thrust aganist the spring (20) which, compressing, transmits motion in the direction of the solid arrows, to the lever (22), the lever (18), the link (17), the lever (15), the Link (9) and the lever (6), thereby setting the control valve in the arm lifting position (S, page 12).
The arms will rise until the resulting draught reduction on the lower links reduces the compression of spring (20) and causes lever (22) to rotate in the opposite direction, allowing lever (6) to move backwards, pulled by the control valve spool spring (4, page 14)

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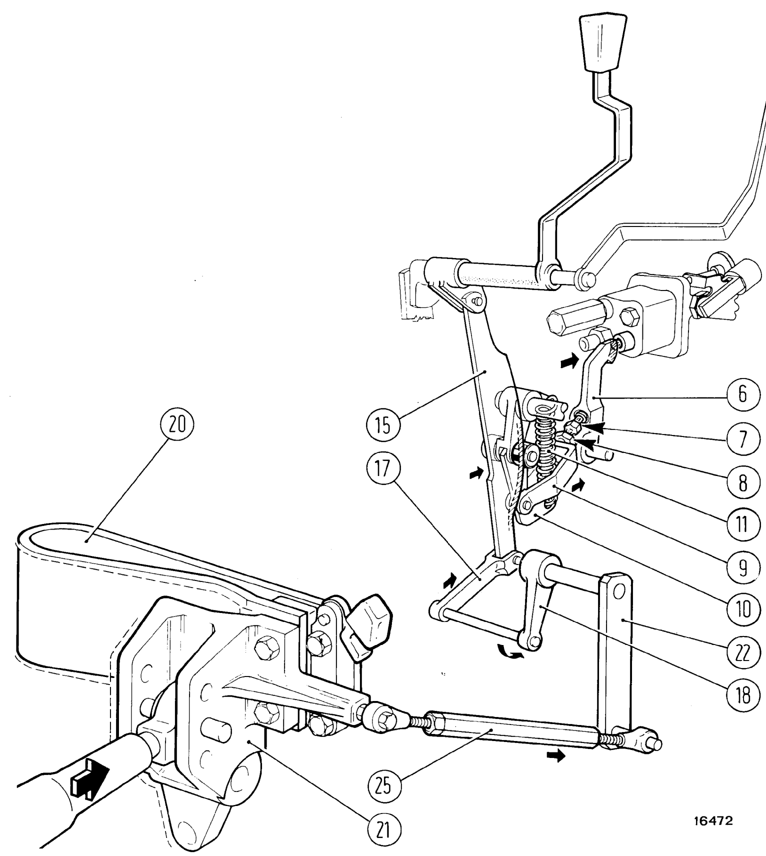

Increasing draught.

(Lift arms rise momentarily. When obstacle has been overcome, the draught control spring returns to its normal position and permits the arms to drop).

6. Control valve lever - 7. Control valve lever link pin - 8. Locknut - 9. Control valve lever link - 10. Link Lever - 11. Link lever spring - 15. Draught control inner lever - 17. Draught control link - 18. Lever - 20. Top link draught control spring - 21. Draught control spring support - 22. Draught control outer lever - 25. Draught control adjustable link.

Control valve returns to neutral and arms stop.
Once the hard stretch has been left behind, the draught control spring (20) returns completely to its original position and lever (6) moves further back.
The control valve returns to the discharge position (A, page 14) so that the arms lower the implement to its original working position.
If the control lever (F) is positioned further back on quadrant (draught reduction), the hollow shaft (26, page 16) pushes lever (15), roller (13), link (9) and lever (6) to act aganist the control valve spool, setting the valve in delivery position (S, page 12).
If the lever (F) is moved foreward (increased draught), operation in the same but in the opposite direction.

Combined draught and position control

With position control lever (P) fully forward, and moving the draught control lever (F) forward from the fully back position, the working depth is established as described above. When lever (P) is then shifted backwords, lever (14), link (9) and lever (6) move in the direction indicated by the solid arrows in the position control diagram, placing the control valve in the delivery position and causing a slight upward movement of the lift arms.

This condition permits lift to operate in draught control mode when patches of hard or compact soil are encountered.

Combined draught and position control therefore limits the changes in working depth occur when draught control alone is used.

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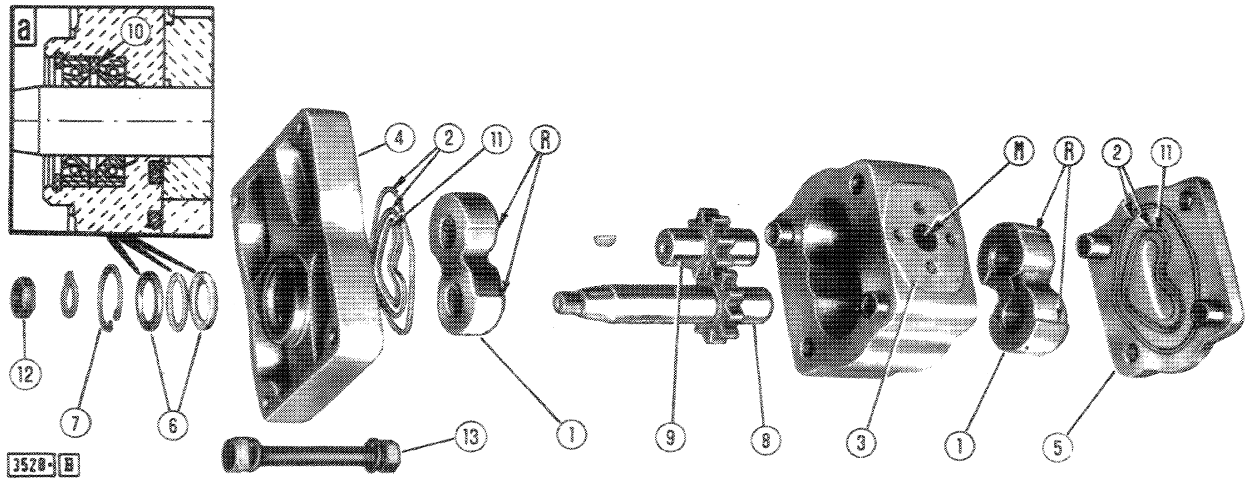


Lift pump components.
a. Seal assembly detail - M. Pump delivery port - R. Gear bearing fittings (delivery side) - 1. Gear bearings - 2. Cover seals - 3. Pump body - 4. Rear cover - 5. Front cover - 6. Drive shaft seals - 7. Seal retaining ring - 8. Drive gear shaft - 9. Driven gear shaft - 10. Spacer - 11. Anti-extrusion ring - 12. Sleeve nut and associated tab washer - 13. Cover retaining nuts.

HYDRAULIC PUMP

Pump is valve gear driven throught a front dog-tooth clutch.

To again access to drive gear, remove valve gear cover.

Oil circulating in pump automatically lubricates and takes up gear end float.

Lubricate the parts using the same grade of oil as the hydraulic lift system. Then reassemble, noting the following:

— remember the marks made during diassembly;
— position plastic anti-extrusion ring (11) inside central O-ring (2);
— position the bearings by hand so that fillets (R) face towards outlet port (M) and with frontal surfaces with lubrication slots flush with the gears.

Overhaul

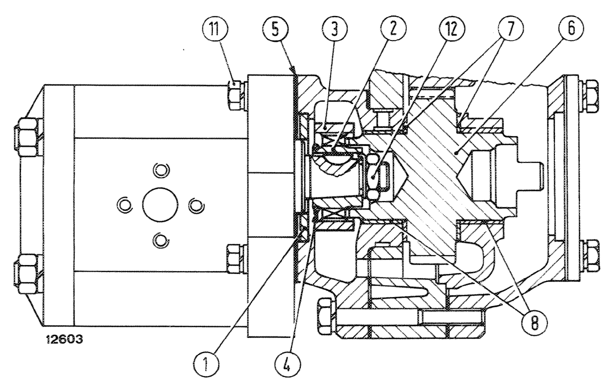
To disassemble pump, refer to figure above.

Mark the position of the internal parts so as to restore them to their original positions on assembly.

Check gear shafts and bearings for wera, referring to the values shown in the table, page 3, section 50.

Check side face flatness and squareness relative to bearings, smearing the surfaces in question with carbon black. Small defects may be rectified using wet zero-grade emery cloth.

— Check that gear end float in the pump body with bearings in position is 0.090 to 0.160 mm (0.0003 to 0.006"). Dress if necessary using wet zero-grade emery cloth, removing as little material as possible.



Section through pump drive.
1. Centralizer - 2. Pump drive sleeve - 3. Sleeve drive ring - 4. Retaining ring securing ring (3) - 5. Seal - 6. Pump driven gear - 7. Thrust washers - 8. Gear bushings - 11. Pump capscrews - 12. Sleeve nut.

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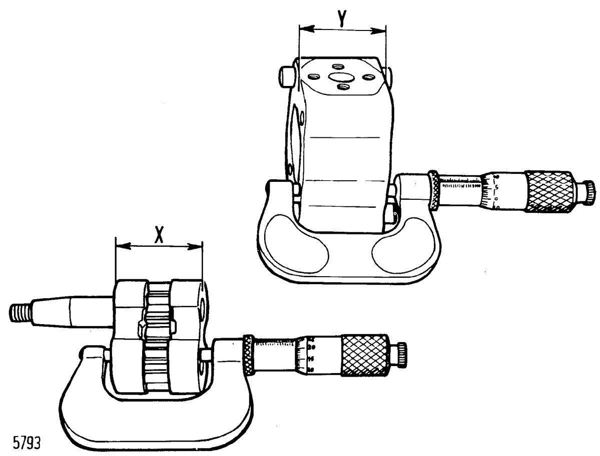
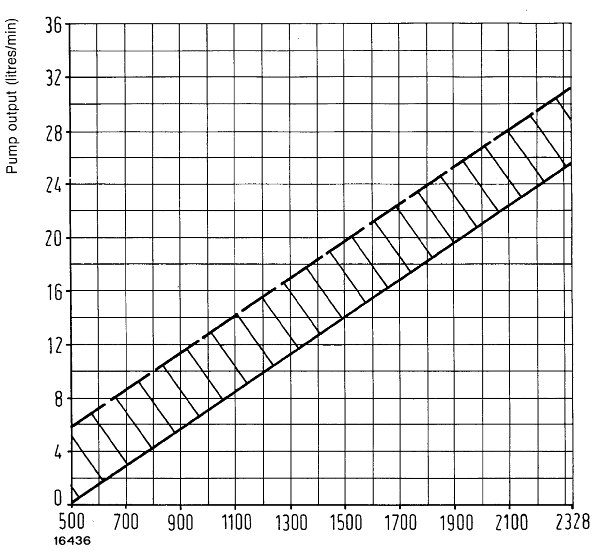


Checking gear end clearance in pump body.
Dimension **X** to be smaller than dimension **Y** by 0.090 to 0.160 mm (0.002 to 0.006'').

— fit drive shaft rotary seals (6, page 1) on rear cover (4) complete with associated spacer (10), turned as shown in detail (a), and pack lip cavity with **FIAT TUTELA G9 grease;**



Speed/output graph for lift pump A31
Test pressure: 166 bar (170 kg/cm² or 2418 psi) - Oil temperature 55-65°C (131 - 149°F) - Pump drive ratio 0.931 to 1.

— progressively tighten the cover nuts and capscrew to pump body to specified torque (page 7, sect. 50).

When installing pump on tractor, fill suction line and pump body with **Fiat TUTELA MULTI F oil** to facilitate priming and prevent seizure during initial service.

Output test

Couple pump to drive motor and connect to output test machine using the equipment shown in the figure. Use **Fiat IDRAULICAR AP51 oil** (SAE 20) supplied with the test machine and carry out the output test at the specified temperature and pressure settings. Compare results with values given on graph, noting the following:

— output ratings of new or reconditioned pumps should be close to the dotted line;

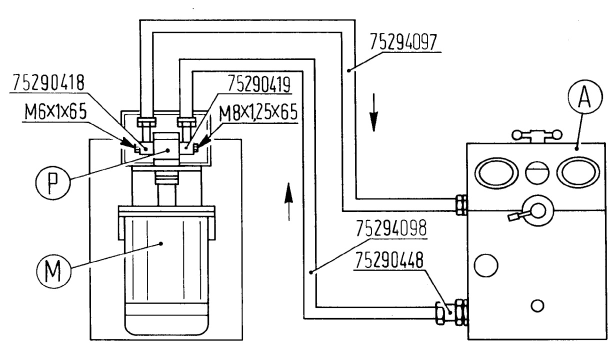
— output ratings for used are acceptable if within the shaded area on graph.

If the rating is near on below the continuous line, the pump must be overhauled or replaced.

OIL FILTER

The lift oil filter is located on the pump suction line.

The filtering element consists of a paper cartridge wich should be changed every 400 working hours.



Lift pump output test machine.

A. Output teste 75297784 - M. Electric motor 75294086 - P. Pump under test.

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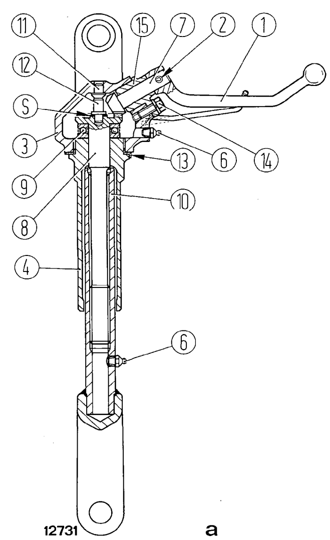

Section through RH lifting rod.

S. end float shims - 1. Lifting rod adjustment handle - 2. Roll pin - 3. Top housing - 4. Cover - 6. Lubricator - 7. Drive pinion - 8. Driven gear - 9. Thrust bearing - 10. Lower housing - 11. Fixed pin - 12. Driven gear pin - 13. Tab washer - 14. Drive pinion support capscrew - 15. Drive pinion support.

IMPLEMENT ATTACHMENT

The implement attachment is a three-point linkage with adjustable lifting rods and top link and check chains and, optionally, with adjustable links (1st and 2nd category attachments) or, optionally, with lower check blocks

Right-hand lifting rod

To remove RH lifting rod, proceeed as follows:

— straighten tab washer (13) and unscrew cover (4), removing it together with driven gear (8);

— back off screw (14) and remove support (15) together with drive pinion (7);

— unscrew lower housing (10) and remove driven gear and thrust bearing (9);

— remove handle (1) and roll pin (2), retrieving the drive pinion.

On assembly, pack top and bottom recesses with **Fia TUTELA G9 grease** and insert shims (S) between pin (12) and driven gear (8) so as to obtain 0.1 to 0.3 mm (0.004 to 0.012") end float: end float can be measured by inserting feeler gauge between pins (11 and 12).

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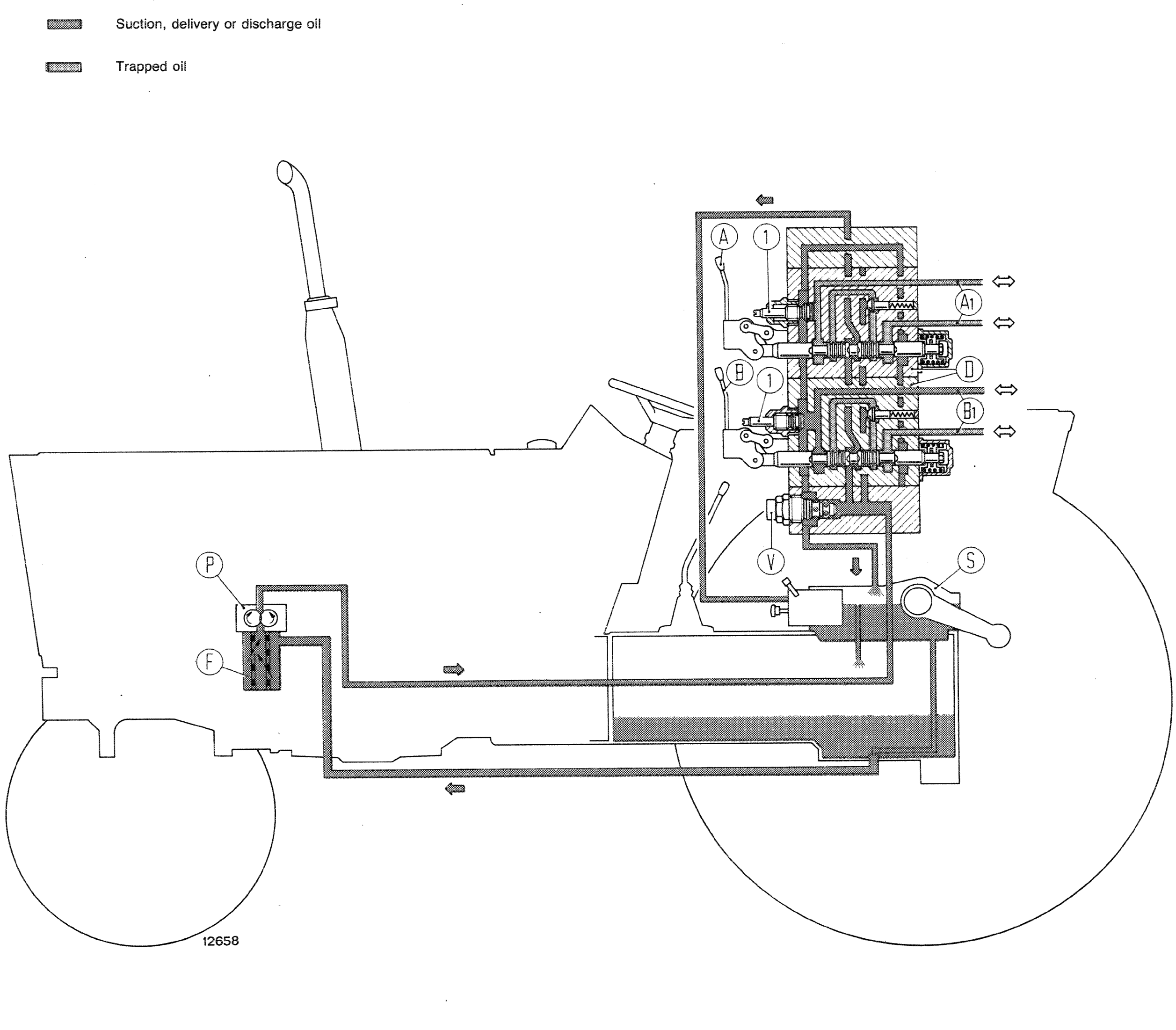
DESCRIPTION AND OPERATION

The spool-type hydraulic remote control valves can be used for single and double-acting ram applications. Float operation is possible and an optional hydraulic trailer brake remote control valve is also available (see pages 8,9,10 and 11).
For single acting cylinder operation, screw (1) should be fully backed off, while for double-acting operation, screw should be fully in.
Remote controlled valves are installed in banks, max 2, on special brackets on the RH final drive.
Operation is by means of the hydraulic lift oil with separate control by means of hand levers (A and B).
Simultaneous operation of a remote control valve and the lift is only possible when the control valve in float position.
The relief valve (setting 186-191 bar, 190-195 kg/cm ^{2} or 2702-2775 psi), normally housed in the hydraulic lift cantrol valve, is on control valve retaining plate (V) when remote control valve are installed.
Figure below illustrates oil circulation through the two remote control valves (one for a double-acting cylinder and one a single-acting cylinder) with associated control levers in the neutral position so that the oil coming from the pump passes through the valve bodies in the direction indicated by the arrows and flows into the lift control valve.



Remote control valve hydraulic system operation.
A. Double-acting valve lever - B. Single valve lever - $A_1$and B_1. Female half-coupling for cylinders - D. Remote control valves - F. Full flow paper cartridge oil filter (common to lift) - P. Hydraulic pump (common to Lift) - S. Lift body - V. Relief valve - 1. Single/double action conversion screw.

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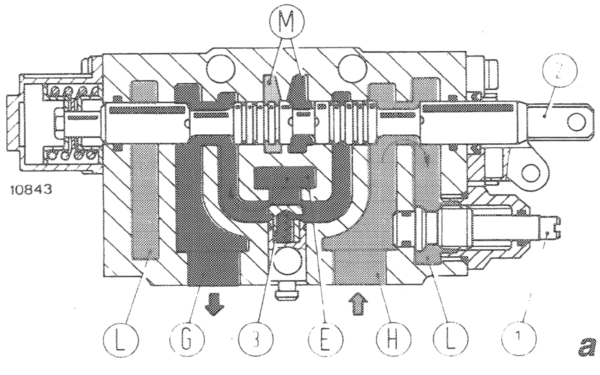
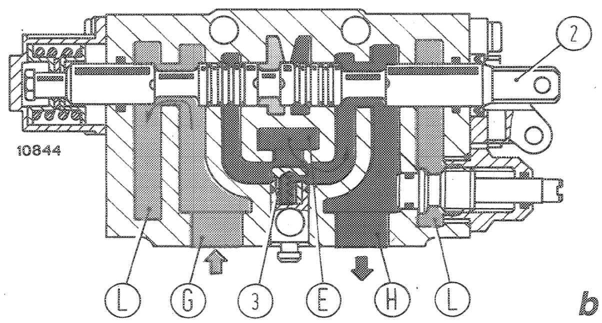
HYDRAULIC LIFT UNIT: Remote control valves

- Oil under pressure
- Suction, delivery or discharge oil
- Trapped oil



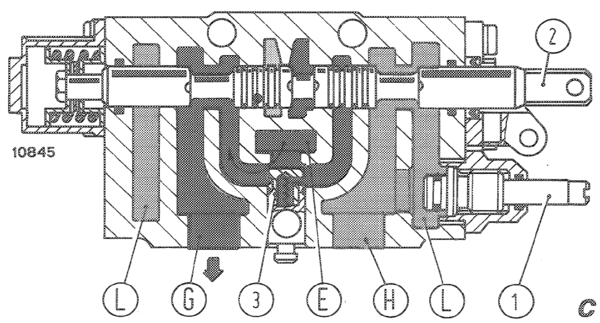
a

a. RAISING — When lever (A, page 1) is pulled back, spool (2) establishes communication between inlet (E) and cylinder lower chamber through check valve (3) and port (G) and between cylinder upper chamber and exhaust port (L) through port (H), preventing oil delivery to lift control valve. If the control lever is held back, the raising phase continues until relevant cylinder reaches the end of its travel. On release, the lever springs back to neutral and the entire pump output is directed to the lift control valve through ports (M).



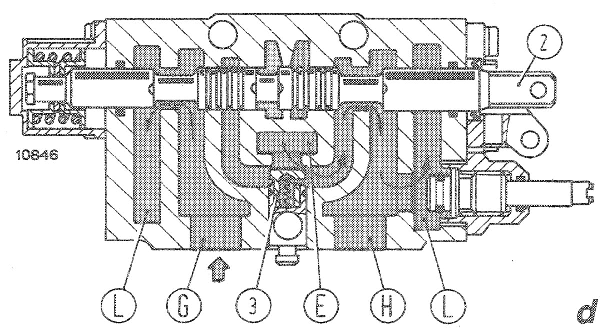
b

b. LOWERING — To lower implement, push control lever (A, page 1) forward. Spool (2) moves as shown in fig. b and permits oil contained in cylinder lower chamber to flow to discharge (L) through port (G), while upper chamber is placed in communication with outlet port (E) through port (H) and check valve (3).



c

c. RAISING — When lever (B, page 1) is pulled back, spool (2) establishes communication between inlet (E) and cylinder lower chamber through check valve (3) and port (G). Port (H), used for double-acting cylinders, is not used in this phase since it is permanently connected to discharge (L) when conversion valve (1) is open.



d

d. LOWERING — When lever control (B, page 1) the spool (2) moves as shown in fig. d. The oil in the cylinder, pushed by weight of lifted implement, flows to discharge (L) through port (G) through entire pump output is directed to discharge (L) through check valve (3) and port (H).

Double-acting cylinder (figs. a, b) and single-acting cylinder (figs. c, d) remote control valve operation.

Note: For double-acting cylinder operation, screw (1) should be fully screwed in; back-off for single-acting cylinders.

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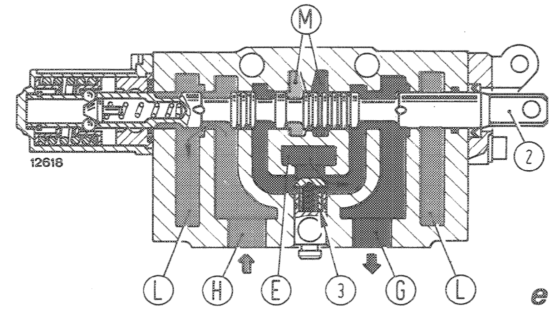
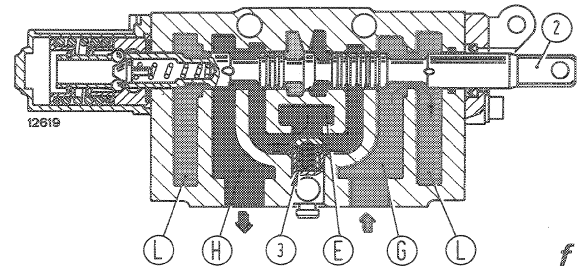
e.RAISING — When lever (B, page 7) is pulled back, spool (2) establishes communication between inlet (E) and cylinder lower chamber through check valve (3) and import (G) and between cylinder upper chamber and exhaust port (L) through port (H), preventing oil delivery to lift control valve. If the control lever is held back, the raising phase continues until relevant cylinder reaches the erd of its travel. On release, the lever springs back to neutral and the entire pump output is directed to the lift control valve through ports (M).



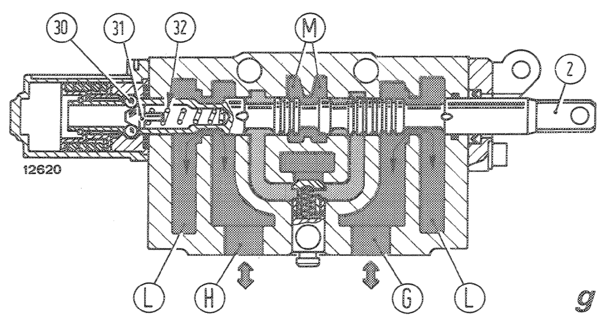
e

f. LOWERING — To lower implement, push control lever (B, page 7) forward. Spool (2) moves as shown in fig. f and permits oil contained in cylinder lower chamber to flow to discharge (L) through port (G), while upper chamber is placed in communication with outlet port (E) through port (H) and check valve (3).



f

g. FLOAT — For implement float operation, push lever (B, page 7) fully forward.
Spool (2) takes up position shown in fig. g where it is held by ball (30) retained in place by pin (31) and spring (32) and establishes communication between ports (M) directing entire pump output to lift control valve, and between discharge port (L) through ports (H, G) and upper and lower chambers respectively. Implement may therefore follow ground contour as lift arms are free. Lift may be operated in float control.



g

Remote control valve operation for double-acting cylinder (figs. e, f) and float (fig. g).

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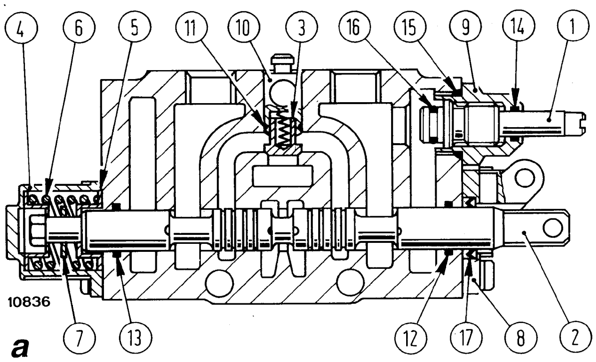
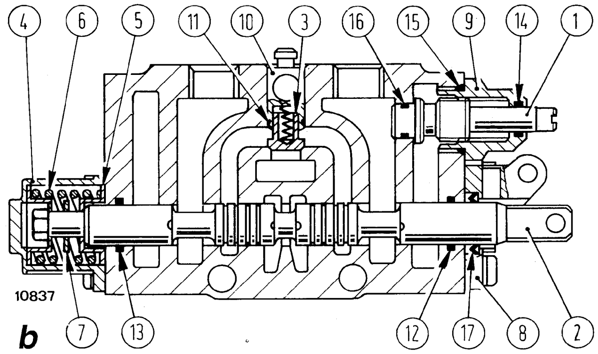
REMOTE CONTROL VALVES (Diassembly)



a



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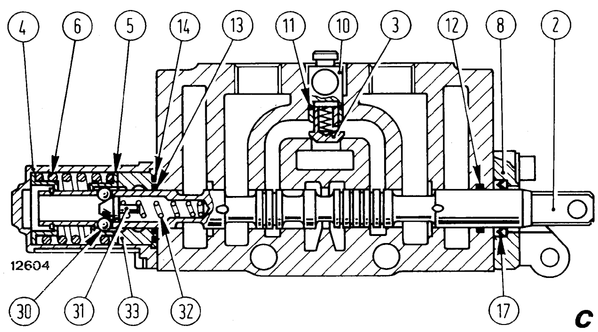
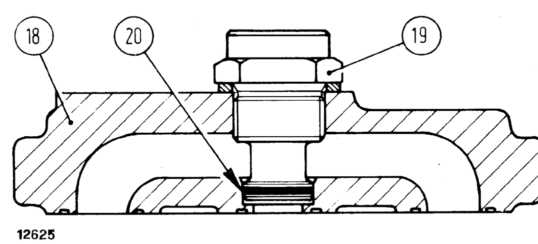
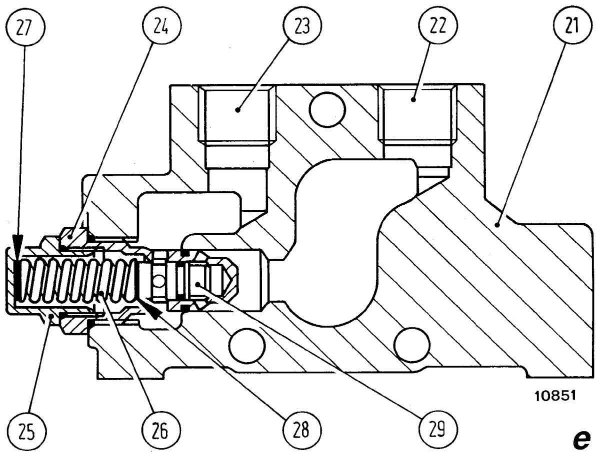


c



d



e

Section through remote control valves.

a. Single-acting cylinder remote control valve - b. Double-acting cylinder remote control valve - c. Float double-acting cylinder remote control valve - 1. Single/double action conversion valve - 2. Spool - 3. Check valve - 4. Cap. - 5. Cup - 6. Spool spring - 7. Spacer - 8. Actuating lever support - 9. Valve (1) plug - 10. Check valve seat - 11, 12, 13, 14, 15 and 16. O-ring - 17. Seal - 18. Rear plate - 19. oil outlet connection to lift - 20. O-ring - 21. Front plate - 22. Inlet port - 23. Outlet port - 24. Relief valve body - 25. Plug - 26. Relief valve plunger - 27. Shim - 28. Spacer - 29. Relief valve spring - 30. Spool detent balls - 31. Ball (30) retaining pin - 32. Spring - 33. Bushing - d. Outlet cover (see page 1) - e. Inlet cover.

Disassemble remote control valves referring to the above drawing and noting the following:

— remove caps (4), springs (6) and cups (5) and withdraw spools from actuating side of each valve body (with float double-acting cylinder control valve (fig. c), also retrieve spool detent ball (30), pin (31), and spring (32)

— for control valves with single/double action conversion valve (figs. a, b), back off plug (9) and remove valve (1);

— remove valve seat (10) using pliers. take out check valve (3) and retrieve spring;

— unscrew valve body (24) to remove relief valve body from retaining plate; on the bench, remove plug (25) and retrieve spring (26), shims (27 and 28) and plunger (29);

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— check seal for wear, replacing as required.

If spool replacement is necessary, note that spare spools are supplied complete with associated control valve body.

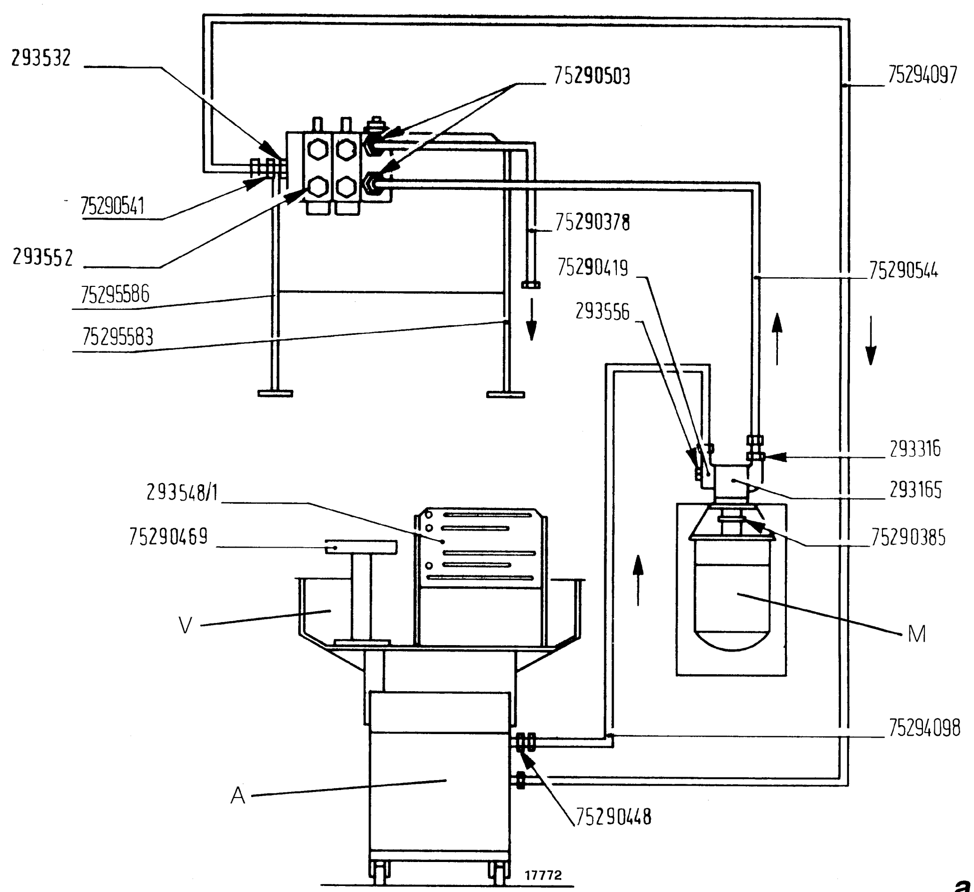
To install control valves, reverse the diassembly procedure and tighten control valve link nuts to 20 Nm (2 Kgm or 14.5 lb ft). The test as descibed below.

On tractor relief valve check (29, e, page 4).

See page 10, section 501

On bench relief valve check (29, e, page 4).

Install remote control valve assembly under test and test equipment as directed in diagram (a), noting that oil return piping **75294097** from control valve must be connected to the valve using connection fitting **293532**. make connections as indicated in the diagram, gradually increase pressure by acting on handle of tester and check on pressure gauge that relief valve check off at 186-191 bar (190-195 kg/cm² or 2702-2775 psi). If it does not, scrap and replace valve or adjust shims (27, page 4). Add shims if crack-off pressure is lower than specified, remove shim if it is higher.



a

Relief valve tester installation diagram.

A. Test apparatus 75297784 - M. Electric motor 75294086 - V. Tank 75296155

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Note — If test apparatus is filled with Fiat AP51 (SAE 20W), the above test and those that follow must be carried out at 60°C (140°F) approx., and 12.5 1/min (22 Imp. pints/min) output, obtainable by running tested motor at top speed (1450 rpm).

Spool return test (b, b1).

Install remote control valve assembly under test and test equipment as shown in diagram (b, b1) noting the following:

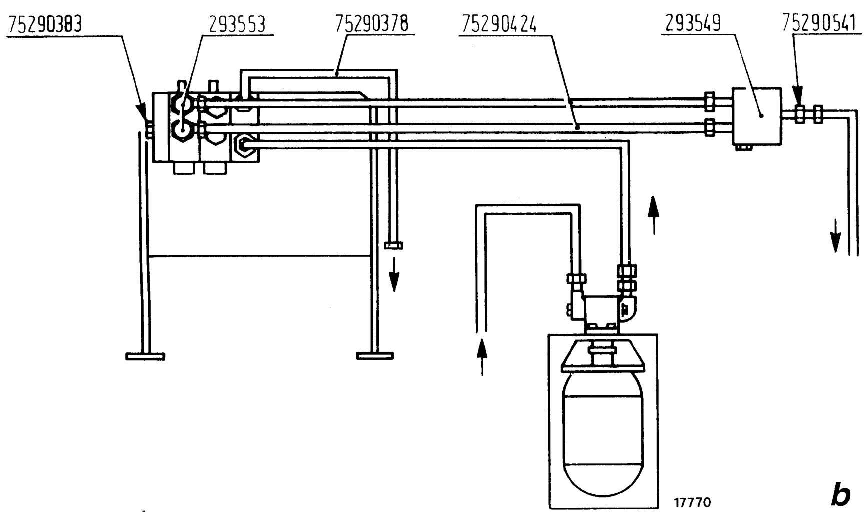
— On double-acting cylinder control valves (fig. b), oil delivery ports to cylinder must be connected to fitting with ball **293549** through associated lines **75290424** and banjos **293553:**

— on singler-acting cylinder control valves (fig. b_1), return line **75290447** must be connected - by means of banjo **293553**, to oil delivery port to cylinder (port on opposite side of conversion, 1, page 4).

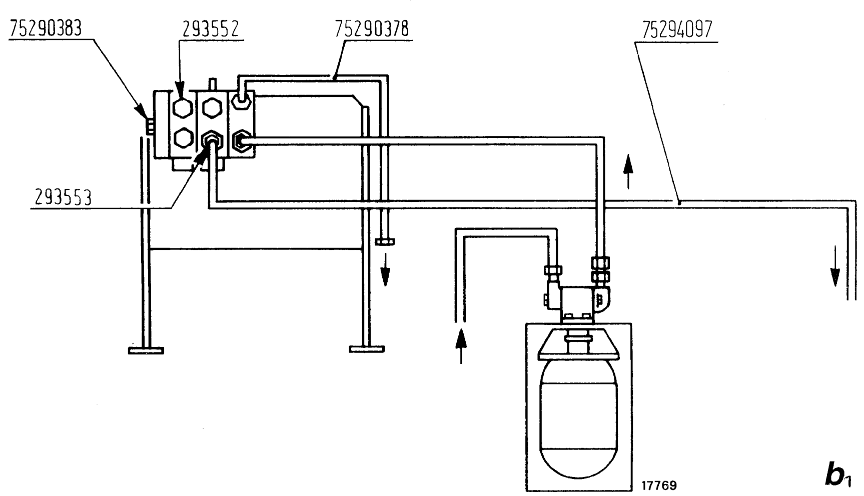
After connecting as shown in diagram, proceed as follows:

— start hydraulic pump and activate spool hand lever (in both directions for double-acting control valves)

— gradually increase pressure by means of output tester knob and check on pressure gauge that pressure reaches 172 bar (175 kg/cm² or 2489 psi). In these conditions, the spool should slide freely and return the two cylinder delivery posts in turn to neutrals without seizing on release of control lever.



b



b_1

Spool return test equipment installation diagram for doubl-acting (b) and single-acting (b_1) remote control valves

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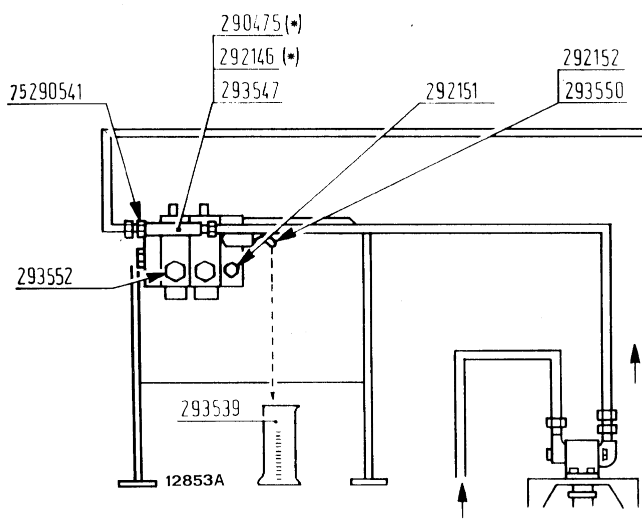
Sppol leakage test equipment installation diagram for remote control valves (c).

(*) **290475** = Early type 3-way adapter
(*) **292146** = late type 3-way adapter



— Test the other spools after establishing the necessary corrections.

Remote control valve spool leakage test (c).

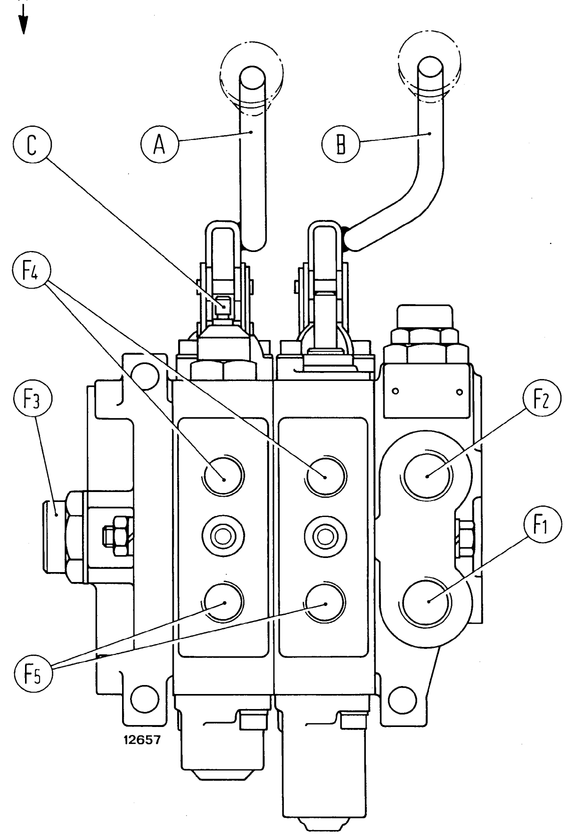
Install remote control valve assembly under test and test equipment as indicated in diagram (c), noting that three-way connection **292146** (or. **290475**) must fitted to single-acting and doubler-acting remote control valves using adapters **293547.**

After connecting as shown, proceed as follows:

— start hydraulic pump and gradually increase pressure by menas of output tester knob and check on pressure gauge that pressure reaches 150 bar (147 kg/cm² or 2091 psi);

— collect leakage oil flowing from connection **293550**, in burette **293539** for exactly one minute and check that leakage does not exceed 25 cc/min (1.526 in 3/min) with new control valves and 60 cc/min (3.66 in 3/min) with used ones.

Repeat test on each remote control valve, testing each of the two cylinder delivery ports in turn.



Remote control valve piping connection diagram.

A. Single/double-acting convertible remote control vale lever - B. Float double-acting remote control valve lever - C. Single/double action conversion valve - F_1. Threaded hole (M22x1,5) for oil inlet line fitting - F_2. Threaded hole (M22x1,5) for oil discharge line fitting - F_3. Threaded hole (M20x1,5) for oil delivery connection to lift control valve - F_4 and F_5. Threaded holes for oil delivery connections to single-acting or double-acting cylinders.

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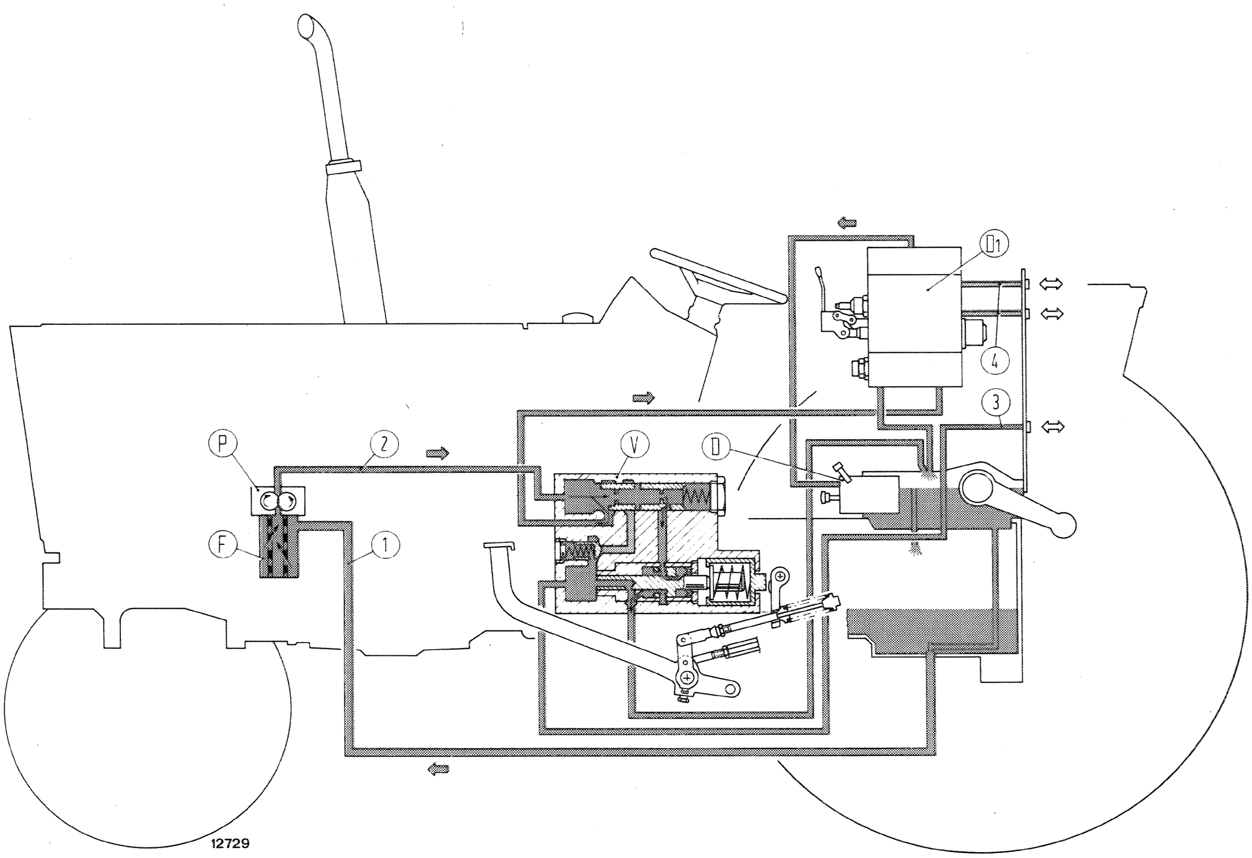
TRAILER BRAKE REMOTE CONTROL VALVE

The optional trailer brake remote control valve is fitted on the transmission housing by means of a bracket.

The trailer brake is operated manually by means of the LH tractor brake pedal and makes used of the tractor hydraulic circuit.



Trailer brake remote control valve hydraulic system diagram.

D. Lift control valve - D_1. Remote control valve - F. Filter - P. Hydraulic pump (common to hudraulic lift) - V. Trailer brake remote control valve - 1. Suction line from rear transmission housing - 2. Delivery line to trailer brake control valve - 3. Delivery line to trailer brake - 4. Delivery line to tractor circuits.

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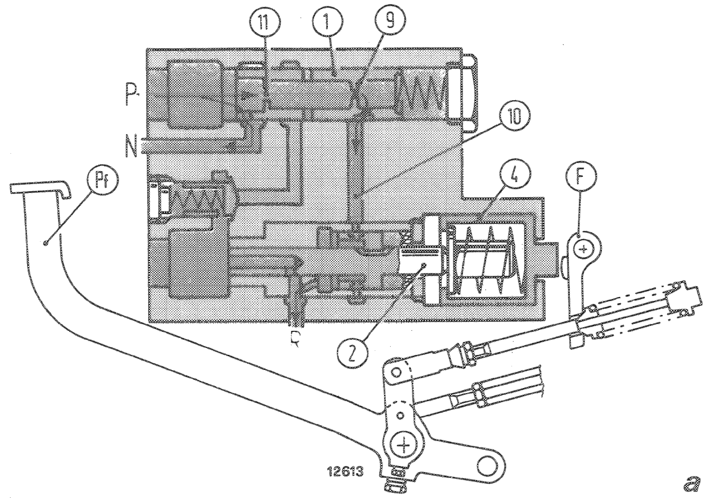
a. TRAILER BRAKE RELEASED — When tractor brakes are not engaged, relief valve (4) and piston (2) are in the positions shown in fig. a.

Oil from hydraulic pump (P, page 8) is directed to fitting (P_1), throught diaphragn (11) and restriction (9) which causes a pressure drop to move control valve (1) to the right.

Most of the oil flows through connection (N) to the remote control valves. The remaining output is discharged into the hydraulic lift through port (10), piston (2) and connection (R).



a

Trailer brakes released.
N. To remote control valves - P_1. From lift pump - R. To lift discharge.

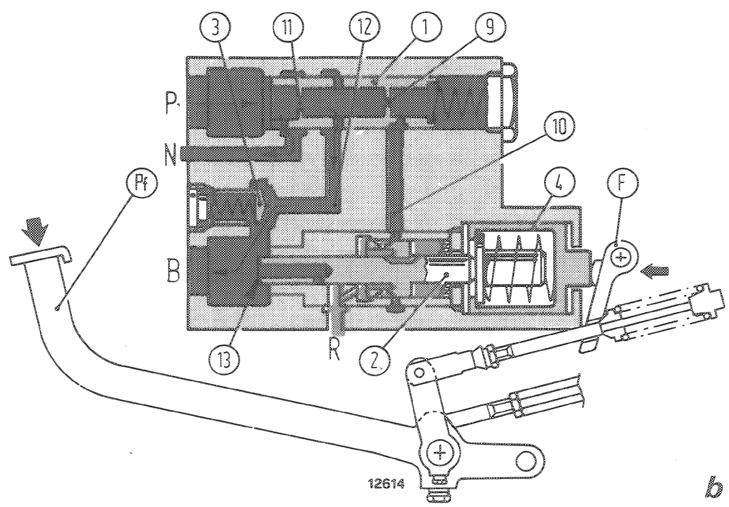
Oil under pressure
Suction, delivery and discharge oil
Trapped oil

b. BRAKE APPLICATION — When tractor brake pedal (Pf) is applied, fork (F) moves relief valve and piston (2) to the left, discontinuing communication between oil discharge fitting (R) and both trailer brake connection (B) and port (10).

Oil inside flow control valve (1) maintains a constant pressure and, under spring load, moves to the left to take up position shown in fig. b.

Part of hydraulic pump output at connection (P_1) flows to the remote control vales through connection (N), while remaining output reaches trailer brake through diaphgram (11), port (12), check valve (3) and connection (B).

Increased oil pressure in trailer brake connection (B) acts on effective area (13) of piston (2), opposing the effect of control fork (F) on relief valve (4).



b

Brake application

B. To trailer brake - N. To remote control valves - P_1. From lift pump - R. To Lift discharge.

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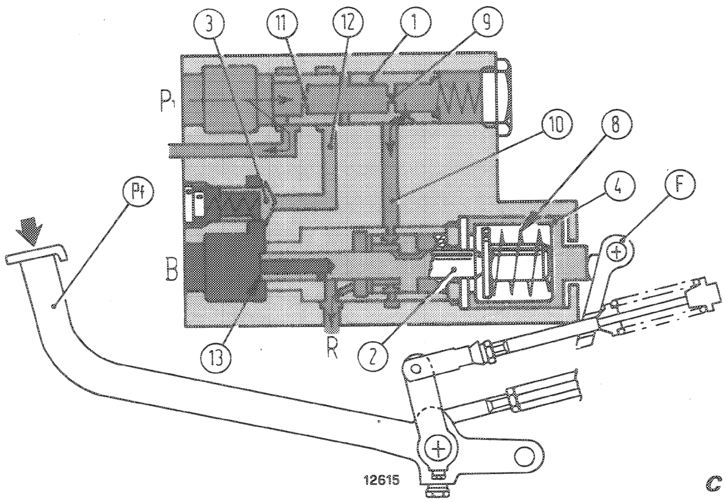


C

Braking.

B. To trailer brake - P_1. From hydraulic lift pump - R. To hydraulic lift discharge.

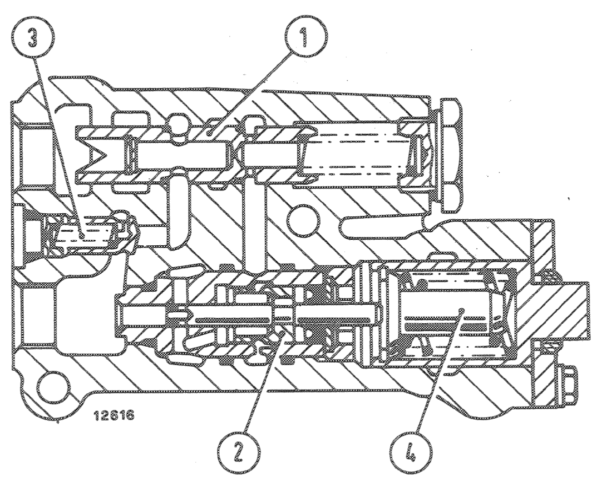
c. BRAKING — Continued application of tractor brake pedal (Pf) causes an increase in oil pressure at trailer brake connection (B) which, acting on effective area (13) of piston (2) moves to latter to the right, thereby overcoming the opposition of relief valve (4) springs (8).

When the trailer brake circuit oil pressure is equal to spring (8) pressure, piston (2) stabilizes as shown in fig. **C** and establishes communication between oil from pump and lift drain through connection (P_1), diaphragm (11), restriction (9), port (10) and connection (R).

Diaphragm (11) and restriction (9) cause a pressure drop in flow control valve (1) which moves towards the right to close port (12) and therefore check valve (3).

Further depression of tractor brake pedals (Pf) causes leftward movement of relief valve (4) and piston (2) with a consequent increase in trailer brake circuit oil pressure as the sequence describeb in par. **b**, "BRAKE APPLICATION"is repeated.

On releasing brake pedals, the system returns to the conditions shown in fig. **a**, page 9.



Section through trailer brake remote control valve.

1. Flow control valve - 2. Piston - 3. Check valve - 4. Relief valve .

Oil under pressure

Suction, delivery and discharge oil

Trapped oil

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10 - ENGINE

100 - Removal - Installation - Performance data

See mods. 55-46 and 65-46

101 - Engine block - Cylinder head.

***292240 (99390425)**	Screw tap (M12x1.75), injector sleeve.
***292243 (99390771)**	Remover, injector sleeve chips from cylinder head
***293784 (99242137)**	Puller, injector sleeve.
***293742/2**	Cutters, Injector sleeve.
***293861**	Burnisher, injector sleeve
292248	Torque gauge, angular tightening, cylinder head capscrew.
292913	Kit, engine valve seat.
293329	Installer, distribution shaft front gland (with handle **293709**)
293299	Installer, distribution shaft front gland (with handle **293708**)
Note	* Tools contained in kit 293270

102 - Valve gear

291046/1 (99360409/1)	Remover, valve guide
291177 (99390310)	Reamer, valve guide
293231 (99360293)	Installer, engine intake and exhaust valve guides (use with **291046/1**)
290064	Grinder, power, engine valve
291050	Compressor, valve spring.
291883 (99350108)	Wrench, valve clearance.

103 - Crank gear.

See mods. 55-46 and 65-46

104 - FUEL SYSTEM

See mods. 55-46 and 65-46

On-bench injection pump test.
See mods. 55-46 and 65-46

BOSCH injection pump.

See mods. 55-46 and 65-46

C.A.V. injection pump

See mods. 55-46 and 65-46

105 - Lubrication system.

See mods. 55-46 and 65-46

106 - Cooling system.

291182/1	Puller, engine cooling water pump impeller
291979	gauge, temperature, engine cooling water.
293280	Burnisher water pump impeller seal installation.

20 - POWER TRAIN.

201 - Clutch

See mods. 55-46 and 65-46

202 - Transmission and splittler.

See mods. 55-46 and 65-46

204 - Bevel drive and differential

See mods. 55-46 and 65-46

206 - Final drives.

See mods. 55-46 and 65-46

30 - FRONT AXLE - STEERING.

301 - Axle

293890	Gauge, wheel toe-in
292927 290793	Puller, slide hammer and associated adapter (M12x1,25), axle pivot.
291182/1	Puller, steering wheel

303 - Power steering.

See mods. 55-46 and 65-46

Power steering hydraulic test equipoment.

	Tester, pump output.
	Tank.
	Motor electric.
75290385	Coupling
293165	Pump, hydraulic
293723	Support

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75295586 75295583	Brackets for suport 293723
293192/1	Wrench rotary valve
75294098	Pipe, suction
75290448 75290540	Reduction fittings, suction pipe.
293316	Reduction fittings 2 off), suction pipe and delivery pipe.
75290554	Delivery pipe
292146	Fitting, 3-way
75290541	Reduction fitting, discharge pipe
75294097	Discharge pipe
293315	Plug (2 off)
293721	Fitting, drain
75292775	Pipe, plastic, oil discharge

40 - FOUR WHEEL DRIVE
401 - Front live axle

See mods. 55-46 and 65-46

50 - LIFT UNIT
501 - Lift

290284	Pump, hand, valve setting check.
292870	Kit, gauges and fittings, hydraulic circuit pressure testing.
292547	Installer, lift arm shaft pistons and rings
292535	Installer, lift arm shaft seal.
290828	Adapter, cylinder safety valve setting (use with **290284**)
290824	Adapter, relief valve setting (use with **290284**)
293849	Adapter control valve spool leakage check (use with **290284**)
291862	Wrench, cylinder safety valve adjustment.
291863	Wrench, relief valve adjustment.
291215	Hook, link, control valve lever retaining spring
293839	Installer, control valve spool roller bearing.
293838	Installer, draught control top/bottom levers and distributor linkage arm roller bearings.
293846	Adjuster, lift draught and position control.
293870	Wrench, arm travel limit adjustment.
293858	Protector, arm descent control valve seal installation.
293872	Connection fitting, air (with 293846), lift arm travel limit adjustment.

502 - Lift pump A31

	tester, output, large, complete with:
75290419	- union, inlet.
75290418	- union, output.
75290448	- adapter, inlet.
75294098	- pipe, inlet.
75294097	- pipe, output.
	Motor, electric, pump drive, complete with:
75290385	- coupling drive.

504 - Remote control valve

293195	- Guide, one-way valve seal installation
	- tester output, complete with:
	- electric motor.
	- tank.
293165	- pump, hydraulic.
75290385	- union.
293548/1	- support, valves.
75295586	- bracket.
75295583	- bracket.
75290469	- support.
293539	- burette.
75290448	- reduction fitting.
75294098	- pipe.
75290419	- pipe, inlet.
293556	- screw.
293316	- reduction fitting.
75290544	- pipe.
293532	- connection fitting.
75290503	- reduction fitting.
75290378	- pipe, discharge.
75290541	- reduction fitting.
75294097	- pipe, return.
293552	- plug.
75290383	- plug.
293553	- connection fitting.
75290424	- pipe.
293549	- ball union.
292146 or 290475	- fitting, 3-way.
293547	- reduction fitting.
292152	- reduction fitting.
293550	- connection fitting.

60 - ELECTRIC SYSTEM

See mods. 55-46 and 65-46

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