FIATALLIS®

FiatTrattori

FIAT

1180 - 1280 - 1380
1580 - 1880

Form Number 06910064

WORKSHOP MANUAL

Fiat Trattori

FIAT

1180 - 1280 - 1380
1580 - 1880

WORKSHOP MANUAL

QUICK REFERENCE INDEX

D I R E Z I O N E   C O M M E R C I A L E

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.).*
- *A contents list is provided to facilitate retrieval of desired information.*
- *Each sheet carries the print number of the manual and the date of issue in the bottom right-hand corner of the front page.*
- *Revised sheets will carry the same print number followed by a 2-digit number (e.g. first revision 603.54.220/01, second revision 603.54.220/02 etc.) and date of issue.*
  Revised sheets will be accompanied by the updated contents sheet.
- *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.*

The Imperial weights and measures are given for operators' 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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CONTENTS

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GENERAL: Index

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SHIMS

When adjusting, measure each shim with 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 should a mallet of hammer be used for installation;
— 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 some sort of 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, RHODOR-SHIL CAF 1 or LOCTITE PLASTIC GASKET.
Before applying the sealing compound, prepare the surfaces as follows:
— remove any deposits using a wire brush;
— thoroughly degrease using solvent, kerosene or hot water/soda solution.

BEARINGS

To install bearings:
— preheat to 80°C ÷ 90°C and slide over shaft;
— cool before pressing outer races home.

ROLL PINS

When fitting straight roll pins ensure that the split faces toward the direction of work stressing 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 indicated below.

ricambi originali

FiatTrattori

FIAT

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These are the only spares that ensure the quality, durability and safety of original parts as they are the same as those 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 to offer efficient and durable service.
Mechanics are also reminded that being equipped means:
— operating in optimum working conditions;
— obtaining the best results;
— saving time and energy;
— working in more 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 direction of forward travel.

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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 occuring 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

- Study the Operator's Manual before starting, operating, maintaining, fuelling or servicing machine.
- 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, ear protectors, 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 that seated in the operator's seat.
- Never lubricate, service or adjust a machine with the engine running, except as called for in the Operator's Manuals.
- Shut off engine and check that hydraulic oil is no longer under pressure before removing caps 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.
- 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 blocking or other means.
- Ensure that the fuel gun is in contact with the filler when refuelling. To reduce the chance of a 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. Be sure pins and locks as provided are secure before pulling. Stay clear of drawbars, cables or chains under load.
- To move a disabled machine, use a trailer or low body truck if available.
- Load and unload on level ground affording full support to the trailer wheels.
- Use only grounded auxiliary power source for heaters, chargers, pumps and similar equipment to reduce the hazards of electrical shock.

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GENERAL: Safety precautions

- Lift and handle all heavy parts with a lifting device of proper capacity.
- Watch out for people in the vicinity.
- 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 in a closed building without adequate ventilation.
- Do not smoke or permit any open flame or spark near when refuelling or handling highly flammable materials.
- Do not use an open flame 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 hat, safety glasses, safety shoes, ear protectors.
- When making equipment checks that require engine running, an operator should be in the opertor's seat at all times with the mechanic in sight.
- For field service, move machine to level ground if possible and block machine. If work is absolutely necessary on a gradient, block 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 exposed personnel clear of anchor point and cable or chain.
- Keep maintenance area CLEAN and DRY. Remove water or oil puddles 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 and adjust and lock operator's seat. Be sure all personnel in the area are clear before staring 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 hat, safety shoes, heavy gloves where metal or other particles are apt to fly or fall.
- Wear welders'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 WTHOUT 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.

START UP

- Do not run the engine of this machine in closed areas without proper ventilation to remove deadly exhaust gases.
- Do not place head, body, limbs, feet, fingers or hands near a rotating fan or belts. Be especially alert around a pusher fan.

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.
- Avoid running engine with open unprotected air inlets. If such running is unavoidable for service reasons, place protective screen over all inlet openings before servicing engine.

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ELECTRICAL

- BATTERY GAS IS HIGHLY INFLAMMABLE. Leave battery box open to improve ventilation when charging batteries. Never check charge by placing metal objects across the posts. Keep sparks or open flame 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 area. 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

- 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 wook to search for suspected pressure leaks. DO NOT USE HANDS. If injured 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 the manufacturer's specified pressure. Inspect for damage periodically.
- Stand to one side when changing inflation of tyres.
- 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 block the machine in front and back of all wheels. After jacking up, place blocking under machine to protect from falling according to local or national requirements.
- Deflate tyres before removing objects from the tread.
- Never inflate tyres with flammable gases. Explosion and personal injury could result.

ATTACHMENTS

- Lift and handle all heavy parts with a lifting device of proper capacity. Be sure parts are supported by proper slings and hooks. Use lifting eyes if provided. Watch out for people in the vicinity.
- 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 chain or cable.

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1280 - PRELIMINARY INFORMATION

The section dealing with the 1280 tractor will be included in a later edition. Components of the recently marketed 1280 tractor are noted below, together with corresponding parts of 1180, 1180 H, 1380, 1580 and 1880 tractors covered in this manual which may be referred to in order to carry out most service operations.

Engine block - See 1180 and 1380
Cylinder head - See 1180
Crankshaft and bearings - See 1180 and 1380
Connecting rods - See 1180 and 1380
Pistons - See 1380.

Valve gear - See 1180 and 1380
Tappets - See 1180 and 1380
Rockers - See 1180 and 1380
Valves, guides and springs - See 1180

Oil pump - See 1180
Oil filter - See 1180 and 1380
Heat exchanger - See 1380

Water pump and thermostat - See 1180 and 1380
Fan - See 1380

Turbocharger type: GARRETT TO4B/Y7 1.00E.
Disassembly and overhaul: See 1380 tractor, GARRETT turbocharger. Equipment is the same.

Feed pump - See 1180

Injection pump type - CAV DPA 3362 F850 4762361
Calibration table - Page 18, Section 10
Performance data - Page 3, Section 100
Overhaul instructions - To be included in next edition.

Injectors - See 1180 and 1380
Clutch - See 1380, 1580 and 1880
Transmission and splitter - See 1180, 1380, 1580 and 1880
Crawler and reverser - See 1180, 1380, 1580 and 1880
Bevel drive and differential - See 1380
Brakes - See 1180, 1380, 1580 and 1880
Final drives - See 1380
Power take-off - See 1380 and 1580.
P.T.O. Hydraulic pump - See 1380, 1580 and 1880
Front axle, power steering - See 1180, 1380, 1580 and 1880
Front wheel drive, axle drive - See 1380 DT
Lift - See 1180, 1380, 1580 and 1880
Lift pump - See 1380, 1580 and 1880
Electrical system - See 1180, 1380, 1580 and 1880.

Note. For adjustment of transmission, bevel drive, final drives, front wheel drive and hydraulic lift, use service tools described for 1180, 1380, 1580 and 1880 tractors, noting directions in the appropriate sections.

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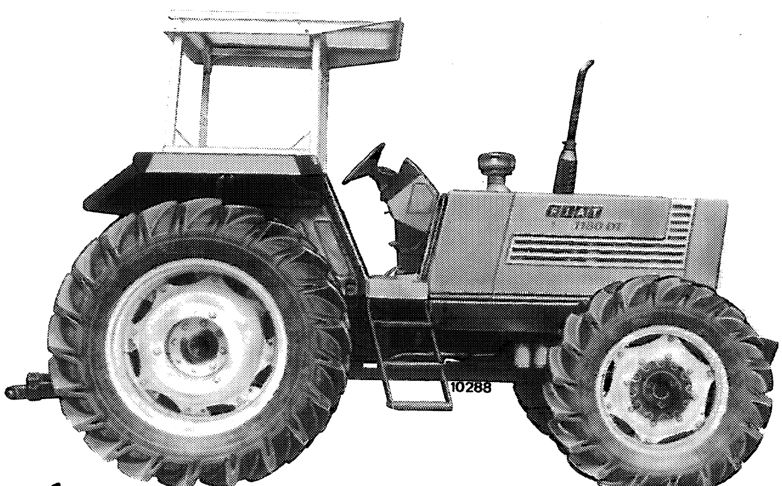
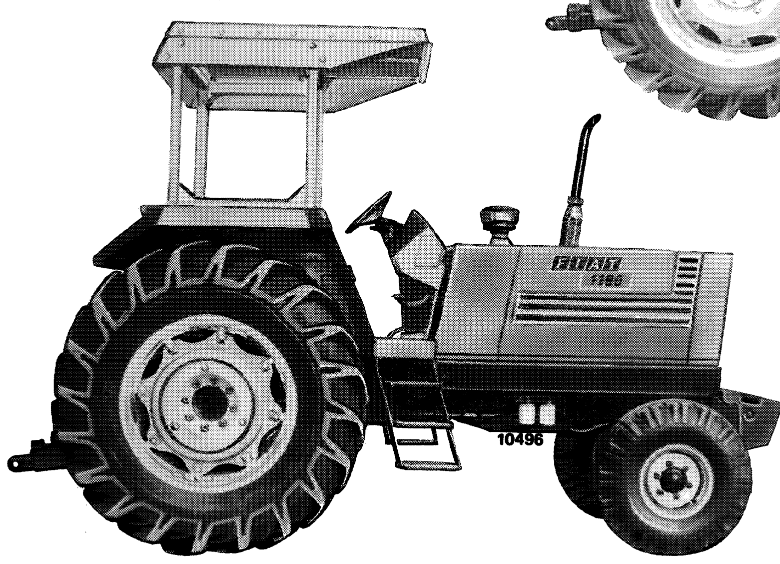
IDENTIFICATION DATA

Marketing code:				
— 2-wheel drive	1180	1380	1580	1880
— 4-wheel drive	1180 DT	1380 DT	1580 DT	1880 DT
Engineering code:				
— 12-speed, 2-wheel drive	658.100.000	659.100.000	660.200.000	660.100.000
— 12-speed, 2-wheel drive with reverser	658.100.000 var. 720.110	659.100.000 var. 720.110	660.200.000 var. 720.110	660.100.000 var. 720.110
— 12-speed, 2-wheel drive with high speed bevel drive	658.100.000 var. 720.320	659.100.000 var. 720.320	—	—
— 24-speed, 2-wheel drive	658.100.000 var. 720.111	659.100.000 var. 720.111	660.200.000 var. 720.111	660.100.000 var. 720.111
— 24-speed, 2-wheel drive with high speed bevel drive	658.100.000 var. 720.111 + var. 720.320	659.100.000 var. 720.111 + var. 720.320	—	—





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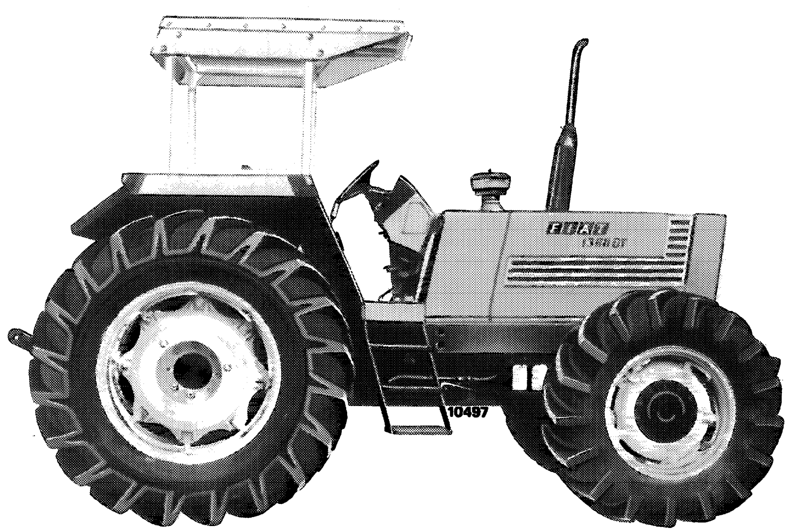
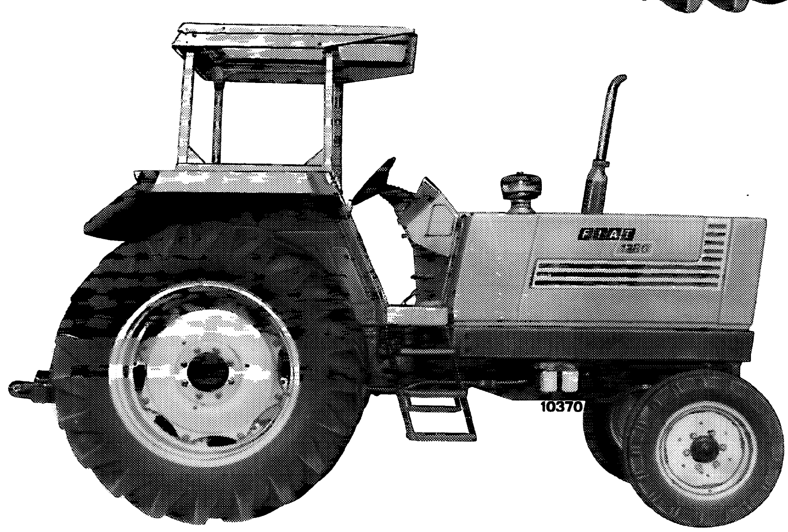
SPECIFICATION

	1180 1180 DT	1380 1380 DT	1580 1580 DT	1880 1880 DT
— 12-speed, 4-wheel drive	658.127.000	659.127.000	660.227.000	660.127.000
— 12-speed, 4-wheel drive with reverser	658.127.000 var. 720.110	659.127.000 var. 720.110	660.227.000 var. 720.110	660.127.000 var. 720.110
— 12-speed, 4-wheel drive with high speed bevel drive	658.127.000 var. 720.320	659.127.000 var. 720.320	—	—
— 24-speed, 4-wheel drive	658.127.000 var. 720.111	659.127.000 var. 720.111	660.227.000 var. 720.111	660.127.000 var. 720.111
— 24-speed, 4-wheel drive with high speed bevel drive	658.127.000 var. 720.111 +var.720.320	659.127.000 var. 720.111 +var.720.320	—	—





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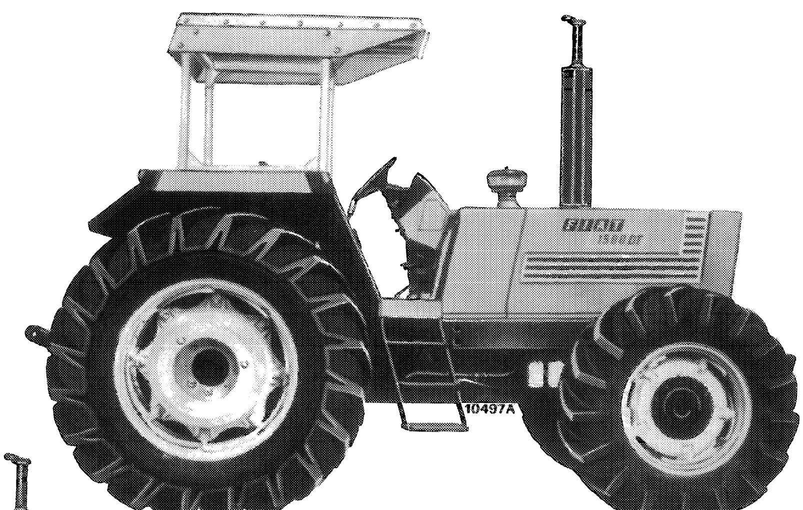
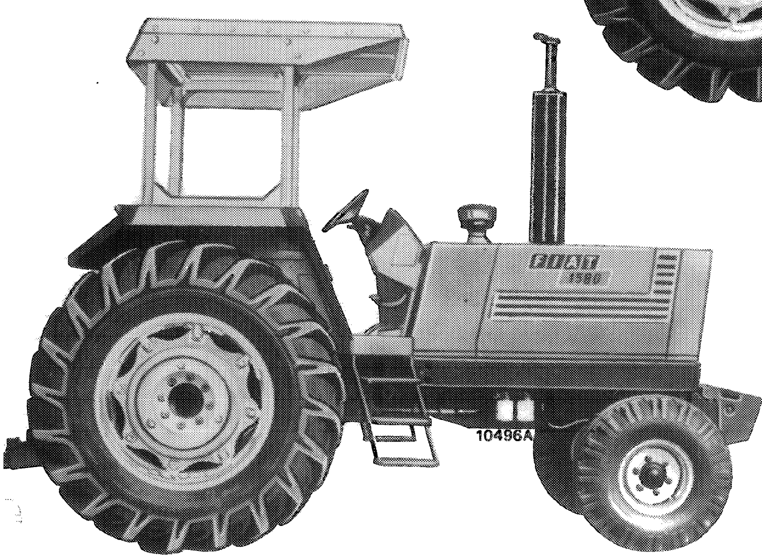
	1180 1180 DT	1380 1380 DT	1580 1580 DT	1880 1880 DT
Engine type (all versions)	FIAT Nat. aspirated 8065.04.217 (BOSCH pump)	FIAT Turbocharged	FIAT Nat. aspirated	FIAT Turbocharged
	FIAT Nat. aspirated 8065.04.317 (C.A.V. pump)	8065.24.000 (FIAT pump)	8365.05.500 (FIAT pump)	8365.25.500 (BOSCH pump)
WEIGHTS				
Operating weight (including lift, implement attachment, tow hook and ROPS cab)				
— 2-wheel drive ... kg	4450	5450	6000	6100
lb	9812	12,017	13,230	13,450
— 4-wheel drive ... kg	4850	6050	6450	6550
lb	10,694	13,340	14,222	14,443





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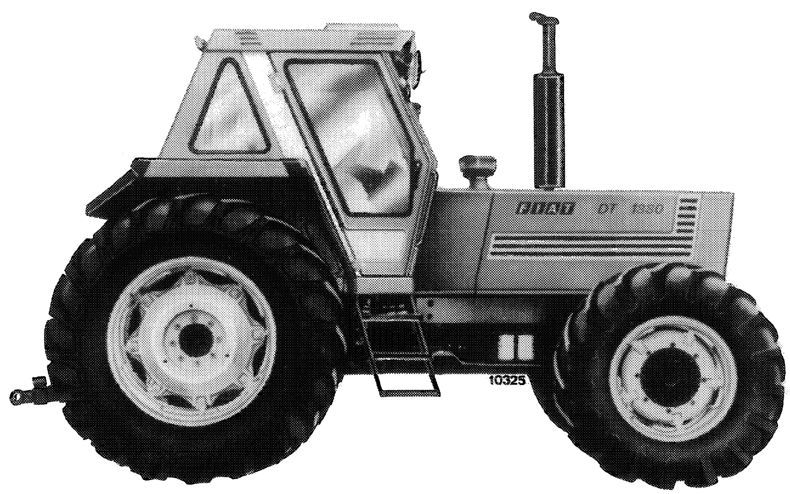
1180 H and 1180 DTH

1180 H and 1180 DTH are designed for heavy duty application and differ from **1180** and **1180 DT** in that they incorporate the following features:

- 2-wheel drive: 14″ master clutch, multi-disc oil bath PTO clutch and release brake installed in the transmission housing, hydraulic differential lock and hydraulic pump with flow control valve to control both PTO clutch and differential lock .... 658.100.000 var. 720.326

- 4-wheel drive: equipped with the same features as the 2-wheel drive plus front hydraulic differential lock .... 658.127.000 var. 720.326

Note - In this manual, whenever the code numbers **1180 H** and **1180 DTH** are not indicated for service operations, refer to service operations for models **1180** or **1180 DT.**



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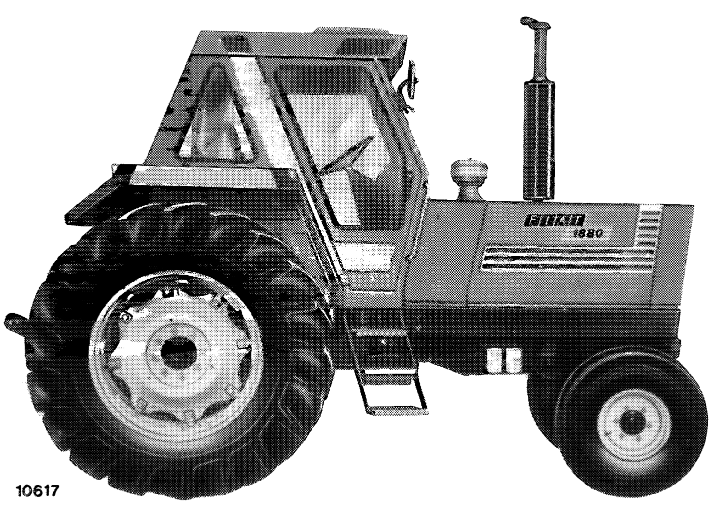

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ENGINE

	1180 1180 DT	1380 1380 DT	1580 1580 DT	1880 1880 DT
Type	Nat. aspirated	Turbocharged	Nat. aspirated	Turbocharged
Injection	direct			
No. of cylinders	6			
Cylinder sleeves	dry, press fit		wet	
Bore x stroke	103 × 110 mm (4.05 × 4.33 in)		115 × 130 mm (4.53 × 5.12 in)	
Displacement	5499 cm^3		8102 cm^3	
Compression ratio	17 to 1	15.7 to 1	17 to 1	15.5 to 1
Max. horsepower DGM/DIN, metric	84.6 kW (115 HP)	99.4 kW (135 HP)	114.1 kW (155 HP)	132.5 kW (180 HP)
Max. output speed	2500 rpm	2400 rpm	2100 rpm	2100 rpm
Max. torque speed	1400 rpm	1600 rpm	1400 rpm	1400 rpm
Main bearings	7			
Sump	iron			

VALVE GEAR

	1180 – 1380	1580 – 1880
VALVE GEAR	OH valves, push rod operated	
Inlet – Opens B.T.D.C.	3°	8°
Inlet – Closes A.B.D.C.	23°	60°
Exhaust – Opens B.B.D.C.	48°30′	60°
Exhaust – Closes A.T.D.C.	6°	8°
Valve clearance — for timing check	.45 mm (.018 in)	.41 mm (.016 in)
Normal – Inlet	.25 mm (.010 in)	.30 mm (.012 in)
Normal – Exhaust	.35 mm (.014 in)	.50 mm (.020 in)

FEED

	1180	1380	1580 – 1880
Air cleaner	dry, double cartridge, restriction indicator with centrifugal precleaner on hood		
Fuel filters (between pumps)	two, in line disposable paper cartridge (water separator with first filter)	two, in parallel, disposable paper cartridge (water separator integral with both filters) and bowl filter with mesh element on pump suction	two, in line, disposable paper cartridge (one paper, the other cloth) and bowl filter with mesh element on feed pump suction

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SPECIFICATION

	1180 1180 DT	1380 1380 DT	1580 1580 DT	1880 1880 DT
Feed pump	double diaphragm	incorporated in injection pump		
— drive	cam	—		
Injection pump	distributing rotor with integral governor and automatic advance	in-line, integral governor and aneroid	in-line, integral governor	in-line, integral governor and aneroid
— type: BOSCH	EP/VA6/11H 1275CR185-3 4746605	—	—	PES6MW100 4754679
— type: FIAT	—	PES 6A 90B: L4/214- 4747763	PES 6A 90B 410:L4/217- 4750345	—
— type: C.A.V.	DPA 3362F640- 4756102	—	—	—
Integral all-speed governor:				
— BOSCH	hydraulic	—	—	centrifugal
— FIAT	—	centrifugal		—
— C.A.V.	centrifugal	—	—	—
Integral automatic advance	hydraulic	—	—	—
Fixed advance, at spill cut-off B.T.D.C.				
— BOSCH	15° ± 1°	—	—	20° ± 30′ (1) 15° ± 30′ (2)
— FIAT	—	28° ± 1°	25° ± 30′	—
— C.A.V.	14° ± 1°	—	—	—
Injection pump lubrication	fuel	engine oil		

(1) Early model up to engine 750749.
(2) Late model from engine 750750.

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	1180 1180 DT	1380 1380 DT	1580 1580 DT	1880 1880 DT
Injector nozzles	3 orifice		4 orifice	
— injector type	see page 12, section 10			
— nozzle opening pressure	221 to 230 bar (225 to 235 kg/cm^2) (3200 to 3342 psi)		200 to 208 bar (204 to 212 kg/cm^2) (2959 to 3075 psi)	
Firing order	1 - 5 - 3 - 6 - 2 - 4			
Turbocharger, exhaust gas driven	—	GARRETT	—	HOLSET
— type	—	TO4B/Y7/ 0.84 E	—	3FJ-530 V/2 85 S4
— turbine and compressor shaft lubrication and cooling	—	engine oil	—	engine oil
LUBRICATION	force-feed, gear pump			
Pump drive	engine crankshaft			
Oil filters	gauze element on pump suction side and two full-flow cartridge on delivery side		gauze element on pump suction side and one full-flow cartridge on delivery side	
Pressure relief valve	integral, pump body		integral, filter body	
— oil pressure at governed speed	2.9 to 3.9 bar (3 to 4 kg/cm^2, 42 to 57 psi)		4.7 to 5.1 bar (4.8 to 5.2 kg/cm^2, 68 to 74 psi)	
Oil cooler	—	water flow		
— make	—	BEHR or LANGERER & REICH	BEHR or CHAUSSON	
COOLING SYSTEM	water, centrifugal pump			
Radiator	four row (early model) or five row (late model) vertical tubes			
Expansion tank	semi-transparent plastic			
Fan, installed on water pump pulley	suction, steel			
Temperature control	wax type thermostat			
TRACTOR METER	dashboard-mounted			
— drive	camshaft gear		camshaft drive gear	
— hourmeter activation speed	1800 rpm			
— meter to engine ratio	1 to 2			

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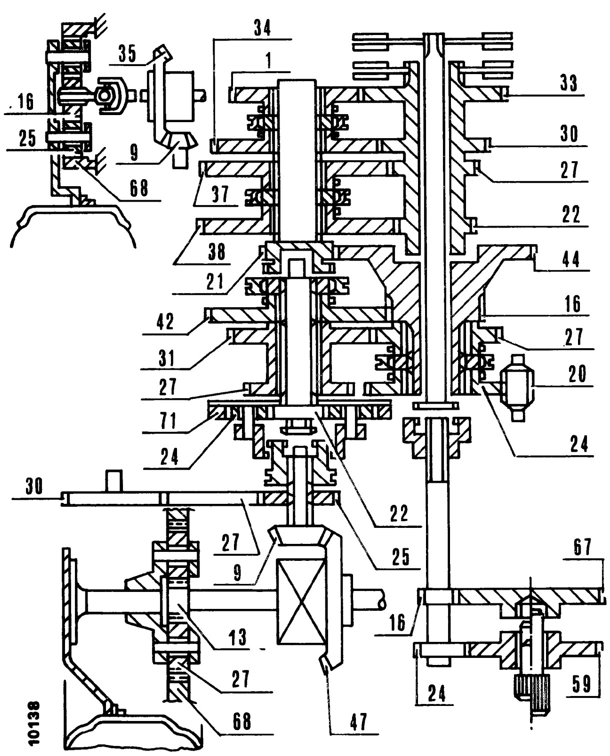
POWER TRAIN SCHEMATICS

1180-1180 DT (12-24 speed)



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Tractor speeds at maximum engine speed						
GEARS	1180-1180 DT (12-24 speed) with rear tyres:					
	16.9/14-38		18.4/15-38		23.1/18-34	
	KPH	MPH	KPH	MPH	KPH	MPH
1ª low splitter	.6	.37	.6	.37	.6	.37
2ª »	.7	.43	.7	.43	.7	.43
3ª »	.9	.56	.9	.56	.9	.56
4ª »	1.0	.62	1.1	.68	1.1	.68
1ª normal splitter	1.3	.81	1.3	.81	1.3	.81
2ª »	1.6	.99	1.7	1.06	1.7	1.06
3ª »	2.0	1.24	2.0	1.24	2.1	1.30
4ª »	2.4	1.49	2.5	1.55	2.5	1.55
1ª high splitter	3.2	1.99	3.2	1.99	3.3	2.05
2ª »	4.0	2.49	4.1	2.55	4.1	2.55
3ª »	4.8	2.98	4.9	3.04	5.0	3.11
4ª »	5.8	3.60	5.9	3.67	6.0	3.73
1ª low	2.4	1.49	2.5	1.55	2.5	1.55
2ª »	3.0	1.86	3.1	1.93	3.2	1.99
3ª »	3.7	2.30	3.8	2.36	3.8	2.36
4ª »	4.5	2.80	4.5	2.80	4.6	2.86
1ª normal	5.6	3.48	5.7	3.54	5.8	3.60
2ª »	7.0	4.35	7.1	4.41	7.3	4.54
3ª »	8.5	5.28	8.6	5.34	8.8	5.47
4ª »	10.2	6.34	10.4	6.46	10.6	6.59
1ª high	13.4	8.33	13.6	8.45	13.9	8.64
2ª »	16.9	10.56	17.2	10.69	17.5	10.87
3ª »	20.4	12.68	20.8	12.93	21.2	13.17
4ª »	24.6	15.29	25.1	15.60	25.6	15.90
1ª reverse splitter	1.3	.81	1.4	.87	1.4	.87
2ª »	1.7	1.06	1.7	1.06	1.7	1.06
3ª »	2.0	1.24	2.1	1.30	2.2	1.37
4ª »	2.5	1.55	2.5	1.55	2.5	1.55
1ª reverse	5.7	3.56	5.8	3.60	5.9	3.67
2ª »	7.1	4.41	7.3	4.54	7.4	4.60
3ª »	8.6	5.34	8.8	5.47	9.0	5.59
4ª »	10.4	6.46	10.6	6.59	10.8	6.71

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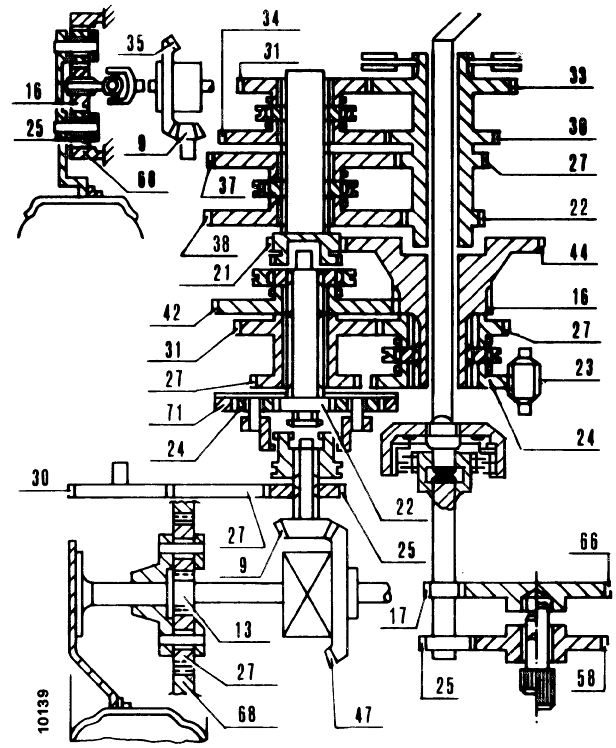
POWER TRAIN SCHEMATICS

1380-1380 DT (12-24 speed version)

Tractor speeds at maximum engine speed						
GEARS	1380-1380 DT (12-24 speed) with rear tyres:					
	20.8/38		18.4/15-38		23.1/18-34	
	KPH	MPH	KPH	MPH	KPH	MPH
1ª low splitter	.6	.37	.6	.37	.6	.37
2ª »	.8	.50	.7	.43	.7	.43
3ª »	.9	.56	.9	.56	.8	.50
4ª »	1.1	.68	1.0	.62	1.0	.62
1ª normal splitter	1.4	.87	1.3	.81	1.3	.81
2ª »	1.7	1.06	1.6	.99	1.6	.99
3ª »	2.1	1.30	2.0	1.24	1.9	1.18
4ª »	2.5	1.55	2.4	1.49	2.4	1.49
1ª high splitter	3.3	2.05	3.2	1.99	3.1	1.93
2ª »	4.2	2.61	4.0	2.49	3.9	2.42
3ª »	5.1	3.17	4.8	2.98	4.7	2.92
4ª »	6.1	3.79	5.8	3.60	5.7	3.54
1ª low	2.5	1.55	2.4	1.49	2.4	1.49
2ª »	3.2	1.99	3.1	1.93	3.0	1.86
3ª »	3.9	2.42	3.7	2.30	3.6	2.24
4ª »	4.7	2.92	4.5	2.80	4.4	2.73
1ª normal	5.8	3.60	5.5	3.42	5.4	3.36
2ª »	7.3	4.54	7.0	4.35	6.8	4.23
3ª »	8.9	5.53	8.5	5.28	8.3	5.16
4ª »	10.7	6.65	10.2	6.34	10.0	6.21
1ª high	14.0	8.70	13.4	8.33	13.1	8.14
2ª »	17.7	11.00	16.8	10.44	16.5	10.25
3ª »	21.4	13.30	20.4	12.68	19.9	12.37
4ª »	25.8	16.03	24.6	15.29	24.0	14.91
1ª reverse splitter	1.4	.87	1.3	.81	1.3	.81
2ª »	1.8	1.12	1.7	1.06	1.6	0.99
3ª »	2.1	1.30	2.0	1.24	2.0	1.24
4ª »	2.6	1.62	2.5	1.55	2.4	1.49
1ª reverse	5.9	3.67	5.7	3.54	5.4	3.36
2ª »	7.5	4.66	7.1	4.41	7.0	4.35
3ª »	9.0	5.59	8.6	5.34	8.4	5.22
4ª »	10.9	6.77	10.4	6.46	10.2	6.34



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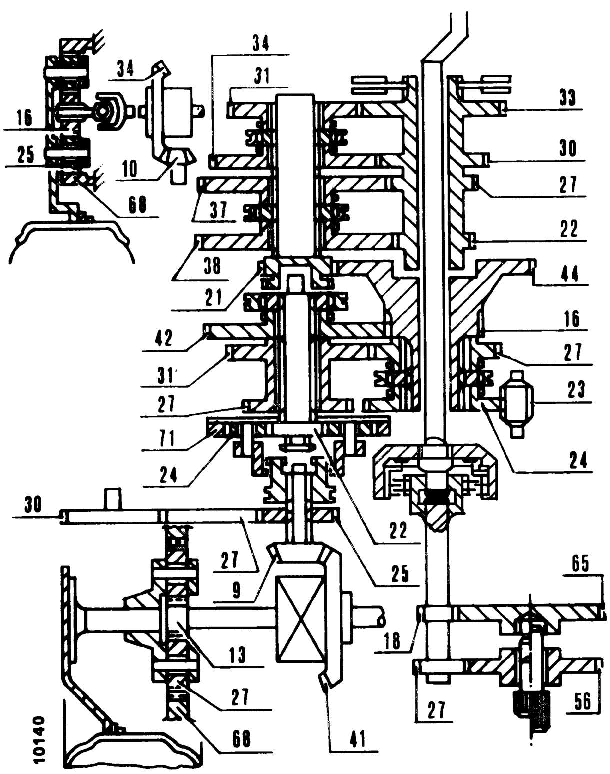
POWER TRAIN SCHEMATICS

1580-1580 DT (12-24 speed version)



Tractor speeds at maximum engine speed						
GEARS	1580-1580 DT (12-24 speed) with rear tyres:					
	23.1/18-34		18.4/15-38		20.8/38	
	KPH	MPH	KPH	MPH	KPH	MPH
1ª low splitter	.6	.37	.6	.37	.6	.37
2ª »	.7	.43	.7	.43	.7	.43
3ª »	.9	.56	.9	.56	.9	.56
4ª »	1.0	.62	1.1	.68	1.1	.68
1ª normal splitter	1.3	.81	1.3	.81	1.4	.87
2ª »	1.6	.99	1.7	1.06	1.7	1.06
3ª »	2.0	1.24	2.0	1.24	2.1	1.30
4ª »	2.4	1.49	2.4	1.49	2.5	1.55
1ª high splitter	3.1	1.93	3.2	1.99	3.3	2.05
2ª »	3.9	2.4	4.0	2.5	4.2	2.61
3ª »	4.7	2.92	4.8	2.98	5.1	3.17
4ª »	5.7	3.54	5.8	3.6	6.1	3.79
1ª low	2.4	1.49	2.4	1.49	2.6	1.62
2ª »	3.0	1.86	3.1	1.93	3.2	1.99
3ª »	3.6	2.24	3.7	2.30	3.9	2.42
4ª »	4.3	2.67	4.5	2.80	4.7	2.92
1ª normal	5.4	3.36	5.6	3.50	5.9	3.67
2ª »	6.8	4.23	7.0	4.35	7.4	4.60
3ª »	8.3	5.16	8.5	5.28	8.9	5.53
4ª »	10.0	6.21	10.2	6.34	10.8	6.71
1ª high	13.1	8.14	13.4	8.33	14.1	8.76
2ª »	16.5	10.25	16.9	10.50	17.7	11.00
3ª »	19.9	12.37	20.4	12.68	21.5	13.36
4ª »	24.0	14.91	24.6	15.29	25.9	16.09
1ª reverse splitter	1.5	.23	1.5	.93	1.6	.99
2ª »	1.7	1.06	1.7	1.06	1.8	1.12
3ª »	2.0	1.24	2.1	1.30	2.2	1.37
4ª »	2.4	1.49	2.5	1.55	2.6	1.62
1ª reverse	5.6	3.48	5.7	3.54	6.0	3.73
2ª »	7.0	4.35	7.2	4.47	7.5	4.66
3ª »	8.5	5.28	8.7	5.41	9.1	5.65
4ª »	10.2	6.34	10.5	6.52	11.0	6.84

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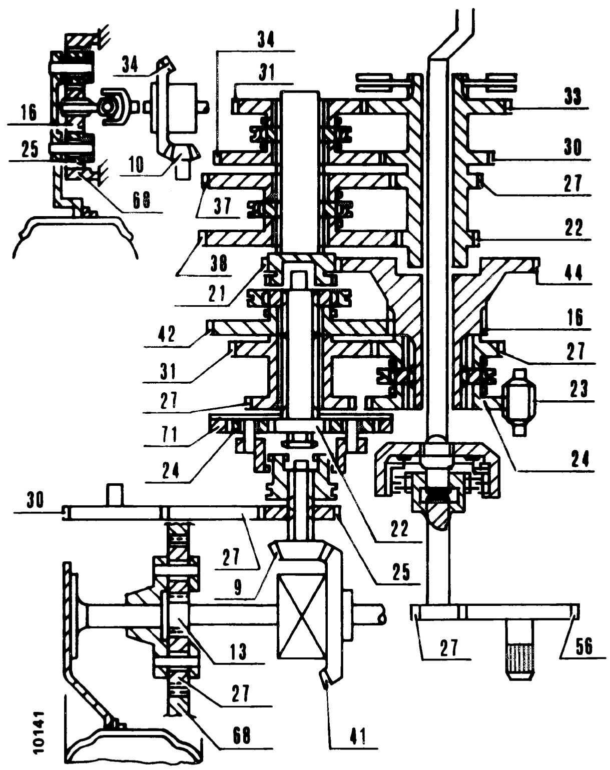
POWER TRAIN SCHEMATICS

1880-1880 DT (12-24 speed version)

Tractor speeds at maximum engine speed		
GEAR	1880-1880 DT (12-24 speed) with rear tyre:	
	20.8/38	
	KPH	MPH
1ª low splitter	.6	.37
2ª »	.7	.43
3ª »	.9	.56
4ª »	1.1	.68
1ª normal splitter	1.4	.87
2ª »	1.7	1.06
3ª »	2.1	1.30
4ª »	2.5	1.55
1ª high splitter	3.3	2.05
2ª »	4.2	2.61
3ª »	5.1	3.17
4ª »	6.1	3.79
1ª low	2.6	1.62
2ª »	3.2	1.99
3ª »	3.9	2.42
4ª »	4.7	2.92
1ª normal	5.9	3.67
2ª »	7.4	4.60
3ª »	8.9	5.53
4ª »	10.8	6.71
1ª high	14.1	8.76
2ª »	17.7	11.00
3ª »	21.5	13.36
4ª »	25.9	16.09
1ª reverse splitter	1.6	.99
2ª »	1.8	1.12
3ª »	2.2	1.37
4ª »	2.6	1.62
1ª reverse	6.0	3.73
2ª »	7.5	4.66
3ª »	9.1	5.65
4ª »	11.0	6.84



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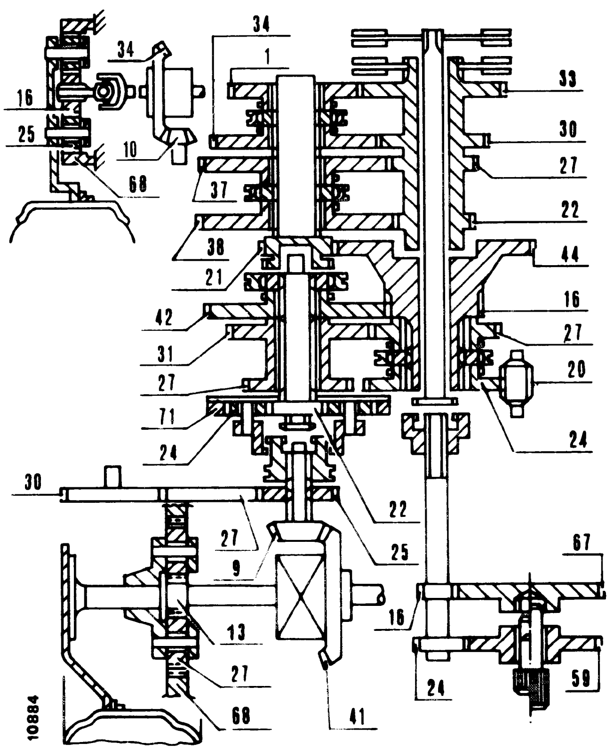
POWER TRAIN SCHEMATICS

1180-1180 DT with high speed bevel drive (12-24 speed version)



Tractor speeds at maximum engine speed						
GEARS	1180-1180 DT with high speed bevel drive (12-24 speed) with rear tyres:					
	16.9/14-38		18.4/15-38		23.1/18-34	
	KPH	MPH	KPH	MPH	KPH	MPH
1ª low splitter	.7	.43	.7	.43	.7	.43
2ª »	.8	.50	.8	.50	.9	.56
3ª »	1.0	.62	1.0	.62	1.1	.68
4ª »	1.2	.75	1.2	.75	1.3	.81
1ª normal splitter	1.5	.93	1.5	.93	1.6	.99
2ª »	1.9	1.18	1.9	1.18	2.0	1.24
3ª »	2.3	1.43	2.4	1.49	2.4	1.49
4ª »	2.8	1.74	2.8	1.74	2.9	1.80
1ª high splitter	3.6	2.24	3.7	2.30	3.8	2.36
2ª »	4.6	2.86	4.7	2.92	4.8	2.98
3ª »	5.5	3.4	5.7	3.54	5.8	3.60
4ª »	6.6	4.10	6.9	4.29	7.0	4.35
1ª low	2.8	1.74	2.9	1.80	2.9	1.80
2ª »	3.5	2.17	3.6	2.24	3.7	2.30
3ª »	4.2	2.61	4.4	2.73	4.5	2.80
4ª »	5.1	3.17	5.3	3.29	5.4	3.36
1ª normal	6.3	3.91	6.5	4.04	6.7	4.16
2ª »	8.0	4.97	8.3	5.16	8.5	5.28
3ª »	9.7	6.03	10.0	6.21	10.2	6.34
4ª »	11.7	7.27	12.0	7.46	12.3	7.64
1ª high	15.3	9.51	15.8	9.82	16.1	10.00
2ª »	19.3	11.99	19.9	12.37	20.4	12.68
3ª »	23.3	14.48	24.0	14.91	24.6	15.29
4ª »	28.1	17.46	29.0	18.02	29.7	18.46
1ª reverse splitter	1.5	.93	1.6	.99	1.6	.99
2ª »	1.9	1.18	2.0	1.24	2.0	1.24
3ª »	2.4	1.49	2.4	1.49	2.5	1.55
4ª »	2.8	1.74	2.9	1.80	3.0	1.86
1ª reverse	6.5	6.04	6.7	4.16	6.8	4.23
2ª »	8.2	5.10	8.4	5.22	8.6	5.34
3ª »	9.9	6.15	10.2	6.34	10.4	6.46
4ª »	11.9	7.39	12.3	7.64	12.6	7.83

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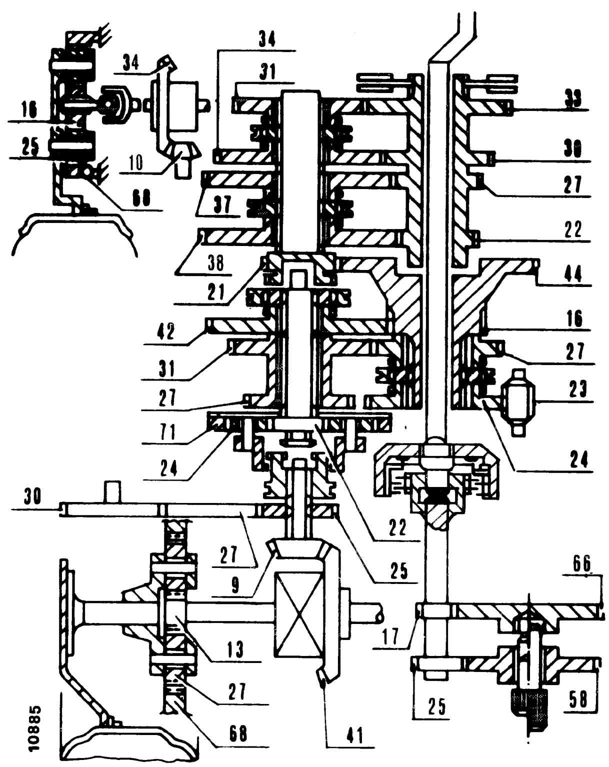
POWER TRAIN SCHEMATICS
1380-1380 DT with high speed bevel drive (12-24 speed version)

Tractor speeds at maximum engine speed						
GEARS	1380-1380 DT with high speed bevel gear (12-24 speed) with rear tyres:					
	18.4/15-38		23.1/18-34		20.8/38	
	KPH	MPH	KPH	MPH	KPH	MPH
1ª low splitter	.6	.37	.7	.43	.7	.43
2ª »	.8	.50	.8	.50	.8	.50
3ª »	1.0	.62	1.0	.62	1.0	.62
4ª »	1.2	.75	1.2	.75	1.2	.75
1ª normal splitter	1.5	.93	1.5	.93	1.5	.93
2ª »	1.9	1.18	1.9	1.18	1.9	1.18
3ª »	2.3	1.43	2.3	1.43	2.4	1.49
4ª »	2.7	1.68	2.8	1.74	2.8	1.74
1ª high splitter	3.6	2.24	3.7	2.30	3.7	2.30
2ª »	4.5	2.80	4.6	2.86	4.7	2.92
3ª »	5.5	3.42	5.6	3.48	5.7	3.54
4ª »	6.6	4.10	6.7	4.16	6.9	4.29
1ª low	2.7	1.68	2.8	1.74	2.9	1.80
2ª »	3.5	2.17	3.5	2.17	3.6	2.24
3ª »	4.2	2.61	4.3	2.67	4.4	2.73
4ª »	5.1	3.17	5.2	3.23	5.3	3.29
1ª normal	6.3	3.91	6.4	3.98	6.6	4.10
2ª »	7.9	4.91	8.1	5.03	8.3	5.16
3ª »	9.6	5.97	9.8	6.09	10.0	6.21
4ª »	11.6	7.21	11.8	7.33	12.1	7.52
1ª high	15.1	9.38	15.5	9.63	15.8	9.82
2ª »	19.1	11.87	19.6	12.18	19.9	12.37
3ª »	23.1	14.35	23.6	14.67	24.0	14.91
4ª »	27.8	17.27	28.5	17.71	29.0	18.02
1ª reverse splitter	1.5	.93	1.5	.93	1.6	.99
2ª »	1.9	1.18	2.0	1.24	2.0	1.24
3ª »	2.3	1.43	2.4	1.49	2.4	1.49
4ª »	2.8	1.74	2.9	1.80	2.9	1.80
1ª reverse	6.4	3.98	6.6	4.10	6.7	4.16
2ª »	8.1	5.03	8.3	5.16	8.4	5.22
3ª »	9.8	6.09	10.0	6.21	10.2	6.34
4ª »	11.8	7.33	12.1	7.52	12.3	7.64



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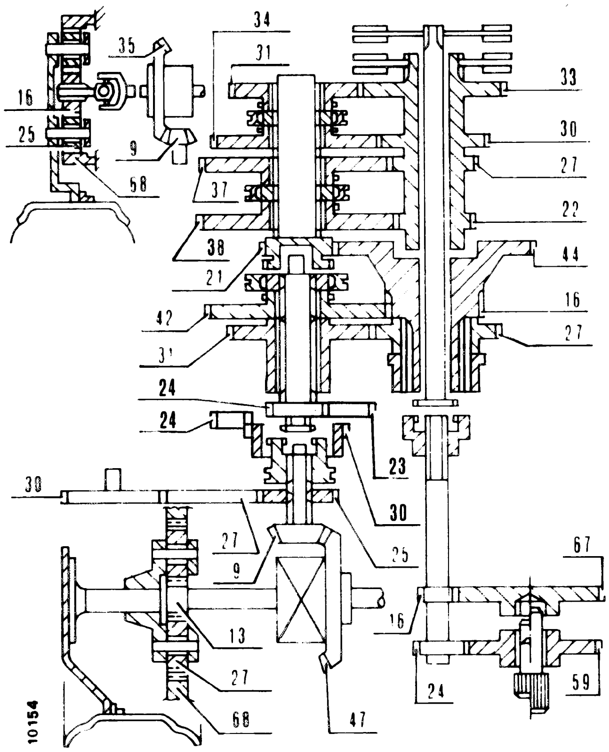
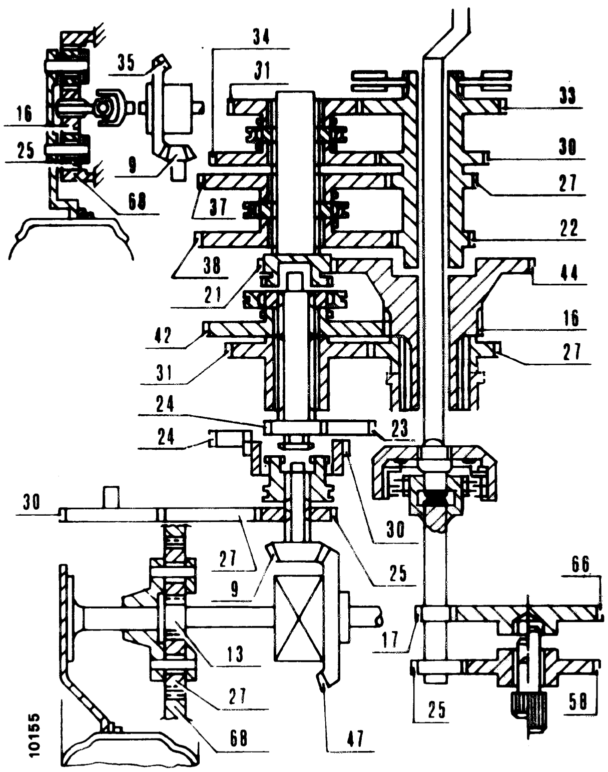
POWER TRAIN SCHEMATICS

1180-1180 DT with mechanical reverser



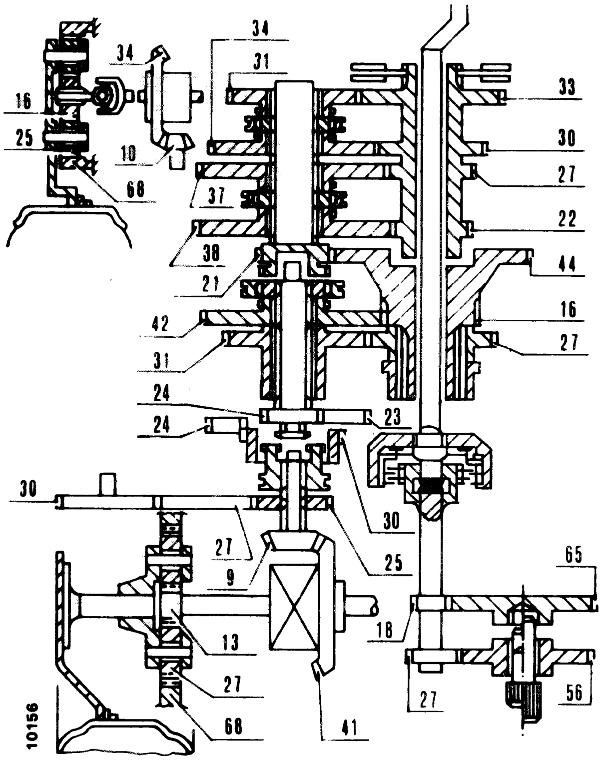
1380-1380 DT with mechanical reverser



Tractor speeds at maximum engine speeds												
GEARS	1180-1180 DT with rear tyres:						1380-1380 DT with rear tyres:					
	16.9/14-38		18.4/15-38		23.1/18-34		20.8/38		18.4/15-38		23.1/18-34	
	KPH	MPH	KPH	MPH	KPH	MPH	KPH	MPH	KPH	MPH	KPH	MPH
1ª low	2.4	1.49	2.5	1.55	2.5	1.55	2.5	1.55	2.4	1.49	2.4	1.49
2ª »	3.0	1.86	3.1	1.93	3.2	1.99	3.2	1.99	3.1	1.93	3.0	1.86
3ª »	3.7	2.30	3.8	2.36	3.8	2.36	3.9	2.42	3.7	2.30	3.6	2.24
4ª »	4.5	2.80	4.5	2.80	4.6	2.86	4.7	2.92	4.5	2.80	4.4	2.73
1ª normal	5.6	3.48	5.7	3.54	5.8	3.60	5.8	3.60	5.5	3.42	5.4	3.36
2ª »	7.0	3.35	7.1	4.41	7.3	4.54	7.3	4.54	7.0	3.35	6.8	4.23
3ª »	8.5	5.28	8.6	5.34	8.8	5.47	8.9	5.53	8.5	5.28	8.3	5.16
4ª »	10.2	6.34	10.4	6.46	10.6	6.59	10.7	6.65	10.2	6.34	10.0	6.21
1ª high	13.4	8.33	13.6	8.45	13.9	8.64	14.0	8.70	13.4	8.33	13.1	8.14
2ª »	16.9	10.50	17.2	10.69	17.5	10.87	17.7	11.00	16.8	10.44	16.5	10.25
3ª »	20.4	12.68	20.8	12.93	21.2	13.17	21.4	13.30	20.4	12.68	19.9	12.37
4ª »	24.6	15.30	25.1	15.60	25.6	15.91	25.8	16.03	24.6	15.29	24.0	14.91
1ª low reverse	1.9	1.18	2.0	1.24	2.0	1.24	2.0	1.24	1.9	1.18	1.9	1.18
2ª »	2.4	1.49	2.5	1.55	2.5	1.55	2.6	1.62	2.4	1.49	2.4	1.49
3ª »	2.9	1.80	3.0	1.86	3.1	1.93	3.1	1.93	3.0	1.86	2.9	1.80
4ª »	3.5	2.17	3.6	2.24	3.7	2.30	3.7	2.30	3.6	2.24	3.5	2.17
1ª normal reverse	4.4	2.73	4.5	2.80	4.6	2.86	4.7	2.92	4.4	2.73	4.3	2.67
2ª »	5.6	3.78	5.7	3.54	5.8	3.60	5.9	3.67	5.6	3.78	5.5	3.42
3ª »	6.8	4.23	6.9	4.29	7.0	4.35	7.1	4.41	6.8	4.23	6.6	4.10
4ª »	8.2	5.10	8.3	5.16	8.5	5.28	8.6	5.34	8.2	5.10	8.0	4.97
1ª high reverse	10.7	6.65	10.9	6.77	11.1	6.90	11.2	6.96	10.7	6.65	10.4	6.46
2ª »	13.5	8.39	13.8	8.58	14.0	8.70	14.1	8.76	13.5	8.39	13.2	8.20
3ª »	16.3	10.13	16.6	10.32	16.9	10.50	17.1	10.63	16.3	10.13	15.9	9.88
4ª »	19.7	12.24	20.1	12.49	20.4	12.68	20.6	12.80	19.6	12.18	19.2	11.93

POWER TRAIN SCHEMATICS

1580-1580 DT with mechanical reverser



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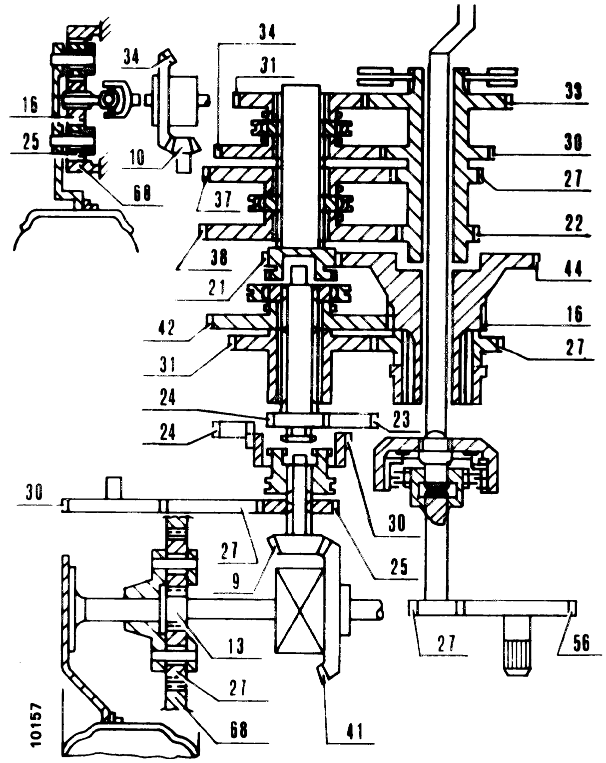
1880-1880 DT with mechanical reverser



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Tractor speeds at maximum engine speeds								
GEARS	1580-1580 DT with rear tyres:						1880-1880 DT with rear tyres:	
	23.1/18-34		18.4/15-38		20.8/38		20.8/38	
	KPH	MPH	KPH	MPH	KPH	MPH	KPH	MPH
1ª low	2.4	1.49	2.4	1.49	2.6	1.62	2.6	1.62
2ª »	3.0	1.86	3.1	1.93	3.2	1.99	3.2	1.99
3ª »	3.6	2.24	3.7	2.30	3.9	2.42	3.9	2.42
4ª »	4.3	2.67	4.5	2.80	4.7	2.92	4.7	2.92
1ª normal	5.4	3.36	5.6	3.48	5.9	3.67	5.9	3.67
2ª »	6.8	4.23	7.0	3.35	7.4	4.60	7.4	4.60
3ª »	8.3	5.16	8.5	5.28	8.9	5.53	8.9	5.53
4ª »	10.0	6.21	10.2	6.34	10.8	6.71	10.8	6.71
1ª high	13.1	8.14	13.4	8.33	14.1	8.76	14.1	8.76
2ª »	16.5	10.25	16.9	10.50	17.7	11.00	17.7	11.00
3ª »	19.9	12.37	20.4	12.68	21.5	13.36	21.5	13.36
4ª »	24.0	14.91	24.6	15.29	25.9	16.09	25.9	16.09
1ª low reverse	1.9	1.18	1.9	1.18	2.0	1.24	2.0	1.24
2ª »	2.4	1.49	2.5	1.55	2.6	1.62	2.6	1.62
3ª »	2.9	1.80	3.0	1.86	3.1	1.93	3.1	1.93
4ª »	3.5	2.17	3.6	2.24	3.8	2.36	3.8	2.36
1ª normal reverse	4.3	2.67	4.6	2.86	4.7	2.92	4.7	2.92
2ª »	5.5	3.42	5.6	3.48	5.9	3.67	5.9	3.67
3ª »	6.6	4.10	6.8	4.23	7.1	4.41	7.1	4.41
4ª »	8.0	4.97	8.2	5.10	8.6	5.34	8.6	5.34
1ª high reverse	10.5	6.52	10.7	6.65	11.3	7.02	11.3	7.02
2ª »	13.3	8.26	13.5	8.39	14.2	8.82	14.2	8.82
3ª »	15.9	9.88	16.3	10.13	17.2	10.69	17.2	10.69
4ª »	19.2	11.93	17.7	11.00	20.7	12.86	20.7	12.86

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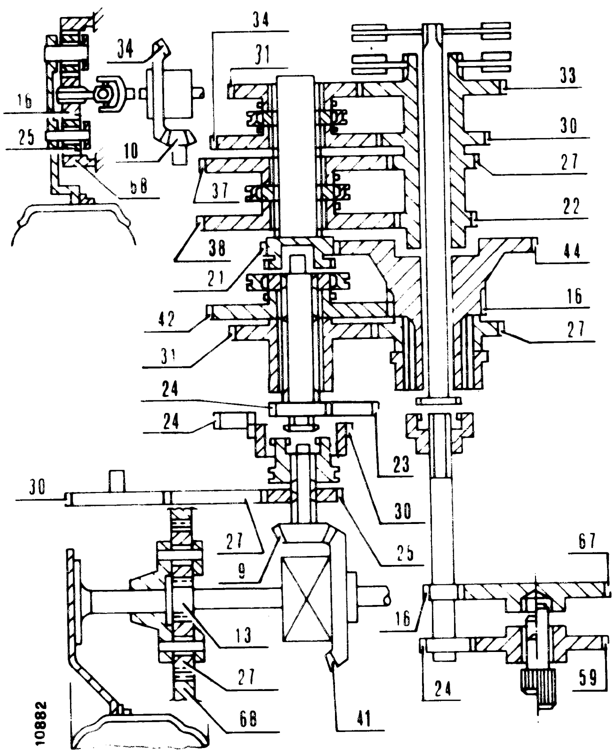
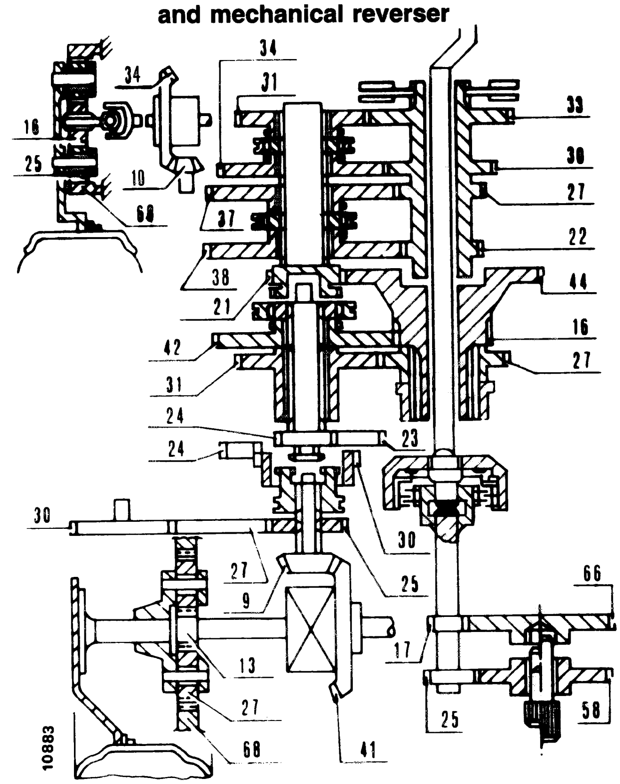
POWER TRAIN SCHEMATICS

1180-1180 DT with high speed bevel drive and mechanical reverser



1380-1380 DT with high speed bevel drive and mechanical reverser



Tractor speeds at maximum engine speeds												
	1180-1180 DT with rear tyres:						1380-1380 DT with rear tyres:					
GEARS	16.9/14-38		18.4/15-38		23.1/18-34		18.4/15-38		23.1/18-34		20.8/38	
	KPH	MPH	KPH	MPH	KPH	MPH	KPH	MPH	KPH	MPH	KPH	MPH
1ª low	2.8	1.74	2.9	1.80	2.9	1.80	2.7	1.68	2.8	1.74	2.9	1.80
2ª »	3.5	2.17	3.6	2.24	3.7	2.30	3.5	2.17	3.5	2.17	3.6	2.24
3ª »	4.2	2.61	4.4	2.73	4.5	2.80	4.2	2.61	4.3	2.67	4.4	2.73
4ª »	5.1	3.17	5.3	3.29	5.4	3.36	5.1	3.17	5.2	3.23	5.3	3.29
1ª normal	6.3	3.91	6.5	4.04	6.7	4.16	6.3	3.91	6.4	3.98	6.6	4.10
2ª »	8.0	4.97	8.3	5.16	8.5	5.28	7.9	4.91	8.1	5.03	8.3	5.16
3ª »	9.7	6.03	10.0	6.21	10.2	6.34	9.6	5.97	9.8	6.09	10.0	6.21
4ª »	11.7	7.27	12.0	7.46	12.3	7.64	11.6	7.21	11.8	7.33	12.1	7.52
1ªᵉ high	15.3	9.51	15.8	9.82	16.1	10.00	15.1	9.38	15.5	9.63	15.8	9.82
2ª »	19.3	11.99	19.9	12.37	20.4	12.68	19.1	11.87	19.6	12.18	19.9	12.37
3ª »	23.3	14.48	24.0	14.91	24.6	15.29	23.1	14.35	23.6	14.67	24.0	14.91
4ª »	28.1	17.46	29.0	18.02	29.7	18.46	27.8	17.27	28.5	17.71	29.0	18.02
1ª low reverse	2.2	1.37	2.3	1.43	2.3	1.43	2.2	1.37	2.3	1.43	2.3	1.43
2ª »	2.8	1.74	2.9	1.80	3.0	1.86	2.8	1.74	2.8	1.74	2.9	1.80
3ª »	3.4	2.11	3.5	2.17	3.6	2.24	3.4	2.11	3.4	2.11	3.5	2.17
4ª »	4.1	2.55	4.2	2.61	4.3	2.67	4.0	2.49	4.1	2.55	4.2	2.61
1ª normal reverse	5.1	3.17	5.2	3.23	5.4	3.36	5.0	3.11	5.2	3.23	5.2	3.23
2ª »	6.4	3.98	6.6	4.10	6.8	4.23	6.3	3.91	6.5	4.04	6.6	4.10
3ª »	7.7	4.78	8.0	4.97	8.2	5.10	7.7	4.78	7.9	4.91	8.0	4.97
4ª »	9.3	5.78	9.6	5.97	9.9	6.15	9.2	5.72	9.5	5.90	9.6	5.97
1ª high reverse	12.2	7.58	12.5	7.77	12.8	7.95	12.1	7.52	12.4	7.71	12.6	7.83
2ª »	15.4	9.57	15.9	9.88	16.3	10.13	15.3	9.51	15.6	9.69	15.9	9.88
3ª »	18.6	11.56	19.2	11.93	19.7	12.24	18.4	11.43	18.9	11.74	19.2	11.93
4ª »	22.5	13.98	23.2	14.42	23.7	14.73	22.3	13.86	22.8	14.17	23.2	14.42

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POWER TRAIN

Clutch (1180)

Type ....LUK or FERODO 12″
Construction ....twin, dry single plate
Controls:
— transmission .... pedal
— P.T.O. ....hand lever
Plate material:
— transmission ....Cerametallic compound
— P.T.O. ....organic compound.

Master clutch (1180 H, 1380, 1580 and 1880)

Type ....FERODO or LUK 14″
Construction .... dry single plate
Material ....Cerametallic compound
Control .... mechanical, pedal

P.T.O. clutch (1180 H, 1380, 1580 and 1880)

Type ....multidisc, oil bath
Location .... rear transmission housing
Operation ....hydraulic

Transmission

Type .... constant mesh, full-synchromesh
Gear ....helical
Splitter ....pinion drive
Forward ....3 ranges; 12 forward speeds
Reverse ....1 range; 4 reverse speeds

Crawler version:

Crawler type ....planetary
Forward ....24 speeds
Reverse ....8 speeds

Mechanical reverser version:

Forward ....12 speeds
Reverse ....12 speeds
Transmission and splitter controls separate levers below steering wheel.
Crawler or reverse control handle on left of operator's

Bevel drive .... Standard

High speed ....optional for 1180 and 1380
— Maximum speed .... 30 km/h (18.63 mph)

Differential

Type ....4 pinion
Mechanical lock .... pedal operated

Hydraulic differential lock. Standard for 1180, optional for 1380, 1580 and 1880.
Type ....multidisc hydraulic clutch
Drive ....oil bath P.T.O. clutch pump equipped
....with flow divider valve
Early model differential lock control independent pedal
Late model differential lock release ....brake pedals

Final drives

Type .... planetary, 3 planets

BRAKES

Service

Oil-bath, disc, inboard, hydrostatic, divided circuit, separate pedals.

Parking and emergency

Twin oil-bath discs, fully independent, acting on bevel pinion shaft, hand lever operated.

STEERING

Type ....hydrostatic power steering
Circuit ....independent
Steerage joints ....sealed for life
Turning radius (no brakes):

	mm	ft.	in.
— 1180	4600	15	1
— 1180 DT, front wheel drive in	6600	21	8
— 1380	4600	15	1
— 1380 DT, front wheel drive in	6600	21	8
— 1580	5100	16	9
— 1580 DT, front wheel drive in	7300	23	11½
— 1880	5100	16	9
— 1880 DT, front wheel drive in	7300	23	11½

FRONT AXLE (1180, 1380, 1580 and 1880)

Type ....inverted U, telescoping, center pivoting
Track adjustment ....sliding axle ends
Track widths .... 6 off

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FRONT WHEEL DRIVE (1180 DT, 1180 DTH, 1380 DT, 1580 DT and 1880 DT)

Type .... full floating, center pivotting
Shaft (no U-joints) and
articulations .... coaxial, on tractor centerline
Differential .... 2 pinion
Final drives .... planetary

Hydraulic differential lock

Standard for 1180 DTH, optional for 1380 DT, 1580 DT and 1880 DT equipped with rear hydraulic differential lock.
Type .... oil bath hydraulic clutch
Control .... rear differential lock pedal
Supply .... rear differential lock pump

Track widths

— disc/rim/hub repositioning (1180DT and 1180DTH) .... 5 off
— spiral adjustment (RAIL rims, 1380, 1580 and 1880) .... 5 off

REAR WHEELS

Track widths:

— disc/rim/hub repositioning (1180, 1180 H, 1380 and 1580) .... 8 off
— spiral adjustment (RAIL rims, 1380, 1580 and 1880) .... 7 off

POWER TAKE-OFF

Type .... fully independent

540 - 1000 rpm .... 1180, 1180H, 1380 and 1580
1000 rpm 1880

Shaft	540 rpm	1⅜" - 6 spline or 1¾" - 6 spline
	1000 rpm	1⅜" - 21 spline

Control:

— single, dry plate mechanical clutch (1180);
— multiplate, oil bath, hydraulic clutch (1180 H, 1380, 1580, and 1880).

Speed selection (540 or 1000 rpm) automatic upon changing splined ends (1180, 1180 H, 1380, and 1580).

Engine speed with P.T.O. at standard speeds:

— 1180	540 rpm	2260
	1000 rpm	2460
— 1180 H	540 rpm	2260
	1000 rpm	2460
— 1380	540 rpm	2095
	1000 rpm	2320
— 1580	540 rpm	1950
	1000 rpm	2075
— 1880	1000 rpm	2075

Rotation (tractor viewed from rear).

LIFT

Type .... hydraulic, draught, position
.... and draft/position control.
Draft control .... lower links (sensing bar)
Control from operator's seat .... two independent
.... levers, sensitivity
.... control knob
Control from ground .... outer lever
Main cylinder .... single-acting
Auxiliary outer cylinder
linked to LH lift arm .... standard for .... 1580 and
.... 1880, optional for 1180,
.... 1180 H and 1380
Response rate .... automatically controlled
Pump .... gear, engine valve gear driven
Hydraulic fluid .... real transmission oil
Design lifting capacity max. lift
travel max load capacity .... see section 50, pages 1, 5 and 6
Three point linkage .... category 2 or 3
Lower links .... quick connect or telescoping
Sway restrictors .... check links or check blocks

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Remote control valves

Number .... one (standard)
Type .... single and double-acting, convertible
Lift circuit pressure relief valve .... integral
Optional 2 or 3 remote control valves type:
— single and double-acting, convertible;
— single and double-acting, convertible with automatic hydraulic kick-off;
— double-acting with float position and automatic hydraulic kick-off.
Tractor brake pedal controlled hydraulic
trailer brake remote control valve ....optional

TOWING ATTACHMENTS

Rear:

— swinging drawbar;
— tow hook, adjustable for height;
— rockinger hook.

Front:

— fixed pull hook, not useable with front ballast.

BALLASTING

Front axle

Four plates of 48 kg (106 lb.) each located inside front axle support. Total weight: 192 kg (430 lb.).
Moreover:
— 1180, 1180H and 1380: 10 cast iron plates with handles, 40 kg (88 lb.) each, and 130 kg (287 lb.) support. Total weight: 530 kg (1169 lb.).
— 1580 and 1880: 10 or 20 cast iron plates with handles, 40 kg (88 lb.) each, and 130 kg (287 lb.) or 255 kg (562 lb.) support. Total weight: 530 kg (1169 lb.) or 1055 kg (2326 lb.).

Rear wheels

— 1180, 1180H, 1380 and 1580: 2, 4 or 6 wheel disc mounted cast iron rings, 65 kg (143 lb.) each.Total weight: 130 kg (287 lb.), 260 kg (573 lb.) or 390 kg (860 lb.).
— 1380, 1580 and 1880: cast iron discs (spiral adjustment rim), 300 kg (661 lb.) each. Total weight: 600 kg (1323 lb.). Optional 2, 4 or 6 cast iron rings. Total weight: 730 kg (1610 lb.), 860 kg (1896 lb.) or 990 kg (2183 lb.).

BODY

Platform and operator's seat

Platform fully suspended, mounted on 6 rubber buffers. Integral structure including footboards, fenders and dashboard. Compact, rigid, vibration-free. Provision for ROP frame or cab installation.
Fuel tank located behind operator's seat, boxed between fenders. Two auxiliary fuel tanks, standard on 1180 1180 H and 1380, located below platform and laterally on rear transmission.
Operator's seat de luxe, padded with tiltable arm rests. Parallelogram suspension, hydraulic dampers, manual adjustment for height and ride.
Steering wheel height and take adjustable.

Dashboard

16-function instrument panel plus control board.

Hood

Fully enclosed, in 6 sections.
LH panels ....access to oil filters, dipstick
RH panels ....access to fuel filters, feed pump,
....................................injection pump, power steering
.... fluid reservoir, lift filters

Cab

Visibility .... all round
Accessibility ....on both sides
Rear window ....adjustable
Sunblind .... curtain
Safety hatch .... in cab roof
Heating and ventilation .... 3-speed fan
Air conditioner ....optional
Protection .... fully insulated against dust, cold, heat, etc.
Windshield washer and wiper .... standard
Accessories ....bottle holder, courtesy light and provision for stereo radio/tape player.

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ELECTRICAL SYSTEM

Voltage .... 12 V
Alternator .... 55 A, with integral electronic voltage regulator
Type .... MARELLI AA 125-14 V-55 A
Starter .... MARELLI MT 68 LB or BOSCH JD 12
Battery location .... in front or radiator
Capacity
— 1180-1380 .... 132 Ah or 140 Ah
— 1580-1880 .... 176 Ah

Lighting

Headlamps .... twin, high and asymmetric low beam (45/40 W bulb)
Front lamps
— parking .... 5 W
— turn signal .... 21 W

Tail lamps
— parking .... 5 W
— turn signal .... 21 W
— stop .... 21 W
— number plate .... LH rear parking bulb

Instruments and accessories

Instrument panel .... 16-function (see section 60, page 9)
Control board .... (see section 60, page 9)
Floodlight .... 35 W
Rear power point .... DIN, 7-pole
Dash power point .... Single-pole, control board-mounted
Horn .... push
Cold starting .... thermostarter or start-pilot
Cigar lighter .... dash-mounted
Fuses .... up to 12 (see Section 60, page 9)
Hazard warning lights .... tractor and trailers

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TYRE SIZES

	1180	1380	1580	1880
Front	7.50-20	9.00-16	11.00-16	11.00-16
	9.00-16	10.00-16	—	—
	10.00-16	11.00-16	—	—
Rear	16.9/14-38	18.4/15-38	18.4/15-38	20.8/38
	18.4/15-38	23.1/18-34	23.1/18-34	—
	23.1/18-34	20.8/38	20.8/38	—
	23.1/18-30	—	—	—

	1180 DT	1380 DT	1580 DT	1880 DT
Front	13.6/12-28 (1)	14.9/13-28 (4) (5)	14.9/13-28 (7) (8)	16.9/14-28 (10)
	14.9/13-28 (2) (3)	16.9/14-28 (6)	16.9/14-28 (9)	—
Rear	16.9/14-38 (1)	18.4/15-38 (4)	18.4/15-38 (7)	20.8/38 (10)
	—	23.1/18-34 (5)	23.1/18-34 (8)	—
	18.4/15-38 (2)	20.8/38 (6)	20.8/38 (9)	—
	23.1/18-34 (3)	—	—	—

(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) Tyre matching references.

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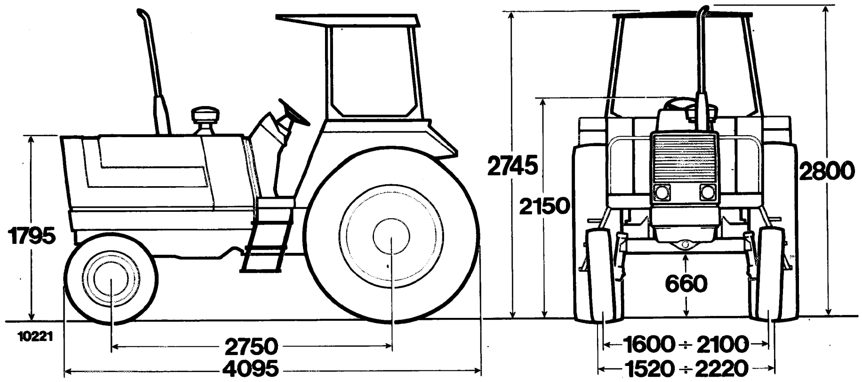
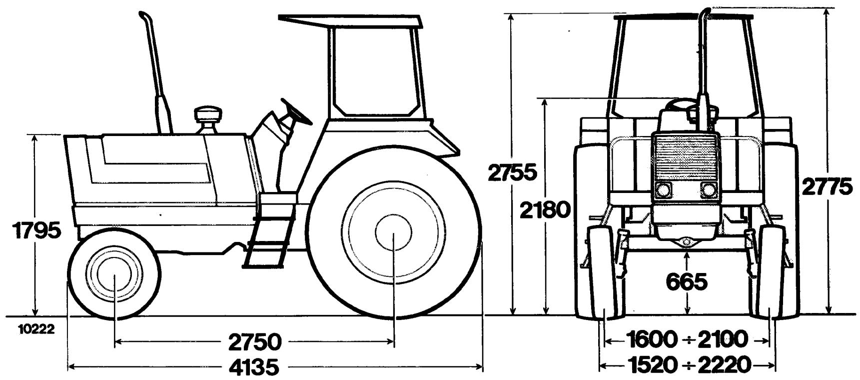
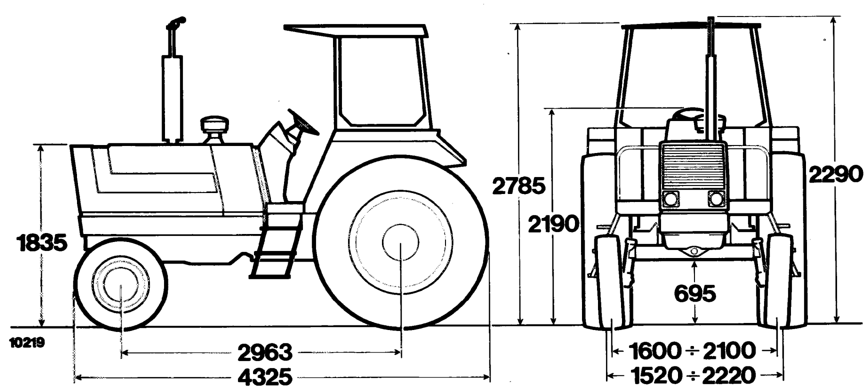


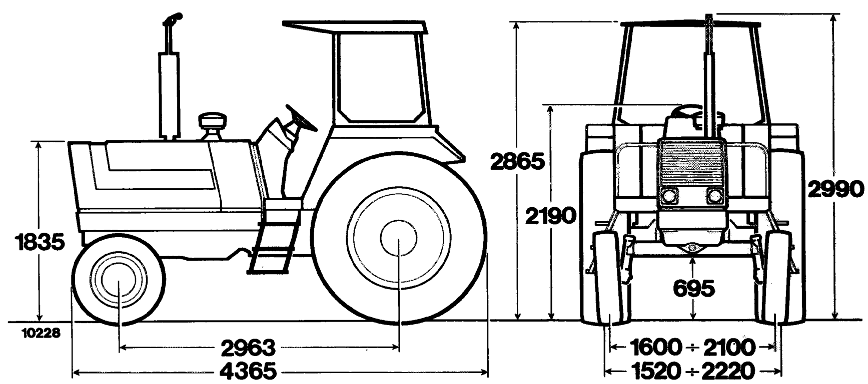
1180
(7.50-20 front and
16.9/14-38 rear tyres).



1380
(9.00-16 front and
18.4/15-38 rear tyres).



1580
(11.00-16 front and
18.4/15-38 rear tyres).



1880
(11.00-16 front and
20.8/38 rear tyres).

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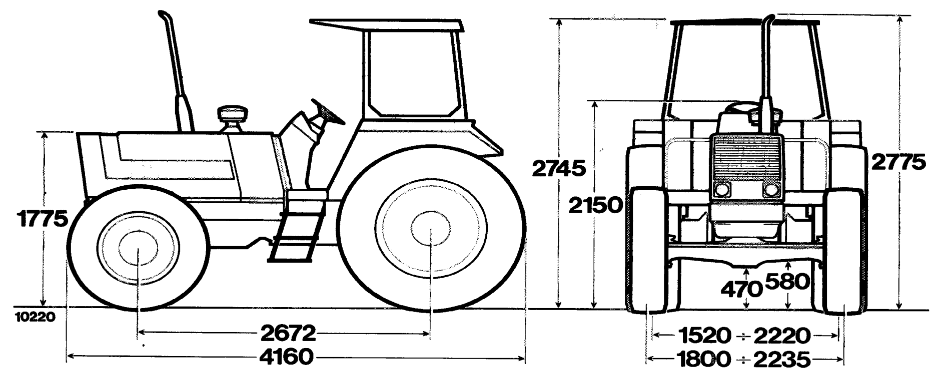
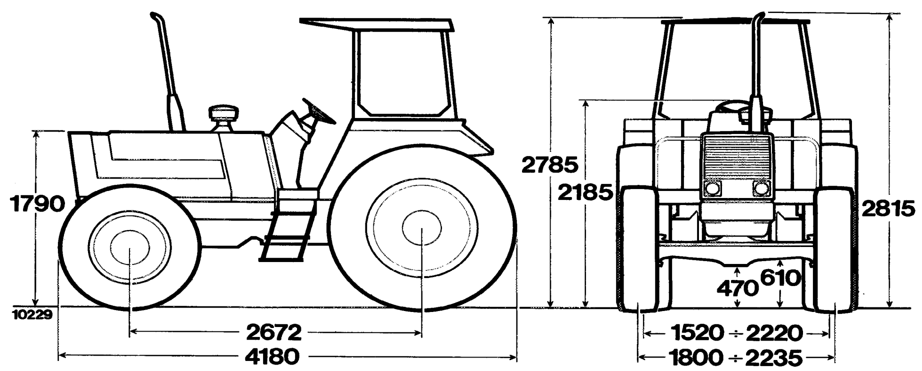
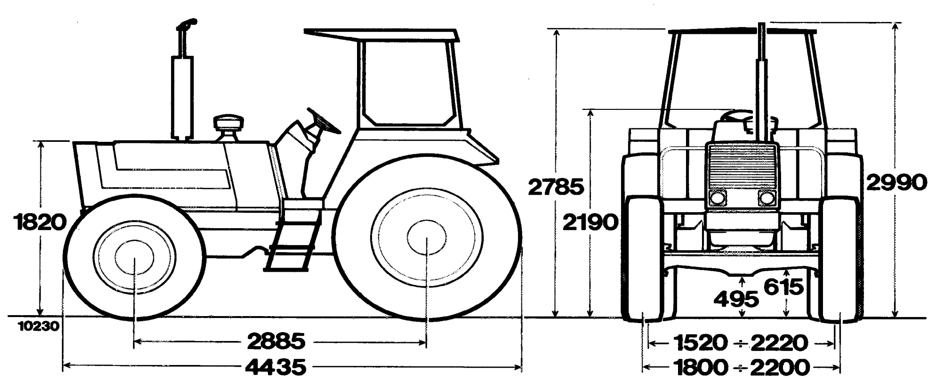
1180 DT
(13.6/12.28 front and
16.9/14-38 rear tyres).

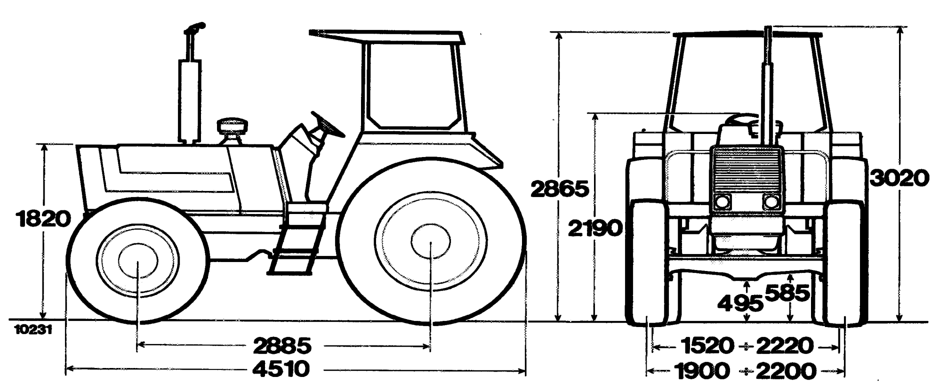




1580 DT
(14.9/13-28 front and
18.4/15-38 rear tyres).

1380 DT
(14.9/13-28 front and
18.4/15-38 rear tyres).





1880 DT
(16.9/14-28 front and
20.8/38 rear tyres).

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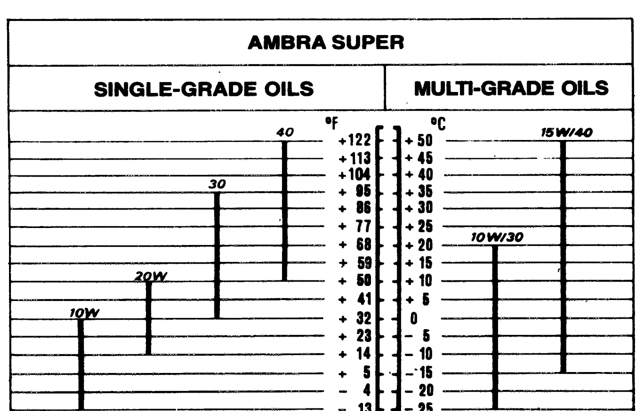
CAPACITIES

DESCRIPTION	FIAT RECOMMENDED PRODUCT	FLUID												INTERNATIONAL DESIGNATION
		CAPACITY												
		1180-1180 DT			1380-1380 DT			1580-1580 DT			1880-1880 DT			
		litres	pints	kg	litres	pints	kg	litres	pints	kg	litres	pints	kg	
Sump and filter oil	AMBRA SUPER	15.2	26¾	13.7	15.2 (4)	26¾	13.7 (4)	18.3	32¼	16.5	18.3	32¼	16.5	Diesel engine oil to MIL-L-2104C and API CD service
Sump oil		13.3	23½	12	13.3 (4)	23½	12 (4)	16.6	29¼	15	16.6	29¼	15	
Power steering fluid	TUTELA MULTI F	2.4	4¼	2.2	2.4	4¼	2.2	2.4	4¼	2.2	2.4	4¼	2.2	Transmission, drive train, oil-bath brakes and lift oil to Massey Ferguson MF1135 and Ford M2C 86A
Sensing bar support oil		1.2	2	1.1	1.2	2	1.1	1.2	2	1.1	1.2	2	1.1	
Transmission oil		18.3	32¼	16.5	18.3	32¼	16.5	18.3	32¼	16.5	18.3	32¼	16.5	
Live front axle oil:														
– axle casing		10.8	19	9.7	10.8	19	9.7	10.8	19	9.7	10.8	19	9.7	
– final drives (each)		2.1	3¾	1.9	2.1	3¾	1.9	2.1	3¾	1.9	2.1	3¾	1.9	
Rear transmission (bevel drive, final drives, brakes) and lift oil:														
– 2-wheel drive		54.2	95½	48.8 (1)	56.4	99½	50.8 (1)	56.4	99½	50.8 (1)	57.5	101½	51.8 (1)	
– 4-wheel drive		55.5	97¾	50 (2)	58.9	103¾	53 (2)	58.9	103¾	53 (2)	60	105¾	54 (2)	
Brake fluid	AMBRA SUPER 10W	.48	¾	.45	.48	¾	.45	.48	¾	.45	.48	¾	.45	MIL-L-2105C and API CD - SAE 10W oil
Front hub grease	TUTELA G9	—	—	—	—	—	—	—	—	—	—	—	—	Lithium-calcium grease to NLGI No. 2
Lubricator grease		—	—	—	—	—	—	—	—	—	—	—	—	
Coolant (incl. expansion tank):	Water and "PARAFLU 11" (5)													
– without cab		17	30	—	17	30	—	27	47½	—	27	47½	—	
– with cab		19	33½	—	19	33½	—	28.5	50¼	—	28.5	50¼	—	
Windshield washer fluid	Water and DP1 (6)	2	3½	—	2	3½	—	2	3½	—	2	3½	—	
Fuel (diesel oil)														
– Main tank	Diesel oil	180	317	—	180	317	—	180	317	—	180	317	—	
– Auxiliary tank		100 (3)	176	—	100 (3)	176	—	100	176	—	100	176	—	

(1) For rear hydraulic differential lock increase normal capacity by .5 kg (.55 dm³ or 1 Pint).
(2) For front and rear hydraulic differential lock increase normal capacity by 1.5 kg (1.7 dm³ or 2¼ Pint).
(3) Optional.
(4) Also applicable to 1280 and 1280DT.
(5) See section 106, page 3.
(6) Detergent fluid effective down to –10°C in 50-50 mixture. For temperatures below –10°C use DP1 without water.

SAE VISCOSITY VERSUS OUTDOOR TEMPERATURE FOR OIL GRADE SELECTION



11798

NOTE
For utilization of existing OLIOFIAT stocks adhere to the following:
- AMBRA SUPER may be used to top up AMBRA and AGERTER, and vice versa;
- On supercharged engines **never top up** AMBRA SUPER with AMBRA;
- **Never top up** transmission with oil-bath brakes employing TUTELA MULTI F oil with AMBRA;
- Transmission with oil-bath brakes employing AF87S oil may be topped up with TUTELA MULTI F and vice versa.

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ENGINE BLOCK - CYLINDER HEAD

	1180 - 1380		1580 - 1880	
	mm	in	mm	in
Engine Block				
Cylinder bore diameter in engine block ...	106.890 to 106.940	4.2083 to 4.2102	122.000 to 122.030	4.303 to 4.8043
Liner O.D.	107.020 to 107.050	4.2127 to 4.2145	121.920 to 121.970	4.799 to 4.8019
Liner fit in block				
— 1180-1380 (interference)	.080 to .160	.0031 to .0062	—	—
— 1580-1880 (clearance)	—	—	.030 to .110	.0012 to .0043
Liner O.D. oversize	.2	.008	—	—
Liner bore diameter	103.000 to 103.018([1])	4.0551 to 4.0558([1])	115.000 to 115.022	4.527 to 4.528
Maximum ovality and taper due to wear([2])	.12	.0047	.15	.006
Liner bore undersize	.2-.4-.6-.8	.008-.016-.024-.032	.6	.024
Liner protrusion	—	—	.13 to .17	.005 to .006
Maximum liner misalignment	—	—	.04	.0015
Liner protrusion shim thickness	—	—	3.09-3.11-3.13-3.15-3.17-3.19-3.21-3.23-3.25-3.27-3.29-3.31-3.33-3.35-3.37-3.39-3.41-3.43-3.45-3.47-3.49	.1216-.1224-.1232-.1240-.1248-.1256-.1264-.1272-.1288-.1296-.1304-.1312-.1320-.1328-.1336-.1344-.1352-.1360-.1368-.1376-.1384
Housing bore diameter				
— Camshaft bushes (1180-1380)				
– Front	55.280 to 55.305	2.176 to 2.177	—	—
– Front intermediate	54.780 to 54.805	2.1567 to 2.1577	—	—
– Rear intermediate	54.280 to 54.305	2.1370 to 2.1380	—	—
– Rear	53.780 to 53.805	2.1173 to 2.1183	—	—
— Camshaft bushes (1580-1880)				
– Front (1 off)	—	—	52.000 to 52.025	2.040 to 2.048
– Intermediate (5 off)	—	—	52.000 to 52.025	2.040 to 2.048
– Rear (1 off)	—	—	52.000 to 52.025	2.040 to 2.048
Tappet housing bore diameter	15.000 to 15.018	.5905 to .5912	27.000 to 27.033	1.0630 to 1.0643
Tappet oversize	.1-.2-.3	.004-.008-.012	.2-.4	.008-.016
Main bearing housing bore diameter	80.587 to 80.607	3.1727 to 3.1735	84.206 to 84.226	3.3151 to 3.159
Cylinder Head				
Valve guide housing bore diameter in head	13.966 to 13.983	.5498 to .5505	14.000 to 14.018	.5512 to .5519
Valve guide oversize	.2	.008	.04-.2-.4	.0016-.008-.016
Valve seat dimensions	See page 3, Section 101			
Valve stand-in				
— Inlet valve	.7 to 1.1	.028 to .0433	.1 to .5	.004 to .020
— Maximum stand-in	1.4	.055	.7	.028
— Exhaust valve	.7 to 1.1	.028 to .0433	.4 to .8	.016 to .031
— Maximum stand-in	1.4	.055	1	.039

(follows)

([1]) After reaming in position. Liners may be finished to .1 mm or .004 in oversize in production, in which case they are matched to corresponding oversize pistons.
([2]) Measurement to be carried out over the swept area both parallel and at right angles to engine centreline.

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ENGINE BLOCK - CYLINDER HEAD

(continued)

	1180 - 1380		1580 - 1880	
	mm	in	mm	in
Injector stand-out (1180-1380)	1 to 1.5	.04 to .06	—	—
— Maximum stand-out	1.8	.07	—	—
Injector stand-out (1580):				
— WEBER EPPZ 10F1-771252 injector	—	—	2.7 to 3.5	.11 to .14
— Maximum stand-out	—	—	3.8	.15
— OMAP EPPZ 70 F15-771236 or BOSCH EPPZ 50 F15-771403 injector	—	—	2.2 to 3	.09 to .12
— Maximum stand-out	—	—	3.3	.13
Injector stand-out (1880):				
— WEBER EPPZ 10 FV4-4750415 injector	—	—	2.7 to 3.5	.11 to .14
— Maximum stand-out	—	—	3.8	.15
— BOSCH EPPZ 50FV6-4750504 injector	—	—	2.1 to 2.9	.08 to .114
— Maximum stand-out	—	—	3.2	.12
Cylinder head height	92	3.62	99.78 to 100.00	3.93 to 3.94
Maximum head dressing allowance	0.5	.02	0.5	.02

CRANK GEAR

	1180 - 1380		1580 - 1880	
	mm	in	mm	in
Crankshaft - Bearings				
Main journal diameter	76.187 to 76.200([1])	2.9995 to 3.0000([1])	79.782 to 79.800([1])	3.1410 to 3.1417([1])
Main journal undersize	.254-.508-.762-1.016 mm (.010-.020-.030-.040 in)			
Main bearing wall thickness	2.162 to 2.172	.0851 to .0855	2.168 to 2.178	.0853 to .0857
Main bearing undersize	.254-.508-.762-1.016 mm (.010-.020-.030-.040 in)			
Main journal clearance in bearings	.063 to .096	.0025 to .0038	.070 to .108	.003 to .004
— maximum wear clearance	.180 mm (.0071 in)			
Crankpin diameter	58.730 to 58.743([1])	2.3122 to 2.3127([1])	72.482 to 72.500([1])	2.8536 to 2.8543([1])
Crankpin undersize	.254-.508-.762-1.016 mm (.010-.020-.030-.040 in)			
Big end bearing wall thickness	1.805 to 1.815	.0710 to .0714	2.060 to 2.070	.0811 to .0815
Big end bearing undersize	.254-.508-.762-1.016 mm (.010-.020-.030-.040 in)			
Crankpin clearance in big end bearing	.060 to .080	.0024 to .0031	.058 to .111	.0023 to .0044
— maximum wear clearance	.180 mm (.0071 in)			

(follows)

([1]) .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)

	1180 - 1380		1580 - 1880	
	mm	in	mm	in
Crankshaft thrust washer thickness	3.378 to 3.429	.1330 to .1350	3.378 to 3.429	.1330 to .1350
Thrust washer oversize	.127	.005	.127-.254-.508	.005-.010-.020
Width of main bearing housing over thrust washers	31.766 to 31.918	1.2506 to 1.2566	49.756 to 49.932	1.9589 to 1.9657
Length of corresponding main journal	32.000 to 32.100	1.2598 to 1.2638	50.000 to 50.050	1.9685 to 1.9704
Crankshaft end float	.082 to .334	.0032 to .0131	.068 to .294	.003 to .0116
— maximum wear end float	.40 mm (.016 in)			
Maximum main journal and crankpin ovality or taper after grinding	.01	.0004	.01	.0004
Maximum main journal and crankpin ovality or taper due to wear	.05	.0020	.05	.0020
Maximum main journal misalignment with crankshaft resting on end journals	.10	.0040	.10	.0040
Maximum crankpin misalignment relative to main journals (in either direction)	.25	.0100	.25	.0100
Maximum tolerance on distance from outer crankpin edge to crankshaft centreline	±.10	±.0040	±.10	±.0040
Maximum crankshaft flange run-out with stylus in A, page 2, section 103, over:				
— 1180-1380 = 108 mm (4.25 in) diameter T.I.R.	.025	.0010	—	—
— 1580-1880 = 119 mm (4.68 in) diameter, T.I.R.	—	—	.025	.0010
Maximum flywheel seat eccentricity relative to main journals (see B, page 2, section 103), T.I.R.	.04	.0016	.04	.0016
Connecting Rods				
Small end bore diameter	37.877 to 37.916	1.4912 to 1.4928	45.946 to 45.971	1.8089 to 1.8099
Small end bushing ID	37.979 to 38.017	1.4952 to 1.4967	46.069 to 46.120	1.8137 to 1.8157
Bushing interference fit in small end	.063 to .140	.0025 to .0055	.098 to .174	.0038 to .0068
Small end bushing fitted ID	34.005 to 34.012	1.3388 to 1.3391	42.025 to 42.035	1.6545 to 1.6549

(follows)

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CRANK GEAR

(continued)

	1180 - 1380		1580 - 1880	
	mm	in	mm	in
Big end bore diameter	62.408 to 62.420	2.4570 to 2.4575	76.698 to 76.713	3.0196 to 3.0202
Maximum connecting rod axis misalignment at 125 mm (5 in)	±.07	±.0027	±.05	±.0020
Maximum connecting rod weight difference over a complete set of the same engine	25 grams (1 oz)		20 grams (⅔ oz)	
Pistons				
Piston diameter: 1180-1380 50 mm (2 in) from base of skirt, at right angles to pin; 1580 30 mm (1 ¼ in) from base of skirt, at right angles to pin; 1880 35 mm (1 ⅜ in) from base of skirt, at right angles to pin				
— modd. 1180-1380	102.813 to 102.825	4.0477 to 4.0482	—	—
— mod. 1580	—	—	114.833 to 114.847	4.5210 to 4.5219
— mod. 1880	—	—	114.813 to 114.827	4.5202 to 4.5207
Piston clearance in liner				
— modd. 1180-1380	.175 to .205	.0069 to .0081	—	—
— mod. 1580	—	—	.153 to .189	.006 to .007
— mod. 1880	—	—	.173 to .209	.007 to .008
Max wear clearance	.30	.012	.30	.012
Piston oversize range	.2-.4-.6-.8	.008-.016-.024-.032	.6	.024
Piston pin diameter	33.983 to 33.990	1.3379 to 1.3382	42.000 to 42.006	1.6535 to 1.6538
Piston pin housing bore in piston	33.993 to 34.000	1.3383 to 1.3386	42.018 to 42.024	1.6542 to 1.6544
Piston pin clearance in piston	.003 to .017	.0061 to .0007	.012 to .024	.0005 to .0010
Piston pin oversize	.2-.5	.008-.020	.2	.008
Piston pin clearance in small end bush	.015 to .029	.0006 to .0011	.019 to .035	.0007 to .0014
— maximum wear clearance	.06	.0024	.10	.004
Maximum weight difference over a complete set of pistons	20 grams (⅔ oz)		15 grams (½ oz)	

(follows)

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CRANK GEAR

(continued)

	1180 - 1380		1580 - 1880	
	mm	in	mm	in
Piston ring clearance in groove				
— Top 1180-1380	.090 to .122	.003 to .005	—	—
— Top 1580	—	—	.090 to .122	.003 to .005
— Top 1880	—	—	.062 to .112	.002 to .004
— 2nd 1180-1380	.050 to .082	.002 to .008	—	—
— 2nd 1580	—	—	.050 to .082	.002 to .003
— 2nd 1880	—	—	.060 to .092	.002 to .004
— 3rd	.040 to .072	.001 to .003	.040 to .072	.001 to .003
Maximum wear clearance				
— Top 1180, 1380 and 1580	.50	.02	.50	.02
— Top 1880	—	—	.45	.018
— 2nd 1180, 1380 and 1580	.20	.008	.20	.008
— 2nd 1880	—	—	.20	.008
— 3rd	.20	.008	.20	.008
Piston ring gap				
— Top 1180	.35 to .55	.014 to .022	—	—
— Top 1380	.25 to .50	.010 to .020	—	—
— Top 1580	—	—	.40 to .60	.016 to .024
— Top 1880	—	—	.40 to .65	.016 to .025
— 2nd	.30 to .50	.012 to .020	.40 to .60	.016 to .024
— 3rd	.30 to .45	.012 to .018	.30 to .45	.012 to .018
Maximum wear gap	1.20	.047	1.20	.047

VALVE GEAR

	1180 - 1380		1580 - 1880	
	mm	in	mm	in
Valve Timing Gears				
Timing gear backlash	.08	.0031	.08	.0031
Idler gear jack shaft diameter	31.975 to 32.000	1.2588 to 1.2598	49.975 to 50.000	1.9675 to 1.9685
Idler gear bush fitted I.D. after reaming	32.050 to 32.075	1.2618 to 1.2628	50.050 to 50.075	1.9705 to 1.9714
Jack shaft journal clearance in bush	.050 to .100	.0020 to .0040	.050 to .100	.0020 to .0040
— maximum wear clearance	.15	.0060	.15	.0060
Bush interference fit in idler gear	.063 to .140	.0025 to .0055	.046 to .142	.002 to .006

(follows)

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VALVE GEAR

(continued)

	1180 - 1380		1580 - 1880	
	mm	in	mm	in
Steering and lift pump gear shaft diameter	36.975 to 37.000	1.4557 to 1.4567	36.975 to 37.000	1.4557 to 1.4567
Bush fitted I.D. after reaming	37.050 to 37.075	1.4586 to 1.4596	37.050 to 37.075	1.4586 to 1.4596
Shaft clearance in bushes	.050 to .100	.0020 to .0040	.050 to .100	.0020 to .0040
Bush interference fit in housing	.063 to .140	.0025 to .0055	.063 to .140	.0025 to .0055
Pump drive shim thickness	1.45 to 1.50	.057 to .059	—	—
Pump drive gear thrust washer thickness	—	—	3.93 to 4.00	.155 to .157
Camshaft				
Camshaft bush O.D.				
1180 - 1380				
— Front	55.375 to 55.430	2.180 to 2.182	—	—
— Front intermediate	54.875 to 54.930	2.1604 to 2.1626	—	—
— Rear intermediate	54.375 to 54,430	2.1407 to 2.1429	—	—
— Rear	53.875 to 53.930	2.1211 to 2.1232	—	—
1580-1880				
— Front (1 off)	—	—	52.098 to 52.136	2.0511 to 2.0526
— Intermediate (5 off)	—	—	52.098 to 52.136	2.0511 to 2.0526
— Rear (1 off)	—	—	52.098 to 52.136	2.0511 to 2.0526
Bush interference fit in housing	.070 to .150	.0027 to .0060	.073 to .136	.003 to .005
Camshaft bush fitted I.D. after reaming				
1180-1380				
— Front	51.580 to 51.630	2.030 to 2.032	—	—
— Front intermediate	51.080 to 51.130	2.6110 to 2.0130	—	—
— Rear intermediate	50.580 to 50.630	1.9913 to 1.9933	—	—
— Rear	50.080 to 50.130	1.9716 to 1.9736	—	—
1580-1880				
— Front (1 off)	—	—	49.055 to 49.090	1.9313 to 1.9327
— Intermediate (5 off)	—	—	49.055 to 49.090	1.9313 to 1.9327
— Rear (1 off)	—	—	49.055 to 49.090	1.9313 to 1.9327
Camshaft journal diameter				
1180-1380				
— Front	51.470 to 51.500	2.0264 to 2.0275	—	—
— Front intermediate	50.970 to 51.000	2.0067 to 2.0079	—	—
— Rear intermediate	50.470 to 50.500	1.9870 to 1.9882	—	—
— Rear	49.970 to 50.000	1.9673 to 1.9685	—	—
1580-1880				
— Front (1 off)	—	—	48.950 to 48.975	1.9272 to 1.9281
— Intermediate (5 off)	—	—	48.950 to 48.975	1.9272 to 1.9281
— Rear (1 off)	—	—	48.950 to 48.975	1.9272 to 1.9281
Camshaft journal clearance in bush	.080 to .160	.0030 to .0063	.080 to .140	.003 to .005
Maximum wear clearance	.20	.008	.20	.008
Camshaft end float (thrust plate to associated seat in camshaft)	.070 to .220	.0027 to .0087	.060 to .110	.002 to .004

(follows)

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VALVE GEAR

(continued)

	1180 - 1380		1580 - 1880	
	mm	in	mm	in
Tappets				
Tappet O.D.	14.950 to 14.970	.5886 to .5894	26.939 to 26.960	1.0606 to 1.0614
Tappet clearance in housing on engine block	.030 to .068	.0012 to .0027	.040 to .094	.0016 to .0037
— maximum wear clearance	.15	.006	.15	.006
Tappet oversize	.1-.2-.3	.004-.008-.012	.3-.4-.5	.012-.016-.020
Rockers				
Rocker bush O.D.	21.006 to 21.031	.8270 to .8280	—	—
Rocker bore diameter	20.939 to 20.972	.8244 to .7902	—	—
Bush interference fit in rocker	.034 to .092	.0013 to .0036	—	—
Rocker bracket bore diameter	18.016 to 18.034	.7093 to .7100	21.050 to 21.080	.8287 to .8299
Rocker shaft diameter	17.982 to 18.000	.7079 to .7087	21.015 to 21.036	.8200 to .8200
Rocker shaft clearance in bracket	.016 to .052	.0006 to .0020	.014 to .065	.0005 to .0026
— maximum wear clearance	.15	.006	.15	.006
Rocker spacer spring length				
— free	59.5	2.3425	96	3.7795
— under				
– 46 to 52 N, 4.7 to 5.3 kg (10.4 to 11.7 lb)	44	1.7323	—	—
– 25 N, 2.5 kg (5.5 lb)	—	—	62	2.4409
Valves, guides and springs				
Valve head diameter				
— Inlet 1180	43.750 to 44.000	1.7224 to 1.7323	—	—
— Inlet 1380	44.250 to 44.500	1.742 to 1.752	—	—
— Inlet 1580-1880	—	—	48.200 to 48.500	1.8973 to 1.9094
— exhaust	36.750 to 37.000	1.4468 to 1.4567	40.700 to 41.000	1.6023 to 1.6141
Valve stem diameter	7.985 to 8.000	.3144 to .3149	7.945 to 7.960	.3128 to .3134
Valve face angle				
— 1180	45°30′ ± 7′		—	
— 1380 Inlet	60° ± 7′		—	
— 1380 Exhaust	45°30′ ± 7′		—	
— 1580-1880	—		45°15′ to 45°20′	
Valve clearance				
— Timing check	.45	.0177	.41	.0161
— Normal (cold or warm)				
– inlet	.25	.0010	.30	.0118
– exhaust	.35	.0138	.50	.0197

(follows)

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VALVE GEAR

(continued)

	1180 - 1380		1580 - 1880	
	mm	in	mm	in
Cam lift				
— inlet	5.250	.2067	7.34	.289
— exhaust	5.777	.2274	7.34	.289
Valve lift				
— inlet	9.3	.3661	12.8	.504
— exhaust	10.2	.4016	12.8	.504
Valve guide O.D.	13.988 to 14.016	.5507 to .5518	14.028 to 14.039	.5523 to .5527
Valve guide oversize	.2	.0079	.04-.2-.4	.0016-.008-.016
Valve guide interference fit in housing on cylinder head	.005 to .050	.0002 to .0020	.010 to .039	.0004 to .0015
Valve guide protrusion from cylinder head face (1580-1880)				
— inlet	—	—	2	.0787
— exhaust	—	—	9	.3543
Valve guide fitted I.D. after reaming	8.023 to 8.038	.3158 to .3164	7.987 to 8.012	.3144 to .3154
Valve stem clearance in guide	.023 to .053	.0009 to .0021	.027 to .067	.0010 to .0026
— maximum wear clearance	.13	.0051	.13	.0051
Maximum valve stem eccentricity over one revolution with stylus on sealing face	.04	.0016	.04	.0016
Inlet and exhaust valve spring length (1180):				
— free	65.5	2.58	—	—
— under 295 to 332 N, 30.1 to 33.9 kg (66.4 to 74.7 lb)	41	1.61	—	—
— under 472 to 511 N, 48.1 to 52.1 kg (106 to 114.8 lb)	30.8	1.21	—	—
1380 (external spring)				
— free	63	2.48	—	—
— under 189 to 213 N, 19.3 to 21.7 kg (43 to 48 lb.)	41	1.61	—	—
— under 357 to 386 N, 36.4 to 39.4 kg (80 to 87 lb.)	30.8	1.21	—	—
1380 (internal spring)				
— free	51	2.00	—	—
— under 64 to 74 N, 6.55 to 7.55 kg (14 to 17 lb.)	38	1.50	—	—
— under 151 to 164 N, 15.4 to 16.7 kg (34 to 37 lb.)	27.8	1.09	—	—
1580 to 1880				
— free	—	—	49.3	1.94
— under 221 to 244 N, 22.5 to 24.9 kg (50 to 55 lb.)	—	—	42	1.65
— under 599 to 662 N, 61.1 to 67.5 kg 135 to 149 lb.)	—	—	29.5	1.16

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LUBRICATION SYSTEM

	1180 - 1380		1580 - 1880	
	mm	in	mm	in
Oil pump	gear, camshaft driven		gear, crankshaft driven	
Oil pump drive ratio	1.265 to 1		.906 to 1	
Oil pressure, warm, at governed speed	3 to 4 kg/cm^2 (bar)	42 to 57 psi	4.8 to 5.2 kg/cm^2 (bar)	68 to 74 psi
Relief valve crack-off setting	3.6 kg/cm^2 (bar)	51.2 psi	5 kg/cm^2 (bar)	71 psi
Drive gear shaft diameter	17.989 to 18.000	.7082 to .7087	19.987 to 20.000	.7869 to .7874
Shaft bush fitted I.D. after reaming	18.016 to 18.059	.709 to .711	—	—
Shaft clearance in support	.016 to .070	.0006 to .0027	.020 to .054	.0008 to .0021
Bush interference fit in housing	.023 to .091	.0009 to .0036	—	—
Driven gear shaft interference fit in cover	.012 to .050	.0005 to .0020	.020 to .054	.0008 to .0021
Driven gear shaft diameter	14.989 to 15.000	.5001 to .5905	19.900 to 19.913	.7835 to .7847
Bush fitted I.D. after reaming	15.016 to 15.043	.5912 to .5922	—	—
Driven gear shaft clearance in support	.016 to .054	.0006 to .0021	.000 to .034	.0000 to .0013
Bush interference fit in housing	.051 to .073	.0020 to .0029	—	—
Gear end float	.016 to .107	.0006 to .0042	.040 to .125	.0016 to .0050
Relief valve spring length				
— free	45	1.75	70.5	2.75
— under 88 to 94 N, 9 to 9.6 kg (20 to 21 lb)	30.5	1.2	—	—
— under 108 N, 11 kg (24 lb.)	—	—	48.5	1.90
Oil filters	gauze on suction and main cartridge on delivery			
Oil cooler (1380-1580-1880)	oil to water			
Make	BEHR or LANGERER & REICH		BEHR or CHAUSSON	
Type	four-row steel tube core		six-row steel tube core	

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COOLING SYSTEM

	1180 - 1380		1580 - 1880	
	mm	in	mm	in
Water pump	centrifugal, blade			
Water pump drive ratio	1.403 to 1		1.435 to 1	
Shaft interference fit in impeller	.027 to .060	.0011 to .0024	.029 to .060	.0011 to .0024
Shaft interference fit in fan hub	.015 to .061	.0006 to .0024	.025 to .061	.0010 to .0024
Face sealing bush interference fit in impeller	.012 to .058	.0005 to .0023	—	—
Thermostat				
Type	BEHR-THOMSON or SAVARA		BEHR-THOMSON	
Opening temperature	79 ± 2°C		79 ± 2°C	
Fully open at	94°C		94°C	
Valve travel when fully open	7.5	.295	7.5	.295
Radiator	Vertical tube, 4-deep (early models) and 5-deep (late models) and 5-deep (late models) steel fins (1180) or copper fins (1380)		Vertical tube 4-deep (early models) and 5-deep (late models) steel fins (1580) or copper fins (1880)	
Expansion tank	semi-transparent plastics			
Fan	suction, steel, 4-bladed (1180 and 1580 + 1880 early models) or 6-bladed (1380, and 1580 + 1880 late models)			
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			

FUEL SYSTEM

	1380	1880
Turbocharger		
— make	GARRETT	HOLSET
— type	TO 4B/Y7/0.84E	3FJ-530 V/2.85S4

(follows)

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FUEL SYSTEM

(continued)

	1380		1880	
	mm	in	mm	in
Shaft end float	.025 to .10	.001 to .004	.10 to .15	.004 to .006
Shaft radial play	.075 to .180	.003 to .007	.53 max	.021 max.

	1180-1180 H	1380	1580	1880
Lift pump	double diaphragm	piston		
Operation	cam driven	injection pump camshaft driven		
Min. output at 1600	100 liter/hour	—		
Shaft rpm	(22 Gall/hour)	—		
Drive shaft eccentricity	5.25 mm (.206 in)	—		
Min. output at 1.2 to 1.5 bar (kg/cm^2) (17 to 22 psi):				
— at 500 rpm	—	.7 litre/min (1.23 Imp.pts./min)		
— at 1000 rpm	—	1.3 litre/min (2.29 Imp/pts./min)		
Lift pump drive (1180-1180 H)				
Shaft journal diameter .... mm	49.975 to 50.000	—		
(in)	1.9675 to 1.9685	—		
Bush fitted I.D. after reaming ....(mm)	50.050 to 50.075	—		
(in)	1.9704 to 1.9715	—		
Shaft clearance in bush ....(mm)	.050 to .100	—		
(in)	.002 to .005	—		
Bush interference fit in housing ....(mm)	.066 to .142	—		
(in)	.002 to .005	—		
Inner washer thickness ....(mm)	1.45 to 1.50	—		
(in)	1.057 to 1.059	—		
Outer washer thickness ....(mm)	2.93 to 3.00	—		
(in)	.115 to .118	—		
Injection pump	distributor, integral governor	in-line, integral governor		
— BOSCH	EP/VA6/11H 1275 CR185-3 4746605	—	—	PES6MW100-4754679
— C.A.V.	DPA 3362F640-4756102	—	—	—
— FIAT	—	PES6A 90B: L4/214-4747763	PES6A 90B 410: L4/217-4750345	—
Direction of rotation	clockwise			
Firing order	1-5-3-6-2-4			

(follows)

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FUEL SYSTEM

(continued)

	1180-1180 H	1380	1580	1880
Automatic advance device	—		mechanical flyweights	
Type	—		PAV 5° 500-1500 ARD 32-771483	
Advance device cut-in speed .... rpm	—		500	
Advance device max. rated speed rpm	—		1500	
Max. advance at max. speed	—		5°	
Fuel injectors				
— Type: WEBER	EPPZ 10 F1-770577		EPPZ 10 F1-771252	EPPZ 10 FV4-4750415
— Type: BOSCH	EPPZ 50 F3-771064		EPPZ50 F15-771403	EPPZ 50 FV6-4750504
— Type: C.A.V.	EPPZ 60 F3-770897		—	—
— Type: OMAP	EPPZ 70 F3-770957		EPPZ 70 F15-771236	—
— WEBER: nozzle holder	KB 70 S1 F10-767107		KB 88 S50 F20-771243	KB 88 S50 F20-4750417
— WEBER: spray nozzle	DLL 140 S64 F-770578		DLL 145 S69 F-771249	DLL 145 S73 F-4750416
— BOSCH: nozzle holder	KBL 70 SV1830-771065		KBL 88 S203/4-771404	KBL 88 S203/4-771404
— BOSCH: spray nozzle	DLLA 141 S662-771066		DLLA 145 S770-771405	DLLA 145SV 12624/1-4750505
— C.A.V.: nozzle holder	BKBL 69 S5376-770899		—	—
— C.A.V.: spray nozzle	BDLL 140 S6655-770902		—	—
— OMAP: nozzle holder	OKLL 70 S2974-770958		OKLL 88 S2925-771237	—
— OMAP: spray nozzle	OLL 140 S64F-770959		OLL 145 S69F-771238	—
Number of spray orifices	3		4	4
Spray orifice diameter .... mm (in)	.35 (.014)		.32 (.013)	.34 (.013)
Release pressure .... bar	221 to 230 (225 to 235 kg/cm^2) (3205 to 3335 psi)		200 to 208 (204 to 212 kg/cm^2) (2900 to 3016 psi)	
Delivery pipes — type	PRR25F24Z-770913	PRR25F10Z ..F7Z/..F11Z ..F12Z/..F13Z/..F14Z-767412/..08/ ..14/..15/ ..16/..18	PRR11F21Z-769652	PRR2022FV1-4750418 or PRR2022FV2-4750419
— size .... mm	1.5 × 6 × 650	1.5 × 6 × 300/ 320/340/370/ 470/545	2 × 6 × 600	2 × 6 × 600 or 2 × 6 × 620

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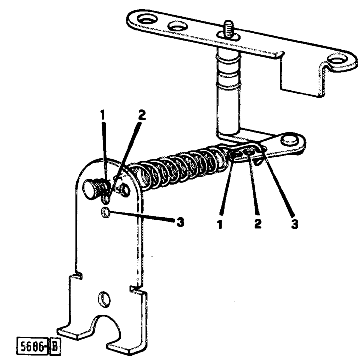
MODEL 1180 - CALIBRATION DATA - C.A.V. INJECTION PUMP TYPE DPA 3362 F640-4756102

Assembly data

Pump rotation (drive end) .... clockwise
Firing order 1-5-3-6-2-4
Governor control stud to metering valve
  lever pin .... 53 to 54 mm (2.08 to 2.13 in)
Roller spacing .... 50.24 mm (1.978 in)
Pump timing .... 14° ± 1° B.T.D.C.
External timing mark degree position with 334° ± 30′
  respect to shaft key (on tool **290757**)
Delivery connection of cylinder no. 1 ...... Marked with letter U



Governor spring attachment position on control arm: 1 to 3

Test plan

HARTRIDGE test machines: 1100-875-800 with BDN 12 SD 12 (*) spray nozzle.

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.

Pump shall be calibrated with original delivery connections.
Injector release pressure .... 175 to 183 bar
(178 to 187 kg/cm² - 2538 to 2654 psi)
Pipes .... 2 × 6 × 845 mm
Glass emptying time .... 30″
Calibration fluid .... FIAT CFB at 40 ± 2°C
Fuel supply pressure .... .15 bar, kg/cm² (2.2 psi)

Test no.	Lever position L_1 = throttle L_2 = shut-off	Speed rpm	Transfer bar (kg/cm²)	Advance degrees	Injector delivery cm³/200 shots	Spread cm³/200 shots	Injector cm³/100 shots	Start retard
1(¹)-2	L_1 = max L_2 = out	100	⩾0.8	—	—	—	—	—
3(²)		800	—	7.5 to 8	—	—	—	
4		1200	—	10.5 to 11.5	—	—	—	
5		100 to 200	—	3.8 to 4.3	—	—	—	
6		1200	3.9 to 5	—	—	—	—	
7-8		600	—	—	10.7 to 10.9(⁷)	1	3 to 50	
9		1100	—	10.5 to 11.5	—	—	—	
10		300	—	0	—	—	—	in
11		100	—	—	⩾9.3(⁷)	—	—	
12	L_1 = full - L_2 = in	200	—	—	⩽.8	—	—	out
13(³)	L_1 = idle - L_2 = out	200	—	—	⩽1	—	—	
14(⁵)	L_1 = max L_2 = min	1250	—	—	—	—	—	
15(⁵)		1360	—	—	1.8	—	—	
16(⁶)		1250	—	—	—	—	—	

Carry out tests 1-2-3-4-5-6-7-8 and replace start retard device with tool **290760**. Carry out other tests with start retard device installed. Max no-load speed test to be carried out on engine.
(¹) Delivery to all injectors.
(²) If necessary, shim to a max. of 3 mm. .5 mm shim applied to spring seat in piston must not be removed.
(³) Back off idle adjusting screw fully.
(⁴) Record average delivery.
(⁵) No cylinder to exceed 2.8 cm³/200 shots. Tighten screw.
(⁶) Output not to be less than that of test 14. .4 cm³/200 shots less is acceptable.
(⁷) Take reading after 15 seconds.
(*) In case of dispute, only values recorded on Hartridge test machines will apply.

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MODEL 1180 - CALIBRATION DATA - BOSCH INJECTION PUMP TYPE EP/VA6/11 H 1275CR185-3-4746605

Assembly data

Pump rotation (drive end) .... clockwise

Firing order 1-5-3-6-2-4

Rotor stroke to spill cut-off .... .5 ± .02 mm (.020 ± .0008 in)

Pump timing, cylinder no. 1 on compression stroke 15° ± 1° B.T.D.C.

Delivery connection to cylinder no. 1: marked with letter A.

Test plan

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 ...... 150 bar (153 kg/cm^2, 2176 psi)
Pipes .... 2 × 6 × 840 mm
Calibration fluid .... FIAT CFB, 40°C to 45°C (for lower test temperatures add .25 cm^3/1,000 shots to each degree).
Fuel supply pressure .... .2 bar (kg/cm^2) 2.9 psi.

Test no.	Lever position L_1 = shuttle L_2 = throttle	Speed	Transfer pressure	Advance piston stroke (*)	Delivery	
					injector	back leakage
		rpm	bar (kg/cm^2)	mm	cm^3/1000 shots	cm^3/100 shots
1	L_1 = shut-off L_2 = max	800	—	—	0	—
2	L_1-L_2 = max	800	—	—	71 to 73	—
3	L_1-L_2 = max	1325	—	—	42 to 50	—
4	—	100	.6 to 1.1	—	—	—
5		800	4.2 to 4.7	—	—	—
6		1275	6.4 to 6.9	—	—	—
7	L_1-L_2 = max	250	—	—	≤60	—
8	L_1-L_2 = max	100	—	—	≥130	—
9	—	250 to 400	—	0 (start)	—	—
10		800	—	4.0 to 5.0	—	—
11		1050 to 1100	—	7.5 (end)	—	—
12	L_1 = max	1450 to 1500	—	—	0	—
13	L_2 = max (1)	1325	—	—	42 to 50	—
14	L_1 = max (2) L_2 = max	1275^{+0}_{-20}	—	—	70.5 to 72.5 (•)	—
15		1000	—	—	—	20 to 50
16		800	—	—	71 to 73	—
17		500 ± 5	—	—	70 to 72	45 to 70
18	L_1 = max	400 to 500	—	—	0	—
19	L_2 = min (3)	350	—	—	12 to 22	—

(*) Using tool **292817**.
(•) Max. spread 2.5 cm^3/1000 shots.
(1) Adj. max. speed screw.
(2) Adj. max. fuel screw.
(3) Adj. idling speed stop screw.

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MOD. 1380 - CALIBRATION DATA - FIAT INJECTION PUMP TYPE PES6A90B:L4/214-4747763

Pump components

Pumping element: EPPK 203 F1Z-771595, 9 mm dia; 12 mm pitch, LH helix.
Check valve PVE 161 S2Z - 755708, valve spring PSF 9S3X - 754799, spring length 32.4 to 32.9 mm (1.27 to 1.29 in). Valve fitting PRV 122S1X - 746368, fitting torque 59 to 64 Nm, 6 to 6.5 kgm (43 to 47 ft.lb.).

Governor RPVA 300 - 1200 - F258 - 771594

Feed pump FP/KS22A: L4/12-767893, supply pressure: 1.2 to 1.5 bar (kg/cm^2) (17 to 22 psi)

Drive coupling PZR 11F2X/...3X-767373/767374

Assembly data

Pump rotation .... clockwise
Firing order 1-5-3-6-2-4
Plunger lift to spill cut-off .... 2.2 ± .05 mm (.087 ± .002 in)
Pump timing, cylinder no. 1 in compression stroke 28° ± 1° B.T.D.C.
Max. fuel device stroke .... .70 ± .05 mm (.028 ± .002 in)

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 .... 175 bar, 178 kg/cm^2 (2.538 psi)
Pipes .... 2 × 6 × 600 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 (3205 to 3336 psi)
Pipes .... 1.5 × 6 × 510 mm
Fuel density .... 830 ± 10 g/l at 40 ± 3°C

Lever position	Speed rpm	Rack stroke mm	PROCEDURE A		PROCEDURE B		LDA air pressure bar (kg/cm^2)
			Delivery				
			injector	pump*	injector	pump*	
			cm^3/1000 shots		cm^3/1000 shots		
Idle	300^{+0}_{-10}	9.5 ± .5	10 ± 1	—	10 ± 1	—	—
Maximum	•1200^{+0}_{-10}	13 ± .5 (*)	73.5 ± 1.5 (*)	441 ± 3 (*)	66.5 ± 1.5 (*)	399 ± 3 (*)	⩾.50
		11.5 ± .1	58 ± 1.5	348 ± 3	53.5 ± 1.5	321 ± 3	—
Maximum (1)	800 ± 5	—	—	450 ± 3 (*)	—	435 ± 3 (*)	⩾.50
		—	—	351 ± 3	—	357 ± 3	—
Maximum	⩽1330	—	0	—	0	—	—
Maximum (2)	200	—	⩾110	—	⩾110	—	—

• Governor cut-in speed 1200 to 1210 rpm.
* For governor stop adjustment.
(1) For max. fuel device (control rack stop).
(2) Excess fuel.
(*) LDA in.

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MOD. 1580 - CALIBRATION DATA FIAT INJECTION PUMP TYPE PES6A90B410:L4/217-4750345

Pump components

Pumping elements EPPK202 F5Z-766061; 9 mm dia. 12 mm pitch, L.H. helix – Check valve PVE161 S1Z-754792, valve spring PSF 9S3X-754799, spring length 32.4 to 32.9 mm (1.27 to 1.29 in) — Valve fitting PRV 122S1X-746368, fitting torque 59 to 64 Nm, 6 to 6.5 kgm (43 to 47 ft.lb.).

GOVERNOR RPVA 300-1100 F266-771620

AUTOMATIC ADVANCE DEVICE PAV 5° 500-1500 ARD 32-771483

PUMP FP/KS22A: L4/4-763150 - Supply pressure: 1.6 to 1.8 bar (kg/cm^2) (23 to 26 psi).

DRIVE COUPLING: 4708207-4748722-4708205.

Assembly data

Pump rotation (drive end) .... clockwise
Firing order 1-5-3-6-2-4
Plunger lift to spill cut-off .... 2.3 ± .05 mm (.091 ± .002 in)
Pump timing (cylinder no. 1 on compression stroke 25° ± 30′ B.T.D.C.

Test plan

Procedure A

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

RABOTTI test machine with FIAT **656829** injector springs and EFEP 182 spray nozzles.
Release pressure ...... 175 bar, 178 kg/cm^2 (2538 psi)
Pipes .... 2 × 6 × 600 mm

Procedure B

Test machine incorporating same injector bodies and nozzles as fitted to engine.
Release pressure .... 200 to 208 bar, (204 to 212 kg/cm^2) (2901 to 3017 psi)
Pipes .... 2 × 6 × 600 mm
Fuel density: .... 830 ± 10 g/l at 40 ± 3°C.

Lever position	Speed	Rack stroke	PROCEDURE A		PROCEDURE B	
			Delivery			
			injector	pump*	injector	pump*
	rpm	mm	cm^3/1000 shots		cm^3/1000 shots	
Idle	300^{+0}_{-10}	7 ± .5	10 ± 1	—	10 ± 1	—
Maximum	•1100^{+0}_{-10}	12 ± .1	83.5 ± 1.5	501 ± 3	78.5 ± 1.5	471 ± 3 (3)
Maximum (1)	700 ± 5	—	—	492 ± 3	—	495 ± 3
Maximum (2)	200	—	⩾135	—	⩾135	—

• Governor cut-in speed 1200 to 1210 rpm
* Governor stop adjustment.
(1) Max. fuel device (rack stop).
(2) Excess fuel.
(3) For pump calibration adopt max. settings indicated for both tests A and B and pay particular attention to pump element alignment.

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MODEL 1880 - CALIBRATION DATA - BOSCH INJECTION PUMP TYPE PES6MW100 - 4754679

Pump components

Pumping element 1418415045, 10 mm dia. check valve 1418512202, valve spring 1414613018 – Valve fitting 1413356018.

GOVERNOR RQV 300 ... 1100 MW19

AUTOMATIC ADVANCE DEVICE PAV 5° 500-1500 ARD 32-771483 (up to engine no. 750749), A 5.5/3 - 10AD 4764728 (from engine no. 750750).

SUPPLY PUMP FP/K22MW10, Supply pressure 1.2 to 1.8 bar (kg/cm^2) (17 to 26 psi).

DRIVE COUPLING: 4733800-4733801-4733802. (up to engine no. 750749), 4733802 - 4744146 - 4744148 (from engine no. 750750).

Assembly data

Pump rotation (drive end) .... Clockwise
Firing order 1-5-3-6-2-4
Plunger lift to spill cut-off .... 2.95 ± .05 mm (.116 ± .002 in)

Pump timing (cylinder no. 1 on compression stroke) 20° ± 30′ (early, up to engine no. 750749) or 15° ± 30′ (later, from engine no. 750750)

Test plan

Procedure A

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

RABOTTI test machine with FIAT **656829** injection springs and EFEP 182 spray nozzles.

Release pressure ...... 175 bar, 178 kg/cm^2 (2538 psi)
Pipes .... 2 × 6 × 600 mm

Procedure B

Test machine incorporating same injector bodies and nozzles as fitted to engine.

Release pressure .... 200 to 208 bar, (204 to 212 kg/cm^2) (2901 to 3017 psi)
Pipes .... 2 × 6 × 600 mm
Fuel density: .... 830 ± 10 g/l at 40 ± 3°C.

Lever position	Speed	Rack stroke	PROCEDURE A		PROCEDURE B		LDA air pressure bar
			Delivery				
			injector	pump*	injector	pump*	
	rpm	mm	cm^3/1000 shots		cm^3/1000 shots		(kg/cm^2)
Idle	300	6.5 ± .5	18 ± 1	—	18 ± 1	—	—
Maximum	•1100	11.6 ± .5(*)	100 ± 1.5(*)	600 ± 3(*)	97 ± 1.5(*)	582 ± 3(*)	⩾.50
		11.1 ± .1	94 ± 1.5	564 ± 3	91.5 ± 1.5	549 ± 3	—
Maximum (1)	700	—	—	642 ± 3(*)	—	624 ± 3(*)	⩾.50
		—	—	528 ± 3	—	531 ± 3	—
Maximum	600	—	—	—	—	—	.08 to .18 (3)
		—	—	—	—	—	.26 to .36 (4)
Maximum (2)	100	—	⩾170	—	⩾170	—	—

• Governor cut-in speed 1100 to 1110 rpm.
* Governor stop adjustment.
(1) Max. fuel device (rack check).
(2) Excess fuel.
(3) LDA cut-in.
(4) LDA cut-off.
(*) LDA in.

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MODEL 1280 - CALIBRATION DATA - C.A.V. INJECTION PUMP TYPE DPA 3362 F 450 - 4762361

Assembly data

Pump rotation (drive end) .... Clockwise

Firing order 1-5-3-6-2-4

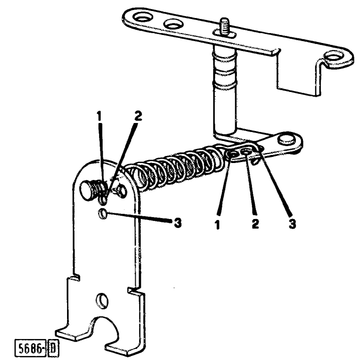
Governor control stud to metering valve lever pin .... 53 to 54 mm (2.08 to 2.13 in)

Roller spacing .... 50.3 mm (1.98 in)

Pump timing .... 14 ± 1° B.T.D.C.

External timing mark degree position with respect to shaft key (on tool **290757**) .... 334° ± 30′

Delivery connection of cylinder no. 1 ...... Marked with letter U



Governor spring attachment position on control arm: 1 to 3

Test plan

HARTRIDGE test machine 1100-875-800 with BDN 12 SD 12 (*) spray nozzles.

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.

Pump to be calibrated with original fittings.

Release pressure 175 to 183 bar, 178 to 187 kg/cm² (2538 to 2654 psi)

Pipes .... 2 × 6 × 845 mm

Burette drain rate .... 30 seconds

Calibration fluid .... FIAT CFB at 40° ± 2°C

Supply pressure .... .15 bar (kg/cm²), 2.1 psi

Test no.	Lever position L_1 = throttle L_2 = shut-off	Speed rpm	Transfer pressure kg/cm²	Advance degrees	Injector delivery * cm³/200 shots	Spread cm³/200 shots	Back leakage cm³/100 shots	Start retard
1 (1)-2		100	≥.8	—	—	—	—	
3 (2)		800	—	7.5 to 8	—	—	—	
4		1200	—	10.5 to 11.5	—	—	—	—
5	L_1 = full	100 to 200	—	3.8 to 4.3	—	—	—	
6	L_2 = out	1200	3.8 to 4.8	—	—	—	—	
7-8		600	—	—	11.2 to 11.4 (•)	1	15 to 45	
9		1100	—	10.5 to 11.5	—	—	—	open
10		300	—	0	—	—	—	in
11	L_1 = max-L_2 = in	200	—	—	≤.8	—	—	
12	L_1 = min-L_2 = out	200	—	—	≤1	—	—	
13 (3)		1250	—	—	—	—	—	open
14 (4)	L_1 = max	1360	—	—	1.8	—	—	
15 (5)	L_2 = out	1250	—	—	—	—	—	
16 (6)		100	—	—	9.8 to 11.3 (•)	—	—	in
17 (7)		325	—	—	≤.5	—	—	open

Carry out tests 1-2-3-4-5-6-7-8 replacing advance retard device with tool **290760**. Carry out other tests with advance retard installed.
(1) Delivery to all injectors.
(2) Shim as necessary up to 3 mm (.118 in) max. - .5 mm (.020 in) shim in spring seat on piston must not be removed.
(3) Take average delivery.
(4) No cylinder must exceed 2.8 cm³/200 shots. Tighten screw.
(5) Delivery not to fall below value of test 13 - .4 cm³/200 shots less shall be acceptable.
(6) Max speed, no-load, setting to be adjusted on engine.
(7) Shut-off solenoid to be alway energized unless otherwise specified.
(•) Take reading after 15 seconds.
(*) In case of dispute only values recorded on Hartridge test machines will apply.

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TORQUE DATA

DESCRIPTION	Thread size	Torque Nm	Torque kgm	Torque ft.lb
Engine block and cylinder head - valve gear - crank gear - Section 10				
Capscrew, cylinder head, (C_1, pages 21 and 22)	M12 × 1.25	147	15	108
Nuts, cylinder head, 1580 (C_1, page 23)	M16 × 1.5	216	22	159
Nuts, cylinder head, 1880 (C_1, page 24)	M16 × 1.5	245	25	181
Capscrew, rocker shaft brackets (C_2, pages 21, 22, 23 and 24) 1180-1380	M 8 × 1.25	23	2.3	17
Capscrew, rocker shaft brackets (C_2, pages 21, 22, 23 and 24) 1580-1880	M10 × 1.25	49	5	36
Capscrew, intermediate gear jackshaft, 1580 and 1880 (C_7, pages 23 and 24)	M 8 × 1.25	29	3	22
Capscrew, main bearing cap (C_3, pages 21, 22, 23 and 24) mod. 1180 and 1380	M14 × 1.5	147	15	108
Capscrew, main bearing cap (C_3, pages 21, 22, 23 and 24) 1580	M16 × 1.5	206	21	152
Capscrew, main bearing cap (C_3, pages 21, 22, 23 and 24) 1880	M16 × 1.5	235	24	173
Capscrew, connecting rod cap (C_4, pages 21, 22, 23 and 24) 11180 and 1380 early (*)	M12 × 1.25	108	11	79
Capscrew, connecting rod cap (C_4, pages 21, 22, 23 and 24) 11180 and 1380 late (*)	M12 × 1.25	88	9	65
Capscrew, connecting rod cap (C_4, pages 21, 22, 23 and 24) 1580 and 1880	M14 × 1.5	118	12	87
Capscrew, flywheel (C_5, pages 21, 22, 23 and 24) 1180 and 1380	M12 × 1.25	118	12	87
Capscrew, flywheel (C_5, pages 21, 22, 23 and 24) 1580 and 1880	M16 × 1.5	275	28	202
Nut, crankshaft pulley hub, 1180 and 1380 (C_6, pages 21 and 22)	M30 × 1.5	294	30	217
Capscrew, crankshaft pulley hub, 1580 and 1880 (C_6, pages 23 et 24)	M22 × 1.5	559	57	412
Fuel system - Section 104				
Capscrew, rear cover to GARRETT turbocharger (15, page 3)	—	10	1	7
Nut, GARRETT turbocharger turbine shaft (3)	—	see text		
Capscrew, GARRETT turbocharger compressor housing (13) to turbine housing (14)	—	15	1.5	11
Nut, HOLSET turbocharger turbine shaft (13)	—	18	1.8	13

(*) Early capscrews (torqued to 108 Nm, 11 kgm, 80 ft.lb) are identified by bright silver colour, whereas late capscrews (torqued to 88 Nm, 9 kgm, 65 ft.lb.) are identified with black oxide colour.

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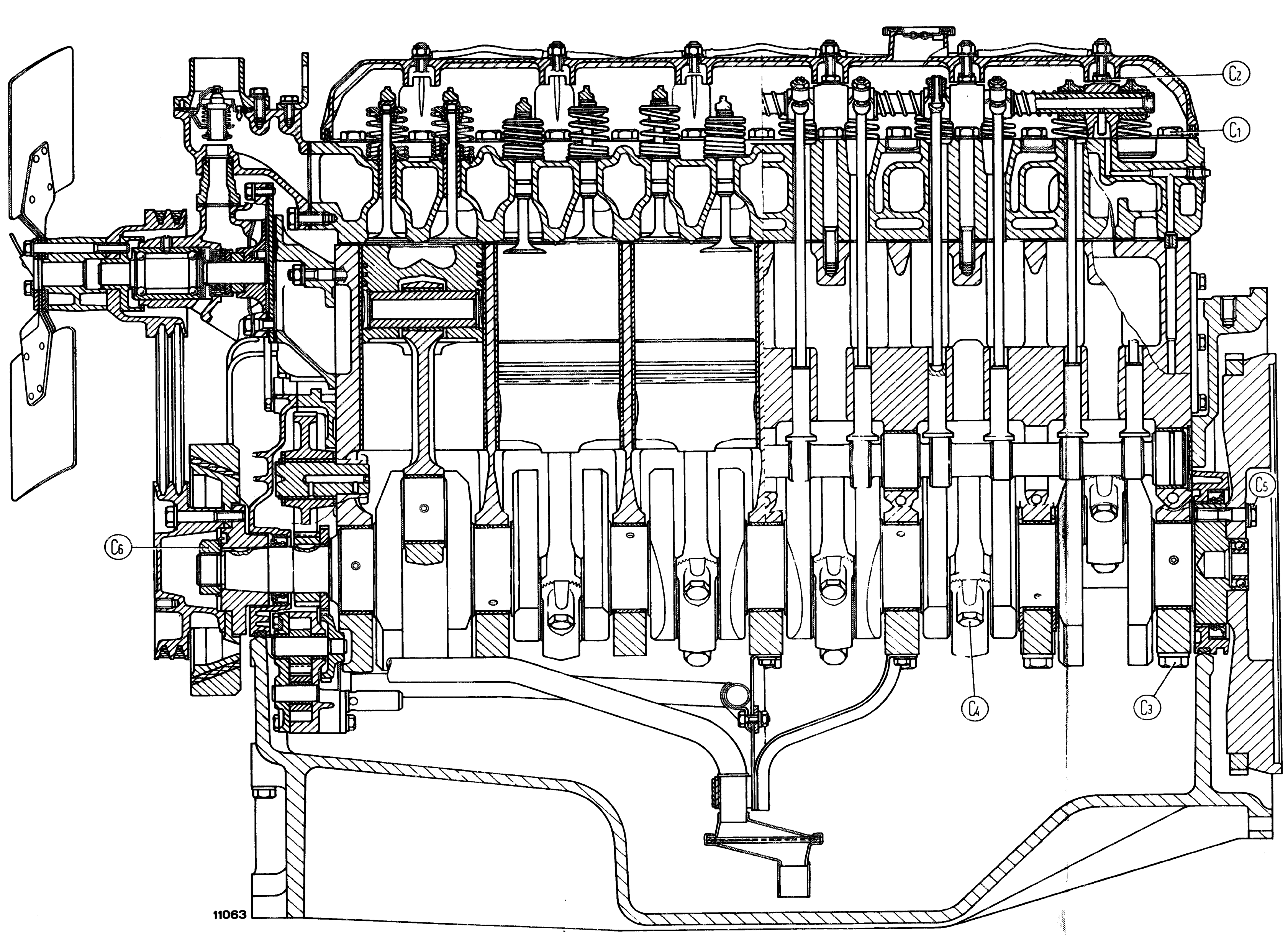

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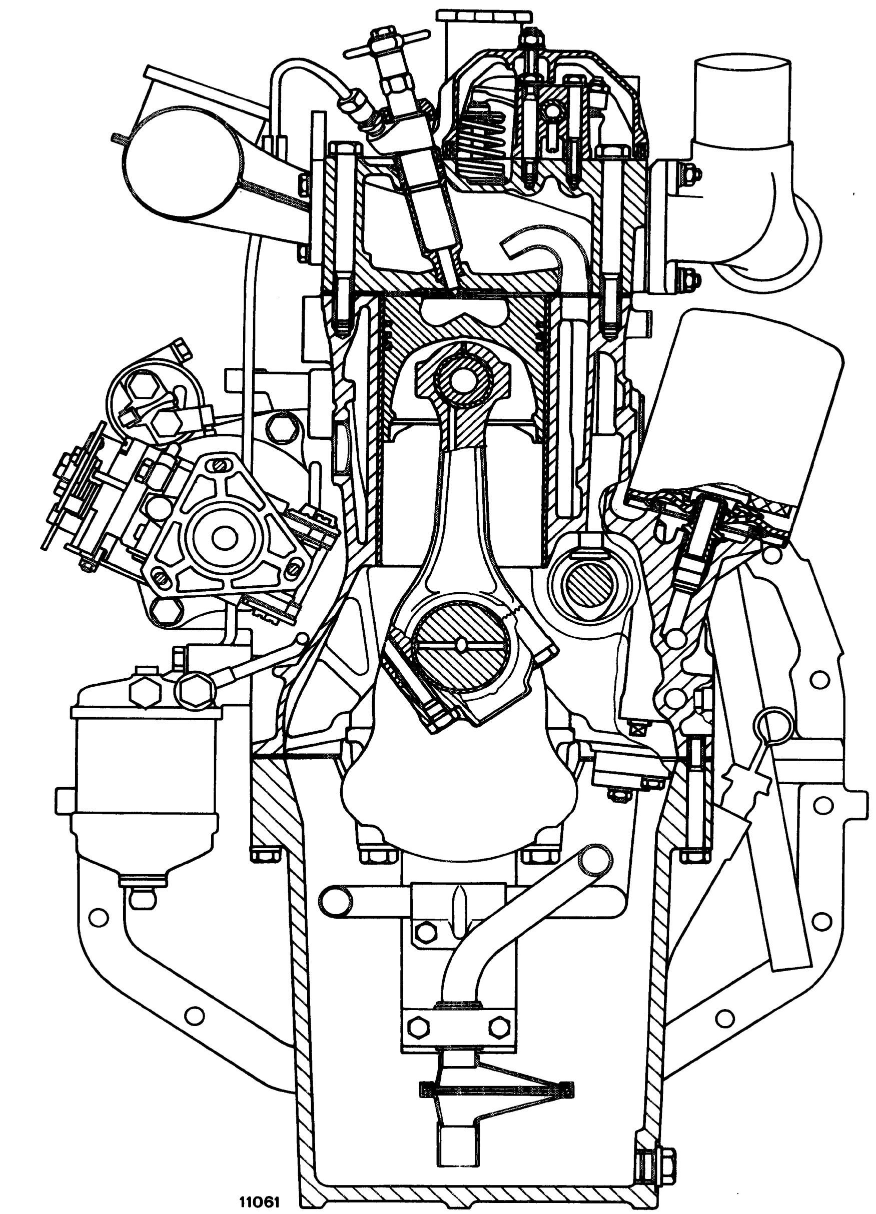

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Longitudinal and cross sections through 1180 engine.

TORQUE DATA

C_1 = 147 Nm (15 kgm, 108.5 ft.lb.)
C_2 = 23 Nm (2.3 kgm, 17 ft.lb.)
C_3 = 147 Nm (15 kgm, 108.5 ft.lb.)
C_4 = { 108 Nm (11 kgm, 80 ft.lb.) (early)* / 88 Nm (9 kgm, 65 ft.lb.) (late)* }
C_5 = 118 Nm (12 kgm, 87 ft.lb.)
C_6 = 294 Nm (30 kgm, 217 ft.lb.)
(*) See note on page 19.

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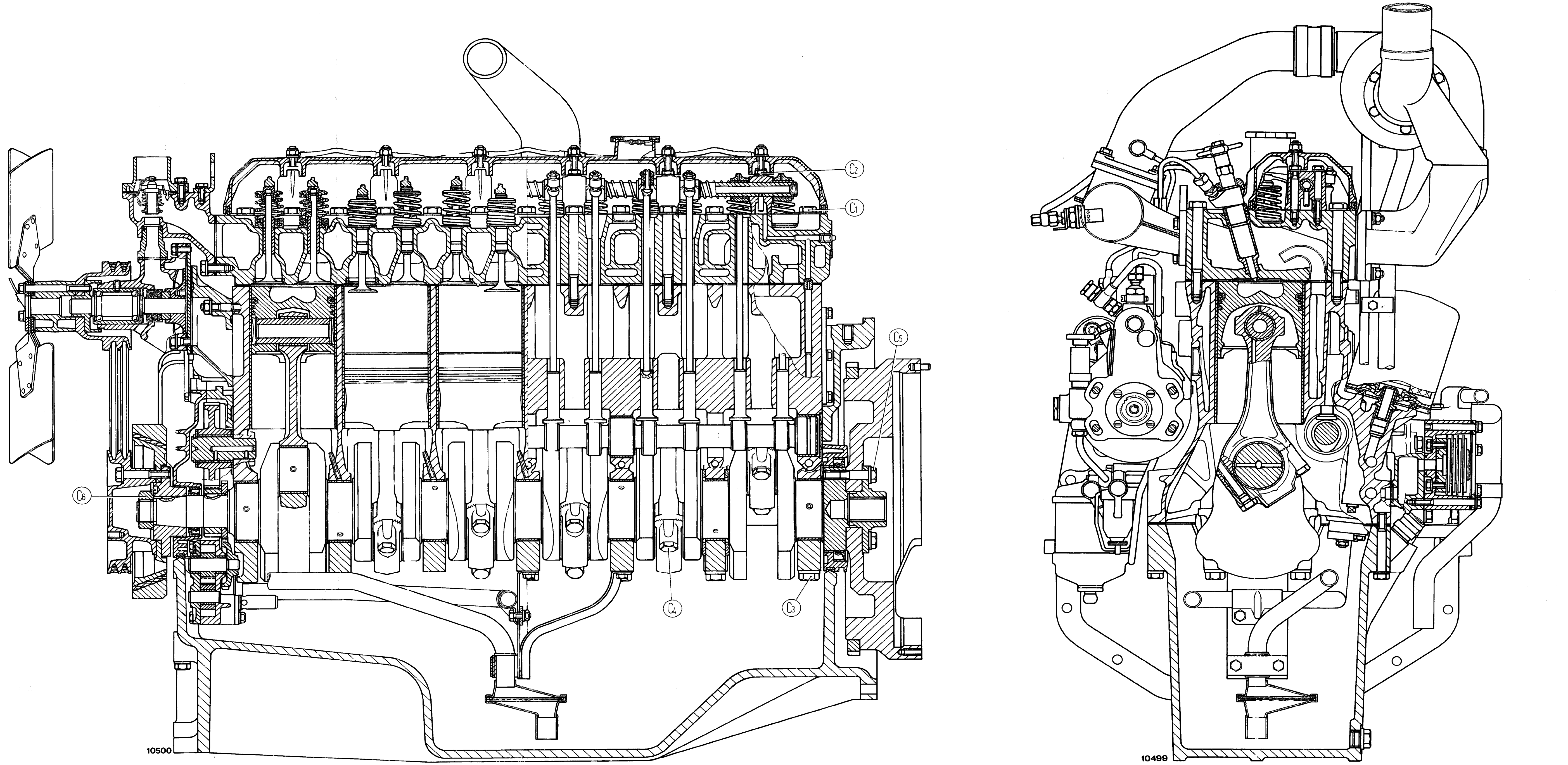

TORQUE DATA

Longitudinal and cross sections through 1380 engine.

C_1 = 147 Nm (15 kgm, 108.5 ft.lb.)
C_2 = 23 Nm (2.3 kgm, 17 ft.lb.)
C_3 = 147 Nm (15 kgm, 108.5 ft.lb.)
$C_4 = \begin{cases} \text{108 Nm (11 kgm, 80 ft.lb.) (early)*} \\ \text{88 Nm (9 kgm, 65 ft.lb.) (late)*} \end{cases}$
C_5 = 118 Nm (12 kgm, 87 ft.lb.)
C_6 = 294 Nm (30 kgm, 217 ft.lb.)
(*) See note on page 19.

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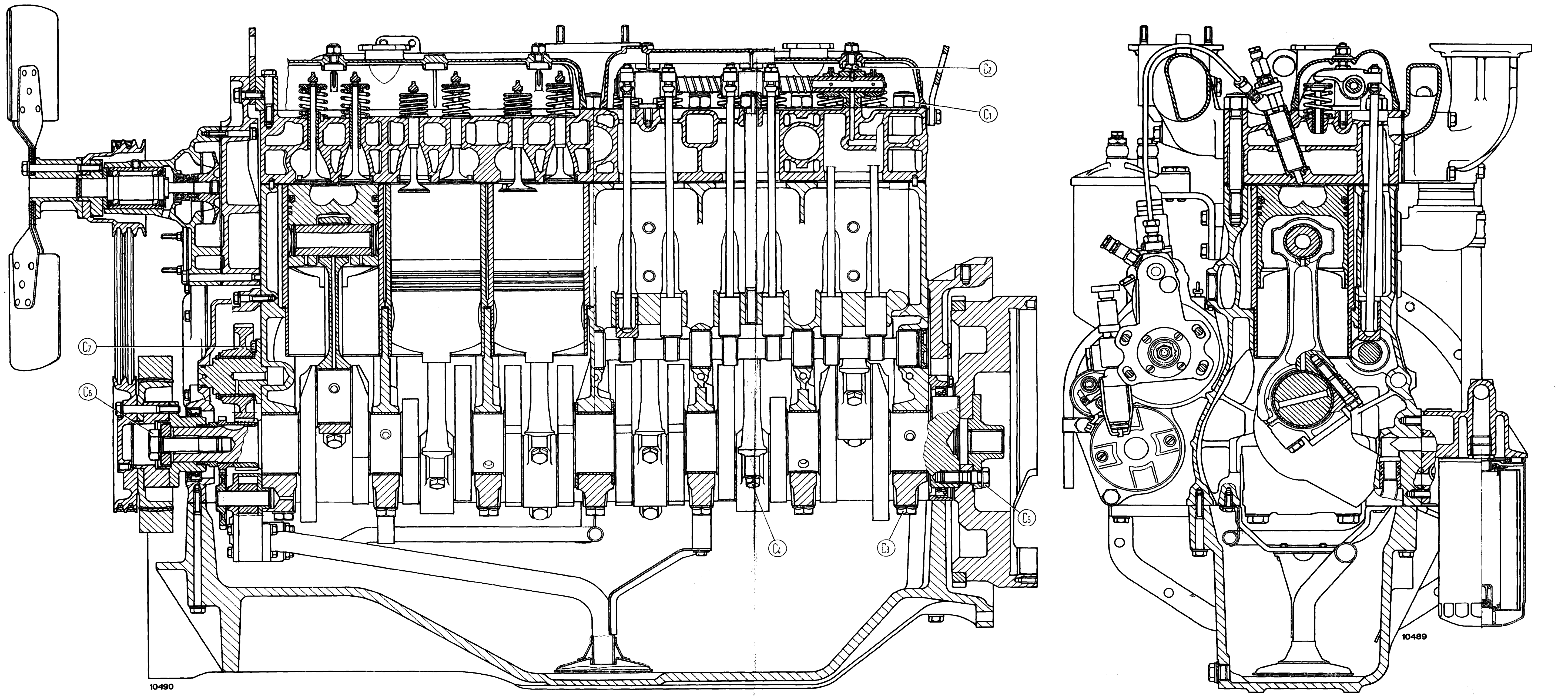

Longitudinal and cross sections through 1580 engine.

TORQUE FIGURES

C_1 = 216 Nm (22 kgm, 160 ft.lb.)
C_2 = 49 Nm (5 kgm, 36 ft.lb.)
C_3 = 206 Nm (21 kgm, 152 ft.lb.)
C_4 = 118 Nm (12 kgm, 87 ft.lb.)
C_5 = 275 Nm (28 kgm, 202 ft.lb.)
C_6 = 559 Nm (57 kgm, 412 ft.lb.)
C_7 = 29 Nm (3 kgm, 22 ft.lb.)

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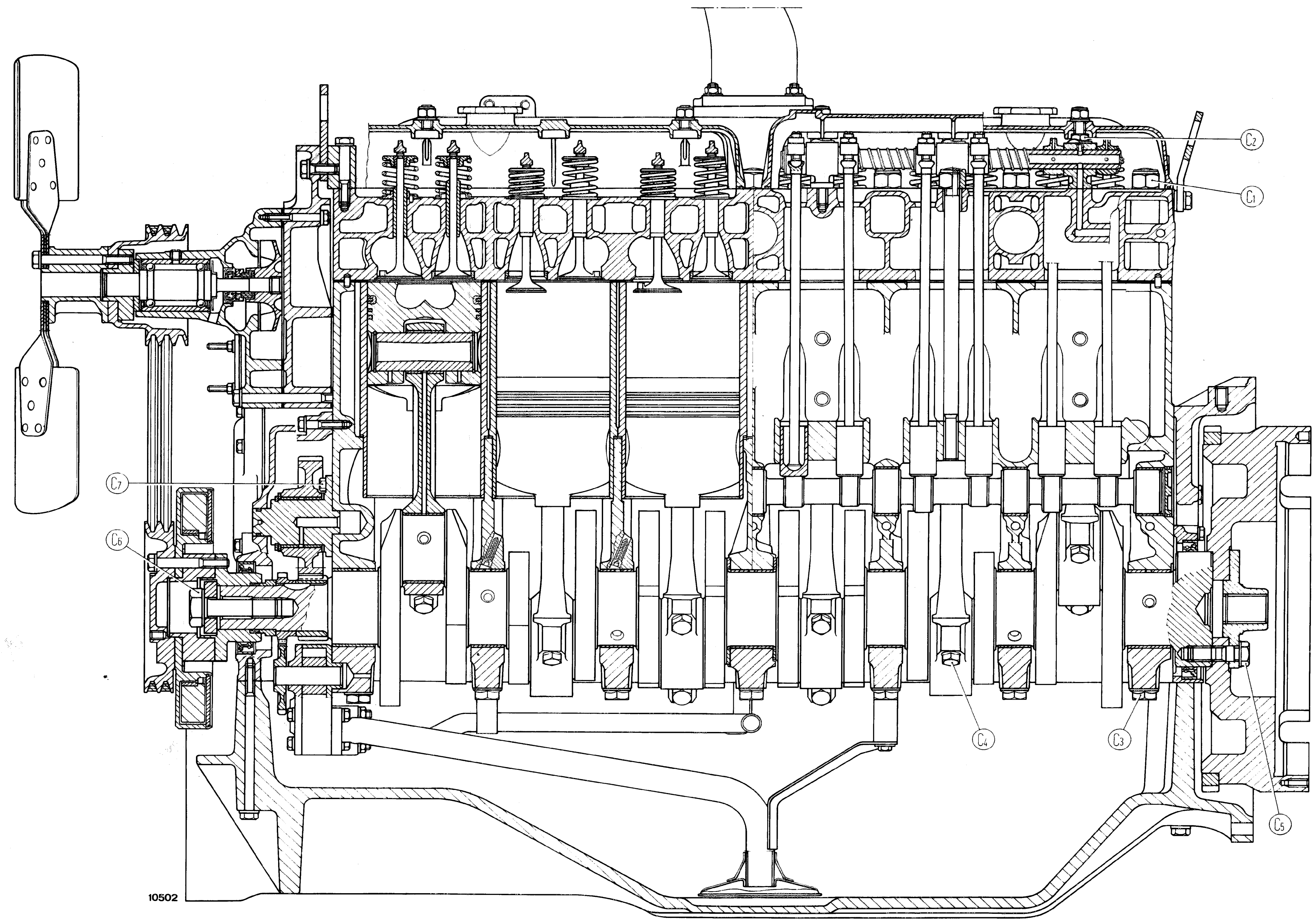

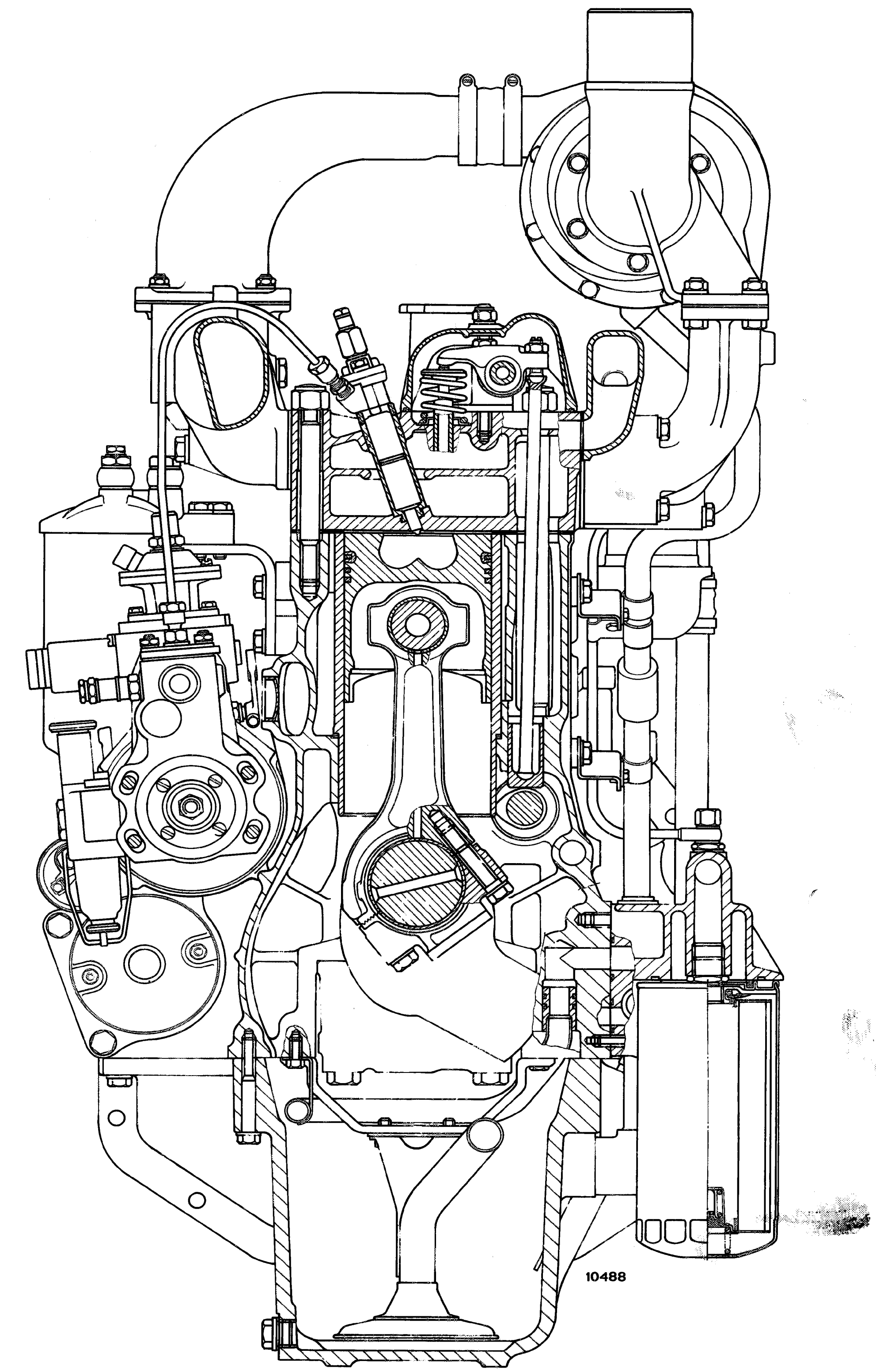

Longitudinal and cross sections through engine 1880.

TORQUE FIGURES

C_1 = 245 Nm (25 kgm, 180 ft.lb.)
C_2 = 49 Nm (5 kgm, 36 ft.lb.)
C_3 = 235 Nm (24 kgm, 174 ft.lb.)
C_4 = 118 Nm (12 kgm, 87 ft.lb.)
C_5 = 275 Nm (28 kgm, 202 ft.lb.)
C_6 = 559 Nm (57 kgm, 412 ft.lb.)
C_7 = 29 Nm (3 kgm, 22 ft.lb.)

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DESCRIPTION

FIAT engines fitted to 1180, 1280, 1380, 1580 and 1880 tractors are high-speed, four stroke, in-line Diesel units.

Engine block: single iron casting, wet liners on 1580 and 1880 engines and dry liners on 1180, 1280 and 1380 engines, incorporating crankshaft and camshaft housings and valve tappet bores.

Cylinder head: integral valve seats.

Valve gear: helical train, pushrod operated, overhead valves.

Crank gear: crankshaft running on 7 bearings, 3-ring light alloy pistons.

Air intake: through dry air cleaner, naturally aspirated for 1180 and 1380, turbocharged for 1280, 1380 and 1880.

Fuel system: distributor-type injection pump (1180 and 1280) or in-line pump (1380, 1580 and 1880).

Lubrication system: forced feed, gear pump, full-flow oil filter (2 for 1180, 1280 and 1380 and ... for 1580 and 1880. Heat exchanger on 1280, 1380, 1580 and 1880).

Cooling system: water, centrifugal pump, wax thermostat.

Engine starting: 12 V, electromagnetically operated starter and thermostarter (where fitted).

ENGINE PERFORMANCE DATA

Test conditions

Engine with fan, air cleaner and exhaust silencer removed.
Barometric pressure 740 ± 5 mm Hg at 239 metres (785 ft.) above sea level.
Ambient temperature 20° ± 3°C.
Relative humidity 70% ± 5%.
Fuel density 830 ± 10 g/litre.

Pump timing B.T.D.C., cylinder no. 1 in compression stroke:
— 1180, BOSCH injection pump .... 15° + 1°
— 1180, C.A.V. injection pump .... 14° ± 1°
— 1380, FIAT injection pump .... 28° ± 1°
— 1580, FIAT injection pump .... 25° ± 30′
— 1880, BOSCH injection pump .... 20° ± 30′ (1) / 15° ± 30′ (2)
— 1280, C.A.V. injection pump .... 14° ± 1°

MODEL 1180 - BOSCH INJECTION PUMP

Throttle	Engine load	Engine rpm	kW		Time to burn 250 cm³ (15 in³) of fuel (seconds)
			2-hour run-in	50-hour run-in	
Full	Full load	2550	78.7 (107HP) min.*	83.1 (113HP) min.	36.7 min.
Full	Full torque	1400	47.8 (65HP) min.*	49.2 (67HP) min.	58.9 min.
Full	No load	2850 max.	—	—	—
Idle	No load	650 to 700	—	—	—

(*) Predicted values.
(1) Early, up to engine no. 750749.
(2) Late, from engine no. 750750.

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ENGINE:
Performance data

MODEL 1180 - C.A.V. INJECTION PUMP

Throttle	Engine load	Engine rpm	kW		Time to burn 250 cm^3 (15 in^3) of fuel (seconds)
			2-hour run-in	50-hour run-in	
Full	Full load	2550	81 (110 HP) min.(*)	83 (113 HP) min.(*)	35.6 min.
Full	Full torque	1400	47.8 (65 HP) min. (*)	49.2 (67 HP) min.	61 min.
Full	No load	2730 max	—	—	—
Idle	No load	650 to 700	—	—	—

MODEL 1380 - FIAT INJECTION PUMP

Throttle	Engine load	Engine rpm	kW		Time to burn 250 cm^3 (15 in^3) of fuel (seconds)
			2-hour run-in	50-hour run-in	
Full	Full load	2400	100.1 (136 HP) min. (*)	102.9 (140 HP) min. (*)	31.1 min.
Full	Full torque	1600	73.5 (100 HP) min. (*)	79.4 (108 HP) min.	42.3 min.
Full	No load	2600 max	—	—	—
Idle	No load	625 to 675	—	—	—

MODEL 1580 - FIAT INJECTION PUMP

Throttle	Engine load	Engine rpm	kW		Time to burn 250 cm^3 (15 in^3) of fuel (seconds)
			2-hour run-in	50-hour run-in	
Full	Full load	2200	104.4 (142 HP) min.	106.6 (145 HP) min.	28.9 to 29.9
Full	Full load	1400	72.8 (99 HP) min.	74.3 (101 HP) min.	42.9 to 45.6
Full	No load	2430 ± 10	—	—	—
Idle	No load	600	—	—	—

(*) Predicted values.

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MODEL 1880 - BOSCH INJECTION PUMP

Throttle	Engine load	Engine rpm	kW		Time to burn 500 cm³ (30 in³) of fuel (seconds)
			2-hour run-in	50-hour run-in	
Full	Full load	2200	128 (174 HP) min.	128.7 (175 HP)	49 to 50.6
			122.1 (166 HP) min. (°)	122.9 (167 HP) min. (°)	52.5 min. (°)
Full	Full load	1400	94.9 (129 HP) min.	94.9 (129 HP) min.	66.4 to 70.6
			83.1 (113 HP) min. (°)	83.1 (113 HP) min. (°)	82.5 min. (°)
Full	No load	2425 ± 10	—	—	—
Idle	No load	650	—	—	—

MODEL 1280 - C.A.V. INJECTION PUMP

Throttle	Engine load	Engine rpm	kW		Time to burn 250 cm³ (15 in³) of fuel (seconds)
			2-hour run-in	50-hour run-in	
Full	Full load	2550	86.1 (117 HP) min.(*)	88.2 (120 HP) min.	34 min.
Full	Full load	1200	46.4 (63 HP) min. (*)	47.8 (65 HP) min.	66.6 min.
Full	No load	2730 max.	—	—	—
Idle	No load	650 to 700	—	—	—

(*) Predicted values. (°) Values with LDA out.

Turbocharged engine performance test for 1280, 1380 and 1880.

For dynamometer testing install air cleaner to engine or connect test room filter (if sufficiently large) even though performance data apply to test conditions without filter.

This requirement is dictated by the need to protect compressor impeller from the ingress of foreign bodies which, even if small, might be the cause of inefficient operation or damage.

Note that air cleaner installation results in a 1% reduction in power output indicated in the tables.

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.
To check engine compression use tester **291309** proceeding as follows:
- remove the fuel injectors;
- fit dummy injector **292631**, 1180 and 1380, or **292635**, 1580 and 1880, in place of the injector of the cylinder under test, together with the associated copper washer (applicable to 1180 and 1380 only);
- hold the injection pump in shut-off condition and take the readings driving the engine through the starter.

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ENGINE: Compression test - To remove

Compression should be as follows as recorded at 40°C sump oil temperature, 760 mm Hg (sea level) barometric pressure with the engine running at 200 to 280 rpm.

— Min. 26.5 bar (27 kg/cm^2, 384 psi) 1180;
— Min. 24.5 bar (25 kg/cm^2, 355 psi) 1280 and 1380;
— Min. 26.5 bar (27 kg/cm^2, 384 psi) 1580;
— Min. 24.5 bar (25 kg/cm^2, 355 psi) 1880;

The minimum acceptable compression is:

— 21.5 bar (22 kg/cm^2, 313 psi) 1180;
— 19.5 bar (20 kg/cm^2, 284 psi) 1280 and 1380;
— 22.5 bar (23 kg/cm^2, 237 psi) 1580
— 22.5 bar (23 kg/cm^2, 237 psi) 1880

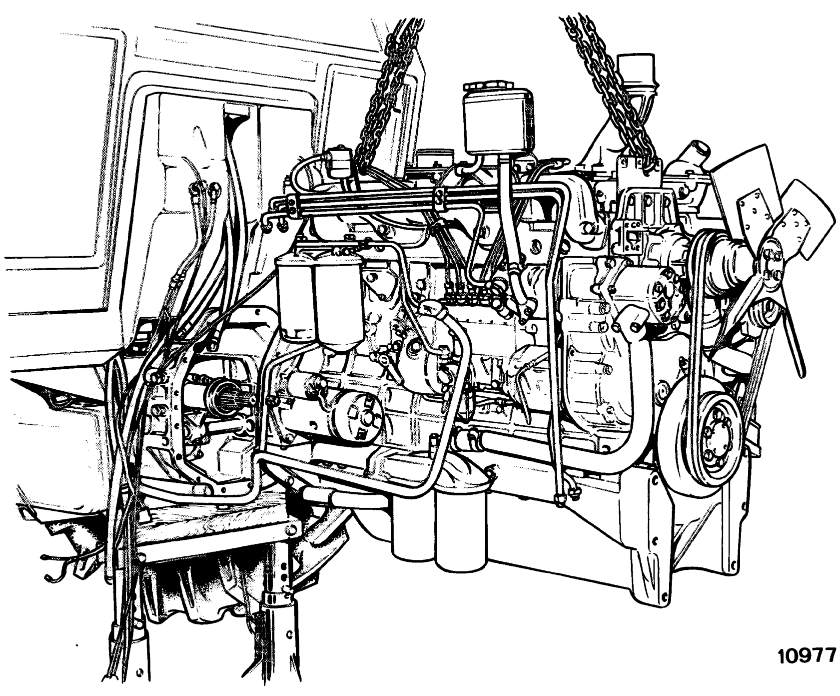
Maximum compression differential between cylinders is not to exceed 3 bar, kg/cm^2 (42.7 psi).

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, cylinder liners 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.

TO REMOVE

— Apply parking brake, chock rear wheels and remove front ballast weights;
— drain the cooling system and remove front and rear side panels, exhaust silencer and top center engine cover;
— disconnect battery, starter, front light and horn leads;
— remove grill and front engine cover and lift off the battery;
— remove battery support and side members;
— disconnect radiator and thermostat rubber hose, remove air cleaner with hose and prefereably remove the radiator;
— disconnect hose from hydrostatic steering line rigid both on power steering cylinder and platform, and rubber hose from hydrostatic steering reservoir, drain the reservoir;



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Removing (installing) engine using lift hook 290740/1 (1580).

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— remove brake line bracket, shut off fuel cock under platform near accelerator pedal and disconnect fuel lines from feed pump, injection pump and thermo-starter reservoir;
— drain rear transmission housing;
— disconnect accelerator linkage, engine shut-off cables from injection pump and tractor meter angle drive, lift inlet and outlet lines from hydraulic pump and rubber hose upstream of oil filters;
— on DT versions, remove drive shaft guard;
— remove air cleaner retainer plate. On heated cab versions, disconnect water inlet and outlet lines to cab. On air conditioned versions disconnect lines from connectors with valves;
— position stand under engine sump, placing two wooden wedges between front axle and support;
— using two slings **293769**, hoist front axle support, remove six capscrews and separate front axle from engine, acting on front wheels;
— hoist the engine using lift hook **290740/1** as shown on page 4, remove cpascrews and bolts retaining engine to transmission and separate engine from transmission.

INSTALLATION

Reverse the removal procedure noting the following points:

— when offering up engine to transmission, slide master clutch and P.T.O. clutch shafts smoothly into associated driven plate splined hubs (1180) or into master clutch driven plate hub and flywheel mounted P.T.O. splined hub (1180 H, 1380, 1580 and 1880);
— strictly adhere to the torque data specified in the table.

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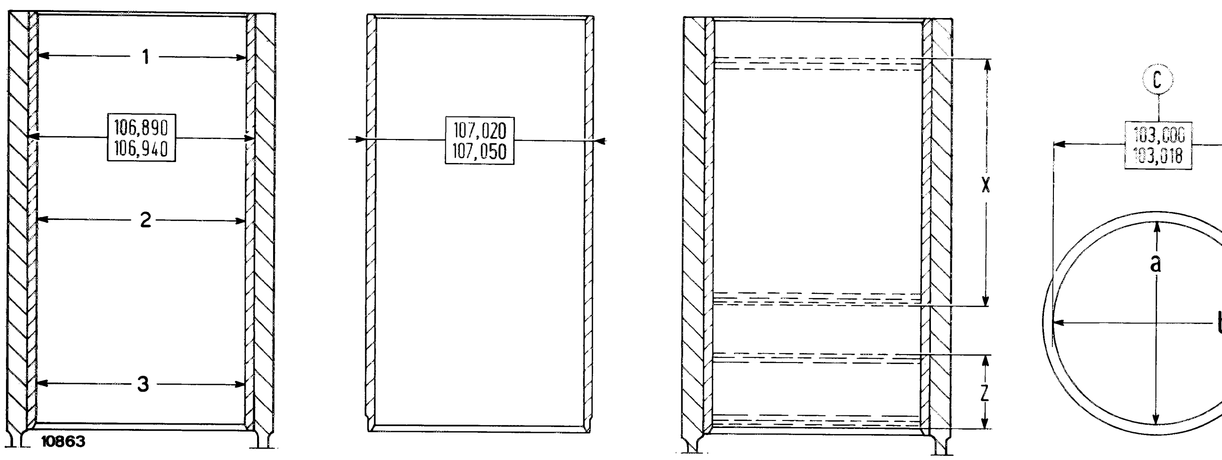
CYLINDER LINERS

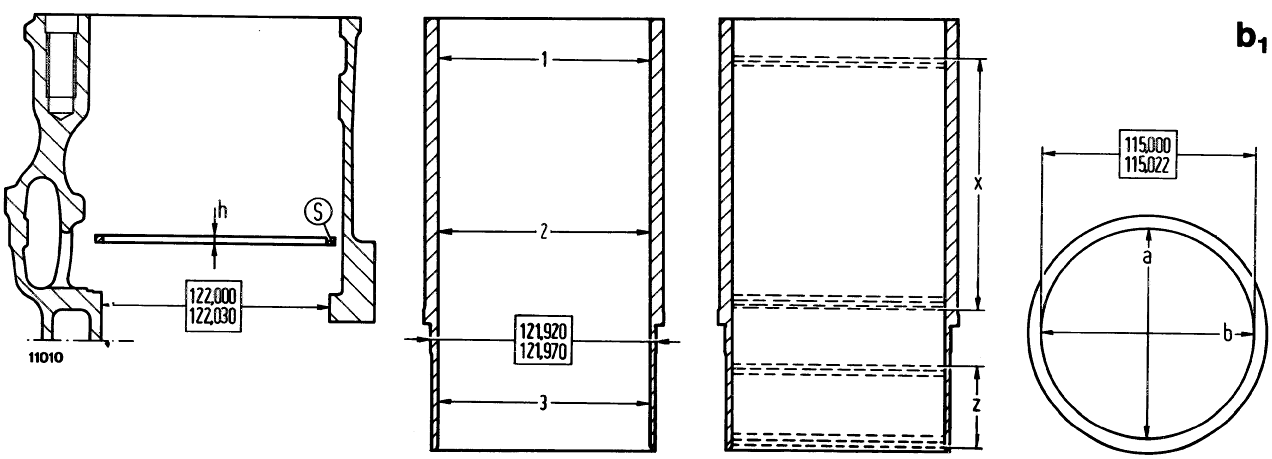
To inspect for wear proceed as follows:

- Measure the liner 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 liner ovality and taper.

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



a₁



b₁

Liner and block inspection data.

a.b. Liner bore measurements at right angles - a_1. Models 1180 and 1380 - b_1. Models 1580 and 1880 - C. Liner fitted bore diameter - h. Protrusion shim thickness (for values see section 10, page 1) - S. Protrusion shims - Z. Liner wear inspection length for assessment of piston fit (on plane b at right angles to crankshaft) - X. Liner wear inspection length (swept area) for assessment of ovality and taper on planes a and b - 1, 2, 3. New or re-bored liner bore measuring depth on planes a and b.

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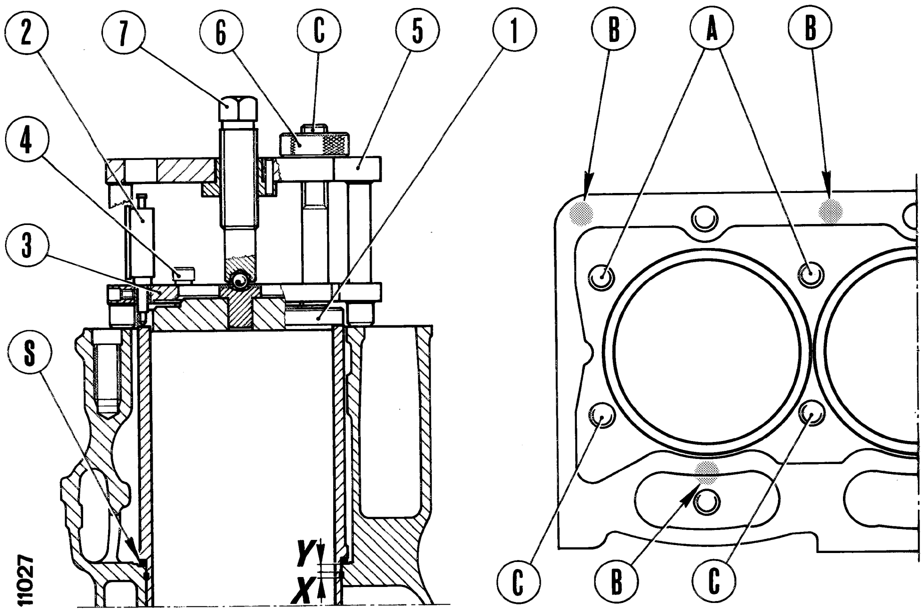

Checking cylinder liner protrusion using gauge A.360445 (293821) for 1580 and 1880 tractor models.

A. Cylinder head studs for installing plate (3) and top plate (5) - B. Points of contact on base of plate (3) - C. Cylinder head studs for installing top plate (5) - S. Liner protrusion shim - X = 3 to 4 mm (.118 to .157 in) jointing compound depth - Y ≅ 4 mm (.157 in) width of land from liner protrusion shim to jointing compound groove - 1. Compressor plate - 2. Dial gauges - 3. Dial gauge carrier plate - 4. Capscrews - 5. Upper plate - 6. Knurled lock rings - 7. Screw.

If ovality or taper in excess of .12 mm (.0048 in), 1180 and 1580, or .15 mm (.0060 in), 1580 and 1880, or piston working clearance in excess of .3 mm (.012 in) is detected, rebore (or renew) the liners to the oversize values envisaged (see 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 4, section 10).
When fitting new or reconditioned liners to 1580 and 1880 engines, check and, if necessary, adjust liner alignment and protrusion as follows:

— remove liners and shims (S) applying a reference mark to each sleeve, shim and engine block to facilitate correct repositioning on assembly;
— thoroughly clean liners and engine block using a suitable solvent to remove all traces of dry jointing compound;
— insert one liner with associated shim (S) and install compression plate (1) of tool **A.360445 (293821)** on cylinder liner;
— rest plate (3) together with four gauges (2) on a surface plate and zero the gauges;
— position plate (3) on engine block over two cylinder head studs (A) and make sure gauge styluses pass through the elongated holes in plate (1);
— connect plate (1) to plate (3) through screws (4);
— install upper plate (5) with screws (7) on 4 cylinder head studs (A and C) and fasten to block through 4 knurled lock rings (6);
— tighten screw (7) to 108 Nm, 11 kgm (80 ft.lb.) and check on the 4 gauges that liner protrusion is .13 to .17 mm (.005 to .007 in). To adjust alter thickness of shim (S) as necessary.

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— repeat the above operation on remaining liners after removing each preceding liner and shim. Ensure that top face misalignment does not exceed .04 mm (.0016 in).

— degrease cylinder liner centralization bore in block and apply a **thin** film of "LOCTITE HVX/PIPE SEALANT" No. 576 jointing compound over a width of 3 to 4 mm (.118 to .157 in) (X, page 2) ensuring that it does not run.

— reinstall the liners and shims, aligning reference marks applied on disassembly.

Since setting of jointing compound takes 24 hours, if crankshaft and pistons are to be rotated during this time, secure liners to block using three spacers **290956** and four spacers **A.360712/3 (292162)** installed on cylinder head studs.

Note: If misalignment exceeds .04 mm (.0016 in) dress the liner centralization bore in the block using tool **A.394102 (291816)** with cutter **A.394107 (291818)**, bush **A.394133 (291820)** and taper **A.394134 (291822).**

For removal and installation of 1180 and 1380 liners proceed as follows, with cold liners, using a suitable press:

— remove worn liner from bottom of block using plate **293349**.

— check block bore for ovality and, if necessary, rebore to .2 mm (.008 in) oversize.

— press replacement liner (if necessary, a .2 mm - .008 in - oversize liner) from the top of the block using plate **291501**.

— bore the liner to restore specified fitted bore diameter.

CYLINDER HEAD

The cylinder head top may be skimmed, if necessary, removing not more than .5 mm (.020 in).

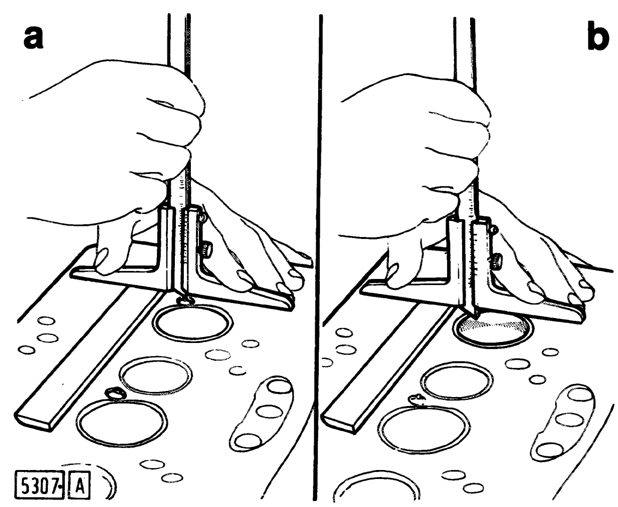
After skimming, check that fuel injector protrusion is as specified.

If necessary, replace injector sleeve proceeding as follows:

— thread the sleeve using taps M12 × 1.75, 1180 and 1380 or M24 × 1.5, 1580 and 1880;

— install puller **293784 (A.342137)** on injector studs and withdraw the sleeve;

— install replacement sleeve with attached sealing rings, press home and burnish in position using tool **293386/1**;



Checking fuel injector stand-out and valve stand-in.

a. Injector stand-out: 1 to 1.5 mm (.040 to .059 in) 1180 and 1380 (max. protrusion 1.8 mm, .071 in), 2.7 to 3.5 mm (.106 to .138 in) 1580 WEBER injectors (max. protrusion 3.8 mm, .150 in), 2.2 to 3 mm (.087 to .118 in) 1580 OMAP and BOSCH injectors (max. protrusion 3.3 mm, .130 in), 2.7 to 3.5 mm (.106 to .138 in) 1880 WEBER injectors (max. protrusion 3.8 mm, .150 in), 2.1 to 2.9 mm (.083 to .114 in) 1880 BOSCH injectors (max. protrusion 3.2 mm, .126 in) - b. Valve stand-in: .7 to 1.1 mm (.028 to .043 in), 1180 and 1380 (max. stand-in 1.4 mm, .055 in), .1 to .5 mm (.040 to .020 in), 1580 and 1880 intake valves (max. stand-in .7 mm, .028 in), .4 to .8 mm (.016 to .032 in) 1580 and 1880 exhaust valves (max. stand-in 1 mm, .040 in).

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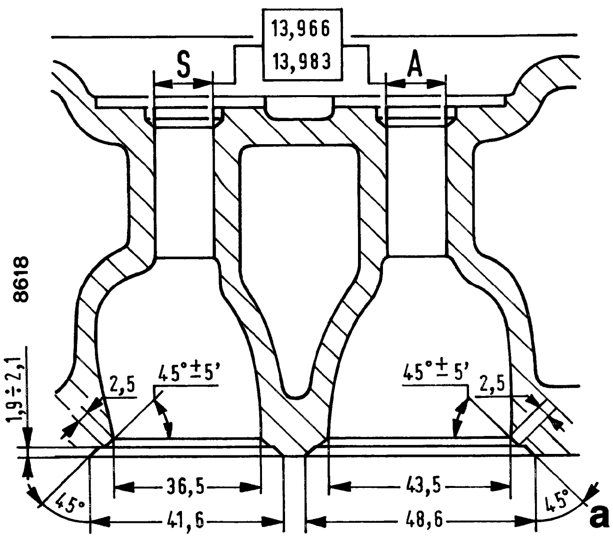

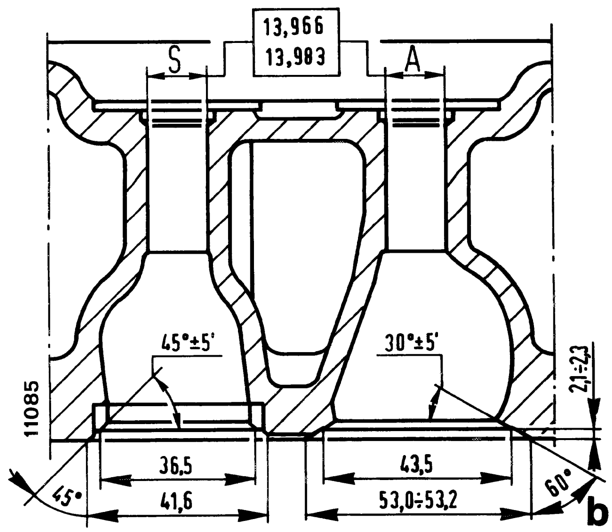

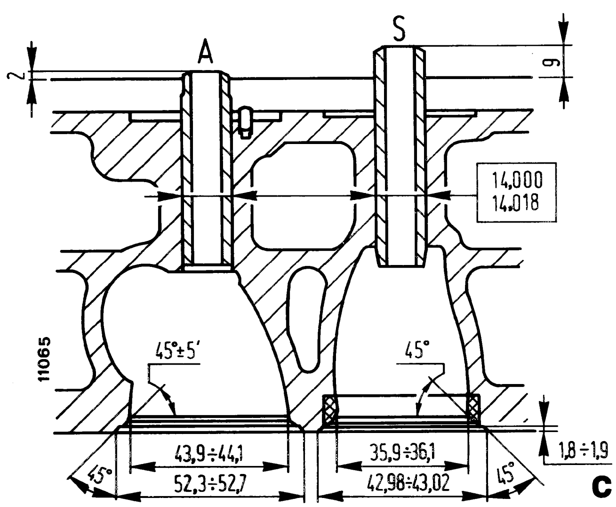

Valve seat and guide details.
a. 1180 - b. 1380 - c. 1580 and 1880 - A. Intake - S. Exhaust.

— position bush **293746** in sleeve and ream lower part of sleeve using reamer **293747** from kit **293742/1**.
— using cutter **293748,** 1180 and 1380, or **293790,** 1580 and 1880, cut injector seat until correct injector stand-out is obtained.

To cut valve seats, use fixture **A.60041 (291113)** and hand lathe **A.604219 (292913)**. Subsequently, check that valve stand-in does not exceed values on page 3.

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

— 1180 and 1380, place the gasket (provided with adhesive face) on the block with the mark "ALTO" facing towards the cylinder head (see a). Offer up the cylinder head and tighten the hold-down bolts to the correct torque in the order shown on page 5.

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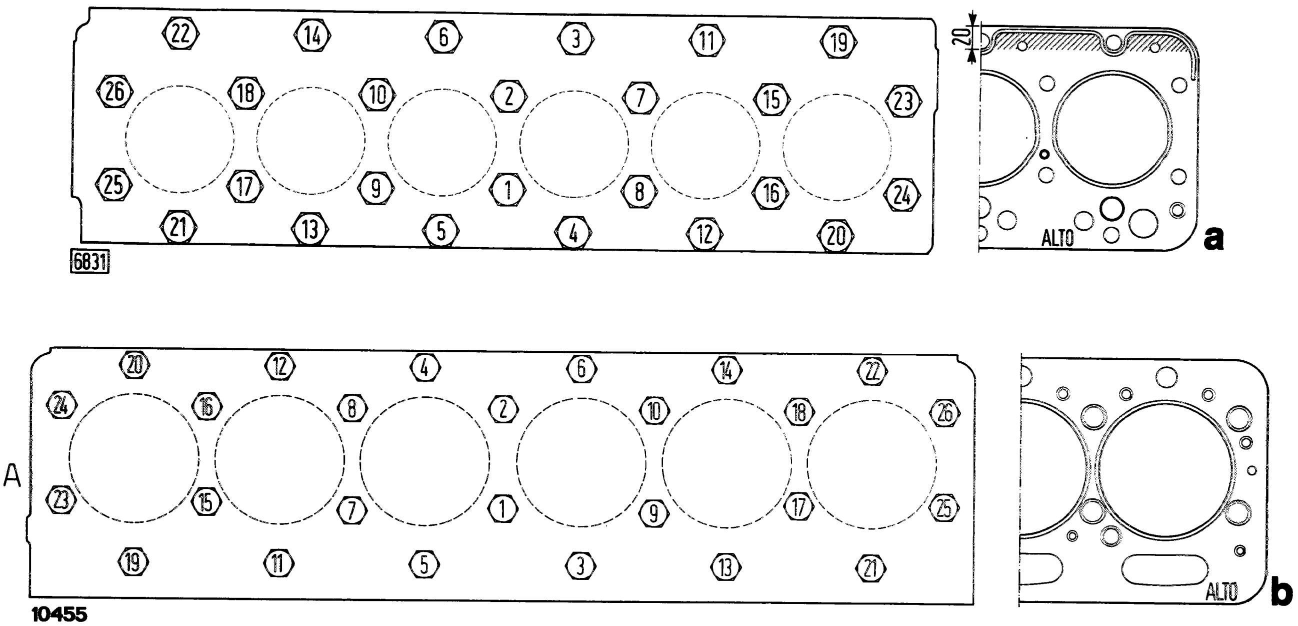

Cylinder head tightening diagram and scrap view of head gasket.
a. 1180 and 1380 - b. 1580 and 1880 - A. Fan side.

— For 1580 and 1880, position gasket without jointing compound on block with the mark "ALTO" facing toward cylinder head. Offer up cylinder head and tighten nuts to the correct torque in the order shown.

— Shaded area on gasket dimensioned in mm indicates adhesive surface for 1180 and 1380.

— Cylinder head capscrews (1180 and 1380) and nuts (1580 and 1880) are to be tightened in 3 successive stages as shown in the table below:

Stage		1	2	3
1180 and 1380	Nm	49	98	147
	kgm	5	10	15
	ft.lb.	36	72	108
1580	Nm	118	167	216
	kgm	12	17	22
	ft.lb.	87	123	159
1880	Nm	118	176	245
	kgm	12	18	25
	ft.lb.	87	130	181

SUMP

For assembly of sump, 1580 and 1880, proceed as follows:

— clean and degrease contact surfaces of engine block, front timing cover, rear engine mounting and rear seal cover. Apply a light coat of "LOCTITE 510" jointing compound, ensuring that threaded holes for sump capscrews are not obstructed;
— clean and degrease sump mating surfaces, offer up, wet capscrews with engine oil and tighten.

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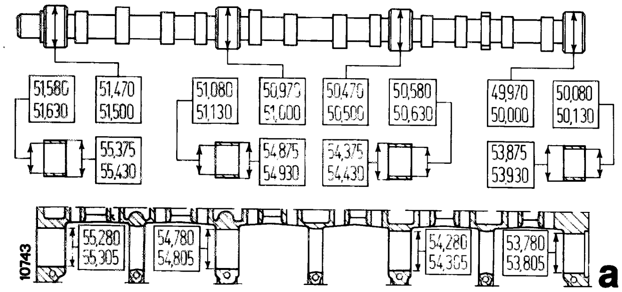
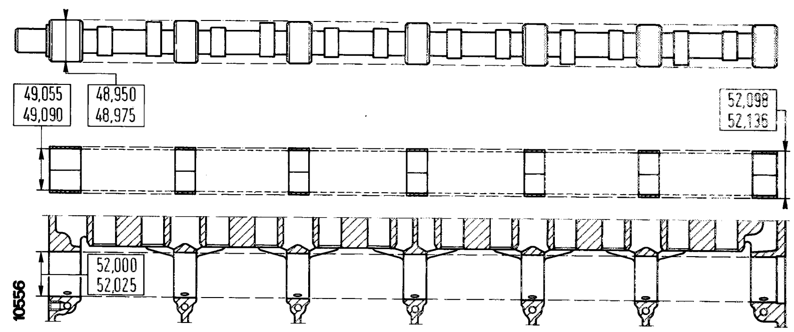




Camshaft and housing details.
Note: Bush fitted I.D. given.
a. 1180 and 1380 - b. 1580 and 1880.

CAMSHAFT

To remove the camshaft take out screws (5) and withdraw thrust plate (7).

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

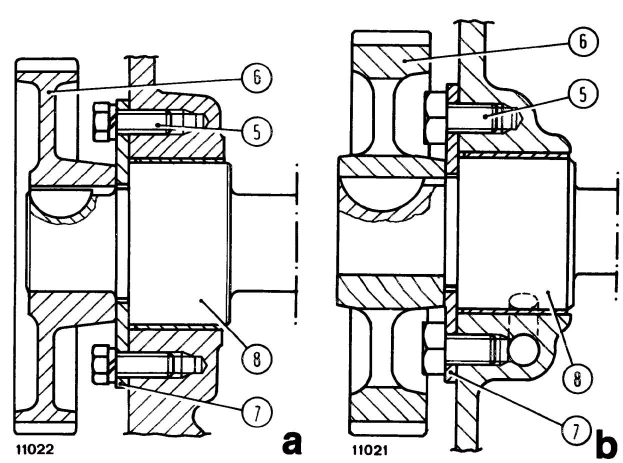
To straighten the camshaft use a press of adequate size for up to .2 mm (.008 in) distortion. If distortion exceeds .2 mm (.008 in), renew the camshaft without hesitation.

Replace worn bushes using a set of punches **292103 (A.360383),** 1180 and 1380, or driver **292164 (A.360380),** 1580 and 1880.

Open out new bushes to I.D.'s indicated in figure using reamer **293269 (A.390363),** 1180 and 1380, or reamer **292163 (A.390368),** 1580 and 1880.

VALVES, GUIDES AND SPRINGS

To remove and reinstall the valves use tool **291050.**
If defective sealing is detected, grind in together with the 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 land below valve head chamfer is not less then .5 mm (.020 in).



Section through camshaft drive.
a. 1180 and 1380 - b. 1580 and 1880 - 5. Plate capscrew - 6. Drive gear - 7. Thrust plate - 8. Camshaft.

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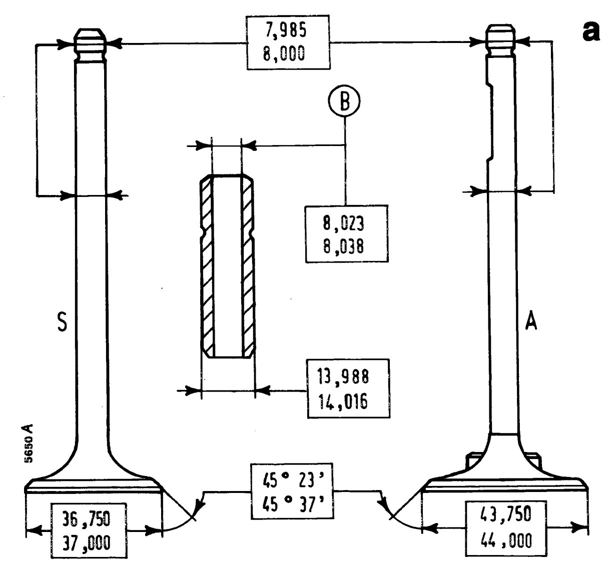

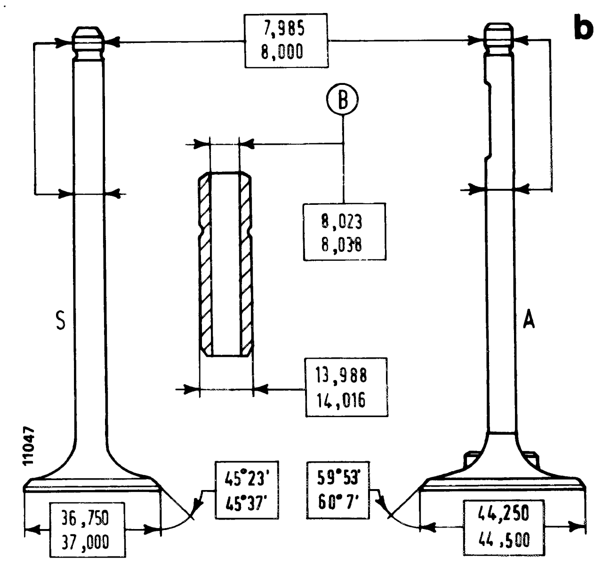

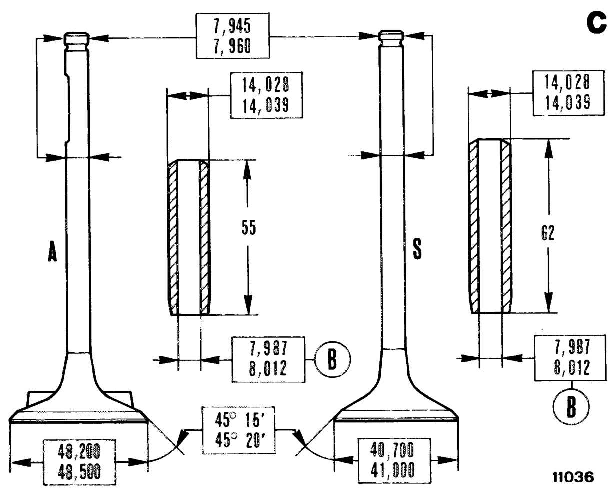

Valve and guide details.
Note: Minimum land below head chamfer is .5 mm or .020 in.
a. 1180 - b. 1380 - c. 1580 and 1880 - A. Intake - B. Fitted diameter - S. Exhaust.

To remove the valve guides use punch **A.360409/1 (291046/1)** and to reinstall use same, together with bush **A.360283 (291779)** (for exhaust valve guide on 1580 and 1880) or together with bush **A.360409/3 (291780)** (for intake valve guide on 1580 and 1880 and intake and exhaust valve guides on 1180 and 1380).

On 1580 and 1880 guides should protrude from cylinder head as indicated in figure (c, page 4, section 10). Valve guides should be a drive fit in their housing. If loose they should be replaced with oversize guides.

After refitting, each guide should be reamed with tool **291177** for 1180 and 1380, and **290944** for 1580 and 1880.

TAPPETS, PUSHRODS AND ROCKERS

Ensure that the tappets slide smoothly in their housings without excessive clearance.
If excessive clearance is detected, renew using oversize tappets and open out the associated housing bores.

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

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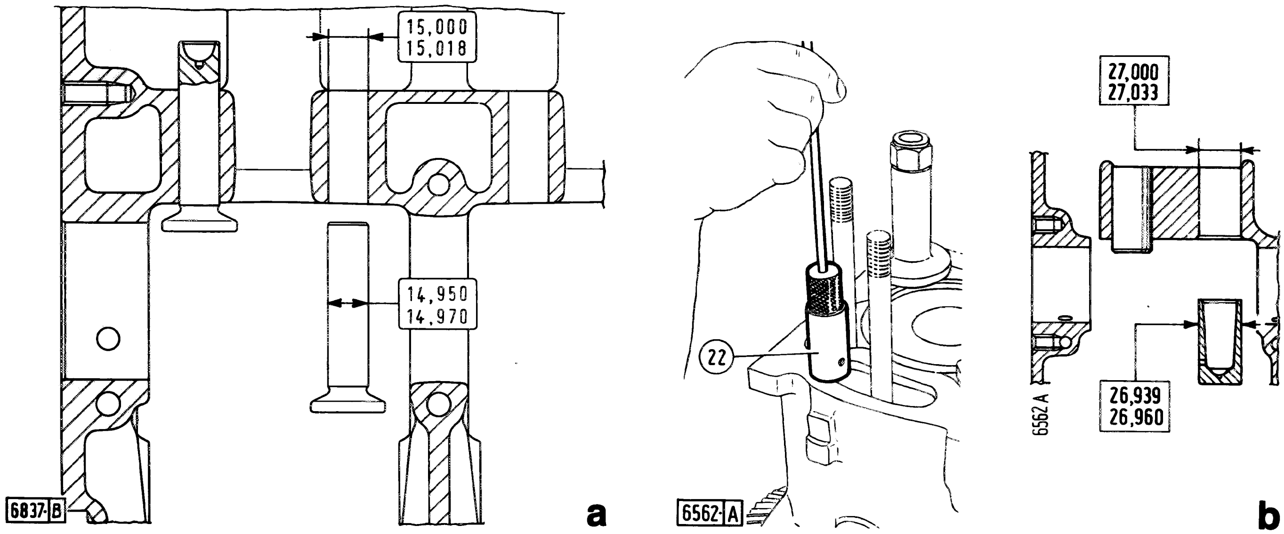
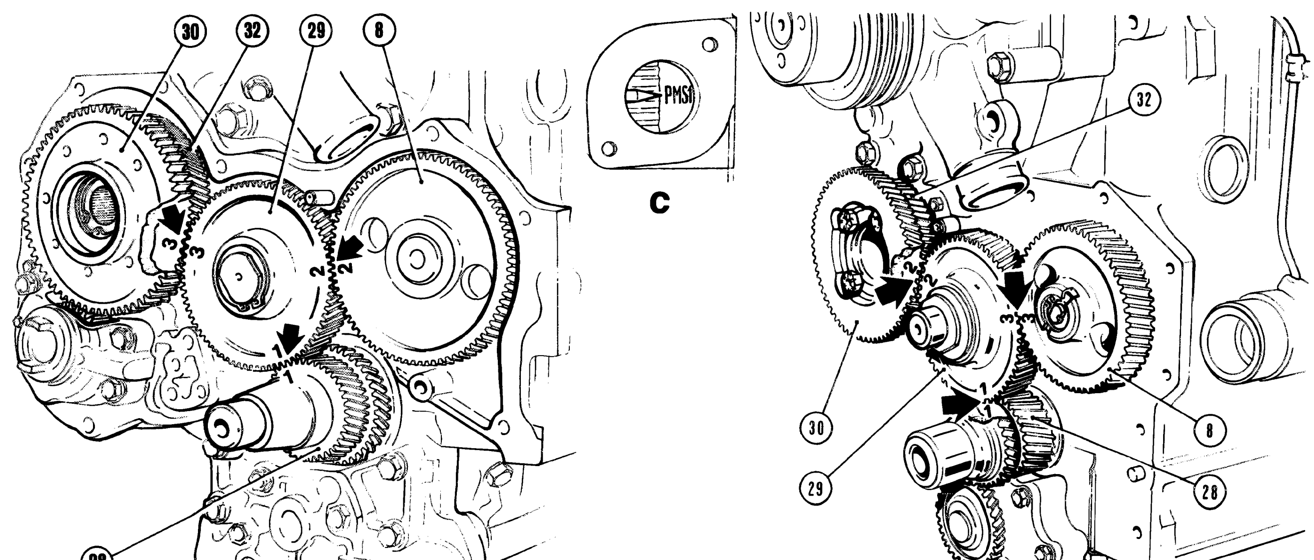


Removing/installing tappets (1580 and 1880) using tool 290947 - Tapping and housing details.
a. 1180 and 1380 - b. 1580 and 1880 - 22. Tappet.



Valve timing.

Note: Timing marks to line up with piston No. 1 at T.D.C. on compression stroke arrowed (inset c.).

a. 1180 and 1380 - b. 1580 and 1880 - c. Flywheel timing mark and pointer (P.M.S.1. = Piston No. 1 at T.D.C.) - 8. Camshaft gear - 28. Crankshaft gear - 29. Idler gear - 30. Lift pump and power steering pump gear - 32. Injection pump drive gear.

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Valve clearance adjustment

Check the valve clearance using a suitable feeler gauge. For correct clearance see the table on page 7, section 10.
To adjust use wrench **290886** (1180 and 1380) or wrench **291883 (A.350108)**, (1580, 1880 as well as 1180 and 1380), working on each cylinder with the valves of the opposite cylinder in a condition of balance (i.e. start of suction stroke). Cylinder matching is 1-6, 2-5 and 3-4.

VALVE GEAR TRAIN

For valve timing, proceed as directed hereunder:

— turn the crankshaft to bring piston No. 1 to T.D.C. position on compression stroke;
— install the drive gears and align as shown on page 3.

Note: For valve timing check adjust valve clearance to .45 mm (.0177 in) (1180 and 1380) or .41 mm (.0161 in) (1580 and 1880).

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CRANKSHAFT

On 1180 and 1380, remove the pulley hub using tool **291504**. Carefully inspect the crankshaft.
Remember that even the slightest crack necessitates crankshaft renewal.

Check both main journals and crankpins noting the following points:

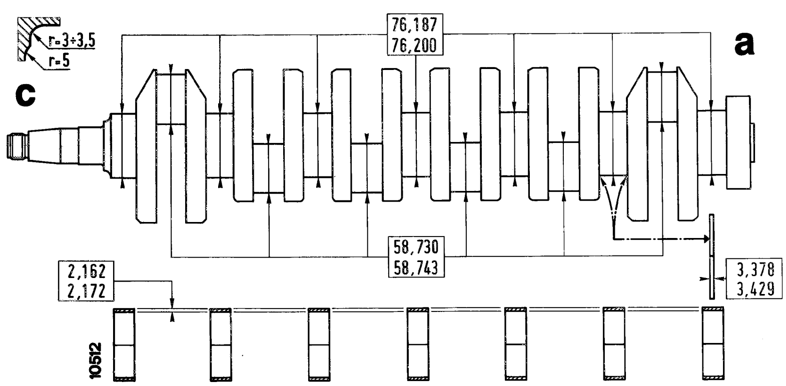
- pick-up and scratch marks may be remedied using zero-grade emery paper;
- score marks, ovality and taper in excess of .05 mm (.002 in), necessitate journal regrinding to the nearest undersize dimension (see data table).

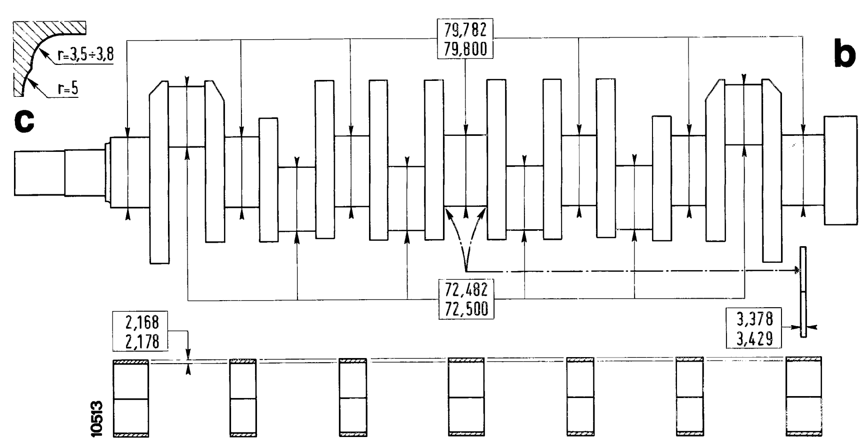
After regrinding, blend the journal fillet radii as shown in (a) and (b), and inspect the crankshaft to ensure that:

- journal ovality does not exceed .008 mm (.0003 in);
- journal taper does not exceed .01 mm (.0004 in);
- maximum main journal misalignment with the shaft over V-blocks does not exceed .10 mm or .004 in (D, page 2);
- maximum misalignment of each pair of crankpins with respect to main journals does not exceed ± .25 mm (± .010 in) (a, page 2);
- the distance from top of crankpin to crankshaft centerline does not exceed ± .10 mm (± .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 of page 3, section 10.

Check the core plugs for leakage with oil at 14.7 bar (15 kg/cm^2, 230 psi). Press fit new core plugs as necessary, peen in position and recheck for leakage.

After refitting the crankshaft and retightening the bearing caps check the end float at the last but one cap (1180 and 1380) or at the center bearing cap (1580 and 1880). If excessive play is detected, install oversize thrust washers (see data table).





Crankshaft, bearing and thrust washer details.
a. 1180 and 1380 - b. 1580 and 1880 - c. Journal fillet radius details.

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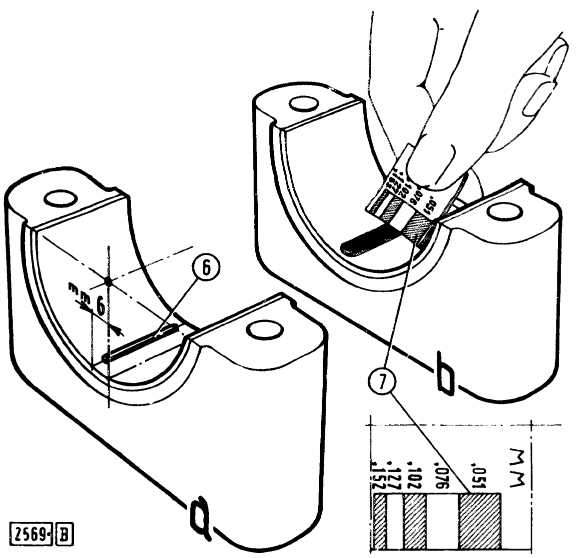


Checking crankshaft journal running clearance.

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.

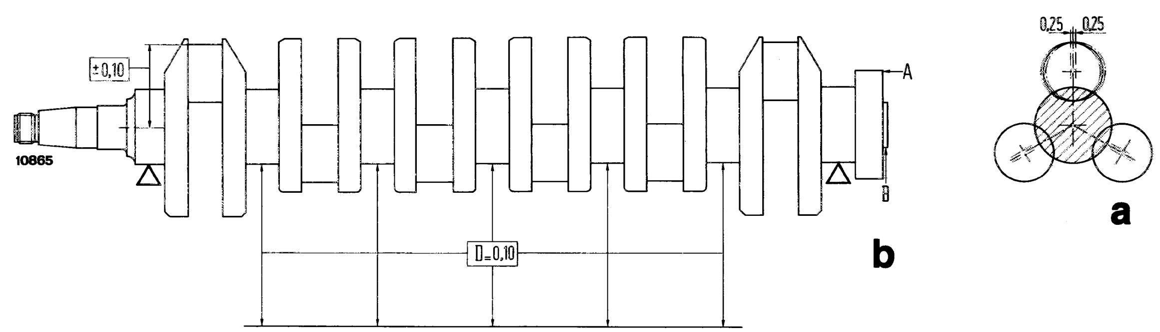
Crankshaft front and rear seals

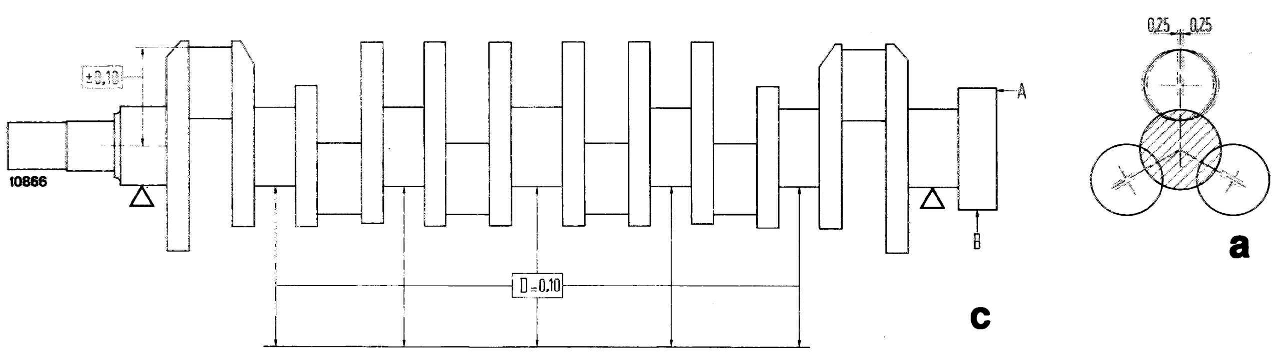
Check the metal-caged, double-lip spring-loaded rubber seals (pages 21, 22, 23 and 24, section 10).
When renewing the seals note the following points:

- wipe off all traces of oil and dirt. The seal seat should be clean and dry;
- soak the seal in engine oil for 30 minutes and install applying a steady even pressure all round using a stuitable drift;
- smear 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 bearing caps with attached thin shell bearings are numbered for correct installation.





Checking main journal and crankpin alignment.

a. Crankpins to main journals maximum misalignment - b. 1180 and 1380 - c. 1580 and 1880 - A. Flange run-out stylus position - B. Stylus position for eccentricity check - D. Maximum main journal misalignment.

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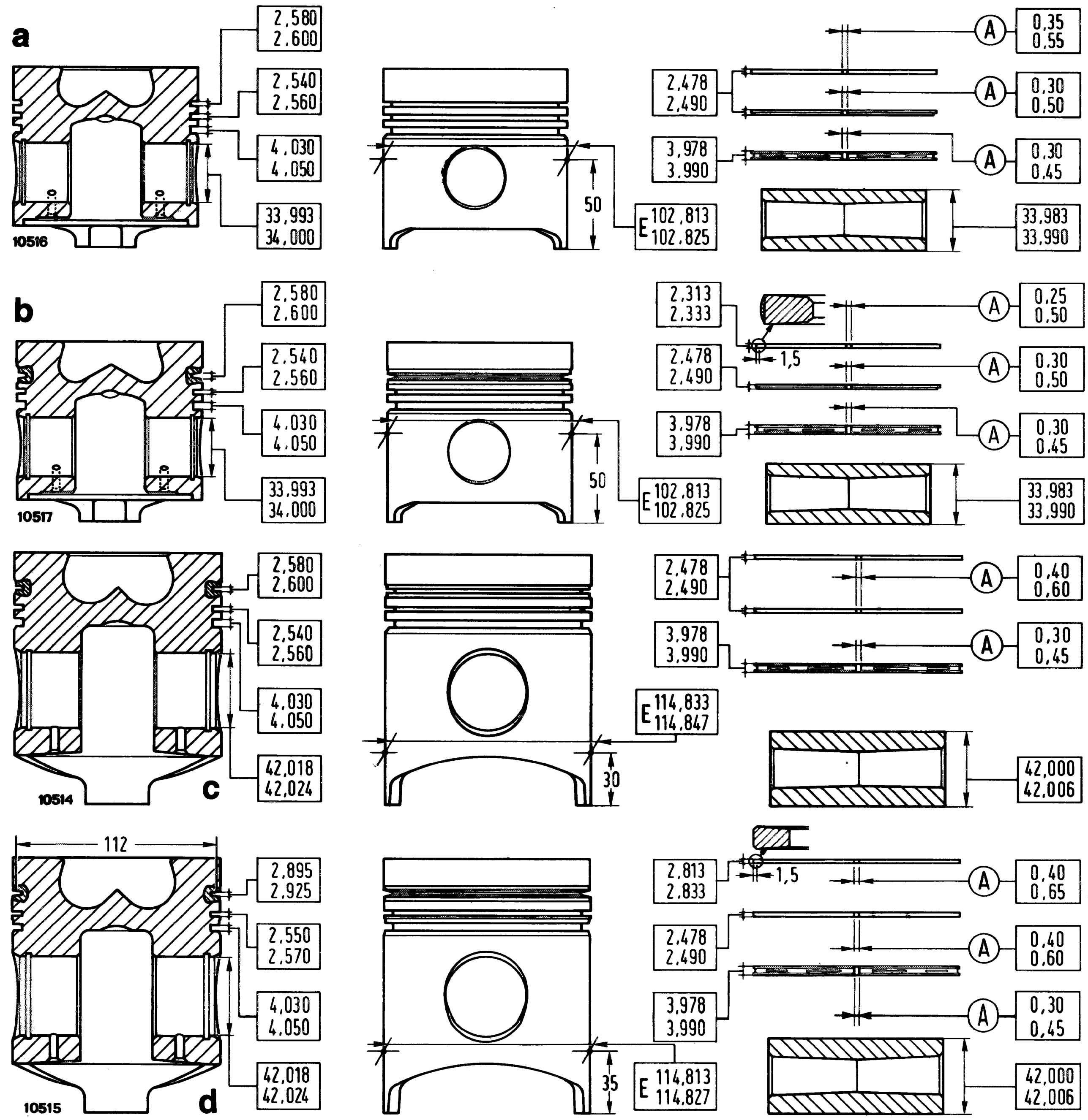
Accordingly, the cap identification number should tally with that stamped on the engine block.
The crankshaft bearing running clearance may be checked using Perfect Circle Plastigage calibrated wire (page 2).

PISTONS AND RINGS

Assess piston and liner wear as directed on page 1, section 101, in the illustration on this page and on page 4.



Piston, pin and ring details.
a. 1180 - b. 1380 - c. 1580 - d. 1880 - A. Piston ring fitted gap - E. Piston diameter as measured 30, 35 or 50 mm (1¼, 1½ or 2 in) from base of skirt.

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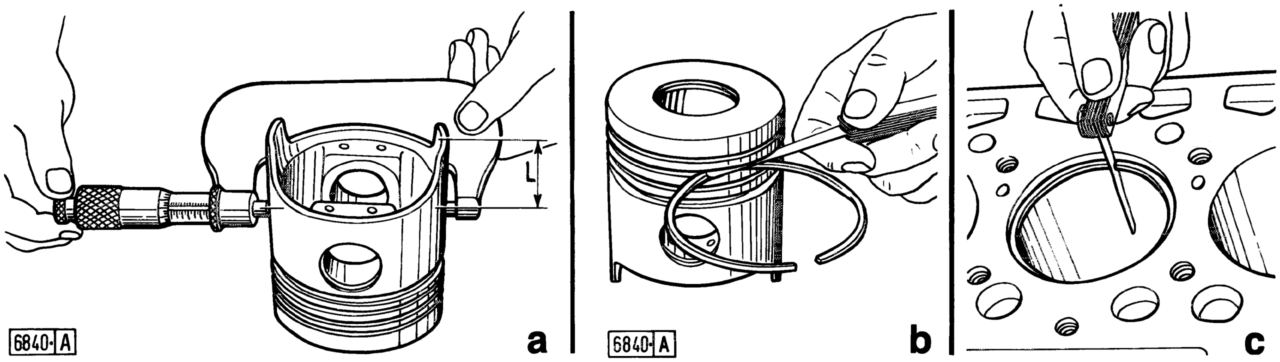


Inspecting the pistons and rings.

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), 1180, 1380, 30 mm (1¼ in), 1580 or 35 mm (1½ in), 1880.

If the clearance is found to be in excess of .30 mm (.12 in), rebore the liners and fit oversize pistons and rings (see table).

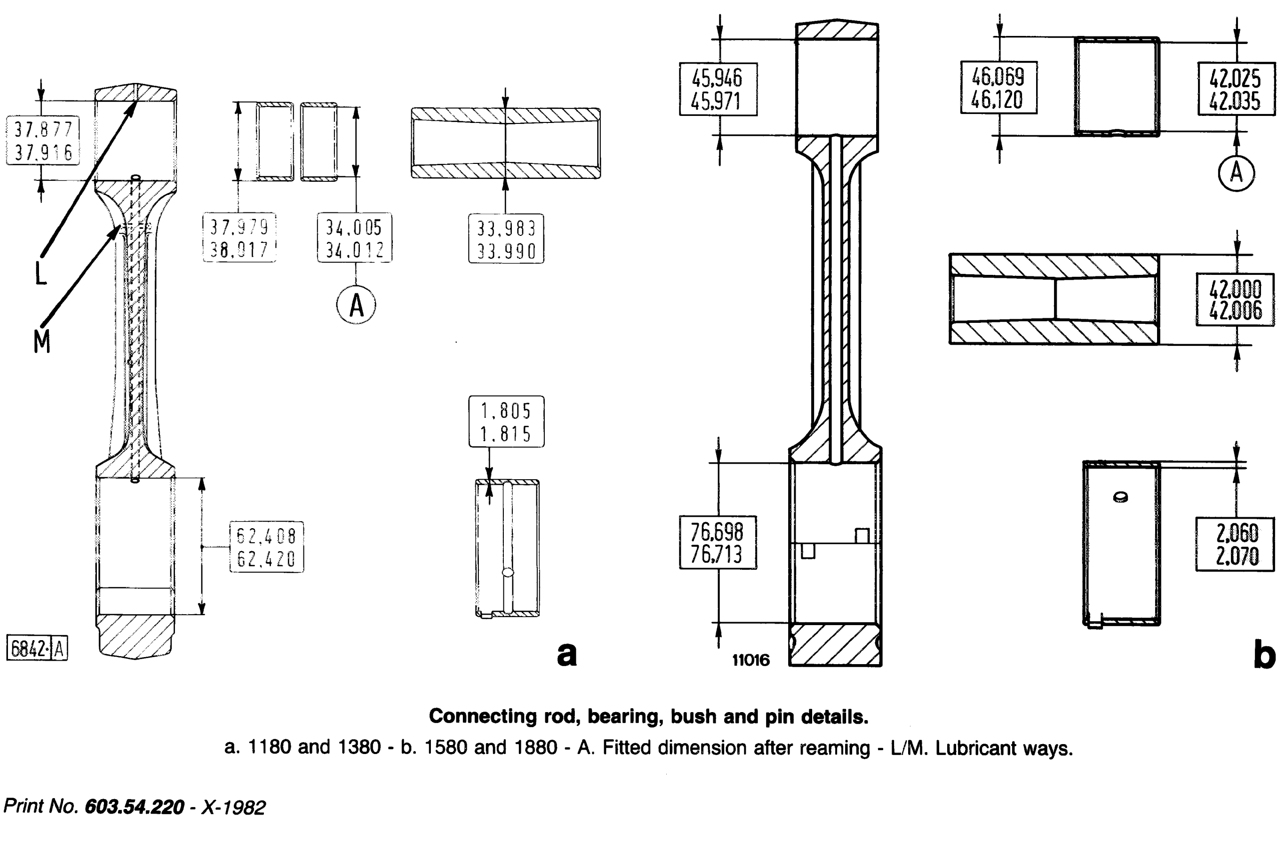
If the pistons are renewed, note that the weight difference between pistons of the same engine should not exceed 20 grams (⅔ oz.), 1180 and 1380, or 15 grams (½ oz.) 1580 and 1880.

To remove and reinstall the piston rings use tool **291160.**

Check the ring side clearance (b) and the fitted cap (c). If ring gap is found to be less than prescribed, grind the ring ends as necessary.

When reinstalling the rings adhere to the instructions given on page 5.

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



Connecting rod, bearing, bush and pin details.

a. 1180 and 1380 - b. 1580 and 1880 - A. Fitted dimension after reaming - L/M. Lubricant ways.

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CONNECTING RODS

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

After press fitting, ream the bushes using a suitable expanding blade reamer.

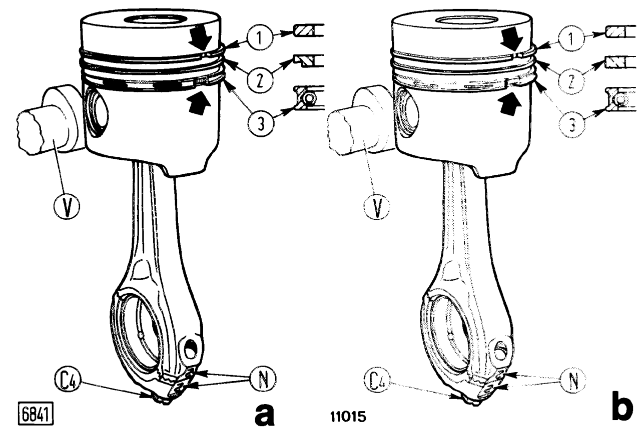
If necessary, the bushes may be opened out to the specified piston pin oversize (see data table), together with the piston.

Use gauge **293459** to check connecting rod axis misalignment of big and small end axis at 125 mm (5 in) away from the rod centerline should be as specified in the table. Any slight distortion may be remedied using a suitable press; however, if distorsion is serious renew the connecting rod without hesitation.

Replacement rods should be stamped with the reference numbers of the cylinders to which they belong. Also ensure that the weight difference between rods of the same engine does not exceed 25 grams (1 oz.), 1180 and 1380, and 20 grams (⅔ oz.), 1580 and 1880.

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

Note: Whenever the connecting rods are dismantled, renew the cap retaining screws.



Connecting rod/piston assembly in correct fitted position.
Note: Ring gaps arrowed (see text).
a. 1180 and 1380 - b. 1580 and 1880 - C_4. Cap bolts - N. Cylinder reference - V. Camshaft - 1. Compression ring - 2. Oil control ring (1180 and 1380) or compression ring (1580 and 1880) - 3. Oil control ring.

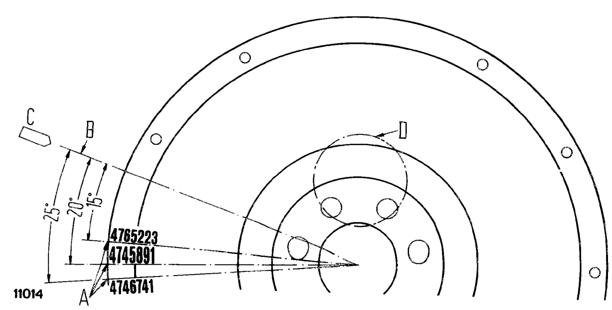
Connecting rod/piston installation

Introduce the pistons with attached rings and connecting rods in the associated liners, prefereably using ring compressor **291048,** and position each assembly so that reference (N) on the connecting rods face towards the side opposite the camshaft (V), as indicated in (a) and (b).

Fitted piston T.D.C. position with respect to engine block should be:
— 1180 and 1380, .46 to .79 mm (.018 to .032 in) stand-out;
— 1580 and 1880, .30 mm (.012 in) stand-in to .61 mm (.024 in) stand-out.

FLYWHEEL

When installing the flywheel, 1580 and 1880, bring crankpin No. 1 (D) to T.D.C. and check that fixed timing pointer (C) is in register with P.M.S. 1 reference (B).
On 1180 and 1380, the fiywheel assembly position cannot be mistaken as bolt position has been offset for the purpose.



Flywheel Assembly References (1580 and 1880).
A. INIEZ. reference position; marked **4746741** aligned with start of delivery (1580), **4745891** aligned with start of delivery (early model 1880 up to engine No. 750749) and **4765223** aligned with start of delivery (1880 late model from engine No. 750750 - B. TDC 1 reference position - C. Fixed timing pointer - D. No. 1 crankpin position for correct flywheel assembly.

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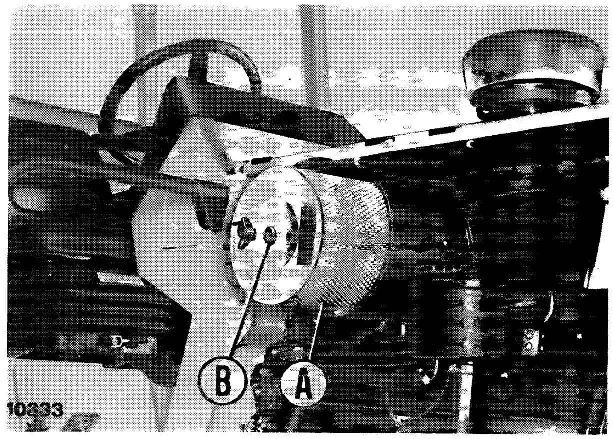
a



b

Precleaner and air cleaner.
a. Precleaner - b. Air cleaner - A. Cartridge - B. Seal.

PRECLEANER AND AIR CLEANER

Clean the bowl when the dust deposit in the precleaner reaches the level arrowed in fig. a.

When the red condition indicator lights up on the instrument panel, remove cartridge (A, fig. b) and clean as follows:

— with a jet of dry compressed air less than 6.9 bar, 7 kg/cm^2 (43 psi), subsequently dry with dry compressed air at below 50°C.

Moreover, note the following:

— never clean the cartridge by striking against a hard surface;

— replace seal (B) if damaged;

— do not separate plastic fins from filter element body;

— clean sheet metal container interior using a damp cloth;

— do not wash or blow the inner cartridge; replace after the outer cartridge has been cleaned three times, or every 400 hours.

FUEL TANK

Clean the fuel tank during tractor overhaul.
Periodically drain the condensate and any deposits by backing off the fuel outlet connection on the underside of the main tank, or of both auxiliary tanks where fitted.
Condensate draining must be carried out with the engine stationary, tractor on level ground and tank almost empty.

FUEL FILTERS

Every 50 hours, 1180 and 1380, drain condensate from filters by backing off screw (1, fig. a, page 2), 1180, or screws (1 and 2, fig. b), 1380 through 3 to 4 turns.

Every 200 hours, 1380, 1580 and 1880, turn off tank cock, remove cup filter and clean with kerosene; on 1180, back off screw (3, fig. a) and replace car tridge (4).

Every 400 hours:

— 1380, back off screws (3, fig. b) and replace cartridges (4);

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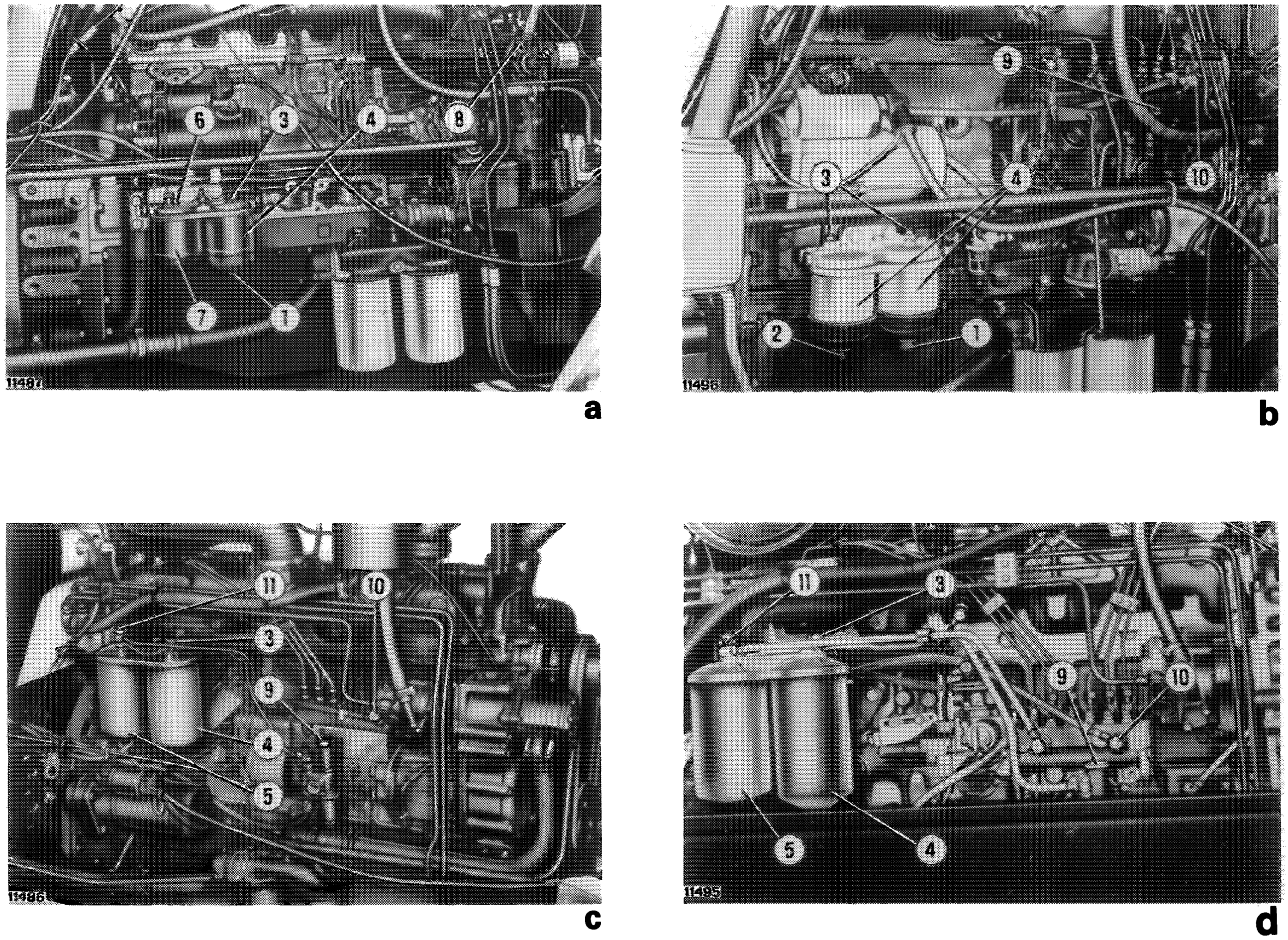

Venting fuel circuit.
a. 1180 - b. 1380 - c. 1580 - d. 1880 - 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11. See text.

— 1580 and 1880, back off screw (3, figs. c and d) and replace cartridge inside container (4).

Every 800 hours:
— 1180, back off screw (6, fig. a) and replace cartridge (7);
— 1580 and 1880, unscrew filter (5, figs. c and d) from support and replace.

Following filter maintenance, bleed the fuel circuit as follows:
— 1180, back off plug (3, fig. a) through two turns and actuate lever (8) until the fuel issuing from the plug is free from air bubbles. Tighten plug (3), repeat the above sequence on plug (6) and actuate lever (8) a few more times;

— 1380, 1580 and 1880, back off screws (3, fig. b, 1380) or screw (11, figs. c and d, 1580 and 1880) and priming knob (9) through two turns, and pump until the fuel issuing from orifice in screws (3 or 11) is free from air bubbles. Tighten screws (3 or 11) and back off connection (10) through two turns and actuate knob (9) until the fuel issuing from the connection is free from air bubbles. Retighten the connection and pump priming knob (9) ten more times.

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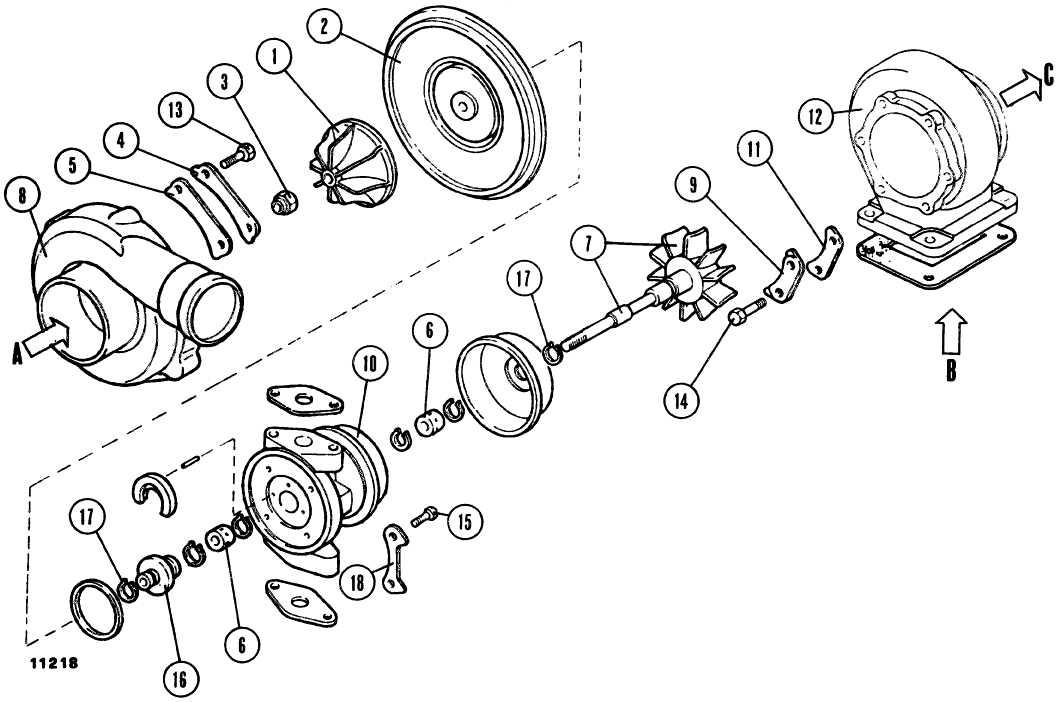
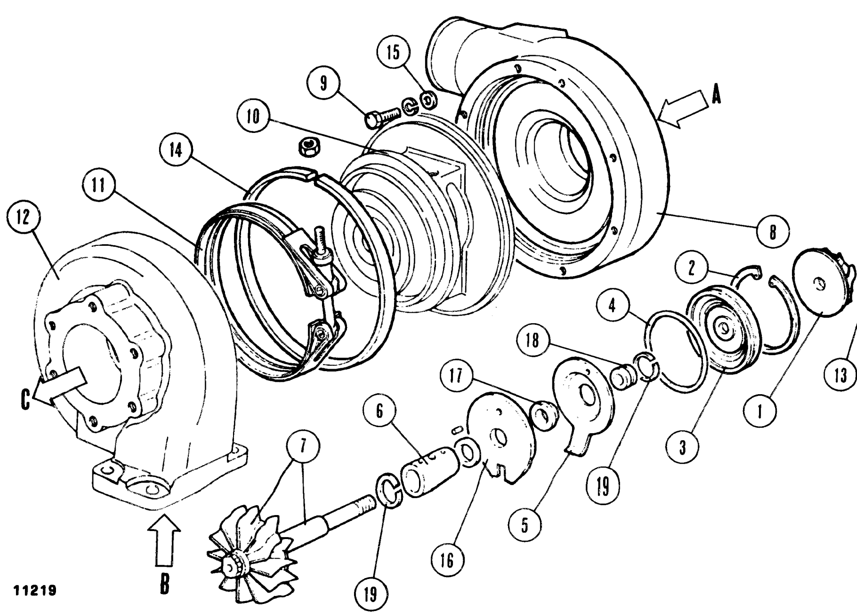


GARRETT turbocharger components (1380).

A. Compressed air inlet - B. Turbine gas inlet - C. Exhaust gas outlel - 1. Compressor impeller - 2. Rear cover - 3. Nut - 4. Lock plate - 5. Retainer plate - 6. Bearing - 7. Turbine and shaft - 8. Compressor body - 9. Lock plate - 10. Center body - 11. Retainer plate - 12. Turbine body - 13. Capscrew - 14. Capscrew - 15. Capscrew - 16. Thrust collar - 17. Sealing ring - 18. Lock plate.



HOLSET turbocharger components (1880).

A. Compressed air inlet - B. Turbine gas inlet - C. Exhaust gas outlet - 1. Compressor impeller - 2. Retaining ring - 3. Seal carrier - 4. Seal - 5. Baffle - 6. Bearing - 7. Turbine - 8. Compressor body - 9. Capscrew - 10. Center body - 11. Collar - 12. Turbine body - 13. Nut - 14. Retaining ring - 15. Washer - 16. Thrust ring - 17. Spacer ring - 18. Thrust collar - 19. Sealing ring.

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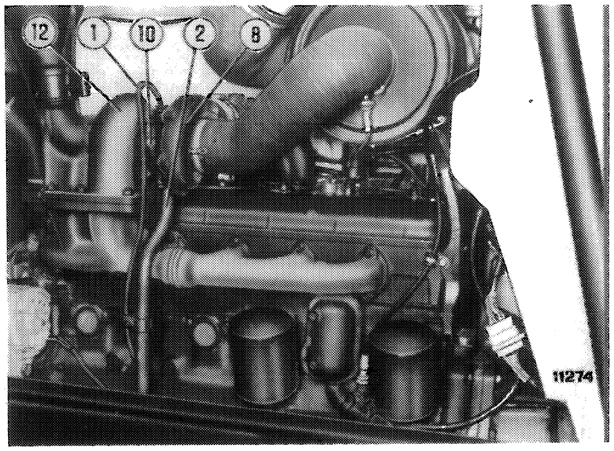
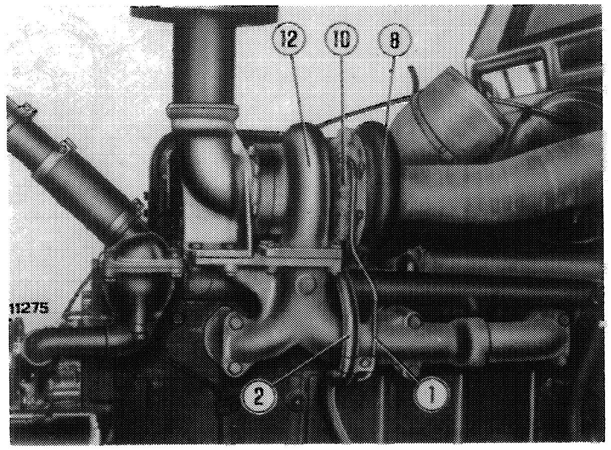
ENGINE:
Fuel system - Turbocharger



a



b

Turbocharger in position on engine.

a. GARRET turbocharger (1380) - b. HOLSET turbocharger (1880) - 1. Lubricating oil inlet line - 2. Lubricating oil outlet line - 8. Compressor body - 10. Center body - 12. Turbine body.

DESCRIPTION AND OPERATION

Prior to being discharged in the atmosphere, exhaust gases are directed through body (12) onto the turbine to set shaft (7) in motion.

Compressor impeller (1) attached to the same shaft (7) turns inside body (8) thereby drawing filtered air which is then compressed and directed to the engine cylinders.

Internal parts are lubricated by engine oil directed under pressure into center body (10) and bearings (6). Oil is retained by sealing rings at both ends of the center body.

General

— Upon starting, run the engine for 30 seconds at 1000 rpm checking that engine oil indicator is out to ensure full lubrication of internal turbocharger parts.

— Prior to stopping a warm engine, allow to run at 1000 rpm for 3 minutes to permit gradual turbocharger cooling and prevent possible coking of lubricating oil in the center body (10).

— Never start the engine with the exhaust sleeve or air suction piping disconnected from the turbocharger.

Foreign particles drawn by the compressor may cause damage to the impeller and seriously affect turbocharger operation.

Removal and replacement

Prior to removal, clean the exterior of the unit and the adjacent areas to prevent the ingress of foreign matter in the engine; also plug the hole in the exhaust manifold, intake manifold and the two turbocharger lubricating oil inlet and outlet pipes.

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— Disassemble the strictly necessary to permit inspection or repair, placing disassembled parts in clean containers to prevent contamination by foreign bodies.

— Prior to cleaning disassembled parts, check for signs of overheating or rubbing or other blemishes that may not be visible after washing.

— Clean compressor impeller using a soft brush; note that uneven deposits may adversely affect impeller balance and result in bearing failure.

— Dip all parts in a non-caustic carbon solvent.

After dipping, remove foreign matter using a hard bristle brush and dry thoroughly using a compressed air line.

Note: A light coat of carbon deposits does not normally affect turbine operation.

Prior to installation on the engine, ascertain whether the repaired or replaced turbocharger was faulty due to the ingress of foreign bodies in the intake system; also ensure that all parts are in good condition and clean to prevent the problem from reoccurring.

— Ensure that hose from air cleaner to turbocharger is in good condition. If it is found to be dry, hardened by heat or otherwise deteriorated, replace without hesitation.

— Ensure that lubricating oil inlet and outlet lines are not obstructed, dirty or damaged.

— Fill the center body with fresh engine oil through the inlet port and turn the wheel assembly by hand to ensure that the oil penetrates to the bearings and thrust faces.

— Apply anti-seize compound to the threads of bolts or studs, offer up the turbocharger on the exhaust manifold and connect to air cleaner and intake manifold ensuring freedom from air leakage.

— Pour more fresh engine oil in the center body through the inlet port ensuring that the latter is clean and unobstructed, and connect the delivery and drain piping.

— Install exhaust silencer, start the engine and run at low speed, checking that the oil delivery and drain connections are free from leakage.

Note: When installing the turbocharger, connect the air and exhaust gas lines without subjecting the unit to mechanical stresses.

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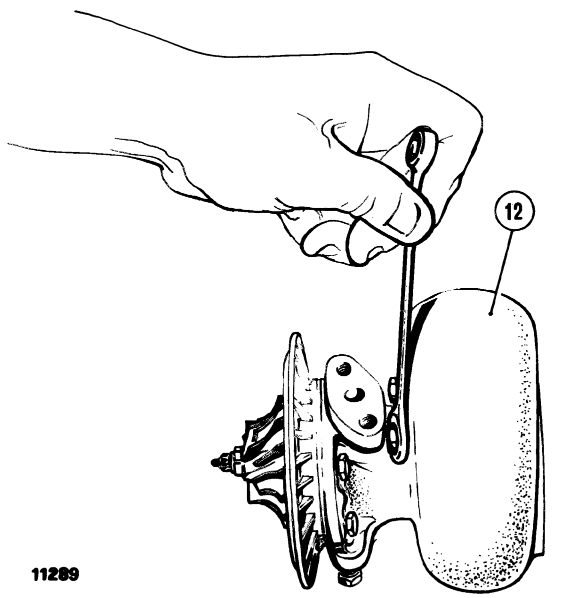
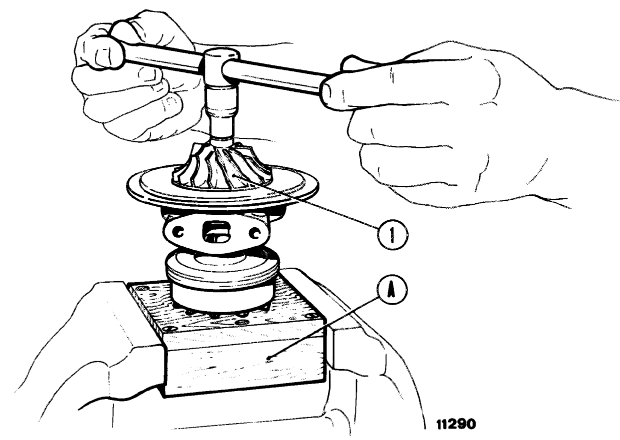


Removing or installing turbine body (12).

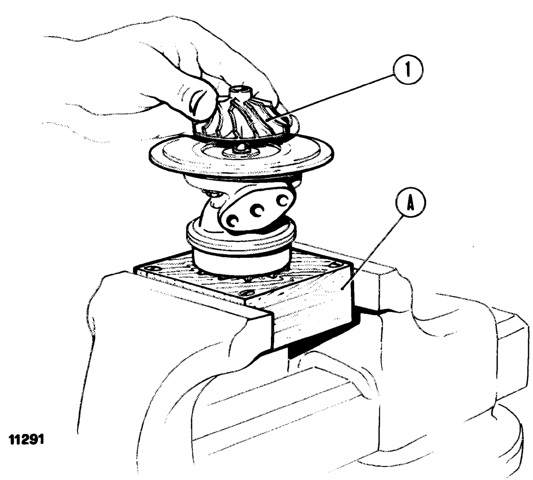


Removing or installing compressor impeller.
A. Tool **293814** - 1. Impeller.

GARRETT TURBOCHARGER OVERHAUL (1380)

After removing the turbocharger from the engine proceed as follows:

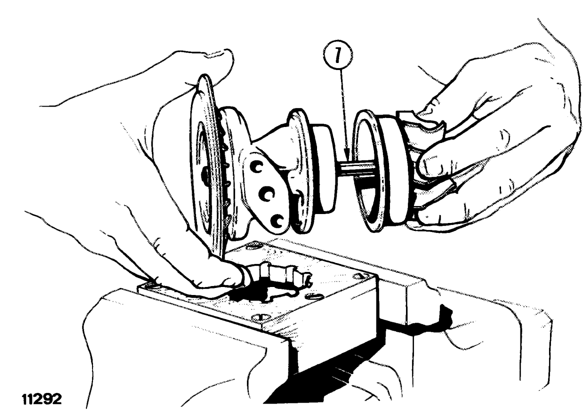
— apply reference marks on compressor body (8, page 3) and rear cover (2);



Removing compressor impeller nut.
A. Tool **293814** - 1. Compressor impeller.

Note: Reference marks must be aligned on assembly.

— raise lock plates (4), back off screws (13) and disassemble compressor body;
— apply reference marks to turbine body (12) and center body (10), raise lock plates (9), back off screws (14) and disassemble turbine body;
— clamp tool **293814** (A) in a vice and install the turbine wheel on the tool;



Removing or installing turbine shaft (7).

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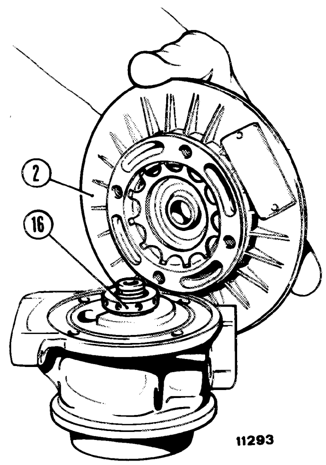
— remove nut (3, page 3) using a T-wrench as shown on page 6 in order not to damage the turbine shaft;

— remove the compressor impeller (1, page 6) followed by turbine shaft (7);

— raise lock plates (18, page 3), back off screws (15), remove rear cover (2) and thrust collar (16);

— using suitable pliers, remove retaining rings and take off bearings (6) from center body (10).



Removing or installing rear cover (2).
16. Thrust collar.

Inspect removed components and ensure that:

— the parts are free from damage, corrosion and wear;

— threads are free from dents, tears or strains;

— turbine and compressor wheels do not show signs of rubbing and that the blades are not broken or worn at the edges;

— the shaft is free from pick-up on the journals in contact with the bearings;

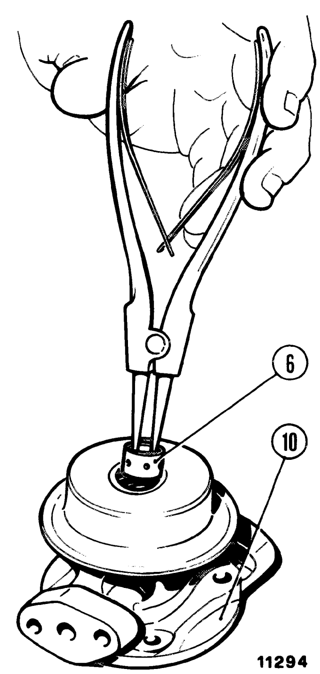
— turbine body, compressor body and center body are free from signs of contact with rotating parts.

Minor imperfections may be remedied using silicone carbide abrasive cloth for aluminium parts and saffron abrasive cloth for steel parts.

If turbine and compressor wheel blades are found to be bent, do not attempt straightening, but replace the wheels in question without hesitation.

It is also advisable to replace the sealing ring, lock plates, turbine body screws, bearing retaining rings, compressor impeller nut and all parts not meeting the above requirements.

Check that thrust collar (16, page 3) is free from dents, score marks, paint deposits or accumulation of foreign matter and replace as necessary.



Removing bearings.
6 - Bearing - 10. Center body.

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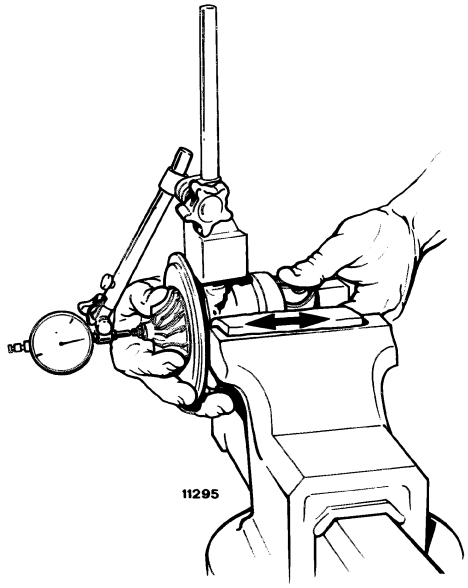


Checking bearing end play.
(Direction of turbine shaft rotation arrowed).

Bearing end float check

Install center body with attached wheel assembly in a vice with interposed lead liners to prevent damaging the body.

Install a magnetic-base dial gauge to the center body, resting the stylus against the end of the shaft as shown.

Move turbine wheel backwards and forwards and check that gauge total indicator reading is .025 to .100 mm (.001 to .004 in).

If the end float is not as specified, repair the unit as necessary or replace.

Bearing radial clearance check

Clamp the unit in a vice and rest the dial gauge stylus against the end of the shaft on compressor side as shown.

Assemble the turbocharger as follows:

— lubricate the retaining rings and bearings (6, page 3) with fresh engine oil and install in center body (10);

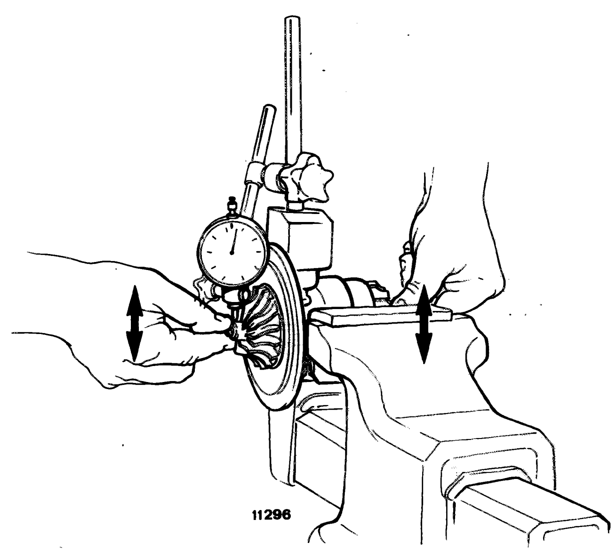
— install turbine shaft (7), thrust collar (16) and sealing ring on center body;

— install rear cover (2) with attached thrust spring taking care not to stress sealing ring (17);

— tighten screws (15) retaining rear cover to center body, to 8.5 - 10 Nm, .85 to 1 kgm (6 to 7 ft.lb.) and lock in position bending lock plates (18);

— install compressor impeller (1), clamp tool **293814** (A, page 6) in a vice, place the turbine on the tool, tighten nut (3, page 3) to 2 - 2.3 Nm, .2 to .23 kgm (1.5 to 1.7 ft.lb.) and continue tightening until the wrench has covered a 90° arc;

— check bearing radial clearance and end float as directed hereunder.



Checking bearing radial play.
(Turbine shaft direction of rotation arrowed).

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Apply equal pressure simultaneously on both ends of the shaft, pushing first towards the dial gauge and then in the opposite direction, checking that the gauge total indicator reading is .075 to .180 mm (.003 to .007 in). If the reading is not as specified, disassemble and repair the unit as necessary.

After end float and radial clearance check, assemble turbine body (12, page 3) aligning the reference marks applied on disassembly on both turbine body and center body (10) and complete the assembly sequence as follows:

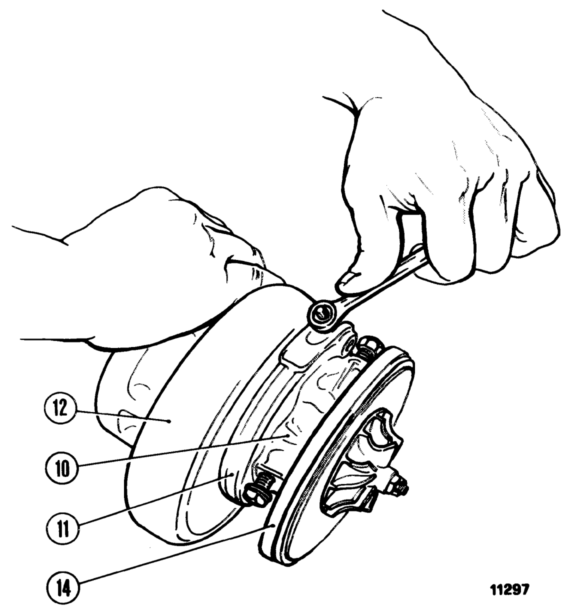
— apply anti-seizure compound to the threads of screws (14), install lock plates (11) and retainer plates (9), tighten the screws to 11.5 - 15 Nm, 1.15 to 1.5 kgm (8 to 11 ft.lb.) and secure in position by suitably bending lock plates (9).

Install compressor body (8) aligning the reference marks applied on disassembly on both compressor body and rear cover.

Install retainer plates (5) and (4), tighten screws (13) to 11.5 - 15 Nm, 1.15 to 1.50 kgm (8 to 11 ft.lb.) and secure in position by suitably bending lock plates (4).

After assembly, push the wheel assembly as far as possible from the turbine end and check for binding.

Repeat the check on the opposite end, pushing from the compressor side. If binding is detected, lightly tap alternately on both sides using a plastic mallet to settle the parts; if the problem is not cured thereby, disassemble and recheck.



Removing turbine body.
10. Center body - 11. Collar - 12. Turbine body - 14. Retaining ring.

HOLSET TURBOCHARGER OVERHAUL (1880)

After removing the turbocharger from the engine, proceed as follows:

— apply reference marks on both compressor body (8, page 3) and center body (10);

Note: Reference marks must be aligned on assembly.

— back off screws (9) and remove compressor body;

— apply reference marks to turbine body (12) and center body (10), back off retaining collar nut and disassemble the turbine body retrieving retaining ring (14);

— clamp the end of the turbine shaft in a vice as shown on page 10, taking care not to damage it, and back off nut (13, page 3) using a T-wrench;

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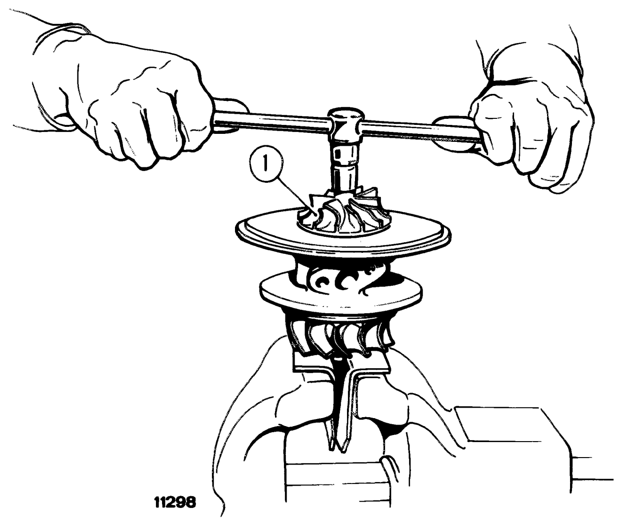
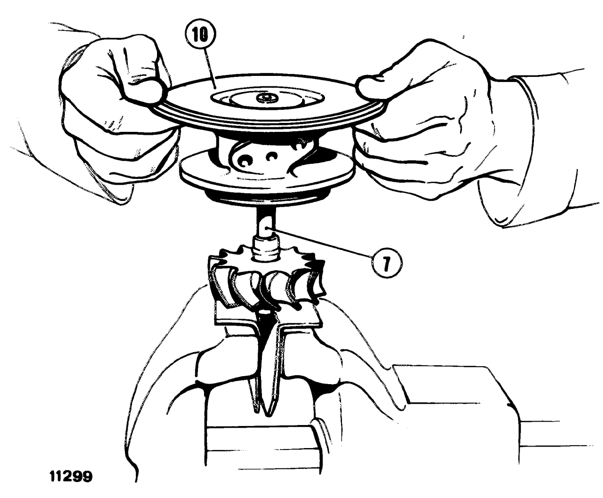


Removing or installing turbine shaft nut.
1. Compressor impeller.

— remove compressor impeller (1) followed by center body (10) from turbine shaft (7);

— take off bearing (6, page 3) with attached thrust washer, retaining ring (2), plate (3) with attached seal (4), using two screwdrivers as shown, thrust collar (18), oil slinger (5), spacer ring (17) and thrust ring (16).



Removing or installing center body.
7. Turbine shaft - 10. Center body.

Inspect to ensure that:

— the parts are not affected by damage, corrosion or wear;

— the threads are not dented, torn or strained;

— turbine wheel and compressor impeller do not show signs of binding and that the blades are not failed or worn at the edges;

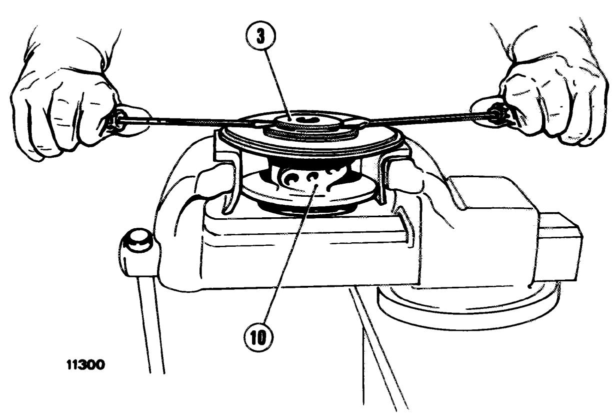
— shaft is free from signs of pick-up on the journals in contact with the bearing;

— turbine body, compressor body and center body do not show signs of fouling with the rotating parts.

Minor imperfections may be remedied using silicone carbide abrasive cloth for aluminium parts and saffron abrasive cloth for steel parts.

If turbine and compressor wheel blades are found to be bent, do not attempt straightening, but replace the wheels in question without hesitation.

It is advisable to replace turbine nut, O-ring seal, sealing rings, thrust ring, the bearing and all parts which do not meet the above requirements.



Removing seal carrier (3) from center body (10).

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Ensure that center body (10, page 3) is free from score marks or signs of pick-up and the bearing housings.

Assemble the turbocharger as follows:

— install turbine shaft (7) with attached sealing ring (19) in the center body;

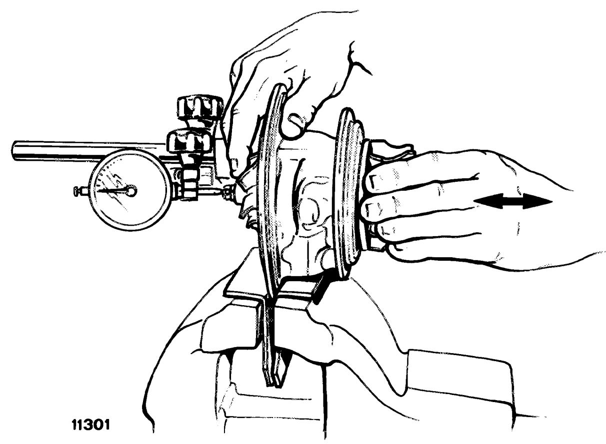
— lubricate the bearing with fresh engine oil and install together with the associated thrust washer;

— install thrust ring (16), spacer (17), oil slinger (5), thrust collar (18) with attached sealing ring, seal carrier (3) with attached seal (4) and retaining ring (2) with the chamfered edge facing outward;

— install compressor impeller (1) and tighten nut (13) to 18 Nm, 1.8 kgm (13 ft.lb.);

— turn the shaft, ensuring freedom from binding;

— check bearing end float and radial clearance as directed hereunder.



Checking bearing end float.
(Turbine shaft direction of rotation arrowed).

Bearing end float check

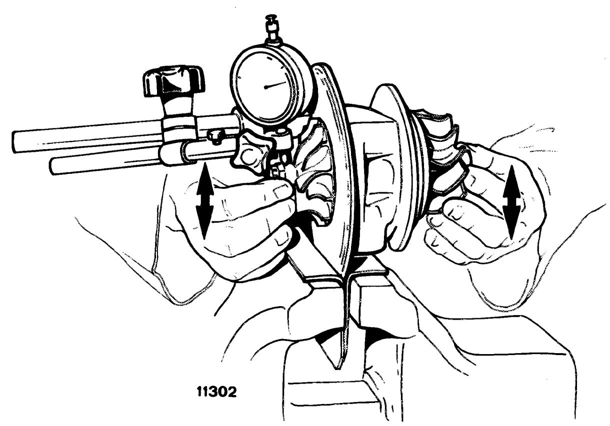
Clamp center body with attached wheel assembly in a suitable vice and install a magnetic-base dial gauge on the center body, resting the stylus against the end of the shaft as shown.

Move turbine wheel backwards and forwards and check that gauge total indicator reading is .10 to .15 mm (.004 to .006 in).

If the end float is not as specified, repair the unit as necessary or replace.

Bearing radial clearance check

Clamp the unit in a vice and rest the dial gauge stylus against the end of the shaft on compressor side as shown.



Checking bearing radial clearance.
(Turbine shaft direction of rotation arrowed).

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Apply equal pressure simultaneously on both ends of the shaft, pushing first towards the dial gauge and then in the opposite direction, checking that the gauge total indicator reading is below .53 mm (.021 in). If the reading is not as specified, disassemble and repair the unit as necessary.

On completion of the bearing end float and radial clearance check, install retaining ring (14, page 3) and the compressor body, ensuring that the reference marks applied on both compressor body and center body on disassembly are in alignment.
Install turbine body and tighten the collar nut (11).

TROUBLE SHOOTING

Defect	Cause	Remedy
1. Turbocharger noise or vibration.	a. Inadequate bearing lubrication.	Check lubrication system and overhaul turbocharger.
	b. Excessive end float and radial clearance.	Check float and clearance and overhaul turbocharger.
	c. Turbine or compressor wheel out of balance owing to damage or accumulation of foreign material.	Overhaul and, if necessary, replace damaged wheels.
2. Low engine power.	a. Injection pump out of adjustment.	Calibrate pump.
	b. Intake and exhaust manifold leakage.	Check intake and exhaust system, including nuts and bolts retaining turbocharger and manifold.
3. Low turbocharging pressure, high exhaust gas temperature and smoky exhaust.	Clogged air cleaner.	Carry out air cleaner maintenance.

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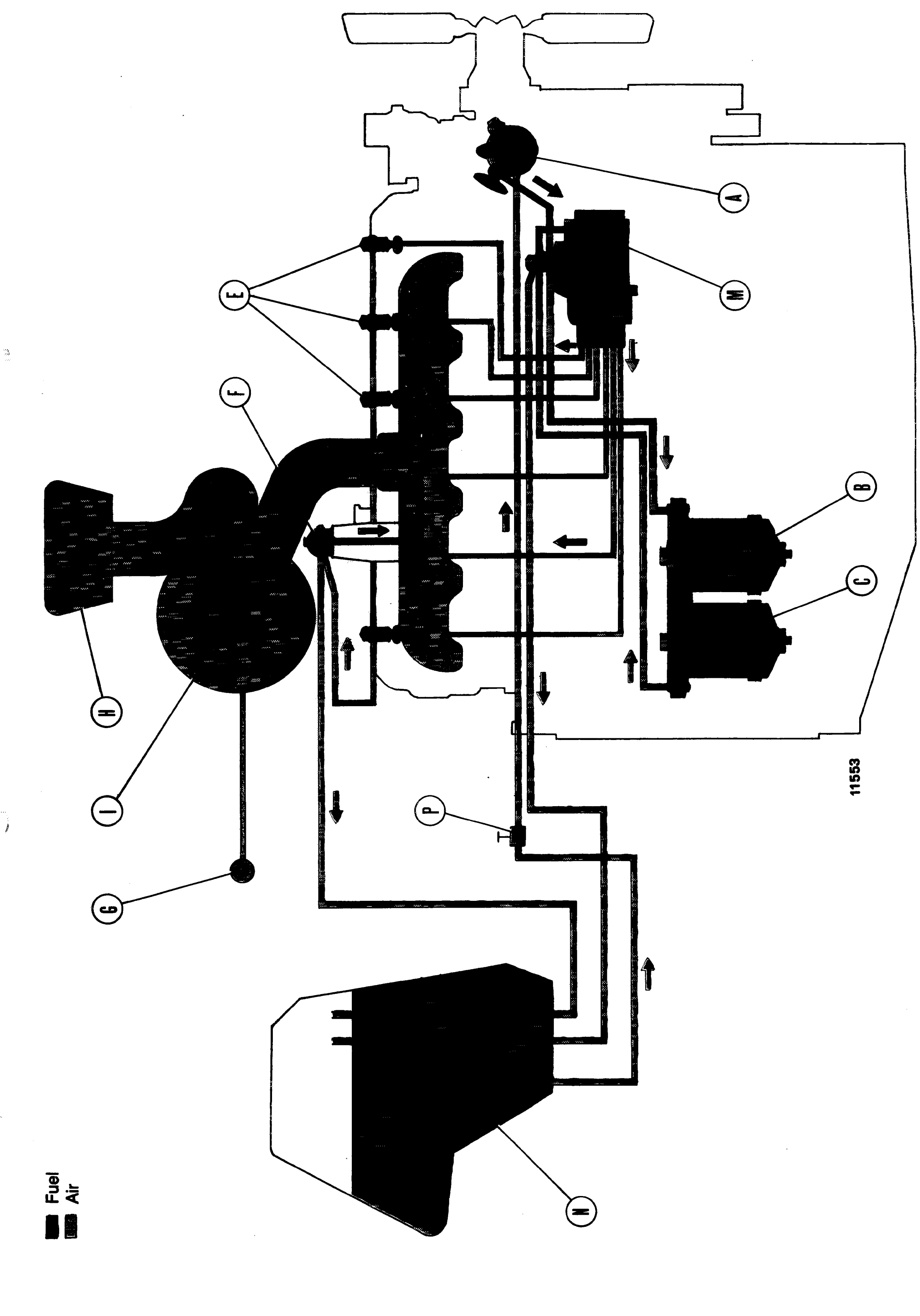

Fuel system diagram - 1180 (BOSCH distributor pump).

A. Fuel feed pump - B. Paper element first fuel filter - C. Paper element second fuel filter - E. Fuel injectors - F. Thermostarter - G. Air cleaner condition indicator - H. Centrifugal precleaner - I. Dry air cleaner - M. Injection pump - N. Fuel tank - P. Tank shut-off cock.

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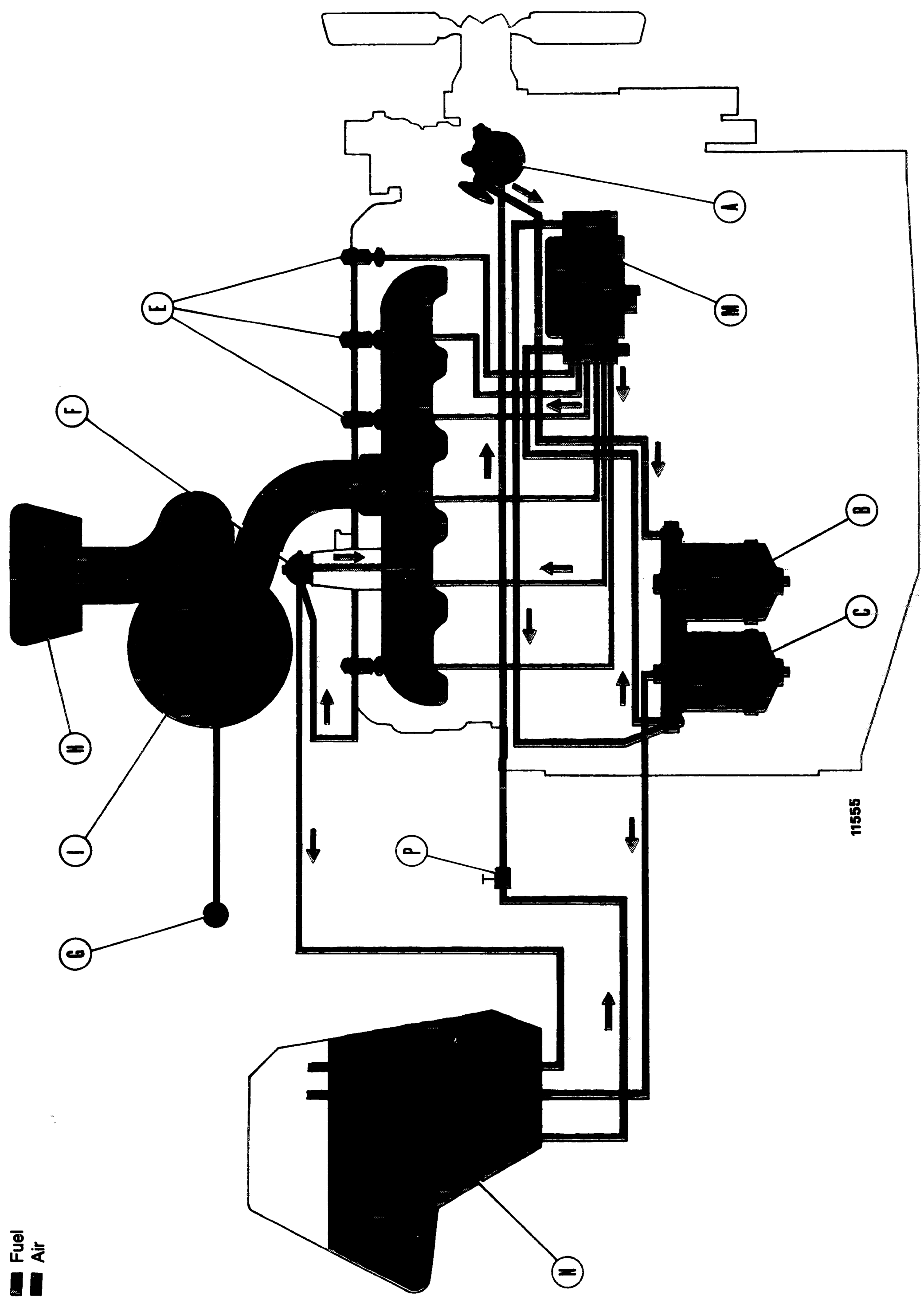
ENGINE: Fuel system - Diagrams



Fuel system diagram - 1180 (C.A.V. distributor pump).

A. Fuel feed pump - B. Paper element first fuel filter - C. Paper element second fuel filter - E. Fuel injectors - F. Thermostarter - G. Air cleaner condition indicator - H. Centrifugal precleaner - I. Dry air cleaner - M. Injection pump - N. Fuel tank - P. Tank shut-off cock.

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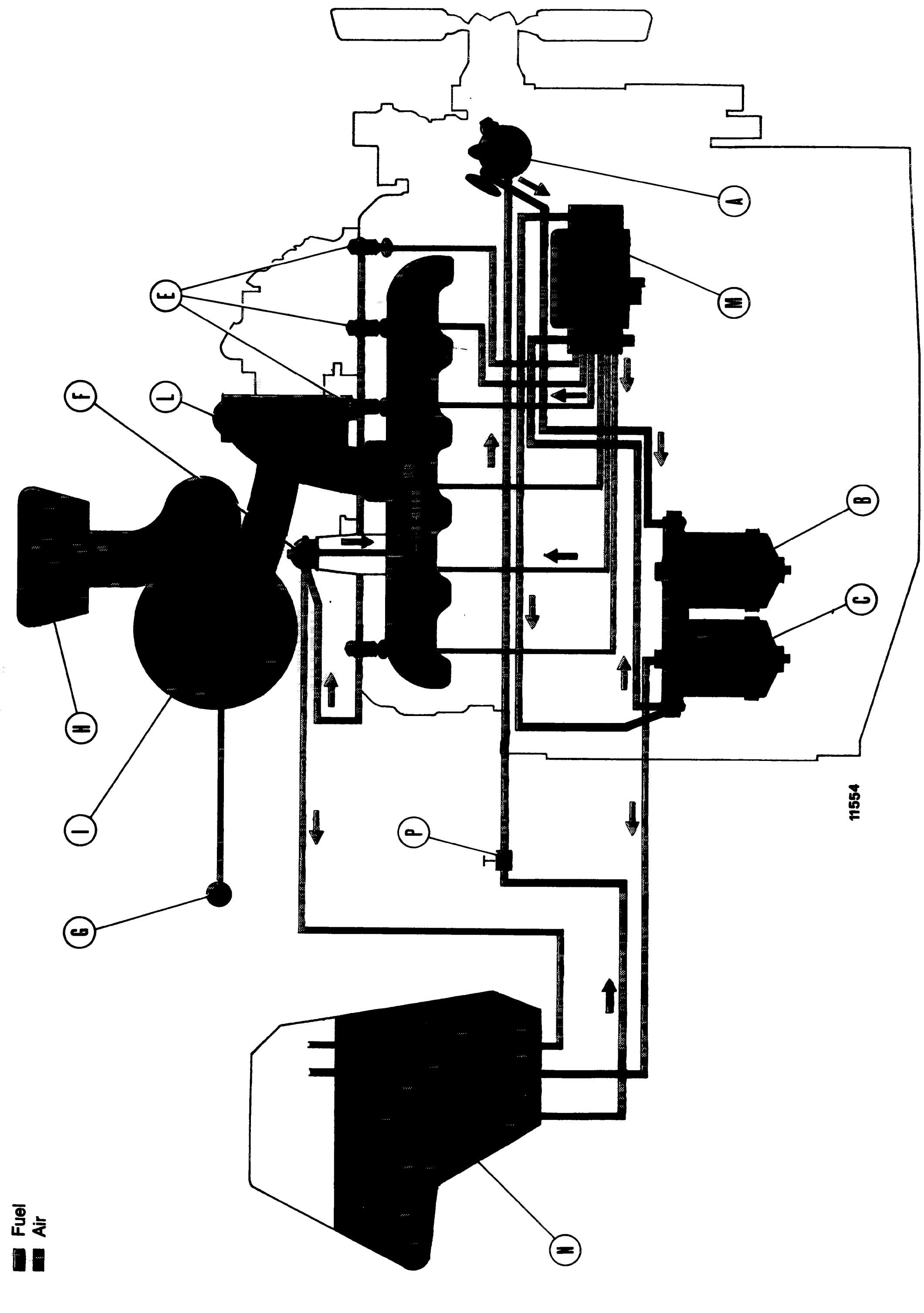

Fuel system diagram - 1280 (C.A.V. distributor pump).

A. Fuel feed pump - B. Paper element first fuel filter - C. Paper element second fuel filter - E. Fuel injectors - F. Thermostarter - G. Air cleaner condition indicator - H. Centrifugal precleaner - I. Dry air cleaner - L. Turbocharger - M. Injection pump - N. Fuel tank - P. Tank shut-off cock.

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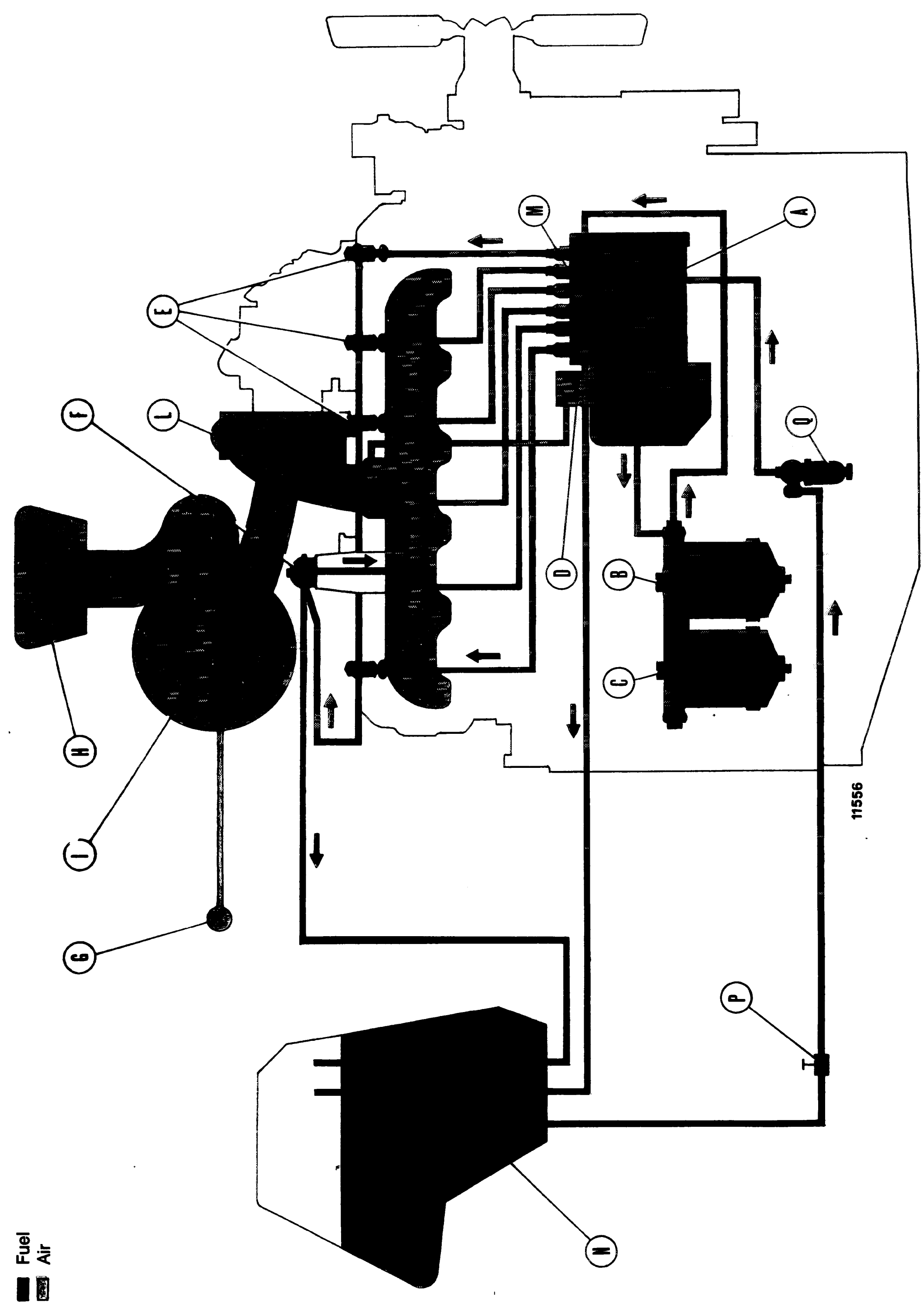

Fuel system diagram - 1360 (FIAT in-line pump).

A. Fuel feed pump - B. Paper element first fuel filter - C. Paper element second fuel filter - D. Aneroid - E. Fuel injectors - F. Thermostarter - G. Air cleaner condition indicator - H. Centrifugal precleaner - I. Dry air cleaner - L. Turbocharger - M. Injection pump - N. Fuel tank - P. Fuel shut-off cock - Q. Bowl filter.

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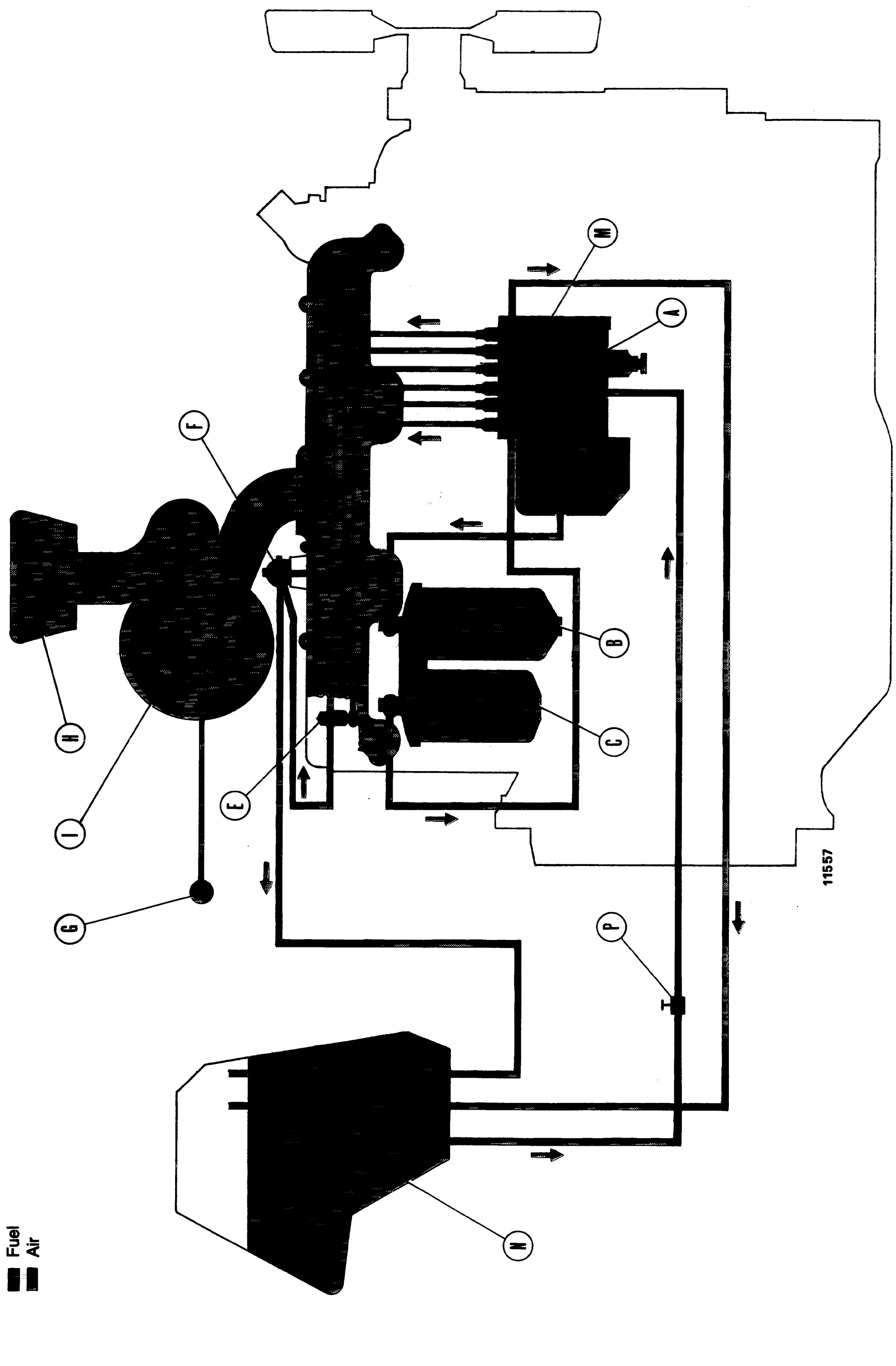

Fuel system diagram - 1580 (FIAT in-line pump).

A. Fuel feed pump with bowl filter - B. Cloth element first fuel filter - C. Paper element second fuel filter - E. Fuel injector - F. Thermostarter - G. Air cleaner condition indicator - H. Centrifugal pre-cleaner - I. Dry air cleaner - M. Injection pump - N. Fuel tank - P. Fuel tank shut-off cock.

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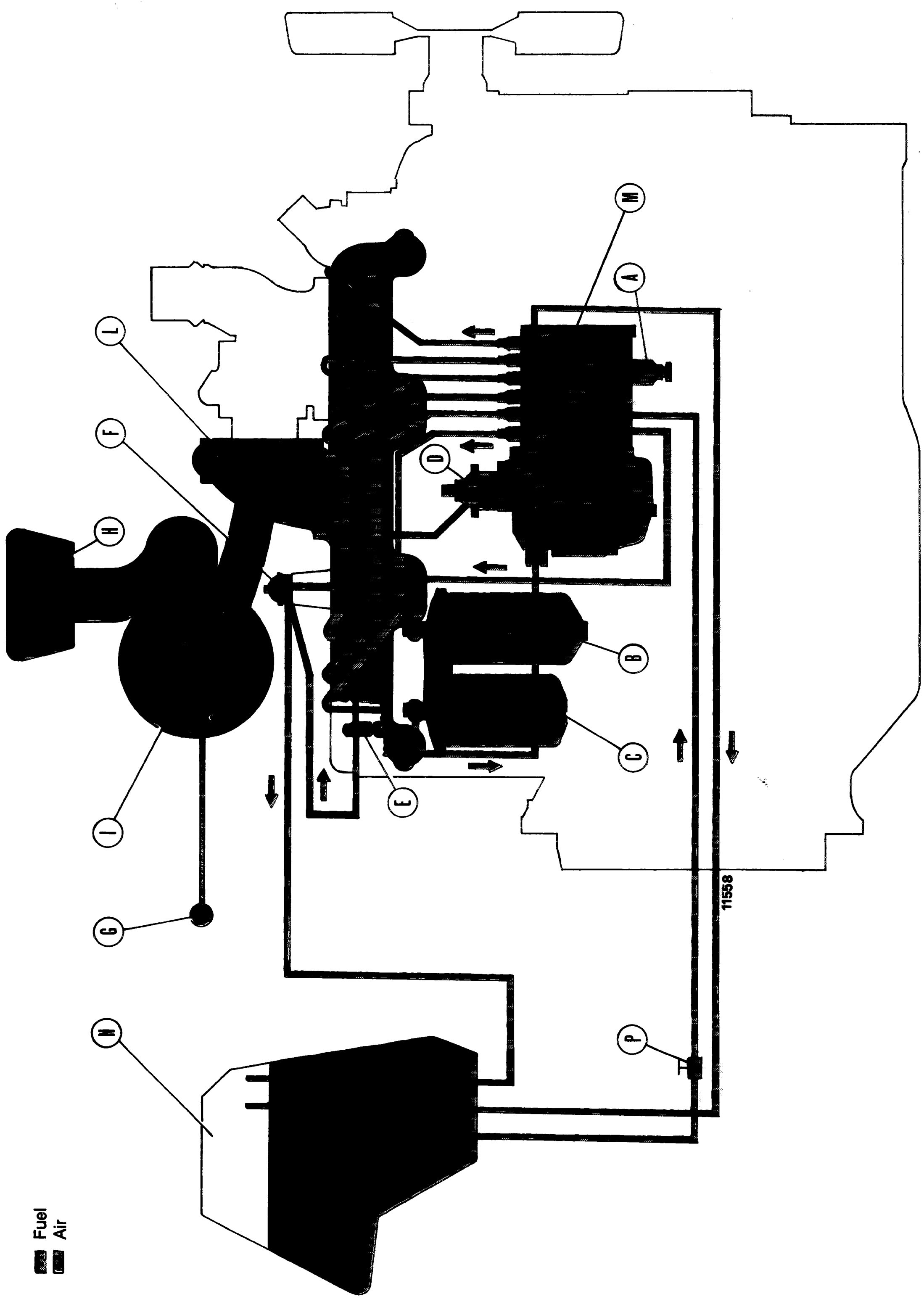

Fuel system diagram - 1880 (BOSCH in-line pump).

A. Fuel feed pump with bowl filter - B. Cloth element first fuel filter - C. Paper element second fuel filter - D. Aneroid - E. Fuel injector - F. Thermostarter - G. Air cleaner condition indicator - H. Centrifugal precleaner - I. Dry air cleaner - L. Turbocharger - M. Injection pump - N. Fuel tank - P. Fuel tank shut-off cock.

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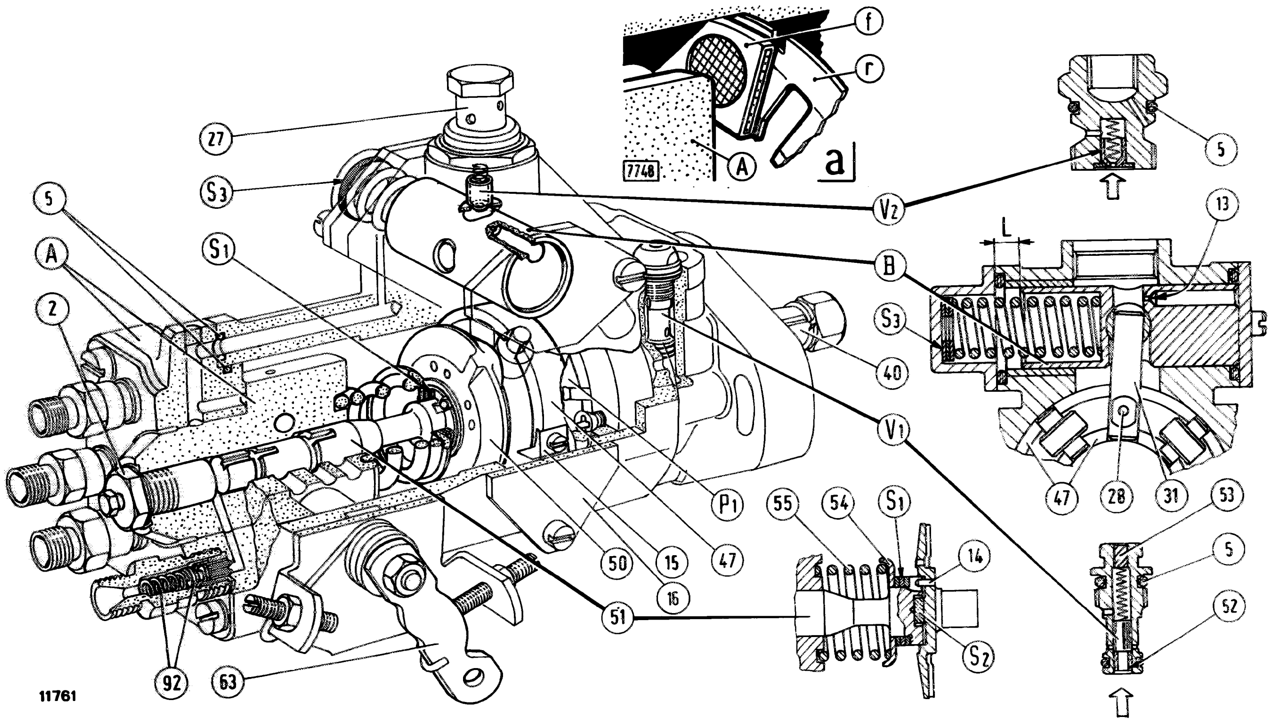


11761

Section through BOSCH injection pump (1180).

a. Ring filter (f) and spring washer (r) inserted beween pump body and hydraulic head - A. Hydraulic head - B. Advance piston - L. Advance piston stroke - P1. Transfer pump - S1. Rotor spring preload shim - S2. Spill cut-off shim - S3. Advance spring preload shim - V1. Pressure regulating valve - V2. Overflow valve - 2. Center plug - 5. O-ring - 13. Fuel pressure feed to advance piston - 14. Rotor drive peg - 15. Timing pointer - 16. Pointer access cover - 27. Return connector - 28. Advance lever retaining pin - 31. Advance lever - 40. Pump drive shaft - 47. Roller carrier - 50. Cam plate - 51. Rotor - 52. Regulating valve plunger retainer - 53. Regulating valve adjusting screw - 54. Spring cup - 55. Rotor spring - 63. Throttle lever - 92. Delivery valve.

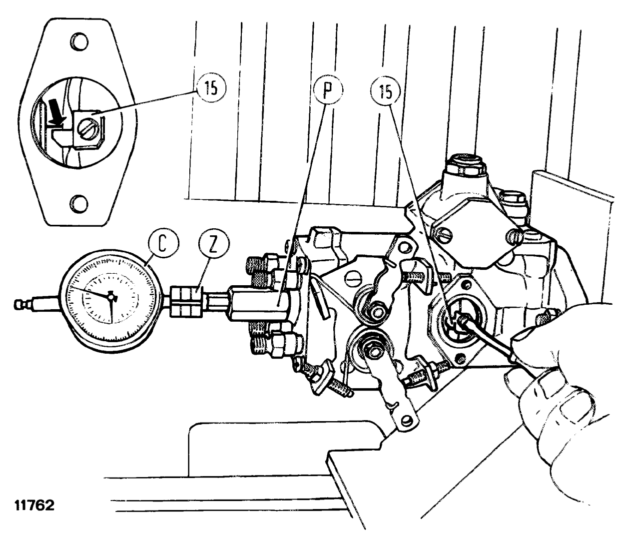
INTERNAL PUMP TIMING - BOSCH DISTRIBUTOR PUMP (1180)

Remove central plug (2) from hydraulic head and turn pump drive shaft to align segmental slot to delivery connector marked "A" coupled to engine cylinder no. 1.

Install tool **290774** (Z) and extension **292551** (P) and zero the associated gauge **292197** (C) with the rotor in start of stroke position.

Remove side cover (16) for access to timing pointer (15) and slowly rotate the drive shaft clockwise until the rotor has moved 1 mm (.04 in).

Hold the shaft still and align pointer (15) to the cam plate mark applied in production.



11762

Adjusting pump timing using tool 290774 (Z), extension 292551 (P) and gauge 292197 (C).

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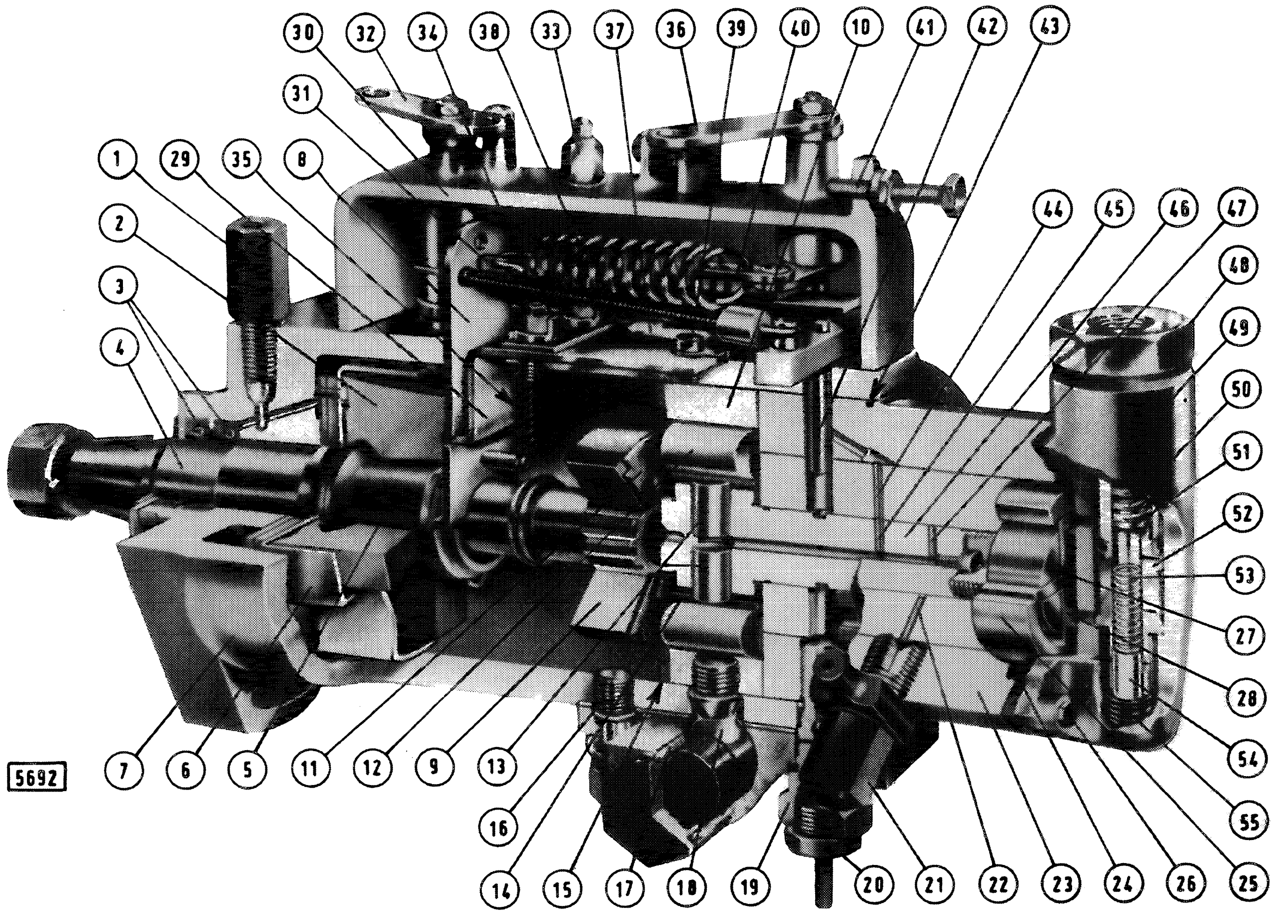

Section through C.A.V. fuel injection pump.

1. Drain connector - 2. Governor flyweight - 3. Shaft seals - 4. Drive shaft - 5. Thrust sleeve - 6. Weight retainer - 7. Pump body - 8. Governor control arm - 9. Internally splined drive plate - 10. Cam ring - 11. Maximum fuel adjustment plate - 12. Roller - 13. Pump plunger - 14. Roller shoe - 15. Circlip (timing ring) - 16. Housing stud - 17. Advance device housing - 18. Cam advance lever - 19. Head locating fitting and transfer pressure fuel passage to advance piston chamber - 20. Manual start-retard control - 21. Delivery connector - 22. Delivery port - 23. Hydraulic head - 24. Head seal - 25. Transfer pump liner - 26. End plate retaining screw - 27. Transfer pump rotor - 28. Vanes - 29. Control bracket - 30. Control cover - 31. Idling spring guide - 32. Shut-off control lever - 33. Cover retaining nut - 34. Spring-loaded linkage hook - 35. Governor arm spring - 36. Throttle control lever - 37. Shut-off bar - 38. Governor spring - 39. Control bracket retaining screw - 40. Throttle link - 41. Maximum speed adjusting screw - 42. Metering valve - 43. Head sealing ring - 44. Metering port - 45. Inlet port - 46. Rotor - 47. Distributing port - 48. Inlet connection - 49. End plate and regulating valve - 50. Retaining spring - 51. Spring guide - 52. Valve sleeve - 53. Regulating spring - 54. Piston - 55. Priming spring.

INTERNAL TIMING C.A.V. DISTRIBUTOR PUMP (1180 and 1280)

Remove pump from test machine and connect inlet fitting marked "U" coupled to the injector of cylinder no. 1 to the end of tool **290755** (page 21).
Connect the other en of the tool to hand pump **290284** (T) filled with FIAT CFB oil, and operate the hand-pump until a 29.5 bar (30 kg/cm^2) (427 psi) pressure is obtained.
Do not exceed the specified pressure. Turn the pump drive shaft clockwise until a definite resistance is felt, indicating that the rollers are in contact with the cam ring lobes (spill cut-off).
Remove the cover plate and align the sharp timing edge of the circlip to reference line B stamped on the internally-splined drive flange (a).

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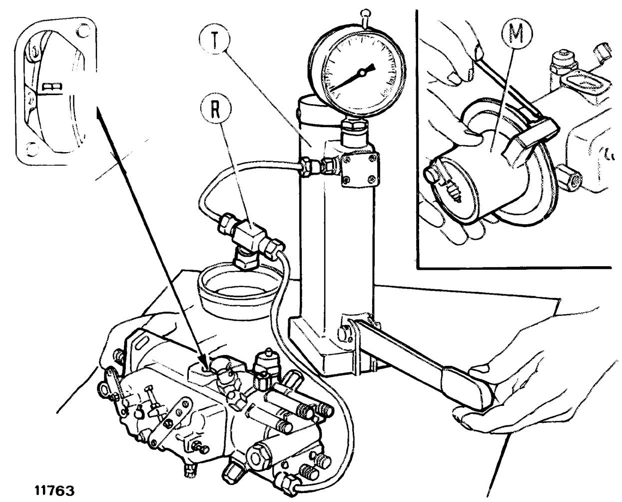
Hold the pump in the timed position, install flange marking tool **290757** (M) set to the degree position stated under "Assembly Data" to the pump drive shaft with attached key, and scribe a timing mark on the mounting flange.



Internal timing pump at 29.5 bar (30 kg/cm², or 47 psi) and applying external timing mark using tool 290757 (M).

a. Correct internal pump timing - T. Hand pump **290284** - R. Marking gauge tool **290755** with 30 kg/cm² relief valve (to be connected to hand pump and to injection pump delivery fitting marked "U".

INJECTION PUMP INSTALLATION AND EXTERNAL TIMING - BOSCH AND C.A.V.

Install injection pump to the engine according to the following instructions:

— smear flange gasket with jointing compound and place in position over the mounting flange;

— introduce the end of the pump drive shaft with attached bushing in the bore of drive gear and position the elongated holes in the mounting flange over the retaining studs;

— align the reference marks on engine block and pump flange;

— tighten pump retaining nuts, reconnect fuel lines and bleed the system.

If external timing marks are missing or suspected to be incorrect, check the timing as follows:

— remove cover plate, turn the flywheel and bring the cam plate timing mark in alignment with timing pointer (15, page 19) on BOSCH pumps, or letter "B" stamped on drive flange in alignment with the sharp timing edge of timing circlip on C.A.V. pumps.

As this timing position is equivalent to the point of commencement of injection (spill cut-off) in cylinder 1, check through bell housing aperture that the engine timing pointer is aligned to INIEZ. BOSCH or INIEZ. C.A.V. marks.

If adjustment is needed, slacken injection pump retaining nuts and turn both pump body and engine flywheel until correct alignment is obtained.

As a safeguard against possible valve timing errors, or incorrect injection pump installation, take off rocker cover and check that piston no. 1 is at the end of the compression stroke (i.e. valves closed).

Reapply the external timing marks on pump flange and engine block to facilitate subsequent pump timing.

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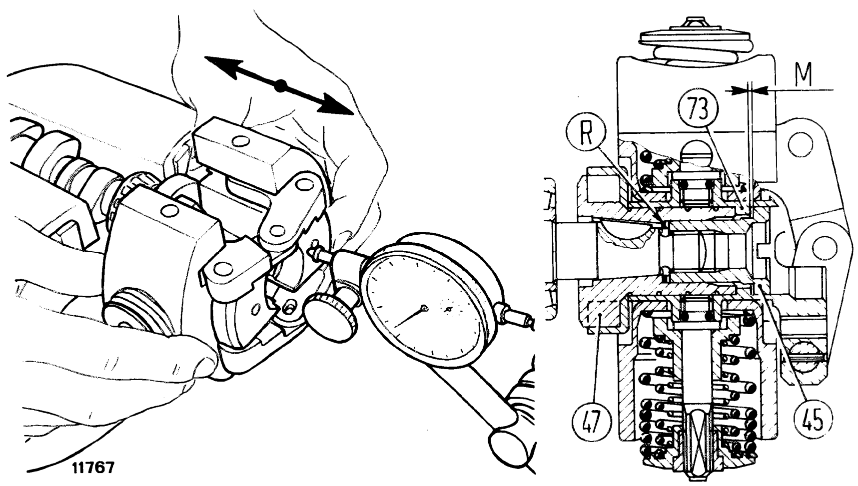
INJECTION PUMP TEST AND CALIBRATION - FIAT IN-LINE PUMP (1380 and 1580)



Checking damper end float.

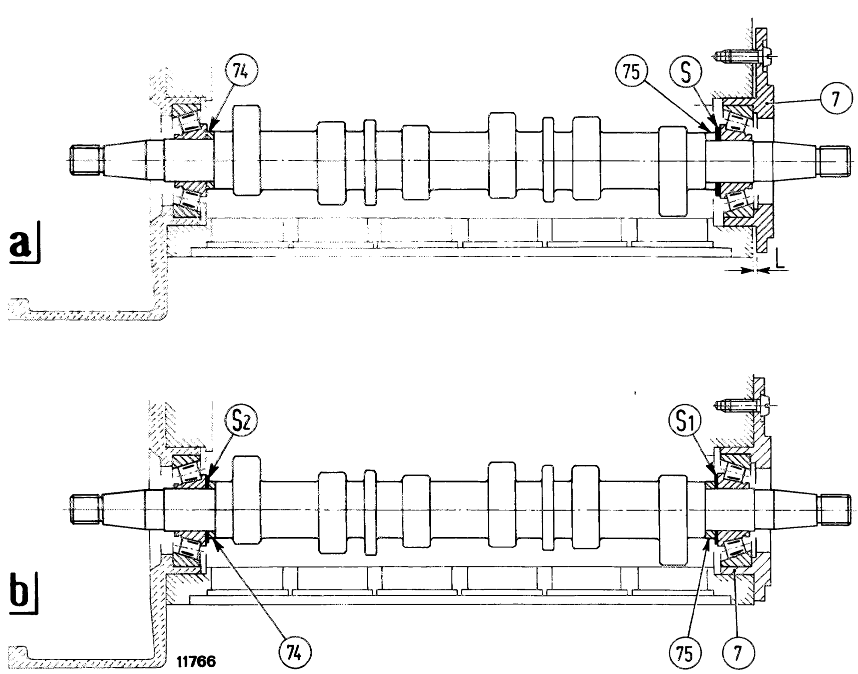
M = .05 to .10 mm (.002 to .004 in) clearance between lock ring and carrier - R. Shim - 45. Lock ring - 47. Coupling - 73. Flyweight carrier.

GOVERNOR DAMPER END FLOAT CHECK

To check governor damper end float proceed as follows:

— install flyweights and damper coupling without cushion pads on camshaft, checking that end float (M) between lock ring and flyweight carrier is .05 to .10 mm (.002 to .004 in); to adjust, alter the thickness of shim (R);

— install the camshaft positioned as shown, together with center bearing and adjust taper roller bearings as directed hereunder.



Adjusting camshaft taper roller bearings.

a. Checking front bearing cap clearance relative to pump body - b. Checking camshaft end float - S. Front bearing cap clearance shim - S_1. Front bearing shim - S_2. Rear bearing shim - 74. Rear spacer - 75. Front spacer.

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CAMSHAFT BEARING ADJUSTMENT

Following camshaft, bearing, cap or pump body replacement, adjust bearing clearance as follows:

— install bearings (a, page 22), applying spacer (74) at the rear and spacer (75) plus a pack of shims (S) at the front so as to provide a clearance (L);

— progressively tighten the capscrews of front bearing cap (7) in staggered fashion, simultaneously turning the camshaft until the clearance is completely taken up without applying any bearing preload endwise (specified end float .02 to .06 mm - .0008 to .0024 in);

— assess clearance (L) taking four readings at peripheral points 90° apart and finding the arithmetical average;

— total shim thickness ($S_1 + S_2$) will be obtained by subtracting clearance (L) from initial shim pack thickness (S);

— divide the total shim thickness into equal parts S_1 and S_2 (b), noting that if the available range of shims is such that it cannot be divided into two packs of equal thickness, the maximum allowance is .2 mm (.008 in);

— after assembly (b) check that camshaft end float is .02 to .06 mm (.0008 to .0024 in).

INJECTION PUMP AND GOVERNOR CALIBRATION AND TESTING

Place the pump on the test machine and connect taper drive coupling **292133** for both models or splined drive coupling **292132** for 1380 or **292131** for 1580.

1. Control rod stroke

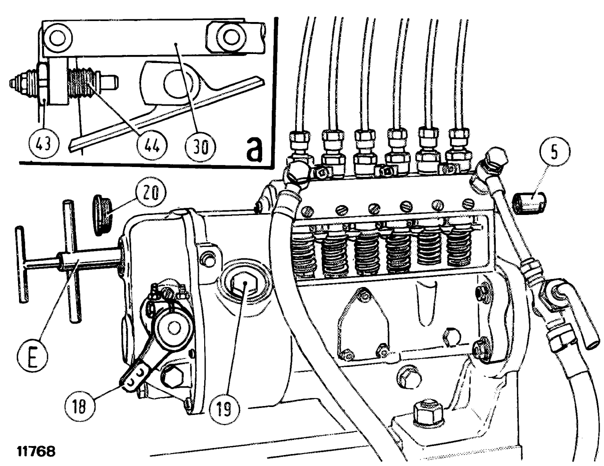
Remove plug (5), check with a depth gauge that control rod stroke is 12.5 to 13.5 mm (.492 to .531 in) with aneroid activated; to adjust, turn screw (80, page 27). With aneroid deactivated, the control rod stroke should be 11.4 to 11.6 mm (.449 to .457 in) for 1380, or 11.9 to 12.1 mm (.468 to .476 in) for 1580 (equivalent to maximum delivery) starting from shut-off. To adjust, turn screw (44) until it is in light contact with stop (29 or 79, page 27) using wrench **291468** (E).

2. Plunger stroke

Prior to starting the tester motor, check maximum plunger stroke, turning the pump by hand and applying a lever to the tappets to ensure that in top-of-stroke position each plunger clears the delivery valve by at least .2 mm (.008 in).
If the clearance is nil, adjust the tappets using wrenches **A.352106 (290896)** to prevent the plunger from fouling the delivery valve.
Also check that control sleeve lug position is the same for all elements.

3. Delivery connector leakage

Check delivery connector tightening torque. Plug the fuel inlet connection, install plugs of kit **291195** on delivery connectors, remove the relief valve from the fuel return connection and connect the latter to hand-pump. At 73 to 98 bar (75 to 100 kg/cm^2 - 1067 to 1422 psi) there should be no leakage.



Checking and adjusting control rod stroke using wrench 291468 (E) (1580).

a. Detail of control rod adjusting screw with maximum fuel device - 5. Control rod protector plug - 18. Throttle lever - 20. Cap - 30. Control rod - 43. Lock ring - 44. Maximum fuel device - E. Wrench.

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4. Feed pressure test

Connect the test machine inlet and return lines to the pump and install the relief valve on the return connection.
Feed the pump and check that the tester reading is 1.2 to 1.5 bar (1.2 to 1.5 kg/cm^2 - 17 to 21 psi), 1380, or 1.6 to 1.8 bar (1.6 to 1.8 kg/cm^2 - 22.7 to 25.6 psi), 1580. If necessary, adjust the relief valve (4, page 27), 1580; note that on 1380 the fuel inlet and return line position is the reverse of that shown in the above-mentioned illustration.

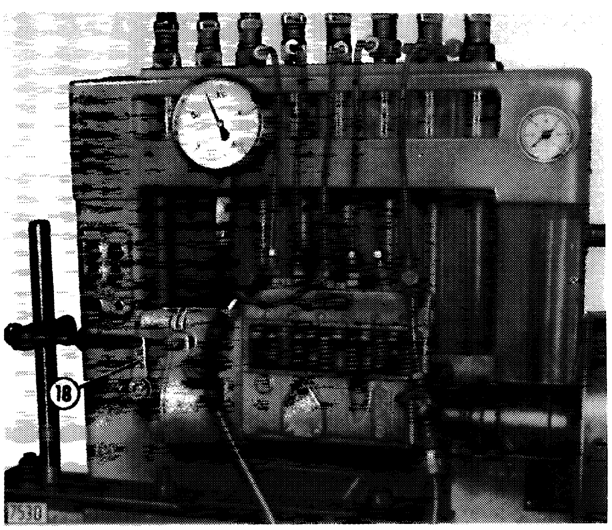
5. Delivery valve leakage test

Place the pressure gauge (scale 600 kg/cm^2) of kit **291195** on the connection of the pump element under test.
Hold throttle lever (18) in full fuelling position.
Run the pump at 200 rpm until the pressure gauge indicates 245 to 295 bar (250 to 300 kg/cm^2 - 3556 to 4267 psi) and stop the pump, recording the pressure.
Check that the pressure drop within 1 minute is:
— 29 to 34 bar (30 to 35 kg/cm^2 - 427 to 498 psi) with new pump elements;
— 69 to 78 bar (70 to 80 kg/cm^2 - 996 to 1138 psi) with used elements.

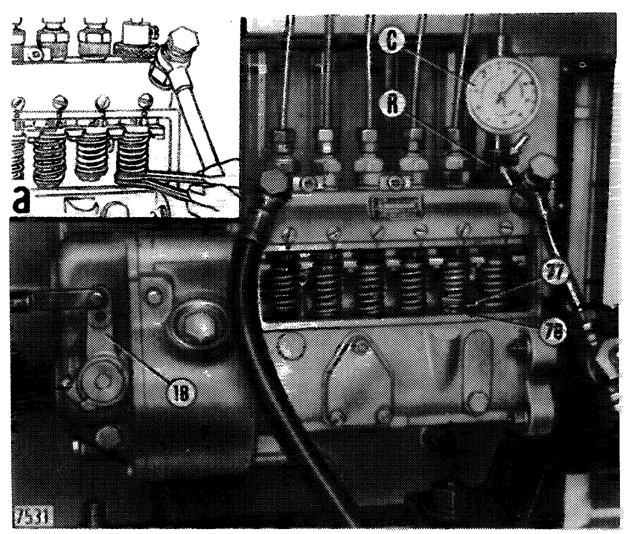
If the pressure drop exceeds the specified values, replace the sealing washer or, if necessary, the complete delivery valve.

6. Spill cut-off adjustment

Reproduce actual pump operating conditions and install throttle lever (18) with tool **290984** with extension **290985** in maximum rack stroke position.
Check spill cut-off on pump element no. 1 as follows:
— remove delivery connection, spring and valve and install fitting **293673** with attached spindle and gauge **292197**;
— turn the shaft by hand with plunger of element no. 1 at bottom of stroke position and check that fuel issues from ports of fitting (R);
— continue to turn clockwise until fuel flow is discontinued;
— turn the shaft counterclockwise and check on the dial gauge that plunger stoke is 2.15 to 2.25 mm (.085 to .089 in), 1380, or 2.25 to 2.35 mm (.089 to .092 in), 1580. To adjust, turn the tappets using wrenches **A.352106 (290896)** and recheck plunge stroke to spill cut-off;
— replace the sealing washer and install both valve and delivery connection.



Checking delivery valve leakage using pressure gauge and fitting of kit 291195 (1580).
18. Throttle lever.



Checking spill cut-off and adjusting plunger stroke using wrenches A352106 (290896) (a) (1580).
Note: Fuel outlet on fitting (R) arrowed.
C. Dial gauge **292197** - R. Fitting **293673** - 18. Throttle lever - 77. Plunger stroke adjusting nut - 78. Lock nut.

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Check spill cut-off point on the other pump elements, adopting the foregoing procedure and check phasing using the bench dial or a suitable stroboscope.
If a stroboscope is used:

— ensure that the contact gap on detecting injector is .45 to .50 mm (.018 to .020 in) connecting the latter to pump element no. 1;

— install the stroboscope and zero the bench dial at a speed 100 rpm lower than maximum;

— hold the speed steady and check on the other elements that the reference marks are aligned to within ± 1°.

7. Governed speed check

With throttle lever (80) in maximum fuelling position, adjust screw (17) so that the rack starts to move back at 1200 to 1210 rpm, 1380, or 1100 to 1110 rpm, 1580 (governor cut-in) and that fuelling is nil at 1330 rpm, 1380, or at 1250 rpm, 1580.

If these conditions cannot be obtained through adjustment of screw (17), alter governor spring load by screwing in or backing off lock rings (66) by an equal number of clicks, using wrench **A.352107 (292730)** (F).

Readjust lever stop screw as directed above.

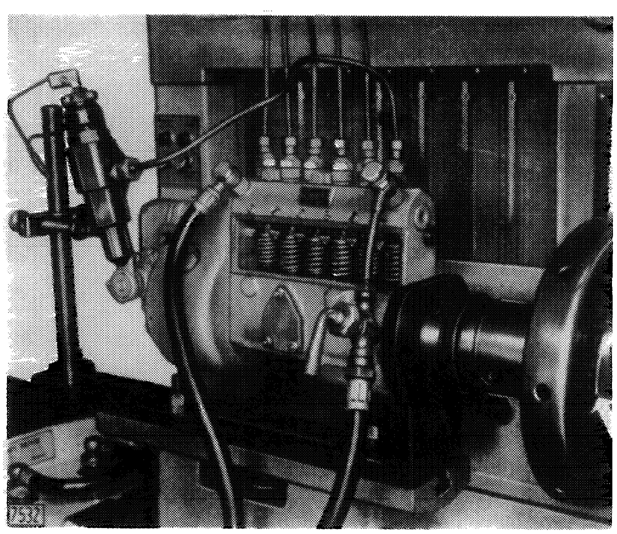
8. Pump plunger leakage test

Spread at 200 rpm compared to that at 1190 to 1200 rpm, 1380, or 1090 to 1100 rpm, 1580 (maximum, full load) between injectors should not exceed 25 to 30%. In this connection, note that:

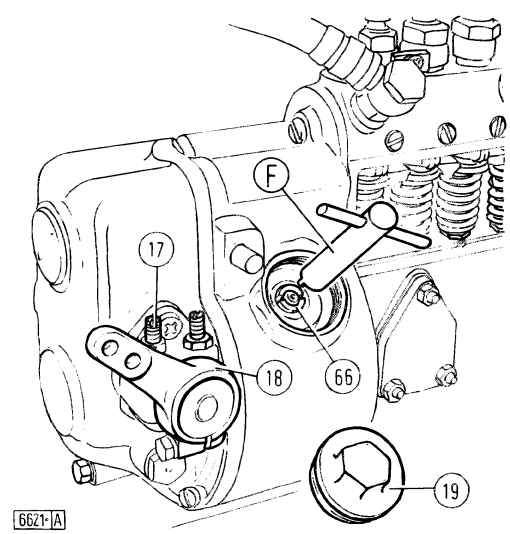
— pump elements resulting in more than 30% spread must be replaced;

— pump elements effected by 25% to 30% spread are to be replaced only if the engine reveals operating anomalies attributable to the pump elements, for it is impossible to obtain the injector delivery specified on page 15, section 10, 1380, and page 16, section 10, 1580.

For each of the speeds specified above, compute delivery as arithmetical average of three readings taken with **throttle lever in maximum fuelling position**, as indicated in the example hereunder.



Checking plunger spill cut-off using a stroboscope (1580).
Note: Dial with light spot arrowed.



Adjusting speed governor setting using wrench A.352107 (292730) (F) (1580).
17. Maximum speed adjustment screw - 18. Throttle lever - 19. Plug - 66. Spring load adjustment lock ring.

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Example.

The arithmetical average of the values recorded on a pump element for 500 shots with the control rack in maximum fuel position are:

$$\text{at 200 rpm} = \frac{24.5 + 25 + 25.5}{3} = \frac{75}{3} = 25\ \text{cm}^3$$

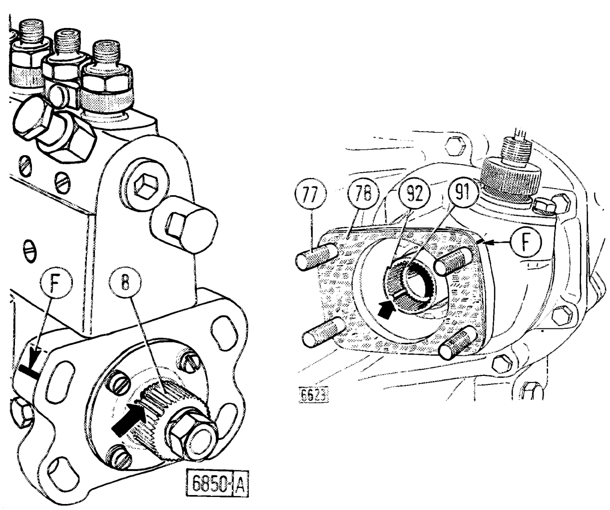
$$\text{at 1090 to 1100 rpm} = \frac{36 + 36.5 + 37}{3} = \frac{109.5}{3} = 36.5\ \text{cm}^3$$

Percent spread (S) will be:

$$S = \text{percent spread} = \frac{36.5 - 25}{36.5} \times 100 = 31.5\%$$

The pump element in question is to be replaced.

Note: The above example applies to a pump fitted to a Rabotti test machine using test procedure "A".



Installing injection pump on engine.

Note: Arrows indicate the double missing tooth on drive bush and the double tooth on outer ring to be aligned on installation.

F. External timing reference marks - 8. Toothed drive bush - 77. Injection pump studs - 78. Gasket - 91. Inner ring - 92. Outer ring.

9. Fuel delivery check and adjustment

Check fuel deliveries and compare with the data table on page 15, section 10, 1380, and page 16, section 10, 1580. To adjust, turn control sleeves using tool **A.365023 (290904/1)**.

EXTERNAL PUMP TIMING

Install the fuel injection system on the engine, noting the following points:

— position gasket (78) on pump support;

— introduce the drive shaft, aligning the double missing tooth of bush (8) with the double tooth on outer ring (92), align reference marks (F) on periphery of flanges and tighten the pump stud nuts (77);

— check pump phasing, adopting the overflow procedure.

The overflow check must be carried out on the first or sixth element as follows:

— disconnect delivery pipe at the injector, back off the delivery connection and temporarily remove the reducing adapter, spring and delivery valve;

— tighten the delivery connection;

— set the **throttle lever to maximum fuelling position** and operate the priming pump, simultaneously bleeding the supply line;

— remove the pump tappet cover and slowly turn the crankshaft clockwise until pump element no. 1 is in bottom-of-stroke position and operate the priming pump to ensure that fuel issues from the connection;

— continue turning the crankshaft and, as soon as fuel flow ceases, check that the fixed timing pointer is aligned to the INIEZ. mark stamped on flywheel, 1380, or ref. no. **4746741** stamped on flywheel, 1580.

To adjust, slacken the retaining nuts and turn the injection pump to retard or advance as necessary. Retighten the nuts.

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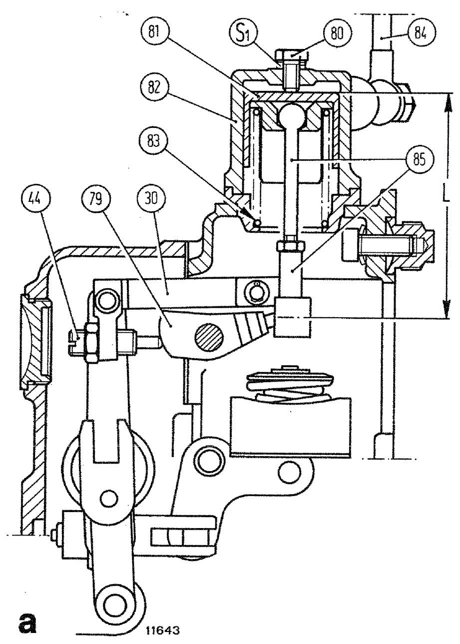

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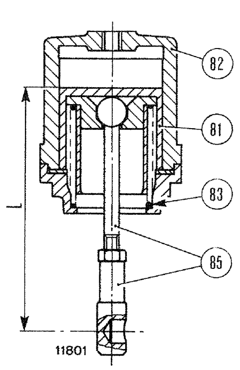

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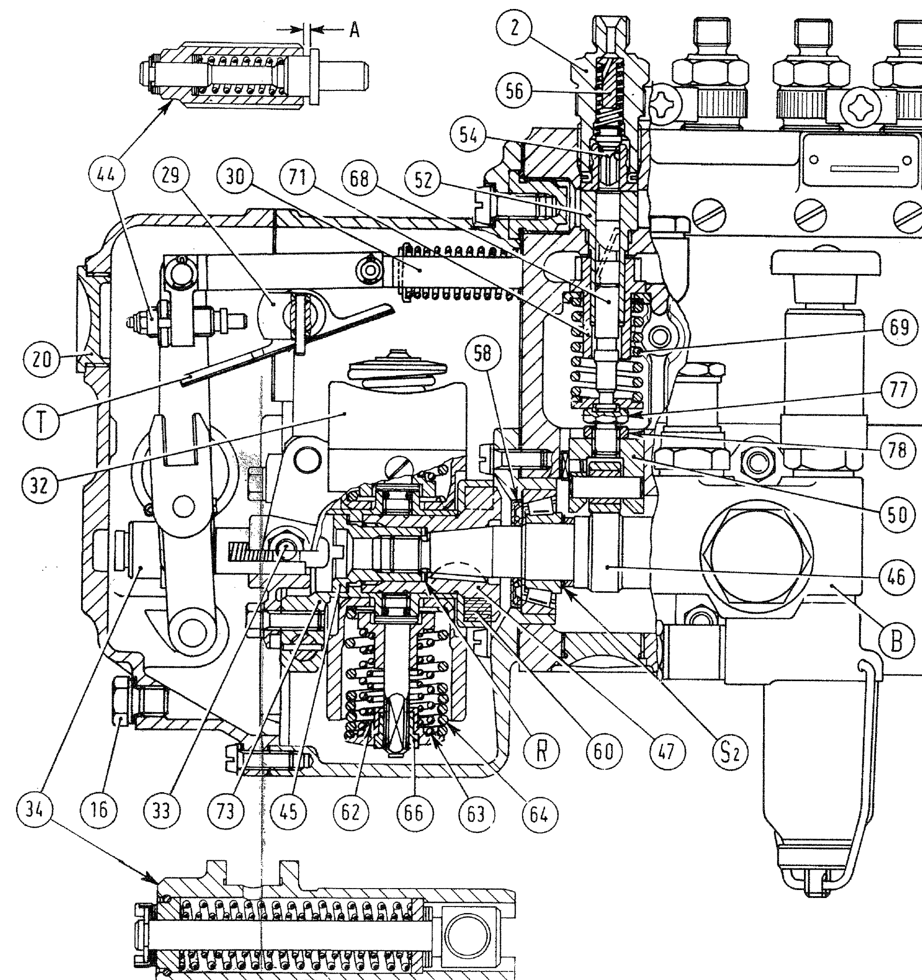

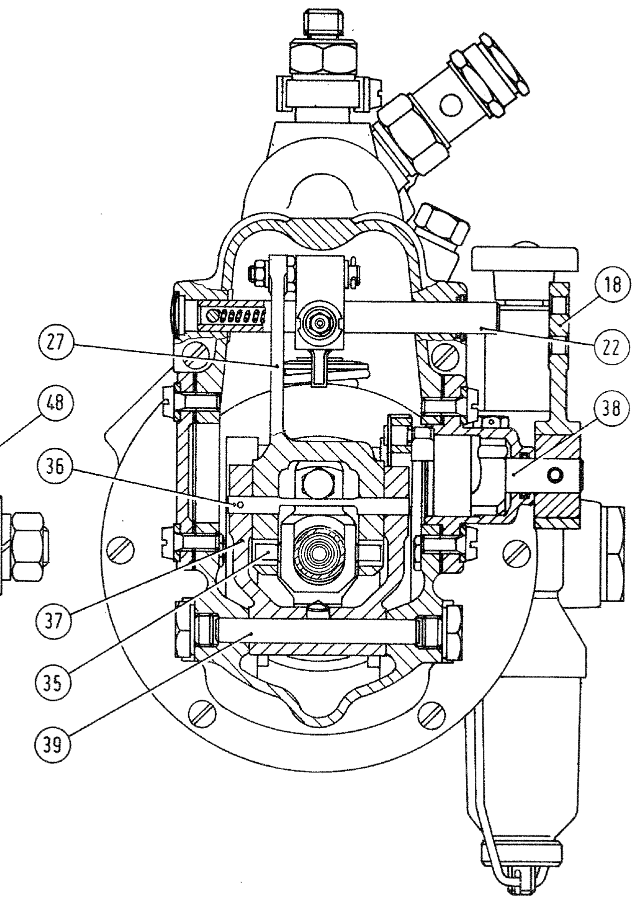

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Adjustment of aneroid link length (L).

If aneroid is disassembled, prior to assembly check spring (83) for:
— free length = 77 to 79 mm (3.03 to 3.11 in);
— length under 28 to 30 N (2.9 to 3.1 kg - 6.4 to 6.8 lb.) = 42.5 mm (1.673 in).

Install aneroid and check that at .50 bar (.50 kg/cm^2 - 7 psi) there is no leakage. Move piston 81 to end of stroke together with rod (85) (see illustration above). Using a Vernier and depth gauge, check that dimension (L) is 83.1 to 83.3 mm (3.272 to 3.280 in). To adjust, back off or screw in the rod fork (85) and retighten the lock nut.

Sections through FIAT in-line injection pump (1380 and 1580).

a. Section through aneroid (1380) - A. = .70 to .75 mm (.028 to .030 in) maximum fuel device stroke (1380) - B. Feed pump (1580, on 1380 the filter is separate from feed pump) - L. = 83.1 to 83.3 mm (3.272 to 3.280 in) aneroid setting - R. Damper clearance shim - S_1. Shim - S_2. Shim - T. Oil catcher - 2. Delivery connection - 4. Relief valve - 16. Governor oil inspection plug - 18. Throttle lever - 20. Plug - 22. Excess fuel button - 27. Rocking lever - 29. Control rod stop - 30. Control rod (rack) - 32. Governor weights - 33. Weight pivot - 34. Spring-loaded joint - 35. Rocking lever fulcrum - 36. Rocking lever pivot - 37. Pivoting fork - 44. Rack stroke adjusting screw with maximum fuel device - 45. Lock ring - 46. Camshaft - 47. Damper coupling - 48. Seal - 50. Tappets - 52. Barrel - 54. Delivery valve - 56. Reducing adapter - 58. Seal - 60. Cushion pads - 62. Inner spring - 63. Intermediate spring - 64. Outer spring - 66. Lock ring - 68. Plunger - 69. Spring - 71. Control sleeve - 73. Damper spider - 77. Plunger/adjuster screw - 78. Locknut - 79. Control rod stop (position varies in relation to supercharging pressure) - 80. Control rod stroke adjusting screw with aneroid in - 81. Aneroid piston - 82. Aneroid body - 83. Spring - 84. Intake manifold connecting pipe - 85. Adjustable connecting rod.

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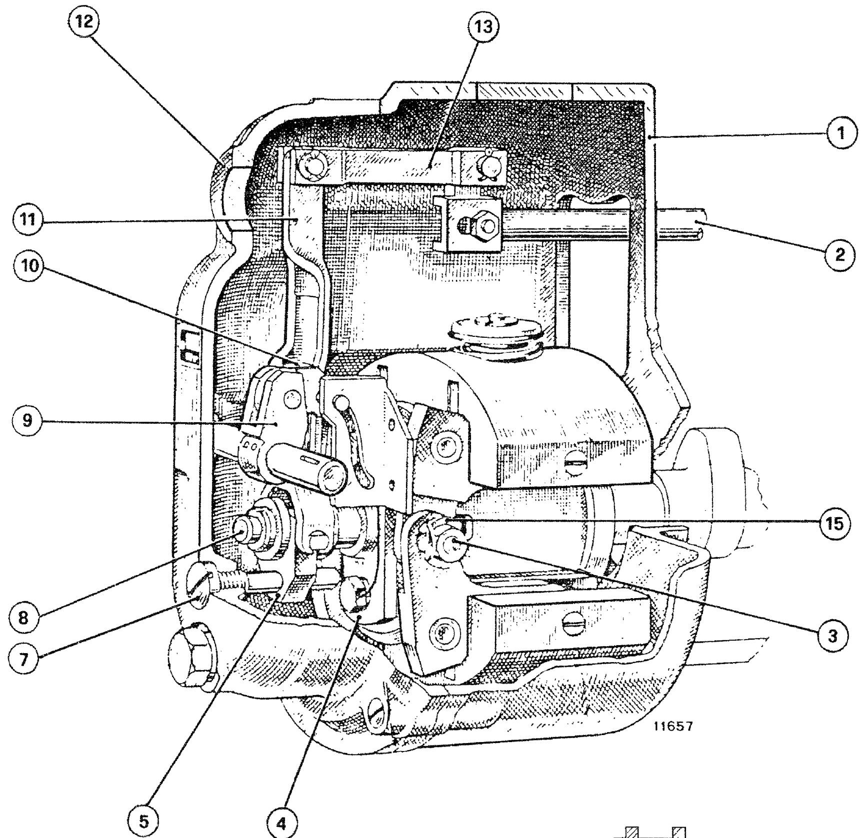
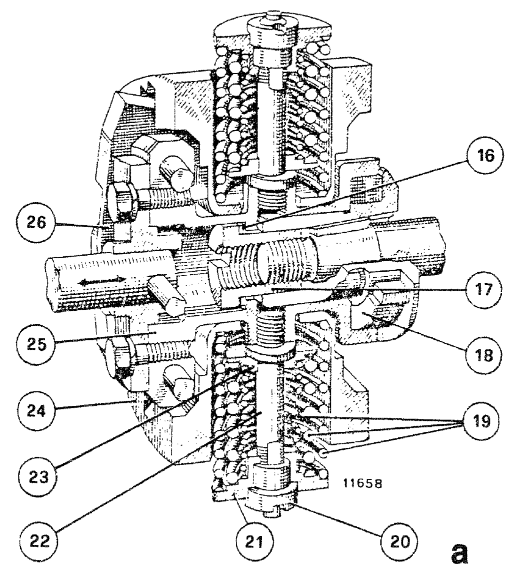
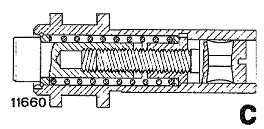
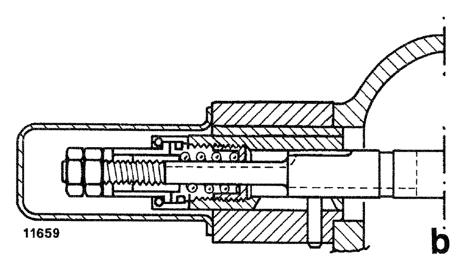
SPEED GOVERNOR

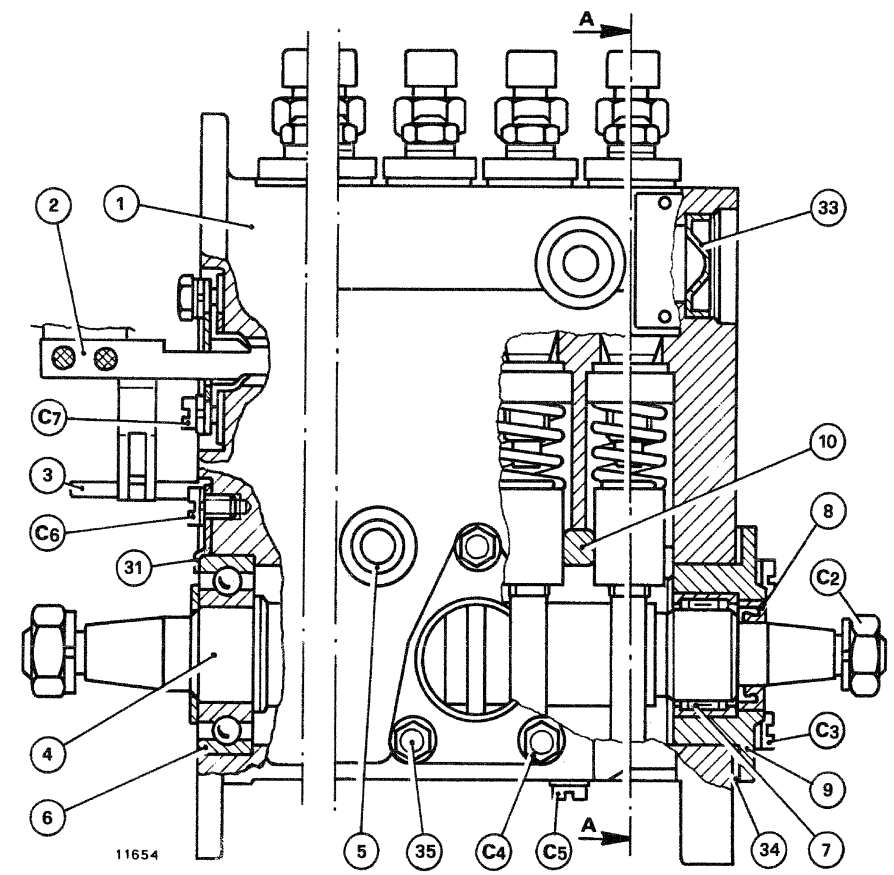


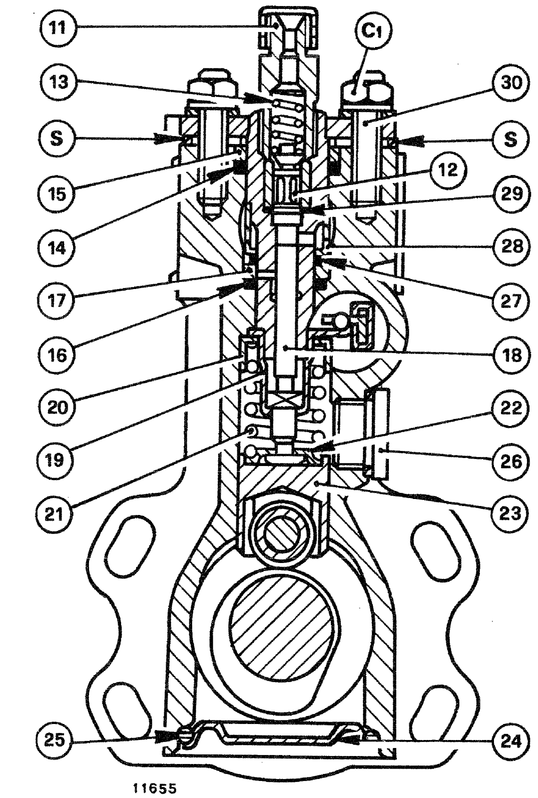






INJECTION PUMP



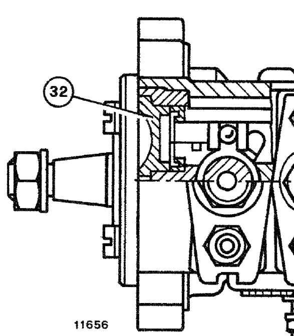


TORQUE DATA

C_1 = 20 to 25 Nm (2 to 2.5 kgm) 14.5 to 18 ft.lb.
C_2 = 60 to 70 Nm (6.1 to 7.1 kgm) 44 to 51 ft.lb.
C_3 = 7 to 9 Nm (.7 to .9 kgm) 5 to 6.5 ft.lb.
C_4 = 4 to 7 Nm (.4 to .7 kgm) 3 to 5 ft.lb.
C_5 = 4 to 7 Nm (.4 to .7 kgm) 3 to 5 ft.lb.
C_6 = 4 to 7 Nm (.4 to .7 kgm) 3 to 5 ft.lb.
C_7 = 4 to 7 Nm (.4 to .7 kgm) 3 to 5 ft.lb.
26 = 30 to 40 Nm (3 to 4 kgm) 22 to 29 ft.lb.
30 = 3 to 4 Nm (.3 to .4 kgm) 2 to 3 ft.lb.
35 = 3 to 4 Nm (.3 to .4 kgm) 2 to 3 ft.lb.

Sections through speed governor for BOSCH in-line pump (1880).

a. Cut-away of centrifugal weights - b. Section through maximum speed device - c. Section through adjuster - 1. Governor body - 2. Control rod - 3. Weight coupling pin - 4. Guide bush - 5. Lower slotted link - 7. Guide pin - 8. Adjuster - 9. Upper slotted link lever - 10. Upper slotted link - 11. Rocking lever - 12. Governor cover - 13. Connecting fork - 15. Lock washer - 16. Shim - 17. Nut - 18. Cushion pad - 19. Springs - 20. Nut - 21. Outer spring plate - 22. Pin - 23. Inner spring plate - 24. Centrifugal weight - 25. Weight carrier - 26. Lever.



Sections through BOSCH in-line injection pump (1880).

C_1. Nut - C_2. Nut - C_3. Capscrew - C_4. Nut - C_5. Capscrew - C_6. Capscrew - C_7. Capscrew - S. Shims - 1. Pump body - 2. Control rod - 3. Guide pin - 4. Camshaft - 5. Side plugs - 6. Ball bearing - 7. Needle roller bearing - 8. Seal - 9. Bearing cap - 10. Spacer - 11. Delivery connection - 12. Delivery valve - 13. Spring - 14. Sealing ring - 15. Spacer ring - 16. Sealing ring - 17. Spacer ring - 18. Pump plunger - 19. Control sleeve - 20. Upper spring plate - 21. Tappet spring - 22. Spring lower plate - 23. Roller tappet - 24. Cover - 25. Sealing ring - 26. Plug - 27. Retaining ring - 28. Atomizer - 29. Sealing washer - 30. Stud - 31. Retainer - 32. Plug - 33. Plug - 34. Gasket - 35. Stud.

Note: If studs (30 and 35) are found to be loose or have to be replaced, bond with sodium silicate (soluble glass) and tighten to 3 to 4 Nm (.3 to .4 kgm - 2 to 3 ft.lb.).

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BOSCH INJECTION PUMP AND GOVERNOR (1880)

The BOSCH injection pump supplies the 6 engine cylinders through as many pump elements actuated by a camshaft (4, page 28), in turn driven from the engine crankshaft through the valve timing gears.

A separate cam load on the camshaft drives the fuel supply pump.

The mechanical, all-speed, centrifugal weight type governor incorporates calibrated springs and a cushion pad type damper to minimize the effect of torsional vibrations.

OVERHAUL

For injection pump and governor overhaul, place the assembly with fuel supply pump removed on support **290239** with attached plate **290312/1** and disassemble as directed hereunder.

Governor disassembly

For governor disassembly, proceed as follows:

— remove the aneroid and excess fuel solenoid;

— back off guide pin (7, page 28) and governor cover capscrews (12), remove the protection and turn and lift off maximum fuel device;

— using a rubber mallet, lightly tap the cover (12, page 28) until it separates from governor body (1). Lift off the cover, taking care not to damage the gasket and holding the lever vertical;

— remove hinge pin from rocking lever (11, page 28), together with connecting fork (13), tying the latter at the top;

— pull control rod (11, page 28) out, together with lower slotted link (5).

To overcome the opposition of adjuster spring (8), turn the lever through 90° and withdraw, together with the slotted link:

— bend back lockwasher (15, page 28), back off 2 nuts on coupling pin (3) and remove the pin, followed by adjuster (8);

— remove the locking wire, take off capscrews retaining guide bush (4, page 28) and remove the bush;

— lock the camshaft, using coupling **290756** or **292131** and, using wrench **290981/2**, back off nut (17, page 28) retaining the centrifugal weights;

— remove drive coupling from camshaft, using puller **290977** and withdraw from the weight carrier (25, page 28) using a pair of screwdrivers; finally, remove cushion pads (18);

— take off the capscrews and separate governor body (13, page 28) from injection pump body and lift off.

The weight assembly, cover lever assembly and control rod stop with attached maximum fuel device should only be disassembled in case of excessive play, roughness during operation, or failed components.

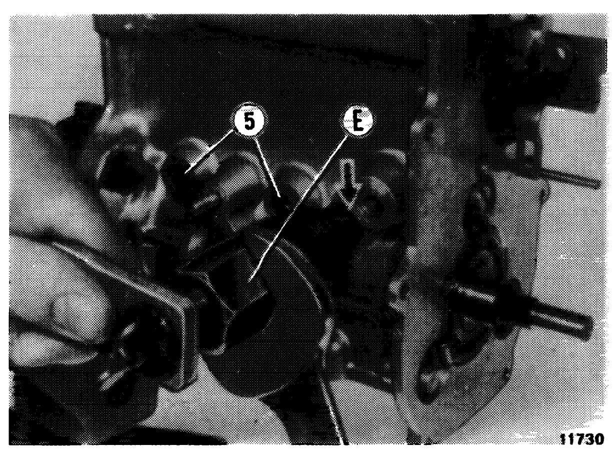
Injection pump disassembly

To disassemble the injection pump proceed as follows:

— position the pump with delivery connections (11, page 28) facing downward, remove cover (24) and sealing ring (25) after backing off the capscrews with attached washers;

— turn the pump vertical, slacken nuts (C_1, page 28) retaining pump elements and take off all shims (S) from both pump sides;

— remove side plugs (5), using puller (E) **292180**, withdraw spacers (10, page 28) using suitable pliers and turn the pump downward;



Removing side plugs.
E. Puller **292180** - 5. Side plugs.

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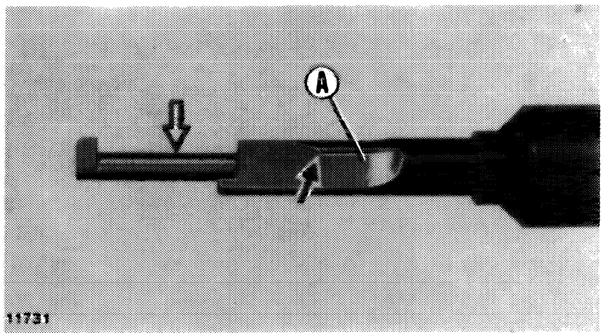


Coat lifter surface (A) in the points arrowed.
A. Lifter **292181**.

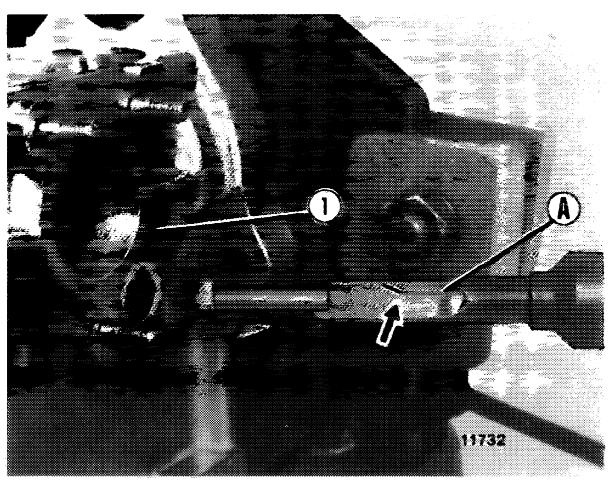
— turn handle of lifter **292181** (A) clockwise right up against the shoulder, and coat both the supporting edge and the guide pin with grease (see illustration above);

— turn camshaft (4) until the first tappet (23, page 28) is at top of stroke (starting from pump drive side);

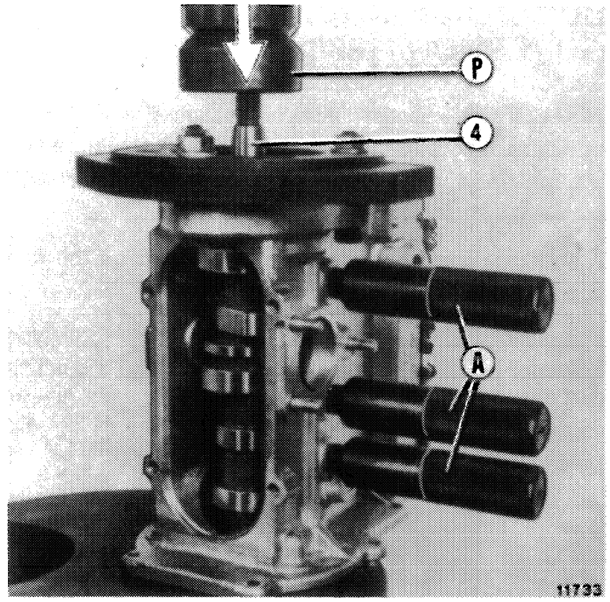
— insert lifter (A) with the support edge facing upward, into the side spacer hole and hand-push fully home (do not strike with hammer). In these conditions, the first tappet is raised from the camshaft;

— continue to turn the camshaft until the second tappet is in top of stroke position, hand-push the lifter (A) fully home (do not strike with hammer; if necessary tap with the palm of the hand). In these conditions, also the second tappet is raised from the camshaft;

— proceed as described above also for the four remaining tappets;



Inserting lift in pump body.
A. Lifter - 1. Pump body.



Removing camshaft and ball bearing.
A. Lifter **292181** - P. Press - 4. Camshaft.

— remove retainers (31, page 28) from bearing (6), take off the intermediate support, the drive coupling and disassemble the camshaft with attached ball bearing (6) at the press. Finally, remove the bearing from the camshaft;

— clamp the gear pump with the connections facing downward. Take off plug (26, page 28) and remove tappets (23), starting from the governor end; to do this, press on the tappet, simultaneously turning the lifter handle clockwise to remove; when a tappet has been released, press on the second tappet and turn the lifter handle further clockwise;

— repeat the above operations on the remaining four tappets;

— using suitable point-nosed pliers, remove tappets (23, page 23), plungers (18) and lower plates (22) and transfer carefully to wooden containers, taking care not to interchange any of the components (plungers and barrels must not be interchanged);

— remove springs (21, page 28), withdraw control sleeves (19) and upper spring plates (20); this operation is only possible when the sleeve drive ball and vertical slot are in register (see illustration on page 31);

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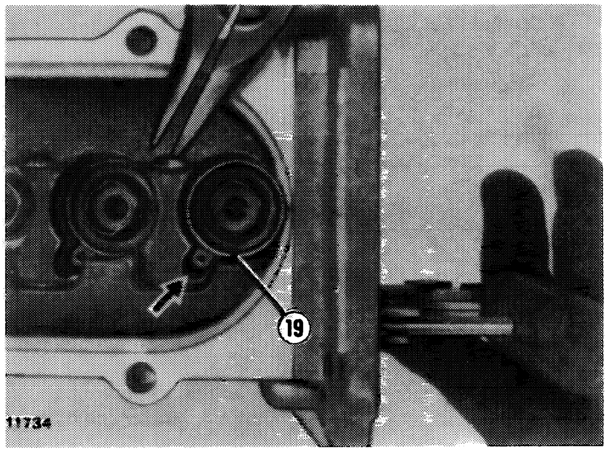


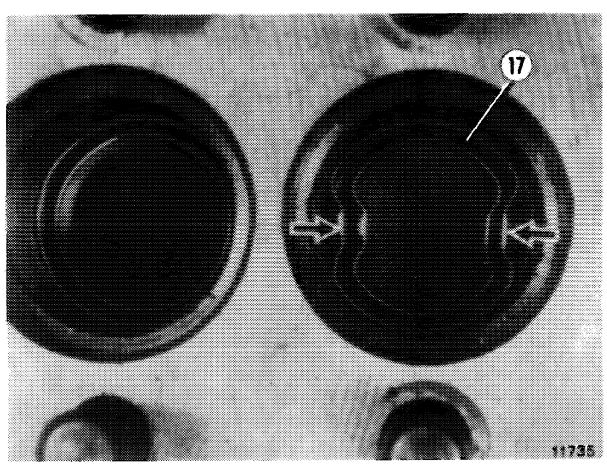
Removing control sleeves.
19. Control sleeve.

— turn the pump so that the delivery connections face upward, remove nuts (C_1, page 28) and associated washers. Take out the pump element assemblies, sealing rings (14) and spacers (15). Place these parts, together with the associated pump plungers;

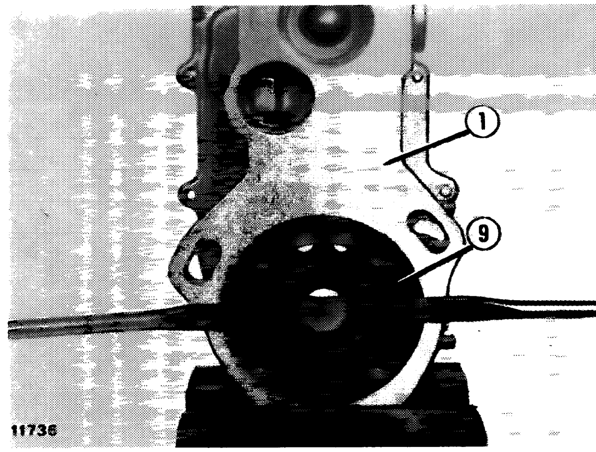
— using a suitable screwdriver and pointed tool, remove spacer ring (17) and sealing ring (16, page 28), applying the screwdriver to ring (17) as shown below;

— remove the capscrews and take off control rod (2, page 28).

Attention: In the course of the following operations, take care to prevent damaging guide pin (3, page 28); if the pin is found to be damaged or distorted, the pump body must be replaced.



Replacing spacer rings.
17. Spacer rings.



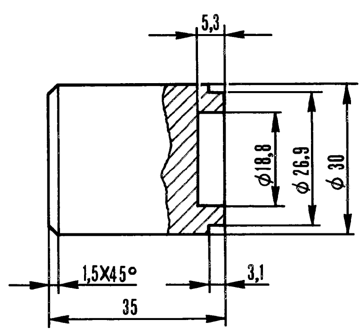
Removing bearing cap.
1. Pump body - 9. Bearing cap.

— Clamp the pump in a vise. Take off the capscrews, and, using a pair of screwdrivers, remove needle roller bearing cap (9) as shown above. Take out seal (8) and remove needle roller bearing (7, page 28) using punch **292189** at the press;

— for suction chamber plug replacement (33, page 28), proceed as follows:

- drill one of the two plugs (33) using an 11 mm diameter drill and, with a 10 mm diameter punch, expell the other through the drilled hole;
- remove the drilled plug using a 17 mm diameter punch;
- clean the two plug seats, coat two replacement plugs with "LOCTITE 601" (°) and press fully home against the shoulder using a special-purpose punch to be constructed as directed in the illustration below.

(°) Setting time at 20°C: 3 hours approx.



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Punch to be built for suction chamber blanking plugs (dimensions in mm).

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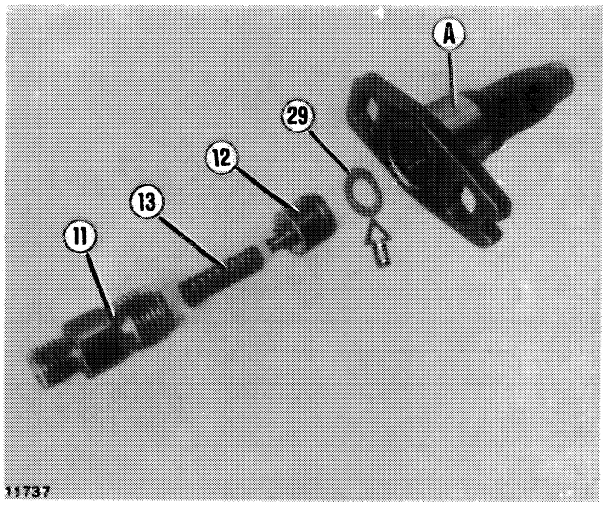
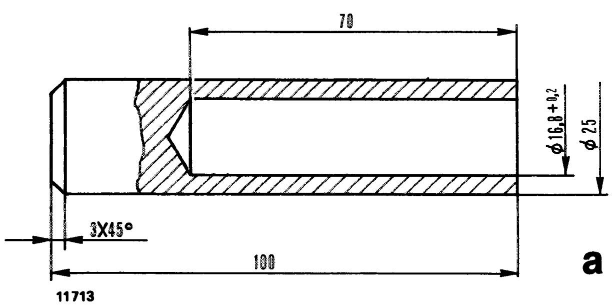
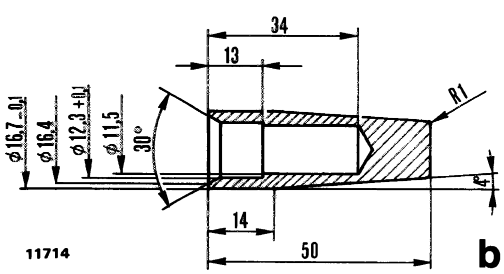


Pump element components.
A. Pump element body - 11. Delivery connection - 12. Delivery valve assembly - 13. Spring - 29. Sealing washer.

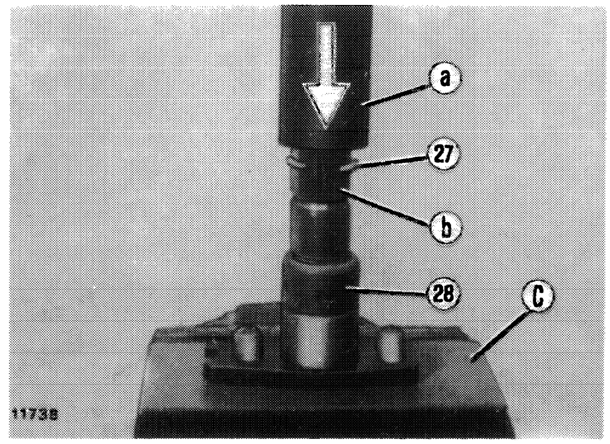
Note: Washer (29) must be installed beween pump element and delivery valve.

— if the pump elements are disassembled, on assembly rest on tool **292182** (C), in the order shown above, and install retaining ring (27) for retention of atomizer (28), using the two tools shown below (to be built for the purpose). The retaining ring must be pressed right up against the shoulder.





Installing atomizer retaining ring.
a. Punch - b. Guide - C. Support plate - 27. Retaining ring - 28. Atomizer.



Punch and guide construction details.
a. Punch - b. Guide - 27. Retaining ring - 28. Atomizer.

Note: Control edges of pump plungers and delivery valves must be sharp and the associated working surfaces must not be affected by undue wear. In the course of repair, do not replace pump elements or delivery valves individually. The tappets and lobes on camshaft affected by wear must be replaced. Camshaft bearings, seals and sealing rings must always be replaced.

Injection pump assembly

Wash all parts, lubricate with **FIAT CFB** test oil and assemble as follows:

— using tool **292189** and a suitable press install needle roller bearing (7, page 28) right up against the shoulder in cap (9);

Note: Pay attention not to damage seal (8, page 28).

— install seal (34, page 28) in bearing cap (9, page 33), offer up the cap onto the pump body (1) and tighten the associated capscrews, ensuring that the two oil return ports face upward (as shown on page 33);

— fasten the pump to its support and clamp in a vise. Insert sealing rings (16, page 28) in their grooves, and, using tool **292315,** install spacer (17) so that the slotted side faces upward;

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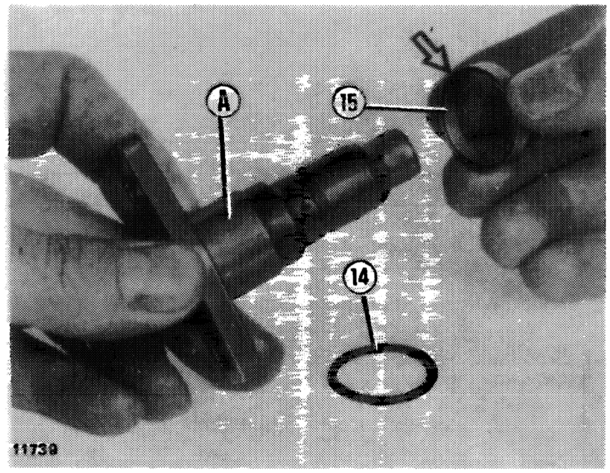
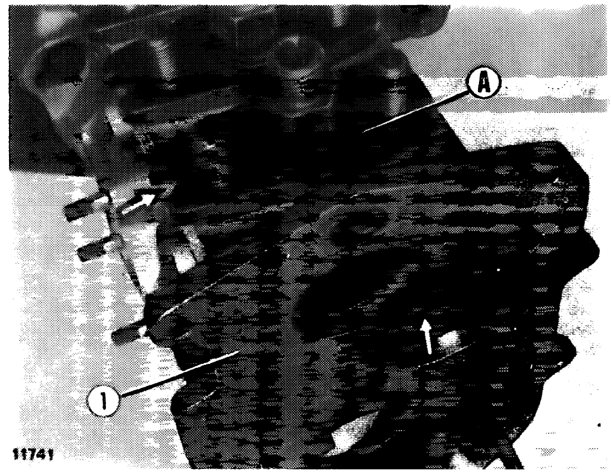


Spacer ring assembly position.
A. Pump element - 14. Sealing ring - 15. Spacer.



Pump element in position on pump body.
A. Pump element - 1. Pump body.

— insert spacer (15) and sealing ring (14) on pump element A as shown above. Install the sub-assembly in pump body so that the milled flat on pump element lies on the side opposite to that of the control rod (see illustration on the right);

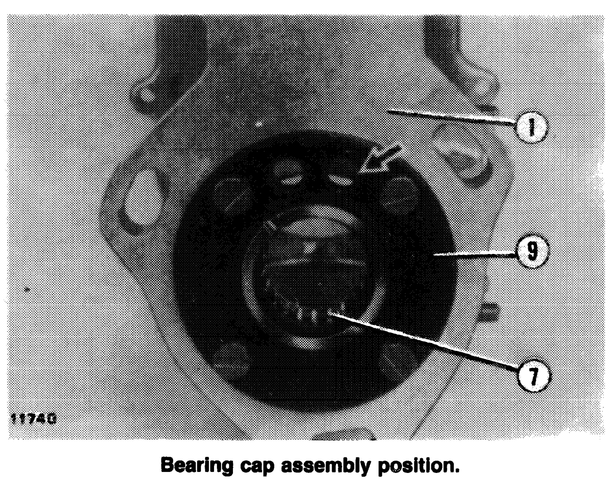
— interpose test shims **292191** between pump body and pump elements and tighten nuts (C_1, page 28) with associated flat washers and lockwashers;

— install control rod in pump body and fasten, using the associated capscrews and lockwashers;

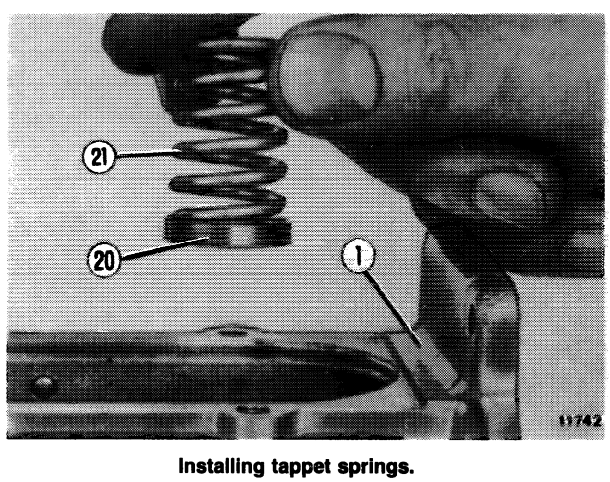
— turn the pump body so that the delivery connections lie lowermost, insert the pump plungers in the associated barrels and check that they slide without binding;

— apply the three separator tubes, **292188,** and fasten to the pump body using the capscrews for retention of cover (24, page 28);

— remove the pump from its support and connect the compressed air hose attached to pressure reducing valve and pressure gauge to the fuel supply connection. Shut off the return using a plug and admit compressed air at 5 bar (5.1 kg/cm^2 - 72 psi) through the reducer. At this point check for hydraulic leakage by dipping the pump in a container full of oil. The pump elements must be free from leakage at the sealing rings (14 and 16, page 28), plugs (33) and delivery connections (11). Any leakage through pump plungers and delivery connection apers is acceptable;



Bearing cap assembly position.
1. Pump body - 7. Needle roller bearing - 9. Bearing cap.



Installing tappet springs.
1. Pump body - 20. Top spring plate - 21. Tappet spring.

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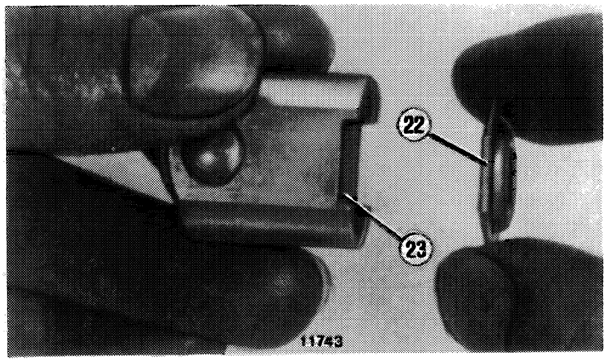


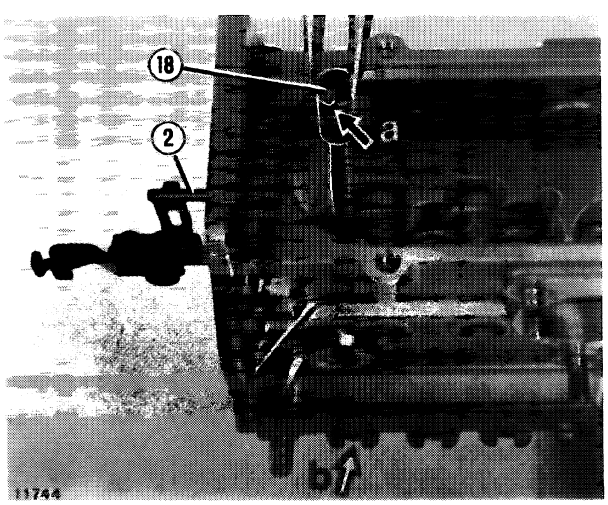
Installing lower spring plate using grease.
22. Lower spring plate - 23. Roller tappet.

— install the pump on its support, remove separator tubes **292188** and pump plungers (keeping them separate so that they may be subsequently installed to their associated pump element);

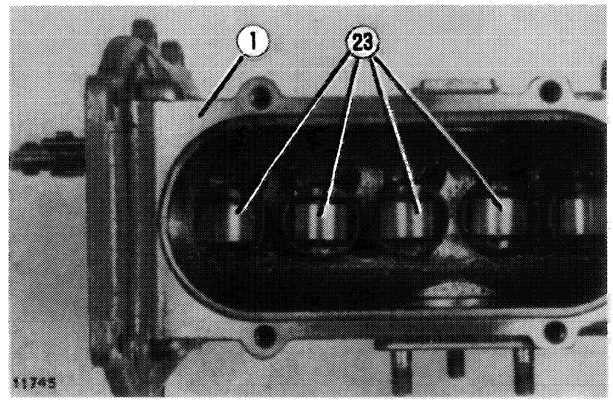
— install control sleeves (19, page 28), ensuring that the drive balls are properly seated in the control rod;

— apply tappet springs (21, page 33) to the top spring plates (20) using grease and insert in the associated seats on pump body as shown on page 33;

— introduce plungers (18) in the associated pump elements, ensuring that reference mark (arrowed **a**) on them faces towards the milled flat on the pump element (arrowed **b**). Check that the control rod is free from binding and that it slides back to end of stroke position under spring load;



Plunger assembly position in pump element (arrow a and b).
2. Control rod - 18. Pump plungers.



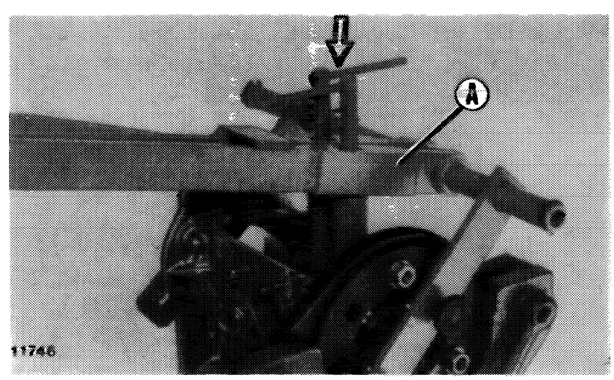
Tappet assembly position.
1. Pump body - 23. Tappets.

— apply bottom spring plate (22) to roller tappet (23) using grease as shown;

— install pump on tool **292192** (A), insert tappets (23) so that the roller centerline lies at right angles to the pump longitudinal centerline (as shown above). Clamp the assembly in a vise;

— turn the handles of lifters **292181** counterclockwise against the stop;

— lower the two levers on tool **292192** (A), ensuring that the two levers are positioned as indicated below and, starting from the pump drive end, depress the first tappet right up against the stop. Turn the lever of the tool lever lowered through 90° counterclockwise; the piston will lock onto the plate after completing a 45° angle. Hold the tool lever depressed and repeat the above operation on the other lever of the second tappet. At this point, holding the two levers fully depressed, insert lift **292181** to lock the two tappets at top of stroke.



Installing tappets in pump body.
A. Tappet installer **292192**.

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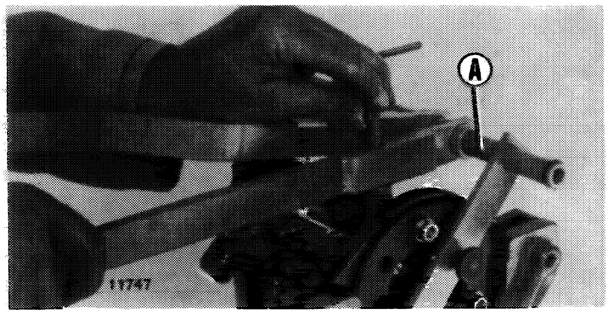


Installing tappets in pump body.
A. Tappet installer **292192.**

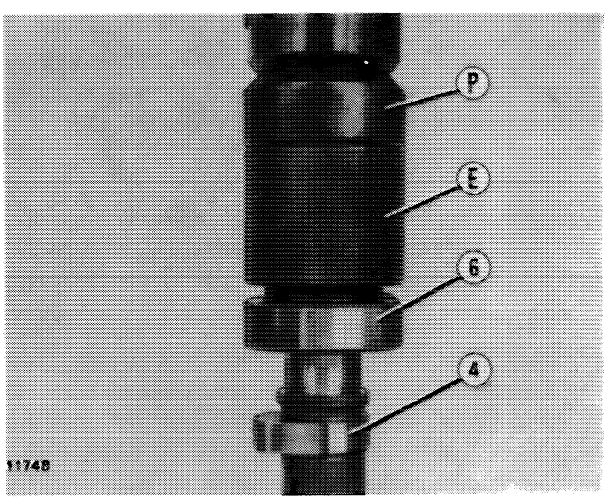
— repeat the above operations for the remaining pairs of tappets;

— remove pump from tool **292192** (A);

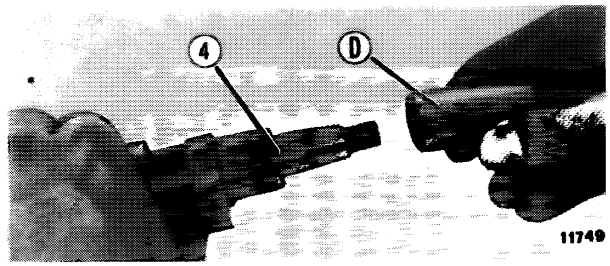
— using tool **292185** (E) (using 38 mm dia. spigot) and a suitable press, press ball bearing (6) fully home on governor side of camshaft (4);

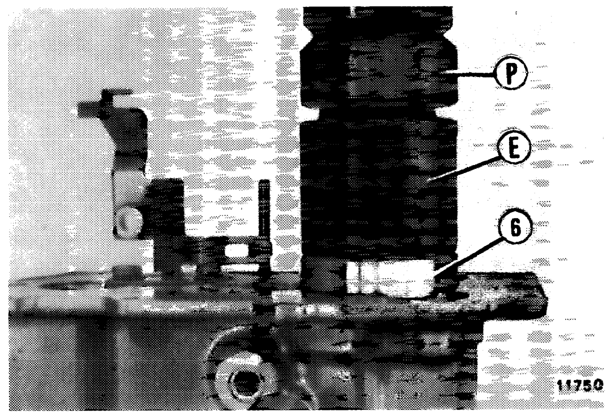
Note: Apply load to bearing inner race only.

— screw in installer **292184** (D) on camshaft (4) and position intermediate support using grease and install on pump body right up against the associated shoulder using a press and tool **292185** (E) on 52 mm dia. spigot;



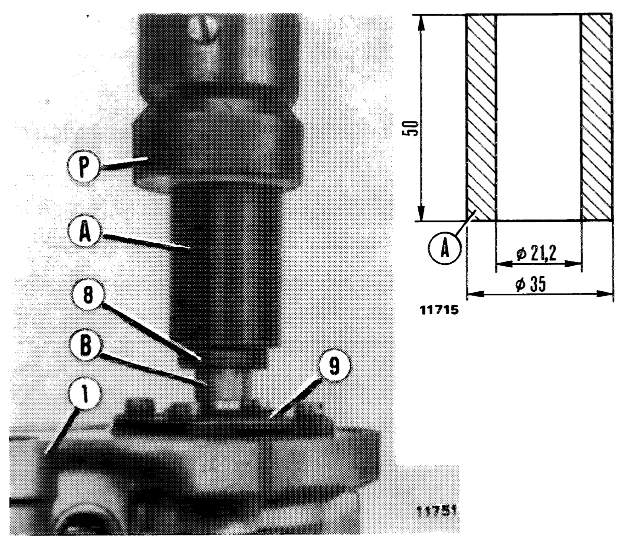
Installing ball bearing on camshaft.
E. Bearing installer **292185** - P. Press - 4. Camshaft - 6. Ball bearing.





Installing camshaft with attached bearing in pump body.
D. Installer bush **292184** - E. Installer **292185** - P. Press - 4. Camshaft - 6. Ball bearing.

Note: Apply load on bearing outer race only.



Installing camshaft seal in bearing cap.
A. Tool to be built for seal installation (dimensions in mm) - B. Protector **292183** - P. Press - 1. Pump body - 8. Seal - 9. Needle roller bearing cap.

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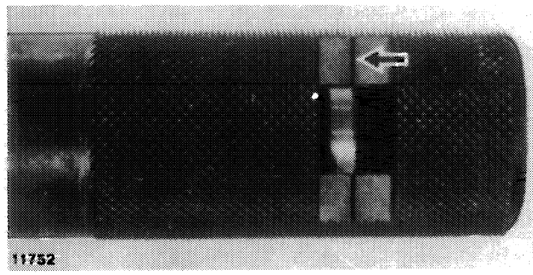


Position to be reached when unlocking the first tappet.

— fasten the intermediate support using the associated capscrews, remove installer bush **292184** and fasten bearing retainers (31, page 28) using the associated capscrews;

— to install seal (8, page 28) apply protector **292183** to the camshaft, smear the outside of the seal with sodium silicate (soluble glass) and, using tool (A) shown on page 35 (to be built), press flush with pump body;

— with the pump clamped in a vise, turn the camshaft until tappet no. 1 (governor side) is at top of stroke; at this point turn the handle of lifter **292181** clockwise until the front edge of the register lines up with the reference mark (see arrow in illustration above). In these conditions, the tappet rests on the camshaft. Turn the camshaft until tappet no. 2 is in top of stroke position, further turn the handle of lifter **292181** clockwise until the lifter comes out completely;

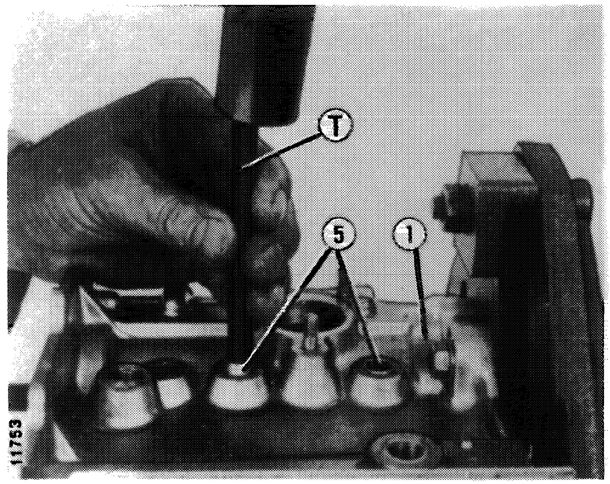
— repeat the above procedure on the remaining pairs of tappets;

— ensure that the control rod slides freely and returns to end of stroke position easily under spring load;

— install sealing ring (25, page 28) on cover (24) and tighten the latter to the pump body using the associated capscrews and washers;

— insert spacers (10, page 28) in the associated seats on the pump body and, using punch **292193** (T), press new plugs (5) fully home;

Note: Side plugs (5) must be replaced whenever removed from pump body.



Installing side plugs in pump body.

T. Side plug installer **292193** - 1. Pump body - 5. Side plugs.

— Slacken pump element nuts (C_1, page 28), remove test shims **292191** and insert 2 mm thick shims, and tighten nuts (C_1).

Note: Shims to be inserted must be of equal thickness for the same pump element, i.e. they must bear the same reference number.

Governor assembly

Replace any worn or damaged components and reverse the disassembly procedure. Prior to installation, thoroughly wash and oil all parts with **FIAT CFB** test oil.

— check damper end float as directed on page 22; correct end float is .05 to .10 mm (.002 to .004 in). To adjust the end clearance replace shim (16, page 28);

— check lower slotted link position using tool **292143** (A, page 37) to be positioned on governor body (1) without seal; pull the control sleeve (8) until the governor weights rest on the carrier without preloading the associated spring; in these conditions tool (8) should enter the control sleeve guide without play. To adjust, turn the sleeve screw until the specified distance is obtained.

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— check that the distance from top of gasket (12) on cover to pin (C) is 24.5 mm (0.964 in).

Example

— specified distance = 24.5 mm;
— pin diameter (C) = 6 mm;
— straightedge thickness (E) = 6 mm.

The measured distance will be 27.5 mm which represents the sum of the 24.5 mm specified distance and 6 mm thick straightedge, minus 3 mm half-pin diameter. To adjust, alter the thickness of shims under support plate (D).

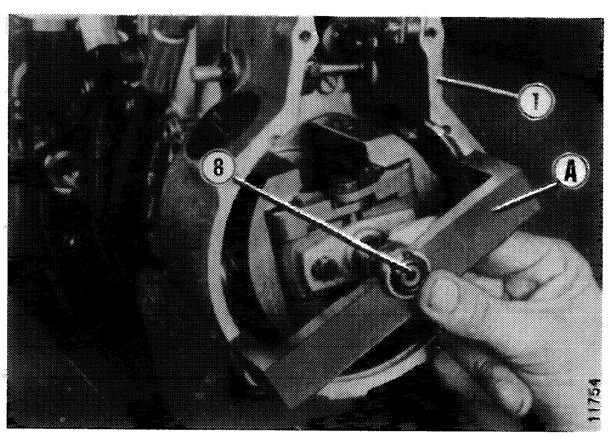
— Finally, install the aneroid and excess fuel solenoid.

INJECTION PUMP AND GOVERNOR ADJUSTMENT

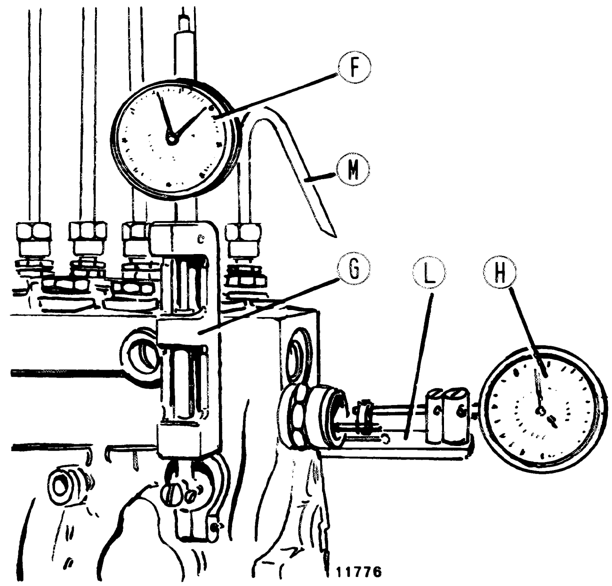
Install the pump on a test machine, connect the delivery pipes, shut off the injection pump inlet port using cover **293217,** seal off fuel return using a suitable plug and connect the test machine supply pipe to the corresponding pump chamber.

Spill cut-off

Proceed as follows:
— bring pump element no. 1 (drive side) to bottom of stroke, install tool **292194** (G) for prestroke check and dial gauge **292197** (F), ensure that the pin lies above the roller tappet and zeroed dial gauge;

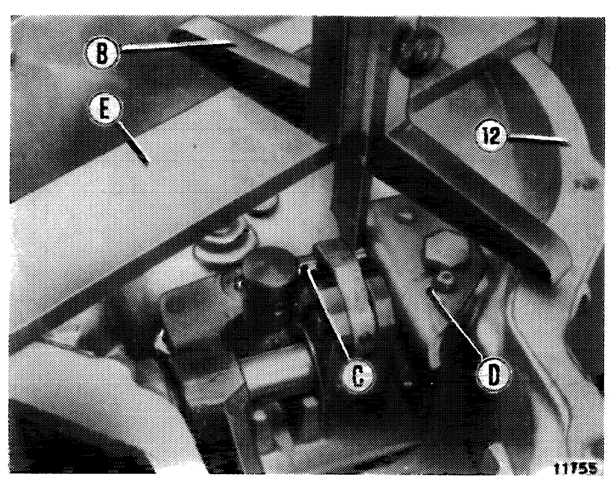


Checking control sleeve position.
A. Gauge **292143** - 1. Governor body - 8. Adjustment sleeve.



Pump element pre-stoke and control rod stroke test position.
F. Dial gauge **292197** - G. Pre-stroke gauge **292194** - H. Dial gauge **292198** - L. Control rod stroke gauge **292196** - M. Spill pipe.

— remove plug (32, page 28) from control rod seat, install tool **292196** (L) for control rod stroke check, dial gauge **292198** (H), preload, zero and ensure that the control rod can cover the entire stroke;
— install a spill pipe (M) of the same size as the delivery lines, suitably terminated and bent, to the pump element under test;



Checking distance of governor cover gasket to pin centerline.
B. Depth gauge - C. Guide pin - D. Curved support plate - E. Straightedge - 12. Gasket.

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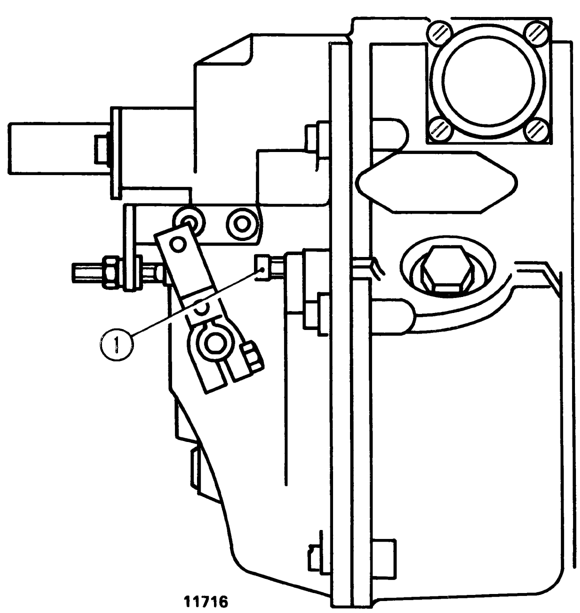
— increase fuel supply pressure until the test fluid issuing from the spill pipe (M, page 37) is free from air bubbles;
— slowly turn the camshaft clockwise (as seen from drive end) until solid fluid flow is discontinued (commencement of delivery or spill cut-off point). Check that the dial gauge reading (F, page 37) is 2.90 to 3 mm (.114 to .118 in). To adjust, alter the thickness of shims as necessary (shims are provided in .05 mm steps (.002 in);

Note: Place a shim of equal thickness on each side of each pump element (same reference number).

— after obtaining the specified pre-stroke (lift to spill cut off) on the first pump element, move the pointer of the graduated bench dial to 0°;
— remove tool (G, page 37) and associated dial gauge (F) and seal off the port using plug (26, page 28) with a new sealing ring;
— remove spill pipe and connector (M, page 37) from pump element no. 1, install the associated delivery line and repeat the above sequence on the remaining pump elements, noting that the specified pre-stroke must be obtained at 60° ± 0.5° between pump elements. To adjust, alter the thickness of shims as necessary.



Governor cut-in adjusting screw (1).

Maximum control rod stroke

Check that at 1100 rpm test machine speed, control rod stroke on dial gauge **292198** (H, page 37) is 11.00 to 11.20 mm (.433 to .441 in) with aneroid at atmospheric pressure; to adjust, turn adjusting screw (3, page 39) after removing cover (2) on aneroid. At the same speed, the control rod stroke should be 11.1 to 12.1 mm (.437 to .477 in) with aneroid at .50 bar (.50 kg/cm^2 - 7.1 psi) minimum; to adjust, turn maximum fuel device adjusting screw as necessary.

Governed speed

With control rod lever in maximum fuelling position, adjust screw (1) (see illustration) so that the control rod starts to return at 1100 to 1110 rpm; to adjust, alter the governor spring load, screwing in or backing off the two lockrings by an equal amount. Finally, readjust the screw.
Remove dial gauge (H, page 37) and tool (L) and seal off the hole using plug (32, page 28).

Spread

Check deliveries comparing the readings with the data of table on page 17, section 10; if necessary, adjust by suitably turning the pump element under test.

PUMP TIMING

Proceed as directed on page 26, noting that fixed pointer must be aligned with:

— No. 4745891 (fixed advance 20°) on engines up to No. 750749.

— No. 4765223 (fixed advance 15°) on engines from No. 750750.

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ANEROID (1880)

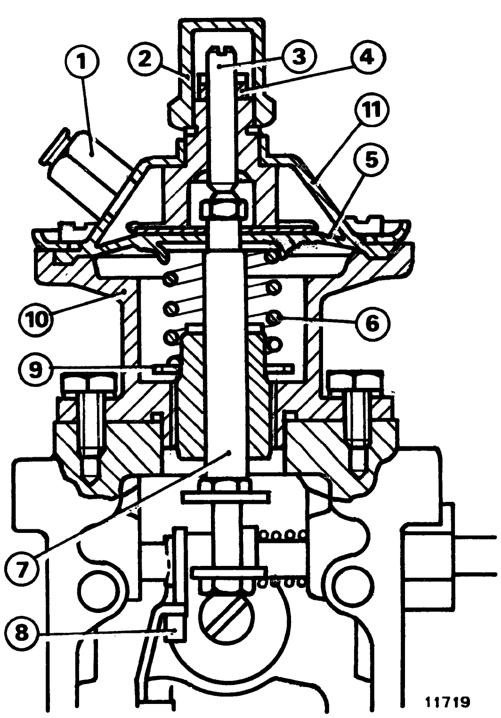
The pneumatically controlled aneroid is provided to adjust fuel delivery to the volume of air (by weight) introduced in the cylinders by the turbocharger. This is necessary because at the low rpm rates, in turbocharged engines, the supercharging pressure is too low and therefore the volume of air (by weight) introduced in the cylinders is insufficient, and consequently fuel delivery must be corrected to suit supercharging pressure. This is obtained through the control rod adjustable stop, a position of which is altered by the aneroid, starting from a predetermined supercharging pressure (selected during adjustment).

The aneroid consists of a body (10), cover (11) with interposed diaphragm (5) which must be air tight. The cover carries supercharging pressure connector (1) and the diaphragm is opposed by spring (6) which rests on lock ring (9) screwed into the aneroid body.

The lock ring is used to alter spring pre-load within given limits, and consequently the cut-in point of the aneroid which must be activated at .08 to .18 bar (.08 to .18 kg/cm^2 - 1.1 to 2.6 psi). Access to the lock ring is obtained through the tapped hole drilled in the pump body after removing the plug provided.

The diaphragm is connected to pushrod (7) through a plate and guide, the pushrod being used to actuate adjuster (8) through a relay lever.
As supercharging pressure increases, the diaphragm drops, overcoming the opposition of its spring and lowers the pushrod which, through the relay lever, enables the adjuster to provide a longer stroke. When supercharging pressure reaches .26 to .36 bar (.26 to .36 kg/cm^2 - 3.7 to 5.1 psi), the aneroid is at end of stroke which enables the adjuster to complete the entire stroke (maximum delivery).

Prior to adjusting the aneroid, check that no leakage occurs at .50 bar (.50 kg/cm^2 7.1 psi) approximately.



Section through aneroid.

1. Supercharging air connection - 2. Cover - 3. Control rod stroke adjusting screw - 4. Lock nut - 5. Diaphragm - 6. Spring - 7. Push rod - 8. Adjuster - 9. Lock ring - 10. Aneroid body - 11. Aneroid cover.

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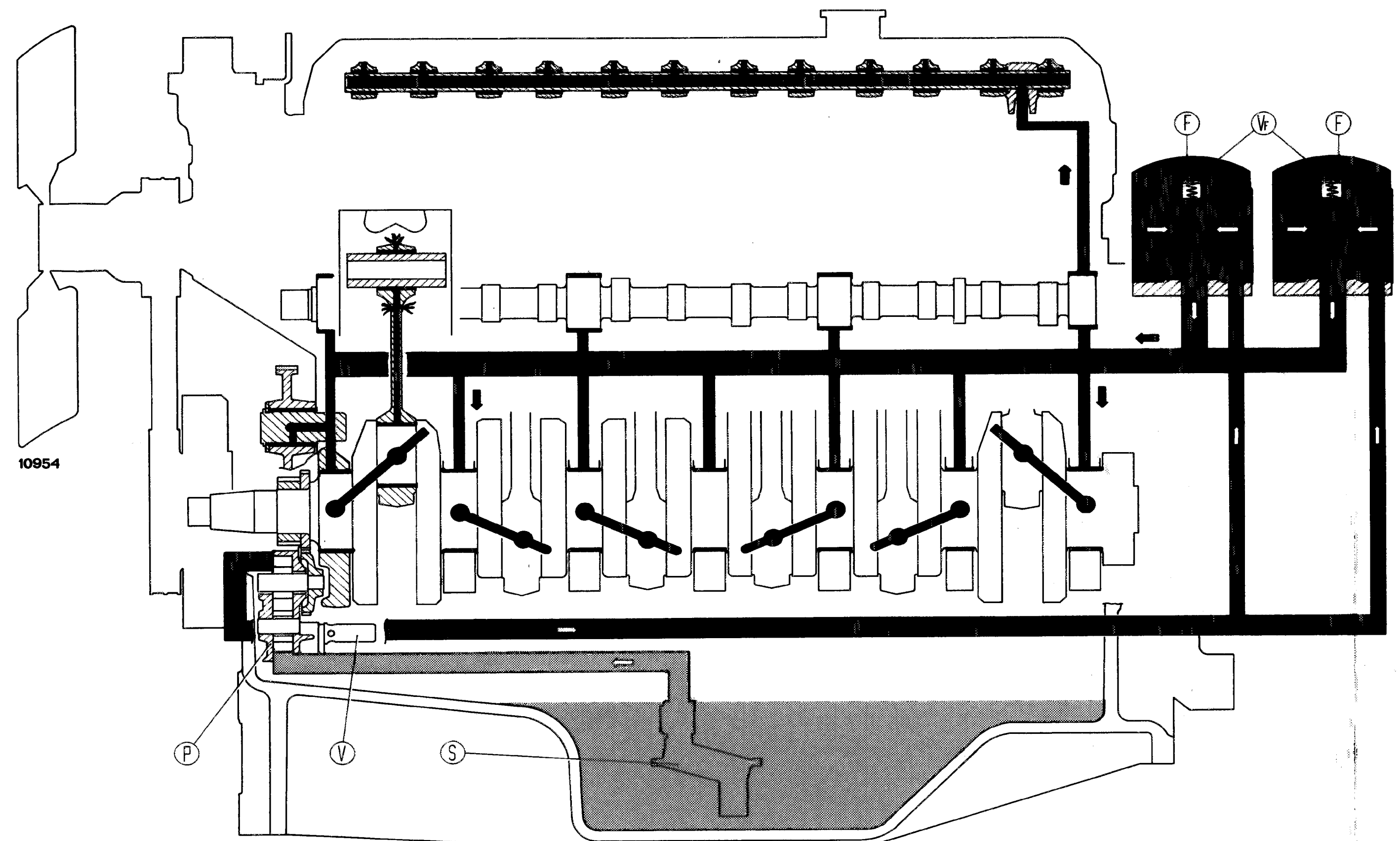

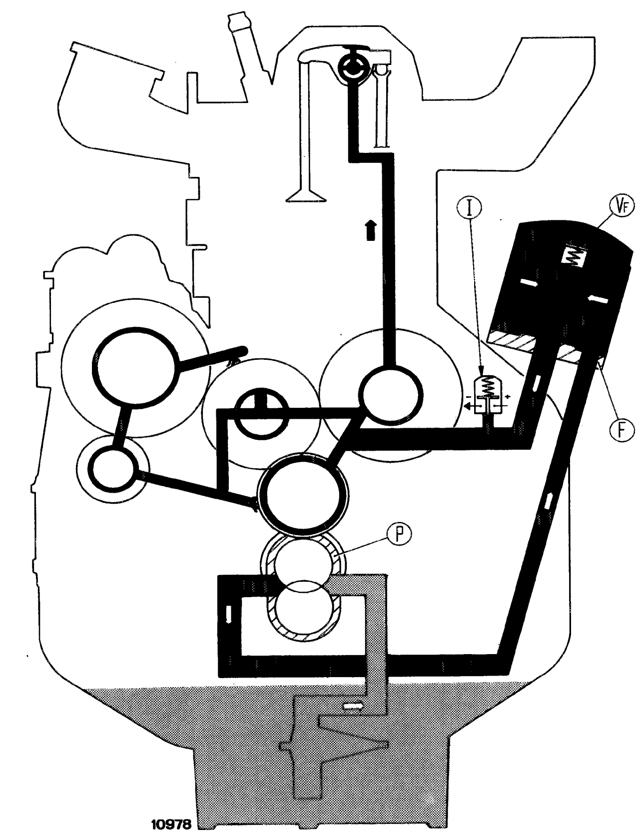

Lubrication system diagram (1180).

F. Filters - I. Low engine oil pressure sending unit - P. Pump - S. Suction filter - V. Oil pressure relief valve - Vf. Filter bypass valve (cuts in when inlet pressure is 1.5 to 1.7 bar - kg/cm² or 21 to 24 psi higher than outlet pressure).

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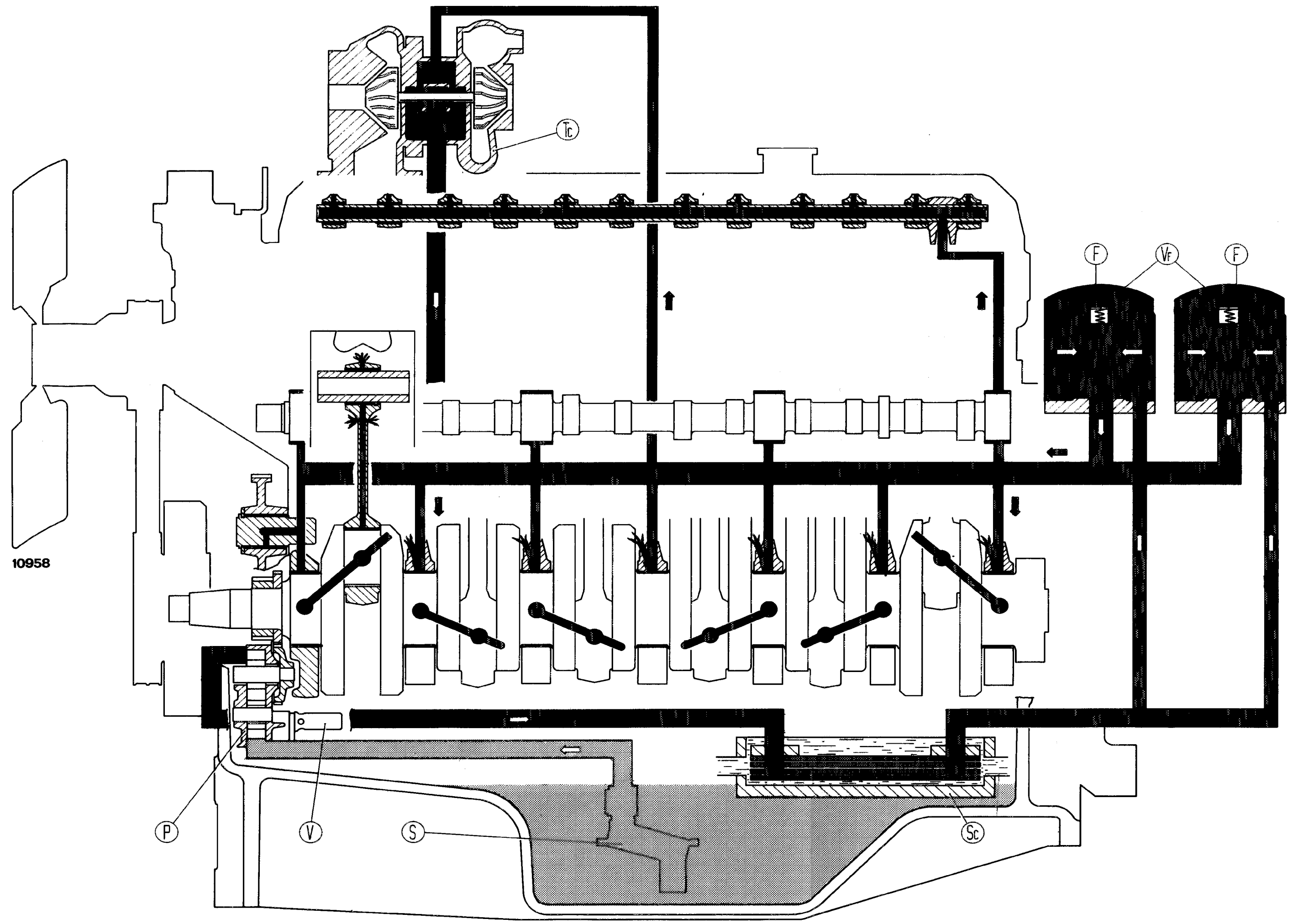

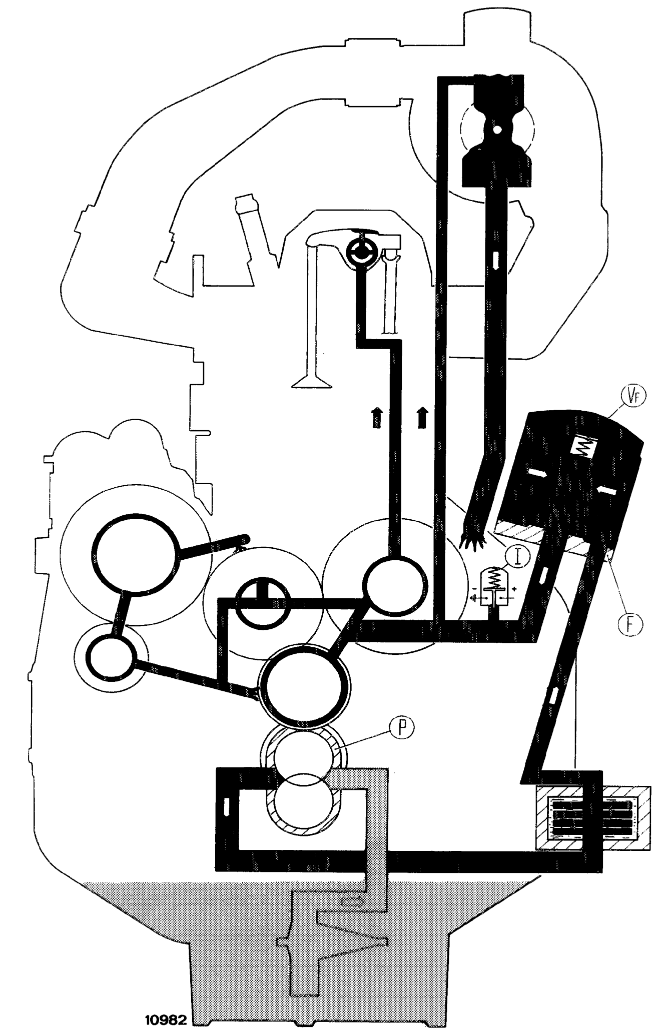

Lubrication system diagram (1380).

F. Filter - I. Low engine oil pressure sending unit - P. Pump - S. Suction filter - Sc. Heat exchanger - Tc. Turbocharger - V. Oil pressure relief valve - Vf. Filter bypass valve (cuts in when inlet pressure is 1.5 to 1.7 bar - kg/cm² or 21 to 24 psi higher than outlet pressure).

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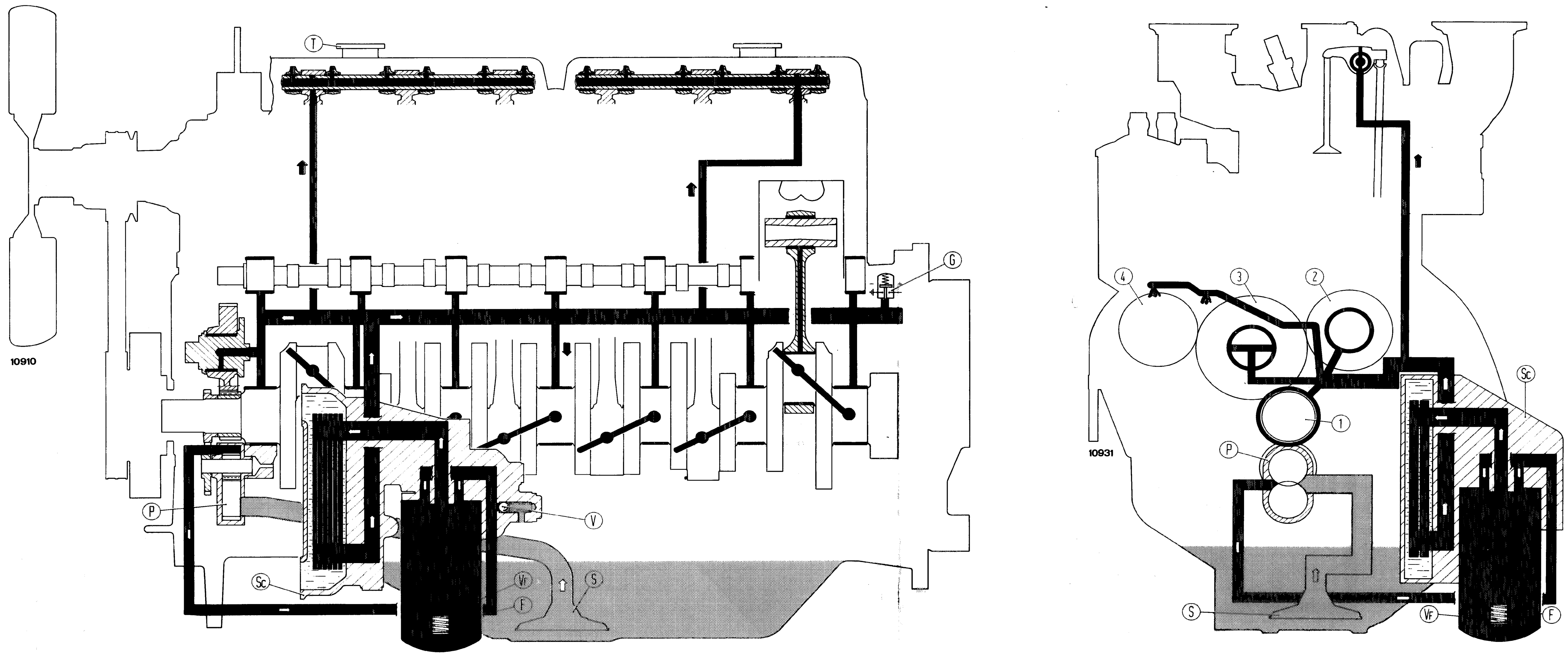

Lubrication system diagram (1580).

F. Filter - G. Low engine lubricating oil pressure sending unit - P. Pump - S. Suction filter - Sc. Heat exchanger - T. Oil filler plug - V. Oil pressure relief valve - Vf. Filter bypass valve (cuts in when inlet pressure is 1.5 to 1.7 bar - kg/cm² or 21 to 24 psi higher than outlet pressure). - 1. Crankshaft pinion - 2. Camshaft drive gear - 3. Idler gear - 4. Injection pump drive gear.

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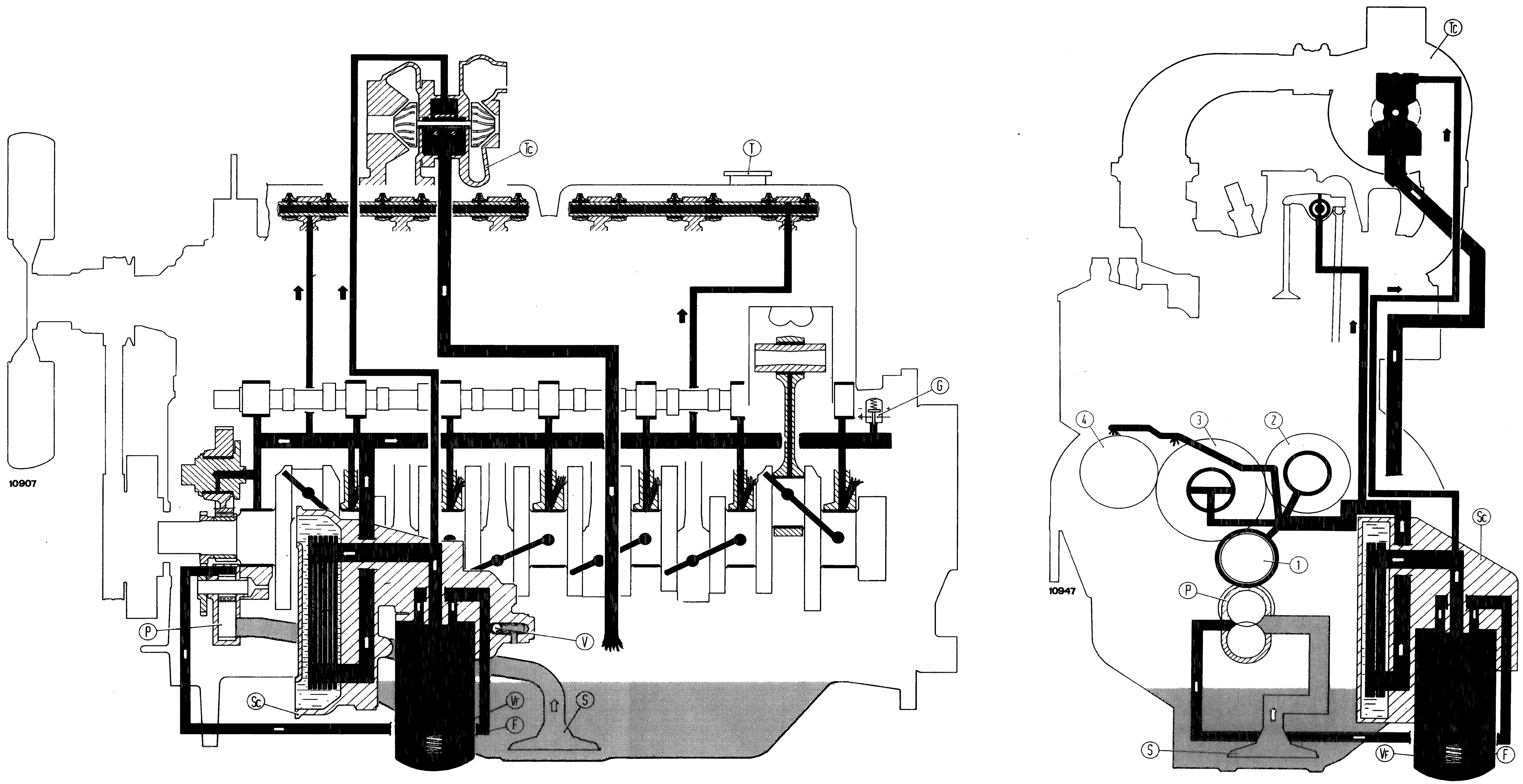

Lubrication system diagram (1880).

F. Filter - G. Low engine oil pressure sending unit - P. Pump - S. Suction filter - Sc. Heat exchanger - T. Oil filler plug - Tc. Turbocharger - V. Oil pressure relief valve - Vf. Filter bypass valve (cuts in when inlet pressure is 1.5 to 1.7 bar - kg/cm² or 21 to 24 psi higher than outlet pressure) - 1. Crankshaft pinion - 2. Camshaft gear - 3. Idler gear - 4. Injection pump drive gear.

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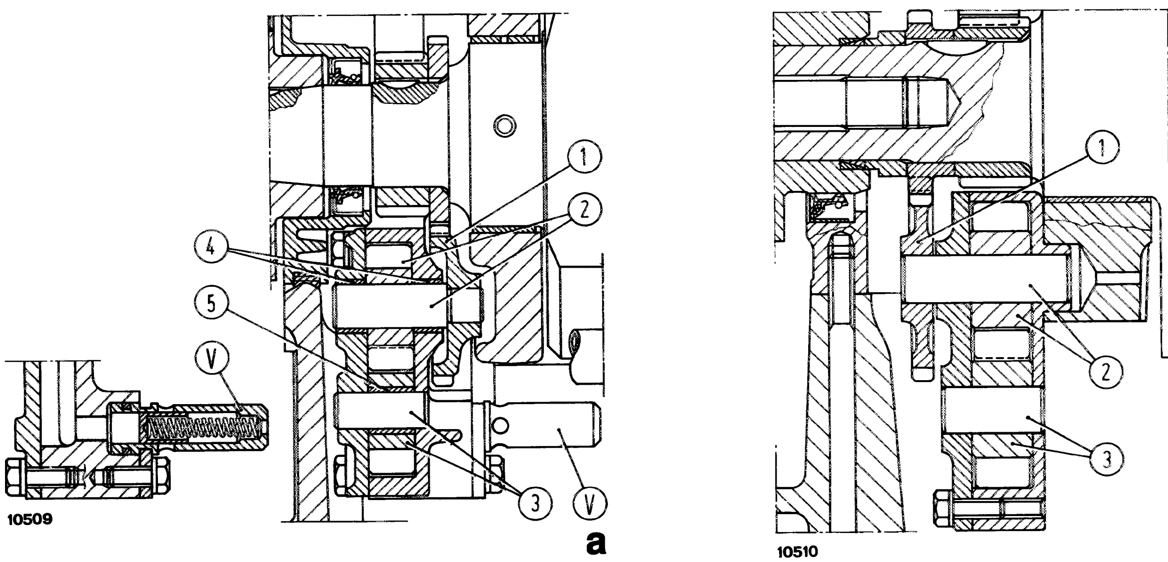


Sections through oil pump.

a. Pump (1180 and 1380) - b. Pump (1580 and 1880) - V. Pump-mounted relief valve (on 1580 and 1880 relief valve is integral with filter support) - 1. Outer drive gear - 2. Pump drive gear and shaft - 3. Pump driven gear and shaft - 4. Bush - 5. Bush.

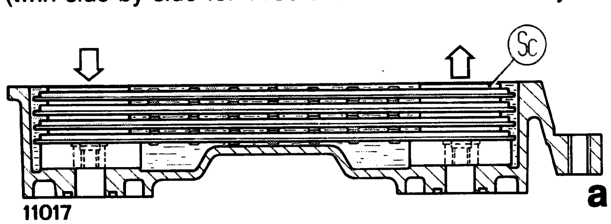
OIL PUMP

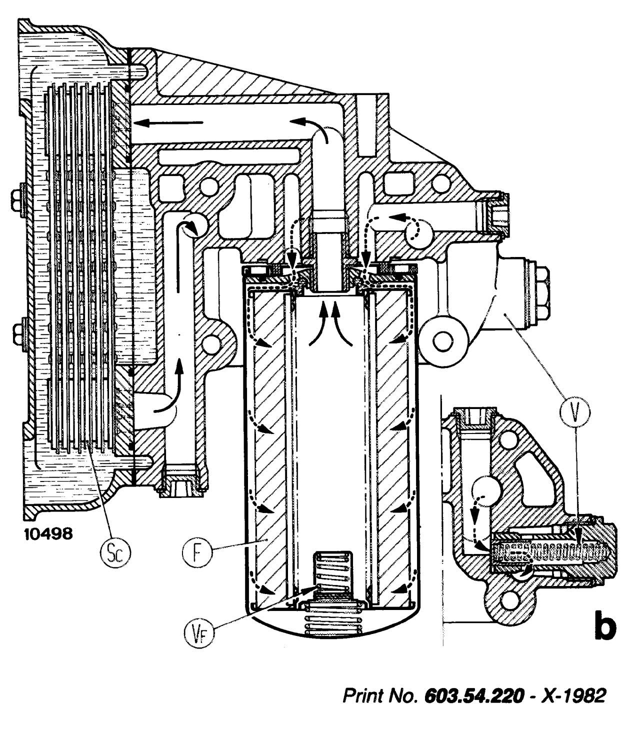
The oil pump is accessible after removing the engine oil sump.
In the course of overhaul, assess the amount of wear affecting the various components by comparison to the dimensions given in the data table.
On 1580 and 1880 tractors, the pump parts are not available and if defective, the pump must be replaced as a whole.

OIL FILTER

The paper cartridge oil filter (F, pages 1, 2, 3 and 4) (twin side-by-side for 1180 and 1380 and one only for 1580 and 1880) is a full-flow unit fitted on the outlet side of the pump.

A bypass valve (Vf) will enable unfiltered oil to enter the engine should the filter become obstructed.





Sections through heat exchanger.

a. 1380 - b. 1580 and 1880 - F. Oil filter - Sc. Heat exchanger - V. Relief valve - Vf. Filter bypass valve.

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Every 400 hours, replace the cartridge, noting the following points:
— smear the external seal with engine oil;
— spin on the new cartridge until contact with the mounting flange is established;
— **hand tighten** the cartridge through a further 3/4 turn.

HEAT EXCHANGER

Heat exchangers installed on 1380 (Fig. a, page 5) and 1580 and 1880 (Fig. b) consist of a four-deep core (1380) or six-deep core (1580 and 1880).
Engine oil is directed into the matrix and the engine cooling water over it.

LOW OIL PRESSURE INDICATING SYSTEM

The oil pressure indicating system includes a sending unit (pages 1, 2, 3 and 4) and a dashboard-mounted indicator light which comes on if:
— oil pressure is low. The light may come on when the engine runs hot at low rpm; however, this is not an indication of anomaly;
— sending unit is inefficient.

If the indicator light fails to come on when the starter switch is operated, the possible causes are:
— a blown fuse;
— burnt indicator bulb filament;
— open circuit across sending unit and indicator light.

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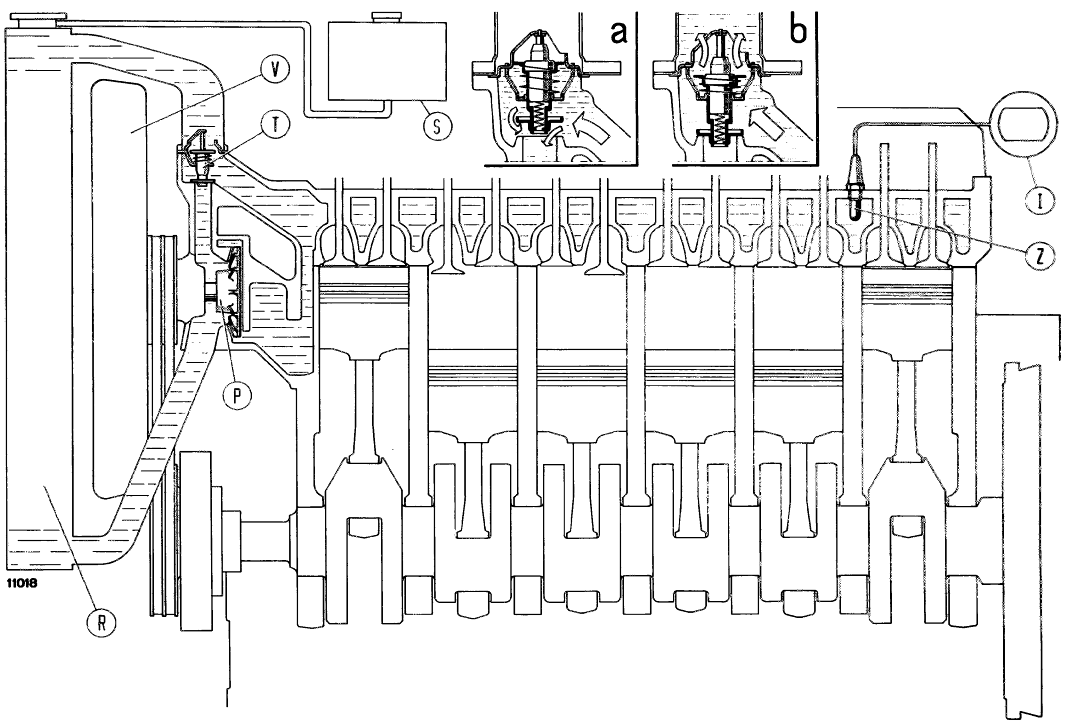

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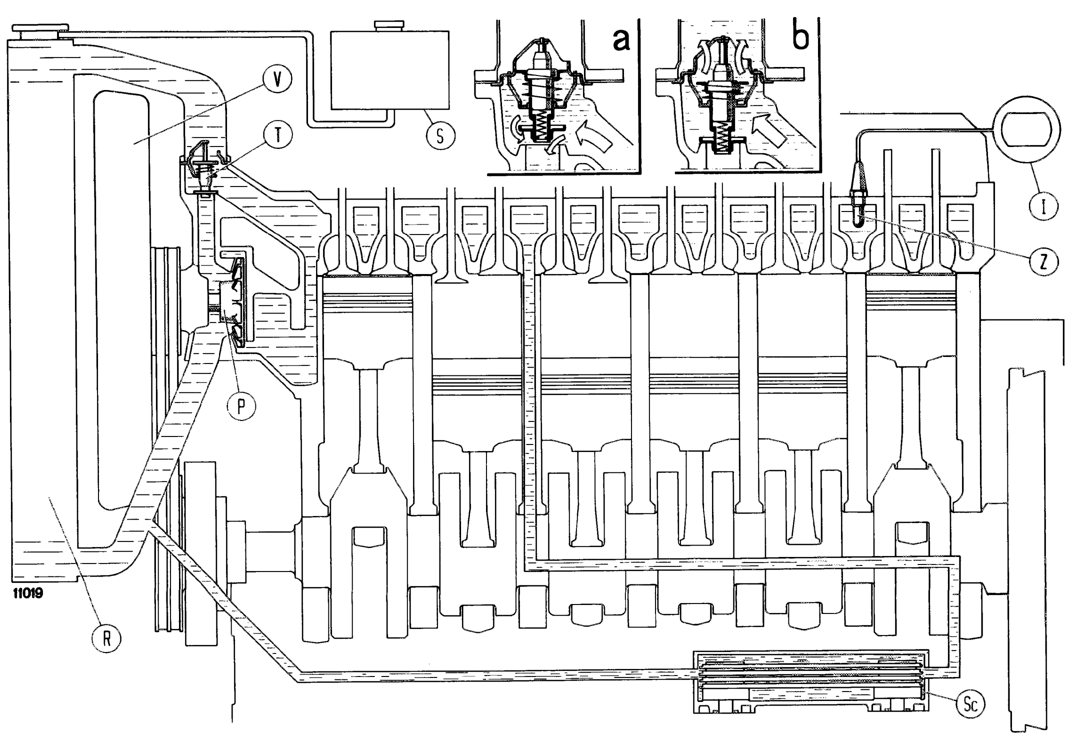

d

Cooling system diagram (1180, 1380).

a. Thermostat closed - b. Thermostat open - c. 1180 - d. 1380 - I. Water temperature gauge - P. Pump - R. Radiator - S. Expansion tank - Sc. Heat exchanger - T. Thermostat - V. Fan - Z. Sending unit.

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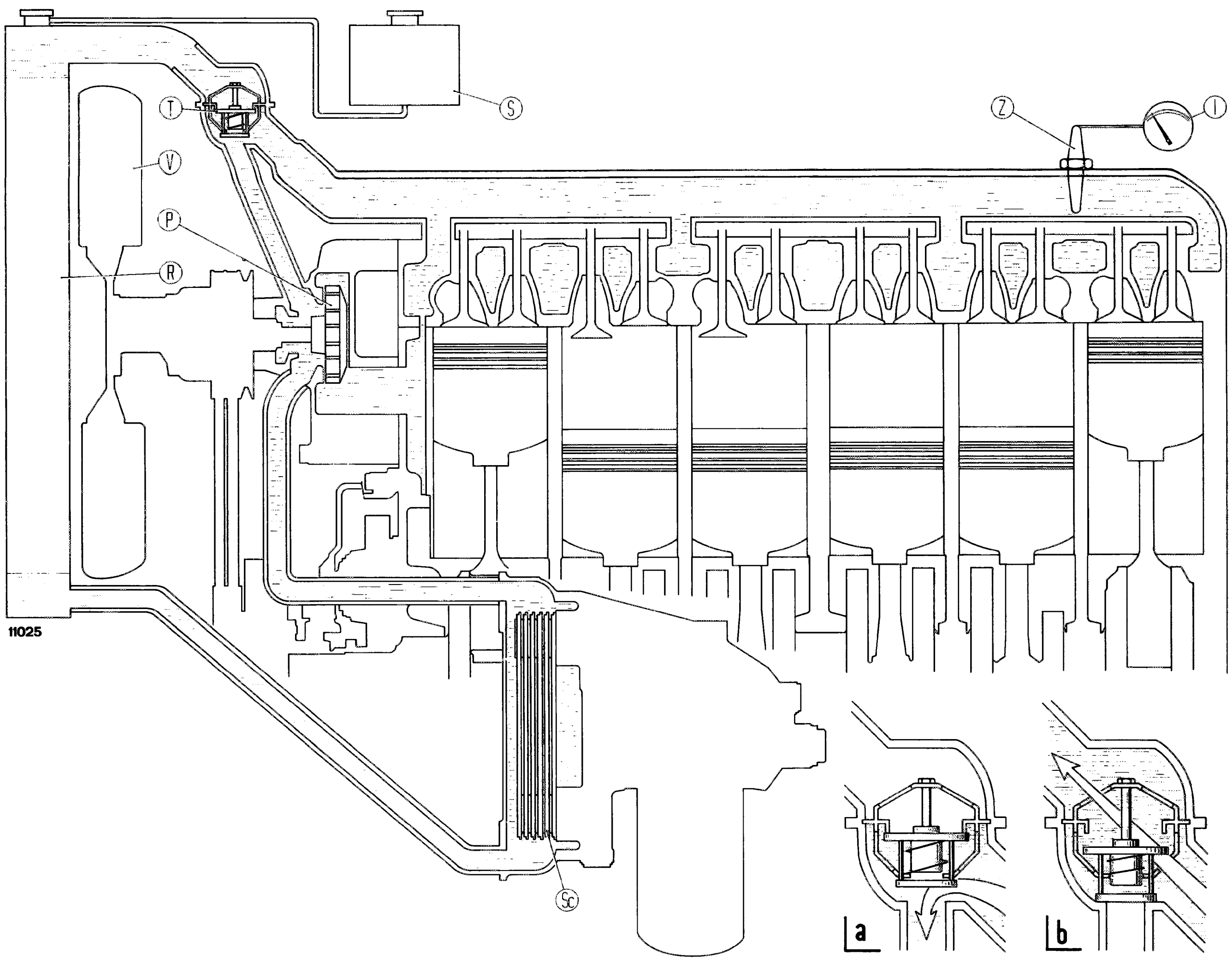

Cooling system diagram (1580, 1880).

a. Thermostat closed - b. Thermostat open - I. Water temperature gauge - P. Pump - R. Radiator - S. Expansion tank - Sc. Heat exchanger - T. Thermostat - V. Fan - Z. Sending unit.

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DESCRIPTION

The cooling system of 1180, 1380, 1580 and 1880 tractors is filled with a mixture of water and **FIAT PARAFLU 11** anti-freeze (50-50 volume) incorporating oxidation, corrosion, foam and scale control properties.

Mixture strengths of 20%, 30%, 40% and 50% give protection down to −8°C, −15°C, −25°C and −35°C, respectively.

An expansion tank (S, pages 1 and 2) connected to the radiator header tank is used to contain the liquid expelled by the system upon heating; the liquid is subsequently returned to the system as the temperature decreases.

Periodically check the coolant level in the transparent expansion tank (S); if the level remains constant it means that the system is free from leakage.

When topping up through the expansion tank, also ensure that the radiator is full by removing the radiator cap with a cold engine.

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.

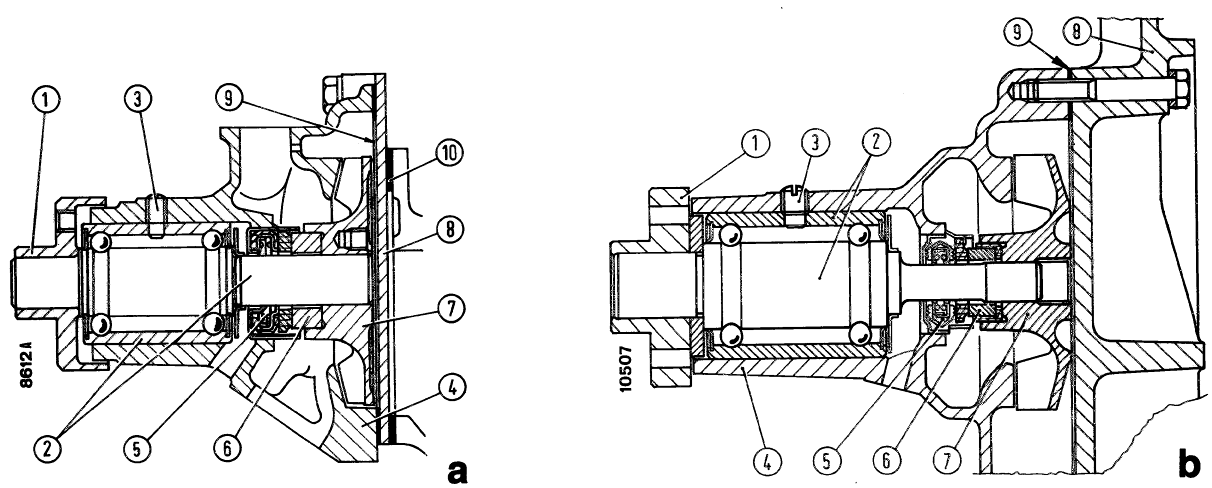
WATER PUMP

In the course of water pump overhaul, proceed as follows:

— remove cover (8) and screw (3) of retaining shaft (2);

— lightly tap the end of the shaft to break the film of oxide between shaft and impeller and remove the latter using puller **291182/1** (fig. a, page 4), 1180 and 1380, or puller **292155 (A.40026)** (fig. b), 1580 and 1880.

— take out the shaft with attached bearing and fan hub using a suitable driver.



Sections through water pump.

a. 1180 and 1380 - b. 1580 and 1880 - 1. Drive hub - 2. Drive shaft assembly - 3. Retaining screw - 4. Pump body - 5. Water seal - 6. Bush - 7. Impeller - 8. Cover - 9. Gasket - 10. Gasket.

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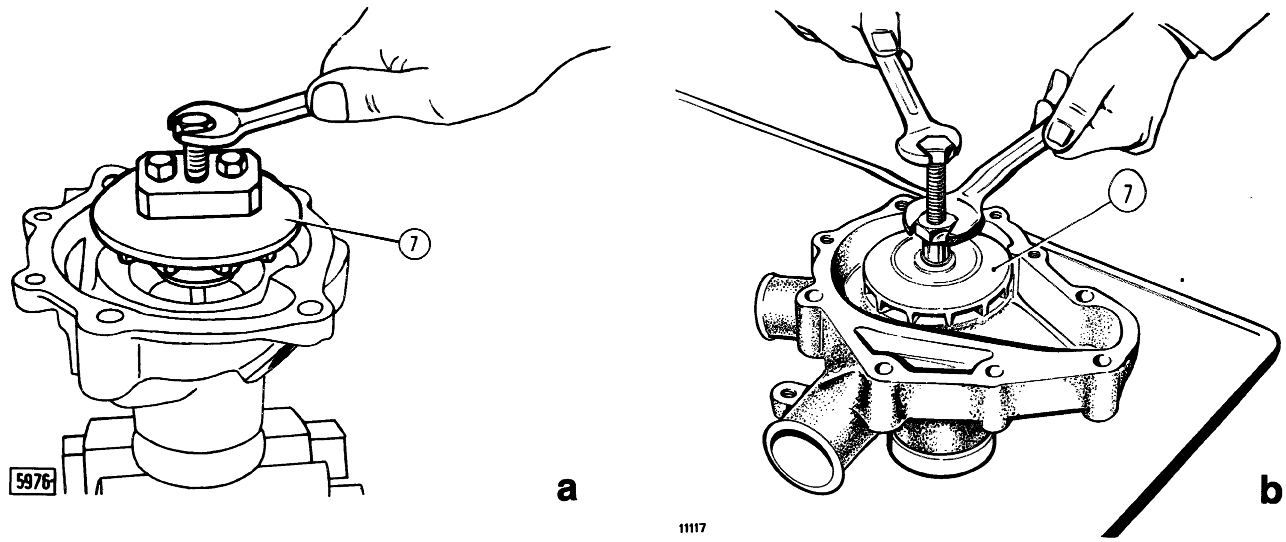


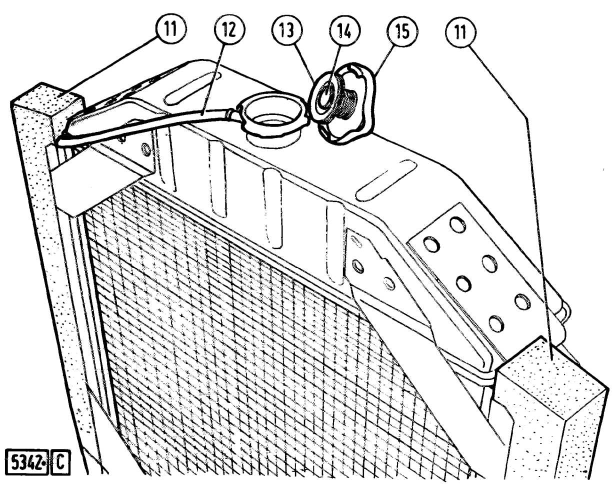
Removing water pump impeller using puller 291182/1 (fig. a, 1180 and 1380) or puller 292155 (A.40026) (fig. b, 1580 and 1880).
7. Impeller.

The water seal (5, page 3) should only be removed for replacement purposes when the carbon face in contact with the impeller bush is worn or damaged to the point of preventing efficient sealing.

On assembly, note the following points:

— bearing (2, page 3) is sealed and does not necessitate lubrication;

— impeller (7), 1180 and 1380, must be fitted flush with the end of the shaft.



Radiator assembly.
11. Sealing surround - 12. Vent pipe - 13. Pressure release valve (set to .7 bar, .7 kg/cm^2 - 10 psi) - 14. Vacuum release valve - 15. Filler cap.

RADIATOR

The radiator cap houses a pressure release valve (13) set to .7 bar, .7 kg/cm^2, 10 psi, and a vacuum release valve (14). These valves should be checked periodically.

To recondition a furred radiator proceed as follows:

— prepare a descaling solution using warm water and **FIAT descaler** in the proportion indicated on the container or 30 grams of bicarbonate of soda to each litre of water. If bicarbonate of soda is used, filter the solution prior to pouring;

— pour the solution in the radiator, drain and flush thoroughly.

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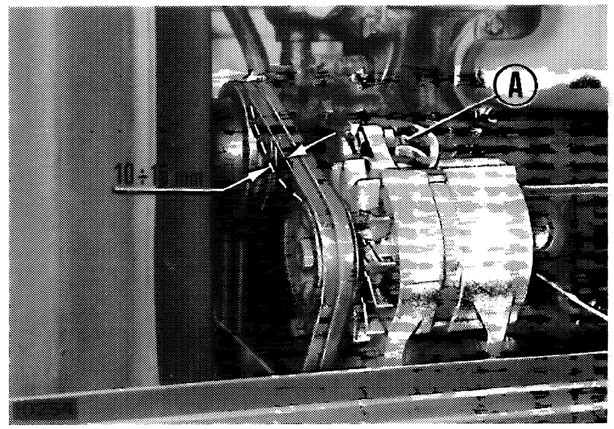
To leakage test the radiator, dip in a water bath at 30° ± 10°C and admit compressed air at 0.98 bar, 1 kg/cm^2, 14 psi for about 2 minutes. Repeat the test at least 3 times.

Whenever possible, the cleaning operation should be extended to the entire system, filling as indicated above and running the tractor for a minimum of one hour. Subsequently, sotp the engine and drain through the cocks provided.



Adjusting fan/water pump/alternator belt tension.

A. Alternator nut on tensioner.

BELT TENSION ADJUSTMENT

The fan/water pump/alternator belt tension is correct when a yield of 10 to 12 mm (1/2 in) is obtained by applying a 118 N, 12 kg, 26½ lb. load on the belt leg between alternator and water pump.
To adjust, proceed as follows:

— slacken alternator nut (A);

— swing the alternator about the tensioner bracket until the correct belt tension is obtained, and re-tighten nut (A).

WATER TEMPERATURE GAUGE

The water temperature gauge incorporates a coloured scale divided into three sectors as follows:

— white sector .... 30 - 65°C

— green sector .... 65 - 105°C

— red sector .... 105 - 115°C

In normal running conditions, the needle should lie over the green sector.
If gauge inefficiency is suspected, test by dipping the sensor in water and compare with a reference gauge. Repeat the test several times to obtain reliable readings.

THERMOSTAT

The thermostat (T, pages 1 and 2) is housed in the cylinder head water outlet connection. As no adjustment is possible, the thermostat should be replaced if the requirements of the data table are not met.

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CLUTCH - FERODO 12″/12″ (1180)

Type .... Control	twin, single drive plate master clutch pedal and PTO clutch hand lever
Release mechanism: — master clutch .... — PTO clutch	 diaphragm spring dished spring
Plate material: — master clutch .... — PTO clutch .... Plate thickness: — master clutch .... — PTO clutch .... — wear limit	 cerametallic compound organic compound 9.7 to 10.2 mm (.382 to .401 in) 8.9 to 9.3 mm (.350 to .366 in) see page 4, section 201
Master clutch control sleeve working clearance .... PTO clutch control sleeve working clearance	.060 to .180 mm (.002 to .007 in) .060 to .136 mm (.002 to .005 in)
Release lever alignment	see page 4, section 201
Clutch linkage adjustment	see page 10, section 201

CLUTCH - LUK 12″/12″ (1180)

Type	twin, single drive plate
Control .... Release mechanism	master clutch pedal and PTO clutch hand lever dished spring
Plate material: — master clutch .... — PTO clutch .... Plate thickness: — master clutch .... — PTO clutch .... — Wear limit	 cerametallic compound organic compound 8.8 to 9.6 mm (.346 to .378 in) 9.35 to 10.05 mm (.368 to .395 in) see page 7, section 201
Master clutch control sleeve working clearance .... PTO clutch control sleeve working clearance	.060 to .180 mm (.002 to .007 in) .060 to .136 mm (.002 to .005 in)
Release lever alignment	see page 9, section 201
Clutch linkage adjustment	see page 10, section 201

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CLUTCH - FERODO 14″ (1180 H, 1380, 1580 AND 1880)

Type	dry single plate
Control	pedal
Release mechanism	diaphragm spring
Plate material	cerametallic compound
Total plate thickness	9.2 to 9.8 mm (.362 to .386 in)
Spline backlash	.030 to .106 mm (.001 to .004 in)
Clutch control sleeve working clearance	.060 to .180 mm (.002 to .007 in)
Pedal free travel (equivalent to 1.5 mm or .06 in clearance between control sleeve and diaphragm spring)	25 mm (1 in)
Clutch pedal adjustment	see page 10, section 201

CLUTCH - LUK 14″ (1180 H, 1380, 1580 AND 1880)

Type	dry single plate
Control	pedal
Release mechanism	diaphragm spring
Plate material	cerametallic compound
Total plate thickness	9.6 to 10.4 mm (.378 to .409 in)
Plate hub spline backlash	.030 to .106 mm (.001 to .004 in)
Clutch control sleeve working clearance	.060 to .180 mm (.002 to .007 in)
Clutch pedal free travel (equivalent to 1.5 mm or .06 in clearance between control sleeve and diaphragm spring)	25 mm (1 in)
Clutch pedal adjustment	see page 10, section 201

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TRANSMISSION AND SPLITTER

Transmission	4-speed, constant mesh, all synchromesh
Gears	helical
Splitter	cascade, 3 forward plus 1 reverse ranges for a total of 12 forward and 4 reverse speeds
Gears	spur
Splitter ratio:	
— low	16:42 = 1:2.625
— normal	27:31 = 1:1.148
— high	1:1
Transmission and splitter controls	separate manual levers below steering wheel
Transmission driven gear bore diameter	65.060 to 65.106 mm (2.5610 to 2.5630 in)
Bush O.D.	64.910 to 64.940 mm (2.5555 to 2.5566 in)
Bush clearance in gear	.120 to .196 mm (.0047 to .0077 in)
Transmission driven shaft diameter	54.160 to 54.190 mm (2.1323 to 2.1335 in)
Bush I.D.	54.200 to 54.246 mm (2.1338 to 2.1357 in)
Shaft clearance in bush	.010 to .086 mm (.0004 to .0034 in)
Splitter driven gear bore diameter	65.060 to 65.106 mm (2.5610 to 2.5630 in)
Bush O.D.	64.910 to 64.940 mm (2.5555 to 2.5566 in)
Bush clearance in gear	.120 to .196 mm (.0047 to .0077 in)

(follows)

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TRANSMISSION AND SPLITTER *(continued)*

Splitter driven shaft diameter	54.160 to 54.190 mm (2.1323 to 2.1335 in)
Bush I.D.	54.200 to 54.246 mm (2.1338 to 2.1357 in)
Shaft clearance in bush	.010 to .086 mm (.0004 to .0034 in)
P.T.O. driven shaft journal diameter	31.950 to 31.975 mm (1.2579 to 1.2588 in)
Bush fitted I.D.	31.990 to 32.085 (°) mm (1.2594 to 1.2632 in) (°)
Shaft clearance in bush	.015 to .135 mm (.0006 to .0053 in)
Transmission driven shaft bearing adjustment	see pages 14, 15 and 16, section 202
Transmission driven shaft bearing shim thickness range:	
— early	1.50 to 2.40 mm in .05 mm steps (.059 to .094 in .002 in steps)
— later	8.85 to 10.30 mm in .05 mm steps (.348 to .405 in, in .002 in steps)
Transmission drive shaft bearing adjustment	see pages 11, 12 and 13, section 202
Transmission drive shaft bearing shim thickness:	
— early	1 mm (.040 in), 1.25 to 2.00 mm in .05 mm steps (.049 to .079 in, in .002 in steps)
— later	6.10 to 7.80 mm in .05 mm steps (.240 to .307 in, in .002 in steps)
Transmission drive shaft bearing thrust washers (early, 3 off, late, 2 off)	2.950 to 3.000 mm (.116 to .118 in)
Drive shaft 4th gear thrust washer	4.950 to 5.000 mm (.195 to .197 in)
Driven shaft 4th gear thrust washer (early)	5.488 to 5.500 mm (.2160 to .2165 in)

(°) No reaming required.

(follows)

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TRANSMISSION AND SPLITTER

(continued)

Input shaft bore diameter	39.900 to 39.950 mm (1.5709 to 1.5728 in)
Bush O.D.	40.000 to 40.030 mm (1.5748 to 1.5760 in)
Bush interference fit in shaft	.050 to .130 mm (.002 to .005 in)
Transmission/splitter remote control spring length:	
— free	124 mm (4.88 in)
— under 73 to 79 N, 7.4 to 8.1 kg (16 to 18 lb.)	50 mm (1.97 in)
Transmission/splitter selector shaft detent ball spring length:	
— free	35.5 mm (1.40 in)
— under 80 to 98 N, 8.2 to 10 kg (18 to 22 lb.)	28.5 mm (1.12 in)

CRAWLER GEAR

Type	planetary, 3-planet, spur
Engagement	sliding sleeve
Drive ratio	22:(22 + 71) = 1:4.227
Control	hand lever on left of operator
Driven gear and support shim thickness	1.470 to 1.530 mm (.058 to .060 in)

REVERSER

Type	mechanical, spur gear, 3 input and 3 output gears
Engagement	sliding sleeve
Drive ratio	$\frac{24 \times 23 \times 24}{23 \times 24 \times 30} = \frac{1}{1.25}$
Control	hand lever on left of operator
Reverser driven sun gear abutment ring thickness	1.97 to 2.03 mm (.077 to .080 in)

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REAR BEVEL DRIVE AND DIFFERENTIAL

Bevel drive ratio:	
— 1180 and 1380	9/47 = 1:5.22
— 1580 and 1880	9/41 = 1:4.55
Bevel drive backlash:	
— 1180 and 1380	.20 to .28 mm (.0078 to .0110 in)
— 1580 and 1880	.25 to .33 mm (.0010 to .0130 in)
High speed bevel drive ratio (optional, 1180 and 1380)	9.41 = 1:4.55
High speed bevel drive backlash (optional, 1180 and 1380)	.25 to .33 mm (.0010 to .0130 in)
Differential	4-pinion
Differential lock control:	
— mechanical	pedal
— hydraulic	pedal
Differential pinion bore diameter	28.090 to 28.120 mm (1.1059 to 1.1071 in)
Differential pinion journal diameter	27.939 to 27.960 mm (1.1000 to 1.1008 in)
Differential pinion running clearance on journal	.130 to .181 mm (.0051 to .0071 in)
Side gear boss housing diameter in differential box	64.000 to 64.046 mm (2.5197 to 2.5215 in)
Side gear boss diameter	63.860 to 63.890 mm (2.5142 to 2.5153 in)
Side gear boss clearance in box	.110 to .186 mm (.0043 to .0073 in)
Bevel pinion position adjustment	see pages 7, 8, 9, 12 and 13, section 204
Bevel pinion position shim thickness	3 to 4 mm in .1 mm steps (.1181 to .1575 in .0039 in steps)
Bevel pinion bearing adjustment	see pages 9, 13 and 14, section 204
Bevel pinion bearing shim thickness	1.75 - 1.80 - 1.85 - 1.90 - 2 - 2.05 - 2.10 - 2.15 - 2.20 - 2.50 - 2.70 - 2.75 mm (.069 - .071 - .073 - .075 - .077 - .079 - .081 - .083 - .085 - .098 - .106 - .108 in)
Bevel drive backlash adjustment	see pages 14, 15, 16 and 17, section 204
Differential bearing and bevel drive backlash shim thickness	.15 - .2 - .5 mm (.006 - .008 - .020 in)

(follows)

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REAR BEVEL DRIVE AND DIFFERENTIAL *(continued)*

Side gear and differential pinion backlash	.18 to .22 mm (.0071 to .0086 in)
Side gear thrust washer thickness	2.96 to 3.04 mm (.1165 to .1197 in)
Differential pinion thrust washer thickness	1.96 to 2.04 mm (.0772 to .0803 in)
Mechanical differential lock fork shim thickness	.05 mm (.002 in)
Mechanical differential lock adjustment	see pages 17 and 18, section 204
Differential lock fork spring length:	
— free	280 mm (11.0 in)
— under 176 N, 18 kg, 39.7 lb.	182 mm (7.16 in)
Mechanical differential lock pedal travel adjustment	see page 18, section 204

HYDRAULIC DIFFERENTIAL LOCK

Control	hydraulically operated oil bath multi-plate clutch
Application	standard on 1180 H and optional on 1380, 1580 and 1880
No. of clutch plates:	
— driven	4
— drive	4
— back-up	1
Driven plate thickness	3.450 to 3.550 mm (.1358 to .1398 in)
Drive plate thickness	1.950 to 2.050 mm (.0768 to .0807 in)
Back-up plate thickness	2.950 to 3.050 mm (.1161 to .1201 in)
No. of hydraulic differential lock release springs	3
— spring free length	29 mm (1.14 in)
— spring length under 75 to 83 N, 7.7 to 8.5 kg, 17 to 18.7 lb.	22 mm (.87 in)
Hydraulic differential lock piston O.D.	227.854 to 227.900 mm (8.9706 to 8.9724 in)
Piston cylinder bore in differential box	228.000 to 228.072 mm (8.9764 to 8.9792 in)
Piston working clearance in cylinder	.100 to .218 mm (.004 to .009 in)
Hydraulic differential lock I.D.	160.000 to 160.063 mm (6.2992 to 6.3017 in)
Piston housing bore in differential box	159.875 to 159.915 mm (6.2943 to 6.2959 in)
Piston I.D. working clearance in differential box	.085 to .188 mm (.0033 to .0074 in)

(follows)

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HYDRAULIC DIFFERENTIAL LOCK

(continued)

Oil pump	gear, also used for PTO hydraulic clutch operation, fitted with flow divider valve (earlier models) or pressure regulator (later models).
Make	FIAT
Control	PTO shaft-mounted gear
Flow divider valve (early models)	
Location	attached to oil pump
Flow divider valve shuttle diameter	17.983 to 17.994 mm (.7080 to .7084 in)
Housing bore in valve body	18.000 to 18.018 mm (.7087 to .7094 in)
Shuttle working clearance in housing	.006 to .035 mm (.0002 to .0014 in)
Flow divider valve spring length (early, 2 off):	
— free	35 mm (1.38 in)
— under 5.6 to 6.2 N, .57 to .63 kg, 1.2 to 1.4 lb.	23 mm (.90 in)
Pressure regulator (later models)	
Location	attached to oil pump
Pressure regulator valve shuttle diameter	9.986 to 9.995 mm (.3931 to .3935 in)
Shuttle housing bore diameter in valve body	10.000 to 10.015 mm (.3937 to .3943 in)
Shuttle working clearance in housing	.005 to .029 mm (.0002 to .0011 in)
Pressure regulator valve spring length (late models, 1 off):	
— free	36 mm (1.42 in)
— under 85 to 95 N, 8.7 to 9.7 kg, 19.1 to 21.4 lb.	32 mm (1.26 in)
Early control valve	
Location	on right of rear transmission case
Construction	one spool controlled by differential lock pedal for both lock-up and unlock functions, plus one pressure relief valve
Pressure relief valve setting	24.5 bar, 25 kg/cm^2, 335 psi
Relief valve spring length:	
— free	43.5 mm (1.71 in)
— under 124 to 138 N, 12.7 to 14.1 kg, 28 to 31 lb.	30 mm (1.18 in)

(follows)

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HYDRAULIC DIFFERENTIAL LOCK *(continued)*

Spool spring length: — free — under 16 to 18 N, 1.6 to 1.8 kg, 3.5 to 4 lb.	 15 mm (.59 in) 12 mm (.47 in)
Spool diameter	15.983 to 15.994 mm (.6292 to .6297 in)
Spool housing bore diameter	16.000 to 16.018 mm (.6299 to .6306 in)
Spool working clearance in housing	.006 to .035 mm (.0002 to .0014 in)
Late control valve	
Location	on left of rear transmission housing
Construction	one spool controlled by differential lock pedal plus one unlock cylinder controlled by the brake pedals
Unlock cylinder spring length: — free — under 104 to 116 N, 10.6 to 11.8 kg, 23.4 to 26 lb.	 64 mm (2.52 in) 33 mm (1.30 in)
Spool diameter	15.973 to 15.984 mm (.6274 to .6293 in)
Spool housing bore diameter	16.000 to 16.018 mm (.6299 to .6306 in)
Spool working clearance in housing	.016 to .045 mm (.0006 to .0018 in)
Hydraulic differential lock detent spring length (early models): — under 5.6 to 6.2 N, .57 to .63 kg, 1.2 to 1.4 lb. — under 28 to 32 N, 2.9 to 3.3 kg, 6.4 to 7.3 lb.	 57 mm (2.24 in) 78 mm (3.07 in)
Pipe support-to-control valve interface bush O.D.	16.957 to 16.984 mm (.6676 to .6687 in)
Bush housing bore diameter in pipe support and control valve	17.000 to 17.027 in (.6693 to .6703 in)
Bush clearance in pipe support and control valve	.016 to .070 mm (.0006 to .0027 in)
Differential lock pedal spool sleeve I.D. (mechanical or hydraulic)	12.150 to 12.260 mm (.4783 to .4827 in)
Differential lock pedal spool diameter (mechanical or hydraulic)	11.957 to 12.000 mm (.4707 to .4724 in)
Spool clearance in sleeve	.150 to .303 mm (.006 to .012 in)
Differential lock pedal travel adjustment	see page 24, section 204

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BRAKES

Type:	
— service	disc, oil bath, drive shaft-mounted
— parking	double disc, oil bath, bevel pinion shaft-mounted
Control:	
— service	hydrostatic, latched pedals
— parking	mechanical, manual level
Service brake disc material	sintered
Parking brake disc material	steel
Parking brake sector material	sintered or organic conglomerate
Disc thickness:	
— service	10 mm (.39 in)
— wear limit	9 mm (.35 in)
— parking	7 mm (.27 in)
Service brake wear plate thickness	7 mm (.27 in)
Parking brake sector thickness:	
— side sectors	3.1 to 3.4 mm (.122 to .134 in)
— intermediate sector	4.2 to 4.5 mm (.165 to .177 in)
Brake pedal support	
Right brake shaft journal diameter (4, page 3, section 205)	16.973 to 17.000 mm (.6682 to .6693 in)
Bush I.D. (4)	17.100 to 17.150 mm (°) (.6732 to .6752 in) (°)
Shaft clearance in bush	.100 to .177 mm (.004 to .007 in)
Right brake shaft journal diameter (5 and 7)	20.967 to 21.000 mm (.8255 to .8268 in)
Bush I.D. (5 and 7)	21.100 to 21.150 mm (°) (.8307 to .8327 in) (°)
Shaft clearance in bushes	.100 to .183 mm (.004 to .007 in)
Left brake shaft journal diameter (6)	39.961 to 40.000 mm (1.5733 to 1.5748 in)
Bush I.D. (6)	40.100 to 40.150 mm (°) (1.5787 to 1.5807 in) (°)
Shaft clearance in bush	.100 to .189 mm (.004 to .007 in)
Hydrostatic control	
Hydraulic pump	two master cylinders operated by separate brake pedals
Operating pressure	17.6 bar, 18 kg/cm^2, 256 psi

(°) No reaming.

(follows)

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BRAKES

(continued)

Master cylinder piston diameter	24.967 to 25.000 mm (.9829 to .9842 in)
Master cylinder bore diameter	25.020 to 25.041 mm (.9850 to .9859 in)
Working clearance in cylinder	.020 to .074 mm (.0008 to .0029 in)
Piston return spring length:	
— free	190 mm (7.48 in)
— under 97 to 107 N, 9.9 to 10.9 kg, 21.8 to 24 lb.	128 mm (5.04 in)
— under 143 to 159 N, 14.6 to 16.2 kg, 32.2 to 35.7 lb.	98 mm (3.86 in)
Pedal adjustment	see page 4, section 205
Brake system bleeding	see page 5, section 205

FINAL DRIVES

Type	planetary, 3-planet, spur
Reduction ratio	13:(13+68) = 1:6.231
Planet thrust washer thickness	1 mm (.04 in)
Planet inter-bearing spacer thickness:	
— 1180, 1380 and 1580	4.900 to 4.950 mm (.193 to .195 in)
— 1880	16.900 to 16.950 mm (.665 to .667 in)
Wheel shaft taper roller bearing adjustment	see pages 2 and 3, section 206

POWER TAKE OFF

Type	fully independent from tractor motion, 2-speed (540 and 1000 rpm, 1180, 1180 H, 1380 and 1580) or single speed (1000 rpm, 1880)
Operation:	
— 1180	dry single plate mechanical clutch
— 1180 H, 1380, 1580 and 1880	oil bath multiplate hydraulic clutch

(follows)

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POWER TAKE OFF

(continued)

Control: — 1180 .... — 1180 H, 1380, 1580 and 1880	 manual lever acting on PTO clutch release lever control sleeve manual lever acting on 2-position control valve; engagement and disengagement including activation of PTO shaft stop device
Direction of rotation (as viewed from rear of tractor)	clockwise
2-speed selector (1180, 1180 H, 1380 and 1580)	splined extension replacement
Engine speed with 540 rmp PTO: — 1180 and 1180 H .... — 1380 .... — 1580 .... PTO speed at full load engine rpm: — 1180 and 1180 H .... — 1380 .... — 1580	 2260 rpm 2095 rpm 1950 rpm 595 rpm 620 rpm 580 rpm
Engine speed with 1000 rpm PTO: — 1180 and 1180 H .... — 1380 .... — 1580 .... — 1880	 2460 rpm 2320 rpm 2075 rpm 2075 rpm
PTO speed at full load engine rpm: — 1180 and 1180 H .... — 1380 .... — 1580 .... — 1880	 1015 rpm 1035 rpm 1010 rpm 1010 rpm
Splined output shaft diameter — 540 rpm .... — 1000 rpm	 1⅜″ (6-spline) 1¾″ (6-spline) 1⅜″ (21-spline)
	1180, 1180 H, 1380, and 1580 models
Driven gear bush O.D. (18, page 2, section 207)	56.910 to 56.940 mm (2.2405 to 2.2417 in)
Driven gear I.D. (14 and 15)	57.060 to 57.106 mm (2.2464 to 2.2483 in)
Gear running clearance in bush	.120 to .196 mm (.005 to .008 in)

(follows)

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POWER TAKE OFF

(continued)

Driven shaft diameter	47.566 to 47.591 mm (1.8727 to 1.8737 in)
Bush I.D. (18)	47.600 to 47.639 mm (1.8740 to 1.8755 in)
Shaft running clearance in bush	.009 mm to .073 (.0003 to .0029)
PTO clutch (1180 H, 1380, 1580 and 1880)	
Type	oil bath multiple plate hydraulic clutch
Make	FERODO
No. of clutch plates:	
— drive	8
— driven	7
No. of clutch release springs	1
Faced drive plate thickness	2.295 to 2.425 mm (.090 to .095 in)
Driven plate thickness	1.450 to 1.550 mm (.057 to .061 in)
Release spring length:	
— free	68 mm (2.68 in)
— under 770 N, 79 kg, 174 lb.	24 mm (.94 in)
Shaft stop brake	
Type	band, acting on separate drum attached to outside of clutch bell housing
Oil pump	gear, also used for hydraulic differential lock (where fitted)
Make	FIAT
Operation	gear on PTO shaft
Direction of rotation (as seen from drive end)	anti-clockwise
Pump drive ratio:	
— 1180 H and 1380	1:1.222(gear ratio 44/36)
— 1580 and 1880	1:1.353 (gear ratio 45/34)
Maximum speed (with engine at full load rpm)	
— 1180 H	3116 rpm
— 1380	2933 rpm
— 1580 and 1880	2976 rpm
Rated output:	
— 1180 H	20 dm^3/min (l/min) (4.4 gall/min)
— 1380	18.7 dm^3/min (l/min) (4.1 gall/min)
— 1580 and 1880	18.9 dm^3/min (l/min) (4.2 gall/min)

(follows)

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POWER TAKE OFF

(continued)

Driven and drive gear shaft diameter	17.400 to 17.424 mm (.6850 to .6860 in)
Bearing bore I.D.	17.450 to 17.470 mm (.6870 to .6878 in)
Gear shaft running clearance in bearing	.026 to .070 mm (.0010 to .0027 in)
— maximum wear clearance	.100 mm (.004 in)
Gear radial clearance in pump body	.020 to .062 mm (.0008 to .0024 in)
Maximum pump body wear on suction side of gears	.100 mm (.004 in)
Gear width	10.500 to 10.515 mm (.4134 to .4140 in)
Bearing width	9.700 to 9.715 mm (.3819 to .3825 in)
Bearing housing width in pump body	30.035 to 30.060 mm (1.1825 to 1.1835 in)
Gear and bearing end float (applicable to new and reconditioned pumps)	.090 to .160 mm (.0035 to .0063 in)
Control valve block	
Control valve construction	1 hand lever-controlled spool; 1 relief valve; 1 lube oil pressure lubricating valve
Relief valve setting	12 bar (12.2 kg/cm^2, 173 psi)
Clutch plate lube oil rated pressure (controlled by regulating valve)	7.5 bar (7.6 kg/cm^2, 108 psi)
Spool clearance in clutch support	.016 to .052 mm (.0006 to .0020 in)
Relief valve spring length:	
— free	49 mm (1.93 in)
— under 163 N, 16.6 kg, 36.6 lb.	25.5 mm (1.00 in)
Lube pressure regulating valve spring length:	
— free	20 mm (.79 in)
— under 24 N, 2.4 kg, 5.3 lb.	39.9 mm (1.57 in)
Spool valve length:	
— free	27 mm (1.06 in)
— under 152 N, 15.5 kg, 34 lb.	21 mm (.83 in)
PTO lever bore diameter	12.016 to 12.059 mm (.4731 to .4748 in)
Pin diameter	11.982 to 12.000 mm (.4717 to .4724 in)
Pin clearance in lever	.16 to .077 mm (.0063 to .0030 in)
Oil filter	
Type	metal cloth cartridge
Location	pump inlet

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TORQUE DATA

DESCRIPTION	Thread size	Torque		
		Nm	kgm	ft.lb.
Platform removal - Section 200 Capscrew, front and rear cushion mounting	M16 × 1.5	108	11	79
Clutch - Section 201 Capscrew, FERODO 12″/12″ clutch to flywheel (C_1, page 3, 1180)	M10 × 1.25	59	6	43
Capscrew, LUK 12″/12″ clutch to flywheel (C_2, page 6, 1180)	M10 × 1.25	59	6	43
Capscrew, FERODO 14″ clutch to flywheel (C_4, page 10, 1180 H, 1380, 1580 and 1880)	M 8 × 1.25	25	2.6	19
Capscrew, LUK 14″ clutch to flywheel (C_4, page 11, 1180 H, 1380, 1580 and 1880)	M 8 × 1.25	25	2.6	19
Capscrew, actuating fork (C_5, pages 3, 6, 7, 10 and 11)	M16 × 1.5	157	16	116
Bolt and nut, clutch housing to engine (C_6, pages 3, 6, 7, 10 and 11)	M12 × 1.25	98	10	72
Capscrew, clutch housing to rear transmission	M14 × 1.5	181	18.5	134
Nut, clutch pedal	M 8 × 1.25	25	2.6	19
Transmission and splitter - Section 202 Nut, driven gear shaft (C_1, page 5)	M50 × 1.5	490	50	362
Nut, drive gear shaft (C_2)	M55 × 1.5	490	50	362
Nut, bearing cap (C_3)	M10 × 1.25	59	6	43
Capscrew, transmission housing cover (C_4)	M10 × 1.25	44	4.5	32
Capscrew, selector shaft gate	M10 × 1.25	34	3.5	25
Lock ring, splitter output shaft (C_5)	M50 × 1.5	294	30	217
Capscrew, transmission rear wall (C_6)	M12 × 1.25	98	10	72
Crawler gear - Section 203 Capscrew, self locking, crawler gear (C_1, page 1)	M12 × 1.25	103	10.5	76
Reverser - Section 203 Capscrew, reverser front and rear support (C_1, page 2)	M12 × 1.25	98	10	72
Capscrew, transmission front support	M12 × 1.25	103	10.5	76
Rear bevel drive and differential - Section 204 Nut, bevel pinion shaft (C_1, page 11)	M50 × 1.5	294	30	217

(follows)

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TORQUE DATA

DESCRIPTION	Thread size	Torque		
		Nm	kgm	ft.lb.
Nut, self locking, ring gear and mechanical differential lock (C_2)	M12 × 1.25	123	12.5	90
Capscrew, ring gear and hydraulic differential lock (C_3, page 19, 1180 H, 1380, 1580 and 1880)	M14 × 1.5	176	18	130
Capscrew, self locking, ring gear support (C_4, page 10)	M10 × 1.25	61	6.2	45
Capscrew, mechanical differential lock lever support (C_5, page 17)	M12 × 1.25	83	8.5	61
Capscrew, rear transmission housing lower side cover	M12 × 1.25	98	10	72
Brakes - Section 205 Capscrew, parking brake support (C_1, page 8)	M10 × 1.25	59	6	43
Capscrew, hydraulic pump body	M16 × 1.5	176	18	130
Nut, hand lever support	M 8 × 1.25	17	1.7	12
Final drives - Section 206 Nut, final drive housing (C_1, page 1)	M16 × 1.5	221	22.5	163
Capscrew, self locking, wheel shaft (C_2)	M22 × 1.5	88	9	65
Nut, sheet steel wheel disc and rim (C_3)	M16 × 1.5	221	22.5	163
Nut, sheet metal wheel disc to hub (C_4)	M18 × 1.5	314	32	231
Nut, cast wheel disc to hub (C_5)	M18 × 1.5	314	32	231
Nut, clamp (C_6)	M20 × 2.5	245	25	181
Nut and bolt, ballast	M16 × 1.5	221	22.5	163
Capscrew, hub (C_7, page 3)	M16 × 1.5	294	30	217
Power take off - Section 207 Nut, driven gear shaft (C_1, page 2)	M36 × 1.5	294	30	217
Nut, self locking, splined extension (C_2)	M12 × 1.25	162	16.5	119
Capscrew, bearing cap	M12 × 1.25	98	10	72
Capscrew, PTO housing (C_3)	M16 × 1.5	221	22.5	163
Capscrew, PTO control rod support (C_4)	M 8 × 1.25	25	2.6	19
Capscrew, flange to oil pump	M 8 × 1.25	25	2.6	19
Capscrew, oil pump (C_6, page 4)	M10 × 1.25	37	3.8	27

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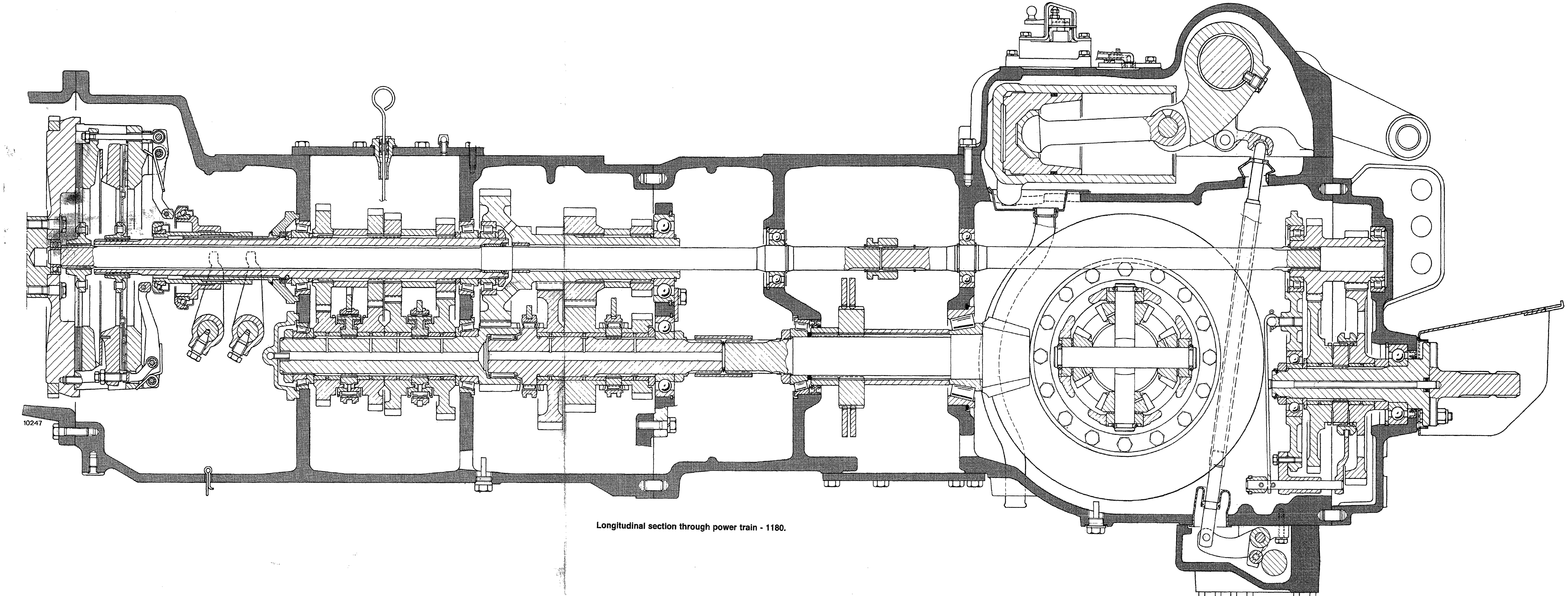

Longitudinal section through power train - 1180.

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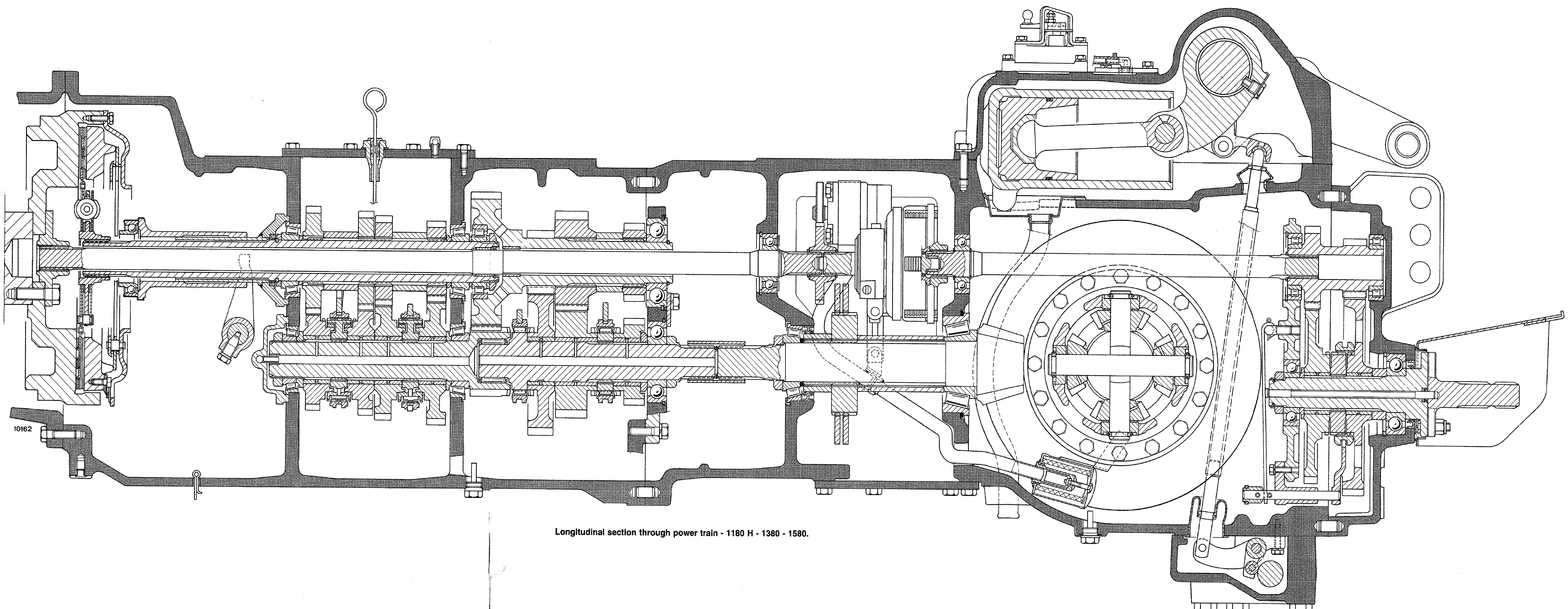

Longitudinal section through power train - 1180 H - 1380 - 1580.

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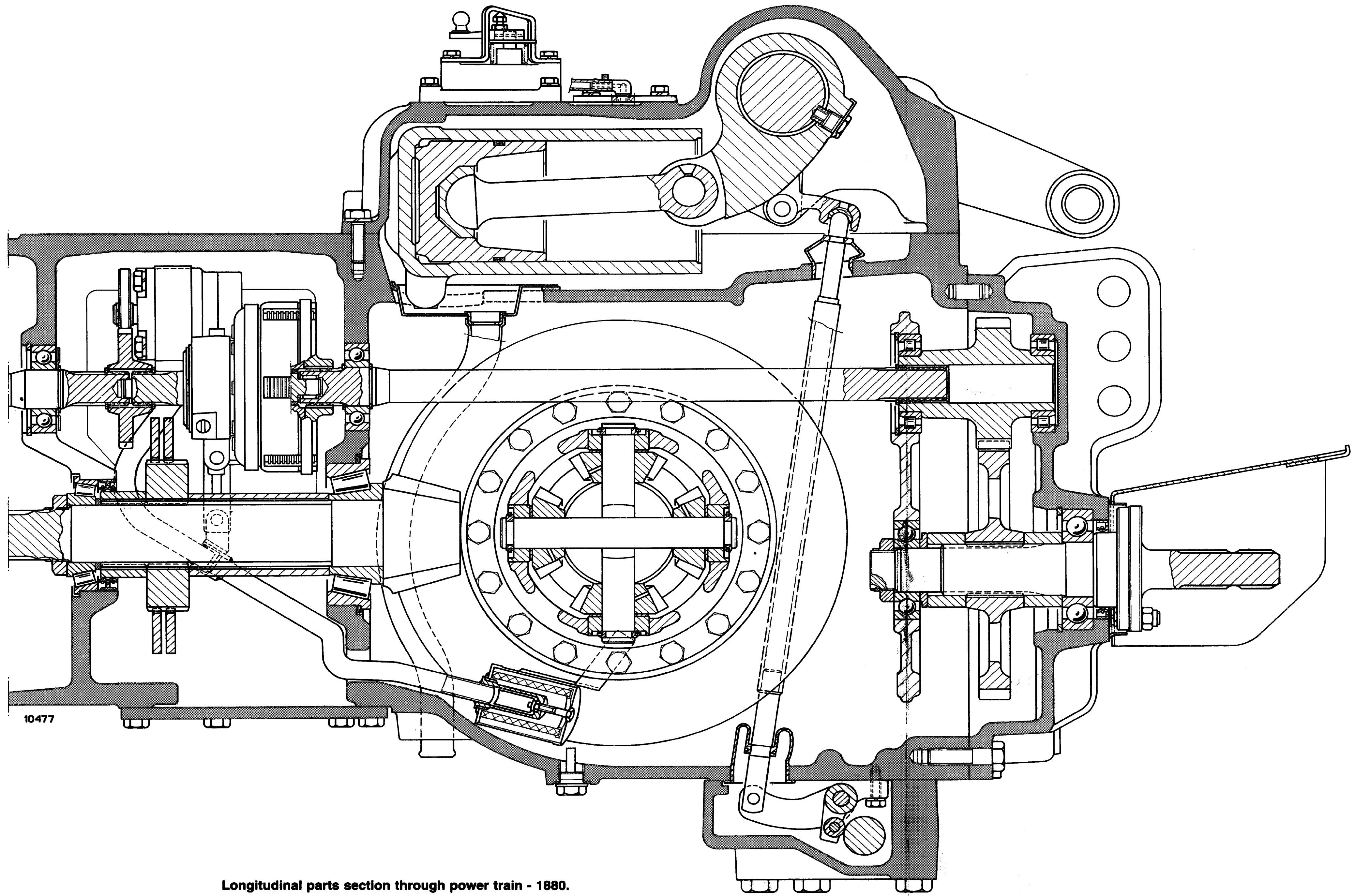

Longitudinal parts section through power train - 1880.

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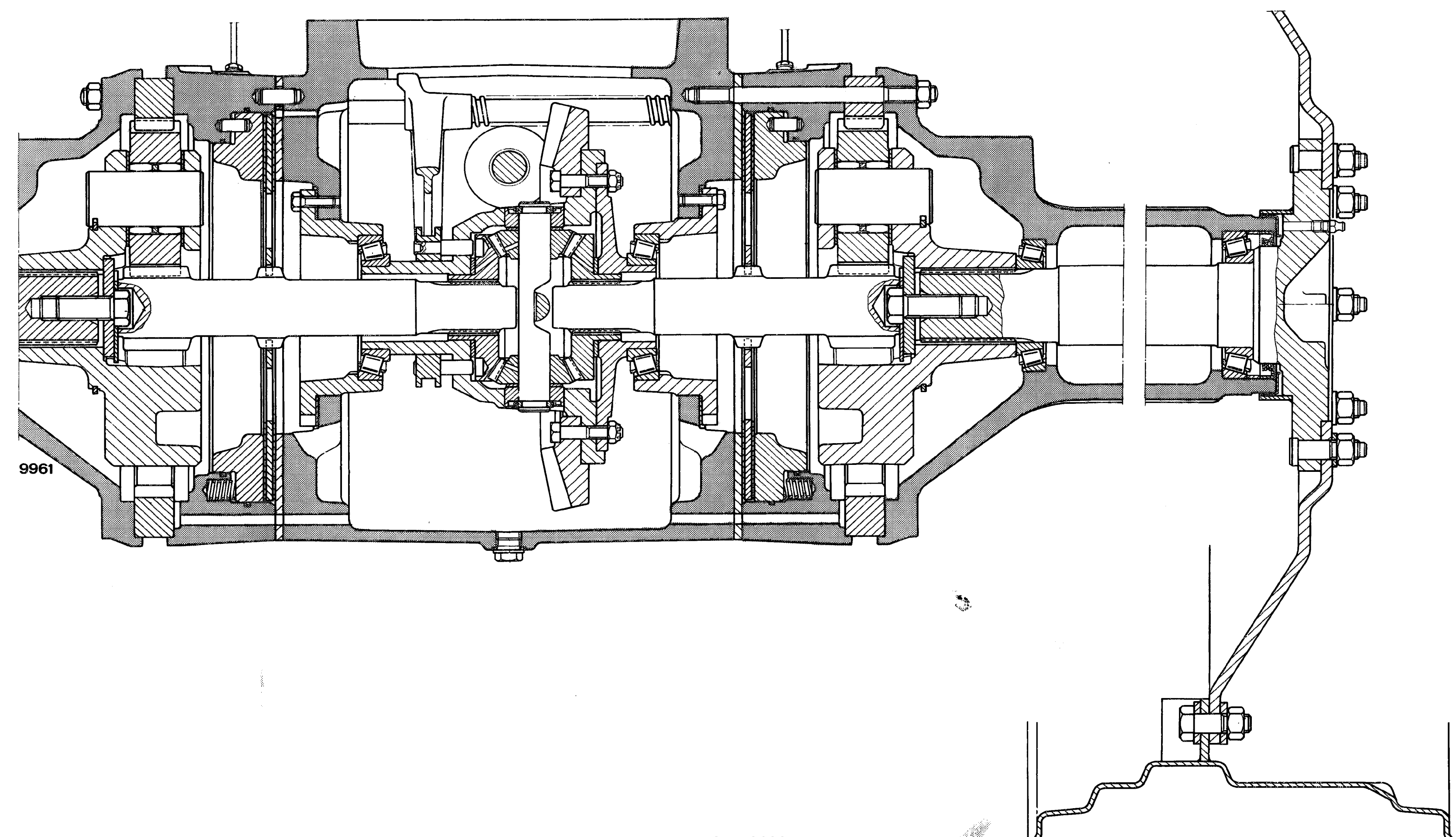

Cross section through power train - 1180.

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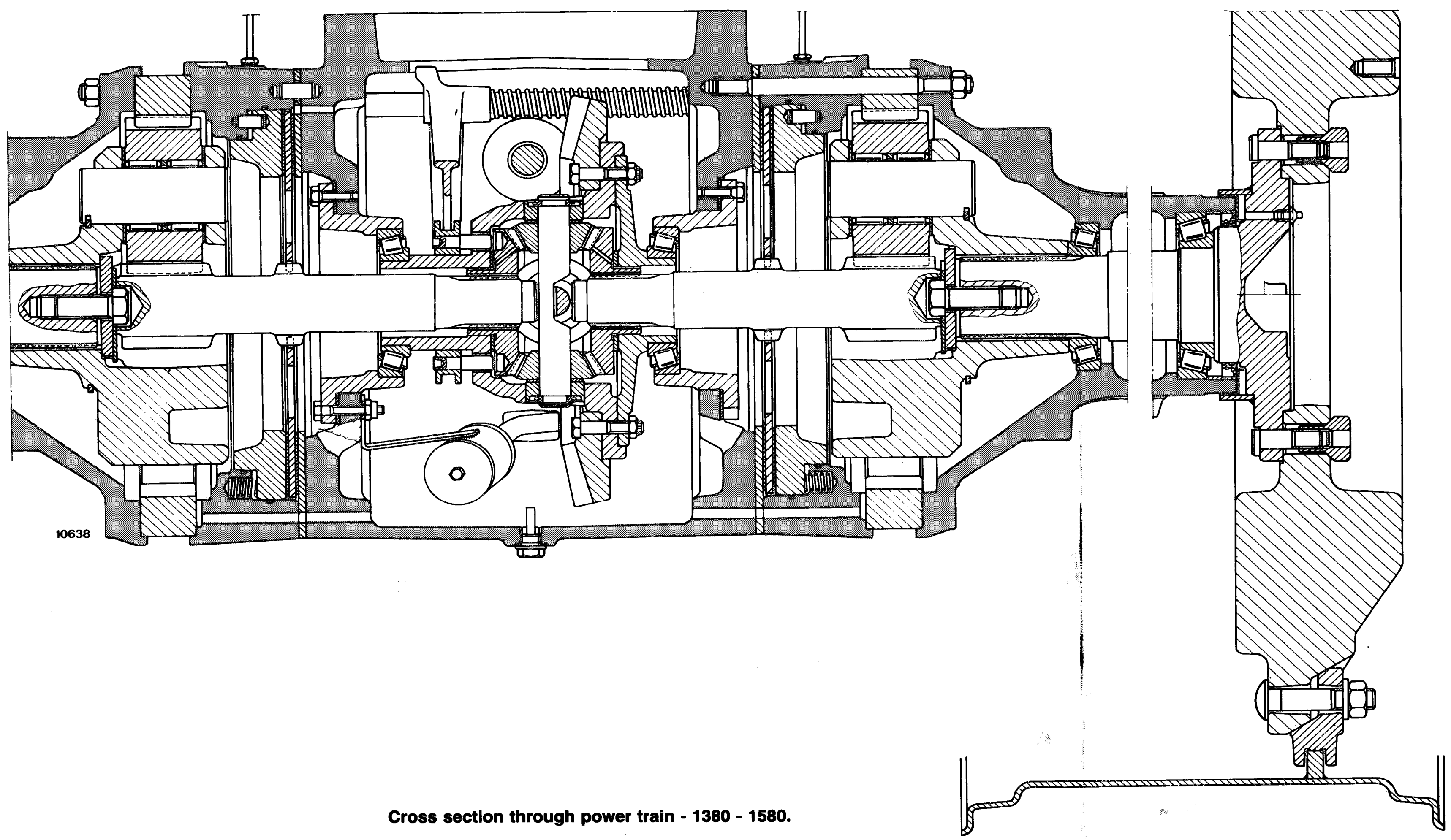

Cross section through power train - 1380 - 1580.

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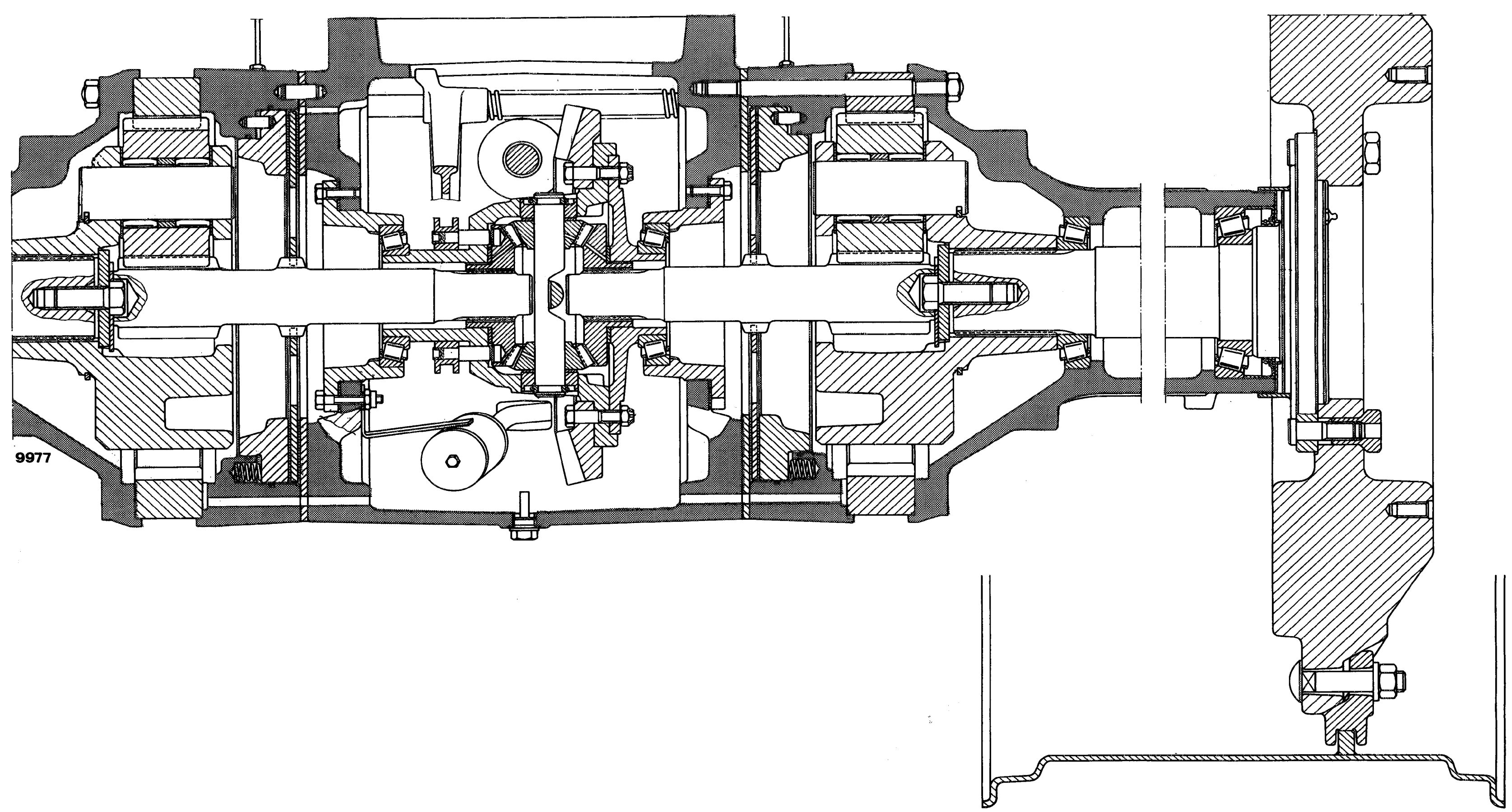

Cross section through power train - 1880.

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PLATFORM REMOVAL AND INSTALLATION

For platform removal proceed as follows:

— take off front and rear side panels, disconnect battery earth lead, starter cable, front end lamp leads, horn lead, hourmeter cable and all electrical connections to dashboard instruments and indicators;

— disconnect hydrostatic steering flexible piping from rigid pipes, rubber hose from steering fluid reservoir, draining the reservoir and hydraulic brake control pipes;

— disconnect accelerator actuating link and engine shut-off cable on injection pump, hand throttle cable from throttle link mounted bracket;

— disconnect piping from fuel tank, feed pump, injection pump, thermostarter reservoir, lift and remote control valves; also remove quick-release coupling flange;

— disconnect lift control link, response lever link, front wheel drive lever link, parking brake link, differential lock link, master and PTO clutch links, crawler gear link or mechanical reverser link (if fitted) and PTO lever link on 1180;

— remove transmission and splitter vertical link capscrews through slots in platform;

— remove 6 capscrews retaining platform to cushion mountings and lift off the platform using a nylon rope **293769**, together with a pair of hooks **292109** applied to the cab mounting holes on the top of the mudguards.

If the tractor is provided with ROPS frame, apply the rope to the top of the frame.

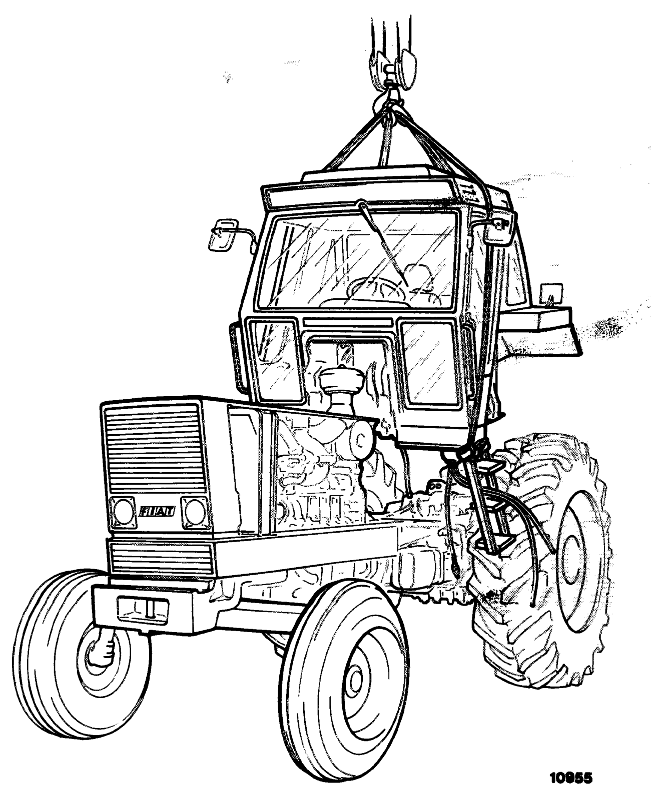
PLATFORM REMOVAL TOGETHER WITH FIAT CAB

To remove the platform together with the FIAT cab, proceed as directed for platform removal, noting the following points:

— disconnect all electrical wiring to dashboard instruments and indicators;

— disconnect water delivery and return lines to cab after draining the radiator and the air conditioning pipes from the associated couplings with integral valves;

Note: When draining the radiator, move heater control lever over to the red sector.



Removing or installing the control platform together with FIAT cab.

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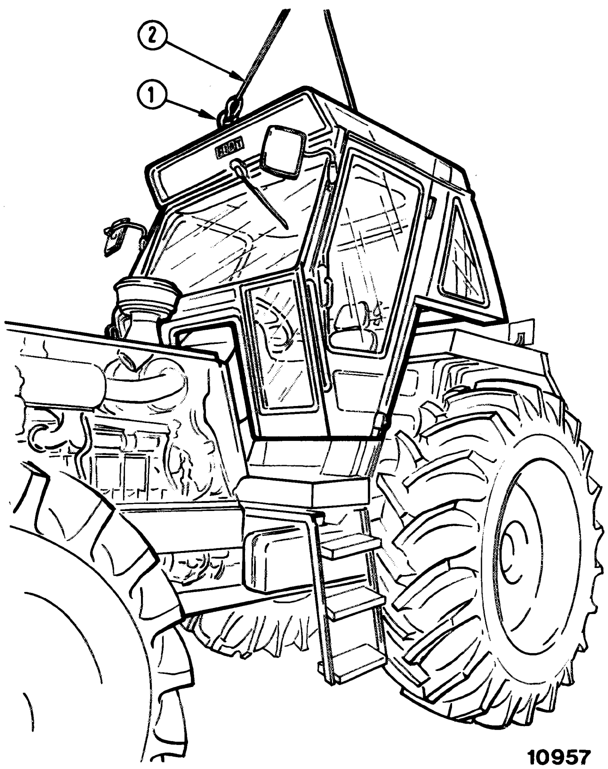

Removing or installing FIAT cab without platform.
1. Lift hook **292109** - Nylon rope **293769.**

— remove 2 capscrews retaining cab to rear of platform and apply 2 lift hooks **292109;**

— tie one end of two nylon ropes **293769** to the access steps as shown in fig. a, page 1, and the other end to hooks **292109** so that they cross one another;

— remove 6 capscrews retaining platform to cushion mountings, connect the ropes to a hoist and lift off the cab with attached platform.

FIAT CAB REMOVAL AND REPLACEMENT WITHOUT PLATFORM

To remove the cab without platform, proceed as follows:

— take off front and rear side panels, disconnect battery earth lead and electrical wiring of instruments and cab windscreen washer system;

— drain the radiator and disconnect the heating and ventilating system pipes from the associated connection, the windscreen washer pipe from the reservoir and the air conditioner pipes from couplings with integral valve;

— remove 2 capscrews from the top of the cab, apply 2 hooks **292109** (1) and connect to a hoist using nylon rope **293769** (2);

— from inside the cab, remove 2 side pillar trim panels and 2 black plastic panels from the sides of the dashboard;

— remove 2 capscrews retaining oddments tray to cab and slightly slacken the 2 capscrews for retention to dashboard frame;

— from inside the cab, remove 4 screws for retention to side mudguards and 4 capscrews for retention to rear mudguards;

— from outside the cab, remove 4 capscrews (2 on each side) for front end retention situated below the access steps, 10 capscrews for side retention from the bottom of the mudguards and 6 capscrews for retention to vertical mudguards;

— slightly raise the cab, check that there is no fouling and lift off.

For cab installation reverse the removal sequence, paying attention not to interchange heating system pipes.

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FERODO OR LUK CLUTCH REMOVAL AND INSTALLATION

To gain access to the clutch, separate engine with attached axle or live front axle from the transmission with attached platform. To do this, proceed as follows:

— remove front and rear side panels, exhaust silencer, bonnet and air cleaner with associated support;

— back off capscrews retaining side members to transmission housing and disconnect negative battery lead and leads to tachometer, alternator and starter motor, accelerator and injection pump shut-off links. Disconnect dash and cab connection leads;

— back off capscrews retaining brake pipe bracket to engine and disconnect fuel lines (after closing cock);

— drain oil from power steering reservoir and on 1180 and 1380, disconnect power steering hoses from pipes. On 1580 and 1880 remove power steering pipes;

— drain oil from rear transmission housing and on 1180 and 1380, disconnect delivery line to control valve from hydraulic pump and suction line from hose upstream of filters. On 1580 and 1880, remove the hydraulic pump and section of suction line between hose and filters;

— on tractors equipped with cab, disconnect water delivery lines to heater and, where present, refrigerant delivery lines to air conditioner from connections;

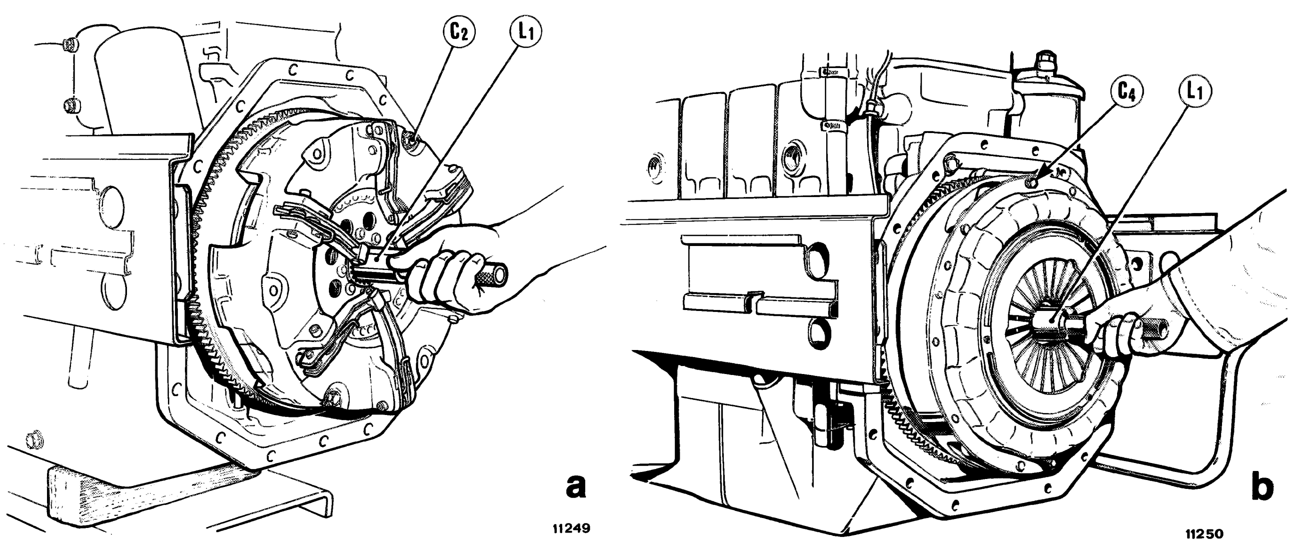
— disconnect delivery line to live front axle hydraulic differential lock and remove live front axle transmission shaft with associated guard;

— apply parking brake; place a suitable support stand under the transmission housing and a hydraulic jack with guide **293568** under the sump;

— chock front axle, apply engine lift chain, remove capscrews and bolts retaining transmission housing to engine and separate engine with attached axle from the tractor.

Subsequently, remove the clutch assembly from the engine flywheel as follows:

— remove four capscrews (C_2) retaining LUK 12″/12″ or FERODO 12″/12″ clutch (1180) or seven capscrews (C_4) retaining LUK 14″ or FERODO 14″ clutch (1180 H, 1380, 1580 and 1880) and slacken the two remaining screws.



Removing (installing) clutch from engine flywheel.
a. LUK 12″/12″ clutch (1180) - b. 14″ clutch (1180 H, 1380, 1580 and 1880) - C_2/C_4. Capscrews, clutch to flywheel - L_1. Centralizer **293801**.

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— insert centralizer **293801** in clutch plate bore, remove the two remaining screws and lift off the assembly retrieving the PTO clutch driven plate (12"/12" clutch only).

When installing the clutch, note the following points:

— on 1180, check ball bearing (10, pages 3 and 6) pressed in engine flywheel and replace if roughness or noise is detected on rotation. Install new ball bearing packing the housing with **grassofiat TUTELA G9** or other approved grease;

— install clutch assembly on flywheel using the centraliser and tighten capscrews (C_2 and C_4) to the specified torque;

— smear clutch driven plate splines with **grassofiat TUTELA G9,** clean and thoroughly degrease mating surfaces and apply one of the jointing compounds detailed on page 7, section A before installing transmission on engine-front axle assembly.

Position two centralisers **292888** on the transmission housing to aid assembly.

FERODO CLUTCH OVERHAUL - FERODO 12"/12" (1180)

For clutch removal, assembly and adjustment, use tool **291291/2** or universal tool **293650.**

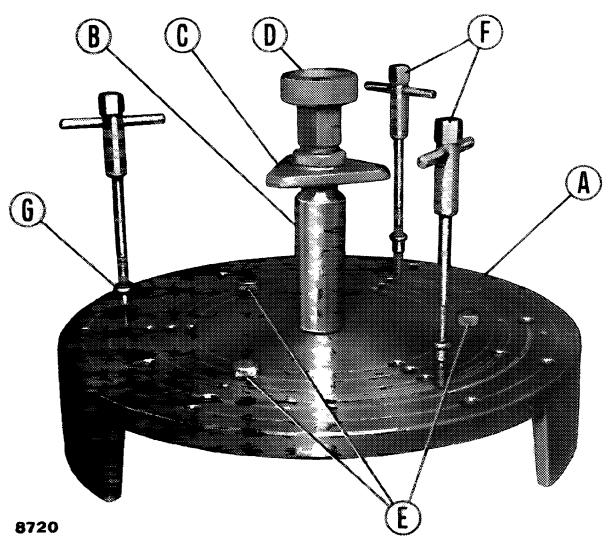
To install clutch on tool **291291/2** proceed as follows:

— place centre spacer (B) on base plate (A) and three locators (E) over 241 mm (9.5 in) PCD;

— rest the clutch assembly without PTO clutch driven plate on the base plate and secure by means of three fasteners (F) provided with guide bushings (G).

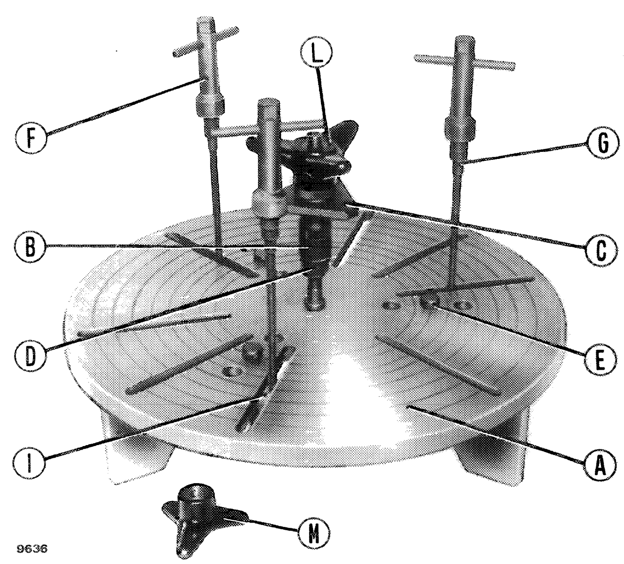
To install clutch on universal tool **293650** proceed as follows:

— position spacer (B) on base plate (A), with register contact surface 137.5 mm (5.4 in) above base plate and tighten locknut (D);



Component parts of FERODO 12"/12" clutch adjuster 291291/2.

A. Base plate **292598** - B. Centre spacer **50.001** (to be constructed referring to diagram on page 3) - C. Register **292347** - D. Nut **292344** securing spacer and register - E. Locators **293683** - F. Fasteners **291292/1** - G. Fastener guide bushings **292293/1.**



Component parts of FERODO 12"/12" clutch universal adjuster 293650.

A. Base plate **293332/1** - B. Centre spacer **293741** - C. Register **293732** - D. Spacer locknut **293730** - E. Locators **293726** - F. Fasteners **293725** - G. Fastener guide bushings **293734** - I. Clamps **293755** - L. Knob **293739** - M. Knobs **293740.**

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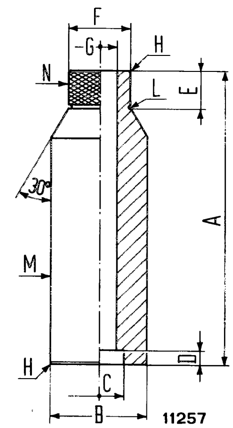
LUK and FERODO 12"/12" clutch adjuster 291291/2 spacer 50.001 construction diagram (1180).

A = 138.7 to 138.8 mm (5.460 to 5.464 in) - B. = Dia 44.80 to 44.85 mm (1.763 to 1.765 in) - C. = Dia 23 mm (.905 in) - D. = 7 mm (.275 in) - E. = 18 mm (.709 in) - F. = Dia 30 mm (1.181 in) - G. = Dia 16.5 mm (.650 in) - H. Chamfer 1 mm (.039 in) - L. Radius 1 mm (.039 in) - M. Stamp **50.001** - N. Knurl 2.

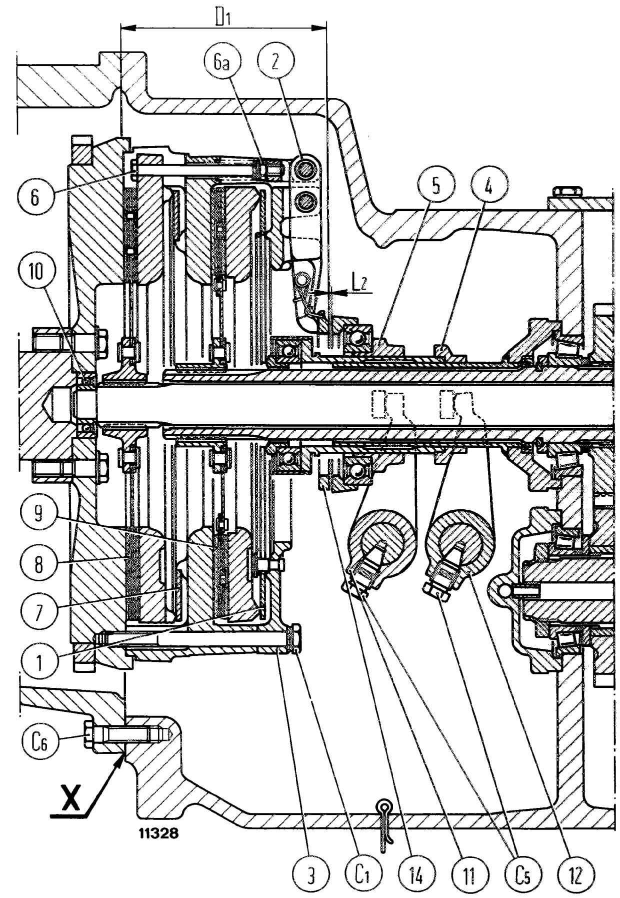


— position ajustable locators (E) over 240 mm (9.4 in) PCD with top plate at a height of 9.6 mm (.378 in.) and tighten through knobs (M);

— rest clutch assembly without PTO driven plate on base plate and secure by means of three fasteners (F) with guide bushings (G) and pads (1).

Slacken nuts (6a) and fully back off adjusting screws (6) using wrench from set **293763.** Remove cover capscrews (3) and gradually back off fasteners (F, page 2) to allow spring unloading and subsequent clutch disassembly.

Check clutch driven plates for wear and replace if the rivets are found to be flush with or near to top of facings. Also replace if the organic facings are found to be soaked with oil.

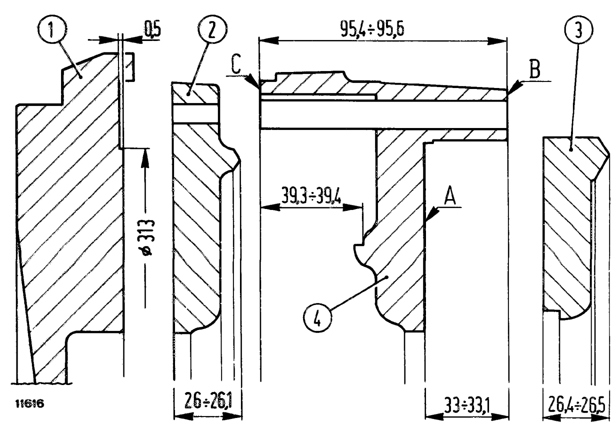


Longitudinal section through FERODO 12"/12" clutch with master clutch pressure plate assembly in contact.

C_1. Capscrews retaining clutch to engine flywheel - C_5. Capscrews retaining levers to fork - C_6. Capscrews and nuts retaining clutch housing to engine - D_1 = 147 mm (5.79 in) nominal distance between ring (14) and flywheel - L_2 = 1.5 mm (.06 in) nominal distance between PTO clutch release lever ring and thrust plate - 1. Diaphragm spring - 2. PTO clutch release levers - 3. Cover - 4 and 5, Control sleeves with attached bearings - 6 and 6a. PTO clutch release levers lock nut and adjusting screw - 7. Dished spring - 8. PTO clutch plate - 9. Master clutch plate - 10. Flywheel bearing - 11 and 12. Sleeve control fork - 14. Release lever ring.

Note: On assembly thoroughly clean and degrease mating surfaces X and apply jointing compound as directed on page 7, section A.

Note: On assembly, ensure that the clutch plates (8 and 9) are positioned as shown, longer hub boss facing.



PTO clutch pressure plate (2), transmission clutch pressure plate (3) and support housing (4) original dimensions in mm.

A. B. C. See text - 1. Engine flywheel.

Check the pressure plate and clutch housing contact surfaces; if necessary, these surfaces may be dressed referring to the dimensions given in the illustration and noting the following points:

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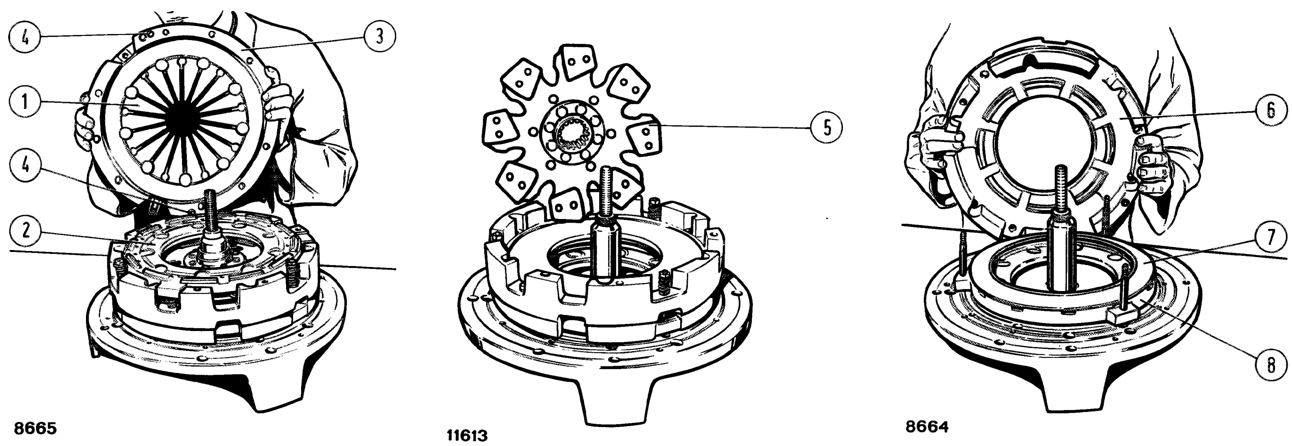

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Disassembling (assembling) clutch using tool kit 291291/2.

1. Diaphragm spring - 2. Master clutch pressure plate - 3. Clutch cover - 4. Clutch cover centralisers - 5. Master clutch plate - 6. Support housing - 7. Dished spring - 8. PTO clutch pressure plate.

1. PTO clutch pressure plate (2, page 3). Dress contact surface to a maximum depth of 1 mm (.04 in). Subsequently dress the clutch housing (C) removing an equivalent amount of material.
2. Master clutch pressure plate (3, page 3). Proceed as described above and remove the same amount of material from clutch housing (B).
3. Clutch housing (4, page 3). Dress surface (A) to a maximum depth of .5 mm (.02 in). Remove the same amount of material from (B).

If necessary, dress engine flywheel contact surface to restore external undercut of .5 mm (.02 in).
Should diaphragm spring replacement be necessary (1, page 3) note that the spring is supplied together with cover (3) to which it is rivetted.
Assemble clutch parts using tools from tool kit **291291/2** or from universal tool kit **293650** noting the following points:

— position dished spring (7) on PTO clutch pressure plate with the convex side uppermost;

— adjust clutch as directed below.

FERODO 12″/12″ CLUTCH ADJUSTMENT (1180)

For a correct clutch adjustment the PTO clutch release levers should be aligned and ring (14, page 3) should be positioned at dimension (D_1) relative to the flywheel surface.
Clutch adjustment may be carried out with the clutch on the bench or installed on the flywheel.

1. On-bench clutch adjustment.

Position the clutch over the base plate of tool **291291/2** or universal tool **293650** and tighten using fasteners as directed for disassembly (pages 2 and 3).
Remove ring (14, page 3), install register (C, page 5) and lock with nut (D), tool **291291/2** or knob (L), universal tool **293650.** Using wrench (M), tighten or slacken PTO clutch release level adjusting screws (2) to obtain clearance (V_1), between the end of each release lever and register (C). Subsequently, tighten the screws through nuts (3).

On-flywheel clutch adjustment.

Insert centraliser **293801** in clutch driven plate bores ensuring that the end is in contact with bearing (10, page 3). Press register **291814** against centraliser.
Adjust clearance between release lever ends and register to .1 mm (.004 in) as directed above for clearance (V_1) adjustment.

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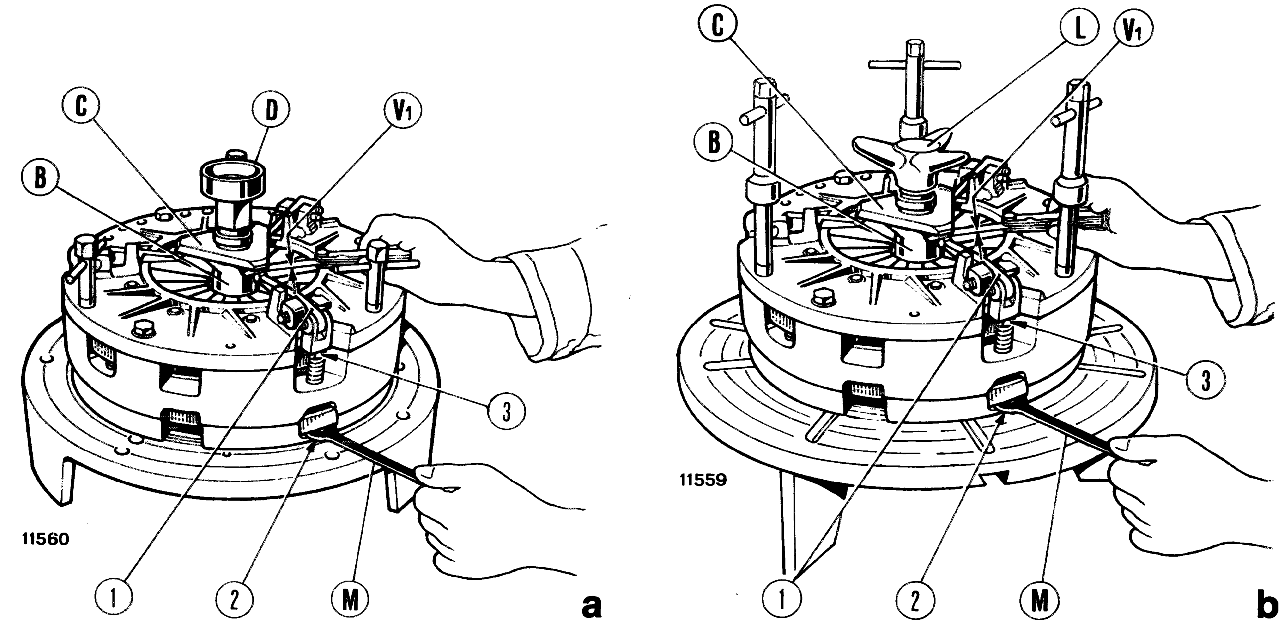
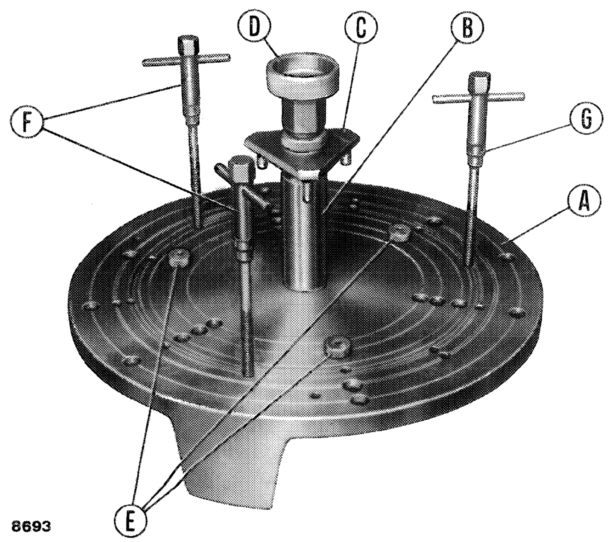
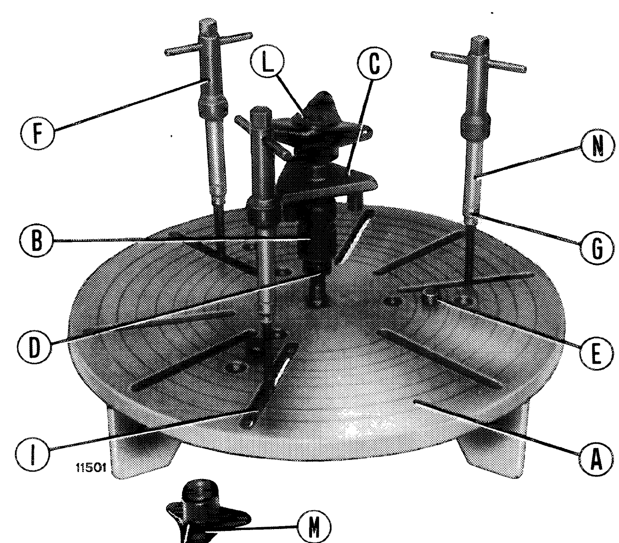


Checking and adjusting PTO clutch release lever alignment on the bench using tool 291291/2 (fig. a) or universal tool 293650 (fig. b).
B. Spacer - C. Register - D. Nut - L. Knob - M. Wrench from set **293763** - V_1 = .1 mm (.004 in) for universal tool **293650** or 1.2 mm (.06 in) for tool **291291/2.** Clearance to be obtained between release lever ends (1) and register (C) - 1. Release levers - 2 and 3. Adjusting screw and lock nut.

Note - On-bench 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 driven plate thickness owing to machining tolerance build-up or wear, plus the magnification inherent in the high leverage ratio.



Parts of tool 291291/2 for LUK 12"/12" clutch adjustment (1180).
A. Base plate **292598** - B. Spacer **50.001** (to be constructed with reference to diagram on page 3) - C. Register **292939/1** - D. Nut **292344** - E. Locators **293733** - F. Fasteners **291292/1** - G. Fastener guide bushings **291293/1.**



Parts of universal tool 293650 for LUK 12"/12" clutch adjustment (1180).
A. Base plate **293332/2** - B. Spacer **293741** - C. Register **293731** - D. Spacer locknut **293730** - E. Locators **293726** - F. Fasteners **293725** - G. Fastener guide bushings **293734.** - I. Pads **293755** - L. Register knob **293739.** - M. Locator knobs **293740.** - N. Fastener spaces **292345.**

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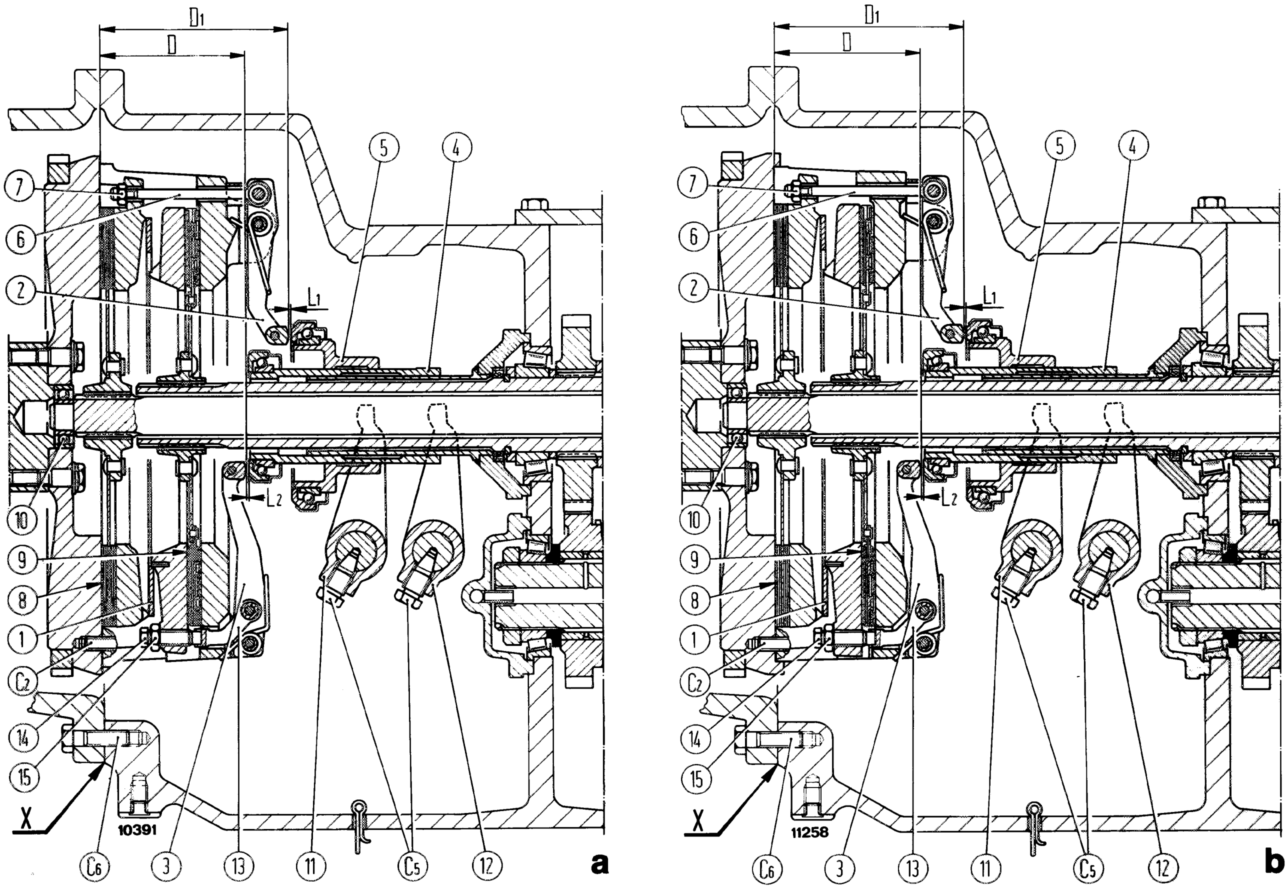

Longitudinal section through LUK 12"/12" clutch (1180).

a. Early model clutch without flywheel centraliser - b. Early model clutch with flywheel centraliser - c. Page 7. Late model clutch with flywheel centraliser and master clutch pressure plate assembly in contact with levers (3) - C_2. Clutch capscrews - C_5. Withdrawal lever capscrews - C_6. Clutch housing capscrews and nuts - D = 103 mm (4.1 in) Release lever (3) height above flywheel face - D_1 = 137 mm (5.4 in) Release lever (2) height above flywheel face - L_1 and L_2 = 1.5 mm (.06 in) PTO clutch release levers to bearing and master clutch release levers to bearing - 1. Dished spring - 2. PTO clutch release levers - 3. Master clutch release levers - 4/5. Release control sleeves with attached thrust bearings - 6 and 7. PTO clutch release lever adjusting link and nut - 8. PTO clutch plate - 9. Master clutch plate - 10. Flywheel bearing - 11 and 12. Withdrawal forks - 13/14/15. Master clutch release lever, adjusting screw and locknut.

Note: On assembly, thoroughly clean and degrease mating surfaces **X** and apply jointing compound as directed on page 7, section A.

Note: On assembly, ensure that the clutch plates (8 and 9) are positioned as shown, i.e. longer hub boss facing toward flywheel.

LUK 12"/12" CLUTCH OVERHAUL (1180).

To disassemble, assemble and adjust the clutch use tool **291291/2,** page 5, or universal tool **293650.**
To install clutch on tool **291291/2,** proceed as follows:

— place spacer (B) on base plate (A page 5) and three locators (E) over 241 (9.5 in) PCD;

— rest clutch assembly without PTO driven plate on base plate and secure by means of three fasteners (F) provided with guide bushings (G).

To install clutch on universal tool **293650,** proceed as follows:

— place spacer (B) on base plate (A, page 5), position register at a height of 128 mm (5.04 in) and tighten locknut (D);

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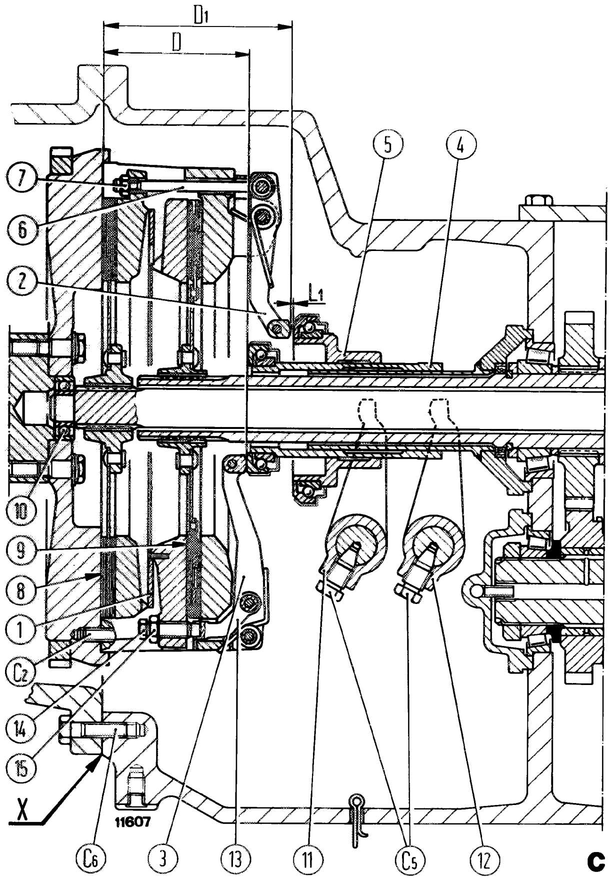
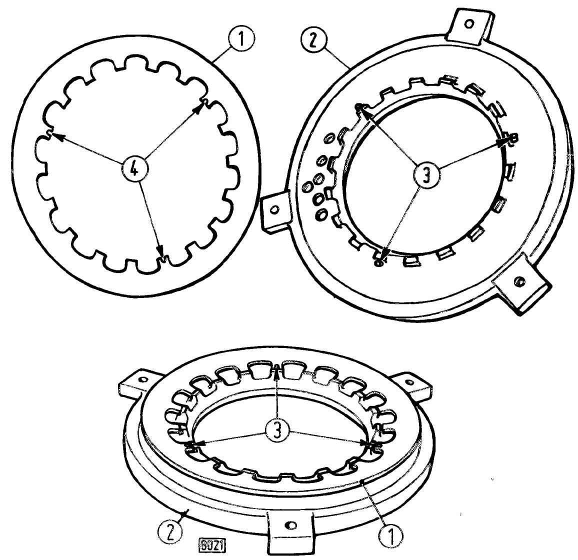


Longitudinal section through LUK 12"/12" clutch (1180).
For references see captions on page 6.



Installating dished spring (1) and PTO clutch pressure plate (2).
3. Dowels - 4. Positioning slots.

— place adjustable locators (E) over 240 mm (9.4 in) PCD with top face at a height of 12.7 mm (.5 in) and tighten through knobs (M);

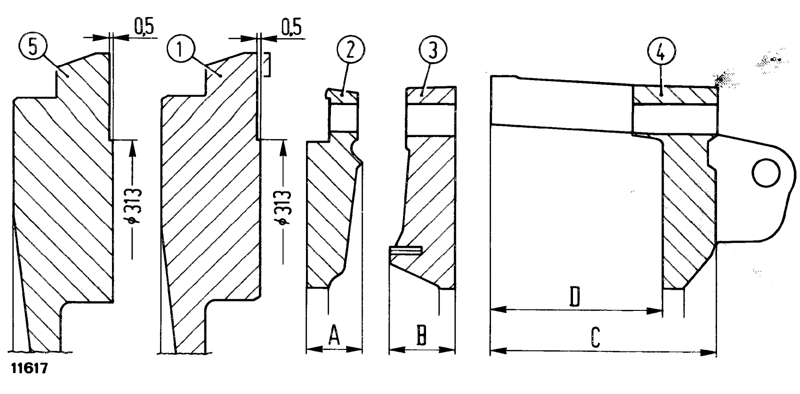
— rest clutch assembly without PTO driven plate on base plate and secure by means of three fasteners (F) provided with pads (I), spacers (N) and guide bushings (G).

Remove PTO clutch release lever adjusting link nuts (7, pages 6 and 7) and gradually back off fasteners (F, page 5) to permit spring unloading and subsequent clutch disassembly.
Check clutch driven plates for wear and replace if rivets are near to or flush with top of facings. Also replace if the organic facings are soaked with oil.
Check pressure plate and clutch housing contact faces.
If necessary, dress noting that dimensions (A, B, C and D) of each part must **not be reduced** below the limits given in the illustrations. Replace as necessary.

Minimum dimensions after wearing part dressing. LUK 12"/12" clutch.

A. = 22 mm (.87 in.) min - B. = 24 mm (.94 in.) min - C. = 94.3 mm (3.71 in.) min - D. = 71.3 mm (2.81 in.).

1. Late model flywheel (with clutch centralisers) - 2. PTO clutch pressure plate - 3. Master clutch pressure plate - 4. Support housing - 5. Early model engine flywheel (without clutch centraliser).



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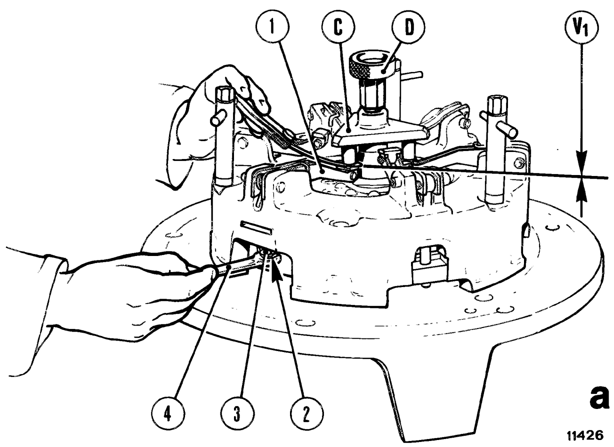

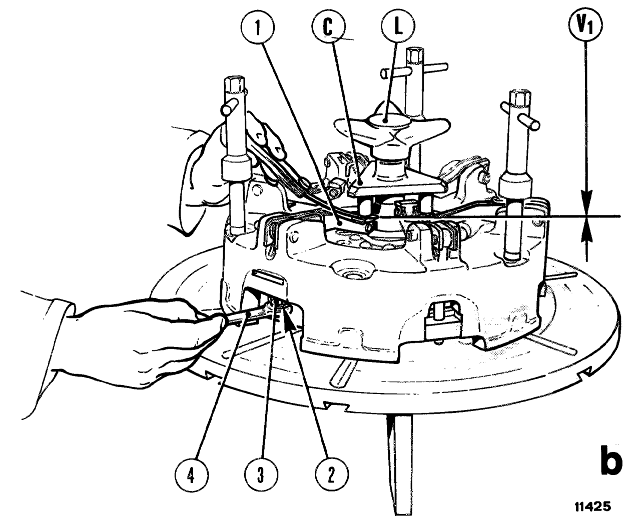

Checking and adjusting master clutch release lever alignment on bench using tool 291291/2 (fig. a) or universal tool 293650 (fig. b).
C. Register - D. Nut - L. Knob - V_1. = .1 mm (.004 in) Gap between release lever (1) and register (C) - 1. Release levers - 2/3. Adjusting screw and locknut - 4. Wrench from set **293763.**

Proceed as follows:
— dress pressure plate surface;
— replace damaged or worn plates;
— dress clutch housing face;
— calculate dimension (D) according to the following formula:

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

where:
A and **B** = measured dimensions of two pressure plates after dressing;
S_1 and S_2 = measured dimensions of PTO and master clutch plates;
L = .5 mm (.02 in) external undercut;
P = 4 mm (.16 in) spring dimension to restore original load;
— check that dimension (D) is greater than or equal to that shown. In restoring dimension (D), check that dimension (C) does not fall below the value given. If necessary, replace one or both of the pressure plates, noting the following points.

Note: Clutch housing width must not be under 23 mm (.90 in); therefore, ensure that the following conditions exists at all times:

C − D = 23 mm (.90 in) min.

Check that undercut (E) is higher than indicated in the illustration and restore as necessary. If necessary, dress friction face on engine flywheel and restore external undercut to .5 mm (.02 in)

Assemble clutch using tool **291291/2** or universal tool **293650,** noting the following points:

— correctly position dished spring (1, page 7) on PTO clutch pressure plate (2) ensuring that centralisers (3) are in register with slots (4);

— adjust clutch as directed below.

LUK 12"/12" CLUTCH ADJUSTMENT (1180)

For correct clutch adjustment the release levers must be aligned and positioned at the dimensions given (D and D_1, pages 6 and 7) relative to flywheel face.
Clutch adjustment may be carried out with the clutch on the bench or fitted to the flywheel.

1. On-bench clutch adjustment.

Place the clutch over the base plate of tool **291291/2** or universal tool **293650** and tighten by means of the fasteners provided, adhering to the instruction given for disassembly (page 7).
Install register (C) and tighten by means of nut (D) tool **291291/2,** or knob (L, page 5), universal tool **293650.** Screw in or back off master clutch release lever adjusting screws (2) to obtain gap (V_1) beween register (C) and release levers. Subsequently, tighten nuts (3).

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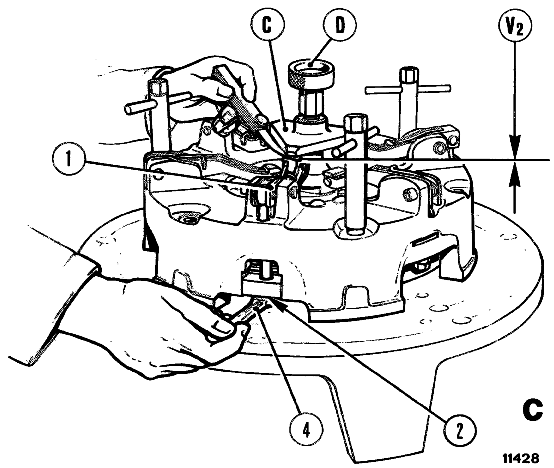
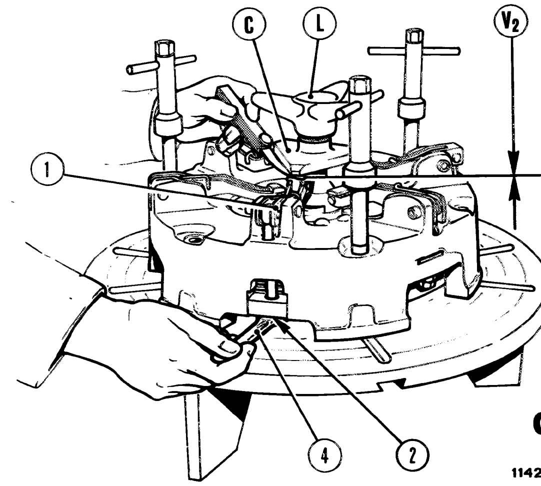




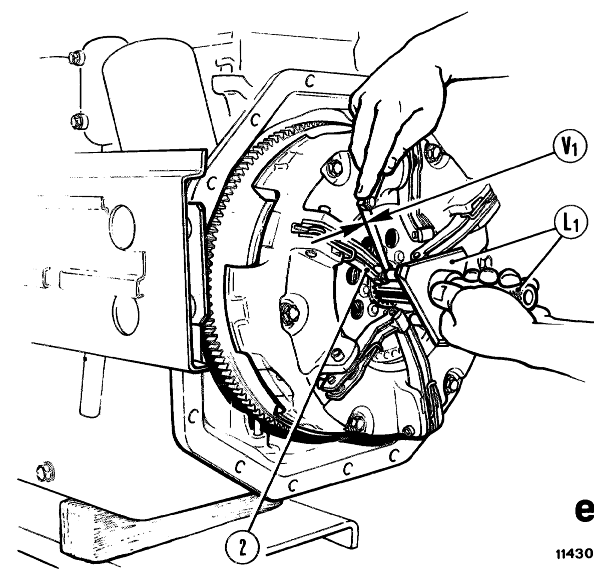
Checking and adjusting PTO clutch release lever alignment on bench using tool 291291/2 (fig. c) or universal tool 293650 (fig. d).
C. Register - D. Nuts - L. Knob - V_2. .1 mm (.004 in) universal tool **293650** or .8 mm (.032 in) tool **291291/2,** Release lever gap - 1. Release lever - 2. Adjustment nut - 4. Wrench from set **293763.**

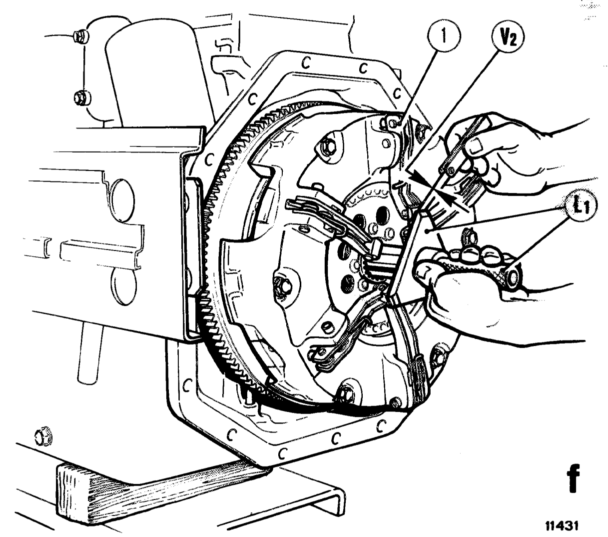
Screw in or back off PTO clutch nuts (2) to obtain a gap (V_2) beween each release lever and register (C).

2. On-flywheel clutch adjustment.

Insert centraliser (L_1) **293801** in clutch plate bore, ensuring that the end is in contact with bearing (10, pages 6 and 7) and press against register **293802.** Adjust gaps (V_1 and V_2) as indicated above.

Note: On-bench and on-flywheel clutch adjustment may result in quite considerable differences in terms of positioning, a fact which does not affect clutch efficien-





Checking clutch release lever alignment on flywheel.
e. Master clutch - f. PTO clutch - L_1. Centraliser **293801** with register **293802** - V_1 = .1 mm (.004 in). Gap between register pin ends **and release** levers - V_2 = .1 mm (.004 in). Gap between release lever and register surface - 1. PTO clutch release levers - 2. Master clutch **release levers.**

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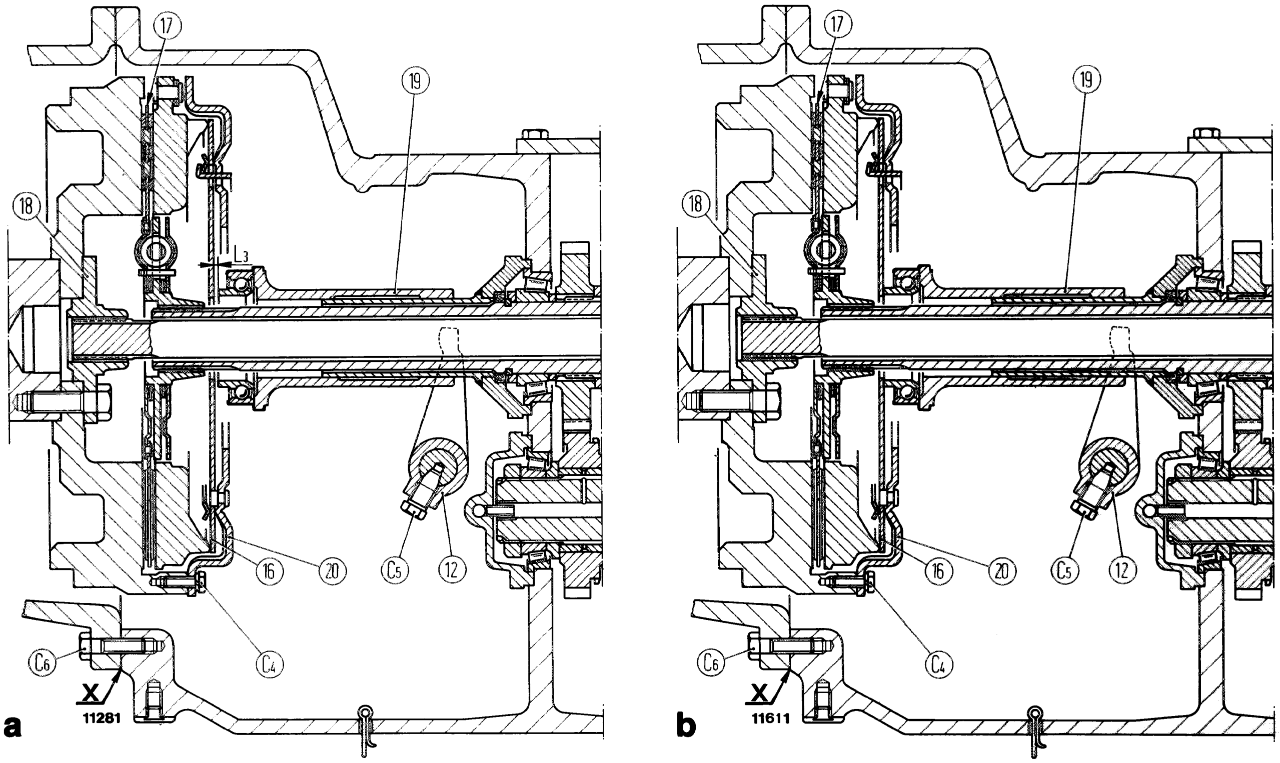

Longitudinal section through LUK 14″ clutch.

a. Early model - b. Late model with release bearing - C_4. Flywheel clutch capscrews - C_5. Withdrawal lever capscrew - C_6. Screws and nuts retaining clutch housing to engine - L_3 = 1.5 mm (.06 in). nominal gap between diaphragm spring and release bearing - 12. Sleeve control fork - 16. Diaphragm spring - 17. Master clutch plate - 18. PTO hydraulic clutch shaft hub - 19. Release sleeve with thrust bearing - 20. Clutch cover.

Note: On assembly thoroughly clean and degrease mating surfaces X and apply jointing compound as directed on page 7, section A.

cy, being due to varying PTO clutch plate thickness owing to machining tolerance build-up or wear, plus the magnification inherent in the high leverage ratio.

After each adjustment, check that return spring length (E) is 175 mm (6.9 in); if not, adjust through elongated holes (D).

EARLY MODEL MASTER CLUTCH LINKAGE ADJUSTMENT (1180, 1380, 1580 and 1880)

For tractors equipped with mechanical master clutch control check that pin (C, page 11) free travel is 4 mm (.16 in) before start of clutch release. When free travel is reduced to 1.5 mm (.06 in), adjust clutch as follows:
- back off lock nut (A) and turn nut (B) counter-clockwise;
- retighten locknut (A);
- ensure that the pedal free travel is 4 mm (.16 in).

PTO CLUTCH LINKAGE ADJUSTMENT (1180)

Move lever (D, page 11) to rest position (fully forward) and check that lever free travel near pin (C) is 3 mm (.12 in) before start of clutch release. When free travel is reduced to 1 mm (.04 in), adjust clutch as follows:
- back off locknut (A) and turn nut (B) clockwise (1 turn is equivalent to 1 mm (.04 in) displacement of pin (C);
- tighten locknut (A);
- check that lever free travel is 3 mm (.12 in).

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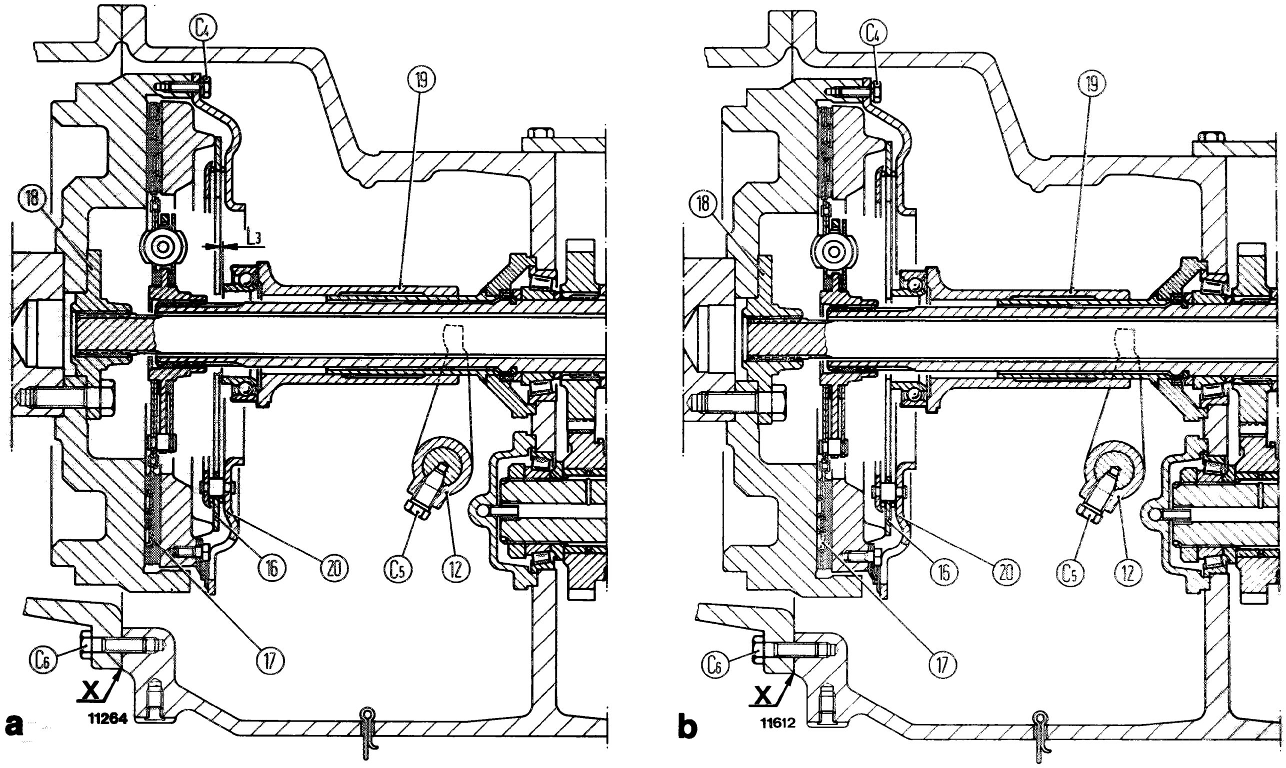
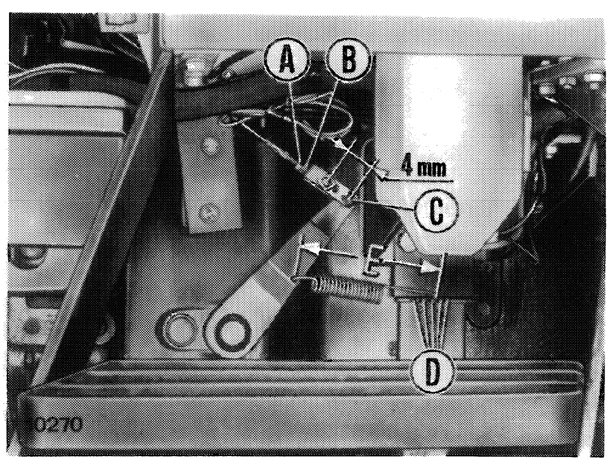


Longitudinal section through FERODO 14" clutch.

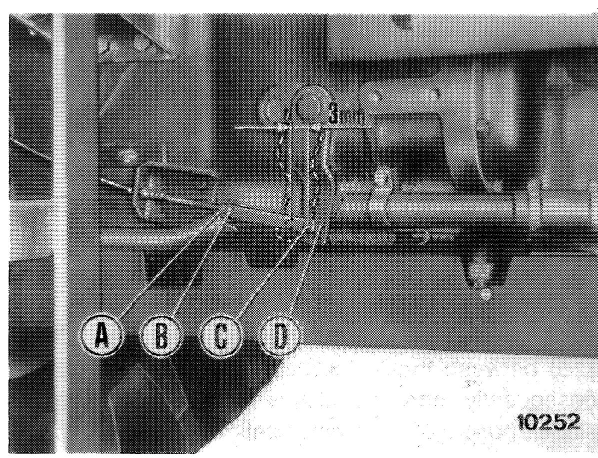
a. Early model - b. Late model with release bearing - C_4. Flywheel - to - clutch capscrews - C_5. Withdrawal lever capscrew - C_6. Capscrews and nuts retaining clutch housing to engine - L_3. = 1.5 mm (.06 in). Nominal distance between diaphragm spring and thrust bearing - 12. Sleeve control fork - 16. Diaphragm spring - 17. Master clutch plate - 18. PTO hydraulic clutch shaft drive hub - 19. Release control sleeve with thrust bearing - 20. Clutch cover.

Note: On assembly, thoroughly clean mating surfaces X and apply jointing compound as directed on page 7, section A.



Adjusting early model master clutch linkage (1180, 1380, 1580 and 1880).

A. Locknut - B. Adjusting nut - C. Pin - D. Return spring bracket elongated holes - E ≅ 175 mm (6.89 in) Return spring length.



Adjusting PTO clutch linkage (1180).

A. Locknut - B. Adjusting nut - C. Pin - D. Lever.

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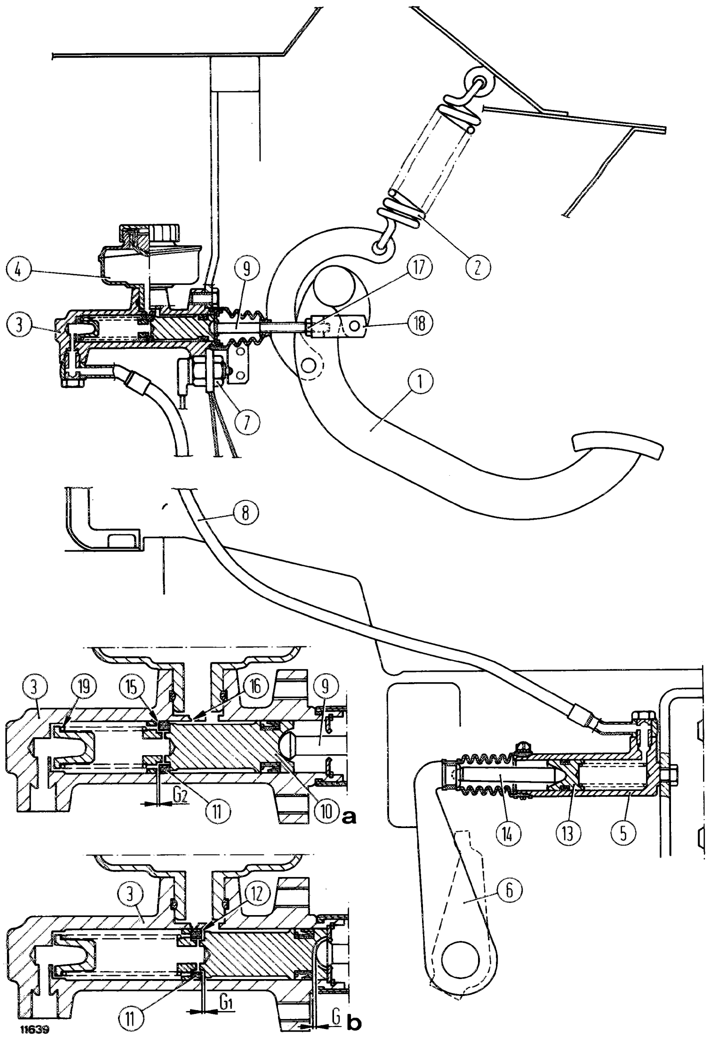

Master clutch hydraulic control.

a. Pump operation with clutch released - b. Pump operation with clutch engaged - G = .1 to 1.4 mm (.004 to .055 in). Pin clearance with pedal at rest - G_1. and G_2. Clearance between seal and piston - 1. Clutch pedal - 2. Pedal release assist spring - 3. Master cylinder - 4. Reservoir - 5. Slave cylinder - 6. Clutch outer lever - 7. Starter inhibitor switch - 8. Line connecting master cylinder to slave cylinder - 9. Pin - 10. Piston - 11. Seal - 12. Port - 13. Piston - 14. Pin - 15. Port - 16. Port - 17. Locknut - 18. Fork - 19. Spring.

Note: On clutch pedal assembly, check that clearance (G) between pin (9) and master cylinder piston (10) is .1 to 1.4 mm (.004 to .055 in). To adjust, back off locknut (17) and turn fork (18) as necessary.

Note: Once correctly installed clutch pedal (1) does not require further adjustment. Any reduction in travel caused by component wear is taken up by the hydraulic oil and may be detected as a raise in reservoir (4) oil level.

MASTER CLUTCH HYDRAULIC CONTROL

Clutch release (fig. a). Upon operating pedal (1), piston (10) moves to the left and takes up clearance (G_1, fig. 6) between master cylinder seal (11) and piston. Consequently, port (12) closes and oil in the master cylinder, no longer in communication with reservoir (4), is compressed by the piston.

Oil under pressure passes through line (8) and acts upon slave cylinder piston (13) which in turn, through pin (14), acts on outer lever releasing master clutch.

Clutch engagement (fig. b). Upon releasing pedal (1), clutch spring moves outer lever (6) to position shown.

Piston (10), no longer held by pedal, moves to the right under the action of circuit oil pressure and spring (19) to establish communication between port (15, fig. a) and tank through port (16). Circuit residual pressure keeping seal (11) in contact with RH side of piston (10) is exhausted to tank. Seal, tight in master cylinder body (3) stops. Piston (10), pushed by spring (19) continues to move to the right through full stroke to re-establish clearance (G_1).

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TRANSMISSION REMOVAL AND INSTALLATION

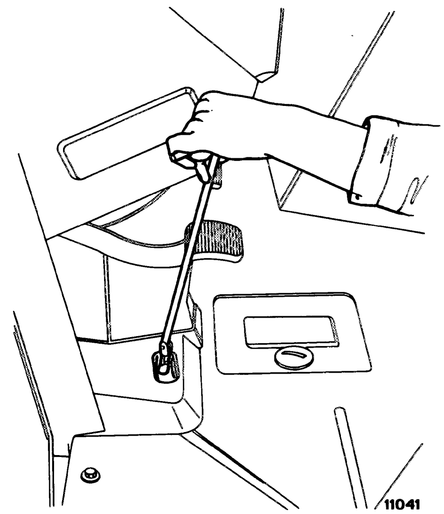
Drain transmission and rear transmission oil making sure not to mix the two types of fluid and proceed as follows:

Note: Transmission removal and installation may be carried out with the platform on or off the tractor.
The following instructions apply to removal with platform on the tractor. To remove the platform, with or without cab, proceed as indicated in the associated sections.

— remove front and rear side panels, exhaust silencer and center cowl;

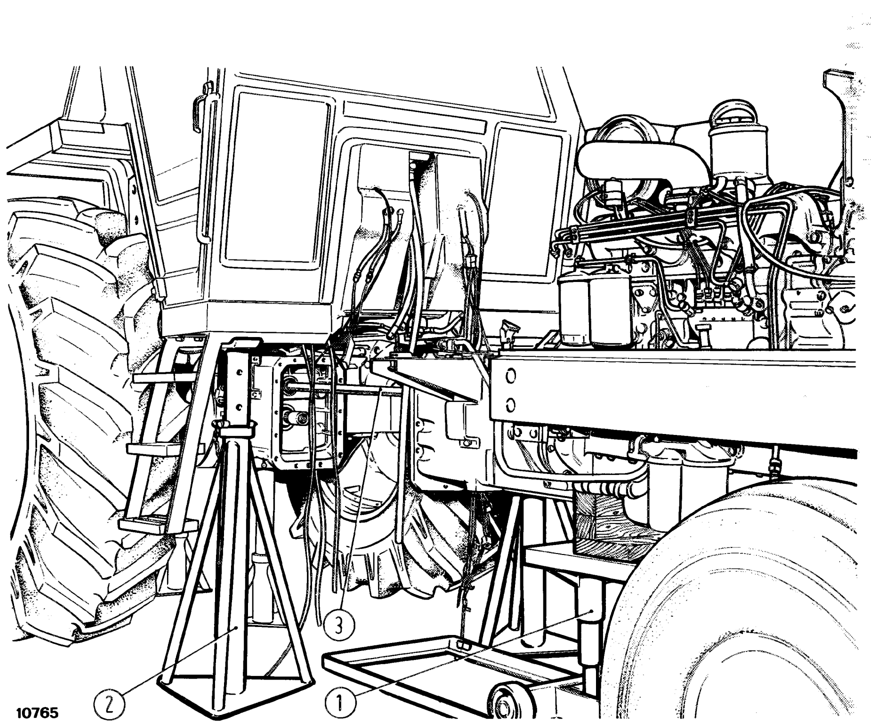
— disconnect battery negative cable, hourmeter drive cable, alternator leads, starter leads and instrument and indicator leads on instrument panel and cab; also disconnect accelerator and engine shut-off linkage;

— drain hydrostatic steering fluid reservoir; disconnect steering piping and brake line bracket from engine;



Removing (installing) transmission and splitter vertical rods.

— drain main fuel tank, remove any auxiliary fuel tanks and disconnect feed pump and injection pump return lines;



Removing (installing) transmission with platform on tractor.

1. Hydraulic stand **293568** - 2. Telescopic stand **292858** - 3. PTO shaft.

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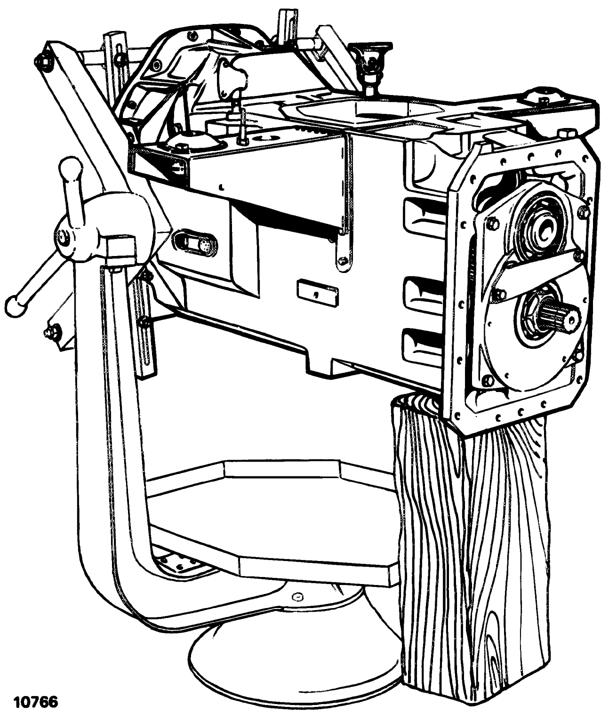
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Positioning transmission on revolving stand.

— back off 3 lower capscrews retaining transmission to engine and place hydraulic stand **293568** (1) under the engine sump;

— apply the parking brake, apply suitable wedges to the front axle, remove capscrews retaining transmission housing to rear tansmission housing and separate engine with attached transmission;

— remove air cleaner with attached support and capscrews retaining side members to transmission housing;

— apply hook **291517**, remove capscrews and bolts for retention to engine and lift off the housing assembly.

Prior to installing overhauled transmission to rear transmission housing and to engine:

— thoroughly clean and degrease mating surfaces and apply one of the approved jointing compounds specified in section A, page 7;

— screw in 2 centralizers **292888** to engine side of transmission housing and 2 centralizers **291584** to transmission housing to facilitate installation.

— remove front axle drive shaft and associated guards;

— on tractors fitted with cab, drain radiator and disconnect water lines to heater and to air conditioner (if fitted);

— disconnect lift power and return oil lines and front differential lock hydraulic line (if fitted);

— remove transmission and splitter vertical rods, master clutch springloaded link and, on model 1180, PTO clutch spring-loaded link from platform;

— remove 2 capscrews retaining platform to front mountings, raise platform 4 to 5 cm (2 in) and hold up using a pair of telescopic stands **292858** (2, page 1) positioned on the sides of the platform as shown on page 1;

— position a fixed stand below tow bar support and a second stand under the front of the rear transmission housing;

DISASSEMBLY

Remove master and PTO clutch sleeves, forks and outer levers (1180) or master clutch sleeve, fork and outer lever (1180 H, 1380, 1580 and 1880).

To facilitate subsequent operations, place transmission/splitter assembly on revolving stand **290086**, resting the rear of the housing on a telescopic stand or a wooden block to maintain balance.

Subsequently, remove the following:

— transmission cover;

— oil delivery line (1, page 3) to transmission driven shaft, retrieving the collector from inside the housing;

— drive and driven shaft bearing caps (2 and 3);

— roll pins (4), retaining forks (5) to splitter horizontal rods, retrieving the forks;

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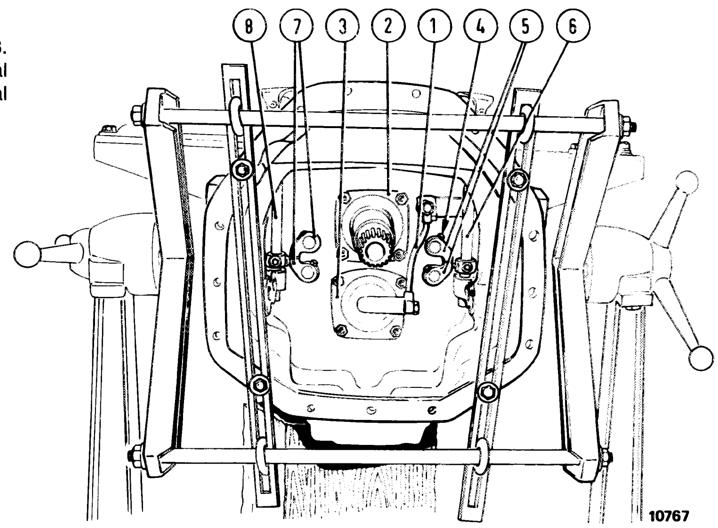


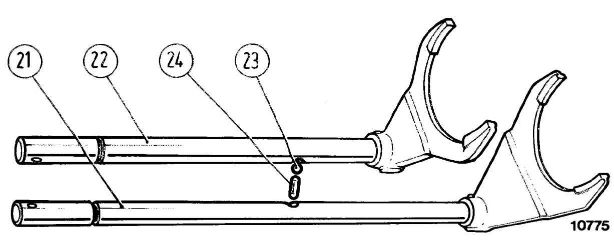
Front view of transmission.

1. Oil line to driven shaft - 2. Drive shaft bearing cap - 3. Driven shaft bearing cap - 4. Roll pin - 5. Splitter horizontal rod forks - 6. Splitter vertical rod - 7. Transmission horizontal rod forks - 8. Transmission vertical rod.

— 3 capscrews (1 and 2, page 10) on left of transmission housing, retrieving 2 balls (3) and springs (4);

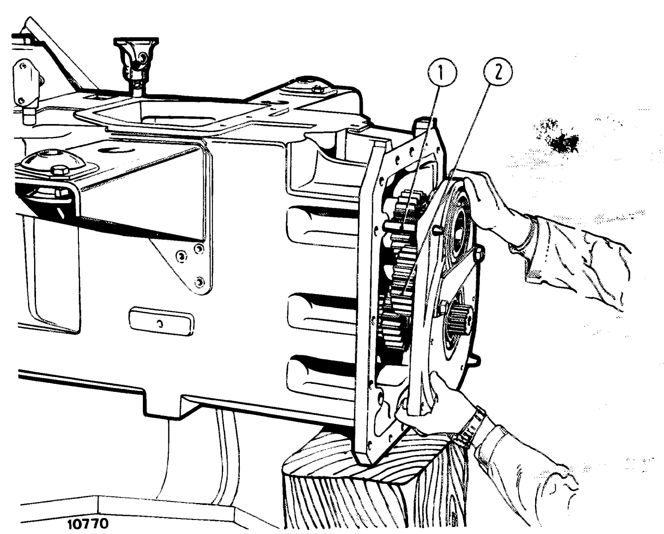
— detent ball (5) (if removal is difficult, retrieve from inside the housing together with plunger (24, page 5) after removing splitter horizontal rods);

— retaining ring (15), nut (C_5) and 4 capscrews (C_6), and screw in a pair of guide pins **292888** (1) in the holes of the capscrews previously removed and take off the splitter rear support with attached bearings and reverse idler gear (2);



Splitter horizontal rods.

21. Normal range and reverse rod - 22. Low and high shifter rod - 23. Detent ball - 24. Detent plunger.



Removing (installing) splitter rear support.

1. Guide pins **292888** - 2. Reverse idler gear.

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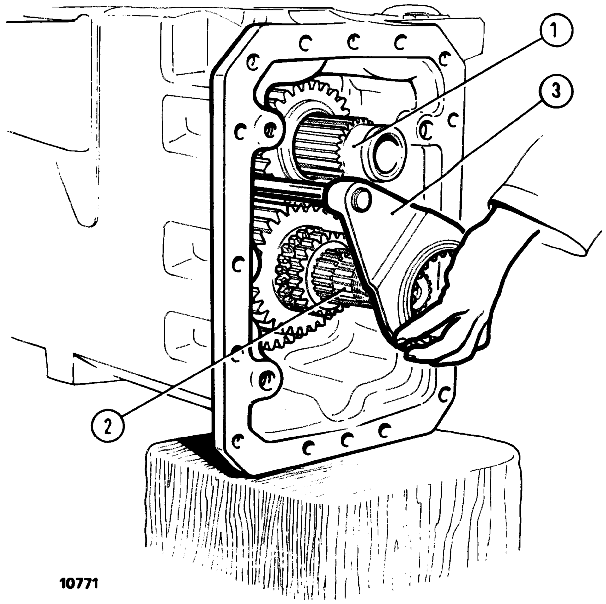
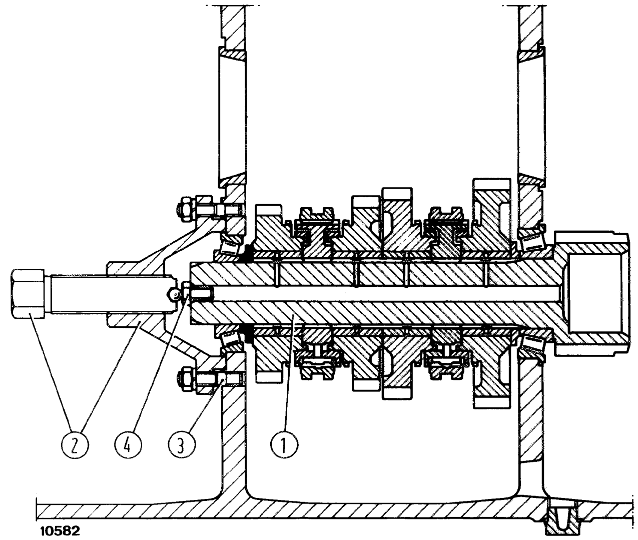


Removing splitter shift rods with attached forks.

1. Splitter drive gear - 2. Splitter driven gear - 3. Shifter rods and forks.



Removing transmission driven shaft using tool 293832.

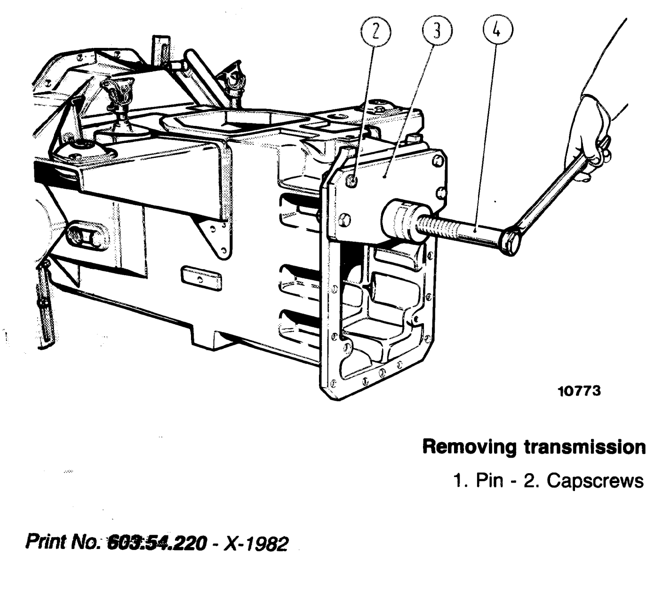
1. Transmission countershaft - 2. Tool **293832** - 3. Bearing cap studs - 4. Forcing screw M10.

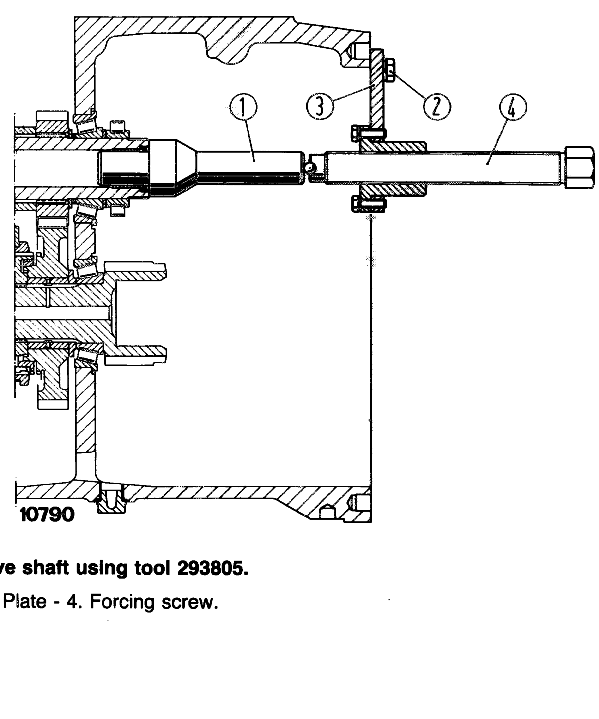
— gears, range sleeves and 2 shifter rods with attached forks, retrieving detent plunger (24) and ball (23) plus splitter driving and driven shafts.

Disassemble transmission drive shaft and associated gears as follows:

— back off nut (C_2, page 5), insert pin (1) of tool **293805** in drive shaft and install plate (3) with attached screw (5) on transmission housing as shown;

— apply capscrew (4) of the tool and remove drive shaft, retrieving gears, the two gear bearings and shims (S_1, page 5) from inside the housing;





Removing transmission drive shaft using tool 293805.

1. Pin - 2. Capscrews - 3. Plate - 4. Forcing screw.

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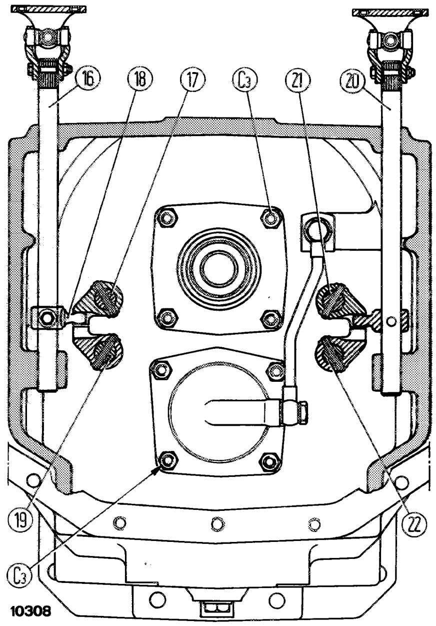

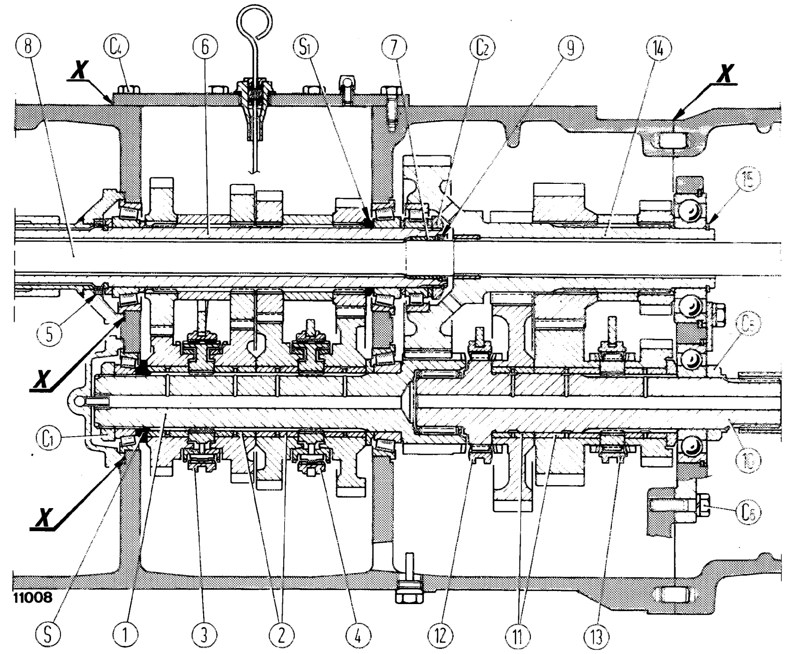

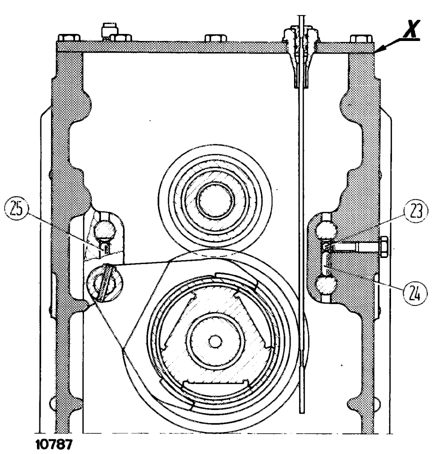

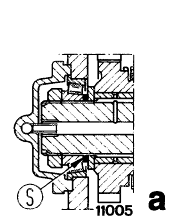

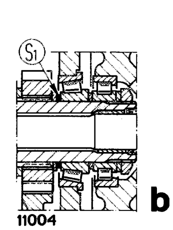

Longitudinal and cross sections through transmission and splitter.

a. Driven shaft bearing shim detail (old) - b. Drive shaft bearing shim detail (old) - C_1. Lock ring - C_2. Lock ring - C_3. Nut - C_4. Capscrew - C_5. Lock ring - C_6. Capscrew - S. Shim - S_1. Shim - 1. Transmission driven shaft - 2. Bushes - 3. 3rd/4th sliding sleeve - 4. 1st/2nd sliding sleeve - 5. Seal - 6. Transmission drive shaft - 7. Bush - 8. PTO shaft - 9. Seal - 10. Splitter driven shaft - 11. Bushes - 12. Low/high sliding sleeve - 13. Normal/reverse sliding sleeve - 14. Splitter drive shaft - 15. Retaining ring - 16. Vertical shifter rod - 17. Horizontal shifter rod for 3rd and 4th - 18. Lever - 19. Horizontal shifter rod for 1st and 2nd - 20. Splitter range and reverse vertical rod - 21. Horizontal rod for normal range and reverse - 22. Horizontal rod for low and high - 23. Detent ball - 24. Range detent plunger - 25. Gear detent plunger.

Note: On assembly, apply jointing compound to surfaces X adhering to the instructions given in section A, page 7.

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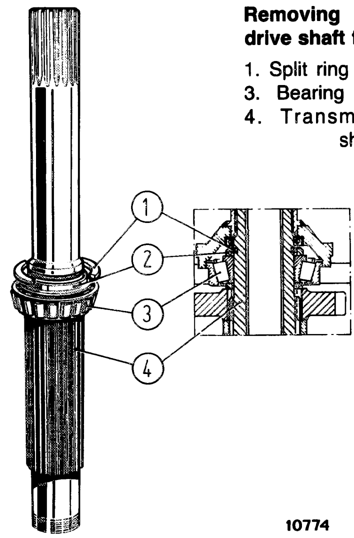


Removing transmission drive shaft front bearing.

1. Split ring - 2. Washer - 3. Bearing inner race - 4. Transmission drive shaft.

— if necessary, remove seal (9, page 5) and bush (7), using an impact type extractor.

If necessary, remove drive shaft front bearing inner race as follows:

— using a suitable punch, move bearing (3) and washer (2) towards splined end of shaft;

— remove split ring (1) and take off the bearing.

Subsequently, remove driven shaft and associated gears as follows:

— remove roll pins retaining forks to horizontal rods;

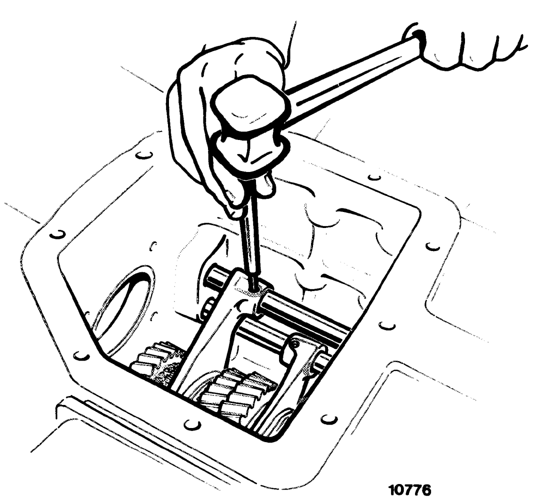
— remove 2 screws from right side of transmission housing, retrieving 2 balls and associated detent springs;

— remove 2 shifter rods as shown, retrieving detent plunger from inside housing;

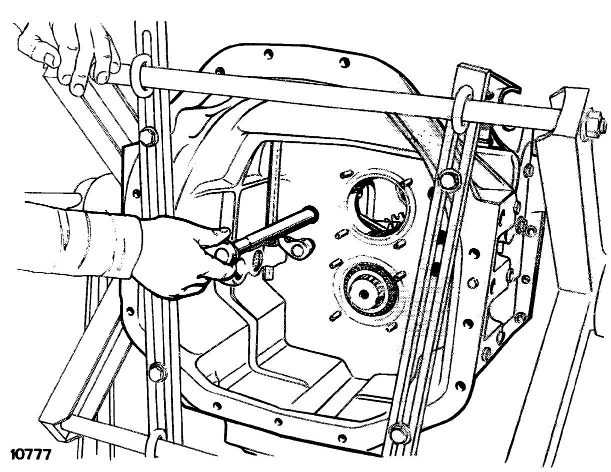
— apply back-up wrench **293808** (1, page 8) to the rear end of the driven shaft, together with a standard offset wrench as shown on page 8, and remove nut (C_1, page 5);

— remove wrench **293808** (2); on later tractors incorporating interference fitted front bearing (1180 from frame 723772, 1280, 1380 from frame 736074, 1580 from frame 741466, 1880 from frame 745798) and on early tractors where removal proves difficult, apply a screw (M10, 4, page 4) to driven shaft lube hole, install tool **293832** (2) onto studs 3 and turn the tool screw until driven shaft release is obtained.

— retrieve the gears and synchromesh assemblies from inside the housing, together with shim (S, page 5) to be used for subsequent taper roller bearing adjustment.



Removing (installing) transmission shifter fork roll pins.



Removing (installing) gear horizontal shifter rods.

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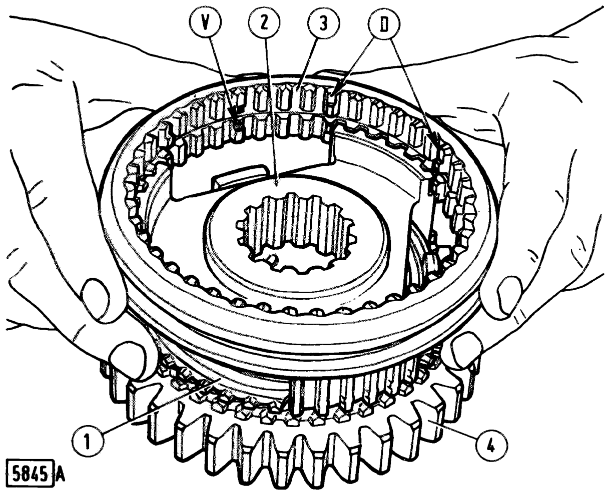
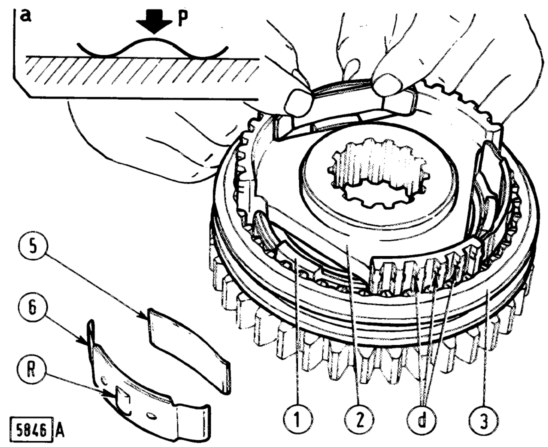


Assembling synchromesh sliding sleeve.
D. Clutch teeth - V. Shifting plate lock recess - 1. Synchrocone - 2. Synchrohub - 3. Sliding sleeve - 4. Driven gear.



Installing shifting plates (6) and retainers (5).
a. Spring inspection detail - d. Detent teeth - P = 31 to 34 N (3.2 to 3.5 kg - 7 to 8 lb.) inspection load - R. Shifting plate bulge - 1. Synchrocone - 2. Synchrohub - 3. Sliding sleeve.

INSPECTION

Inspect the seals for scoring of lip damage or permanent distortions and replace as necessary.
To check the condition of synchromesh springs (5) place a spring over a flat surface (see detail a), depress the spring in the center all along the width, applying a load (P) 31 to 34 N (3.2 to 3.5 kg - 7 to 8 lb.); the camber should be 1.4 mm (.056 in).

Ensure that shifting plates (6) are free from distortion and dents, especially on the center bulge (R).

ASSEMBLY

Refer to illustrations of page (5) for correct positioning of components and note the points hereunder.

3rd/4th synchromesh:

— place a synchrocone (1) on 3rd driven gear (4) with attached baulk ring and synchrohub (2) so that the 3 toothed sectors match the recesses in the baulk ring and the lead-in chamfer on the splines faces towards the gear;

— install sliding sleeve (3) so that the 3 toothed synchrohub sectors (2) are included in the width spanning teeth (D);

— position springs (5) on shifting plates (6) as shown and install in their recesses;

— install the 2nd synchrocone with the three front fins in register with those of the 1st synchrocone previously installed, and position the 4th driven gear;

— test synchromesh effectiveness by operating the sliding sleeve by and in both directions.

Driven shaft and gears:

— prior to driven shaft assembly, adjust the associated taper roller bearings as directed on pages 14, 15 and 16;

— position the transmission housing vertical and install from the top driven shaft (1, page 8) with attached rear bearing, subsequently installing the gears, the associated bushes and synchromesh assemblies from the inside of the housing, liberally lubricating mating parts with engine oil;

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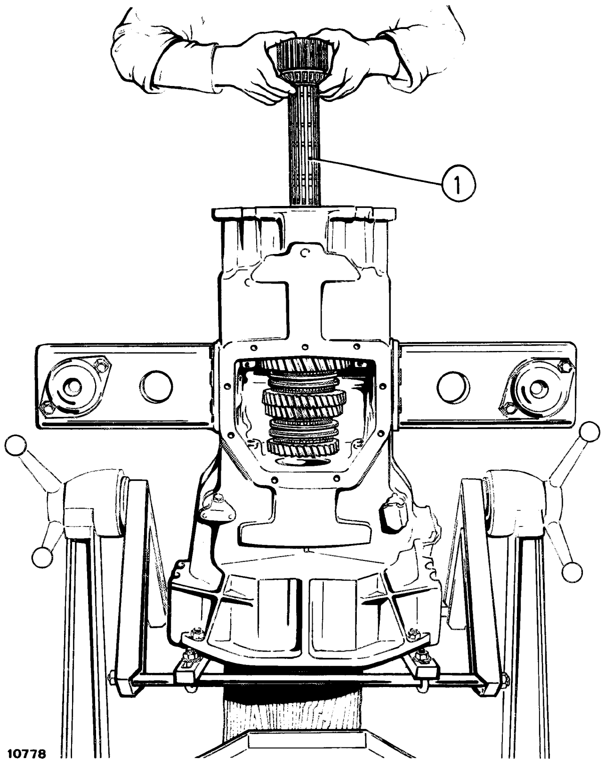
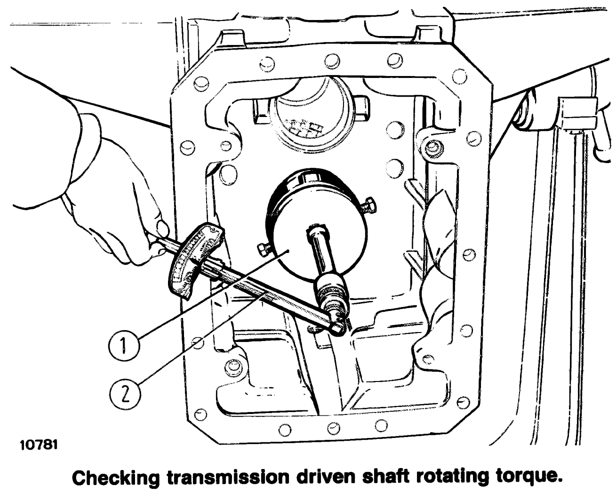


Installing transmission driven shaft with attached bearing.
1. Driven shaft.



Checking transmission driven shaft rotating torque.
1. Back-up wrench **293808** - 2. Torque wrench **293512.**

— return transmission housing horizontal and install washer (early version) and shims (S, page 5).

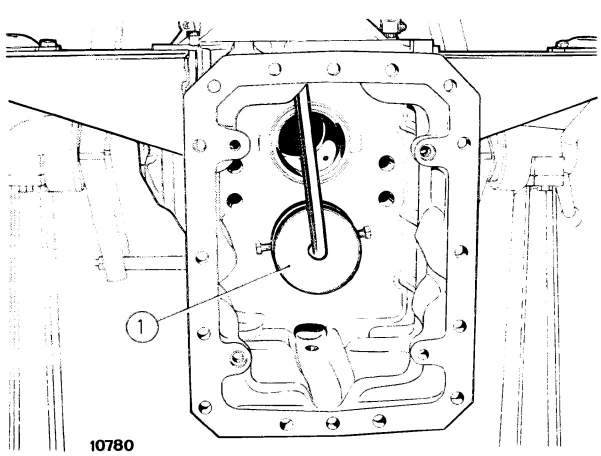
— on tractors incorporating interference fitted front bearing (1180 from frame 723772, 1280, 1380 from frame 736074, 1580 from frame 741466, 1880 from frame 745798) heat bearing cage assembly and install on shaft, together with nut (C_1, page 5);

Note: On early tractors (1180 up to frame 724987, 1280 up to frame 760107, 1380 up to frame 736335, 1580 up to frame 742021, 1880 up to frame 745965) replace hexagonal, 65 mm nut (C_1, page 5) with late hexagonal 70 mm nut.

— apply back-up wrench **293808** (1) together with offset wrench to rear end of driven shaft as shown, tighten nut (C_1, page 5) to the specified torque and stake in position;

— thoroughly clean mating surfaces on transmission housing and cover (3, page 3) and install the latter, applying one of the jointing compounds specified in section (A, page 7);

— **after installing the cover,** check driven shaft rotating torque, applying back-up wrench **293808** (1) and torque wrench **293512** (2) to the rear end of the shaft. The correct torque is .9 to 1.2 Nm (.090 to .120 kgm - .6 to .9 ft.lb.).



Tightening driven gear shaft nut.
1. Back-up wrench **293808**.

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Shifter rods and forks:

— install $1^{st}/2^{nd}$ shifter rod with associated detent balls and spring;

— install detent plunger (25, page 5) (**plunger length 32.5 mm - 1.279 in**) and install $3^{rd}/4^{th}$ shifter rod.

Drive shaft and gears:

— prior to installing drive shaft, adjust the associated taper roller bearings as directed on pages 11, 12 and 13;

— install the shaft with attached front bearing from the clutch end of the transmission housing and install the gears, spacers and shims from inside the housing;

Note: On assembly, ensure that the longer spacer is positioned between 3^{rd} and 4^{th} gears (toward clutch side) and shorter spacer between 1^{st} and 2^{nd} (splitter side).

— heat the inner races of both rear bearings and install on drive shaft with interposed thrust washers in the order shown in fig. a, page 5;

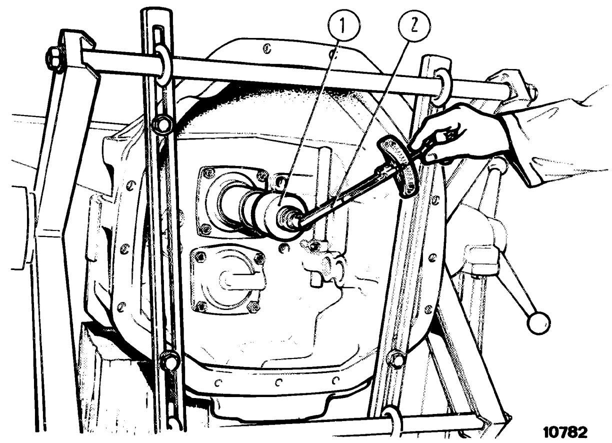
— tighten nut (C_2, page 5) to the specified torque and stake in position; thoroughly clean the contact surfaces on transmission housing and bearing cap (2, page 3) and install the latter, applying one of the jointing compounds specified in section A, page 7;

— **after installing the cover**, check drive shaft tightening torque using back-up wrench **293807** (1) and torque wrench **293512** (2) applied to the front end of the shaft; the correct torque is 1.8 to 2.5 Nm (.180 to .250 kgm - 1.3 to 1.8 ft.lb.) with the driven shaft in neutral.

Splitter and gears:

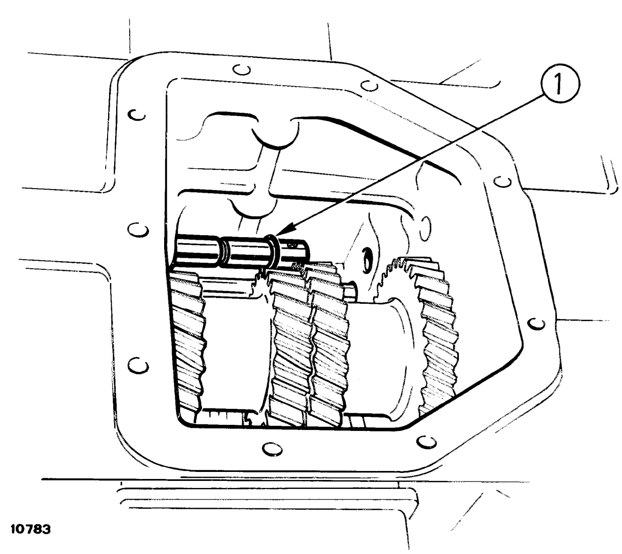
— install drive shaft (14, page 5), driven shaft (10) and low/high sliding sleeve;

— from the transmission side, install shifter rod with attached fork and without seal (1), ensuring that it is correctly positioned in the housing on the partition wall. Apply the seal to the rod from the splitter end and complete splitter assembly;



Checking transmission drive shaft rotating torque.
1. Back-up wrench **293807** - 2. Torque wrench **293512.**

— install range detent plunger (24, page 5) (**plunger length 23.8 mm - 9.7 in**) and complete the assembly sequence referring to the illustrations on page 5 for correct positioning of components, and adhering to the instructions previously given for normal and reverse horizontal shift rod installation;



Installing seal on range horizontal shifter rods.
1. Seal.

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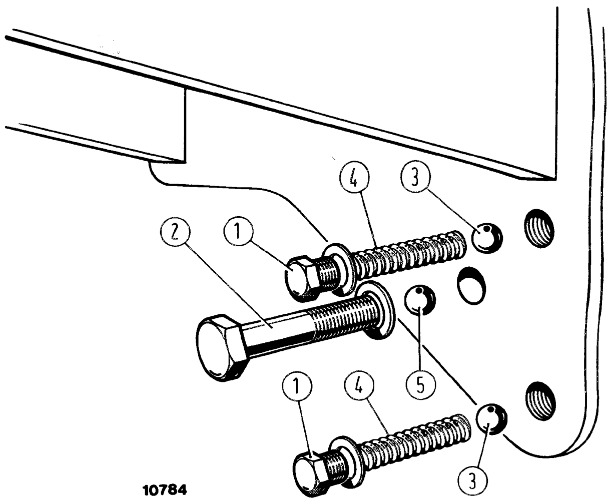


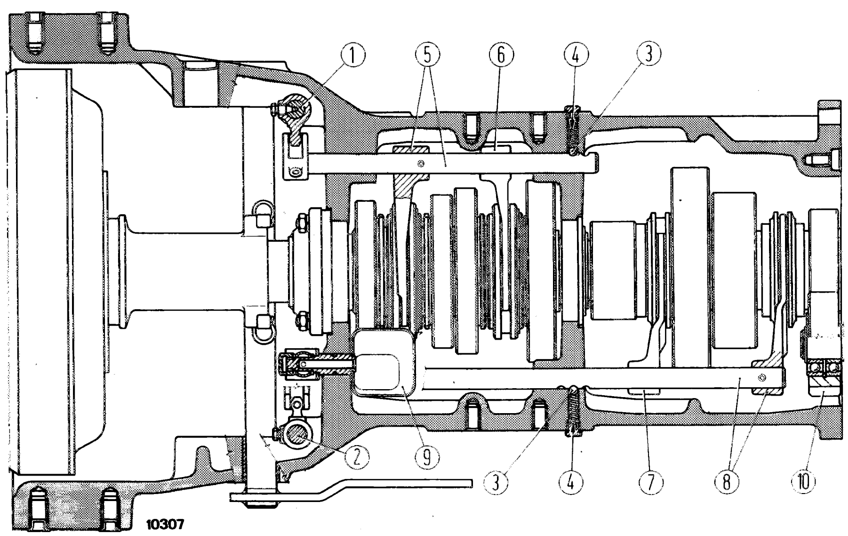
Installing splitter shifter rod detent balls and springs and gear detent ball.

1. Capscrew - 2. Capscrew - 3. Splitter shifter rod detent ball - 4. Splitter detent spring - 5. Gear detent ball.

— install forks retaining horizontal rods to vertical rod, and insert the balls and springs home in the transmission housing;

— apply two guide pins **292888** (1, page 3) to transmission housing and install rear cover with attached bearings and reverse idler gear (10);

— install well (9), transmission countershaft lube oil tubes and top cover, thoroughly cleaning the mating surfaces and applying one of the jointing compounds specified in section (A, page 7).



Plan view of transmission and splitter.

1. Vertical gear shifter rod - 2. Vertical splitter and reverse shifter rod - 3. Horizontal rod detent ball - 4. Horizontal rod detent spring - 5. 3rd/4th horizontal rod and fork - 6. 1st/2nd shifter fork - 7. Low/high shifter fork - 8. Normal/reverse horizontal rod and fork - 9. Driven shaft lube oil well - 10. Reverse idler gear.

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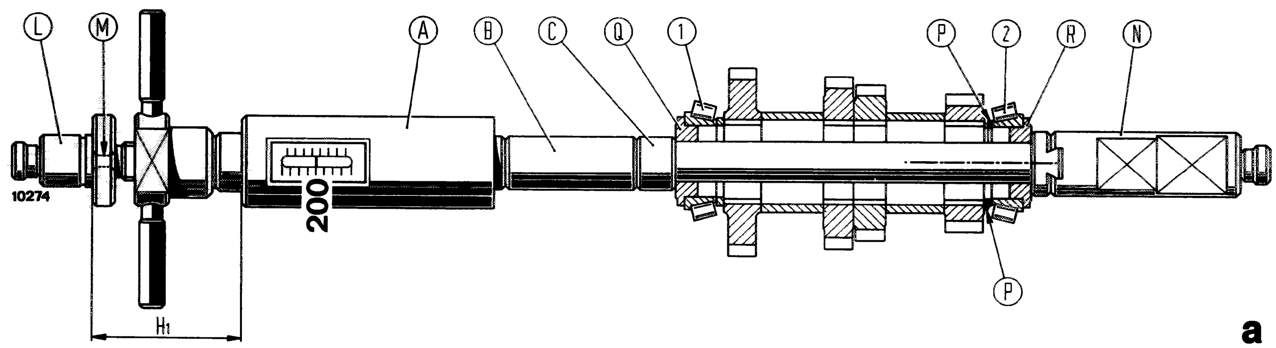
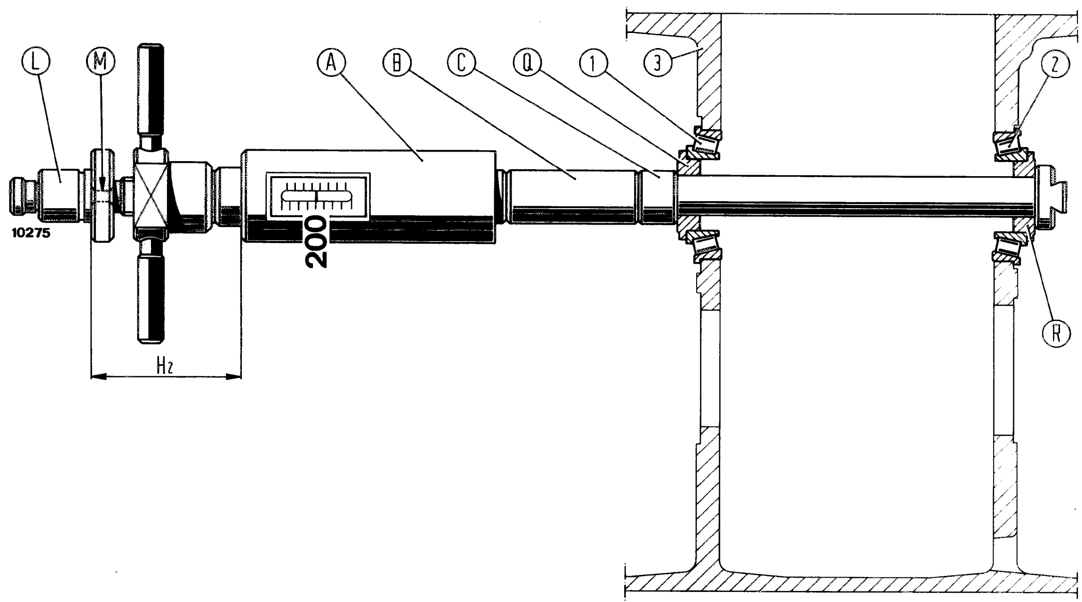


a



b

Assessing transmission drive shaft bearing shim thickness (S_1, page 5) using universal tool 293510.

Note: Upper part of fig. a is shown with early shim, lower part with late shim.

a. Dimension H_1 - b. Dimension H_2 - A. Universal tool **293510** - B. Spacer **293619** - C. Spacer **293625** - H_1/H_2. Dimensions to be measured with depth gauge - L. Register **293624** - M. Register holes - N. Adapter **293617** - P. Test shim - Q/R. Bush **293638** - 1/2. Bearing cones - 3. Transmission housing.

TRANSMISSION ADJUSTMENTS

1. Drive shaft taper roller bearing adjustment with universal tool 293510.

— Install bushes **293638** (Q and R) and spacers **293619** (B) and **293625** (C) on body of universal tool **293510** (A).

— Also install adapter **293617** (N) to provide a grip for the vice, and insert bearing cones (1 and 2), followed by provisional shim (P) to prevent interference between thrust washer (early) or gear (late) and bearing cage (2), plus the parts indicated in fig. a.

— Turn tool handwheel to bring graduated scale pointer gradually to 200 kg.

— Install register **293624** (L) positioning holes (M) in line with flats on handwheel.

— Measure the resulting dimension (H_1) using a suitable depth gauge.

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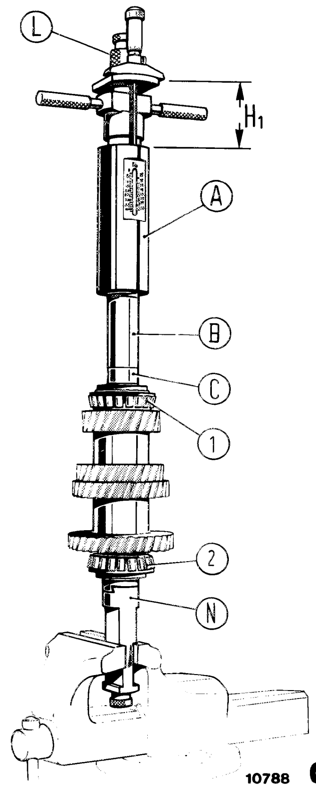
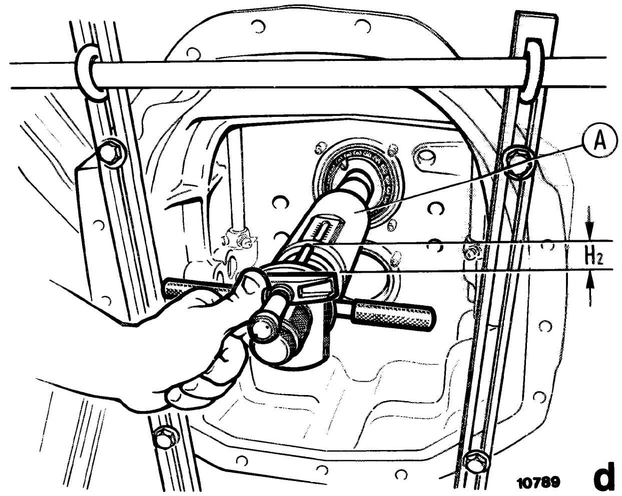


c



d

Assessing drive shaft bearing shim thickness (S_1, page 5) using universal tool 293510.

c. Dimension H_1 - d. Dimension H_2 - A. Universal tool **293510** - B. Spacer **293619** - C. Spacer **293625** - H_1/H_2. Dimensions to be measured with a depth gauge - L. Register **293624** - N. Adapter **293617** - 1/2. Bearing cones.

— Disassemble the pack, lubricate the bearings with engine oil and assemble the tool with attached bushes (Q and R) and spacers (B and C) on transmission as shown in fig. b, page 11.

— Progressively return graduated scale pointer to 200 kg, simultaneously turning the tool to settle the bearings and read dimension (H_2).

The thickness of shim (S_1, page 5) to be fitted will be given by the following:

$$S_1 = H_1 + P - H_2 + .1$$

where:

.1 mm = compensation factor to offset increase in bearing preload generated by shaft nut tightening.
If necessary, round off (S_1) to the nearest .05 mm up.

Example (early shim)

— Provisional shim thickness: P = 1.50 mm.
— Dimension read off micrometer: H_1 = 96.17 mm.
— Dimension read off micrometer: H_2 = 93.72 mm.
— Shim thickness:

S_1 = 96.17 + 1.50 − 93.72 + .1 = 4.05 mm.

2. Drive shaft taper roller bearing adjustment using tool 293803.

— Install bush (G) and spacer (F) on tool **293803** (E, page 13).

— Install bearing cones (1 and 2), a provisional shim (P) to prevent interference between thrust washer (early) or gear (late) and bearing cage (2), plus the parts shown in fig. e.

— Tighten tool nut (T) and measure dimension (H_3) using a depth gauge.

— Disassemble the pack, lubricate the bearings with engine oil and assemble tool (E) with spacer (F) and bush (G) on transmission as shown in fig. f.

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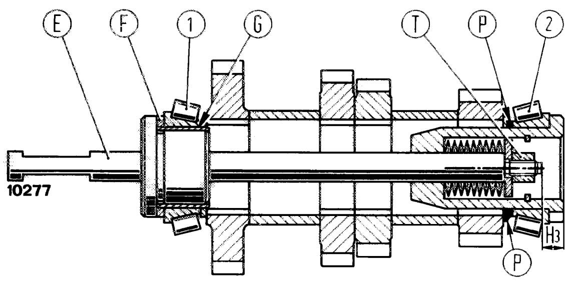
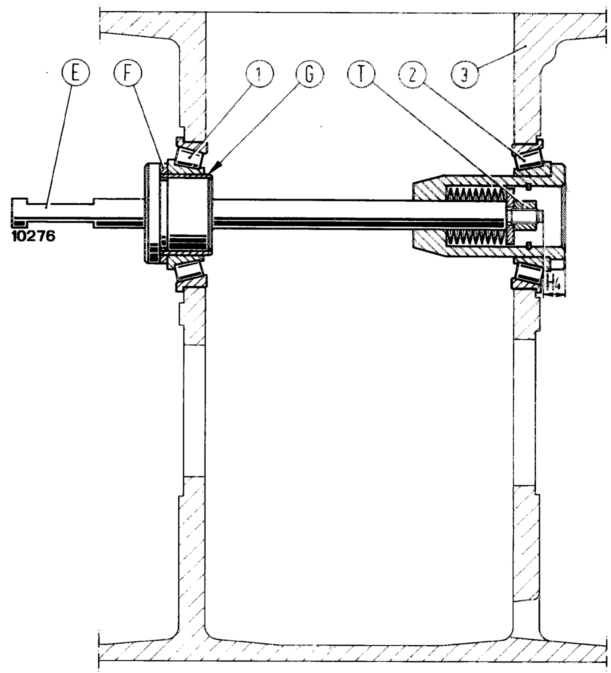


e

Assessing drive shaft bearing shim thickness (S_1, page 5) using tool 293803.

Note: The top of fig. e shows early test shim, the lower part the late test shim.

e. Dimension H_3 - f. Dimension H_4 - E. Adjuster **293803** - F. Spacer - G. Bush - H_3/H_4. Dimensions to be measured with depth gauge - P. Test shim - T. Tool nut - 1/2. Bearing cones - 3. Transmission housing.



f

— Tighten nut (T), simultaneously turning the tool to settle the bearings, and measure dimension (H_4) using a depth gauge.

The thickness of shim (S_1, page 5) to be fitted shall be given by the following:

$$S_1 = H_4 + P - H_3 + .1$$

where:

.1 mm = compensation factor to offset the increase in bearing preload generated by shaft nut tightening.
If necessary, round off (S_1) to the nearest .05 mm up.

Example (early shim)

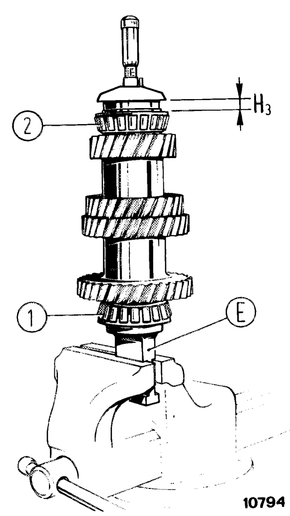
— Provisional shim thickness: P = 1.50 mm.

— Dimension read off micrometer: H_3 = 11.10 mm.

— Dimension read off micrometer: H_4 = 13.55 mm.

— Shim thickness:

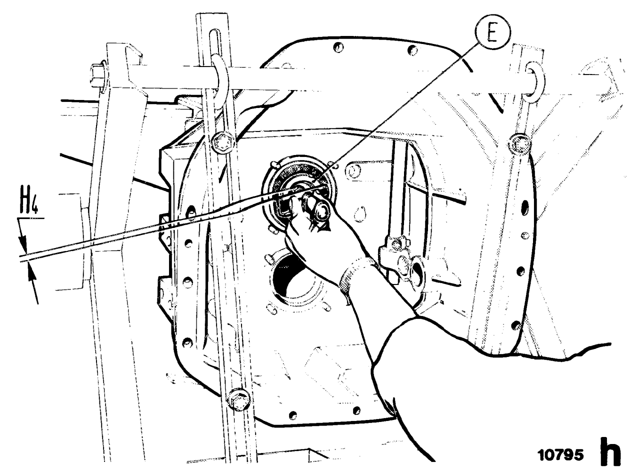
$S_1 = 13.55 + 1.50 - 11.10 + .1 = 4.05$ mm.



g

Assessing drive shaft bearing shim thickness (S_1, page 5) using tool 293803.

g. Dimension H_3 - h. Dimension H_4 - E. Adjuster **293803** - H_3/H_4. Dimensions to be measured with depth gauge - 1/2. Bearing cones.



h

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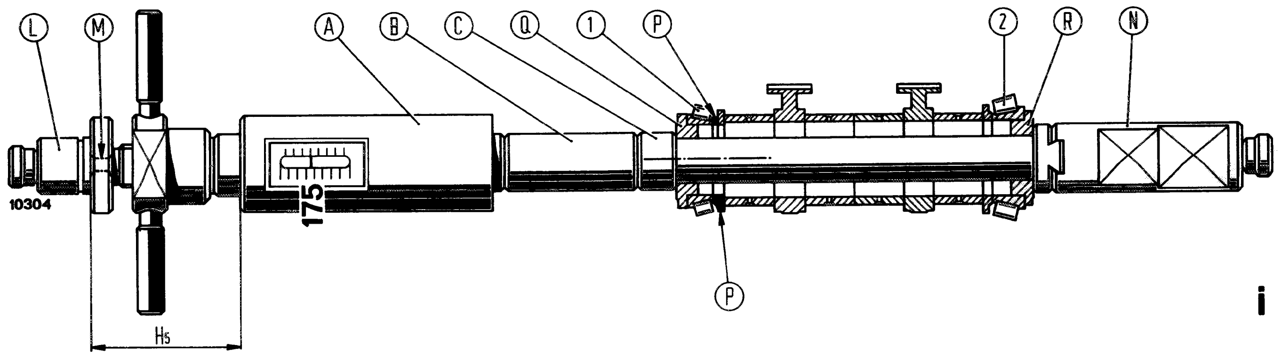
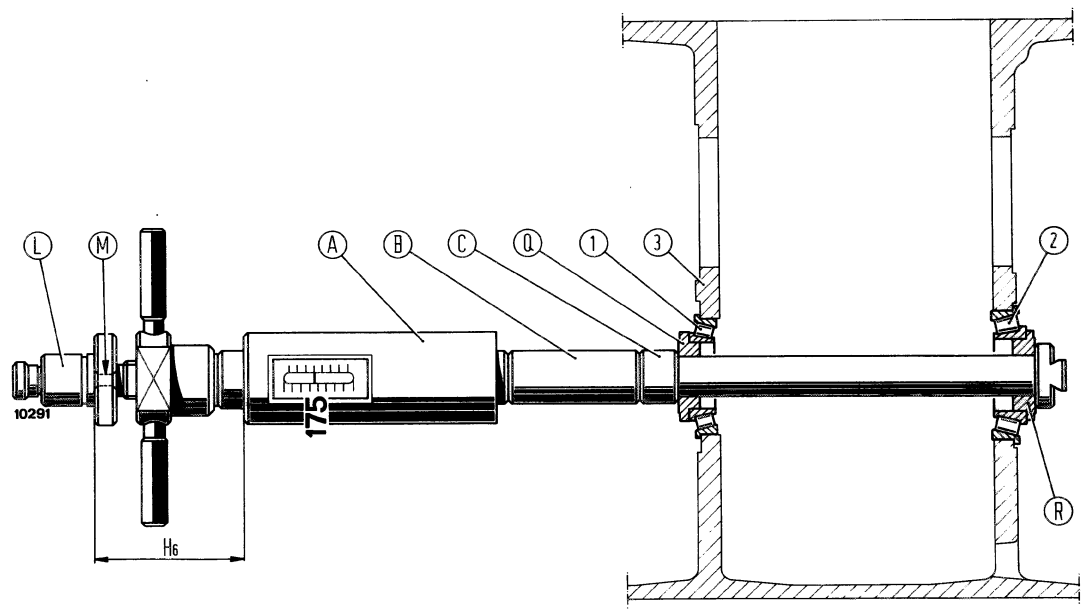


i



I

Assessing driven shaft bearing shim thickness (S, page 5) using universal tool 293510.

Note: Top of fig. i shows early test shim, bottom part shows late test shim.

i. Dimension H_5 - I. Dimension H_6 - A. Universal tool **293510** - B. Spacer **293619** - C. Spacer **293625** - H_5/H_6. Dimensions to be measured with depth gauge - L. Register **293624** - M. Register holes - N. Adapter **293617** - P. Test shim - Q. Bush **293637** - R. Bush **293638** - 1/2. Bearing cones - 3. Transmission housing.

3. Driven shaft taper roller bearing adjustment using universal tool 293510.

— Install bushes **293637** (Q) and **293638** (R) plus spacers **293619** and **293625** (C) on body of universal tool **293510** (A).

— Also install adapter **293617 (N),** to facilitate clamping in the vice, and install bearing cones (1 and 2), a provisional shim (P) to prevent interference between thrust washer (early) or spacer (late) and bearing cage (1), plus parts indicated in fig. i.

— Turn tool handwheel to bring graduated scale pointer gradually to 175 kg.

— Install register **293624** (L), positioning holes (M) in line with flats on handwheel.

— Using a suitable depth gauge, measure the resulting dimension (H_5).

— Disassemble the pack, lubricate the bearings with engine oil and install the tool with attached bushes (Q and R) and spacers (B and C) on transmission housing as shown in fig. I.

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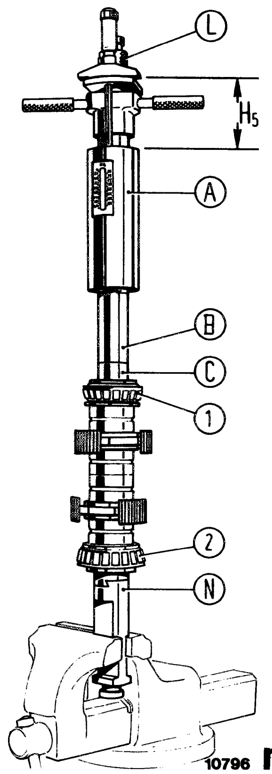
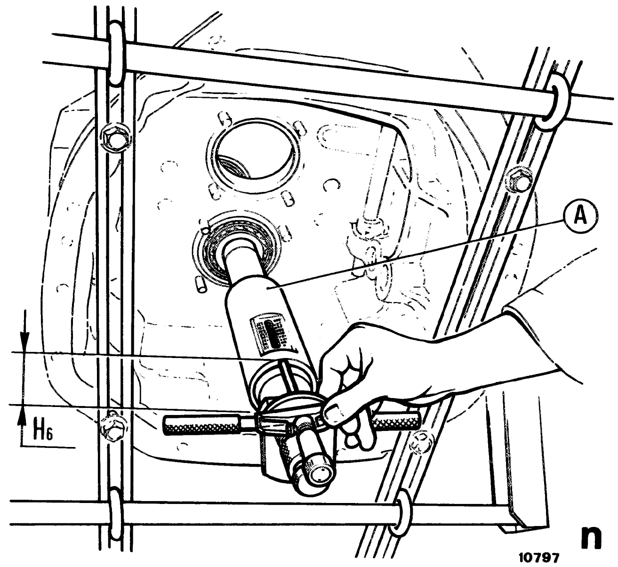
Assessing driven shaft bearing shim thickness (S, page 5) using universal tool 293510.

m. Dimensions H_5 - n. Dimension H_6 - A. Universal tool **293510** - B. Spacer **293619** - C. Spacer **293625** - H_5/H_6. Dimensions to be measured with a depth gauge - L. Register **293624** - N. Adapter **293617** - 1/2. Bearing cones.



m



n

— Progressively return graduated scale pointer to 175 kg, simultaneously turning the tool to settle the bearings, and read dimension (H_6) as directed above.

The thickness of shim (S, page 5) to be fitted will be given by the following:

$$S = H_5 + P - H_6 + .1$$

where:

.1 mm = compensation factor to offset the increase in bearing preload generated by shaft nut tightening.

If necessary, round off (S) to the nearest .5 mm up.

Example (early shim)

— Provisional shim thickness: P = 4.60 mm.
— Dimension read off micrometer: H_5 = 95.43 mm.
— Dimension read off micrometer: H_6 = 95.48 mm.
— Shim thickness:
S = 95.43 + 4.60 − 95.48 + .1 = 4.65 mm.

4. Driven shaft taper roller bearing adjustment using tool 293803.

— Install spacer (F) on tool **293803** (E, page 16); also install bearing cones (1 and 2), provisional shim (P) to prevent interference between thrust washer (early) or spacer (late) and bearing cage (1), plus the parts indicated in fig. p, page 16.

— Tighten tool nut (T) and read dimension (H_7) using a suitable depth gauge.

— Disassemble the pack, lubricate the bearings with engine oil and assemble the tool (E) with attached spacer (F) to the transmission housing as shown in fig. q, page 16.

— Tighten nut (T), simultaneously turning the tool to settle the bearings and measure dimension (H_8) using a suitable depth gauge.

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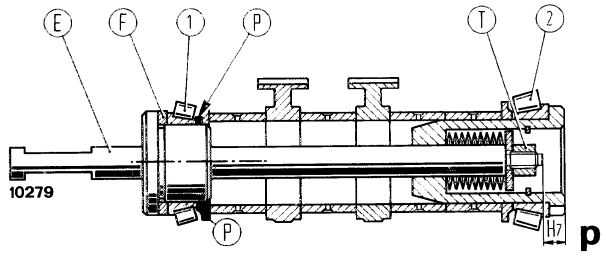
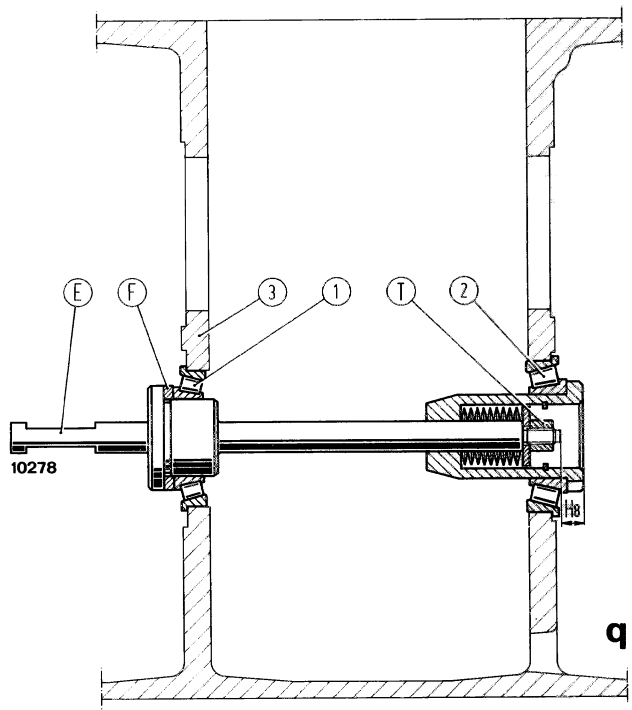


Assessing drive shaft bearing shim thickness (S, page 5) using tool 293803.

Note: The top of fig. p shows early test shim, bottom part shows late test shim.

p. Dimension H_7 - q. Dimension H_8 - E. Adjuster **293803** - F. Spacer - H_7/H_8. Dimensions to be read off depth gauge - P. Test shim - T. Tool nut - 1/2. Bearing cones - 3. Transmission housing.



The thickness of shim (S, page 5) to be fitted will be given by the following:

$$S = H_8 + P - H_7 + .1$$

where:

.1 mm = compensation factor to offset the increase in bearing preload generated by shaft nut tightening.

If necessary, round off (S) to the nearest .05 mm up.

Example (early shim)

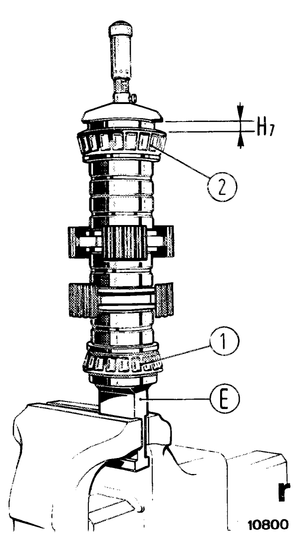
— Provisional shim thickness: P = 4.60 mm.

— Dimension read off micrometer H_7 = 11.86 mm.

— Dimension read off micrometer H_8 = 11.81 mm.

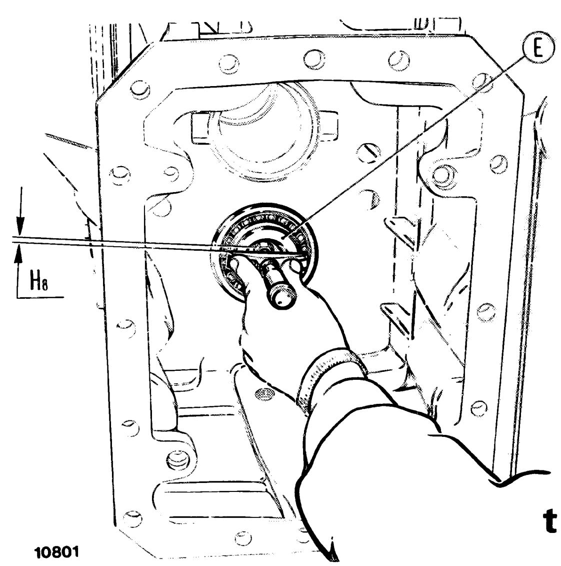
— Shim thickness:

S = 11.81 + 4.60 - 11.86 + .1 = 4.65 mm.



Assessing driven shaft bearing shim thickness (S, page 5) using tool 293803.

r. Dimension H_7 - t. Dimension H_8 - E. Adjuster **293803** - H_7/H_8. Dimensions to be read off depth gauge - 1/2. Bearing cones.



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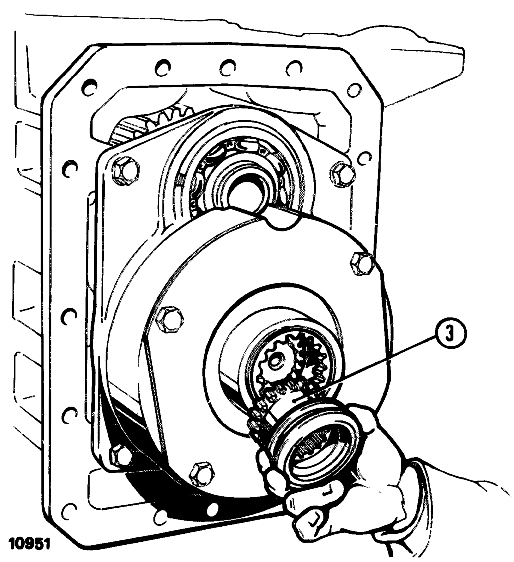
DESCRIPTION

The planetary crawler gear is fitted in-line with the splitter to provide 24 forward and 8 reverse ratios.

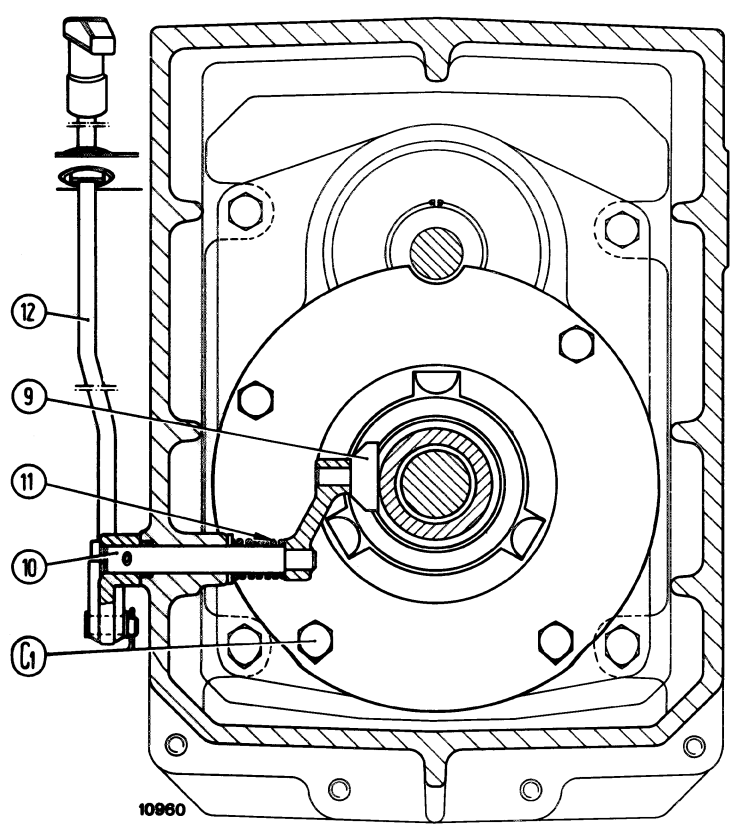
The crawler gear is controlled through a hand lever on the left of the operator.

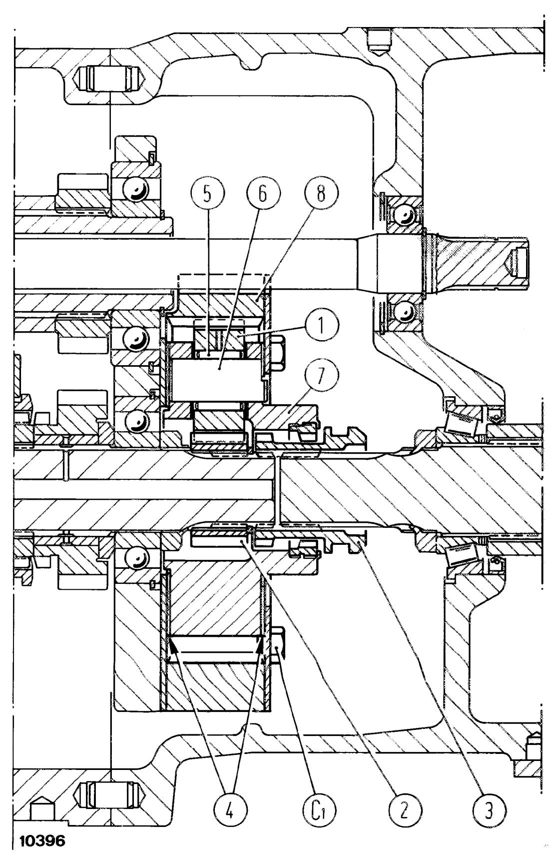
OVERHAUL

Remove sleeve (3), take off capscrews (C_1) retrieving planet wheel carrier (7), ring gear (8), thrust washers (4) and sun gear (2).



Removing (installing) crawler gear sleeve.
3. Sleeve.





Section through crawler gear.
C_1. Capscrew - 1. Planet wheel - 2. Sun gear - 3. Sleeve - 4. Thrust washers - 5. Needle roller bearings - 6. Planet shaft - 7. Planet carrier - 8. Ring gear - 9. Slipper - 10. Pin - 11. Spring - 12. Lever.

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Disassemble planet wheel carrier, removing pins (6, page 1) and retrieving planet wheels (1) and needle roller bearings (5).

Check thrust washers for wear, assemble crawler components referring to the illustration on page 1 for correct positioning, noting the following points:

— install planet wheel (1, page 1) on the bench, using **grassofiat TUTELA G9** or other approved grease to position the needle rollers in the bore of each planet wheel;

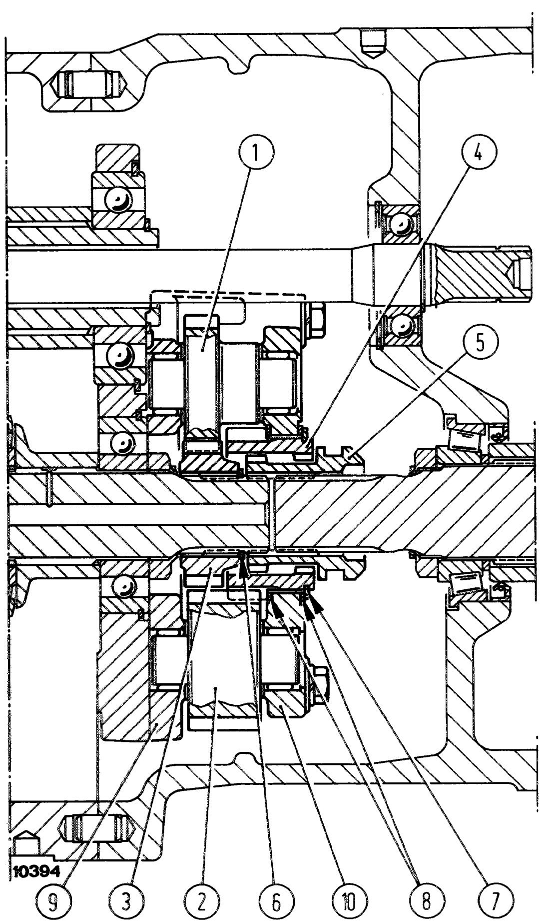
— tighten capscrews (C_1) to the torque specified in the table of page 15, section 20.

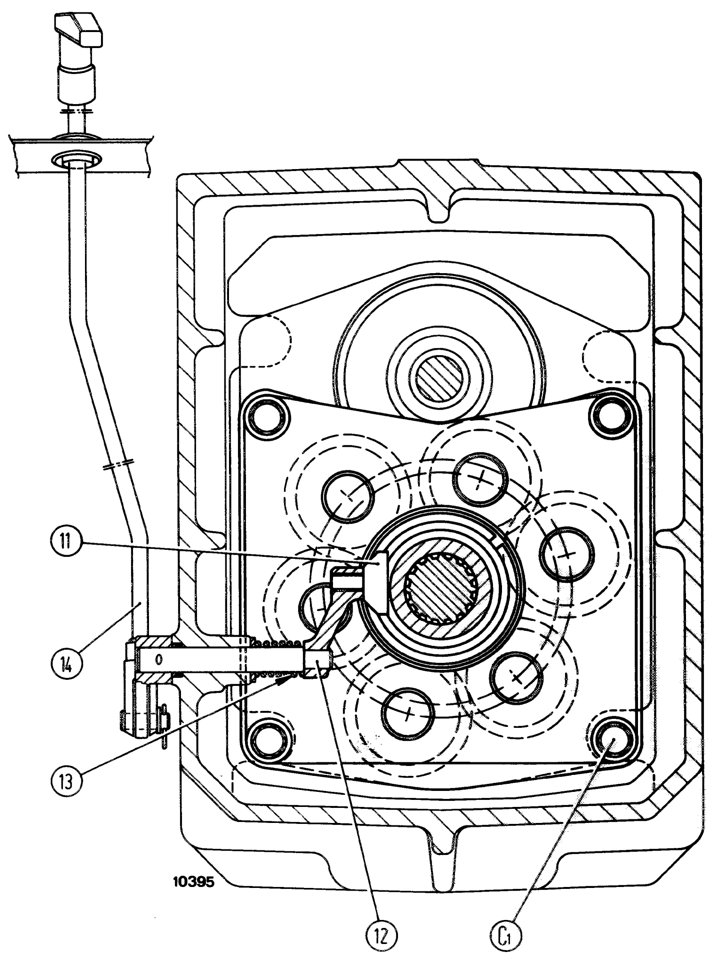
MECHANICAL REVERSER DESCRIPTION

The mechanical reverser is located in-line with the splitter (without reverse gears) to provide 12 forward and 12 reverse ratios. Reverser engagement is controlled through a hand-lever on the left of the operator.

OVERHAUL

Remove engagement sleeve (5), take off capscrews (C_1) and remove rear carrier (10) retrieving thrust rings (8) and needle rollers.





Sections through mechanical reverser.

C_1. Capscrew - 1. Reverser primary planet wheel - 2. Reverser secondary planet wheel - 3. Primary sun gear - 4. Secondary sun gear - 5. Reverser engagement sleeve - 6. Retaining ring - 7. Retaining ring - 8. Thrust ring - 9. Front carrier - 10. Rear carrier - 11. Slipper - 12. Pin - 13. Spring - 14. Lever.

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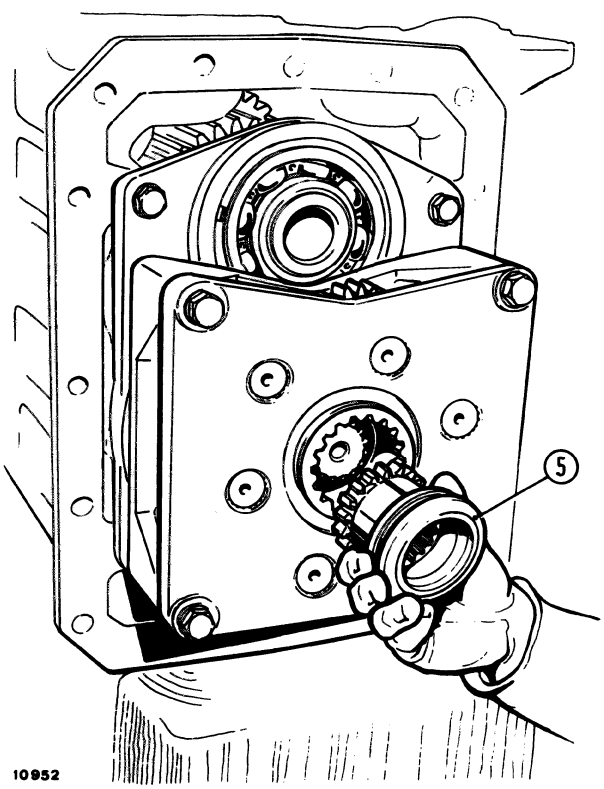
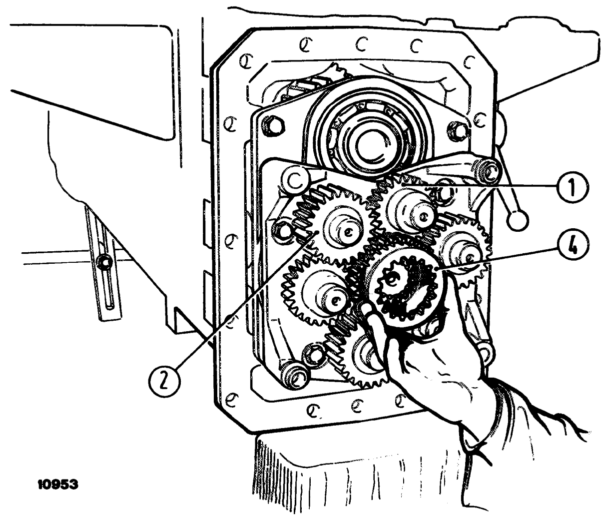


Installing (removing) reverser engagement sleeve.
5. Engagement sleeve.

Remove retaining rings (6 and 7) and take off primary sun gear (3) and secondary sun gear (4). Take off primary planet wheel (1), secondary planet wheels (2) and retrieve the needle rollers.

Check the thrust rings for wear, assemble reverser components referring to the illustrations on page 2 for correct positioning, noting the following points:



Installing (removing) secondary sun gear.
1. Primary planet wheel - 2. secondary planet wheel - 4. Secondary sun gear.

— install primary and secondary planet wheel sets on front carrier (9) using **grassofiat TUTELA G9** or other approved grease to position the needle rollers in the bore of each gear;

— install primary sun gear (3) and associated retaining ring (6);

— install rear carrier (10) with attached thrust rings (8), retaining ring (7) and secondary sun gear (4);

— tighten capscrews (C_1) to the torque specified in the table on page 15, section 20.

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REAR TRANSMISSION REMOVAL AND INSTALLATION

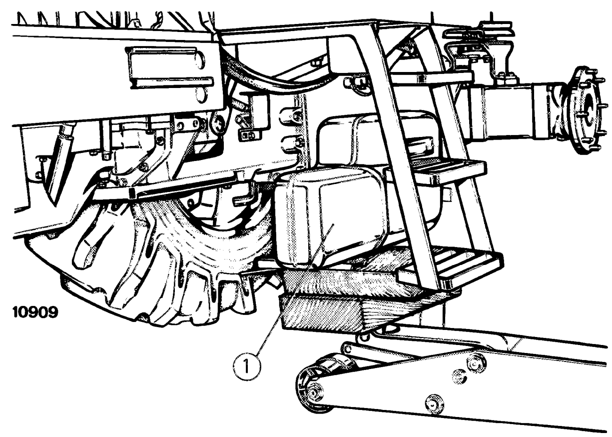
Drain the transmission and rear transmission oil, taking care not to mix the two types of oil, and proceed as follows:

Note: Rear transmission may be removed and installed with platform on or off the tractor. The procedure that follows applies to removal with platform in position. To remove the platform with or without cab, proceed as directed in the relevant sections.

— disconnect parking brake cable and indicator wiring, differential lock linkage, hydraulic PTO clutch linkage (1180 H, 1380, 1580 and 1880) or PTO engagement link (1180), sensitivity lever link and lift lever linkage;

— disconnect lift oil power lines, remote control valve oil return lines, rear transmission oil suction line and brake lines;

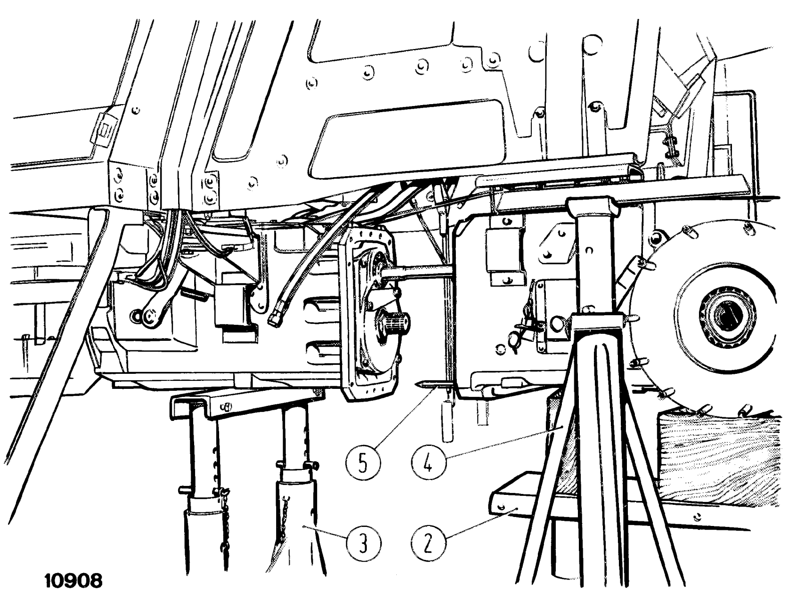
— where fitted, disconnect vent pipe lift top cover to parking brake cover, remove the lift, the PTO housing and the sensing bar support;



Removing (installing) auxiliary side tanks.
1. Auxiliary tanks.

— remove capscrews retaining platform to rubber mounts and the capscrews retaining support (to final drive housings);

— place wooden spacers between rear transmission housing and fuel tank to maintain the platform in raised position and place a hydraulic jack **293568** (2) under the rear transmission housing and a mechanical stand (3) under the transmission housing;



Removing (installing) rear transmission housing.
2. Hydraulic jack **293568** - 3. Mechanical stand - 4. Telescoping stand - 5. Guide pins **291584.**

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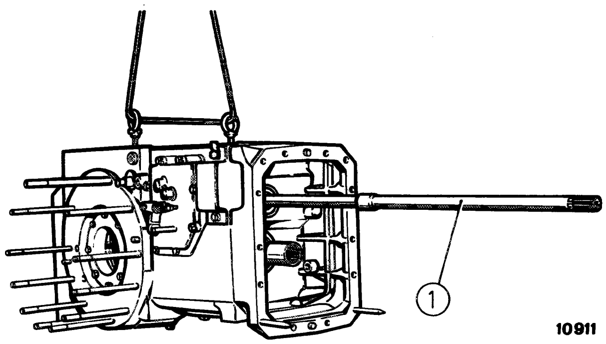
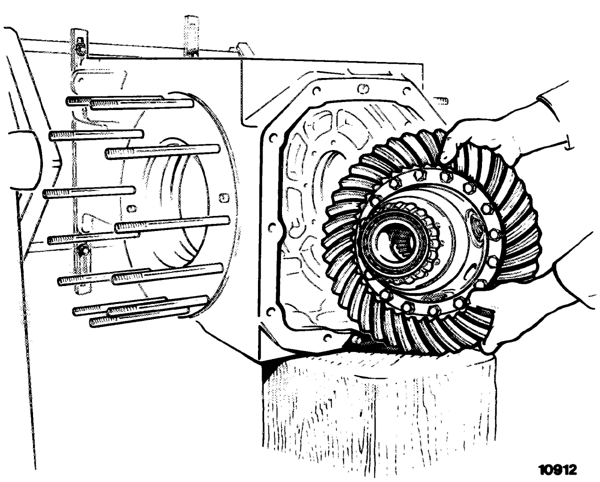


Rear transmission housing.
1. PTO clutch shaft.

— remove rear wheels, final drives, brake housings and any auxiliary fuel tanks (1, page 1) after draining the main fuel tank;

— place a pair of telescoping stands (4) under the rear platform supports and remove the wooden blocks previously inserted between rear transmission housing and fuel tank;

— remove capscrews and take off rear transmission housing slowly, taking care to prevent PTO clutch shaft distortion (1).



Removing (installing) bevel drive and differential (mechanical differential lock version).

REMOVAL AND INSTALLATION OF BEVEL DRIVE AND DIFFERENTIAL (MECHANICAL DIFFERENTIAL LOCK VERSION)

— Remove bevel drive and differential supports (1 and 2, page 11), retrieving the shims and take off the bevel drive and differential assembly from the rear of the housing.

— Disassemble the differential lock, removing support (2, page 17). Subsequently, remove roll pin and take off rod (3), retrieving spring (5) and fork (4) from inside the housing.

Disassemble the unit as follows:

— separate ring gear from differential cage, removing bolts (C_2, page 10);

— remove retaining ring (15), split sealing ring (16), differential pinion shaft (17), the pinions and side gears;

— check each component for wear and defects by comparison to the data of page 6, section 20;

— remove any damaged bearings using suitable universal pullers.

On assembly, note the following points:

— coat differential pinion thrust washers with **grassofiat TUTELA G9** or other approved grease;

— press replacement bearings home using a suitable driver after heating the inner races in oil at 80 to 90°C;

— tighten nuts (C_2, page 11) to the specified torque;

— adjust taper roller bearings as directed in the relevant section, pages 14, 15, 16 and 17;

— install and adjust differential lock as directed in the relevant section, page 17.

REMOVAL AND INSTALLATION OF BEVEL DRIVE AND DIFFERENTIAL (HYDRAULIC DIFFERENTIAL LOCK VERSION)

Proceed as follows:

— disconnect oil line to left support and remove support capscrews (1 and 2, page 19);

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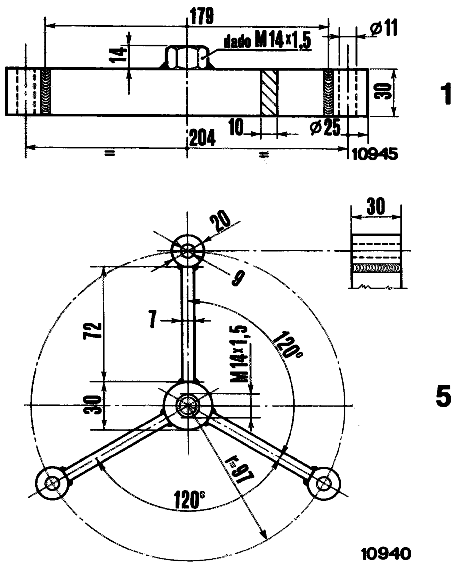
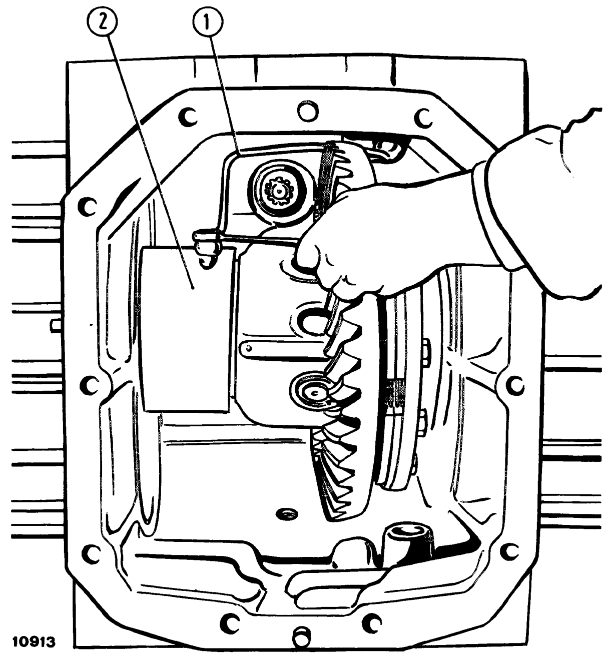


Tool for removal and installation of ring gear bearing supports (tool 1) and hydraulic differential lock piston (tool 5) (dimensions in mm).



Note: The construction of two tools to the dimensions given above will facilitate subsequent removal and installation.

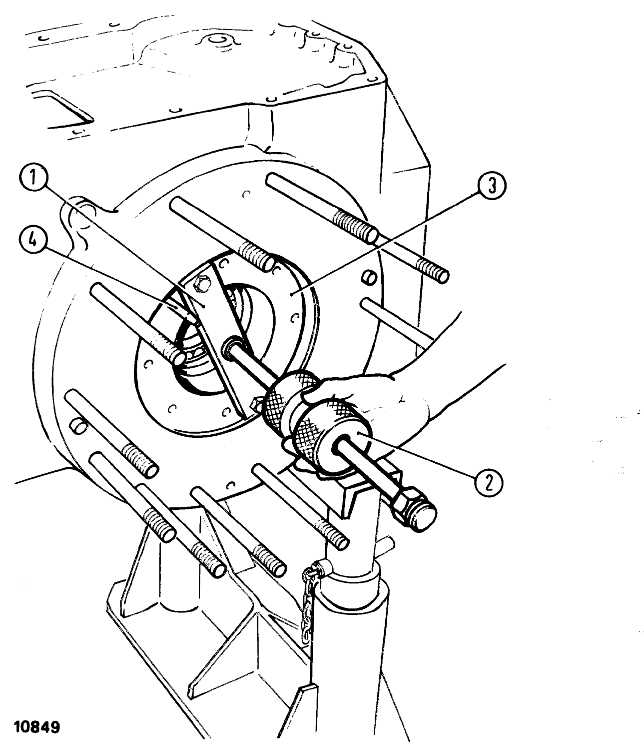
— apply 2 guides **291525** (4) to the rear transmission housing over the 2 left support holes (3) and apply tool (1) with attached slide hammer puller (2) to the left support;

— place a wooden support under the differential cage and actuate the slide hammer (2) until the support (3) is released, subsequently retrieving the shims;

— repeat the above operations to remove the right support and lift off the bevel drive and differential assembly with attached hydraulic differential lock from the rear of the housing.

Disassemble the unit as follows:

— separate the ring gear from the differential cage, removing capscrews (C_3, page 19);



Removing (installing) bevel drive and differential bearing supports (hydraulic differential lock version.

1. Tool - 2. Slide hammer puller - 3. Left support - 4. Guide **291525.**

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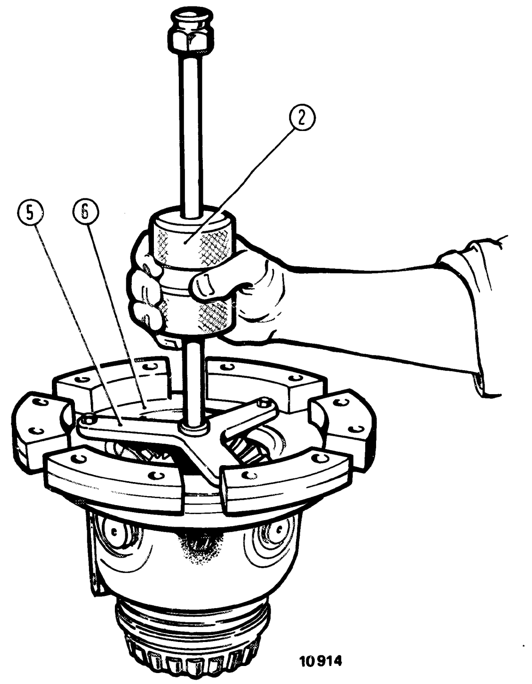


Removing (installing) hydraulic differential lock piston.
2. Slide hammer puller - 5. Tool - 6. Piston.

— remove hydraulic lock clutch drive and driven plates and inspect the driven plates for wear;

— apply tool (5, page 3) with attached slide hammer puller (2) to the three holes of piston (6) as shown and remove the piston by actuating the puller;

— remove retaining ring (15, page 19), the split sealing ring (16), differential pinion shafts (17), and the differential pinions and side gears;

— check the components for wear and inefficiency by comparison to the data of page 7, section 20;

— remove any damaged bearing, using suitable universal pullers.

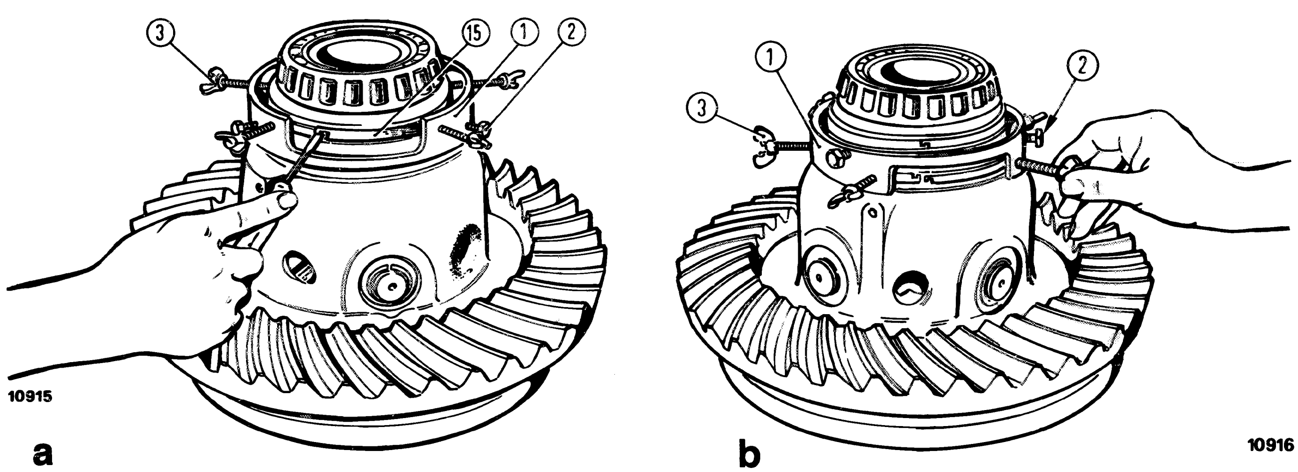
On assembly, note the following points:

— coat differential pinion thrust washers with **grassofiat TUTELA G9** or other approved grease;

— install any replacement bearings using a suitable driver, heating the bearing inner races to 80 to 90°C;

— install sealing rings on piston (6) and attach the latter to tool (5) fitted with slide hammer puller (2);

— insert the piston home in the differential cage and actuate the slide hammer puller to install, taking care to insert the clutch plates and install the ring on the differential cage, tightening capscrews (C_3, page 19) to the specified torque.



Installing differential cage sealing rings (hydraulic differential lock version).
a. Upper ring installation - b. Lower ring installation - 1. Tool **291728** - 2. Capscrew - 3. Steady screw - 15. Sealing rings.

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Check the two oil seals (15, page 4) for wear and replace as necessary, proceeding as follows:

— install upper ring (15) home in the housing;

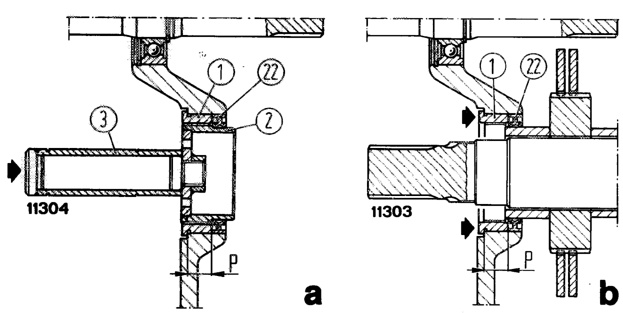
— install tool **291728** on housing as shown on page 4 and fasten using three screws (2) which must react on the center portion of the housing between ring grooves and be positioned at the same depth to permit tool centralization relative to housing;

— screw in the three screws (3) progressively and in a staggered fashion, starting from the left screw and proceeding in a clockwise direction until the ends of the ring come into contact with one another; using a small screwdriver, lock the ends as shown on page 4;

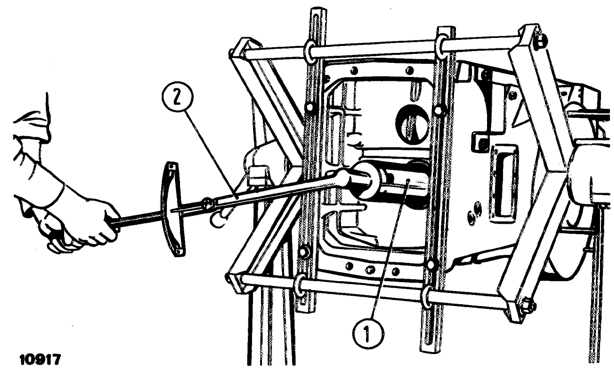
— remove the tool, install the lower ring, reinstall the tool overturned (fig. b, page 4) and repeat the operations specified for upper ring installation.

Install left ring gear support using two guides **291525**, tool (1) and slide hammer puller (2) as shown on page 3, ensuring that the internal oil port for hydraulic clutch lubrication faces upward.

Adjust the taper roller bearings as directed in the associated sections, pages 14, 15, 16 and 17.



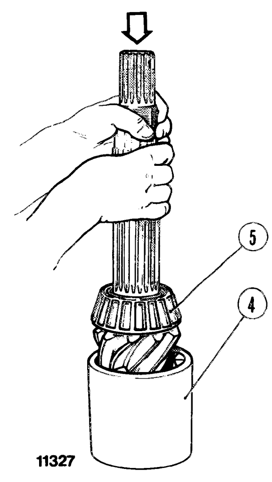
Installing seal on rear transmission housing with bevel pinion removed (fig. a) or with bevel pinion installed (fig. b).
P = 21 mm (.83 in), seal fitted dimension - 1/2. Components of tool **293810/1** - 3. Handle **293800** - 22. Seal.



Removing (installing) bevel pinion shaft.
1. Wrench **293806/1** - 2. Torque wrench.

BEVEL PINION SHAFT REMOVAL AND INSTALLATION

Where fitted, remove hydraulic differential lock control valve (D) as directed on page 18 and, on 1180H, 1380, 1580 and 1880, remove PTO hydraulic clutch as directed on page 3, section 207.



Removing rear bevel pinion bearing cone.
4. Tool **293817** - 5. Bearing cone.

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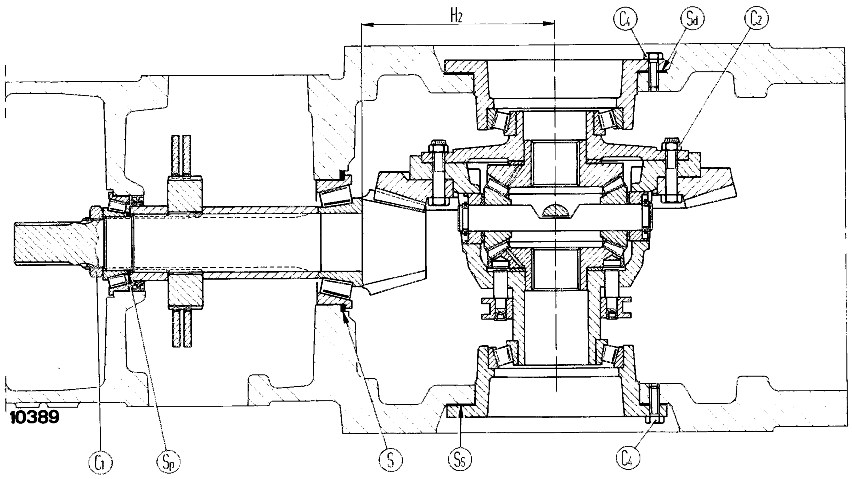
POWER TRAIN: Bevel drive and differential



Section through bevel drive.

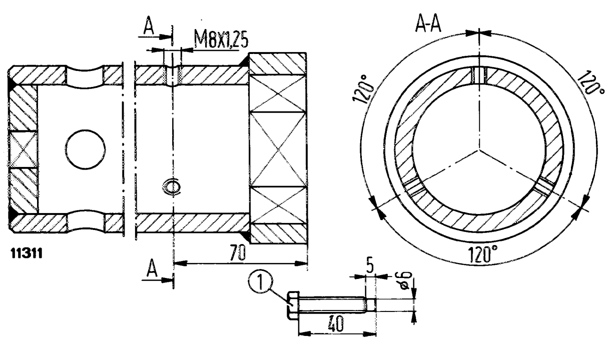
C_1. Nut - C_2. Nut - C_4. Capscrew - H_2. Ring gear centerline to back of pinion - S. Pinion position shim - Sp. Pinion shim - Sd/Ss. Differential bearing shim.

Subsequently, proceed as follows:

— remove nut (C_1) using torque wrench (2, page 5) and tubular wrench **293806/1** (1);

— remove bevel pinion shaft using a hammer and punch applied to the splined end of the shaft;

— remove bearing cups from the housing using suitable pullers and retrieving shims (S) for pinion positioning located between rear transmission housing and pinion end bearing cup;



Modifications to lock ring wrench 293806/1 for bevel drive rotating torque measurement (dimensions in mm).

1. Screws M8 × 1.25 × 40 (R50) to be machined as shown.

— install pinion shaft on tool **293817** (4, page 5) and apply a press to the splined end of the shaft until bearing cone (S) is displaced.

On assembly, note the following points:

— with bevel pinion removed, install the replacement seal (22, page 11) using punch **293810** or **293810/1** (1 and 2, fig. a, page 5) together with handle **293800** (3);

— with bevel pinion installed, press seal (22, page 11) using adapter (1, fig. b, page 5) of punch **293810/1.** In both cases, after installation ensure that dimension (P) is 21 mm;

— modify wrench **293806/1** by drilling three tapped holes as shown and using three screws (1) M8 × 1.25 × 40 (R50) modified as shown (the wrench thus modified will be used for nut (C_1) and also to measure, together with torque wrench **293512,** the bearing rotating torque);

— adjust bevel pinion position and taper roller bearings as directed in the associated sections on pages 7, 8, 9, 12, 13, 14 and 15.

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BEVEL DRIVE ADJUSTMENT

1. Bevel pinion position and shim thickness (S, page 6) using universal tool 293510.

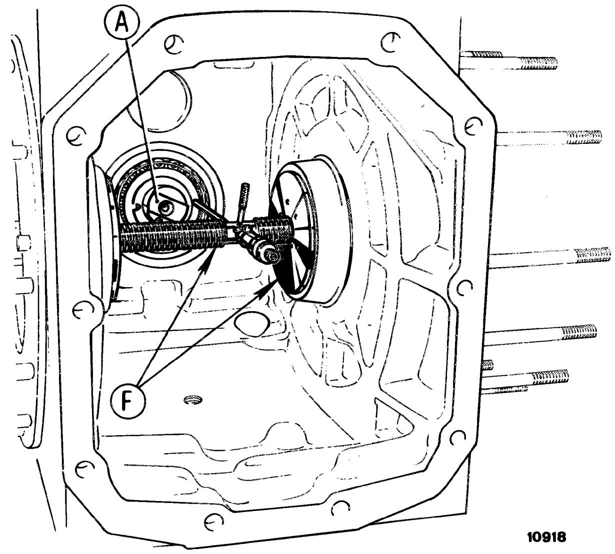
— Install universal tool **293510** (A) with attached bushes **293638** (Q) and **293634** (R) plus spacers **293619** (B) and **293625** (C) on rear transmission housing (3) with taper roller bearings (1 and 2) in position; the bearings must be lubricated with engine oil;

— turn tool handle and progressively bring the graduated scale pointer to 225 kg, simultaneously turning the tool to settle the bearings;

— install tool **293400/1** (F) on differential supports (4 and 5) with attached bearing cups (6 and 7);

— screw in or back off the two centralizer cones (11) to bring spindle (9) of micrometer (8) in contact with bevel pinion shaft bearing (2);

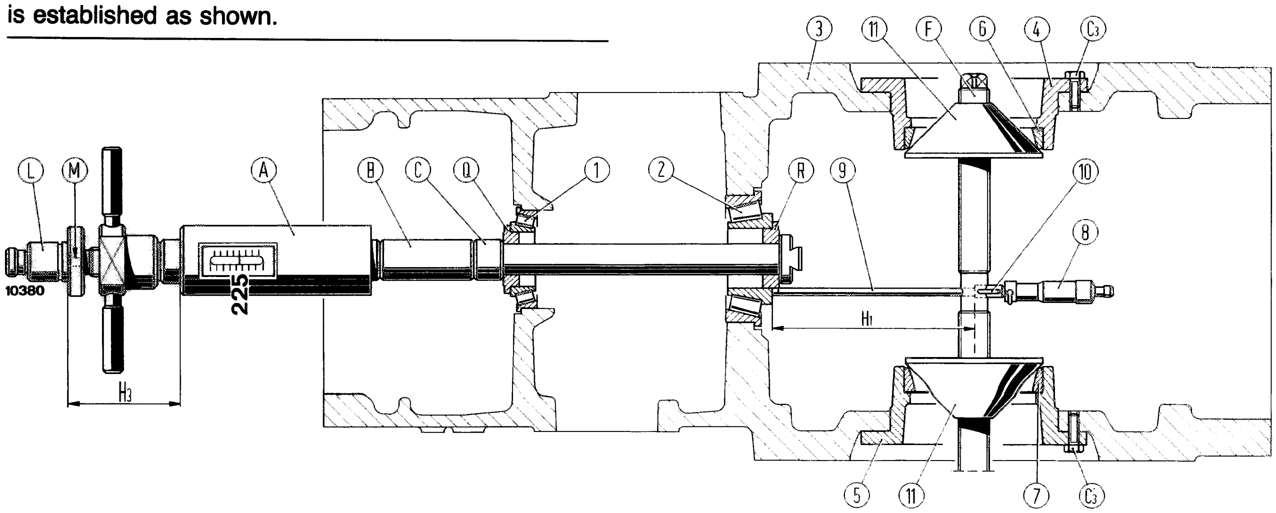
— adjust centralizer cones (11) by hand or using lock ring wrench **293446** and hand tighten the tool on bearing cups (6 and 7) to take up any end play;



Measuring bevel pinion shaft position shim thickness (S, page 6) using universal 293510 or special-purpose tool 293803.

A. Universal tool **293510** or special-purpose tool **293803** - F. Universal tool **293400/1**.

Note: On hydraulic differential lock version tractors, position one centralizer taper of tool **293400/1** (F, page 8) in left support (5) with attached bearing cup (7) and adjust the other centralizer cone using lock ring wrench **293446** until light contact with bearing cup (6) is established as shown.



Determining bevel pinion shaft position shim thickness (S, page 6) using universal tool 293510.

A. Universal tool **293510** - B. Spacer **293619** - C. Spacer **293625** - C_3. Capscrew - F. Universal tool **293400/1** - H_1. Dimension to be measured with tool - H_3. Dimension to be measured with depth gauge - L. Register **293624** - M. Register holes - Q. Bush **293638** - R. Bush **293624** - 1. Bearing cone - 2. Bearing cone - 3. Rear transmission housing - 4. Ring gear and differential support - 5. Ring gear and differential support - 6. Bearing cup - 7. Bearing cup - 8. Micrometer - 9. Micrometer spindle - 10. Retaining screw - 11. Centralizer cone.

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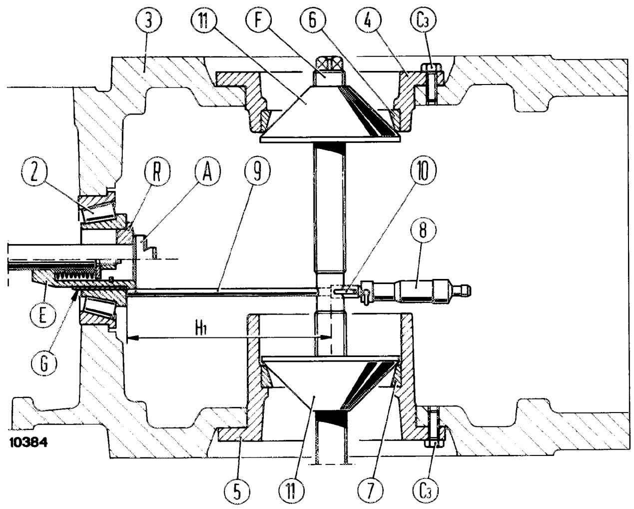


Measuring bevel pinion shaft position shim thickness (S, page 6) on hydraulic differential lock version tractors.

A. Universal tool **293510** - C_3. Capscrew - E. Special purpose tool **293803** - F. Universal tool **293400/1** - G. Bush - H_1. Dimension measured with tool - R. Bush **293634** - 2. Bearing cone - 3. Rear transmission housing - 4. Bevel drive and differential support - 5. Bevel drive and differential support - 6. Bearing cup - 7. Bearing cup - 8. Micrometer - 9. Micrometer spindle - 10. Capscrew - 11. Centralizer cone.

— move micrometer spindle (9) in contact with bearing (2) and measure dimension (H_1);

— establish the corrected nominal dimension (H_2, page 6) from ring gear centerline to back of pinion:

$$H_2 = H_7 \pm C$$

where:

H_7 = 200 mm, nominal distance from ring gear centerline to back of pinion;

C = correction factor stamped on pinion expressed in mm and preceded by + or −, if different from zero, to be added to or subtracted from nominal distance (H_7) depending on sign.

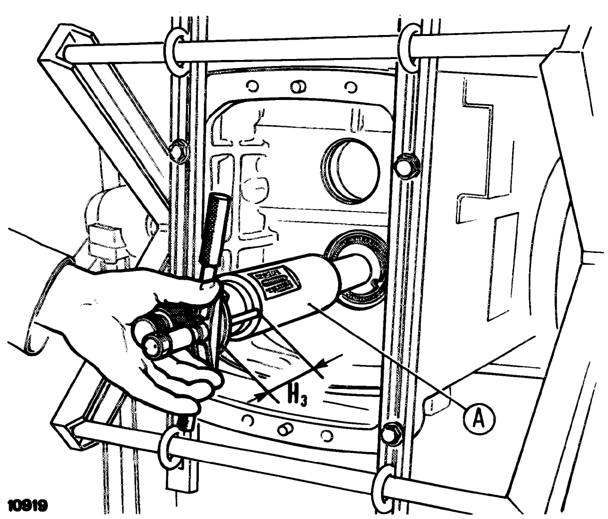
— Shim thickness (S) will be:

$$S = H_1 - H_2$$

where:

H_1 = dimension read off micrometer;

H_2 = corrected nominal distance from ring gear centerline to back of pinion.



Measuring bevel pinion bearing shim thickness (Sp, pag. 6) using universal tool 293510 (A).

H_3. Dimension to be measured with depth gauge.

Example

— Dimension read off micrometer: H_1 = 203.7 mm.

— Nominal distance from ring gear centerline to back of pinion: H_7 = 200 mm.

— Correction factor: C = + .1 mm.

— Corrected nominal dimension: H_2 = 200 + .1 = 200.1 mm.

— Shim thickness: S = 203.7 − 200.1 = 3.6 mm.

— Correction factor: C = − .1 mm.

— Corrected nominal dimension: H_2 = 200 − .1 = 199.9 mm.

— Shim thickness: S = 203.7 − 199.9 = 3.8 mm.

— Correction factor: C = 0 mm.

— Corrected nominal dimension: H_2 = H_7 = 200 mm.

— Shim thickness: S = 203.7 − 200 = 3.7 mm.

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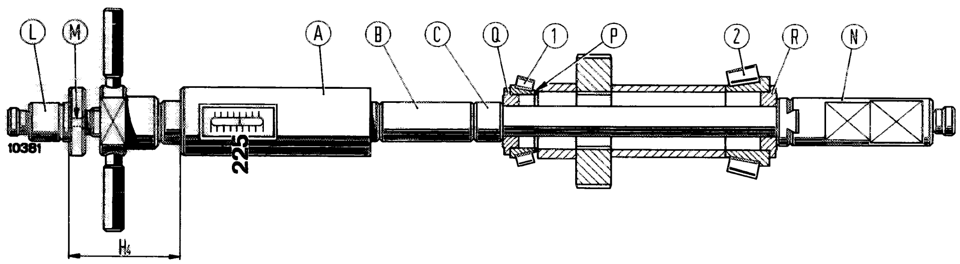
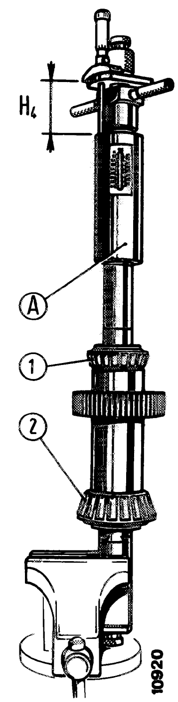


Measuring bevel pinion bearing shim thickness (Sp, page 6) using universal tool 293510.
A. Universal tool **293510** - B. Spacer **293619** - C. Spacer **293625** - H_4. Dimension to be measured with depth gauge - L. Register **293624** - M. Register holes - N. Adapter **293617** - P. Test shim - Q. Bush **293638** - R. Bush **293634** - 1. Bearing cone - 2. Bearing cone.



2. Bevel pinion bearing adjustment using universal tool 293510.

After assessing shim thickness (S, page 6) as directed above, remove universal tool **293400/1** from the rear transmission housing and proceed as follows:

— measure dimension (H_3, page 7) using a suitable depth gauge;

— remove tool **293510** (A) from rear transmission housing and reassemble on bench together with adapter **293617** (N) for clamping in the vice;

— install bushes **293638** (Q) and **293634** (R), spacers **293619** (B) and **293625** (C), bearing cones (1 and 2), a provisional shim (P) to prevent fouling between spacer, bearing cone (1) and the parts shown;

— return graduated scale pointer of tool to 225 kg and, using a depth gauge, measure dimension (H_4).

Shim thickness (Sp, page 6) to be fitted will be given by the following formula:

$$Sp = H_4 + P + S - H_3 + .05$$

where:

S = bevel pinion position shim thickness determined above;

.05 mm = correction factor for offsetting the increase in bearing preload generated upon pinion shaft nut tightening.
If necessary, round off the value of (Sp) to the nearest .05 mm up.

Example

— Bevel pinion position shim thickness determined as directed above: S = 3.8 mm.

— Dimension read off micrometer: H_3 = 89.60 mm.

— Provisional shim thickness: P = 2 mm.

— Dimension read off micrometer: H_4 = 88.60 mm.

— Shim thickness: Sp = 88.60 + 2 + 3.8 − 89.6 + .05 = 4.85 mm.

3. Bevel pinion position adjustment and shim thickness assessment (S, page 6) using special purpose tool 293803.

— Install special purpose tool **293803** (E) with attached bushes (D and G) to the rear transmission housing with taper roller bearings (1 and 2) in position and lubricated with engine oil.

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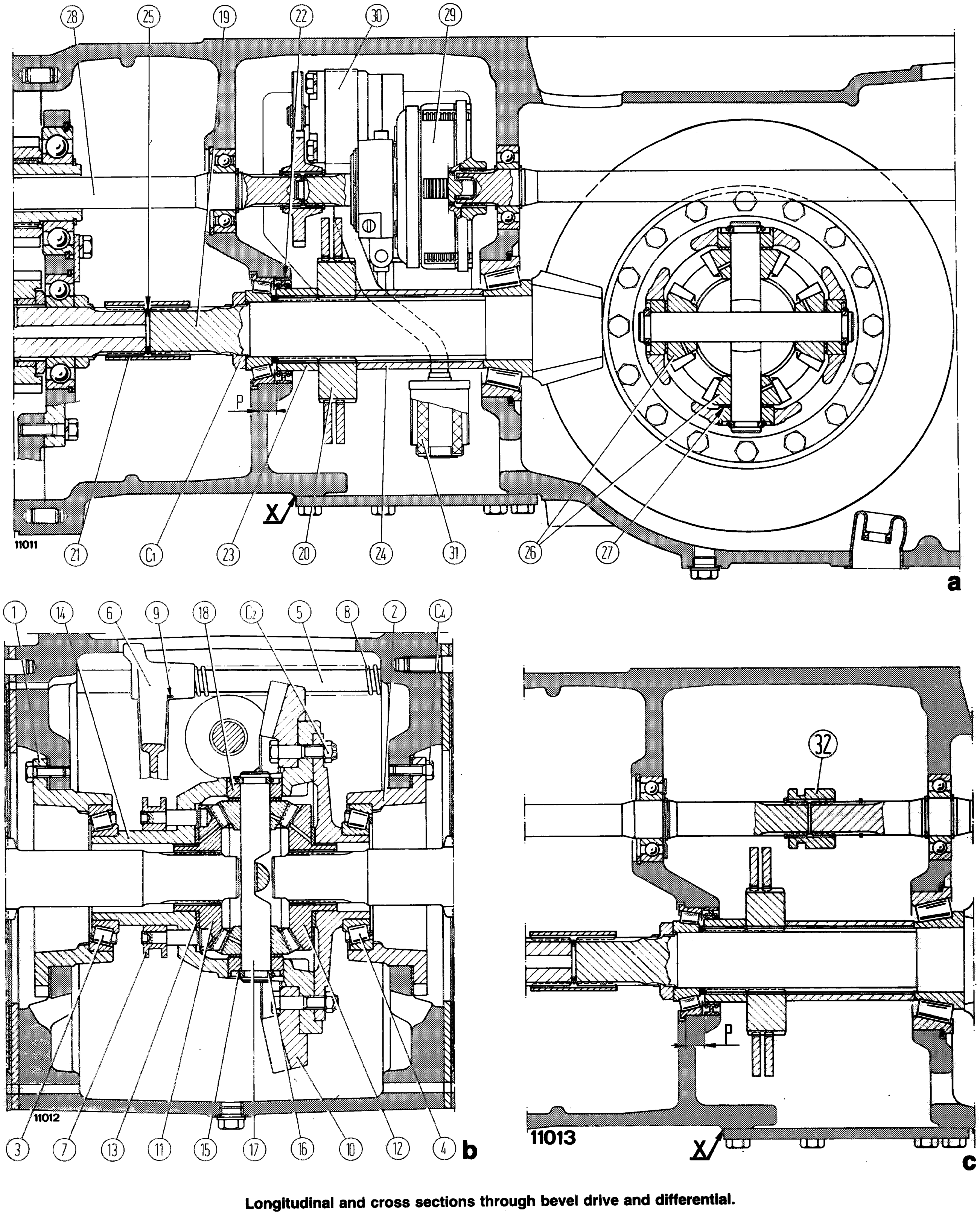

Longitudinal and cross sections through bevel drive and differential.

See caption on page 11.

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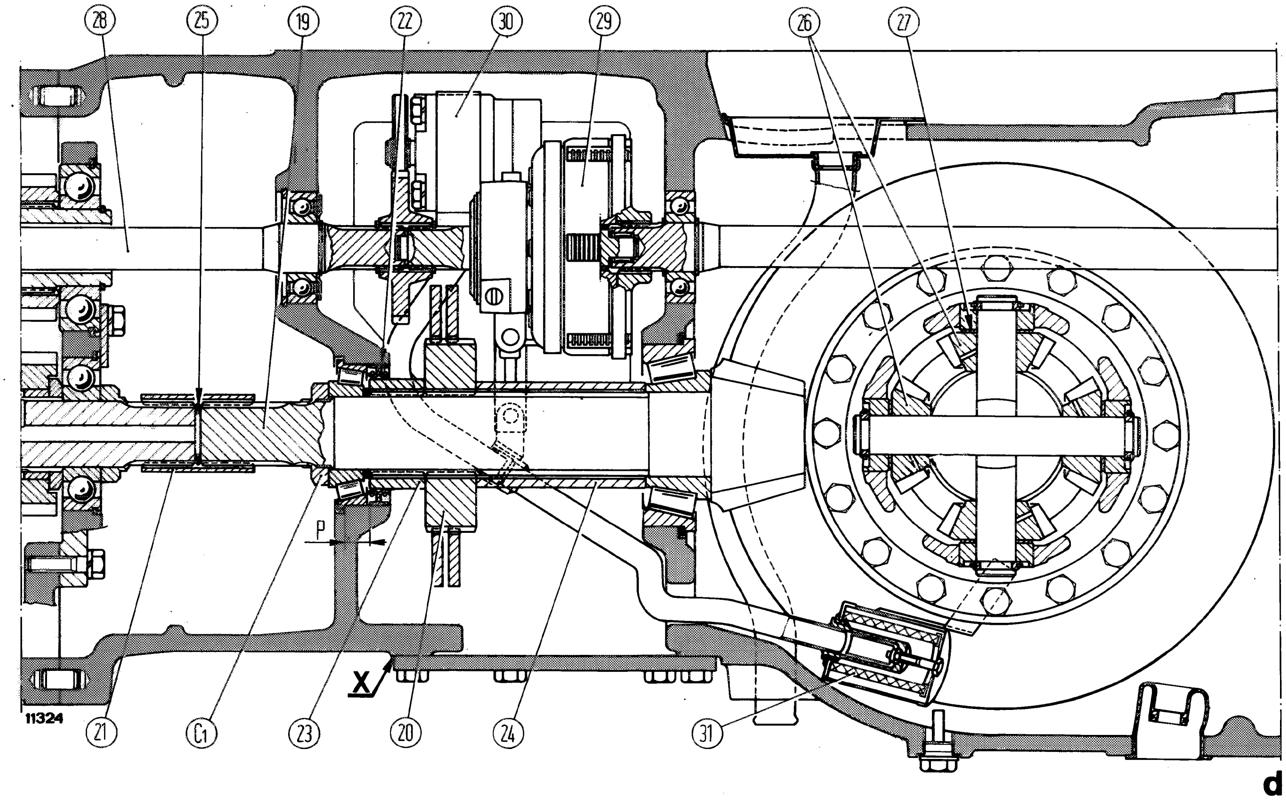

Longitudinal and cross sections through bevel drive and differential.

a, page 10. Longitudinal section (1180 H and 1380 early version) - b, page 10. Cross section (all models) - c, page 10. Longitudinal section (1180) - d. Longitudinal section (1180 H and 1380 late version and 1580 and 1880) - C_1. Nut - C_2. Nut - C_4. Capscrew - P = 21 mm seal stand-in - 1. Differential support - 2. Differential support - 3. Taper roller bearing - 4. Taper roller bearing - 5. Mechanical differential lock rod - 6. Fork - 7. Mechanical diff. lock sleeve - 8. Spring - 9. Roll pin - 10. Ring gear - 11/12. Side gears - 13. Thrust washer - 14. Differential cage - 15. Retaining ring - 16. Split sealing ring - 17. Differential pinion shaft - 18. Bush - 19. Bevel pinion shaft - 20. Parking brake hub - 21. Drive sleeve - 22. Seal - 23. Spacer - 24. Spacer - 25. Retaining ring - 26. Differential pinion - 27. Thrust washer - 28. PTO shaft - 29. PTO hydraulic clutch (1180 H, 1380, 1580 and 1880) - 30. PTO clutch hydraulic pump - 31. Filter - 32. PTO engagement sleeve (1180).

Note: On assembly, apply jointing compound to surfaces marked X adhering to the instructions given on page 7, section A.

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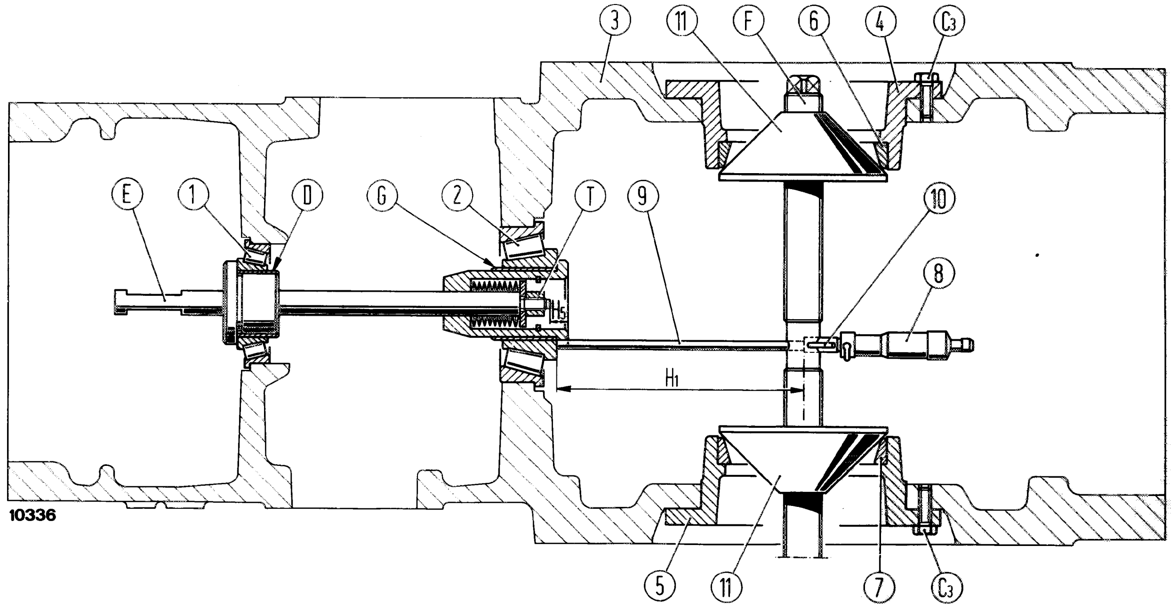

Measuring bevel pinion shaft position shim thickness (S, page 6) using special purpose tool 293803.

D. Bush - C_3. Capscrew - E. Adjuster tool **293803** - F. Universal tool **293400/1** - G. Bush - H_1. Dimension measured with tool - H_5. Dimension to be measured with depth gauge - T. Nut - 1. Bearing cone - 2. Bearing cone - 3. Rear transmission housing - 4. Differential support - 5. Differential support - 6. Bearing cup - 7. Bearing cup - 8. Micrometer - 9. Micrometer spindle - 10. Capscrew - 11. Centraliser cones.

— Tighten nut (T), simultaneously turning the tool to settle the bearings.

— Install universal tool **293400/1** (F) on differential supports (4 and 5) with bearing cups (6 and 7) in position.

— Screw in or back off the two centralizer cones (11) to return spindle (9) of micrometer (8) in contact with bevel pinion bearing (2).

— Adjust cones (11) manually or using lock ring wrench **293446** and hand tighten the tool on cups (6 and 7) to eliminate all end play.

Note: For installation of tool **293400/1** on hydraulic differential lock version tractors, see pages 7 and 8.

— Bring spindle (9) of micrometer in full contact with bearing (2) and measure dimension (H_1).

— Calculate the correct nominal dimension (H_2, page 6) from ring gear centerline to back of pinion as follows:

$$H_2 = H_7 \pm C$$

where:

H_7 = **200 mm,** nominal distance from ring gear centerline to back of pinion;

C = correction factor stamped on pinion, expressed in mm and preceded by + or − sign if different from zero, to be added to or subtracted from nominal dimension (H_7) depending on sign.

— Shim thickness (S) will be given by the following formula:

$$S = H_1 - H_2$$

where:

H_1 = dimension read off micrometer;

H_2 = corrected nominal dimension from ring gear centerline to back of pinion.

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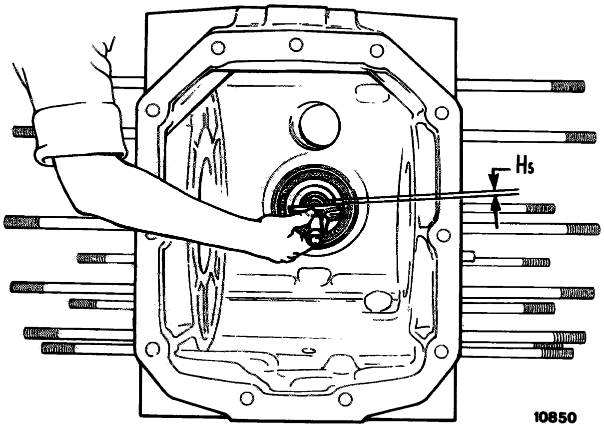
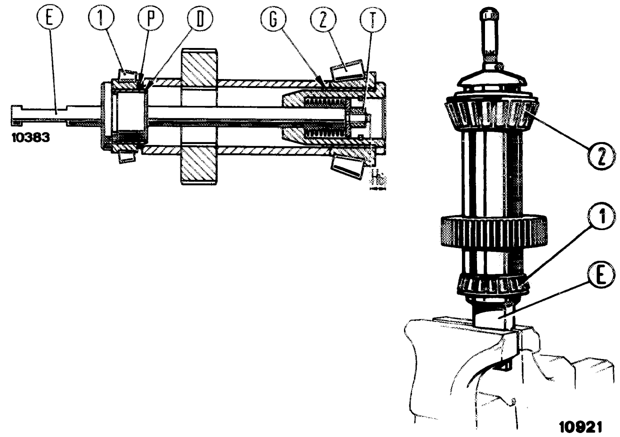


Measuring bevel pinion bearing shim thickness (Sp, page 6) using special purpose tool 293803.

H_5. Dimension to be read off depth gauge.



Measuring bevel pinion bearing shim thickness (Sp, page 6) using special purpose tool 293803.

D. Bush - E. Adjuster tool **293803** - G. Bush - H_6. Dimension to be read off depth gauge - P. Test shim - T. Nut - 1. Bearing cone - 2. Bearing cone.

Example

— Dimension read off micrometer: H_1 = 203.7 mm.

— Nominal distance from ring gear centerline to back off pinion: H_7 = 200 mm.

— Correction factor: C = + .1 mm.

— Corrected nominal dimension: H_2 = 200 + .1 = 200.1 mm.

— Shim thickness: S = 203.7 − 200.1 = 3.6 mm.

— Correction factor: C = − .1 mm.

— Corrected nominal dimension: H_2 = 200 − .1 = 199.9 mm.

— Shim thickness: S = 203.7 − 199.9 = 3.8 mm.

— Correction factor: C = 0 mm.

— Corrected nominal dimension: $H_2 = H_7$ = 200 mm.

— Shim thickness: S = 203.7 − 200 = 3.7 mm.

4. Bevel pinion bearing adjustment using special purpose tool 293803.

Following assessment of shim thickness (S, page 6) as directed above, remove universal tool **2934001/1** from rear transmission housing and proceed as follows:

— measure dimension (H_5, page 12) using a depth gauge;

— remove tool **293803** (E) from rear transmission housing and reassemble on the bench using bushes (G and D), bearing cones (1 and 2) one provisional shim (P) to prevent spacer from fouling bearing cage (1), plus the parts shown;

— tighten nut (T) on tool and measure dimension (H_6) using a depth gauge.

Shim thickness (Sp, page 6) is given by the following formula:

$$\mathbf{Sp = H_5 + S + P - H_6 + .05}$$

where:

S = pinion position shim thickness determined as directed above;

.05 mm = correction factor for offsetting the increase in bearing preload generated upon pinion shaft nut tightening.

If necessary, round off the value of (Sp) to the nearest .05 mm up.

Example

— Bevel pinion position shim thickness assessed as above: S = 3.8 mm.

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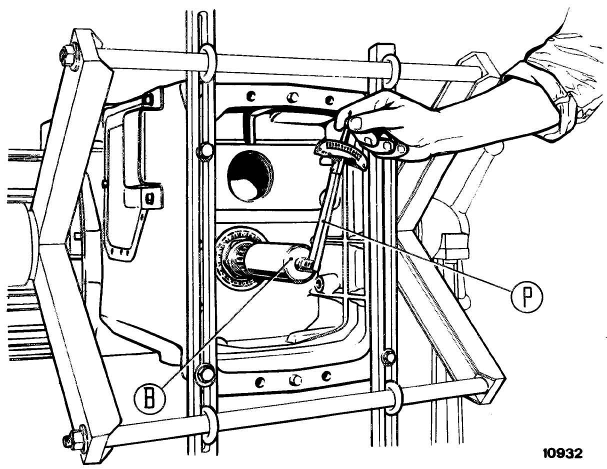


Measuring bevel pinion rotating torque.
B. Wrench **293806/1** - P. Torque wrench **293512.**

— Dimension read off micrometer: H_6 = 16.65 mm.

— Provisional shim thickness: P = 2 mm.

— Dimension read off micrometer: H_5 = 15.65 mm.

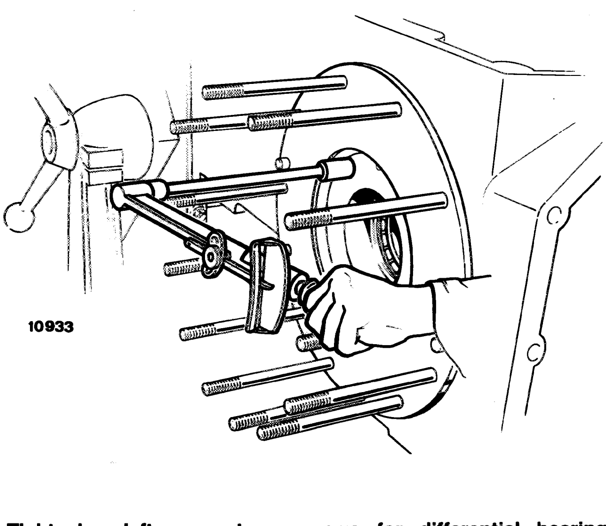
— Shim thickness:
Sp = 15.65 + 3.8 + 2 − 16.65 + .05 = 4.85 mm.

5. Differential bearing adjustment and bevel drive backlash check.

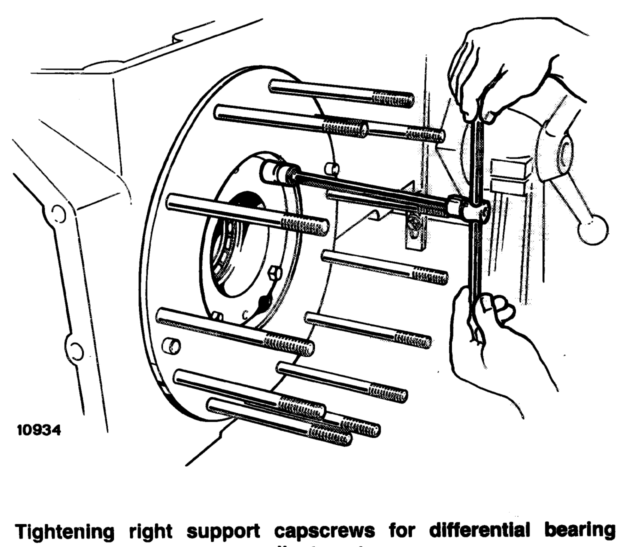
— Install bevel pinion with shims (S and Sp, page 6) and tighten nut (C_1, page 11) to 294 Nm (30 kgm - 215 ft.lb.), simultaneously turning the bevel pinion shaft to settle the bearings.

— Check bevel pinion shaft rotating torque; the correct torque is 1.25 to 2.5 Nm (.125 to .250 kgm - .9 to 1.8 ft.lb.) as measured at the end of the shaft using wrench **293806/1** (B) and torque wrench **293512** (P).

— Install the differential assembly with attached ring gear and fasten left support (1, page 15) without shims, tightening only 4 capscrews (C_4) to 61 Nm (6.2 kgm - 45 ft.lb.)



Tightening left support capscrews for differential bearing adjustment.



Tightening right support capscrews for differential bearing adjustment.

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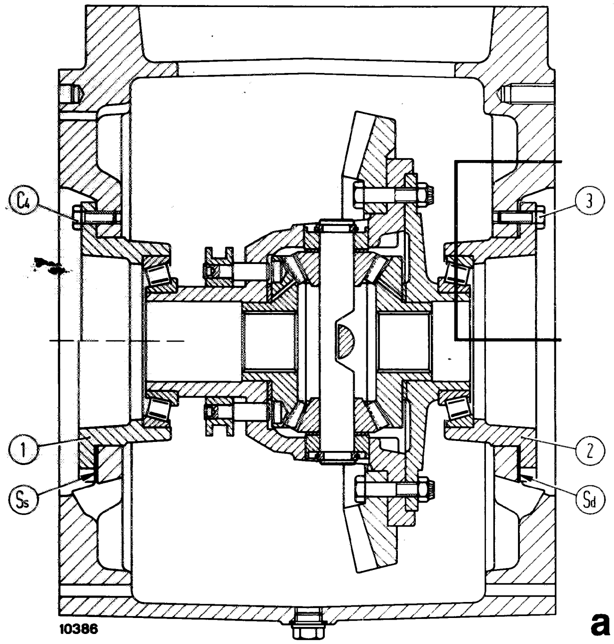

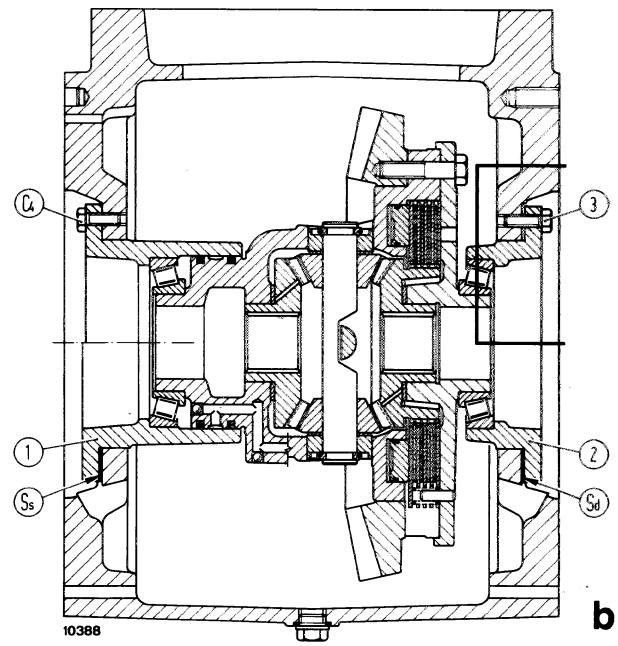

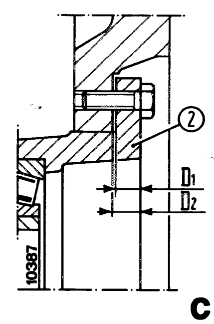

Adjusting differential bearings.

a. Mechanical differential lock version - b. Hydraulic differential lock version - c. Right differential support - C_4. Capscrew - D_1. Shim - D_2. Distance from support face to rear transmission housing boss - Sd. Final right support shim pack - Ss. Final left support shim pack - 1. Left support - 2. Right support - 3. Capscrews.

— Measure thickness (D_1) of right support flange (2) and install the support without shims using four capscrews (3) wet and staggered at 90°.

— Tighten capscrews (3) progressively and in staggered sequence, simultaneously turning the ring gear to settle the bearings, until the pinion/ring gear assembly rotating torque is 3.3 to 4.5 Nm (.330 to .450 kgm - 2.4 to 3.2 ft.lb.); measure the rotating torque at the end of the bevel pinion shaft using wrench **293806/1** (B) and torque wrench **293512** (P).

— Apply a depth gauge to the two recesses in the right support and measure dimension (D_2) from the rear transmission housing boss and calculate the arithmetic average of the two readings.

— Total shim pack (S) to be interposed between housing and right and left supports is calculated as follows:

$$S = D_2 - D_1 + .05$$

where:

.05 mm = increase needed to reduce preload on bearings generated by capscrews (3).

If necessary, round thickness (S) to the nearest .05 mm up.

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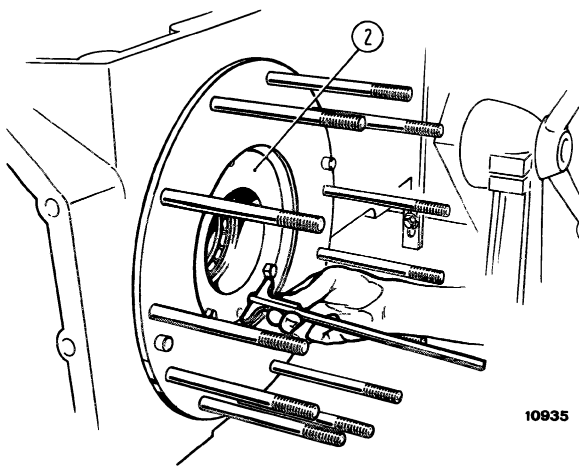
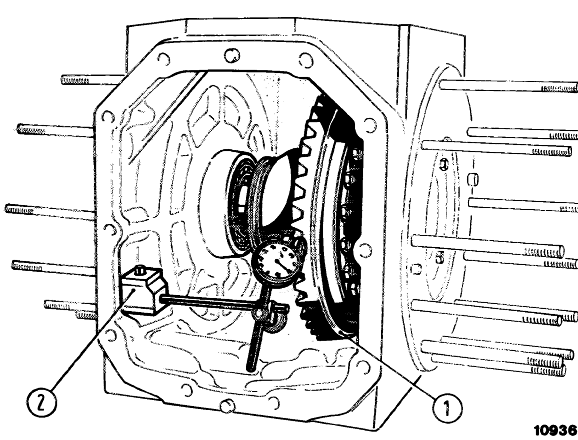


Measuring dimension (D_2) for differential bearing adjustment.
2. Right support.

— Using a suitable dial gauge, measure bevel drive backlash (G) (at three equi-spaced points, and average the three readings arithmetically).

— Normal backlash is:
- 1180 and 1380, standard bevel drive = .20 to .28 mm, average .24 mm (.0079 to .0110 in, average .0094 in);
- 1180 and 1380, high speed bevel drive and 1580 and 1880 = .25 to .33 mm, average .29 mm (.0098 to .0130 in, average .0114 in).



Checking bevel drive backlash.
1. Ring gear - 2. Dial gauge.

— To offset any lower or higher deviations from the specified clearance, consider than the average ratio of normal backlash to the equivalent ring gear endwise displacement is 1 to 1.4.

Thus, axial displacement (z) corresponding to the shim pack to be inserted on left support, is: **Z = (G − .24)** × **1.4** (1180 and 1380, standard bevel drive)

or

Z = (G − .29) × **1.4** (1180 and 1380, high speed bevel drive and 1580 and 1880)

— Shim packs (Sd and Ss) to be inserted on right and left supports are calculated as follows:

Sd = S − Z

Ss = Z

where:

S = total shim thickness.
Z = ring gear endwise displacement as assessed above.

— Install the shim packs on the associated supports and check pinion/ring gear assembly rotating torque and bevel drive backlash as directed above.

Example (1580)

— Bevel pinion shaft rotating torque = 2.0 Nm (.2 kgm).

— Right support flange thickness (D_1) = 14.05 mm.

— Pinion/ring gear rotating torque = 3.7 Nm (.37 kgm).

— Distance (D_2) from right support to rear transmission housing boss: 14.90 mm; 14.70 mm.

— D_2 = average $= \dfrac{14.90 + 14.70}{2} =$ **14.80 mm.**

— Total shim thickness: S = 14.80 − 14.05 + .05 = .80 mm.

— Bevel drive backlash reading: .43 mm; .45 mm; .41 mm.

— G = average $= \dfrac{.43 + .45 + .41}{3} =$ .43 mm.

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— Endwise displacement (Z) equivalent to shim pack to be installed on left support: Z = (.43 − .29) × 1.4 ≅ .20 mm approx.

— Shim thickness for right support Sd = .80 − .20 = .60 mm.
Shim thickness for left support Ss = .20 mm.

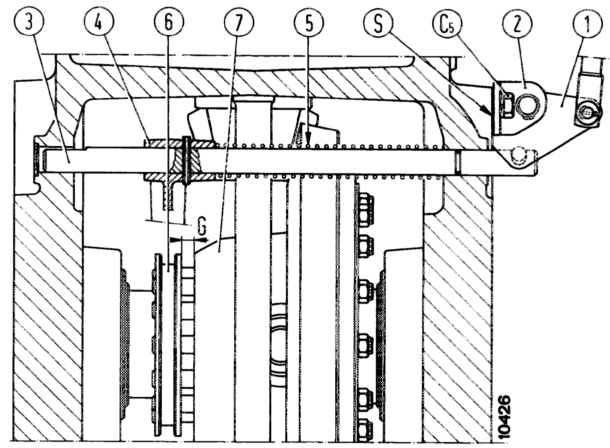
MECHANICAL DIFFERENTIAL LOCK ASSEMBLY AND ADJUSTMENT

— Install differential lock components using tool **291477** to compress return spring (5) and to permit insertion of roll pin retaining fork (4) to rod.

— Install bevel drive and differential assembly on the associated supports.

— Check the clearance between sleeve (6) and differential cage (7); the correct clearance (G) is 10.5 mm (.41 in).

— To adjust, alter thickness of shims (S) between support (2) and rear transmission housing.

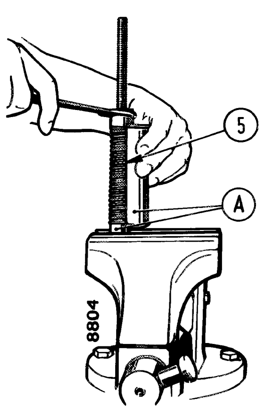


Adjusting mechanical differential lock sleeve.

C_5. Capscrew - G = 10.5 mm (.41 in) sleeve clearance relative to differential cage - S. Sleeve position shim - 1. Control lever - 2. Lever support - 3. Fork rod - 4. Fork - 5. Spring - 6. Sleeve - 7. Differential cage.

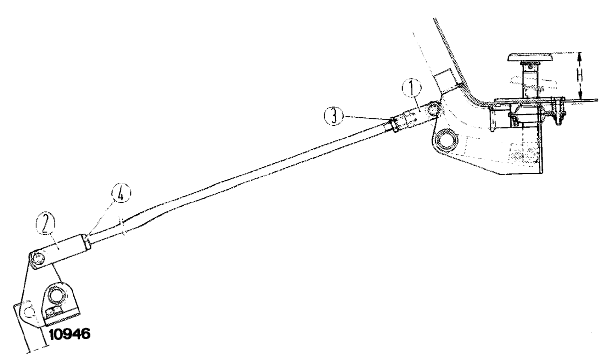
Mechanical differential lock control pedal adjustment.

Pedal distance (H, page 17) from platform must be approx. 59 mm (2.32 in) for cabless tractors, and approx. 83.5 mm (3.29 in) for tractors with cab; this in order to secure differential lock sleeve engagement.
To obtain this distance, adjust fork (1) or opposite fork (2) and lock with locknut (3 or 4).



Assembling mechanical differential lock.

A. Tool **291477** - 5. Spring.



Adjusting mechanical differential lock control pedal.

H = 59 mm (2.32 in) (cabless tractors) or 83.5 mm (3.29 in) (tractors with cab): pedal distance from platform - 1. Fork - 2. Fork - 3. Locknut - 4. Locknut.

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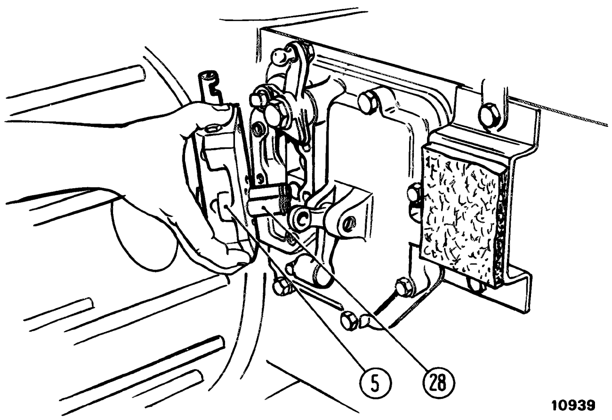
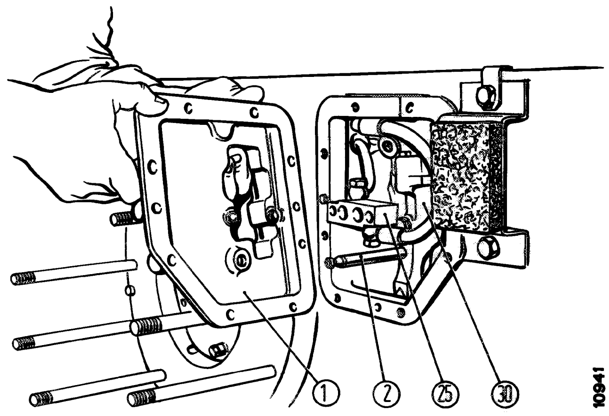


Removing (installing) hydraulic differential lock control valve.
5. Control valve - 28. Oil lines.



Removing (installing) rear transmission side cover.
1. Side cover - 2. PTO hydraulic clutch spool - 25. Pipe support - 30. PTO hydraulic clutch.

HYDRAULIC DIFFERENTIAL LOCK (standard on 1180 H and optional on 1380, 1580 and 1880)

REMOVAL AND INSTALLATION

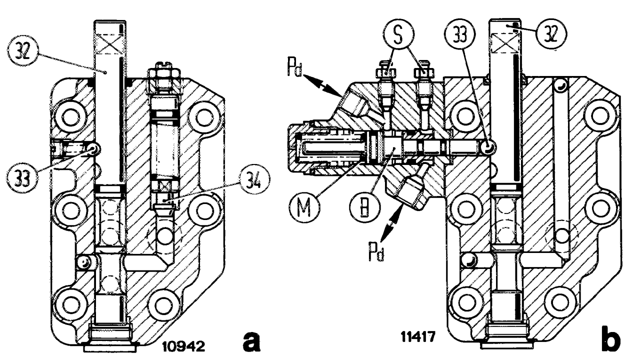
Remove the bevel drive assembly as directed on pages 2, 3, 4, 5 and 6. Moreover:

— remove capscrews (6, page 19) and hydraulic differential lock control valve (5);

— take off roll pin (7), remove pin (8) and PTO clutch lever (9);

— take off rear transmission side cover capscrews and lift off the cover;

— disconnect the lines from the associated connectors (rigid pipe from differential bearing left support and one flexible pipe from early flow divider valve or two flexible pipes from late pressure regulating valve) and remove support (25).



Section through differential lock control valve.
a. Early version - b. Late version - B. Piston - M. Piston spring - Pd. Connections - S. Bleed screw - 32. Spool - 33. Spool detent bowl - 34. Relief valve (set to 24.5 bar, 25 kg/cm² - 355 psi).

Note: When overhauling late control valve (b), fill recess in cylinder containing spring (M) with **grassofiat TUTELA G9** or other approved grease.

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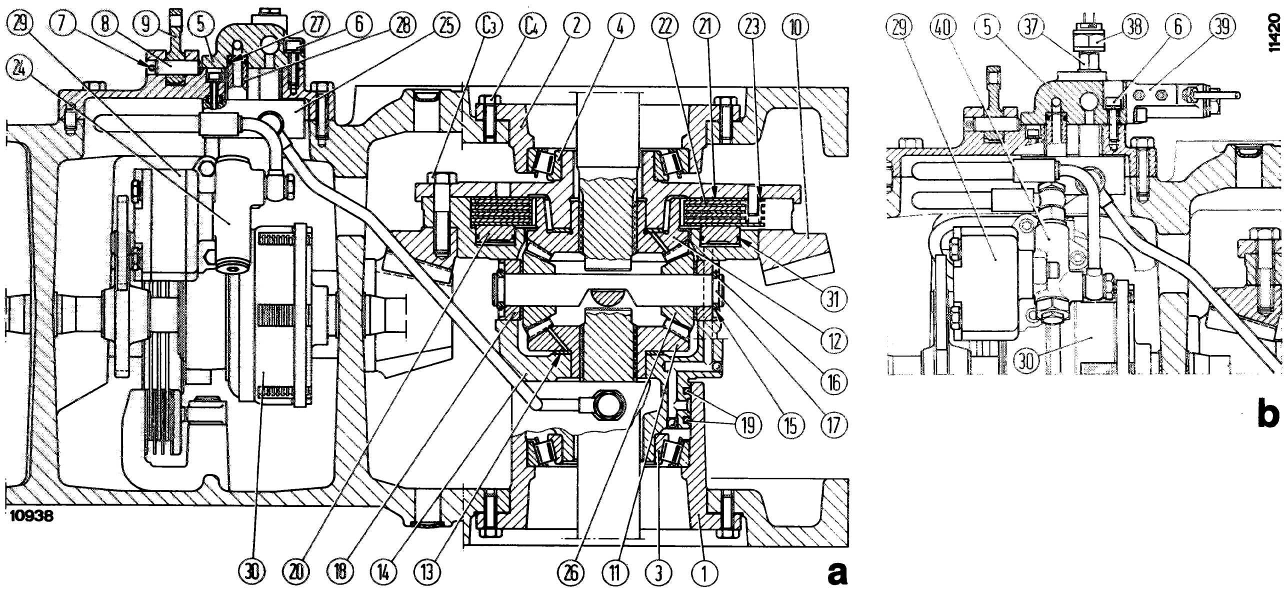


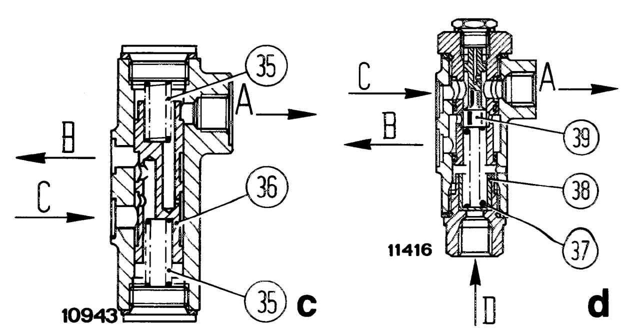
Sectional and plan view of bevel drive with hydraulic differential lock.

a. Section through early hydraulic differential lock - b. Detail of late hydraulic lock - C_3. Capscrews - C_4. Capscrews - 1. Differential supports - 2. Differential supports - 3. Taper roller bearing - 4. Taper roller bearing - 5. Differential lock control valve - 6. Capscrew - 7. Roll pin - 8. Pin - 9. Lever - 10. Ring gear - 11. Side gear - 12. Side gear - 13. Thrust washer - 14. Differential cage - 15. Retaining ring - 16. Split sealing ring - 17. Differential pinion shaft - 18. Bush - 19. Sealing ring - 20. Piston - 21. Clutch drive plates - 22. Clutch driven plates - 23. Return spring - 24. Early flow diverter valve - 25. Piper support - 26. Differential pinion 27. O-ring - 28. Oil bushes - 29. Hydraulic pump - 30. PTO hydraulic clutch - 31. O-ring - 37. Adapter - 38. Hydraulic lock-in indicator sending unit - 39. Hydraulic lock cylinder - 40. Late pressure regulating valve.

HYDRAULIC DIFFERENTIAL LOCK CIRCUIT PRESSURE TEST

Proceed as follows:

- on early control valve tractors, back off the nut on the side of the control valve or, where fitted, the delivery connector to the front wheel drive differential hydraulic lock;
- on late control valve tractors, back off adapter with pressure switch fitting (37);
- install connector **291328** (1, page 24) and connect to 40 kg/cm^2 pressure gauge of kit **293300** (2);



Section through flow divider valve (early, fig. c) and pressure regulating valve (late, fig. d).

A. To control valve - B. To PTO hydraulic clutch - C. From hydraulic pump - D. From hydraulic control valve - 35. Springs - 36. Shuttle - 37. Pressure regulating valve spring (set to 24.5 bar - 25 kg/cm^2 - 355 psi) - 38. Pressure regulating valve plunger - 39. Shuttle.

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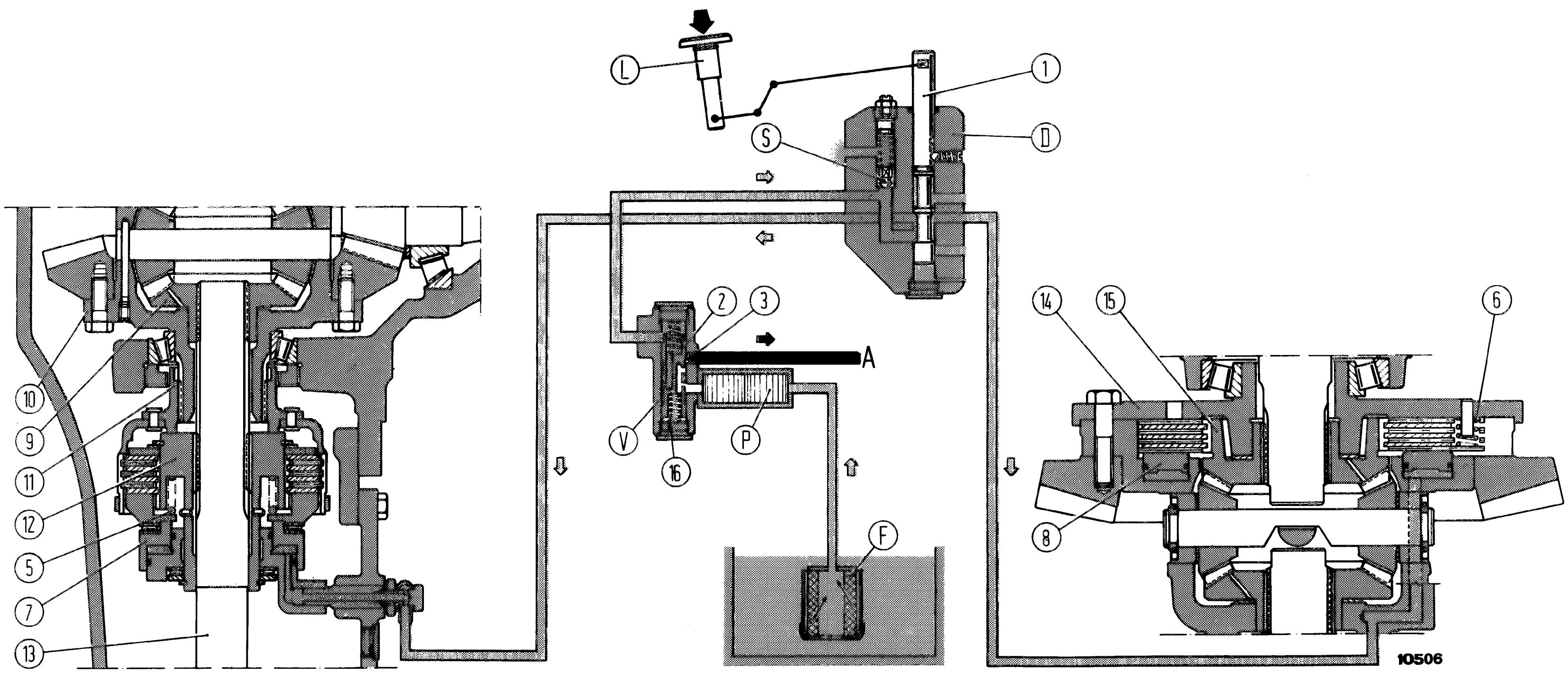

Front and rear differential lock operation diagram (early) - hydraulic lock in.

Note: On tractors with rear differential lock only, control (D) is not provided with oil line to front wheel drive clutch and the associated port is plugged.

A. PTO hydraulic clutch port - D. Control valve - F. Filter - L. Differential lock pedal - P. Hydraulic pump - S. Relief valve - V. Flow divider valve - 1. Spool - 2. Shuttle - 3. Shuttle to valve body clearance - 5. Return spring - 7. Piston - 8. Piston - 9. Side gear - 10. Differential cage - 11. Front wheel drive differential lock clutch - 12. Hub - 13. Axle shaft - 14. Differential cage - 15. Side gear - 16. Spring.

EARLY DIFFERENTIAL LOCK ENGAGEMENT

When pedal (L) is depressed, pin (1) of control valve (D) takes up the position shown and the pedal is held in activated position. Oil pressure is directed to front and rear differential cages and acts on pistons (7 and 8) which overcome the opposition of springs (5 and 6) to lock clutch drive and driven plates together. Consequently, at the front differential the left side gear (9) locks against differential cage (10) through clutch housing (11) and hub (12) splined to axle shaft (13), whereas at the rear differential, differential cage (14) is locked directly to right side gear (15).

Differential lock oil pressure is controlled by relief valve (S) set to 24.5 bar (25 kg/cm^2 - 355 psi), whereas P.T.O. clutch (A) oil pressure is set to 12 bar (12.2 kg/cm^2 - 173 psi, see section 207, page 10).

The upper chamber of flow divider valve (V) is at 24.5 bar, whereas the lower chamber is initially at 12 bar. Shuttle (2) moves downward to create a restriction (3) resulting in an oil pressure increase in the lower chamber of valve (V) which, added to the pressure applied upward by spring (16), offsets the effect of the oil pressure in upper chamber (24.5 bar - 25 kg/cm^2 - 355 psi).

Upon reaching this condition of balance, shuttle (2) stabilizes, directing part of the oil to the differential lock and supplying a sufficient quantity of oil at all times for PTO clutch operation through restriction (3).

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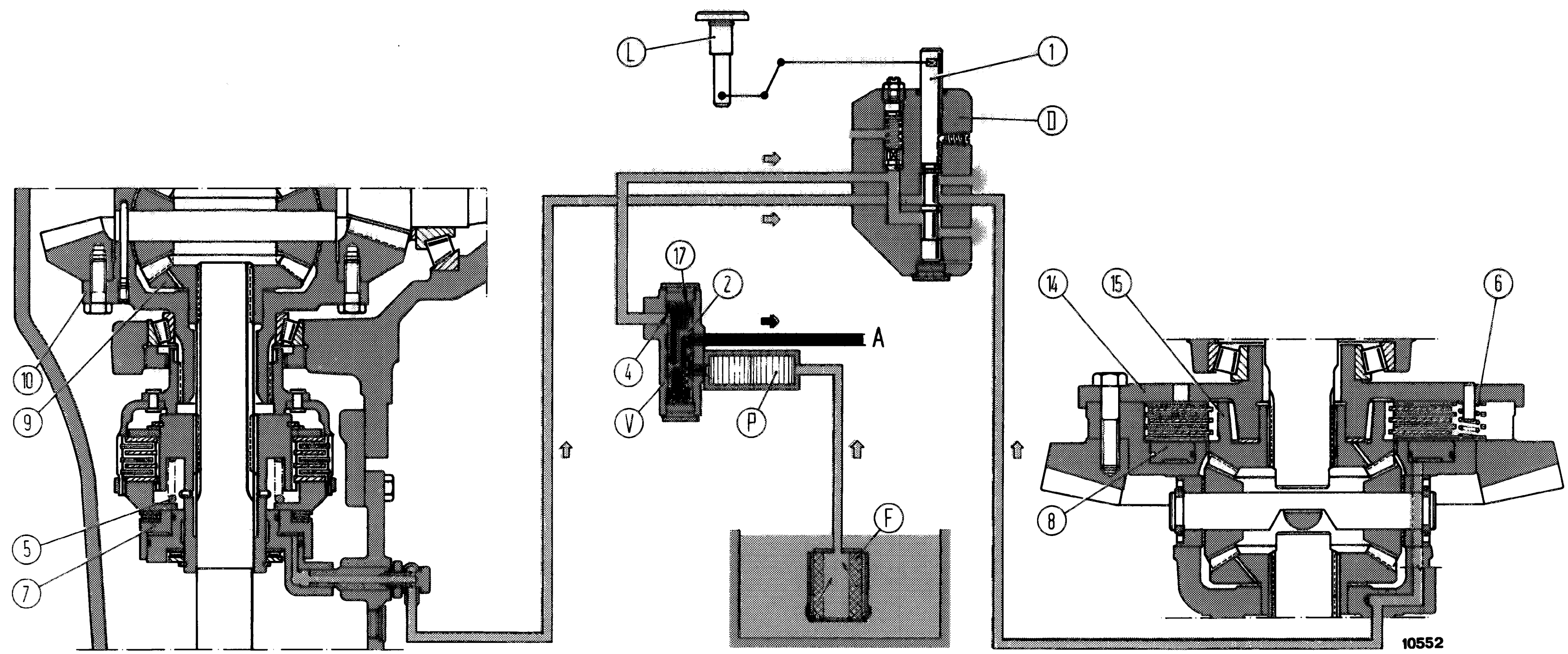

Front and rear differential lock operation diagram (early) - hydraulic lock out.

A. PTO hydraulic clutch line - D. Control valve - F. Filter - L. Differential lock pedal - P. Hydraulic pump - V. Flow divider valve - 1. Spool - 2. Shuttle - 4. Shuttle clearance relative to valve body - 5. Spring - 6. Spring - 7. Piston - 8. Piston - 9. Side gear - 10. Differential cage - 14. Differential cage - 15. Side gear - 17. Spring.

EARLY DIFFERENTIAL LOCK DISENGAGEMENT

To disengage differential lock depress pedal (L) further and release. Spool (1) of control valve (D) takes up the position shown and places the oil pressure in the differential lock circuit in exhaust.

Springs (5 and 6), no longer opposed by oil pressure, bring about clutch plate disengagement and release side gears (9 and 15) from the associated differential gauges (10 and 14).

Oil pressure in upper chamber of valve (V) is placed in exhaust whilst the lower chamber remains at 12 bar (12.2 kg/cm^2 - 173 psi) controlled by PTO clutch relief valve (see section 207, page 10).

Shuttle (2) moves upward to create a restriction (4) thereby generating an increase in oil pressure in the upper chamber of valve (V) which, added to the downward thrust of spring (17), offsets the effect of the pressure existing in the lower chamber (12 bar - 12.2 kg/cm^2 - 173 psi).

Upon establishing this condition of balance, shuttle (2) stabilizes and directs most of the oil pressure to the PTO clutch.

- Hydraulic PTO apply pressure oil.
- Suction, delibery or return oil.
- Pressure oil with differential lock out.
- Differential lock control pressure oil.
- Pressure oil with differential lock in.

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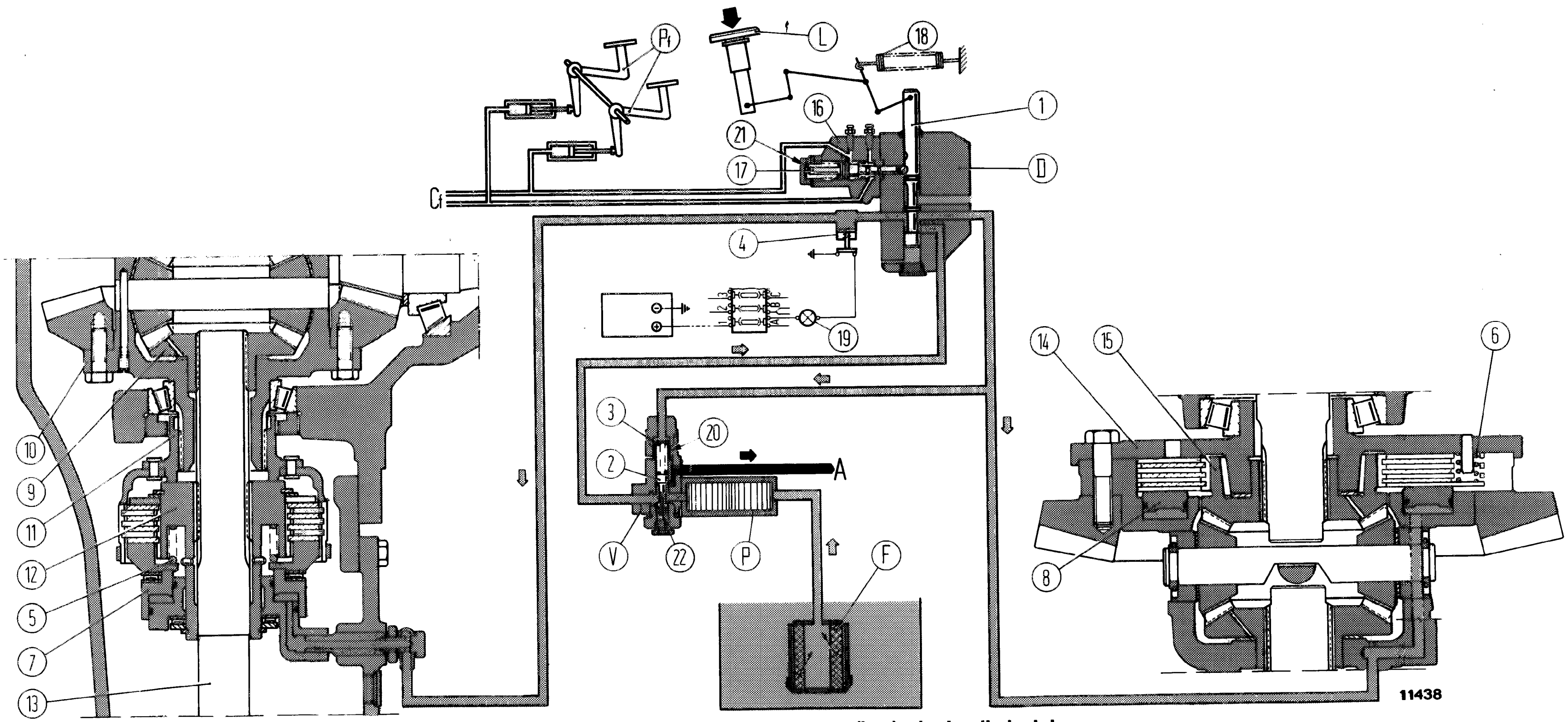

Front and rear differential lock diagram (late) - hydraulic lock in.

Note: On tractors incorporating rear hydraulic differential lock only, pressure switch (4) is applied directly to control valve (D), whereas, on tractors fitted with front wheel drive differential lock a pipe connector for oil supply to front wheel drive is interposed between pressure switch (4) and control valve (D).

A. PTO hydraulic clutch port - D. Control valve - F. Filter - L. Differential lock pedal - P. Hydraulic pump - Pf. Service brake pedals - V. Pressure regulating valve - Cf. To brake circuit - 1. Spool - 2. Shuttle - 3. Spring - 4. Pressure switch (sending unit) - 5. Spring - 6. Spring - 7. Piston - 8. Piston - 9. Side gear - 10. Differential cage - 11. Front differential lock clutch - 12. Hub - 13. Axle shaft - 14. Differential cage - 15. Side gear - 16. Unlock cylinder body - 17. Unlock piston - 18. Return spring - 19. Hydraulic lock operation indicator - 20. Pressure regulating piston - 21. Spring - 22. Shuttle port.

LATE DIFFERENTIAL LOCK ENGAGEMENT

When pedal (L) is depressed, spool (1) of control valve (D) takes up the position shown and is held in that position by detent ball compressed by piston (17) and associated spring (21). Oil pressure flows to front and rear differentials and acts on pistons (7) and (8) which overcome the opposition of springs (5 and 6) to lock drive and driven clutch plates together.

Consequently, at the front differential, left side gear (9) locks against differential cage (10) through clutch housing (11) and hub (12) splined to axle shaft (13), whereas at the rear differential the differential cage (14) is directly coupled to right side gear (15). Differential lock circuit pressure acts both on the lower side of shuttle (2) through port (22) and on piston (20) whose larger effective area causes the piston to move down to full stroke.

Thus, spring (3) is further compressed and causes shuttle (2) to move downward to create a restriction between itself and body (V) at the PTO hydraulic clutch supply port (A).

The resulting increase in pressure is controlled at 24.5 bar (25 kg/cm^2 - 355 psi) by spring (3) which, further compressed by shuttle (2) enables the latter to discharge the excess pressure in the PTO clutch supply circuit (A) whose pressure is adjusted at approximately 12 bar (12.2 kg/cm^2 - 173 psi), see section 207, page 10).

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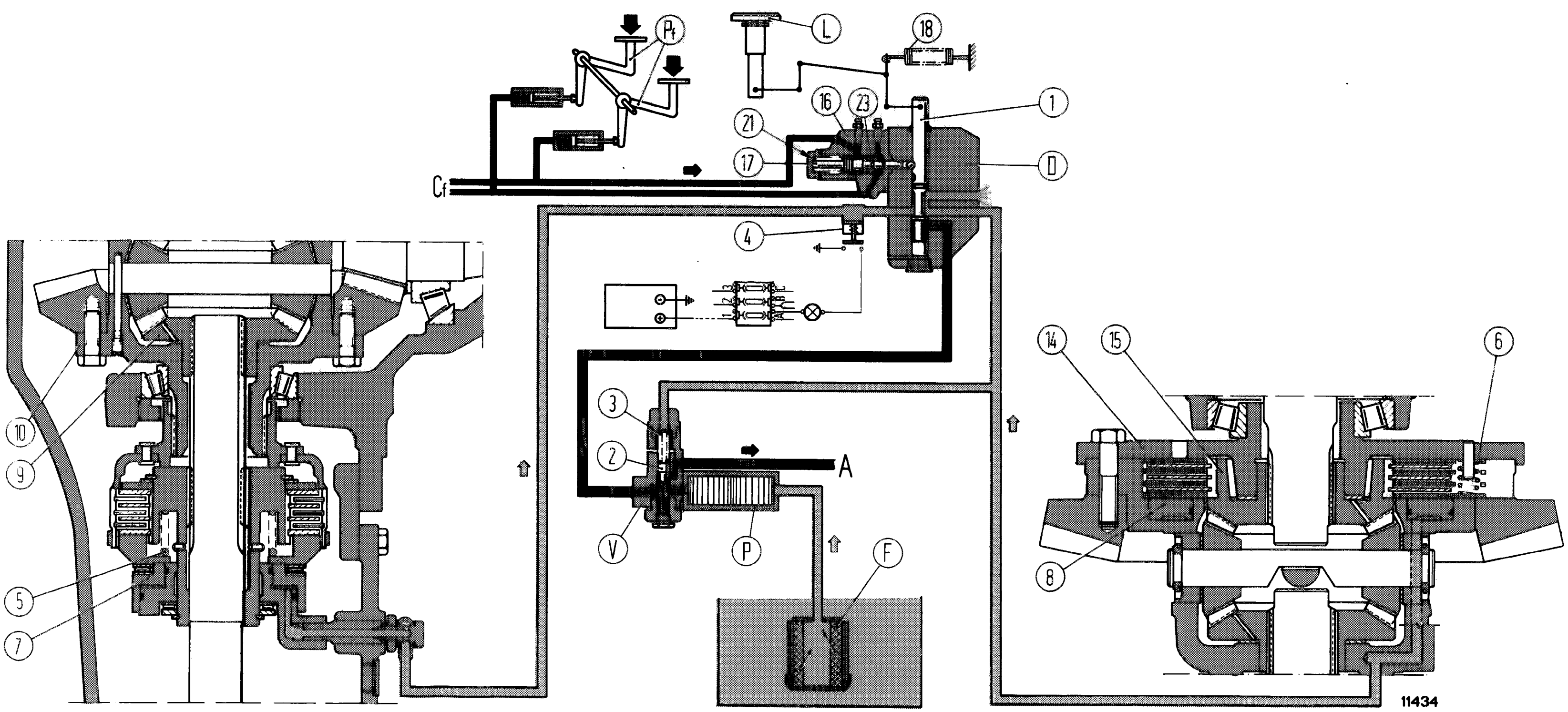

Front and rear differential lock operation (late) - hydraulic lock out.

A. To PTO hydraulic clutch - D. Control valve - F. Filter - L. Differential lock pedal - P. Hydraulic pump - Pf. Service brake pedals - V. Pressure regulating valve - Cf. To brake circuit - 1. Spool - 2. Shuttle - 3. Spring - 4. Pressure switch - 5. Spring - 6. Spring - 7. Piston - 8. Piston - 9. Side gear - 10. Differential cage - 14. Differential cage - 15. Side gear - 16. Unlock cylinder body - 17. Unlock piston - 18. Return spring - 21. Spring - 23. Annular plunger.

During differential lock operation oil pressure activates pressure switch (4) to energize panel mounted indicator (19).

LATE DIFFERENTIAL LOCK DISENGAGEMENT

To disengage the differential lock depress one or both brake pedals (Pf). Oil pressure in the brake circuit acts on piston (17) or annular plunger (23), moves them to the left overcoming the opposition of spring (21) and releases spool (1) which, under the opposition of spring (18), takes up the position shown and places the differential lock oil circuit in exhaust.

Springs (5 and 6), no longer opposed by oil pressure, permit clutch plate disengagement to release side gears (9) and (15) from differential cages (10 and 14).

Circuit oil pressure now acts only on the lower end of shuttle (2) overcoming the opposition of spring (3) which is moved upward, thereby fully opening supply port to PTO hydraulic clutch (A).

- Hydraulic PTO operating pressure oil.
- Suction, delivery or return oil.
- Differential lock operating pressure oil.
- Trapped brake circuit oil.
- Brake pressure oil.

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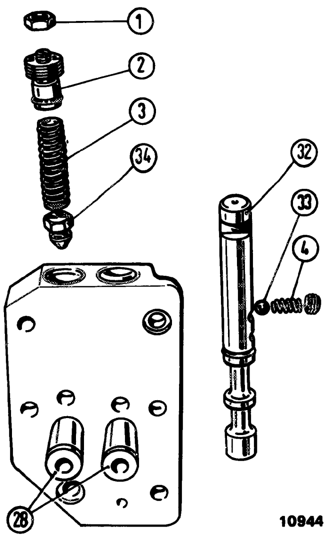


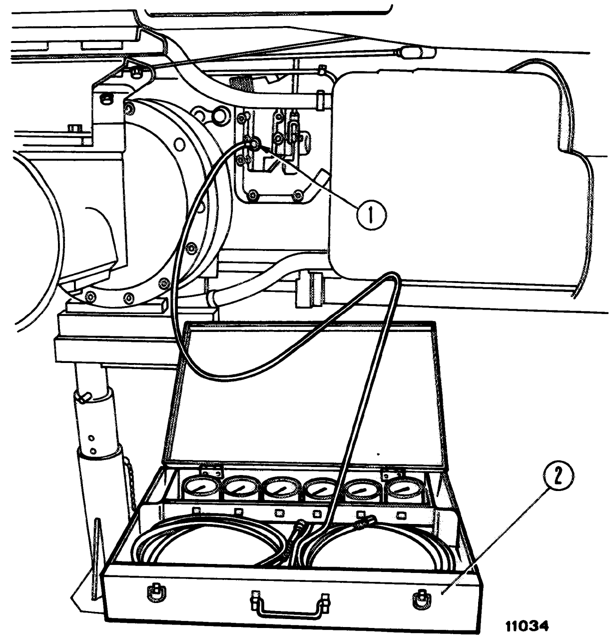
Differential lock control valve (early).

1. Lock nut - 2. Relief valve adjusting screw - 3. Relief valve spring - 4. Spool detent ball spring - 28. Oil bushes - 32. Spool - 33. Detent ball - 34. Relief valve.

— run the engine until oil temperature is approximately 50°C;

— bring engine speed to 1800 - 2000 rpm, depress differential lock pedal and check pressure gauge reading; the correct pressure is 24.5 bar (25 kg/ cm^2 - 355 psi).

Note: On late differential lock tractors this test is carried out to check operating pressure, whereas on early differential lock tractors this pressure may be adjusted by backing off locknut (1) and screwing in or unscrewing adjuster (2).

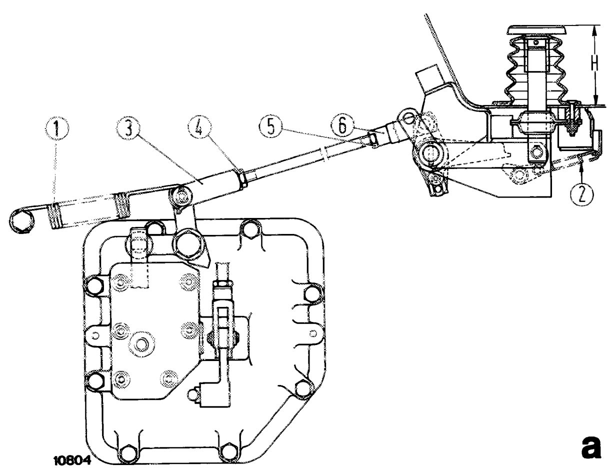


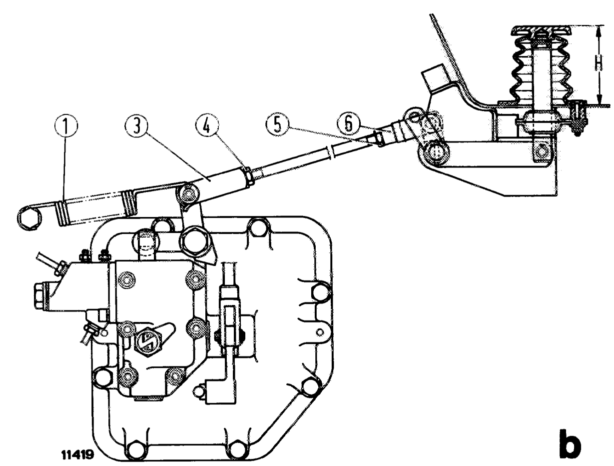
Testing differential lock circuit pressure.

1. Connector **291328** - 2. Kit **293300.**

Differential lock pedal adjustment.

Pedal distance (H) from platform should be 79.5 mm (3.13 in) to ensure correct differential lock engagement.
To adjust, slacken locknut (5 or 4), adjust fork (6 or 3) and retighten the locknut.





Adjusting hydraulic differential lock control pedal.

a. Early version - b. Late version - H = 79.5 mm (3.13 in), pedal to platform - 1. Pedal return spring - 2. Hook up plunger spring - 3. Fork - 4. Locknut - 5. Locknut - 6. Fork.

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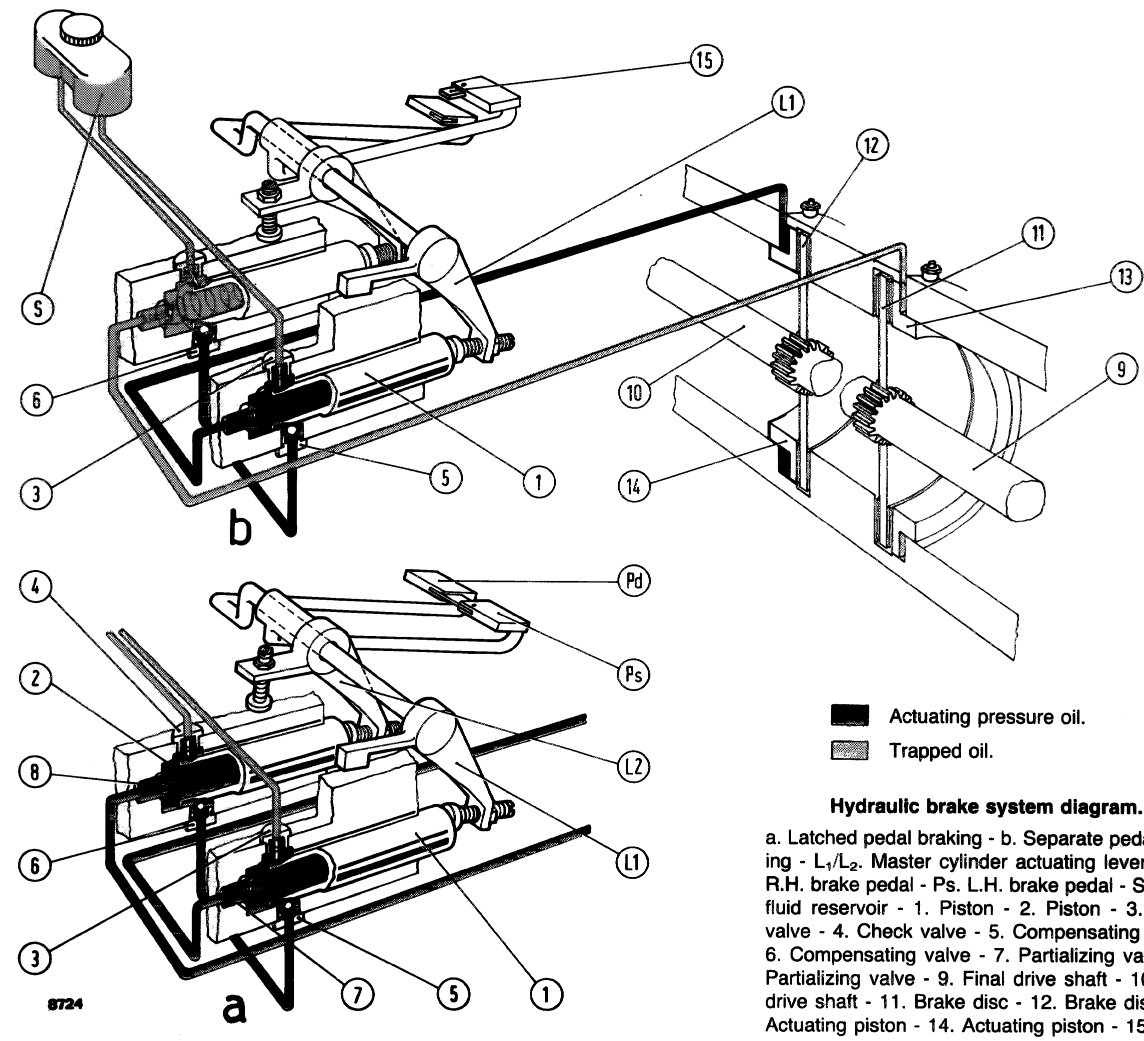
HYDRAULIC SYSTEM OPERATION



Hydraulic brake system diagram.

a. Latched pedal braking - b. Separate pedal braking - L_1/L_2. Master cylinder actuating levers - Pd. R.H. brake pedal - Ps. L.H. brake pedal - S. Brake fluid reservoir - 1. Piston - 2. Piston - 3. Check valve - 4. Check valve - 5. Compensating valve - 6. Compensating valve - 7. Partializing valve - 8. Partializing valve - 9. Final drive shaft - 10. Final drive shaft - 11. Brake disc - 12. Brake disc - 13. Actuating piston - 14. Actuating piston - 15. Latch plate.

Latched pedal braking.

Upon brake application, actuating levers (L_1 and L_2) activate pistons (1 and 2).
Piston operation causes check valves (3 and 4) to cut off the fluid line from the reservoir (S) and simultaneously opens compensating valves (5 and 6) which keep the pressure uniform throughout the circuit. During their stroke, the piston compress the fluid inside the master cylinder body which, through partialising valves (7 and 8), acts on brake actuating pistons.
On full braking, the circuit pressure is approximately 17.6 bar (18 kg/cm^2, 256 psi).
When the brake pedals are released, oil pressure flows from the annular actuating cylinder chambers to the master cylinder body through the restrictions in the partialising valve cups.
The small restriction cause the oil pressure to flow slowly, thereby resulting in a gradual return of the brake pedals.
The actuating pistons return to their rest position, the check valve plates are displaced, the line to the reservoir is opened and the compensating valves close.

Individual pedal braking.

Master cylinder piston (1) actuated by lever (L_1) moves the plate of check valves (3) to close the line from the

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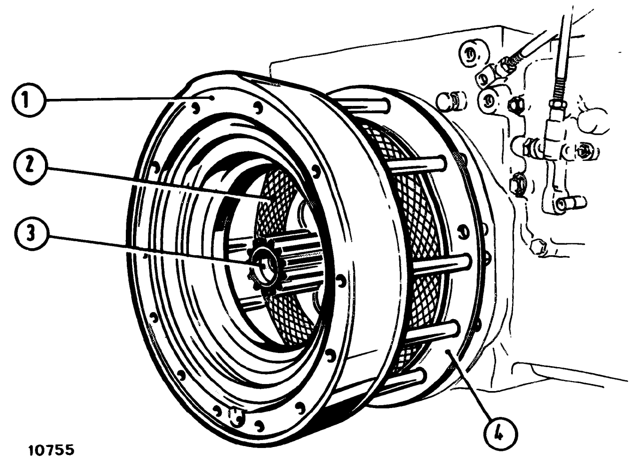

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Disassembling/assembling brake unit.

1. Brake cylinder - 2. Brake disc - 3. Final drive shaft - 4. Brake wear plate.

reservoir, opens the associated compensating valve (5) and causes a pressure build-up in the relevant actuating cylinder. In these conditions, compensating valve (6), which remained closed, prevents oil pressure from reaching the other actuating cylinder.

Note: The twin section fluid reservoir supplies the two master cylinders separately to maintain brake effectiveness in the event of brake line failure.

BRAKE UNIT ASSEMBLY AND DISASSEMBLY

To disassemble the brake unit:

— remove final drive assembly;

— disconnect oil line union;

— remove brake cylinder (1) from transmission housing retrieving disc (2), shaft (3) and wear plate (4);

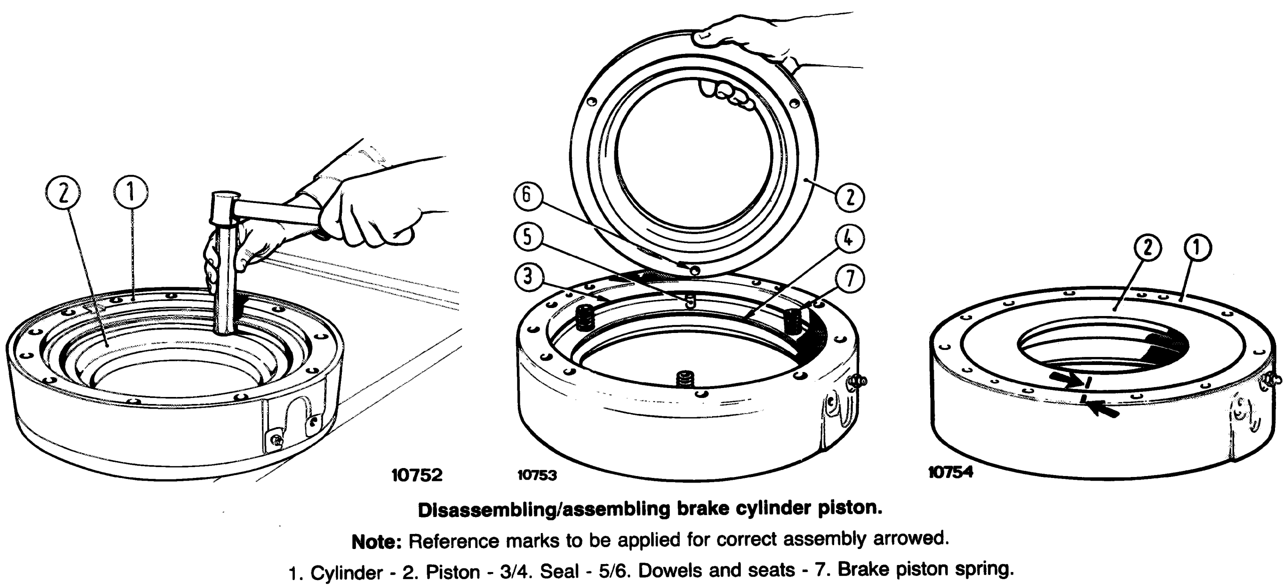
— check brake discs (4) and (2) for wear and replace if sintered coat is excessively worn (see wear limits, page 10, section 20).

Overhaul brake unit referring to the illustration and noting the following points:

— before disassembling brake piston (2), apply reference marks on both piston and cylinder (1) for correct matching of dowels (5) to seats (6) on assembly;

— should seals (3 and 4) need replacing, smear with **grassofiat TUTELA G9** before installation. Ensure that they are correctly seated to prevent damage on piston installation;

— degrease and thoroughly clean wear plate and brake cylinder mating surfaces and apply one of the jointing compounds mentioned on page 7, section A, before installation on rear transmission housing.



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Disassembling/assembling brake cylinder piston.

Note: Reference marks to be applied for correct assembly arrowed.

1. Cylinder - 2. Piston - 3/4. Seal - 5/6. Dowels and seats - 7. Brake piston spring.

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MASTER CYLINDER ASSEMBLY AND DISASSEMBLY

To gain access to the master cylinder:

— remove front and rear RH side panels;

— disconnect battery negative lead;

— drain oil from brake circuit;

— remove power steering reservoir and associated flap on instrument panel and gear change linkage rear protector;

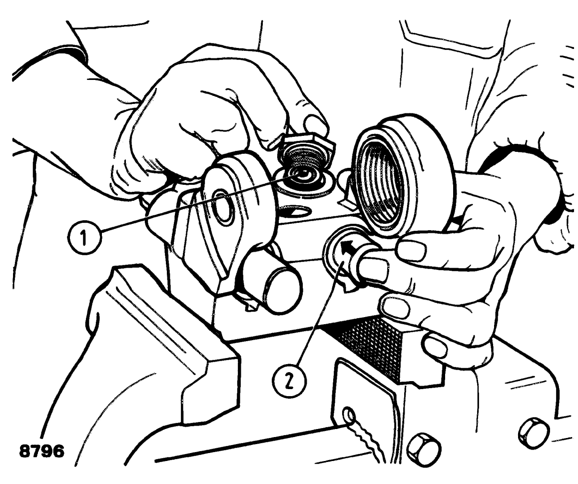
— disconnect the master cylinder inlet lines, slackening the associated clips;

— disconnect the master cylinder outlet line unions;

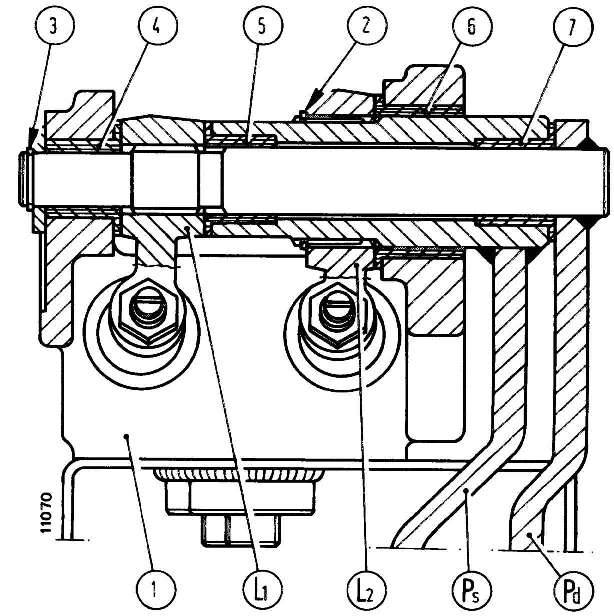
— remove the capscrews and master cylinder with attached pedals;

— remove retaining rings (2 and 3) and withdraw right and left brake pedals (Pd and Ps).

On master cylinder disassembly, note that pistons (8 and 9, page 4) should be withdrawn from outlet line side.
Check master cylinder bore and piston working surfaces for oxidation and roughness; piston clearance in the master cylinder should be as specified on page 10, section 20.

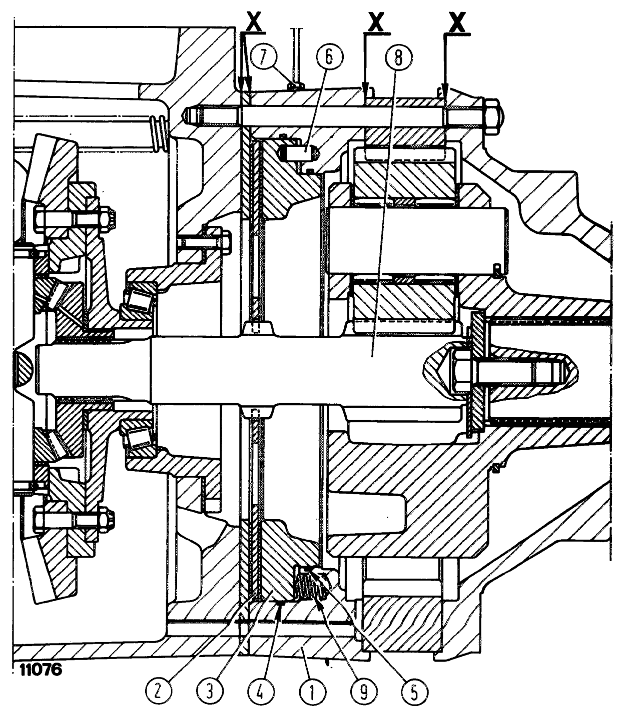


Installing check valve on master cylinder.
1. Valve plate - 2. Master cylinder piston.



Section through pedal linkage and master cylinder control lever.

L_1/L_2. Master cylinder control levers - Pd. RH brake pedal - Ps. LH brake pedal - 1. Master cylinder body - 2/3. Retaining rings - 4/5/6/7. Bushings.



Longitudinal section through brake unit.

1. Brake cylinder - 2. Disc installed on RH final drive shaft - 3. Brake piston - 4/5. Seals - 6. Dowel - 7. Brake oil line union - 8. RH final drive shaft - 9. Brake piston spring.

Note: On assembly, thoroughly clean faces X to be mated and smear with jointing compound (see page 7, section A).

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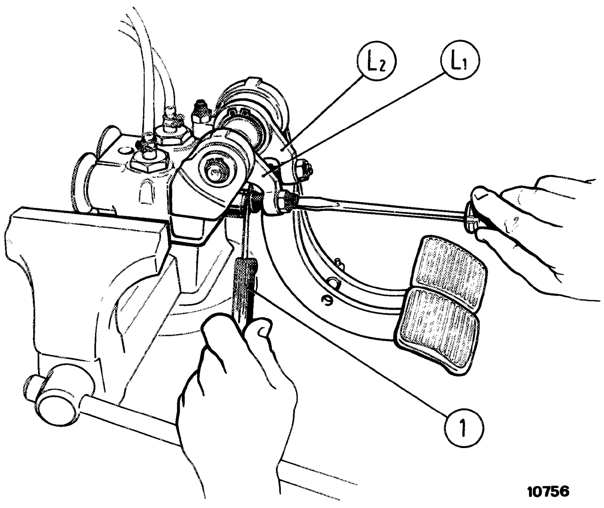


Adjusting pedals on bench.
1. Feeler gauge - L_1/L_2. Master cylinder actuating levers.

Check seals and replace if necessary.

On assembly, install check valves on master cylinder before introducing the pistons to prevent piston from fouling check valve plate.

Note: When installing a check valve on a master cylinder with piston already in position, move the piston forward to prevent check valve plate damage.

BRAKE PEDAL ADJUSTMENT

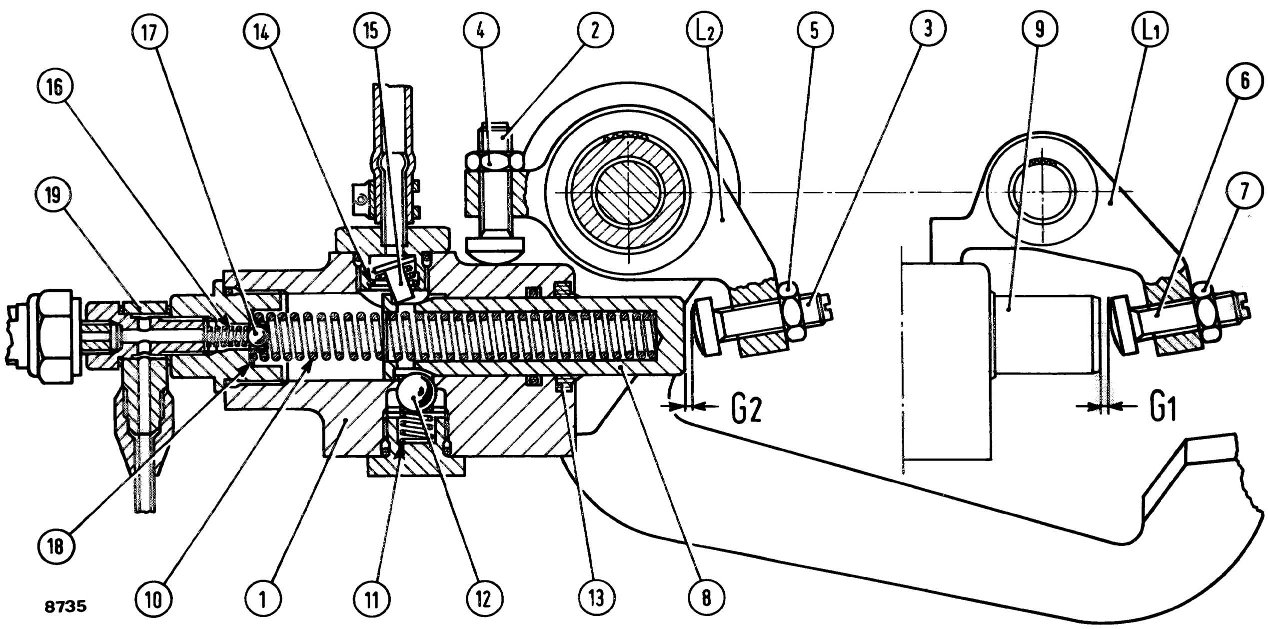
Install the LH brake pedal with attached bushings on the master cylinder body (1) followed by lever (L_2) with adjusting screws (2 and 3) and lock in position using retaining ring (2, page 3). Install RH pedal on lever (L_1) so that the front of the lever rests on master cylinder body and reference marks on lever (L_1) and RH pedal pivot are aligned.

Turn adjusting screw (6) until .1 to .2 mm (.004 to .008 in) clearance (G_1) is obtained and lock in position using lock nut (7). Align the two pedals through the latch plate.

Turn adjusting screw (2) until it contacts the master cylinder body and lock in position by means of lock nut (4).

Tighten adjusting screw (3) to obtain a .1 to .2 mm (.004 to .008 in.) clearance (G_2) and lock in position using lock nut (5).

Note: This adjustment may be carried out with the master cylinder in position on the tractor or on the bench.



Section through master cylinder.

G_1/G_2 = .1 to .2 mm (.004 to .008 in.) piston clearance - L_1/L_2. Control levers - 1. Master cylinder body - 2/3. Adjusting screws - 4/5. Lock nuts - 6. Adjusting screw - 7. Lock nut - 8/9. Pistons - 10. Piston return spring - 11/12. Compensating valve spring and ball - 13. Seal - 14/15. Check valve spring and plate - 16/17/18. Partialising valve spring, ball and cup - 19. Outlet union.

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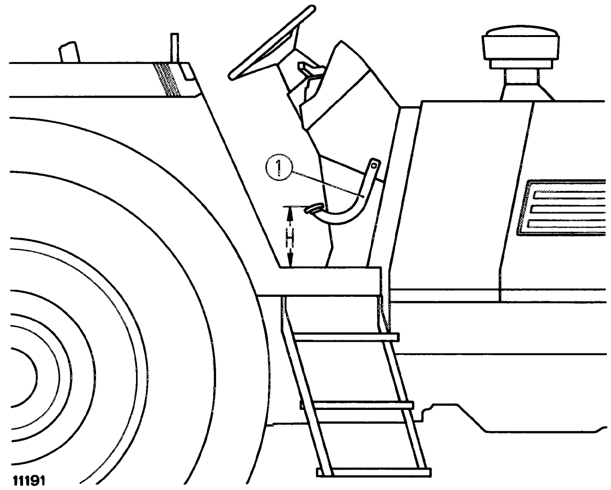
BRAKE PEDAL INSTALLATION

On installation, mate the splined pedal shafts with the associated levers to obtaine dimension (H) shown in diagram.



Installing brake pedals.
H = 215 mm (8.5 in.) height of brake pedals above control platform floor - 1. Brake pedals.

BRAKE SYSTEM BLEEDING

Brake bleeding becomes necessary whenever the brake hydraulic lines have been disconnected or uneven braking is detected.

When bleeding the system note the following points:

— thoroughly clean the area surrounding the bleed screws and the hydraulic oil reservoir cover;

— ensure that the fluid level in RH (A) and LH (B) brake reservoirs is topped up prior to, and during bleeding;

— depress LH brake pedal **slowly through full stroke** to build up fluid pressure;

— hold the pedal depressed, back off bleed screw (C) through half a turn and allow the air to escape;

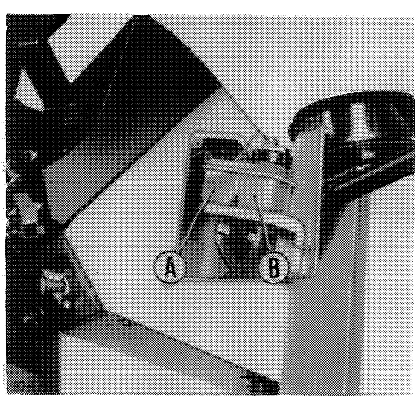
— screw in the bleed screw (C) and repeat the above operation until the issuing fluid is free from air bubbles;

— again operate the brake pedal and check that the pressure builds up without erratic pedal movement;

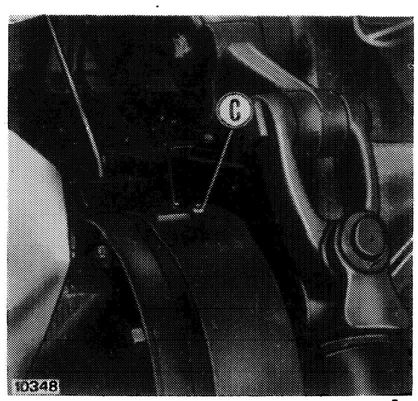
— repeat the above sequence on the RH brake circuit;

— finally, top up the fluid reservoirs.

Note: For tractors equipped with trailer brake remote control valve, bleed air first from screw (C, fig. b) and then through screw (D, fig. c) located on valve.



a



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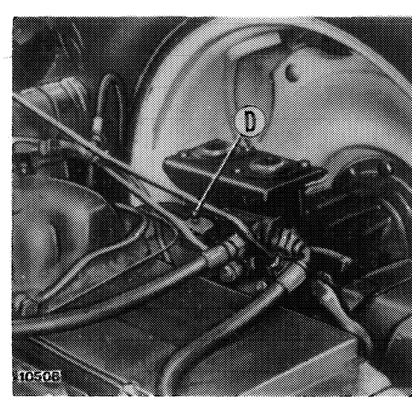

c

Bleeding brake system (figs. a. and b.) and trailer brake remote control valve (fig. c.).
A/B. Right and left brake fluid reservoirs - C/D. Bleed screws.

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MASTER CYLINDER BENCH TEST

Prepare the cylinder to be tested and the test equipment as follows:

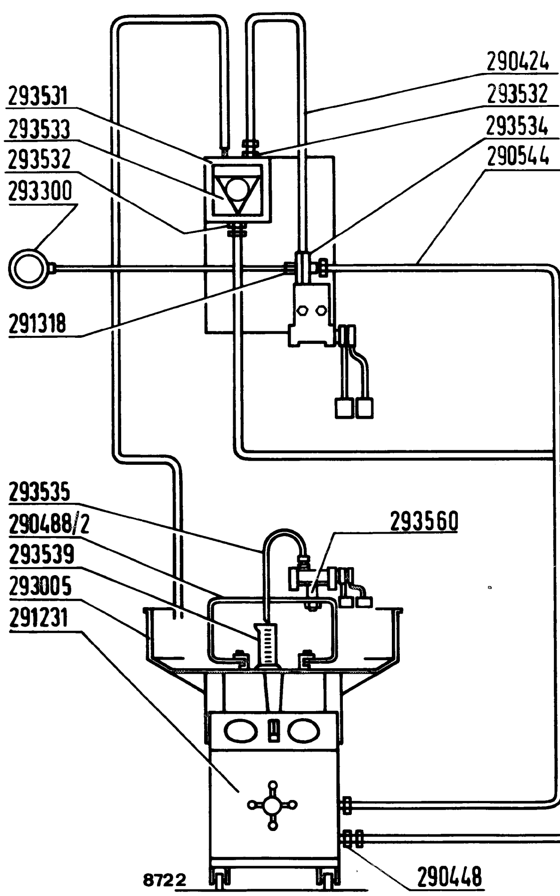
- connect the cylinder body to plate **290488/2** using support **293560**;
- position the plate in tank **293005** coupled to output tester **291231**;
- use trolley-mounted electric motor **291235** and pump **292588** (PLESSEY A18X) connected by means of coupling **290385**;
- connect the pump inlet to test machine **291231** using pipe **290445**;
- install flow control valve **293533** to support plate **293531** and connect to the pump outlet using pipe **290544**;

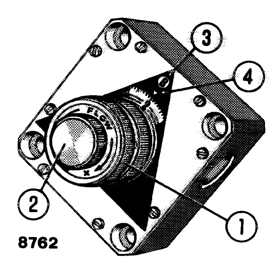
Note: Adjust pump flow rate to 2.5 - 3 litres/min (4.4 to 5.3 pints/min) by screwing in control knob (1, detail a) until letter **B** lines up with slot (3) and digit **2** on graduated scale is in register with pointer (4); subsequently, lock control knob (1) in position by turning locking knob (2) as necessary.

- connect the outlet of flow control valve to 3-way fitting **293534** fitted to the first of the two master cylinders to be tested (detail b.);
- connect a 40 kg/cm^2 (600 psi) pressure gauge to fitting **293534** and return pipe **290544** to output tester **291231**;
- connect pipe **293535** to the check valve plug and collect the leaking fluid in graduated glass **293539**.

Master cylinder bench test set up.

a. Flow control valve - 1. Control knob - 2. Locking knob - 3. Slot - 4. Pointer.





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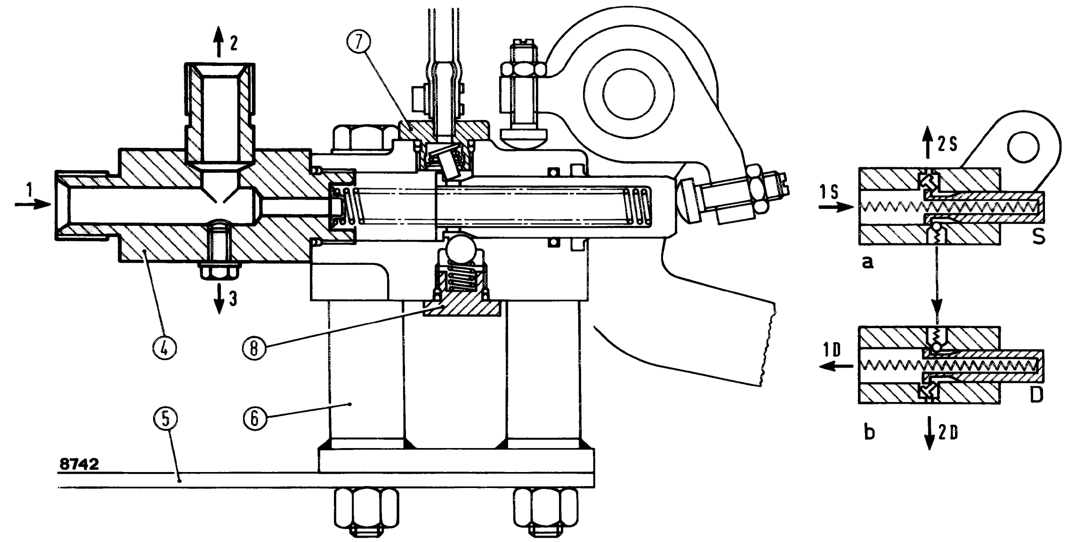


Three-way fitting 293534 in position on master cylinder under test.

a. Master cylinder with 3-way fitting - b. Master cylinder not under test - D/S. Master cylinder pistons - 1D/2D/1S/2S. Ports - 1. Flow control valve outlet - 2. Return to tester - 3. Pressure gauge connection point - 4. 3-way fitting **293534** - 5. Master cylinder support plate **290488/2** - 6. Master cylinder support **293560** - 7. Check valve - 8. Compensating valve.

As test fluid, use **oliofiat IDRAULICAR AP51** (SAE 20 W) provided with the test machine, at 50°C, and run the electric motor at 715 rpm. The test procedure is outlined below.

1. Check valve leakage test.

Place piston (S) in operating position (i.e. 5 mm or .197 in stroke) and bring circuit pressure to 14.5 bar (15 kg/cm^2, 213 psi).
Check the amount of leaking fluid in the graduated glass; the amount of fluid should be less than 2.5 cu.cm/min (.15 cu.in/min).
Return the piston to its rest position.

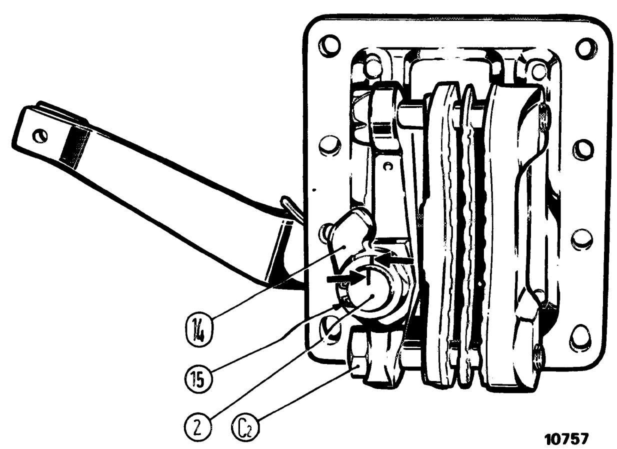
2. Check valve cut-off test.

Slowly move piston (S) forward and check the distance at which the fluid ceases to issue from fitting **293535**; the correct stroke is 2.2 to 2.8 mm (.087 to .110 in).

3. Compensating valve cut-in test (on master cylinder not under test)

Move piston (S) of master cylinder under test to 5 mm or .197 in stroke (equivalent to the operation position) and slowly move piston (D) forward by 2 to 4 mm (.079 to .157 in); in these conditions, the fluid should issue from port (1D).

Repeat operations **1, 2** and **3** on the second master cylinder to be tested.



Disassembling (assembling) parking brake actuating lever.

Note: Arrows indicate notches on lever (14) and splined shaft (2) to be aligned on assembly.

C_2. Lining guide screws - 2. Outer lever splined shaft - 14. Inner lever - 15. Retaining ring.

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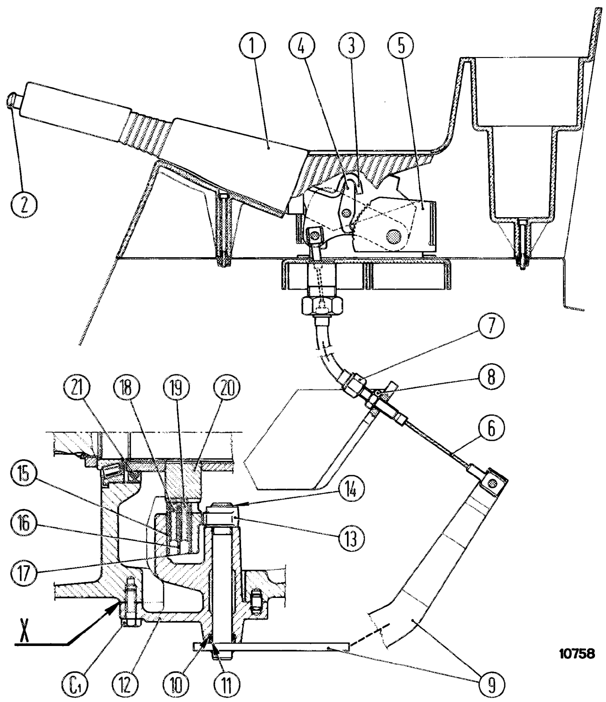

Section through parking brake linkage.

C_1. Parking brake support screws - 1. Parking brake lever - 2. Button - 3. Pawl release link - 4. Pawl - 5. Ratchet - 6. Remote control cable - 7. Lever travel adjusting nut - 8. Lock nut - 9. Outer relay lever - 10. O-ring - 11. Seal bushing - 12. Support - 13. Inner brake lever - 14. Retaining ring - 15/16/17. Linings - 18/19. Discs - 20. Hub - 21. Seal.

Note: On assembly, apply jointing compound to surfaces X as directed on page 7, section A.

PARKING BRAKE

To remove parking brake support (12), drain oil from transmission housing, remove LH rear wheel, disconnect remote control cable (6) and remove capscrews (C_1) securing support to rear transmission housing. Check linings (15, 16 and 17) for wear.

To replace discs (18 and 19) remove bevel pinion shaft as directed on pages 5 and 6, section 204 when installing outer relay lever (9), align the two reference marks on the end of splined shaft (2) and inner lever (14) as shown on page 7.

Clean and thoroughly degrease mating surfaces and apply one of the jointing compounds detailed on page 7, section A, before installing brake support on rear transmission housing.

PARKING BRAKE LEVER ADJUSTMENT

From its rest position, lever (1) handle should move through less than 80 mm (3.1 in.) to fully restrain the tractor.

To adjust, back off lock nut (8) and tighten nut (8) and tighten nut (7) to reduce travel to 60 mm (2.4 in).

Subsequently, tighten lock nut (8).

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REMOVAL

To remove each final drive unit proceed as follows:

— drain oil from rear transmission housing;

— prop up the rear transmission housing;

— remove control platform cushion pad retaining capscrews and tasteners securing support brackets to final drive housings;

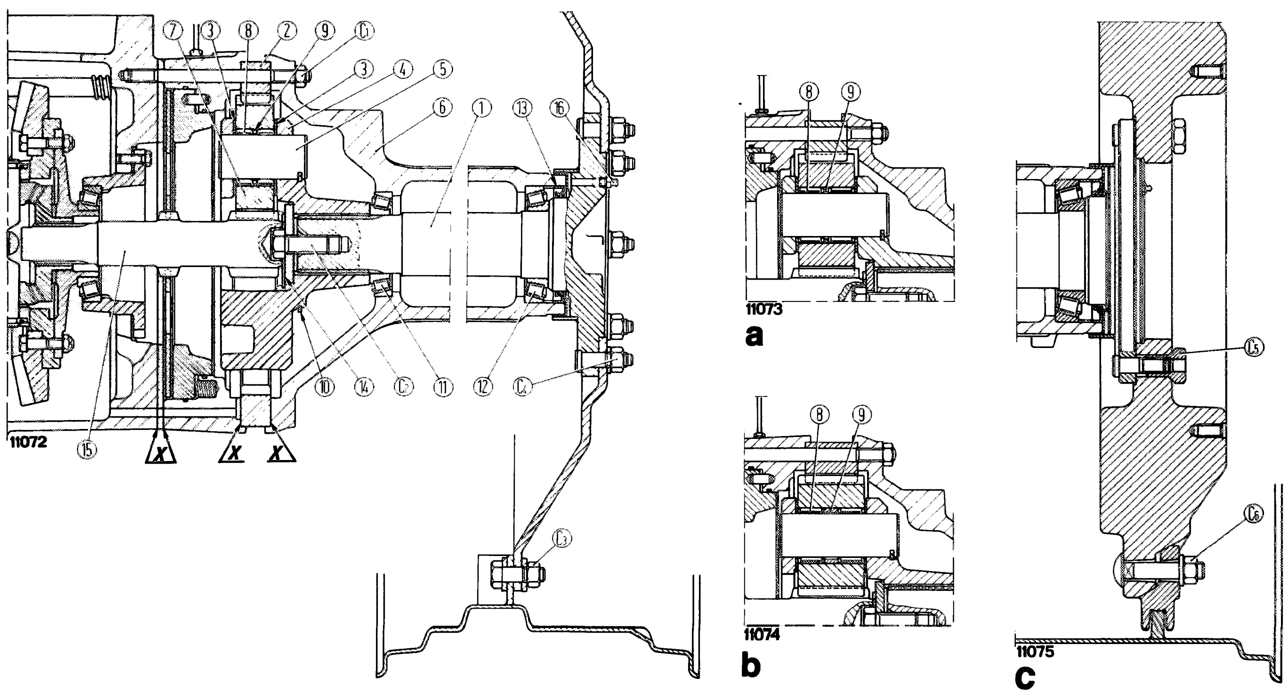
— place wooden spacers between lift body and fuel tank to keep the platform in raised position;

— remove associated rear wheel, place support **293781** (1, page 2) on a trolley-mounted hydraulic jack and firmly secure the housing onto the final drive unit;

— remove nuts (C_1) and take off final drive housing with attached ring gear without separating brake cylinder from transmission housing.

Disassembly:

— place final drive unit vertical, remove lock washer (14, page 1) and back off screw (C_2);



Longitudinal section through RH final drive unit (1180).

a. Detail 1380 and 1580 - b. Detail 1880 - c. Wheel disc, rim and hub, 1380, 1580 and 1880 - C_1. Nuts retaining final drive housing - C_2. Wheel shaft capscrew - C_3. Nut retaining pressed disc to rim - C_4. Nut retaining pressed disc to hub - C_5. Nut retaining cast disc to hub - C_6. Nut retaining spiral adjustment clamp - 1. Wheel shaft - 2. Ring gear - 3. Thrust washers - 4. Planet carrier - 5. Planet journal - 6. Final drive housing - 7. Planet gear - 8. Needle roller bearings - 9. Needle roller spacer - 10. Journal retaining ring - 11/12. Taper roller bearings - 13. Seal - 14. Lock washer - 15. RH final drive shaft - 16. Lube fitting.

Note: On assembly, apply jointing compound to surfaces X as directed on page 7, section A.

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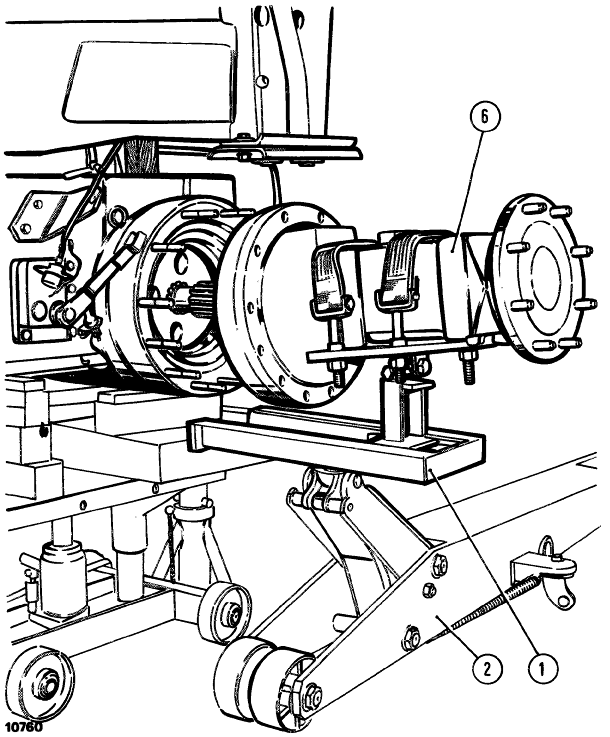
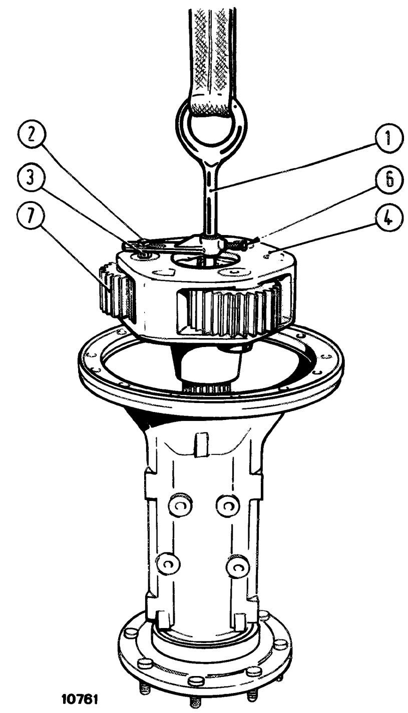


Removing (installing) final drive assembly.
1. Final drive removal support **293781** - 2. Trolley - mounted hydraulic jack - 6. Final drive housing.



Disassembling final drive carrier.
1. Hook **293811** - 2. Pin - 3. Nut - 4. Planet carrier - 6. Screw - 7. Planet gear.

— insert hook **293811** (1) on carrier (4) and rotate to position under the three planet gears;

— insert pin (2) into one of three planet journal lubrication ports (5, page 1), secure in position with nut (3) and screw (6) and remove carrier (4) with attached gears using a sling;

— withdraw wheel shaft (1, page 1) using a suitable universal puller;

— open out retaining ring (10, page 3), withdraw journals (5) and planet gears (7), retrieving needle roller bearings (8, page 1).

If necessary, replace seal (13) using a suitable driver to position the new seal at the correct depth.

ASSEMBLY

Place housing in upright position and assemble noting the following points:

— following seal (13, page 1) and bearing cup (12) assembly, insert wheel shaft;

— position bearing cone (11) and install planet carrier (4);

— tighten capscrew (C_2) to 196 Nm (20 kgm - 145 ft.lb.) simultaneously rotating wheel shaft to settle the bearings;

— back off capscrew and then tighten to 88 to 98 Nm (9 to 10 kgm - 65 to 72 ft.lb.) simultaneously rotating wheel shaft;

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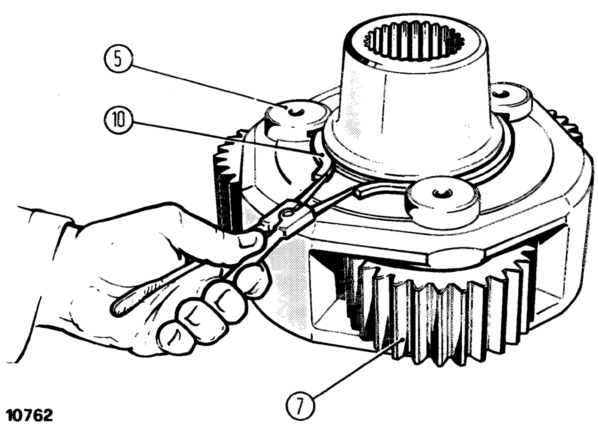
— slide lock washer (14) over head of cap screw and, if necessary, back off the capscrew to a position beyond the first working notch and retighten up to the notch;

— turn wheel shaft by hand to check that end float is negligible.

Clean and throughly degrase mating surfaces and apply one of the jointing compounds detailed on page 7, section A, before installing assembled final drive housing.

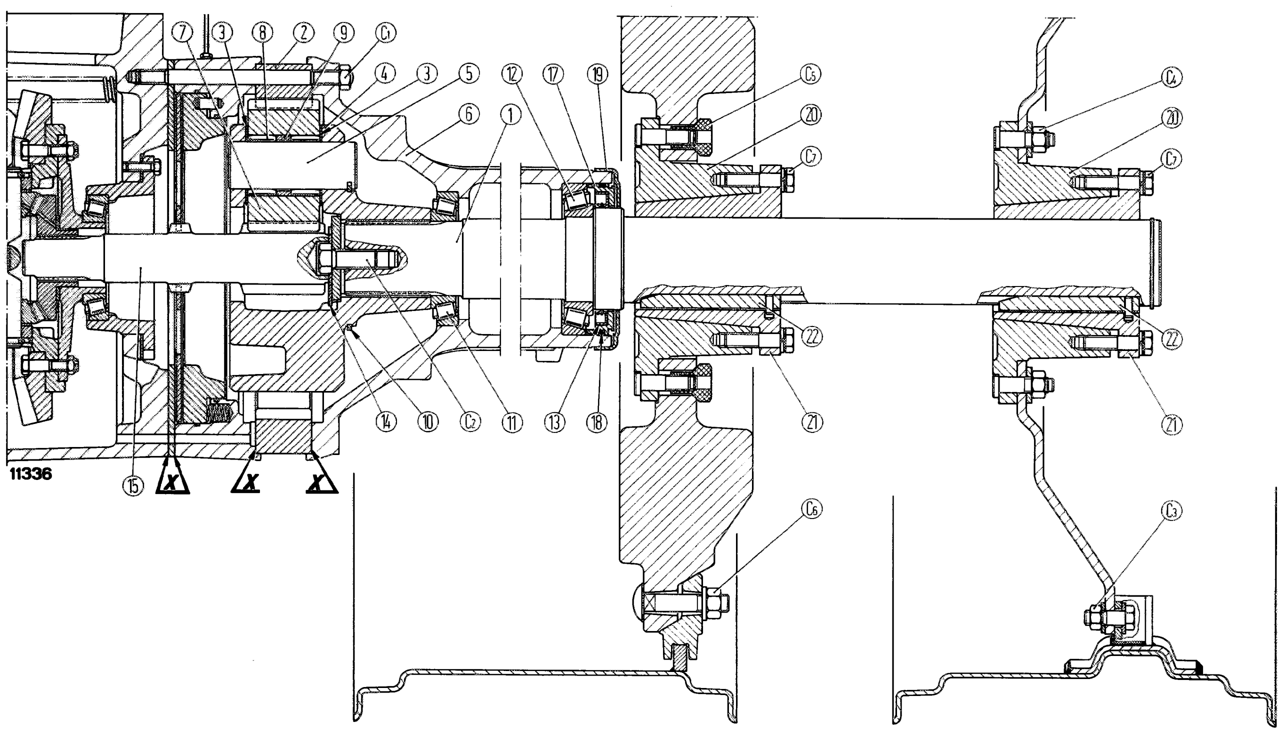
After installation, pump **grassofiat TUTELA G9** or other approved grease into lube fitting on wheel hub until surplus grease issues from inner guard panel; turn wheel hub to ensure complete filling of grease chamber between hub and final drive.



10762

Removing (installing) planet gear journals.

5. Journals - 7. Planet gears - 10. Retaining ring.



11336

Longitudinal section through RH final drive unit with twin wheels.

C_1. Nut retaining final drive housing - C_2. Wheel shaft capscrew - C_3. Nut retaining pressed disc to rim - C_4. Nut retaining pressed disc to hub - C_5. Nut retaining cast disc to hub - C_6. Nut retaining spiral adjustment clamp - C_7. Capscrew securing hub (20) to road wheel taper bushing (21) - 1. Wheel shaft - 2. Ring gear - 3. Thrust washer - 4. Planet carrier - 5. Planet journal - 6. Final drive housing - 7. Planet gear - 8. Needle roller bearing - 9. Needle roller spacer - 10. Journal retaining ring-bushing - 11 and 12. Taper roller bearings - 13. Seal - 14. Lock washer - 15. RH final drive shaft - 17. Seal bushing - 18. O-ring - 19. Final drive housing guard panel - 20. Road wheel hub - 21. Road wheel taper bushing - 22. Wheel shaft key.

Note: On assembly, apply jointing compound to surfaces X as directed on page 7, section A.

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FINAL DRIVE UNITS WITH TWIN WHEELS

To remove final drive units with twin wheels, see procedure for standard final drive units on page 1. Disassemble unit as directed on page 2, and remove seal bushing (17, page 3) to replace seal (13).
To assemble, follow instructions on pages 2 and 3, and pack space between seal bushing (17) and guard panel (19) with **grassofiat TUTELA G9** or other approved grease.

On final drive units with twin wheels the seal may be replaced without removing final drive housing by proceeding as follows:

— remove wheels;

— using a puller or two screwdrivers, withdraw seal bushing (17);

— replace seal and reinstall bushing on final drive housing.

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REMOVAL AND INSTALLATION

To remove PTO assembly proceed as follows:

— drain oil from rear transmission housing;

— disconnect implement attachment top link;

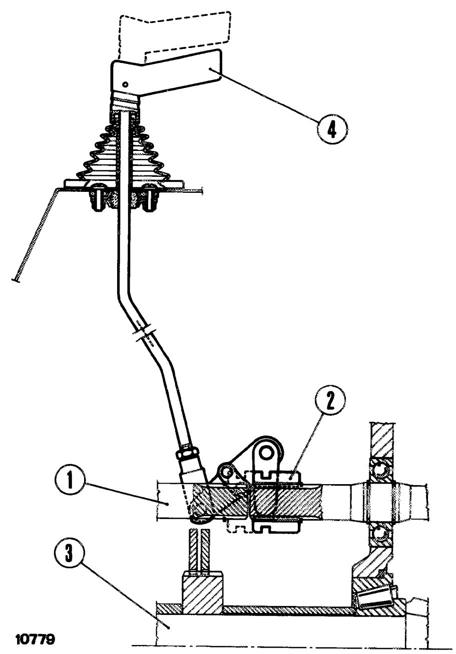
— remove the drawbar (if applicable);

— remove auxiliary cylinder (if applicable);

— attach lift chain, remove capscrews and (1180 only) engage PTO to prevent sleeve (2) from falling when removing PTO housing and attached drive shaft towards the outside.

To gain access to sleeve (2) on 1180, disconnect PTO lever link and remove rear transmission housing RH side cover.

Clean and thoroughly degrease mating surfaces, apply one of the jointing compounds detailed on page 7, section A, and install overhauled PTO assembly to the rear transmission housing.



Section through PTO control (1180).
1. PTO shaft - 2. PTO sleeve - 3. Bevel pinion shaft - 4. Control lever.

DISASSEMBLY AND ASSEMBLY

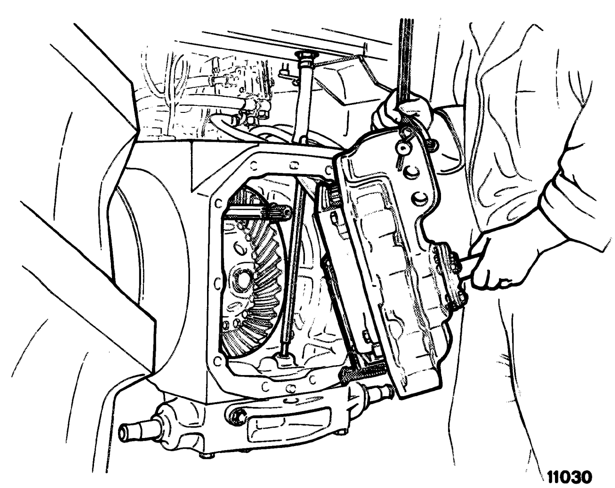
To disassemble 1000 rpm PTO (1880) proceed as follows:

— back off nut (C_1 page 2), remove capscrews and take off front support cover (5);

— remove drive gear (1), driven gear (2) and associated spacers, and push out PTO driven shaft (3) by applying a suitable driver to the splined end.

To disassemble 540/1000 rpm PTO (1180, 1380 and 1580) proceed as follows:

— disconnect spring (20), back off capscrews (C_4) and remove actuating fork (19) with associated spring (23) and support;



Removing (installing) PTO assembly.
Note: 540/1000 rpm PTO shown.

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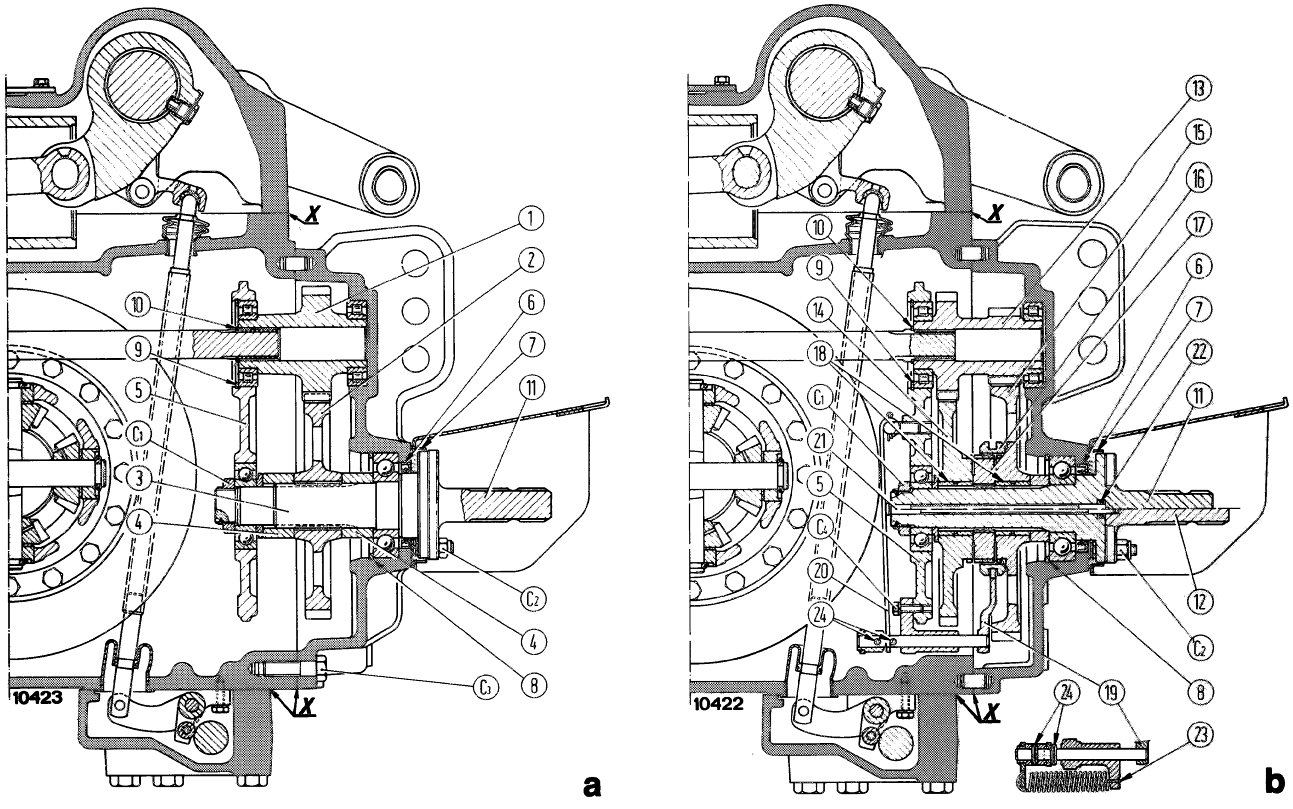

Longitudinal section through PTO

a. Section through 1000 rpm (1880) - b. Section through 540/1000 rpm (1180, 1380, 1580) - C_1. Driven shaft locknut - C_2. Spined adapter self-locking nut - C_3. PTO housing capscrews - C_4. Shifter rod support capscrews - 1. 1000 rpm PTO drive gear - 2. Driven gear - 3. Driven shaft - 4. Spacer - 5. PTO front bearing support - 6. Seal - 7. Seal shield - 8, 9 and 10. Retaining rings - 11. 1000 rpm splined adapter - 12. 540 rpm splined adapter - 13. 540 - 1000 rpm PTO drive gear - 14. 1000 rpm driven gear - 15. 540 rpm driven gear - 16. Sleeve - 17. Splined hub - 18. Driven gear support bushings - 19. Sleeve actuating fork - 20. Spring - 21. Spring pin - 22. Seal - 23. Spring - 24. Roll pin.

Note: On assembly apply jointing compound to faces X as directed in general instructions on page 7, Section A.

— back off nut (C_1), remove capscrews and front support cover (5);

— remove drive gear (13) driven gears (14 and 15) and associated sleeve bushings plus splined hub (17) with attached engagement sleeve (16);

— push out driven shaft using a suitable driver.

Replace any damaged bearings using suitable universal pullers and drivers.

Check gear support bushings (18) for wear and compare fitted clearance with data of pages 12, 13 and 14, section 20.

Replace seals (6 and 22) as necessary.

When assembling PTO, refer to figures and adhere to torque data specified on page 16, section 20.

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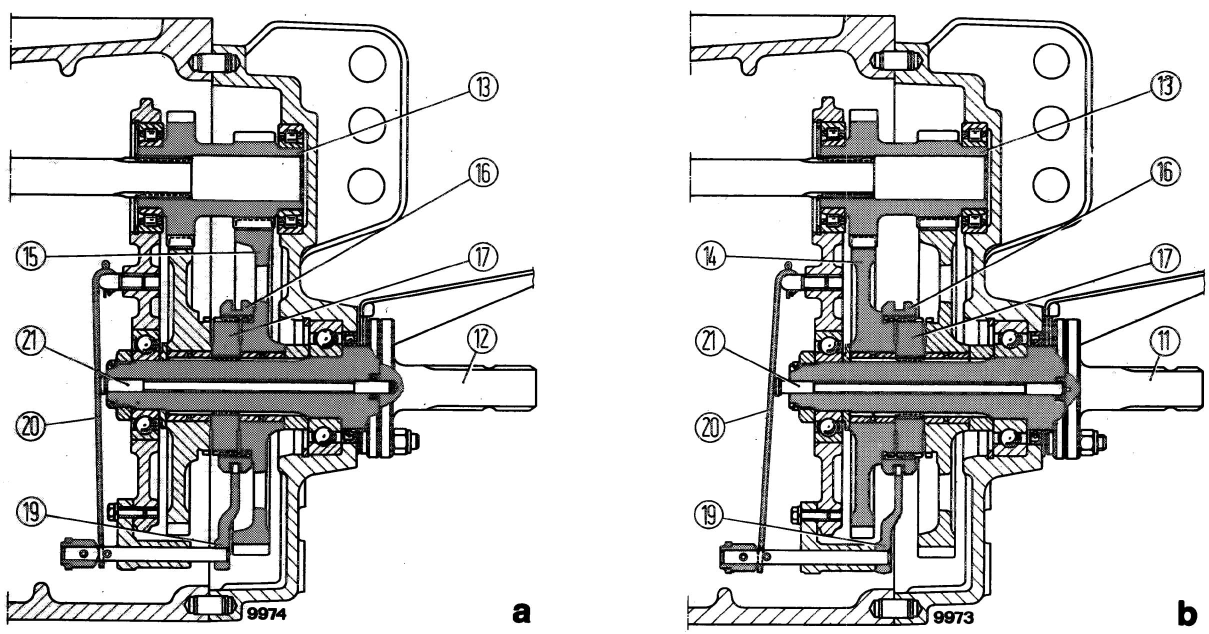


PTO Operation diagram: 540 rpm (fig. a) or 1000 rpm (fig. b).

Note: Working parts shown in grey, stationary or idle parts shaded.

11. 1000 rpm splined adapter - 12. 540 rpm splined adapter - 13. 540-1000 rpm PTO drive gear - 14. 1000 rpm driven gear - 15. 540 rpm driven gear - 16. Sleeve - 17. Splined hub - 19. Sleeve actuating fork - 20. Spring - 21. Spring pin.

PTO HYDRAULIC CLUTCH REMOVAL AND INSTALLATION (1180 H, 1380, 1580 and 1880)

Drain oil from rear transmission housing and proceed as follows:

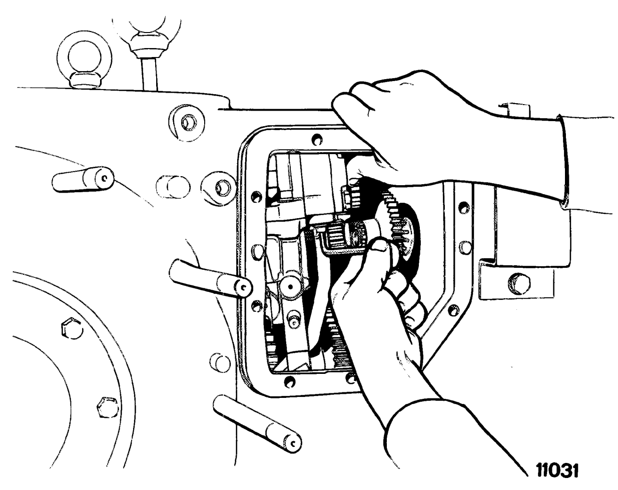
— remove auxiliary cylinder (if applicable), tow hook, PTO hosing, and withdraw PTO drive shaft from the rear;

— remove RH auxiliary tank (if applicable), disconnect differential lock and PTO control link, removing the associated cover;

— move retaining ring (31, page 5) and then pump drive gear (35) toward front transmission housing rib;

— insert M4 screw in pin (1, page 5) and withdraw clutch support;

— back off two pump capscrews and withdraw (early models) filter (39, page 4) with associated line or (late models) upper part of line (40) from lower union;



Removing (installing) hydraulic clutch oil filter.

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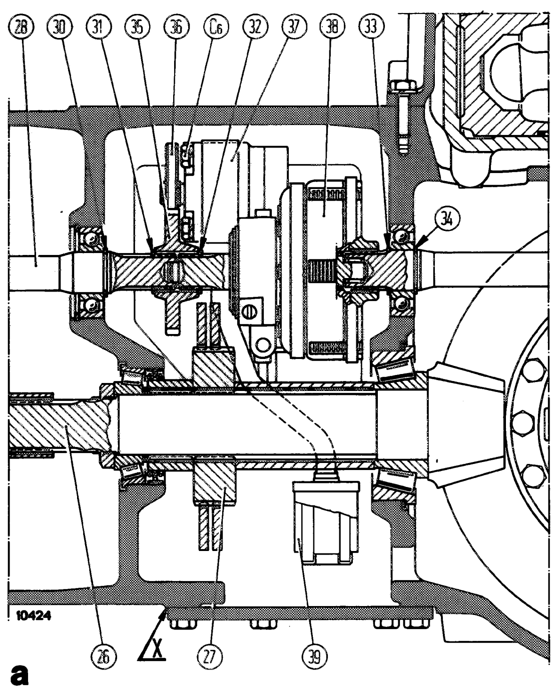
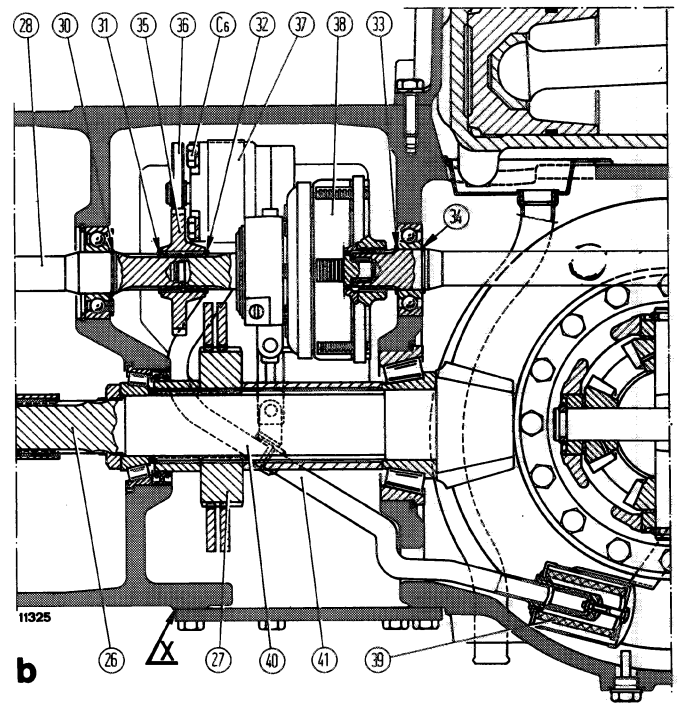




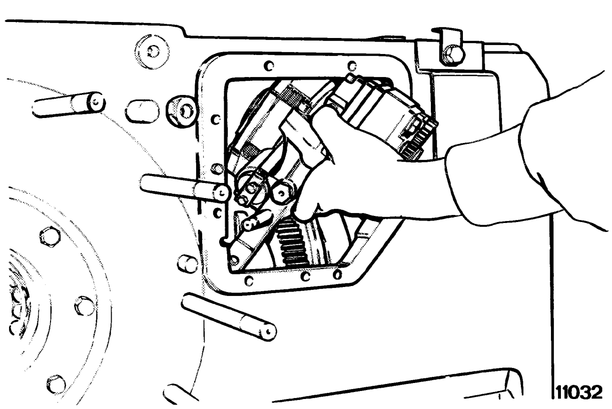
Longitudinal section through PTO drive (1180 H, 1380, 1580 and 1880).

a. Early model - b. Late model - C_6. Pump body capscrews - 26. Bevel pinion shaft - 27. Parking brake hub - 28. PTO shaft - 30, 31, 32, 33 and 34. Retaining rings - 35. Pump drive gear - 36. Pump driven gear - 37. PTO clutch pump - 38. PTO cluch - 39. Oil filter - 40. Pump upper inlet line - 41. Pump lower inlet line.

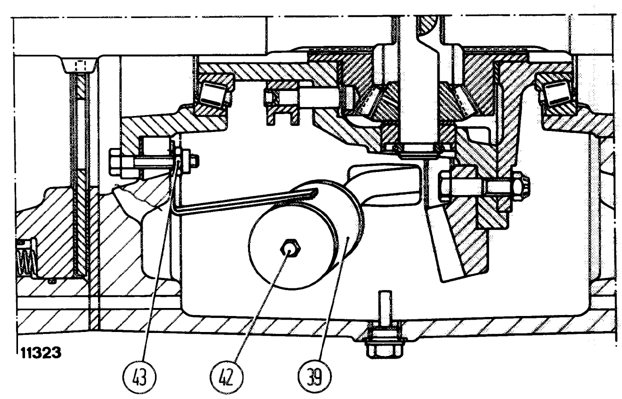
Note: On assembly apply jointing compound on faces X as directed in general instructions on page 7, section A.

— remove clutch-pump-driven gear assembly at an angle as shown to facilitate withdrawal.

Note: For tractors equipped with hydraulic differential lock, proceed as directed and then remove differential lock control valve as directed on page 18, section 204.



Removing (installing) PTO clutch.



Section through rear transmission showing PTO clutch oil filter (39).

42. Screw - 43. Nut.

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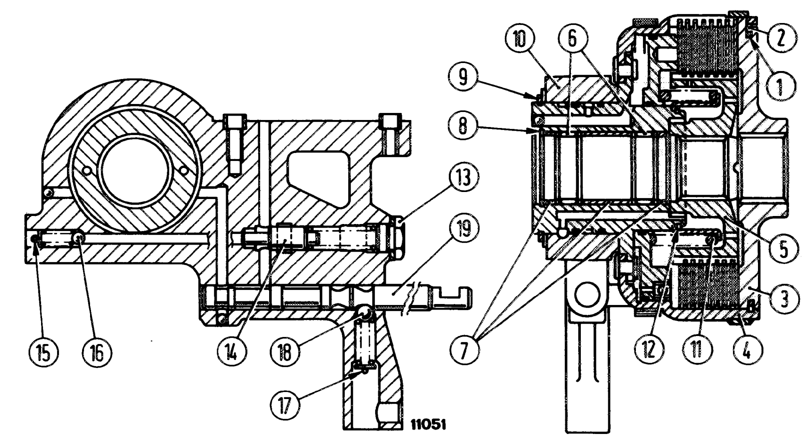


PTO hydraulic clutch.

1. Locking wire - 2, 8, 9 and 12. Retaining rings - 3. Driven hub - 4. Clutch housing - 5. Drive hub - 6. Needle roller bearings - 7. Spacers - 10. Clutch support - 11. Clutch plate spring - 13. Capscrew - 14. Pressure relief valve - 15 and 17. Roll pins - 16. Clutch plate lube pressure limiting valve - 18. Control valve spool detent ball - 19. Control valve spool.

On late model tractors back off screw (42, page 4), to remove filter cartridge or back off nut (43) to remove filter with associated lower line (41).

Disassemble clutch as follows:

— withdraw locking wire (1) using suitable pliers;

— push retaining ring (2) inward using a screwdriver and insert a steel strip between driven hub (3) and the clutch housing (4) as shown;

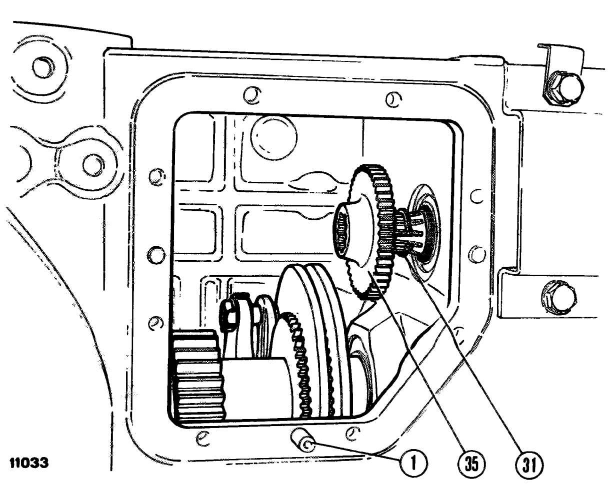
— push out driven hub (3) using a driver applied to internal spline end;

— remove drive hub, driven and drive plates, two needle roller bearings (6) and spacers (7);

— remove retaining rings (8 and 9) and withdraw clutch housing from support (10);

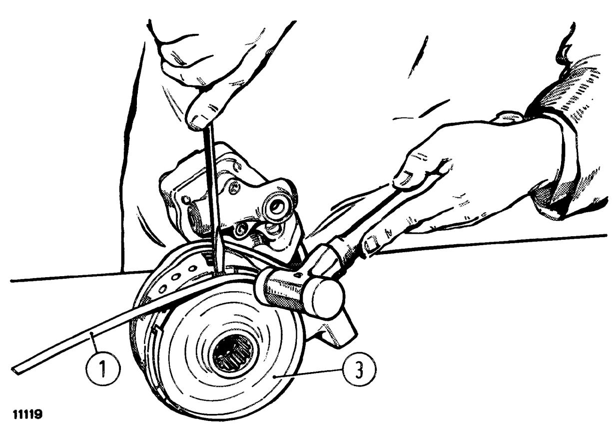
Note: Make a tool as shown on page 6 for spring (11) removal.

— install tool (1) on clutch housing as shown on page 6. Tighten nut to slightly compress spring and remove retaining ring (12);



Removing (installing) PTO clutch pump drive gear.

1. Pin securing clutch support to transmission housing - 31. Retaining ring - 35. Drive gear.



Removing PTO clutch driven hub.

1. Steel strip - 3. Driven hub.

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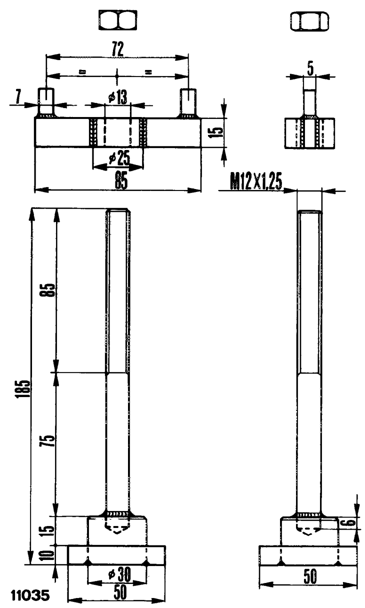
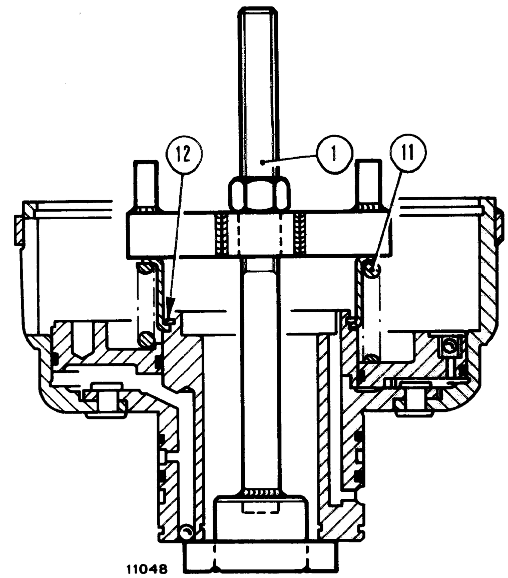


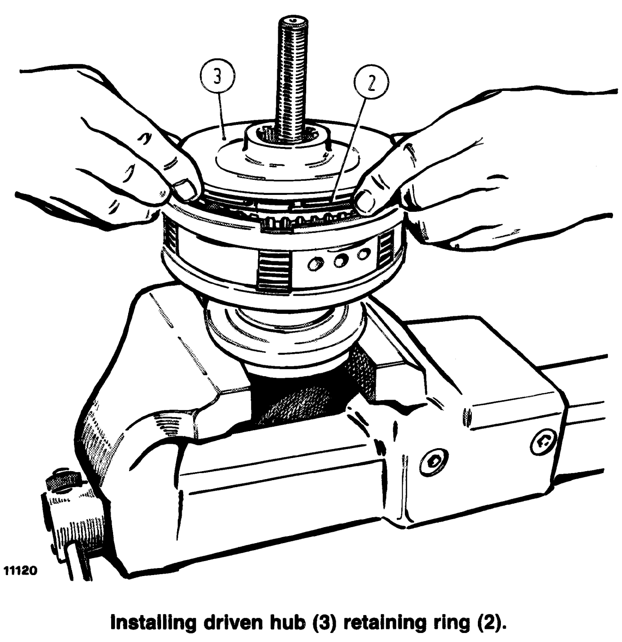
11035

PTO clutch plate spring remover and installer tool (dimensions in mm).



11048

Removing (installing) clutch plate spring.
1. Field tool - 11. Spring - 12. Retaining ring.



11120

Installing driven hub (3) retaining ring (2).

— back off tool (1) nut and retrieve spring (11);

— back off capscrew (13, page 5) and retrieve relief valve (14) with associated spring, withdraw two roll pins (15 and 17) and retrieve lube pressure limiting valve and spool (19).

Check condition of needle roller bearings and clutch plates. Refer to figure on page 5 for correct location, using tool (1) for retaining ring (12) installation. Retaining ring (2) may be installed by hand as shown.

Install locking wire (1, page 5).

After overhaul, install clutch assembly with associated hydraulic pump and, on early model tractors, filter with associated line or, late model tractors, upper line (40, page 4) to inserted into union on lower line (41).

Connect clutch-pump assembly to PTO shaft through drive gear (35) and then connect filter or upper line to the hydraulic pump.

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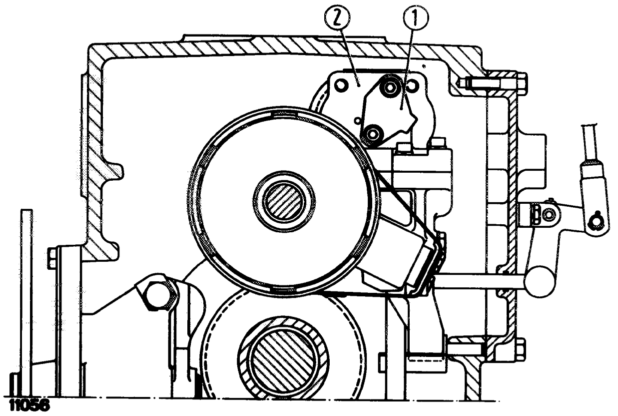
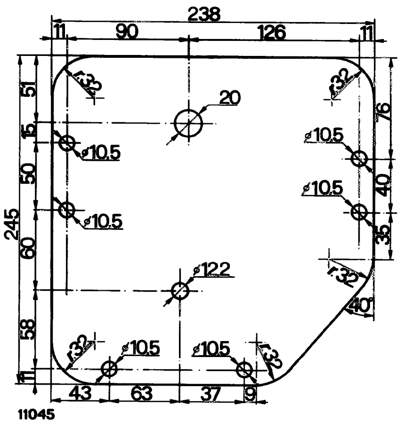


PTO hydraulic clutch.
1. Flange - 2. Hydraulic clutch pump.



PTO clutch relief valve setting test plate (dimensions in mm).

PTO hydraulic clutch pressure relief valve (14, page 5) setting check.

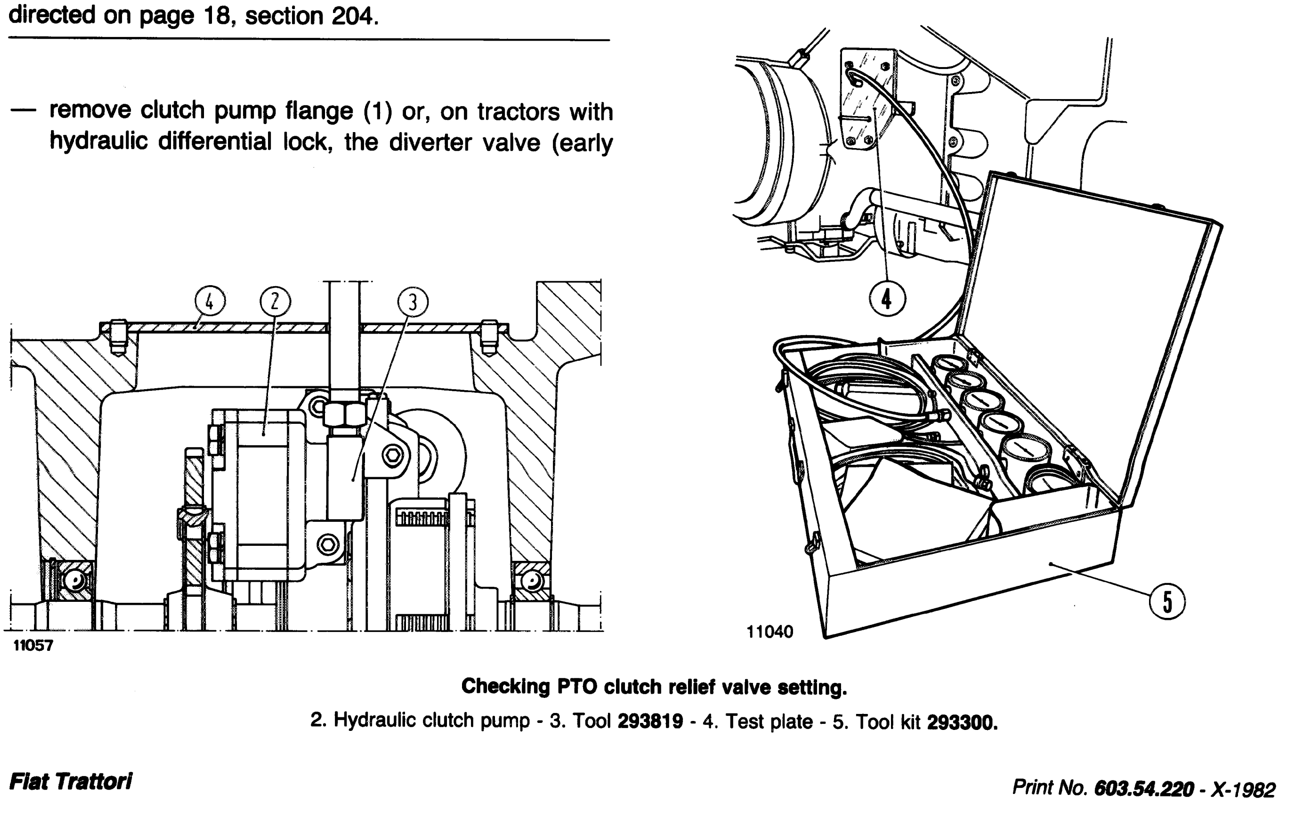
If PTO does not work efficiently check relief valve (14, page 5) setting as follows:

— remove transmission housing side cover;

Note: On tractors equipped with hydraulic differential lock, remove lock control valve beforehand, as directed on page 18, section 204.

— remove clutch pump flange (1) or, on tractors with hydraulic differential lock, the diverter valve (early models) or the pressure regulator valve (late models) ensuring that the capscrews do not fall into the housing, and install tool **293818** (3) of tool kit **293300**;

— construct a 5 mm (.20 in) thick plexiglass plate or a 2 mm (.08 in) thick sheet metal plate as shown in the diagram;



Checking PTO clutch relief valve setting.
2. Hydraulic clutch pump - 3. Tool **293819** - 4. Test plate - 5. Tool kit **293300**.

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— connect tool **293818** (3, page 7) to pressure gauge of tool kit **293300** scale 0 to 25 kg/cm^2 (0 to 356 psi) and install test plate on transmission housing;

— start engine, run at part throttle and check that oil pressure reaches 12 bar (12.2 kg/cm^2 - 174 psi) on pressure gauge.

If not, insert spacers between spring and capscrew (13, page 5) to increase valve setting or between clutch housing and screw (13) to reduce it. However, immediate spring replacement is preferable.

HYDRAULIC PUMP

Pump is controlled through a spur gear installed on the PTO shaft and is located on the hydraulic clutch.

Pump oil automatically lubricates and takes up gear end float.

Overhaul

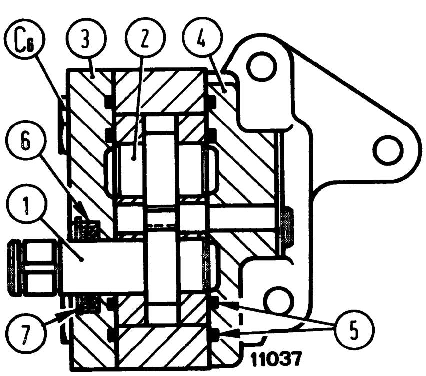
Refer to figure below when disassembling pump.

Mark the parts in order to restore them to their original position on reassembly.

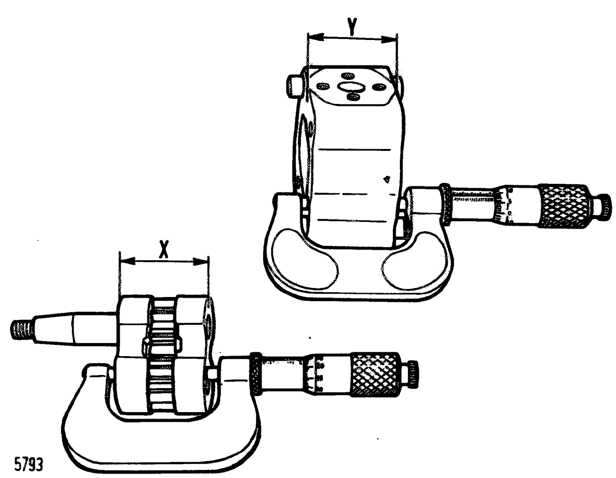
Check gear shafts and seats for wear comparing results with data given in the table on page 14, section 20.

Check gear side face flatness and squareness relative to the seats, smearing the surfaces with carbon black. Small defects may be remedied using wet, extra-fine abrasive paper.

— Ensure that gear end float in pump body is .09 to .16 mm (.0035 to .0063 in). Remedy any defects using wet, extra fine abrasive paper and removing as little material as possible.



Section through PTO hydraulic clutch pump.
C_6. Cover capscrews - 1. Drive gear shaft - 2. Driven gear shaft - 3 and 4. Covers - 5. Cover gaskets - 6. Drive shaft seals - 7. Retaining ring.



Checking gear end float in pump body.
Dimension X should be .09 to .16 mm (.0035 to .0063 in) lower than dimension Y.

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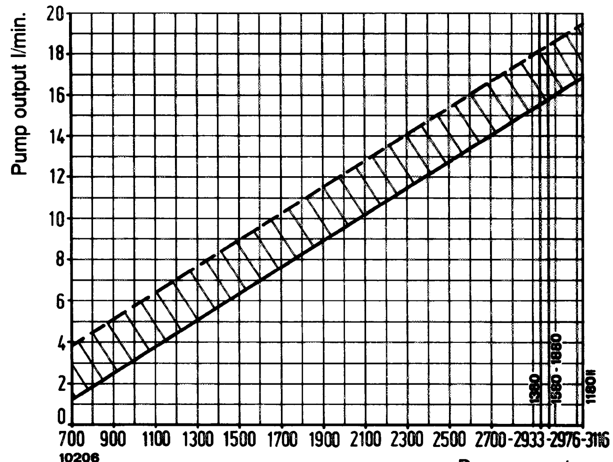
Lubricate all pump parts using hydraulic lift oil, then assemble noting the following points:

- align the reference marks made on disassembly;
- install gear supports in pump body by hand and position so that fillets face outlet ports and slotted frontal surfaces about the gears;
- progressively tighten cover capscrews at the specified torque.



PTO Hydraulic clutch pump speed-output chart.

Max. test pressure 98 bar (100 kg/cm^2) (1421 psi).

Oil temperature 55° to 65°C.

Pump drive ratio:
- 1180 H and 1380 .... 1:1.222
- 1580 and 1880 .... 1:1.353

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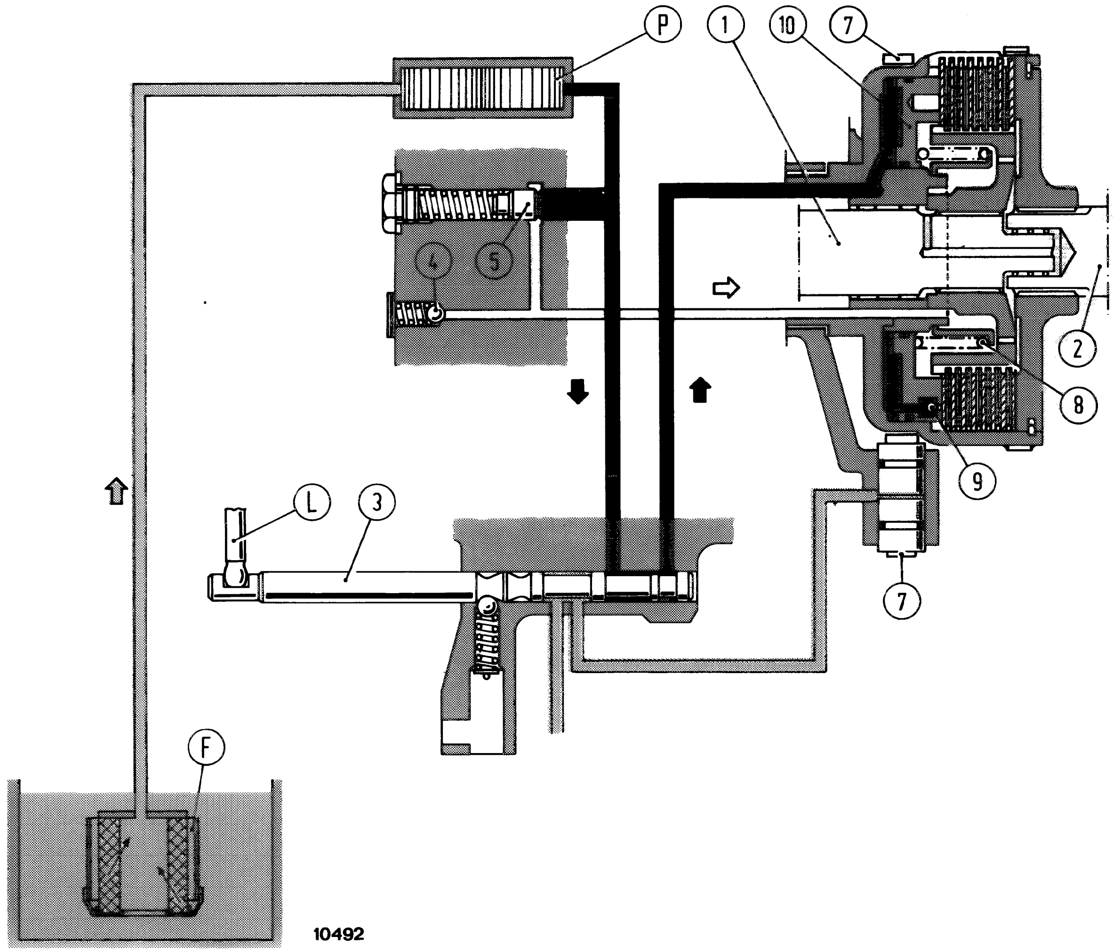

PTO clutch operation diagram - Clutch applied and brake off.

F. Filter - L. Clutch/brake control lever - P. Pump - 1. PTO clutch shaft - 2. PTO rear shaft - 3. Control valve spool - 4. Lube pressure regulator valve (crack-off setting 7.5 bar - 7.6 kg/cm² - 108 psi) - 5. Pressure relief valve (crack-off setting 12 bar - 12.2 kg/cm² - 174 psi) - 7. Brake band - 8. Release spring - 9. Quick unload valve - 10. Pressure plate piston.

PTO HYDRAULIC CLUTCH OPERATION

When lever (L) is moved backward, spool (3) establishes communication between pump delivery port and pressure plate piston (10) wich overcomes the opposition of spring (8) and locks drive plates to driven plates, thereby connecting shaft (1) to rear PTO shaft (2).

Valve (5) maintains oil pressure at 12 bar (12.2 kg/cm², 174 psi) while valve (4) regulates lubricating oil pressure at 7.5 bar (7.6 kg/cm², 109 psi).
Under these conditions brake is not engaged and thus band (7) is not in contact with clutch housing which may turn freely.

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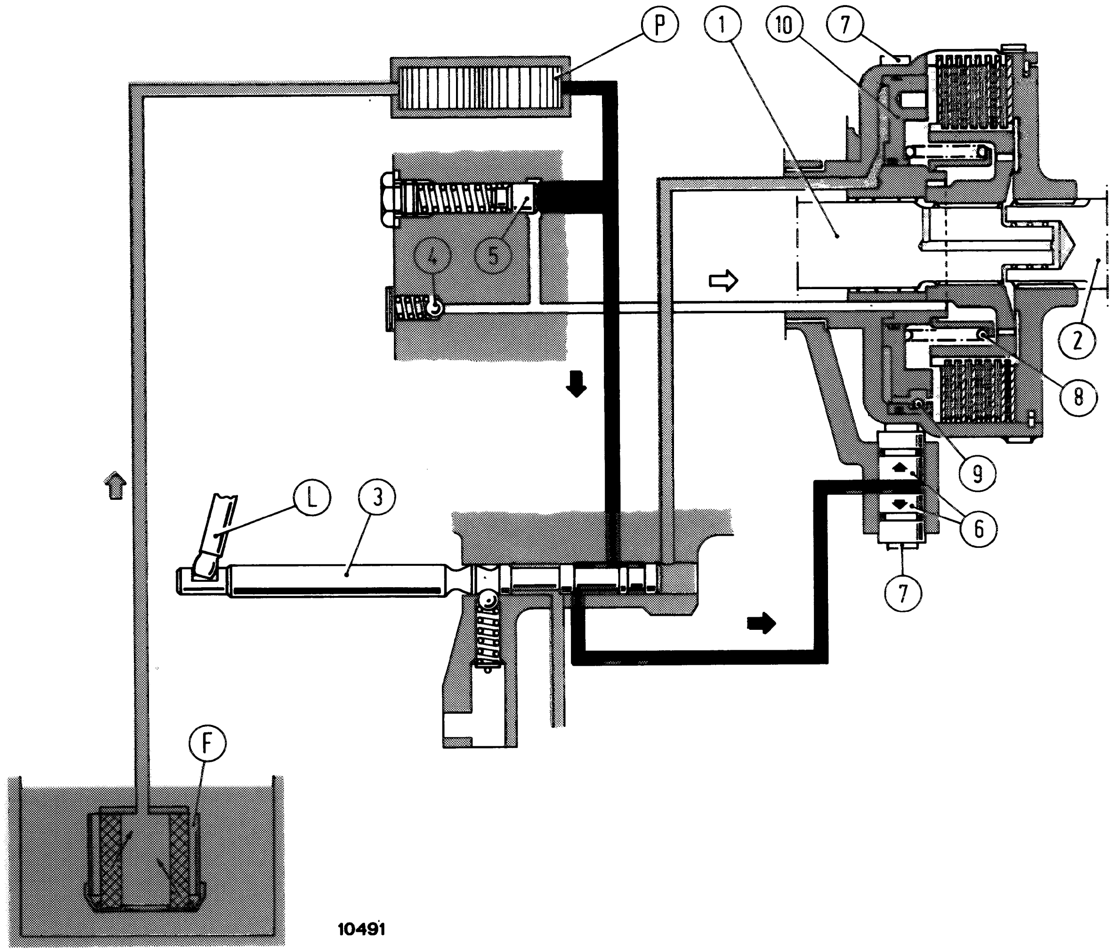

PTO clutch operation diagram - Brake applied and PTO clutch disengaged.

F. Filter - L. Clutch/brake control lever - P. Pump - 1. PTO clutch shaft - 2. PTO rear shaft - 3. Control valve spool - 4. Lube pressure regulator valve (crack-off setting 7.5 bar - 7.6 kg/cm^2 108 psi) - 5. Pressure relief valve (crack-off setting 12 bar - 12.2 kg/cm^2 - 174 psi) - 6. Brake control pistons - 7. Brake band - 9. Quick unload valve - 10. Pressure plate piston.

When lever (L) is moved forward, spool (3) establishes communication between pump delivery port and brake control pistons (6) which move in the direction indicated by the black arrows wrapping band (7) around the clutch housing.

Simultaneously, pressure plate piston (10) returns to off position under the spring (8) load and causes oil to drain from the associated port and through quick unload valve (9) which takes up the position shown due to centrifugal force exerted by clutch housing rotation.

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FRONT AXLE

Type	Inverted "U", telescoping, centre pivotting
Tracks	1600-1700-1800-1900-2000-2100 mm (63-67-71-75-79-83 in)
Camber	3°, equivalent to 21 mm (.83 in) for 16″ rims or 27 mm (1.06 in) for 20″ rims measured at outermost edge of rim (page 2, section 301)
Toe-in	0 to 5 mm (0 to .197 in)
Steering knuckle articulation	
King pin journal dia (2, page 1, section 301):	
— upper	49.961 to 50.000 mm (1.9670 to 1.9685 in)
— lower	49.961 to 50.000 mm (1.9670 to 1.9685 in)
Bushing fitted 1D (3):	
— upper	50.050 to 50.140 ([1]) mm (1.9705 to 1.9740 in)
— lower	50.050 to 50140 ([1]) mm (1.9705 to 1.9740 in)
King pin clearance in bushings	.050 to .179 mm (.0019 to .0070 in)
Bushing interference fit in housing	.014 to .080 mm (.0005 to .0031 in)
Axle pivot	
Pivot dia (9, page 1, section 301)	49.961 to 50.000 mm (1.9670 to 1.9685 in)
Bushing fitted I.D. (10)	50.050 to 50.140 ([1]) mm (1.9705 to 1.9740 in)
Pivot clearance in bushings	.050 to .179 mm (.0019 to .0070 in)
Bushing interference fit in axle housing (10)	.014 to .080 mm (.0005 to .0031 in)

POWER STEERING

Type	hydrostatic
Make	DANFOSS
Hydraulic circuit	Independent, separate pump
Oil reservoir	metal, plug with dipstick on RH side of engine
Oil filter	metal cartridge, in oil reservoir

([1]) Not reamed

(follows)

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POWER STEERING

(continued)

Make	DANFOSS
Type	ORBITROL, with steering wheel operated rotary valve (permitting steering also in case of pump failure (page 7, section 302)
Outfit code	OSPB-100-OVP-20
Relief valve crack-off setting	125 bar (127.5 kg/cm^2 - 1822 psi)
Power cylinder overload valve crack-off setting	200 bar (204 kg/cm^2 - 2903 psi)
Power cylinder	
Type	double acting, located behind front axle
Make	WEBER
Cylinder bore diameter	50 mm (1.97 in)
Maximum piston stroke	250 mm (9.84 in)
Piston rod diameter	22 mm (.866 in)
Hydraulic pump	
Type	gear, integral flow regulator
Make	BOSCH
Model	HY/ZFS 11/11 R 169
Drive	from engine valve gear
Rated delivery	13.50 to 17.25 l/min (23.7 to 30.8 pints/min
Rotation (seen from drive end)	clockwise
Drive ratio:	
— 1180-1380	1:1.166
— 1580-1880	1:1.300
Rated speed (at engine governed speed):	
— 1180	2975 rpm
— 1380	2800 rpm
— 1580 and 1880	2860 rpm
On bench output at 1450 rpm and 125 bar (127 kg/cm^2 - 1813 psi)	16 litre/min (28 pints/min)
Test oil temperature	55 to 65°C
Test oil viscosity	SAE 20

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TORQUE DATA

DESCRIPTION	Thread size	Torque		
		Nm	kgm	ft.lb.
Front axle, section 301				
Capscrew, front axle carrier to engine (C_1, page 1)	M18×1.5	353	36	260
Capscrew, axle pivot (C_2)	M10×1.25	59	6	43
Nut, axle end	M16×1.5	221	22.5	163
Nut, track rod lever (C_4)	M16×1.5	235	24	173
Capscrew, wheel to hub (C_3)	M18×1.5	319	32.5	235
Power steering, - section 302				
Capscrew, control valve to tractor	3/8″-16UNC	44	4.5	32
Capscrew, cover to control valve (C_1, page 7)	M 8×1	34	3.5	25
Nut, power cylinder pivot pin (C_3, page 2)	M20×1.5	294	30	217
Nut, steering wheel to steering column	M18×1.5	69	7	51
Nut, drive sleeve to pump drive shaft	M12×1.5	55	5.6	40
Capscrew or nut, steering pump to engine	M 6×1	8	.8	6
Capscrew, OVP 20 valve block to body	—	64	6.5	47
Capscrew, cover to pump body	—	39	4	29

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REMOVAL AND INSTALLATION

To remove front axle assembly from tractor proceed as follows:

- apply the parking brake, chock the rear wheels and remove the front ballast and its support;
- remove power steering cylinder from axle;
- prop up the axle carrier, raise the tractor and remove the front wheels;
- remove screws (C_2), withdraw pivot (9) using puller **292927** with adapter **290793**, remove the axle assembly and place in position on an axle overhaul stand.

If worn, replace bushings (10) using suitable pullers and drivers.

STEERING KNUCKLE OVERHAUL

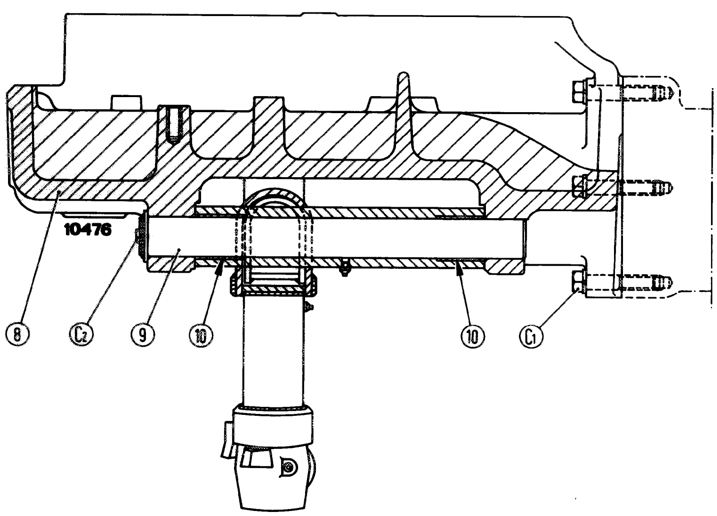
Front steering knuckles and wheel hubs may be removed without separating the front axle from the tractor; proceed as follows:

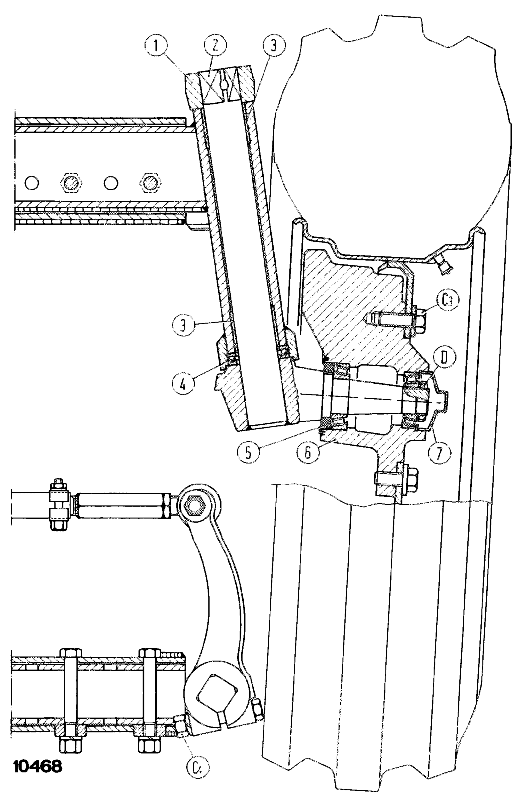
- remove cover (7) and slacken nut (D);
- back off wheel bolts (C_3);
- apply the handbrake, chock the driving wheels, raise the front end of the tractor and rest the axle on two adequate props;
- remove the front wheel;
- back off nut (C_4) and withdraw steering knuckle (2) with attached wheel hub from the bottom, subsequently separating the two items at the bench.

Replace any inefficient seals and worn bushings and bearings using suitable pullers and drivers.

On assembly, pack the wheel hub with **grassofiat TUTELA G9** and adjust the tapered roller bearings as follows:

- tighten nut (D) to 196 Nm (20 kgm - 145 ft.lb.), simultaneously turning hub (6) to settle the bearings;
- slacken the nut and retighten to 24 to 34 Nm (2.5 to 3.5 kgm) (18 to 25 ft.lb.), simultaneously turning the hub;





Sections through steering knuckle and centre pivot.

C_1. Capscrew retaining axle carrier to engine - C_2. Axle pivot capscrew - C_3. Capscrew securing disc to hub - C_4. Lever nut - D. Bearing nut - 1. Track rod lever - 2. King pin - 3. Bushings - 4. Bearing - 5. Seal - 6. Wheel hub - 7. Bearing adjustment and grease cover - 8. Axle carrier - 9. Centre pivot - 10. Axle pivot bushings.

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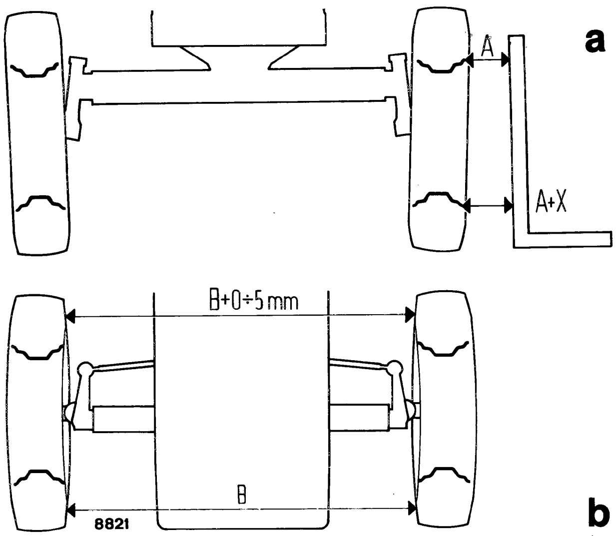

Wheel alignment check diagram.

a. Checking wheel camber - b. Checking wheel toe-in - X ≅ 21 mm (.83 in) for 16″ rims or 27 mm (1.06 in) for 20″ rims.

— slacken the nut again and retighten to 9.8 Nm (1 kgm) (7.2 ft.lb.) simultaneously turning the hub;

Note: Replace nut (D) at every adjustment.

— lock the nut in position by pressing.

AXLE CHECK

Check the steering geometry as follows:

— with the wheels in the straight-ahead driving position, camber should be 3°, equivalent to 21 mm (.83 in) for 16″ rims or 27 mm (1.06 in) for 20″ rims, as measured between rim edges (a) and parallel to the tractor longitudinal centreline. Toe-in should be up to 5 mm (.20 in) as measured on the inside between rims (b);

— to adjust toe-in, turn the adjustable track rod ends.

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POWER STEERING OVERHAUL

Hydrostatic steering system components and their operation are illustrated in the diagram of page 7, section 302.

Removal

Remove the unit from the tractor as follows:

— remove front and rear side panels, exhaust silencer, hood and air cleaner with associated support;

— drain oil from power steering tank, then disconnect battery negative terminal and the four power steering hoses;

— remove steering wheel and transmission and splitter control levers. Disconnect the instrument panel and tip backward toward seat;

— remove control board, back off the four capscrews securing steering column to power steering unit and retrieve the unit from the engine side.

Disassembly

Disassemble the steering unit as follows:

Note: Do not strike sheet metal cap (30, page 7, section 302) on rotary valve for any reason, otherwise leakage will result necessitating renewal of the entire power steering unit.
During removal and installation of sleeve (6) and rotary valve (5), pin (1) should be kept horizontal to prevent it from becoming unseated and falling into the grooves inside the steering unit, which will impede withdrawal of the assembly.

— remove the screws (C_1) retaining the cover to body (3) and withdraw the cover, cam ring (8) with attached rotor (9), thrust washer (10), spacer (12), rotor shaft (7), sleeve (6) with attached rotary valve (5), pin (1) and cup (28), followed by thrust bearing (29) in that order;

— overturn the steering unit and retrieve non-return valve ball (4), after removing the threaded stop.

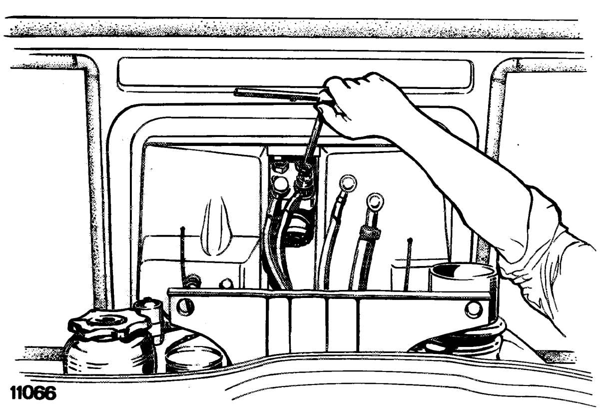
Assembly

Reverse the disassembly sequence noting the following points:

— always replace the seals;

— insert seal (31, page 7, section 302) between body and rotary valve (5) using tool **293388**:

— if spring (2) is to be replaced, use tool **293389**;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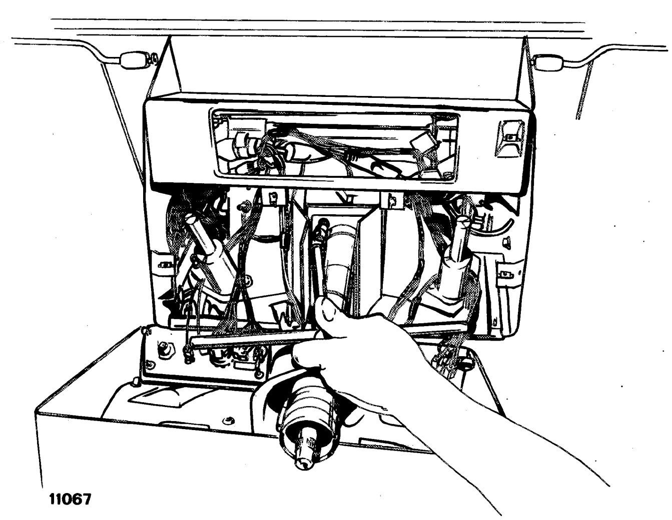
Disconnecting (connecting) power steering hoses.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Removing (installing) steering column from power steering body.

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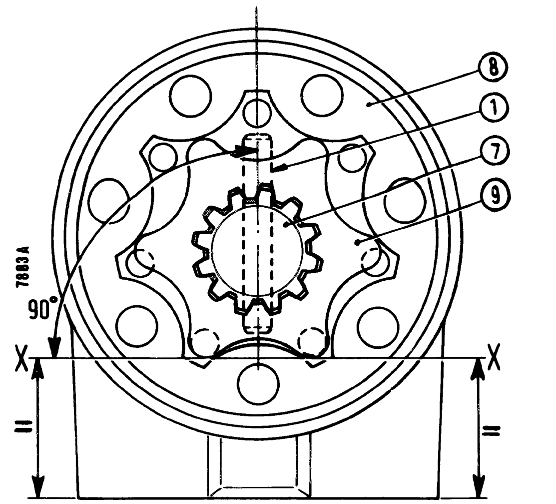


Timing power steering unit.

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

— whenever the steering unit is disassembled, overturn rotor (9) to obtain maximum wear from the splines;

— fit non-return valve ball (4) in its seat, keeping body (3) vertical and overturned relative to its normal operating position on the tractor, and fully tighten the screw to prevent the ball from falling into the recesses between steering unit and pushrod;

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

— tighten cover screws (C_1, page 7, section 302) to the specified torque.

Hydraulic cylinder overhaul

To disassemble cylinder proceed as follows:

— remove lock ring (3), push guide (7) inwards and withdraw retaining ring (5) from cylinder;

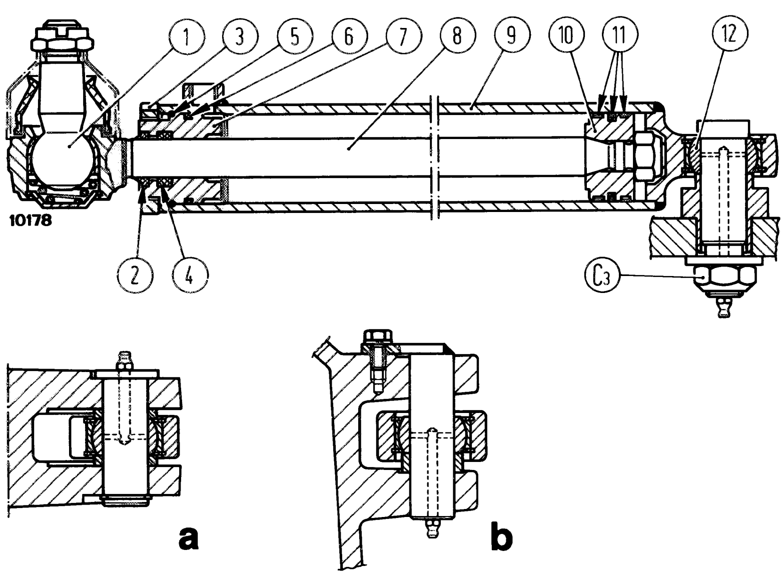
— subsequently, withdraw the piston rod assembly from the cylinder, back off nut and withdraw guide (7) from piston (10).

Liberally lubricate the component parts, assemble in the reverse order given for disassembly referring to the illustrations below and noting the following points:

— tighten piston nut to the specified torque;

— insert the piston rods in their respective guides (7) paying the utmost attention to prevent distortion and damage to the seals;

— check for piston rod seal leakage by pressurising the cylinder chamber on the piston rod ride.



Section through power cylinder.

a. Section through cylinder linkage to RH steering arm - b. Section through cylinder linkage to front axle - C_3. Pivot pin nut - 1. Ball joint - 2. Dust excluder - 3. Lock ring - 4. Seal - 5. Retaining ring - 6. O-ring - 7. Guide - 8. Piston rod - 9. Cylinder - 10. Piston - 11. Piston gland - 12. Spherical joint.

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ON-BENCH POWER STEERING TEST AND CHECKS

Test conditions.

Oil type .... **oliofiat IDRAULICAR AP51**
Oil viscosity ....SAE 20 W
Oil temperature .... 60°C
Hydraulic pump
293165 output ...... 12 dm^3/min(litres/min)(21 pints/min)
Electric motor **291235** .... 1450 rpm

1. ROTARY VALVE WEAR CHECK

Connect apparatus as shown in fig. a. and set up circuit as shown in fig. b, page 4. Keep steering unit control in steer position (left or right) using wrench **293192/1**.

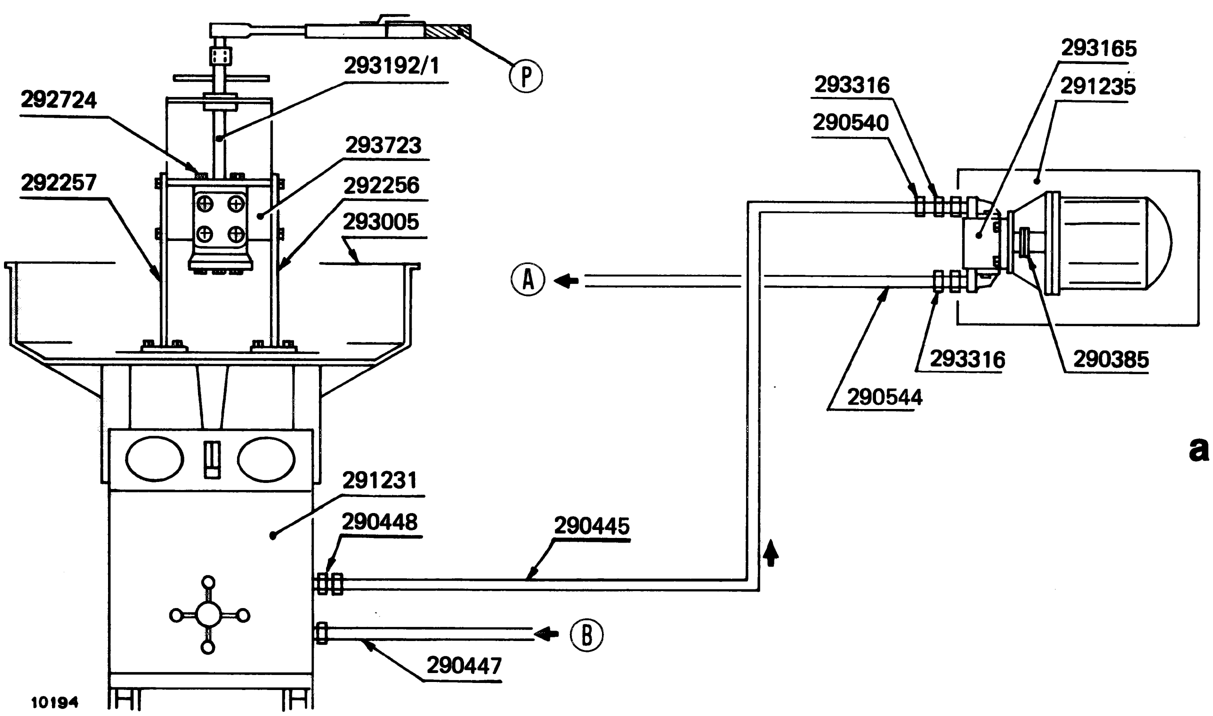
Simultaneously increase circuit pressure by turning apparatus **291231** handwheel until pressure is as near as possible to relief valve (24, page 7) crack-off setting without valve cutting in.
Apply 34 Nm (3.5 kgm - 25 ft.lb.) to wrench **293192/1** using a torque wrench, and check that one rotary valve (5, page 7) turn takes more than 10 seconds to complete. If time is less than 10 seconds, replace rotary valve and associated sleeve (6).

2. RETURN CHECK

With conditions as for test 1, check that rotary valve (5) returns to neutral after each simulated steer leaving wrench **293192/1** free.

3. SEAL CHECK

With conditions as for test 1, keep rotary valve (5, page 7) in steer position for three minutes using wrench **293192/1** and check seals for leakage.



Test set-up for rotary valve check, seal check, pressure relief valve and cylinder safety valve setting.
A. Delivery - B. Restriction - P. Torque wrench.

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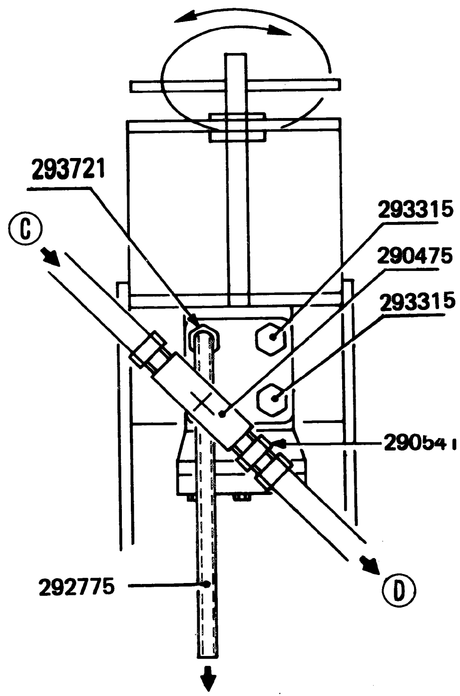
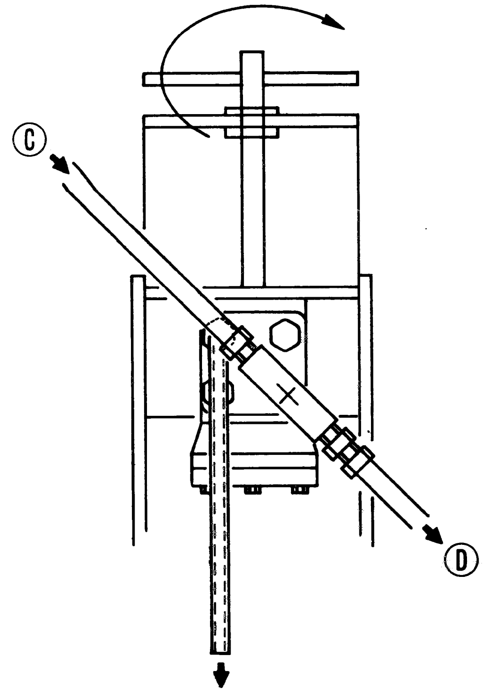


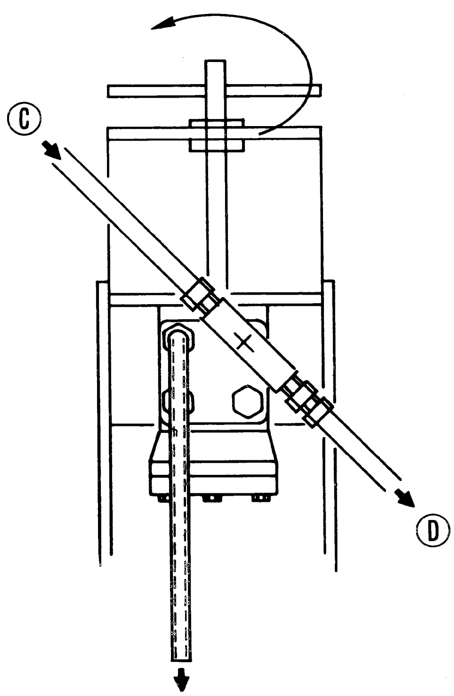
10195 Ⓔ **b**

Rotary valve wear check.
C. From delivery - D. To restriction - E. Drain.



10200 Ⓔ **c**

LH steer cylinder safety valve setting.
C. From delivery - D. To restriction - E. Drain.



10199 Ⓔ **d**

RH steer cylinder safety valve setting.
C. From delivery - D. To restriction - E. Drain.

4. PRESSURE RELIEF VALVE SETTING

Connect apparatus as shown in fig. a, page 3, and set up circuit as shown in fig. b. Using wrench **293192/1** simulate steer to discontinue oil flow to tank.
Gradually increase circuit pressure turning apparatus **291231** handwheel and check on pressure gauge that relief valve (24, page 7) cuts in at the specified pressure (125 bar - 127.5 kg/cm^2 - 1813 psi). If not, increase or decrease relief valve crack-off pressure by screwing in or backing off adjusting screw (36).

5. CYLINDER SAFETY VALVE SETTING

c - LH steer.

Connect apparatus as shown in fig. a, page 3, and set up circuit shown in fig. c, page 4.

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Using wrench **293192/1** simulate LH steer (counter-clockwise rotation) to interrupt oil flow to tank.

Gradually increase pressure turning handwheel and check on pressure gauge that safety valve (33, page 7) cut-in occurs at the specified pressure (200 bar - 204 kg/cm^2 - 2,900 psi).

If the pressure is not as specified, increase or reduce valve (33) setting by tightening or backing off adjusting screw (38).

d - RH steer.

Connect apparatus as in fig. a, page 3, and set up circuit as in fig. d, page 4.

Proceed as directed for LH steer (c) but turn wrench **293192/1** clockwise instead of counter clockwise.

STEERING CONTROL VALVE OVERHAUL

Seal (31, fig. a) and ring (39) installation using tool 293388.

Grease O-ring (31) together with anti-extrusion ring (39) as illustrated in figure) and apply to lower end of tool inner element (1).

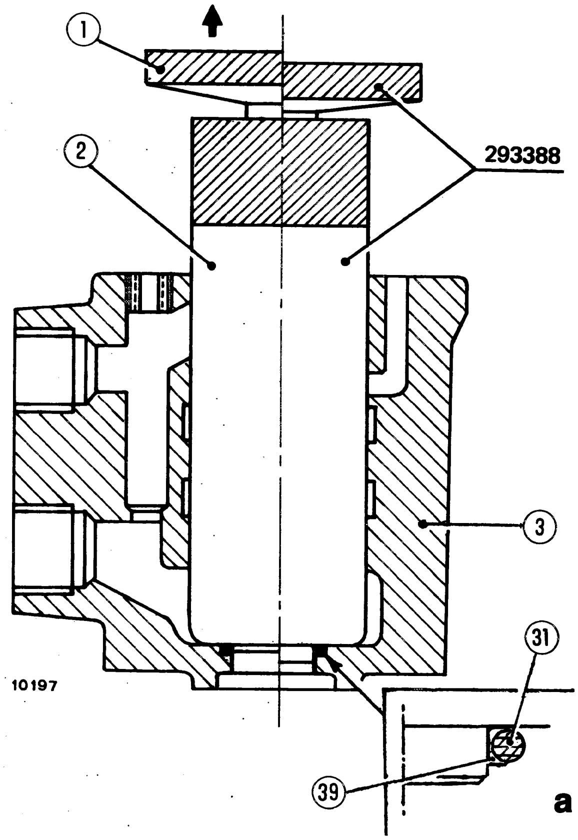
Insert sleeve (2) right up against bottom of steering unit body (3).

Insert element (1) into sleeve (2) until resistance is felt, then turn slightly and push fully home. Withdraw sleeve element (1) by a few millimetres and then remove tool **293388** assembly.

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

Return spring (2) installation using tool 293389 (figures b and c).

Couple rotary valve (5) and associated sleeve (6) matching return spring seats in neutral (2).

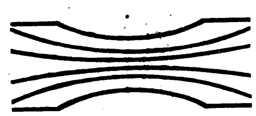


a

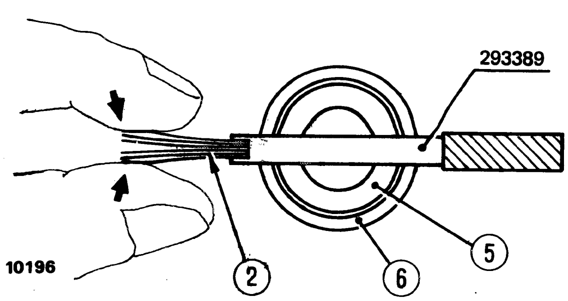
Installing seal (31) and ring (39) using tool 293388.
1. Tool inner element - 2. Sleeve - 3. Seat on steering unit body.

Apply tool **293389** (see fig. c) and insert spring pack as shown in fig. b.

Simultaneously compress and push spring pack into seat withdrawing tool.



b



c

Installing return springs (fig. b) using tool 293389 (fig. c).
2, 5 and 6 See text.

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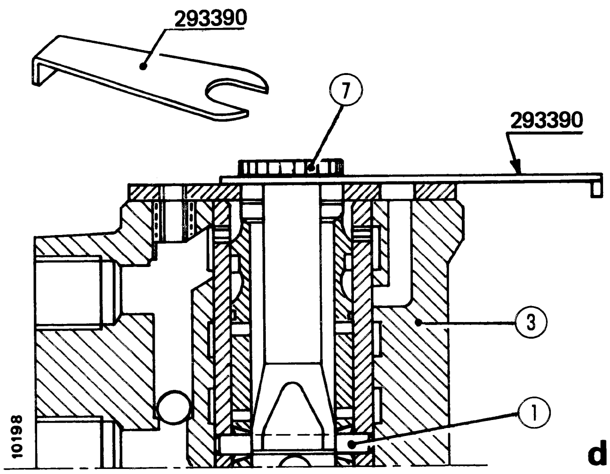
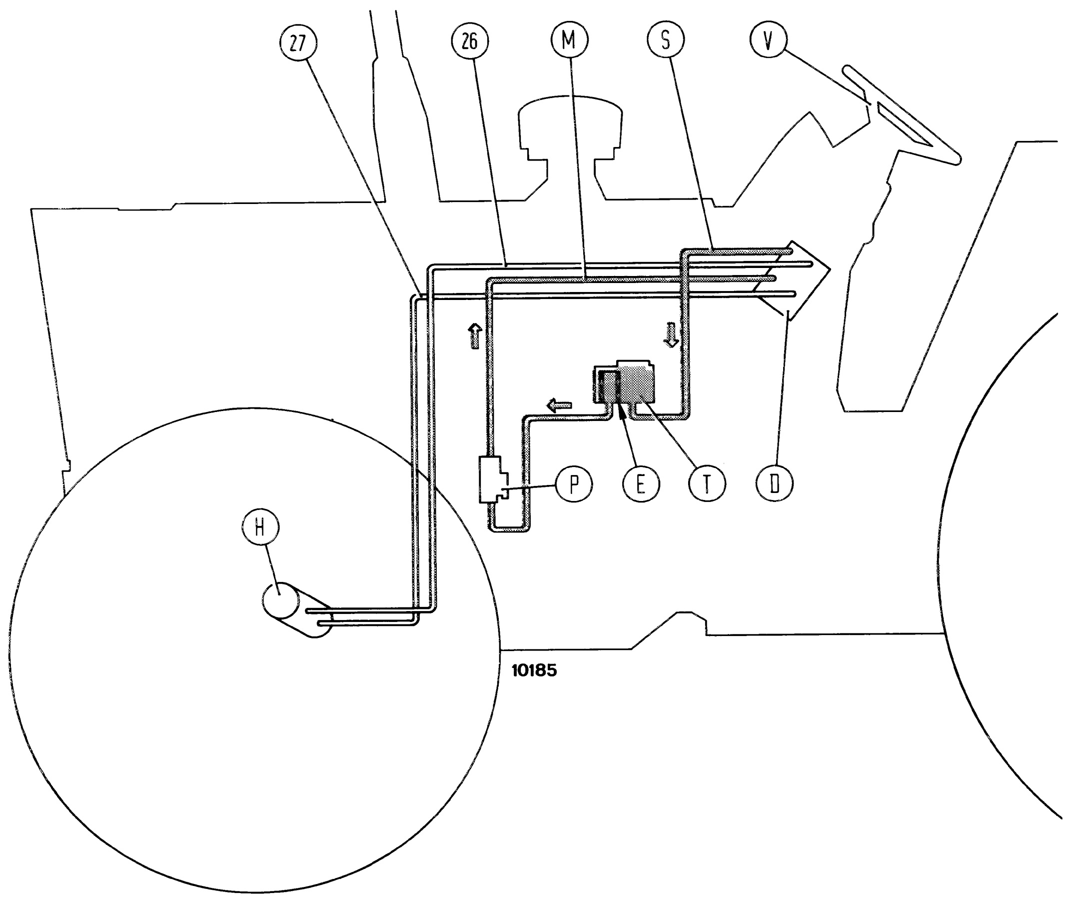
FRONT AXLE - STEERING: Power steering



Rotary shaft (7, page 7) installation using lever 293390 (fig. d).

Introduce rotary shaft (7, page 7) into body (3) with passage parallel to pin (1). Insert lever **293390** as shown in figure to facilitate steering unit timing (see page 2) when installing rotor and associated cam ring (8).

Installing rotary shaft using lever 293390.
1, 3 and 7 See text.



On tractor power steering schematics.

D. Hydraulic control unit including control valve (D_1) with valve block (D_2) - E. Filter cartridge - H. Power cylinder - M. Pump outlet line - P. Hydraulic pump - S. Return to tank - T. Reservoir - V. Steering wheel - 26. Connecting line for LH power cylinder chamber - 27. Connecting line for RH cylinder chamber (rod side).

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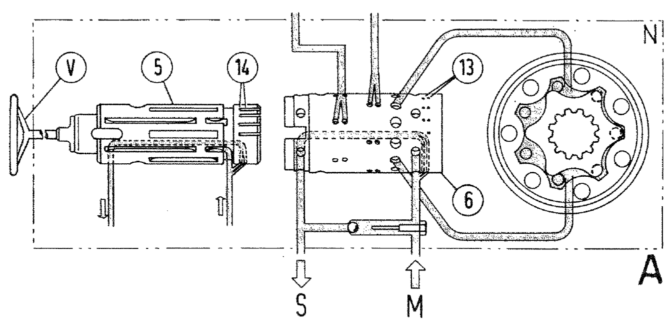

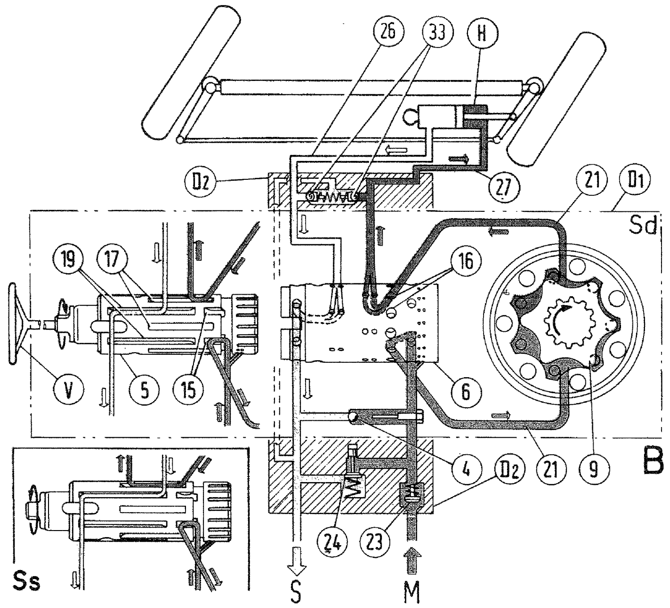

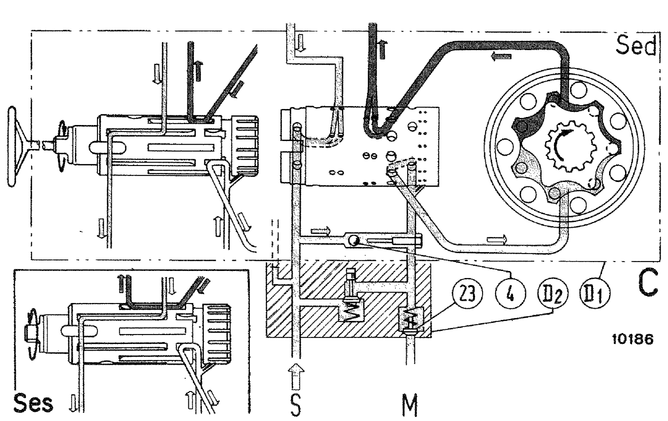

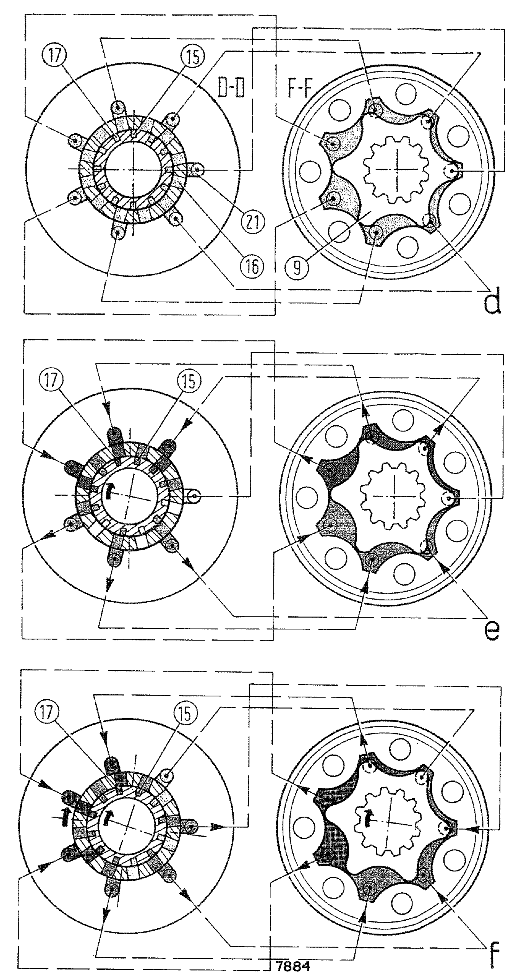

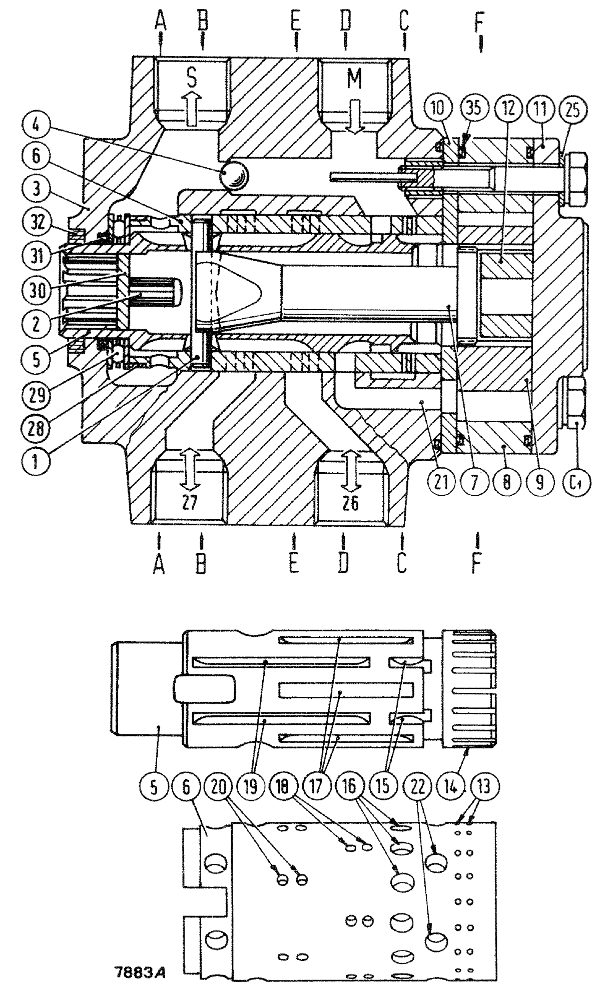

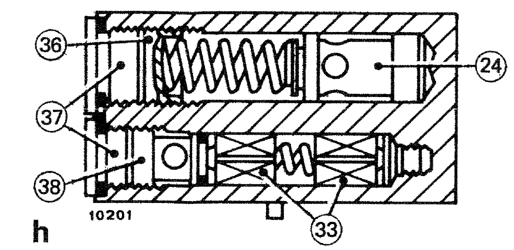

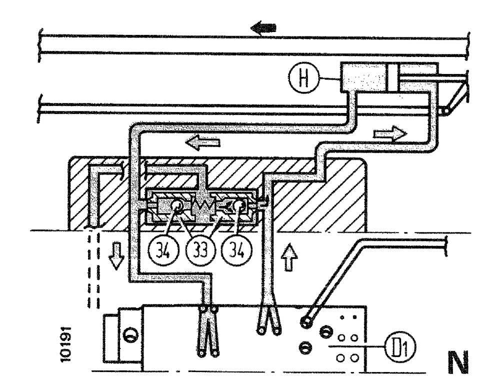

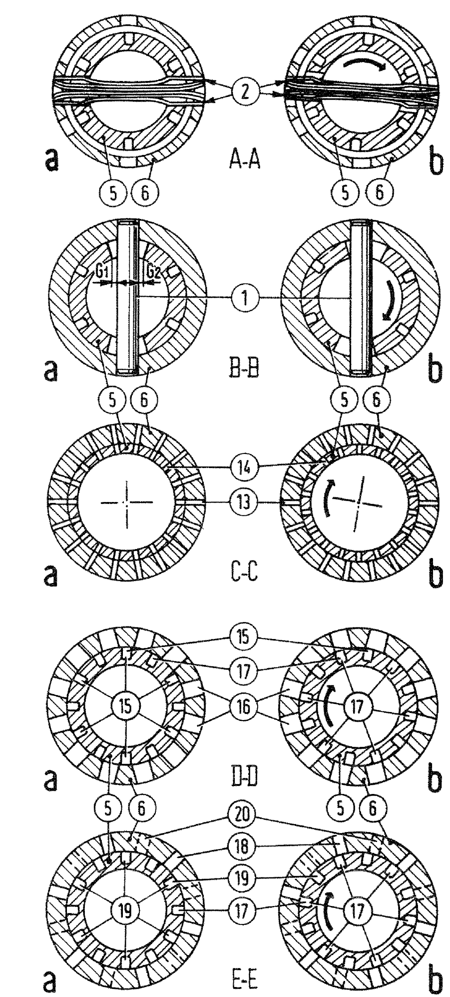

Operation diagram

a. Cross-sections with valve (5) in neutral - A. Operation in straight-ahead driving position - b. Cross-section with valve (5) in RH steer position (for LH steer, valve rotation is symmetrically opposite) - B. RH and LH steer (Sd and Ss) - C. RH and LH emergency steer (Sed and Ses) - C_1. Cover capscrews - d. Operation diagram for straight ahead driving (Sections D-D and F-F) - D_1. Hydraulic control valve OSPB 125 ON - D_2. Valve block OVP 20 - e, f. Operation diagram for two stage RH steering (DD and FF) - G_1 and G_2. Gap between pin (1) and rotary valve (5) - h. Section through valve block OVP 20 - H. Power cylinder - M. Pump outlet line - N. Make-up valve (34) operation with control unit D in neutral and cylinder (H) piston subject to external forces (shown by black arrow) - S. Return to tank - V. Steering wheel - 1. Drive pin - 2. Return spring - 3. Body - 4. Check valve - 5. Rotary valve - 6. Sleeve - 7. Rotary shaft - 8. Cam ring - 9. Rotor - 10. Abutment plate - 11. Cover - 12. Spacer - 13 and 14. Straight ahead pressure ports - 15. Rotor inlet passages (6 off) - 16. Connecting ports (12 off) communicating with passages (15) and (17) alternatively - 17. Outlets (6 off) to power cylinder communicating with the rotor outlet passages and ports (18) and (20) - 18. Outlet or exhaust ports (6 pairs) for RH power cylinder chamber - 19. Power cylinder exhaust passages (6 off) communicating with ports (18) and (20) - 20. LH power cylinder chamber outlet or exhaust ports (6 pairs), rod side - 21. Connecting ports for (16) and inlet or outlet rotor passage - 22. Supply ports for passages (15) - 23. Check valve in valve block (D_2) - 24. Pressure relief valve in valve block (D_2) (Setting: 125 bar - 127.5 kg/cm^2 - 1813 psi) - 25. Washer - 26. Connecting line for LH power cylinder chamber - 27. Connecting line for RH cylinder chamber, rod side - 28. Cup - 29. Thrust bearing - 30. Plug - 31. Seal - 32. Dust excluder - 33. Cylinder safety valve in valve block (D_2) (Setting: 200 bar - 204 kg/cm^2 - 2901 psi) - 34. Make up valve in valve (33) - 35. O-ring - 36. Valve (24) adjusting screw - 37. Plugs - 38. Valve (33) adjusting screw.

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

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OPERATION

Staight-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 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 (section 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).

R.H. 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 steerings 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 R.H. 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.

L.H. 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 L.H. steering.

Emergency hydraulic steer (C, Sed, Ses).

Steering is possible even in cases of lack 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.

Non-return 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.

Cylinder safety valves and make up valve (N).

Safety valve (33) opening exhausts pressure created by piston (H) in one of the cylinder chambers under the action of large external stresses on the wheels. At the same time the low pressure created on the other cylinder is compensated for by oil flow through associated make up valve (34) port.
Pressure in one cylinder chamber caused by small external stresses is insufficient to open the cylinder safety valve but is exhausted by normal control unit leakage.
Low pressure in the other chamber is compensated for by make up valve (34) as shown in detail (N).
Valve cut-in as described above avoids wheel vibration (shimmy), hydraulic circuit brakedown and steering linkage deformation and makes continual steering correction unnecessary.

FAULT FINDING CHART

Fault	Cause	Remedy
1. Leaking control unit: **a.** Control side.	**a.** O-ring (31, page 7).	Replace seal and associated anti-extrusion ring using special tool **293388.**
b. Cover side.	**b_1.** Loose cover capscrews (C_1).	Tighten to specified torque 34 Nm - 3.5 kgm (25 ft.lb.)
	b_2. Damaged washer (25) or O-ring (35).	Replace washers and seals.
2. Heavy steering.	**a.** Faulty hydraulic pump.	Overhaul pump.
	b. Check valve (4) stuck open.	Clean valve and filter. Replace ball if necessary.
	c. Relief valve (24) out of adjustment.	Reset valve (125 bar - 127.5 kg/cm^2 1813 psi.
	d. Relief valve (24) failed or stuck open.	Remove foreign matter and clean filter (E, page 6). If trouble persists, renew valve block assembly (D_2, page 7).
	e. Steering column binding in bushing owing to rusting, pick-up, etc.	Remedy as necessary.
3. Loose steering.	**a.** Excessive clearance between column and rotary valve (5, page 7).	Replace any worn parts.
	b. Excessive clearance between shaft (7) and drive pin (1).	Replace worn parts as necessary.
	c. Excessive spline clearance on rotor (9) relative to shaft (7).	Replace worn parts as necessary.
	d. Build-up of clearance a., b. and c. above.	Replace worn parts as necessary.
	e. Failed or weakened leaf spring (2).	Replace as necessary.
4a. Slow steering.	**a.** Leaking power cylinder piston gland.	Replace gland.
4b. No steering.	**b1.** Failed power cylinder piston rod.	Replace rod.
	b2. Failed actuating shaft (7) or pin (1).	Replace failed parts as necessary.
5. Engine off, no steering.	**a.** Worn rotor (9) and cam ring (8).	Replace worn parts.
	b. Damaged check valve (23, page 7).	Renew valve block assembly OVP-20.
	c. Power cylinder safety valves (33, page 7) stuck open or damaged.	Remove foreign particles and clean filter or replace valve block assembly OVP-20 (D_2, page 7).

(follows)

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FAULT FINDING CHART

(continued)

Fault	Cause	Remedy
6. Steering wheel snatch or out of control, or steering in opposite direction.	**a.** Control unit out of adjustment.	Set as directed on page 2.
	b. Interchanged connecting pipes between control unit and power cylinder.	Reverse connection.
7. Impossible to hold selected course, continuous correction needed.	**a.** Insufficient oil in reservoir.	Top up with oil and bleed as directed on page 12.
	b. Worn power cylinder piston gland.	Replace gland.
	c. Power cylinder safety valves (33, page 7) or make-up valve (34) stuck open.	Remove foreign particles and clean filter or replace valve block assembly OVP-20.
	d. Control valve worn.	Replace control valve (D_1).
8. Impossible to hold straightahead position, steering wheel tends 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 flat spring (2).	Replace flat spring pack.
	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 crack-off setting, (24, page 7).
9. Front wheel vibration, (shimmy).	**a.** Air in the system.	Bleed as directed on page 12 and remedy leakage.
	b. Worn steering linkage joints.	Replace worn parts.
	c. Power cylinder safety valves or make-up valve (33) stuck open.	Remove foreign matter and clean filter or replace valve block assembly OVP-20.
10. Steering difficult in general or only in one direction.	**a.** Insufficient pressure.	Check hydraulic pump (P) and relief valve crack-off setting (24, page 7).
	b. Excessive leakage into control valve.	Replace control valve (D_1).
	c. Cylinder safety valve (33) out of adjustment or leakage across one of the valves due to dirt.	Clean filter. If trouble persists replace valve block assembly OVP-20.

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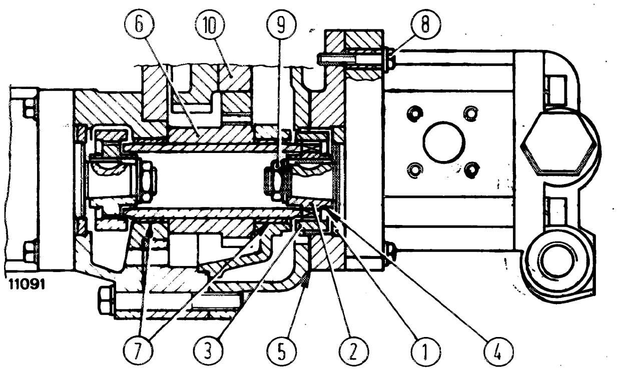
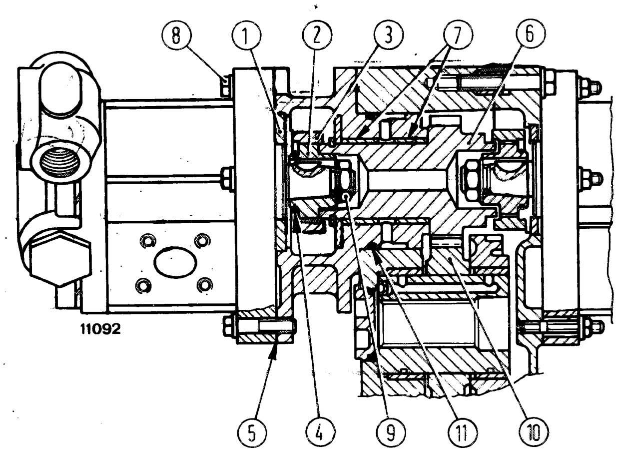


Section through pump drive (1180 and 1380).

1. Centraliser - 2. Drive sleeve - 3. Drive annulus - 4. Retaining ring - 5. Gasket - 6. Pump driven gear - 7. Gear support bushings - 8. Pump capscrews - 9. Sleeve nut - 10. Steering unit and lift drive gear.

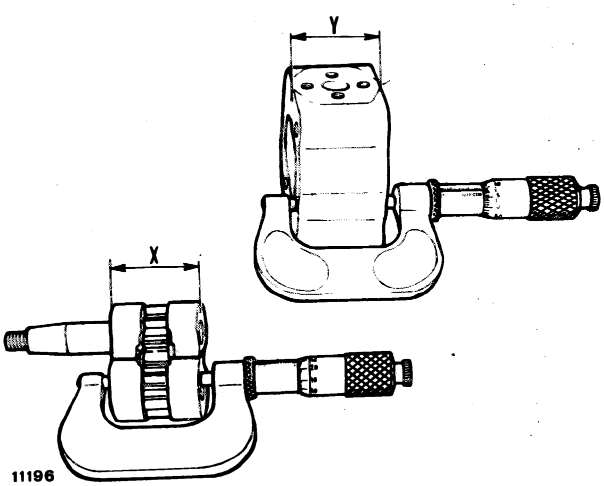


Section through pump drive (1580 and 1880).

1. Centraliser - 2. Drive sleeve - 3. Drive annulus - 4. Retaining ring - 5. Gasket - 6. Pump driven gear - 7. Gear support bushings - 8. Pump capscrews - 9. Sleeve nut - 10. Steering unit and lift drive gear - 11. O-ring.

HYDRAULIC PUMP

The pump is driven from the valve timing gears through a dog clutch.



Checking gear end float in pump body.

Dimension **X** to be smaller than dimension **Y** by .10 to .17 mm (.004 to .007 in).

Remove valve timing cover to gain access to drive gear.

Pump oil automatically lubricates and takes up gear end float.

Overhaul

Refer to figure on page 11 for pump disassembly.

Mark the position of the parts in order to restore them to their original position on assembly.

Check gear side face flatness and squareness relative to the bearings smearing the surfaces with carbon black. Small defects may be remedied using wet extra-fine abrasive paper.

Check gear end float in pump body is within .10 to .17 mm (.004 to .007 in). If necessary, dress surfaces with wet abrasive paper, removing as little material as possible.

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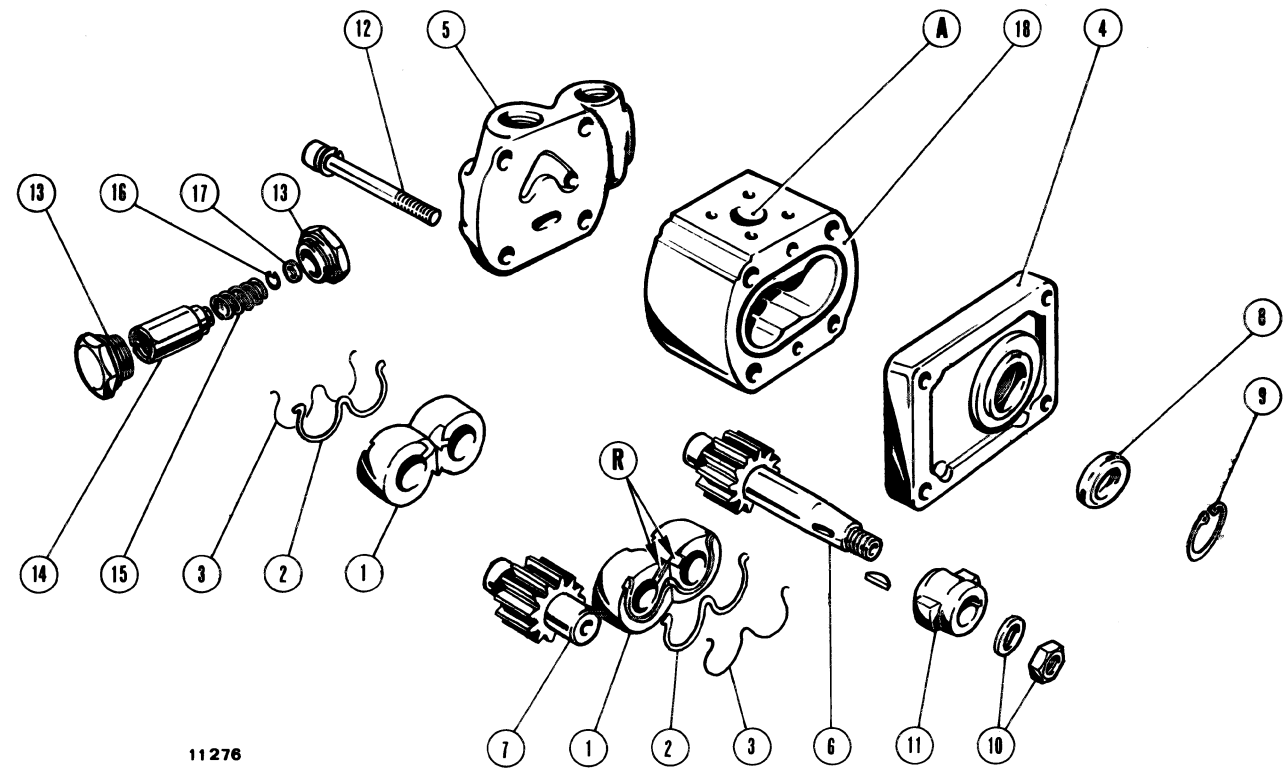


Hydraulic pump parts.

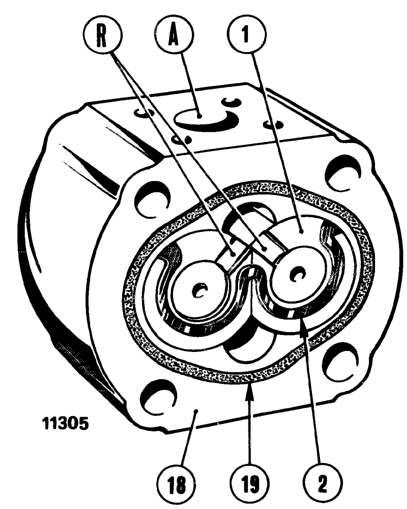
A. Pump inlet port - R. Lube fittings on gear supports - 1. Gear supports - 2. Support gaskets - 3. Antiextrusion ring - 4. Front cover - 5. Flow regulator - 6. Drive gear shaft - 7. Driven gear shaft - 8. Seal - 9. Retaining ring - 10. Sleeve nut and lock washer - 11. Pump drive sleeve - 12. Pump capscrews - 13. Plugs - 14. Flow control valve - 15. Spring - 16. Retaining ring - 17. Cup with calibrated hole (to be installed in flow control valve 14) - 18. Pump body.

Lubricate parts using hydraulic oil and assemble pump referring to figure above and noting the following:

— ensure that the reference marks made upon disassembly are in register;

— install gear supports in pump body by hand, positioning so that lube fittings (R) correspond with inlet port (A) as shown in figure and faces carrying gasket (2) and anti-extrusion ring (3) are in contact with flow regulator (5) or front cover (4);

— install cover (4) and flow regulator (5) on pump body, apply LOCTITE 648 jointing compound to capscrews (12) and hand tighten;



Gasket (2) in correct position on supports (1).

A. Inlet port - R. Lube fittings - 18. Pump body - 19. Pump body gasket.

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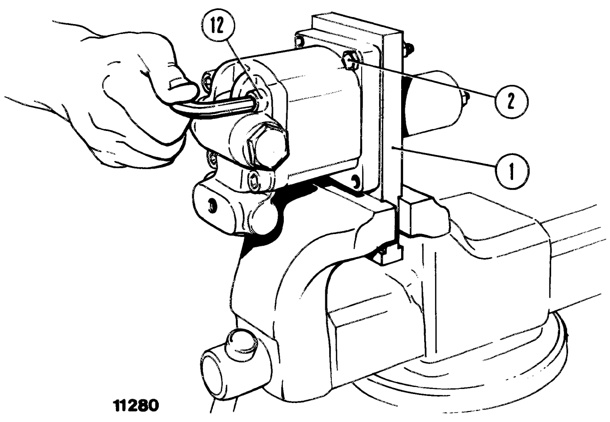
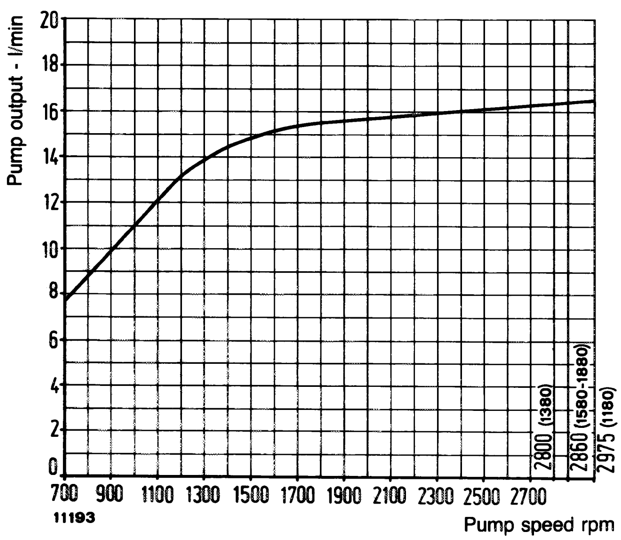


Installing hydraulic pump.
1. Centraliser plate **291756** - 2. Bolts retaining pump to centraliser plate - 12. Pump body capscrews.



Power steering pump HY/ZFS 11/11 R169 speed/output chart.
Test pressure .... 125 bar (127 kg/cm² - 1813 psi)
Oil temperature .... 55° to 65°C

— install pump on centraliser plate **291756** (1) and tighten four bolts (2);

Note: This operation is necessary to centralize the drive shaft with respect to cover (4, page 11) and consequently seal (8).

— gradually and alternatively tighten cover capscrews (12) to 39 Nm (4 kgm - 29 ft.lb.);

— back off four bolts (2), remove pump from centraliser plate and install seal (8, page 11) and retaining ring (9).

On reservoir (T, page 6, Section 302) disassembly, thoroughly clean parts and check:

— oil leakage; repair weld as necessary to remedy leakage;

— metal cartridge filter, sleeve and spring efficiency.

Fill with oil steering several times in both directions to completely fill the circuit.

Hydraulic system bleeding

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

Output test

Couple the pump to the drive motor and connect to output tester using the equipment shown on pages 4 and 5, Section 90.

Use **oliofiat IDRAULICAR AP51** (SAE 20) supplied with the tester and carry out the output test at the specified temperature and pressure.

Compare the output figures obtained with the line on the chart.

If the values obtained are significantly lower, increase shim thickness between spring (15, page 11) and associated plug (13), decrease the shim thickness if the output is higher.

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FRONT AXLE

Type	steering, full floating, centre pivotting	
Bevel drive and differential	mm	in.
Bevel drive ratio:		
— 1180 DT and 1380 DT, standard bevel drive	9/35 = 1:3.89	
— 1180 DT and 1380 DT, fast bevel drive and 1580 DT and 1880 DT	10/34 = 1:3.40	
Standard bevel drive backlash	.20 to .28	.0078 to .0110
Bevel pinion bearing adjustment	see pages 5 and 6, section 401	
Bevel pinion bearing shim thickness (S_1, page 3, section 402)	2.2-2.3-2.4- 2.5-2.6-2.7- 2.8-2.9-3- 3.1-3.2	.086-.090- .094-.098- .102-.106- .110-.114- .118-.122
Bevel pinion position adjustment	see page 7, section 401	
Bevel pinion shim thickness (S_2)	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	.098-.102- .106-.110- .114-.118- .122-.126- .130-.134- .138-.142- .146
Differential gear backlash	.18	.0071
Side gear thrust washer thickness (7, page 3, section 402)	1.470 to 1.530	.058 to .060
Differential pinion thrust washer (6) thickness	1.50 to 1.60	.059 to .063
Differential bearing and bevel drive backlash adjustment	see pages 8, 9 and 10, section 401	
Differential pinion journal dia.	24.939 to 24.960	.9818 to .9827
Differential pinion bore dia.	25.040 to 25.061	.9858 to .9866
Journal clearance in pinion bore	.080 to .122	.0031 to .0048
Side gear spigot dia	50.954 to 51.000	2.0060 to 2.0079
Spigot bore dia in differential box	51.100 to 51.146	2.0118 to 2.0136
Side gear clearance in differential box	.100 to .192 mm	.0039 to .0075
Axle shafts and joints		
Axle shaft journal dia (5, page 3, section 402)	44.975 to 45.000	1.7706 to 1.7716
Axle bushing (13) fitted ID ([1])	45.100 to 45.175	1.7756 to 1.7785
Axle shaft running clearance in bushing	.100 to .200	.0039 to .0079
Bushing interference fit in housing	.064 to .129	.0025 to .0050
Wheel bearing adjustment	see pages 3 and 4, section 401	

([1]) Not reamed

(follows)

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FRONT AXLE

(continued)

	mm.	in.
King pin bearing adjustment	see pages 2 and 3, section 401	
King pin bearing shim thickness	.10-.15-.20-.25-.30	.0039-.006-.008-.010-.012
Final drives		
Reduction ratio	16 (16 + 68) = 1:5.25	
Thrust washer thickness (17, page 3, section 402)	.77 to .83	.0303 to .0327
Centre pivot		
Pivotting angle (on either side)	11°	
Centre pivot diameter	52.652-52.671	2.0729 to 2.0736
Centre pivot front bushing fitted ID	52.720-52.790 ([1])	2.0755 to 2.0783 ([1])
Centre pivot working clearance in bushing	.049-.138	.0019 to .0054
Rear bevel pinion carrier spigot OD	99.040-99.072	3.8992 to 3.9005
Rear bushing fitted ID	99.146-99.221 ([1])	3.9033 to 3.9063 ([1])
Spigot fitted clearance in bushing	.074-.181	.0029 to .0071
Axle front (25, page 3, section 402) and rear (26) thrust washer thickness	4.95-5.00	.1949 to .1968
Turning radius (with brakes off and front wheel drive in):		
— 1180 DT	6600	260
— 1380 DT	6600	260
— 1580 DT	7300	287
— 1880 DT	7300	287
Hydraulic differential lock		
Standard for 1180 DTH and optional for 1380 DT, 1580 DT and 1880 DT:		
Type	multiplate, oil bath clutch	
Control	hydraulic	
Make	VALEO	
No. of clutch plates		
— drive	8	
— driven	9	
No. of clutch release springs	1	

([1]) No reaming.

(follows)

FRONT AXLE

(continued)

	mm.	in.
Drive plate thickness	2.295 to 2.425	.090 to .095
Driven plate thickness	1.450 to 1.550	.057 to .061
Clutch release spring free length	78	3.07
Hydraulic differential lock drive pump		
Type	gear, also supplying PTO clutch and rear transmission differential lock	
Diverter valve (early model) **or pressure regulator valve** (late model)	attached to oil pump supplying rear transmission differential lock	
Control valve	attached to RH side of transmission housing, also controlling rear transmission differential lock	

AXLE DRIVE

	mm.	in.
Reduction ratio	25/27 × 27/30 = 1:1.2	
Relay lever pad width	7.910 to 8.000	.3114 to .3150
Pad seat width in driven gear	8.280 to 8.370	.3260 to .3295
Pad clearance in seat	.280 to .460	.0110 to .0181
Relay lever pivot dia.	15.973 to 16.000	.6288 to .6299
Pivot bore in housing	16.016 to 16.059	.6305 to .6322
Pivot working clearance	.016 to .086	.0006 to .0034
Relay lever detent spring lenght:		
— free	24.5	.965
— under 93 to 102 N (9.45 to 10.45 kg) (21 to 23 lb)	21.8	.858

DRIVE SHAFTS

	mm.	in.
Front drive flange adjustment	see page 1, section 402	
Front drive flange shim thickness (S_4, page 3, section 402)	2.2-2.5-2.8-3-3.3-3.7-4-4.3	.086-.098-.110-.118 .130-.146-.158-.170

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FRONT WHEEL DRIVE: Specification and data

TORQUE DATA

DESCRIPTION	Thread size	Torque		
		Nm	kgm	ft.lb
Front axle - section 402				
Lock ring, bevel pinion shaft (C_1, page 3)	M40 × 1.5	294	30	217
Capscrew, differential gear case to axle casing (C_2)	M12 × 1.25	113	11.5	83
Capscrew, ring gear to differential gear case (C_3)	M12 × 1.25	113	11.5	83
Capscrew, king pin (C_4)	M12 × 1.25	113	11.5	83
Capscrew, steering knuckle (C_5)	M14 × 1.5	176	18	130
Lock ring, wheel bearing (C_6)	M60 × 2	118	12	87
Capscrew, final drive housing (C_7)	M12 × 1.25	113	11.5	83
Bolt, wheel rim (C_8)	M16 × 1.5	176	18	130
Capscrew, front and rear axle pivot support	M18 × 1.5	392	40	289
Capscrew, differential cap (C_9)	M14 × 1.5	176	18	130
Capscrew, front axle support to engine (C_{10})	M18 × 1.5	353	36	260
Locknut, joint, track rod to levers	M16 × 1.5	69	7	51
Capscrew, cast disc to wheel hub (C_{13})	M16 × 1.5	255	26	188
Nut, rail rim clamp (C_{14})	M20 × 2.5	245	25	180
Capscrew, pressed steel disc to wheel hub (C_{15})	M16 × 1.5	255	26	188
Drive shafts and axle drive - section 402				
Capscrew, centre bearing (C_{11}, page 3)	12 × 1.25	98	10	72
Capscrew, axle drive housing to tractor (C_{12})	M12 × 1.25	98	10	72

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REMOVAL

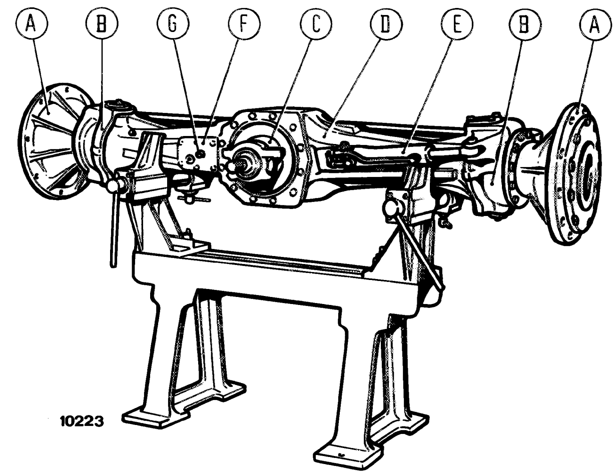
Proceed as follows:

— take off drive shaft guard, move retaining rings (31 and 40, Section 402, page 3) out of the way and withdraw front drive shaft (33) sliding splined drive sleeve (35) towards the rear;

— remove the power steering cylinder, withdrawing its pivots, place a hydraulic jack under the centre of the axle casing and withdraw the wheels;

— place a prop under the front of the engine sump, remove front and rear supports and lower the jack to separate the assembly from the tractor;

— place the axle assembly on a universal stand, take off the track rod and drain the axle oil and final drive oil.



Front axle assembly in position on universal stand.

A. Wheel hubs and final drive units - B. Steering joints - C. Bevel drive housing - D. Axle body - E. Steering cylinder - F. Side cover - G. Hydraulic differential lock oil inlet line (standard on 1180 DTH and optional on 1380 DT, 1580 DT and 1880 DT).

DISASSEMBLY

Final drive, wheel hub and steering knuckle overhaul.

Overhaul may be carried out with the axle in position on the tractor, when the parking brake should be applied and a suitable prop placed beneath the centre of the axle casing.

On disassembly, proceed as follows:

1. Take off final drive housing (1, a, page 2) with attached planet gears.

Note: To facilitate housing removal from wheel hub, remove 10 capscrews and slacken the remaining two, replace oil filler plug with slide hammer puller which may then be used to remove the housing.

---

2. Withdraw the sun gear (2).

3. Take off ring gear assembly (3 and 4, b) as follows:

   — Remove lock ring (C_6, Section 402, page 3) using wrench **293797.**

   — Witdraw the assembly from the steering knuckle.

4. Take off wheel hub (6) with attached bearing cups (7) and seal, taking care not to damage the latter.

5. Withdraw steering knuckle (10, d) with attached hub.

6. Take out axle shaft (9, page 3) with attached bearing housing (11).
   Back off stop screw (9, Section 402, page 3) prior to withdrawing the axle shaft.
   On tractors equipped with hydraulic differential lock, before withdrawing LH shaft remove side cover (F).

7. Remove carrier (8, d, page 2).

8. Remove the differential lock clutch (if fitted).

Replace any worn bearings and bushings using suitable drivers and universal pullers. Check seals for wear or damage.

On assembly, refer to the illustrations on page 3, section 402, for correct positioning noting the following points:

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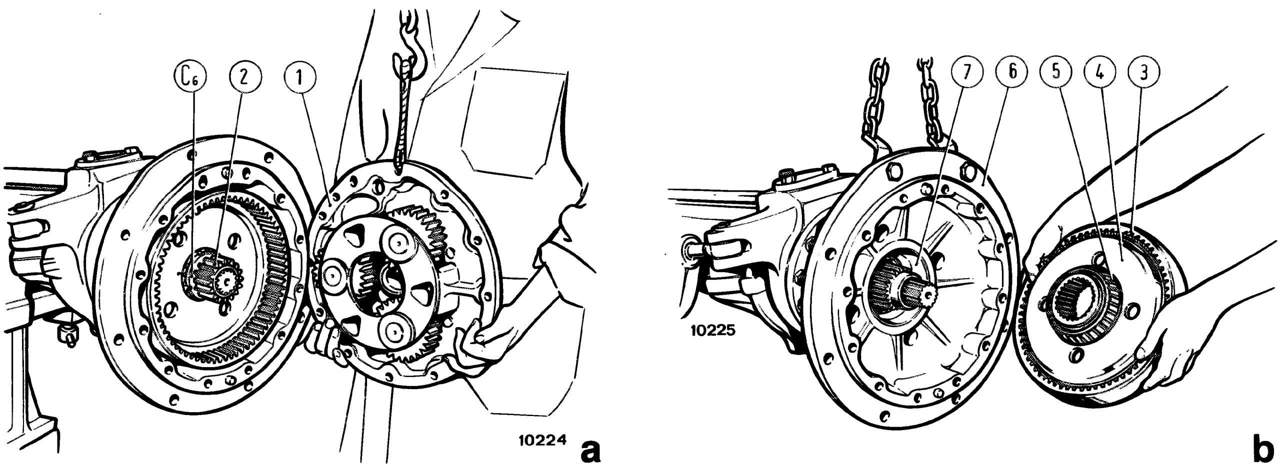


Disassembling (assembling) final drive (a) and ring gear (b).

C_6. Hub bearing lock ring - 1. Final drive housing - 2. Sun gear - 3/4 Final drive ring gear assembly - 5. Taper roller bearings - 6. Wheel hub - 7. Bearing cup.

— prior to installing final drive housing (1), smear the mating surfaces with one of the jointing compounds detailed on page 7, Section A;

— prior to installing carrier (8, d), insert jointed axle shaft (9) in the casing;

— adjust king pin bearing pre-load as directed in the appropriate section;

— adjust wheel hub bearing pre-load as directed on page 3 of appropriate section;

— fill up wheel hubs and bevel drive housing with specified type and grade of oil.

King pin bearing adjustment.

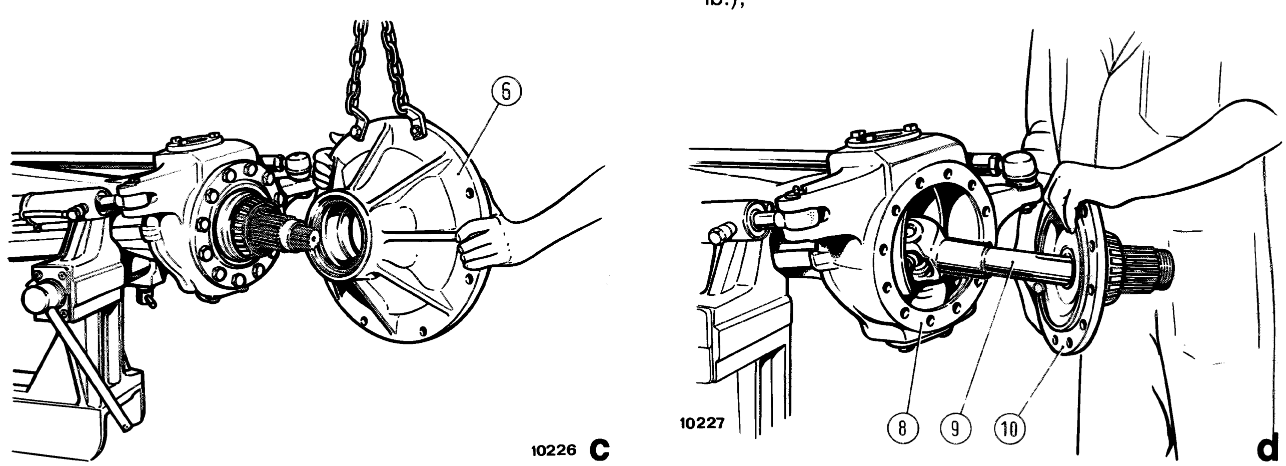
Proceed as follows:

— smear bearing cups with **grassofiat TUTELA G9** or other approved grease;

— install upper cover (1) and tighten the screws to 113 Nm (11.5 kgm) (83 ft.lb.);

— install lower cover (2) without shims and tighten with engine oil lubricated retaining screws;

— tighten the lower cover screws progressively in a staggered fashion with a torque wrench and adapter **292220/3** until the torque needed to rock the carrier is 20 to 24 Nm (2 to 2.5 kgm) (14.4 to 18 ft. lb.);



Disassembling (assembling) wheel hub (c) and steering knuckle (d).

6. Wheel hub - 8. Knuckle carrier - 9. Axle shaft and joint - 10. Knuckle.

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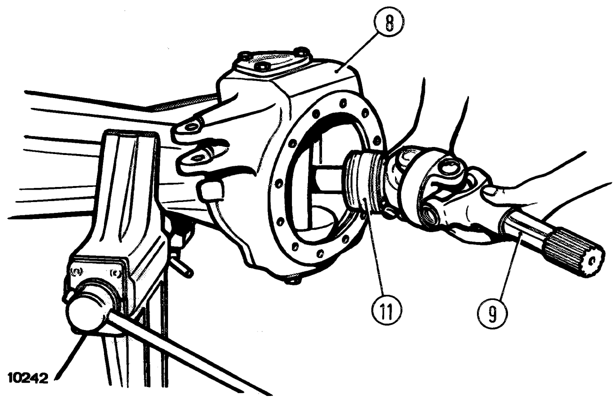
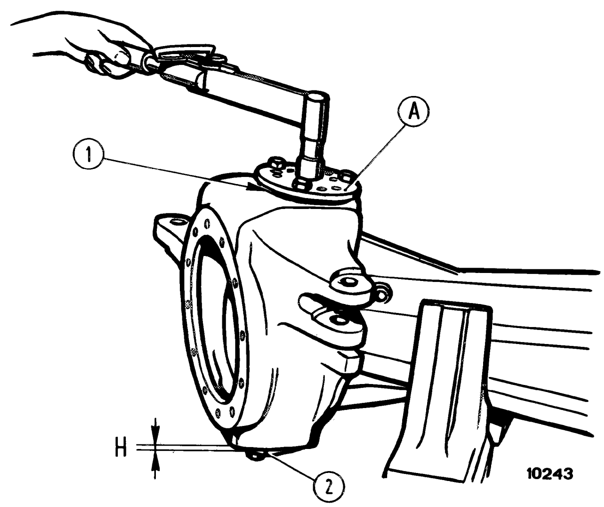


Removing (installing) axle shaft with attached joint.

8. Knuckle carrier - 9. Axle shaft with attached joint - 11. Bearing carrier assembly.



Determining thickness of king pin bearing preload shims (S_3, page 3, Section 402).

A. carrier torque dynamometer **292220/3** - H. Gap between carrier and lower cover - 1. Top cover - 2. Lower cover.

— assess gap (H) between lower cover and carrier in the neighbourhood of the three capscrews;

— take the arithmetic average of three readings, shim pack (S_3, page 3, Section 402) to be inserted under lower cover is given by:

$$S_3 = H - .25 \text{ mm } (.0098 \text{ in})$$

if necessary, round off to the nearest .05 mm (.0020 in.) up.

— insert determined shim thickness beneath lower cover and tighten three capscrews to 113 Nm (11.5 kgm - 83.1 ft.lb.);

— check the torque needed to swing the carrier. Cause the carrier to swing a few times prior to taking the reading; this will permit settling. The correct torque is 108 to 127 Nm (11 to 13 kgm - 79 to 93 ft.lb.) disregarding starting torque.
If torque is higher than specified, increase shim thickness; if torque is lower than specified, decrease shim thickness.

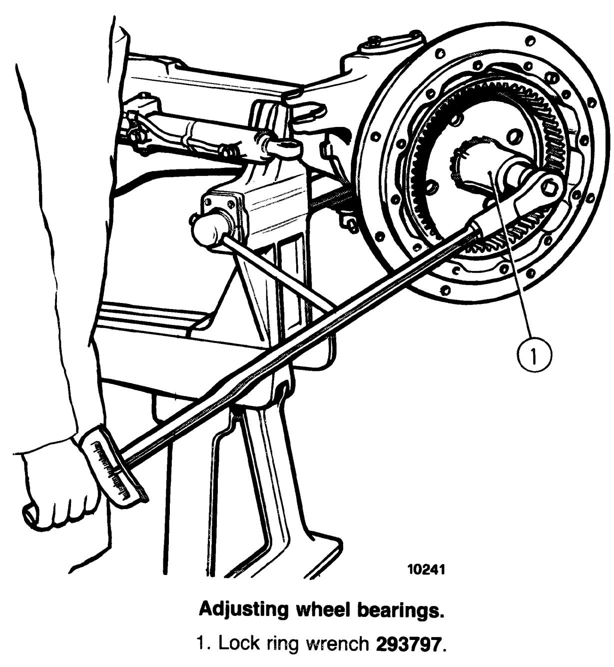
Wheel bearing adjustment.

Proceed as follows:

— remove wheel hub and ring gear assembly;

— gradually tighten lock ring (C_6, Section 402, page 3) using torque wrench and lock ring wrench **293797** (1) to 196 Nm (20 kgm - 144.5 ft.lb.), simultaneously turning wheel hub to settle the bearings;

— fully back off lock ring and tighten to 118 Nm (12 kgm) (87 ft.lb.) simultaneously turning the wheel hub;



Adjusting wheel bearings.

1. Lock ring wrench **293797**.

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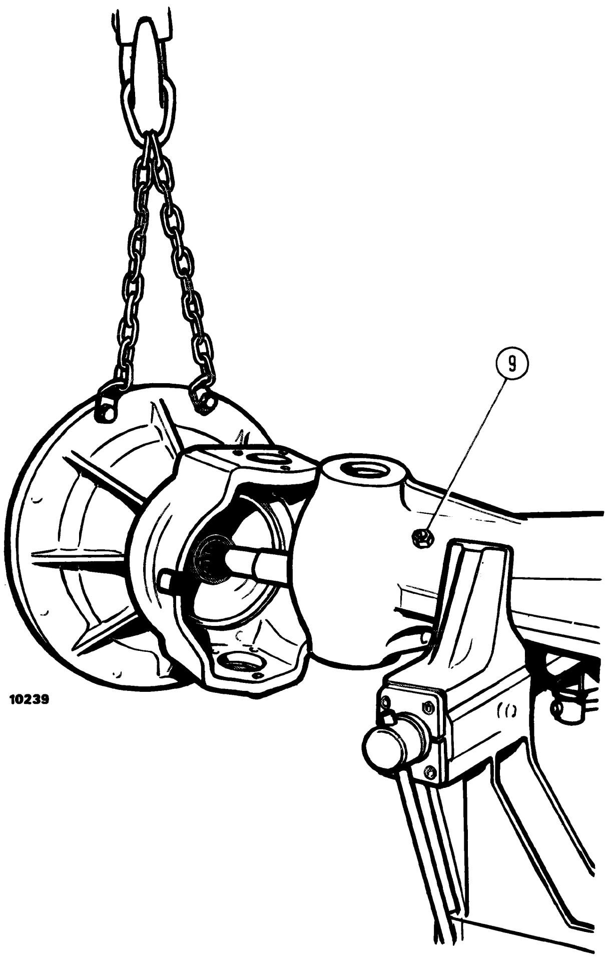
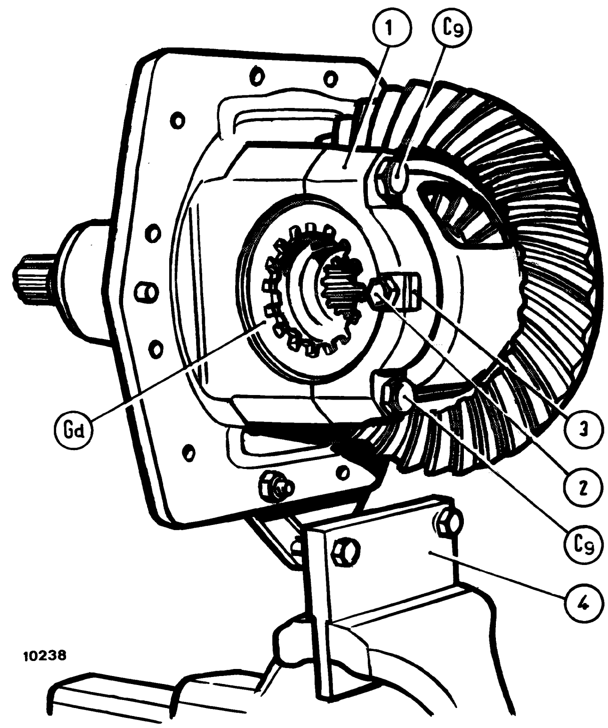


Removing (installing) final drive with wheel hub and knuckle carrier.

9. Bearing carrier capscrew.



Bevel drive assembly.

C_9. Differential cap capscrew - G_d. RH lock ring - 1. Differential cap - 2. Lock plate capscrew - 3. Lock plate - 4. Bevel drive housing support **293743.**

— lock lock ring by folding over lock washer tab (if necessary, slacken the lock ring to bring milled slot level with a lock washer tab);

— check by hand that hub rotates freely without excessive play.

Bevel drive and differential overhaul.

Remove the final drive units with attached wheel hubs and knuckle carriers, remove capscrews (9) retaining bearing carriers to axle housing, withdraw axle shafts with attached joints and, where present, the differential lock clutch.

Remove the bevel drive and differential housing assembly, secure to support **293743** then clamp support in a vice and disassemble as follows:

— remove bevel pinion lock ring (C_1, Section 402, page 3) using wrench **293524/1;**

— separate bevel drive and differential assembly from bevel pinion support removing lock rings and caps (1) and ensuring that they are marked to facilitate assembly;

— remove ring gear capscrews (C_3, Section 402, page 3), differential pinion journal capscrew (8) and disassemble the differential.

Check wear against data table in Section 40.

Replace any inefficient seals and bearings using suitable drivers and pullers.

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On assembly, install the differential caps ensuring that the reference marks are in register, and adjust the bevel drive as directed below.

Install the bevel drive/differential and final drive assemblies adopting a reversal of the disassembly procedure, fasten the bevel drive housing to the axle housing smearing the mating faces with one of the jointing compounds specified on page 7, Section A, and fill up the axle case with the specified type and grade of oil.

Bevel drive and differential adjustment.

1. Bevel pinion bearing adjustment and shim thickness determination using special-purpose tools (figs. a and b).

Proceed as follows:

— install bevel pinion bearing cones (7 and 9) and spacer (8) on tool **293804** (E);

— tighten tool nut (M) fully;

— measure depth (H_2) of tool pin below the top face;

— disassemble, lubricate bearings with engine oil and assemble on the tool, interposing bevel drive housing (10) with attached bearing cups;

— tighten tool nut (M) fully, simultaneously rotating the bevel drive housing through 10 turns to settle the bearings;

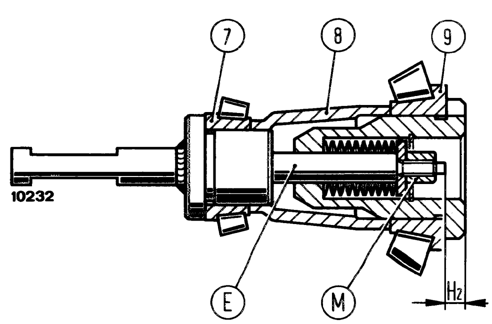
— assess dimension (H_1) in this condition;

— the thickness of shims (S_1) to be fitted is given by the following:

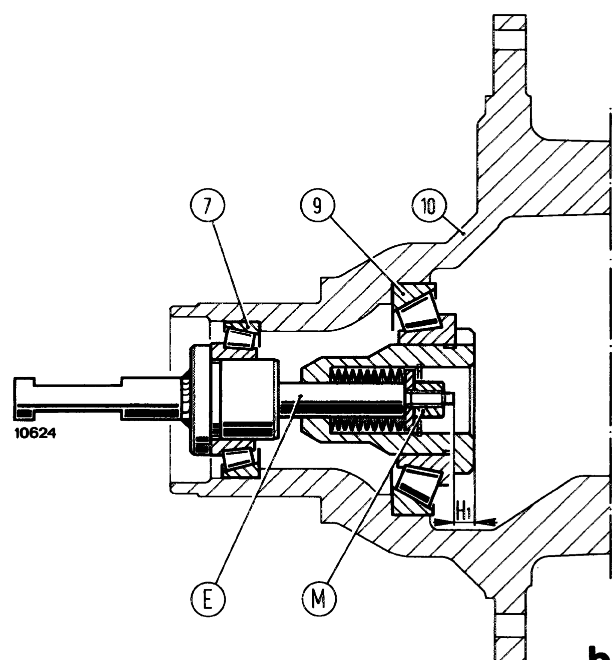
$$S_1 = H_1 - H_2$$

If necessary, round off to the nearest .05 mm (.002 in) up.

Note: On completion of adjustment leave the tool on drive head housing for subsequent bevel pinion position adjustment.



a



b

Determining bevel pinion bearing shim thickness (S_1, page 3, Section 402) using special-purpose tool 293804.

a. Measuring dimension (H_2) - b Measuring dimension (H_1) - E. Tool **293804** - H_1/H_2 Tool pin depth below top face - M. Tool nut - 7/9. Bearing cups - 8. Spacer - 10. Bevel drive and differential housing.

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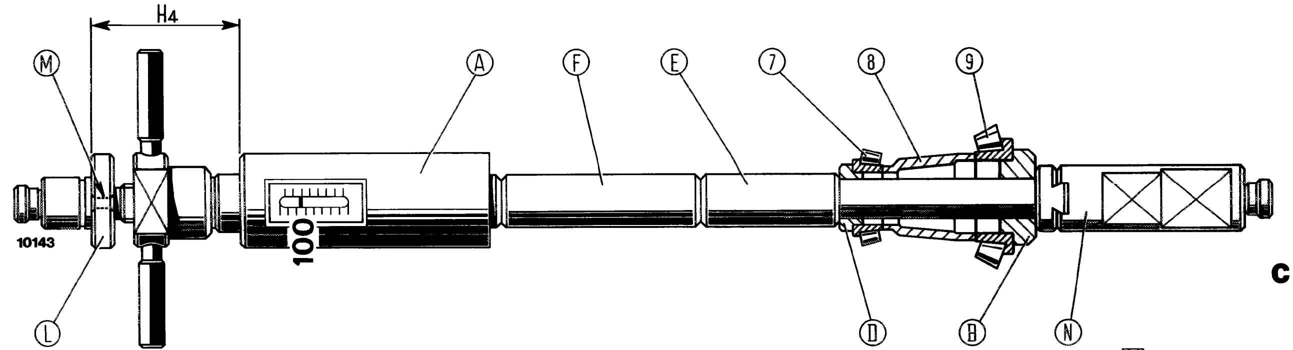

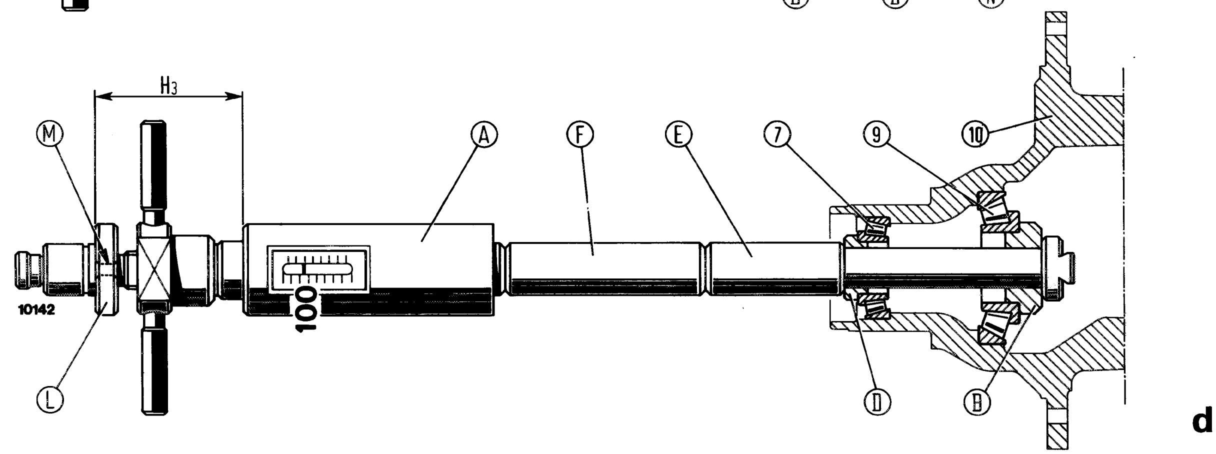

Determining bevel pinion bearing shim thickness (S_1, page 3, Section 402) using universal gauge 293510.

c. Determining dimension H_4 - d. Determining dimension H_3 - A. Universal gauge **293510** - B. Bushing **293638** - D. Bushing **293632** - E. Spacer **293619** - F. Spacer **293620** - H_3/H_4. Dimensions measured using depth gauge - L. Register **293624** - M. Register holes - N. Adapter **293617** - 7/9 Bearing cones - 8. Spacer - 10. Bevel drive and differential housing.

2. Bevel pinion bearing adjustment and shim thickness determination using universal gauge 293510 (figs. c and d).

Proceed as follows:

— install bushings **293638** (B) and **293632** (D), and spacers **293619** (E) and **293620** (F) to universal gauge **293510** (A);

— install adapter **293617** (N) to allow clamping in the vice, subsequently positioning bearing cones (7 and 9) and spacer (8) as shown in fig. **c.**;

— actuate the handle until the graduated scale pointer moves progressively to 100 kg (220 lb.);

— install register **293624** (L) on universal gauge (A) positioning holes (M) in alignment with the flats of the handle hub;

— using a suitable depth gauge, measure dimension (H_4) thus obtained;

— disassemble the pack, lubricate the bearings using engine oil and assemble the gauge installing bushings (B and D) and spacers (E and F) on drive head housing (10) as shown in fig. **d**;

— progressively return the graduated scale pointer to 100 kg (220 lb.), simultaneously turning the gauge to settle the bearings; subsequently, measure dimension (H_3) as directed above;

— shim thickness (S_1, page 3, Section 402) to be fitted will be:

$$S_1 = H_4 - H_3$$

If necessary, round off to the nearest .05 mm (.002 in) up.

Note: On completion of adjustment, do not remove the gauge from the drive head housing as the latter is in position ready for subsequent bevel pinion position adjustment.

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3. Bevel pinion position shim thickness determination (figs. e and f.)

Proceed as follows:

— place the differential bearing cups on shaft (P) of tool **293400/1** with attached cones (R) and position the assembly inside the bevel drive housing, tightening differential cap capscrews (C_9, Section 402, page 3) to 176 Nm (18 kgm - 130 ft.lb.);

— screw in or back off cones (R) so as to align 125 mm (4.92 in.) bar (L) towards the bearing cone (9) and eliminate any end play between cones (R) and differential bearing cups;

— move micrometer (N) to bring bar (L) in contact with cone (9) and read dimensions (H_5);

— determine correct nominal dimension (H_7) from ring gear centreline to back of pinion as follows:

$$\mathbf{H_7 = H_6 \pm C}$$

where,

H_6 = 134.5 mm (5.29 in.) nominal distance from ring gear centreline to back of pinion.

C = correction factor stamped on pinion and preceded by + or − sign if different from 0, to be added to, or subtracted from, nominal dimension (H_6) as applicable.

— thickness of shim (S_2, page 3, Section 402) will be:

$$\mathbf{S_2 = H_5 - H_7}$$

where:

H_5 = micrometer gauge reading;

H_7 = corrected nominal dimension from ring gear centreline to back of pinion.

Example

— Micrometer reading: H_5 = 137.5 mm.

— Nominal dimension from ring gear centreline to back of pinion H_6 = 134.5 mm.

— Correction factor: C = + .2 mm.

— Corrected nominal dimension: H_7 = 134.5 + .2 = 134.7 mm.

— Thickness of shim: S_2 = 137.5 − 134.7 = 2.8 mm.

— Correction factor: C = − .2 mm.

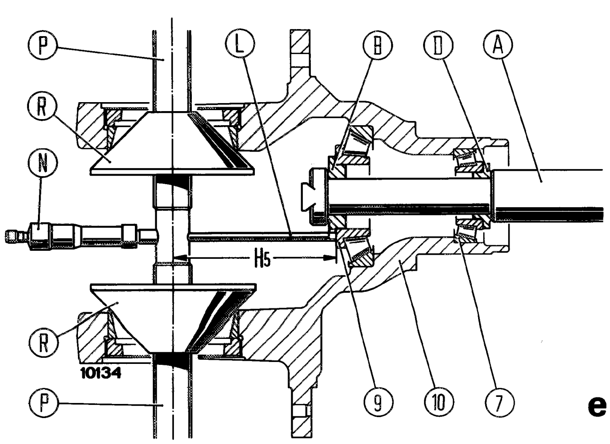
— Corrected nominal dimension: H_7 = 134.5 − .2 = 134.3 mm.

— Thickness of shim: S_2 = 137.5 − 134.3 = 3.2 mm.

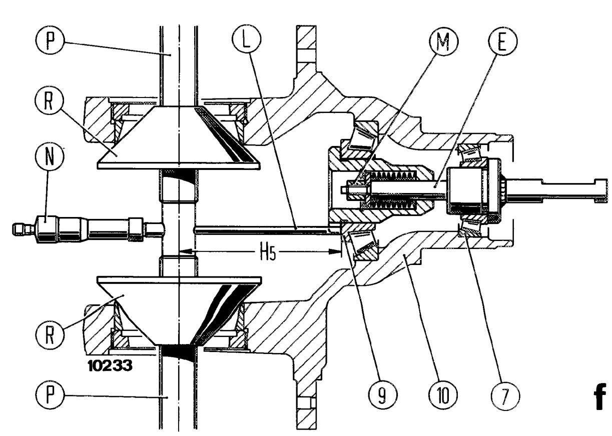
— Correction factor: C = 0 mm.

— Corrected nominal dimension: H_7 = H_6 = 134.5 mm.

— Thickness of shim: S_2 = 137.5 − 134.5 = 3 mm.



e



f

Determining thickness of pinion position shims (S_2, page 3, Section 402).

e. Measuring dimension H_5 using universal gauge **293510** - f. Measuring dimension H_5 using special purpose tool **293804.** - A. Universal gauge **293510** - B. Bushing **293638** - D. Bushing **293632** - E. Special purpose tool **293804** - H_5. Dimension measured using micrometer - L, N, P, R. Tool **293400/1** - M. Nut **293804** - 7. Bearing cup - 9. Bearing cone - 10. Bevel drive and differential housing.

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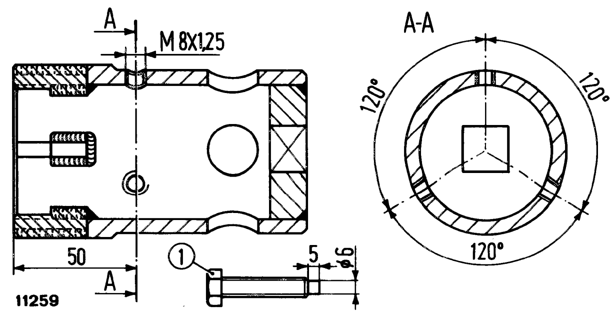


Modification to lock ring wrench 293524/1. (dimensions in mm).
1. Capscrew M8 × 1.25 × 40 (R 50) to be modified as shown.

4. Differential bearing adjustment and bevel drive backlash check.

Proceed as follows:

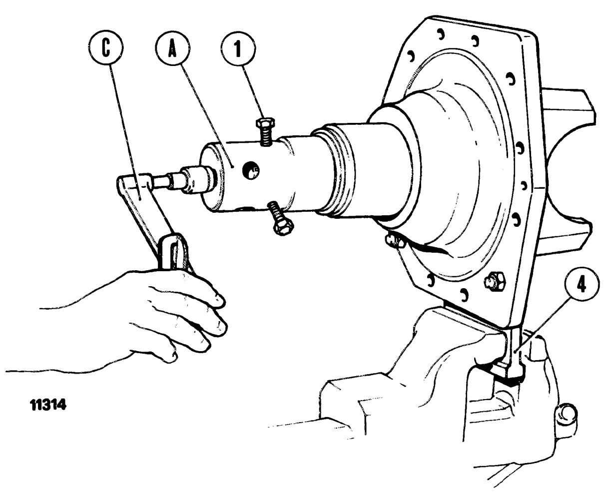
— install the bevel pinion assembly, including shims (S_1 and S_2, page 3, Section 402) as previously determined in bevel drive housing, lubricating the bearings with engine oil, and tighten lock ring (C_1) to 294 Nm (30 kgm) (217 lb.ft.) using wrench **293524/1.**

Modify lock ring wrench **293524/1** by drilling and tapping three holes and adding three modified capscrews (1) M8 × 1.25 × 40 (R50) as shown.

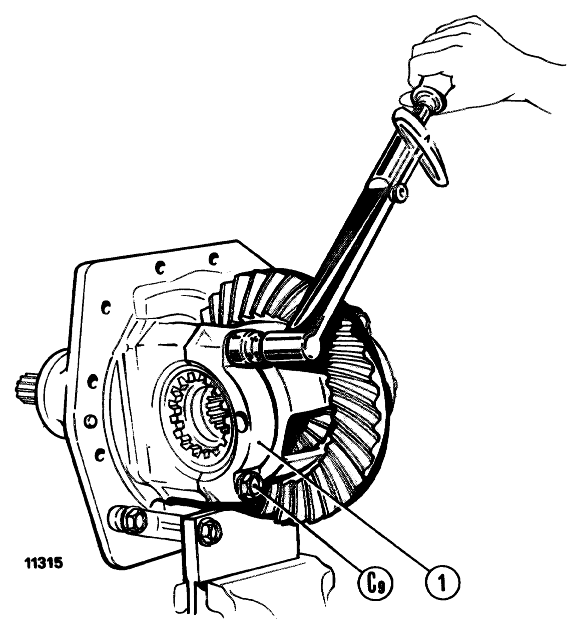
— tighten modified wrench **293524/1,** onto pinion shaft using capscrew (1) and check that shaft rotating torque is .5 to 1 Nm (.05 to .1 kgm) (.72 ft.lb.) using torque wrench **293512** (C) and disregarding the starting torque;

Note: The above rotating torque applies if pinion shaft is installed without seal and retaining ring: if pinion shaft is installed with seal and ring, rotating torque should be .7 to 1.4 Nm (.07 to .14 kgm) (1.01 ft.lb.).

— if rotating torque is less than specified, reduce bearing shim thickness (S_1, Section 402, page 3). Increase thickness if rotating torque is higher than specified;



Checking bevel pinion rotating torque.
A. Modified lock ring wrench **293524/1** - C. Torque wrench **293512** - 1. Capscrew retaining wrench **293524/1** to bevel pinion - 4. Bevel drive and differential housing support **293743.**



Installing differential caps.
C_9. Differential cap self-locking capscrews - 1. Differential caps.

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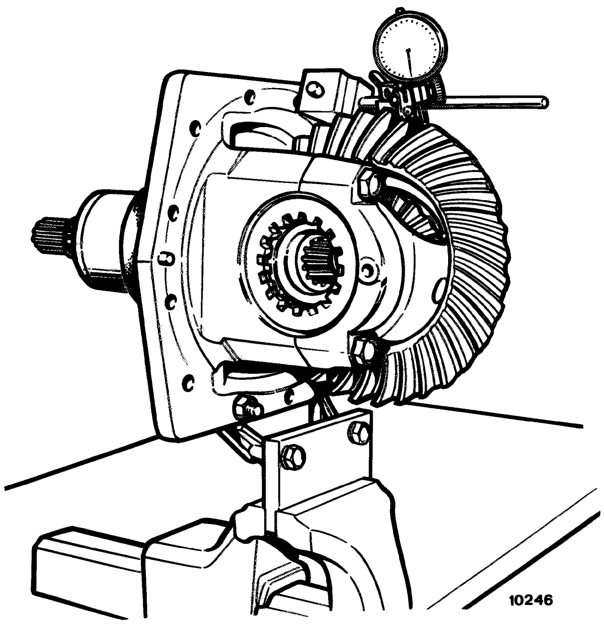
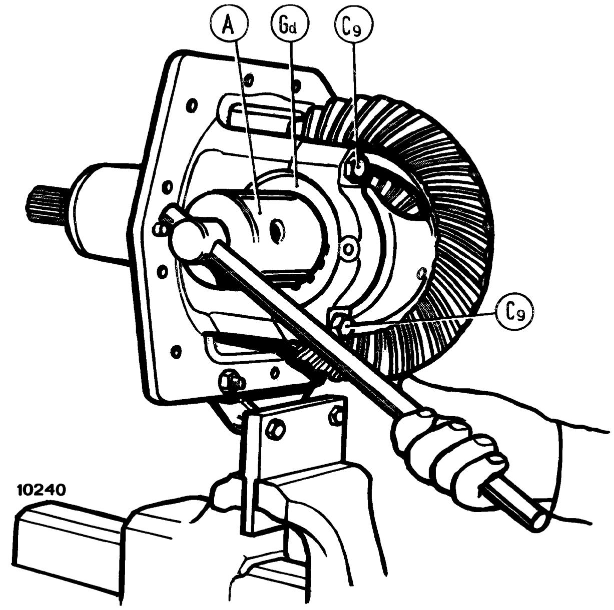


Checking bevel drive backlash.



Adjusting the differential bearings.

A. Wrench **293798** - C_9. Differential cap capscrew - G_d. RH bearing lock ring.

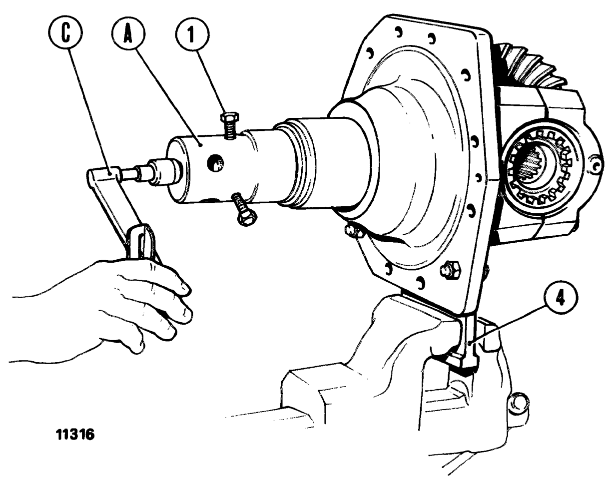
— install the bevel drive assembly in the housing ensuring that the ring gear does not bind when in mesh with the pinion, tighten differential cap screws (C_9, page 8) to 59 Nm (6 kgm - 43 ft.lb.), slacken and tighten to 20 Nm (2 kgm) (14 ft.lb.);

— lubricate the differential bearings, turn LH lock ring (G_s, Section 402, page 3) using wrench **293798**, simultaneously turning the ring gear, until a 39 Nm (4 kgm - 29 ft.lb.) torque is obtained, equivalent to the specified axial pre-load;

— check the bevel drive backlash using a suitable dial gauge with the stylus resting squarely on a ring gear tooth flank;

— repeat the measurement in two other points 120° apart and compare the average of the three readings with the specified backlash, which is .20 to .28 mm (.008 to .011 in.).

To adjust back off one and tighten the other lock ring until the specified backlash is obtained;



Checking bevel pinion rotating torque.

A. Modified lock ring wrench **293524/1** - C. Torque wrench **293512** - 1. Capscrews retaining wrench **293524/1** to bevel pinion - 4. Differential and bevel drive housing support **293743.**

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— under these conditions pinion and ring gear bearing rotating torque determined using the same procedure as used for the pinion torque above should be:

A_2 = A_1 + 1 to **1.5 Nm (.1** to **.15 kgm)** (**.7** to **1.1 ft.lb.)**

where:

A_2 = pinion and ring gear rotating torque;

A_1 = pinion rotating torque found previously, i.e. .5 to 1 Nm (.05 to .1 kgm - .36 to .72 ft.lb.) if the pinion is without seal and retaining ring, .7 to 1.4 Nm (.07 to .14 kgm - .5 to 1.1 ft.lb.) if the pinion is installed together with seal and ring;

1 to **1.5 Nm (.1** to **.15 kgm - .7** to **.1 ft.lb.)** = ring gear rotating torque determined at pinion end using wrench **293524/1** and torque wrench **293512**.

Example

— Pinion rotating torque:
A_1 = .7 Nm (.07 kgm).

— Pinion and ring gear rotating torque to be determined:
A_2 = .7 + (1 to 1.5) = 1.7 to 2.2 Nm
(A_2 = .07 + (.1 to .15) = .17 to .22 kgm).

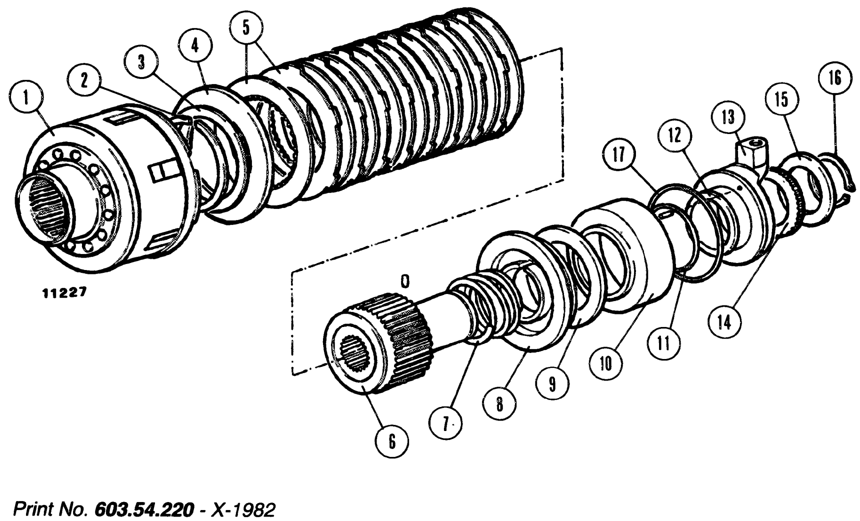
— Tighten capscrews (C_9) to 176 Nm (18 kgm) (130 ft.lb.) and secure the lock rings. If necessary, further slacken lock ring so that milled slot coincides with locking plate.

Front axle hydraulic lock clutch overhaul (standard on 1180 DTH and optional on 1380 DT, 1580 DT and 1880 DT).

Remove final drive assembly consisting of planetary final drive, wheel hub and knuckle carrier from left of axle. Remove capscrew retaining bearing carrier to axle housing, remove side cover (F, page 11) and take off LH axle shaft (18) with attached u-joint.

Lift off clutch assembly, remove housing (1) and retaining ring (2), and retrieve washer (3), thrust plate (4) and clutch drive and driven plates (5).

For plate return spring (7) disassembly, use tool shown on page 6, Section 207, already constructed for P.T.O. hydraulic clutch plate return spring disassembly.



Parts of front axle hydraulic differential lock clutch.

1. Clutch housing - 2/16. Retaining rings - 3. Washer - 4. Thrust plate - 5. Clutch drive and driven plates - 6. Hub - 7. Plate return spring - 8. Pressure plate - 9/14. Thrust bearings - 10. Piston - 11/17. O-rings - 12/15. Washers - 13. Oil delivery cylinder.

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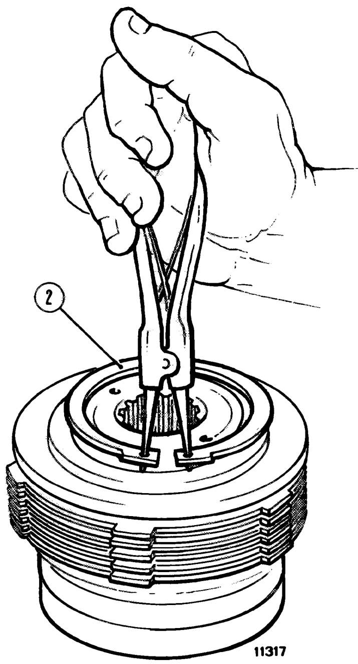
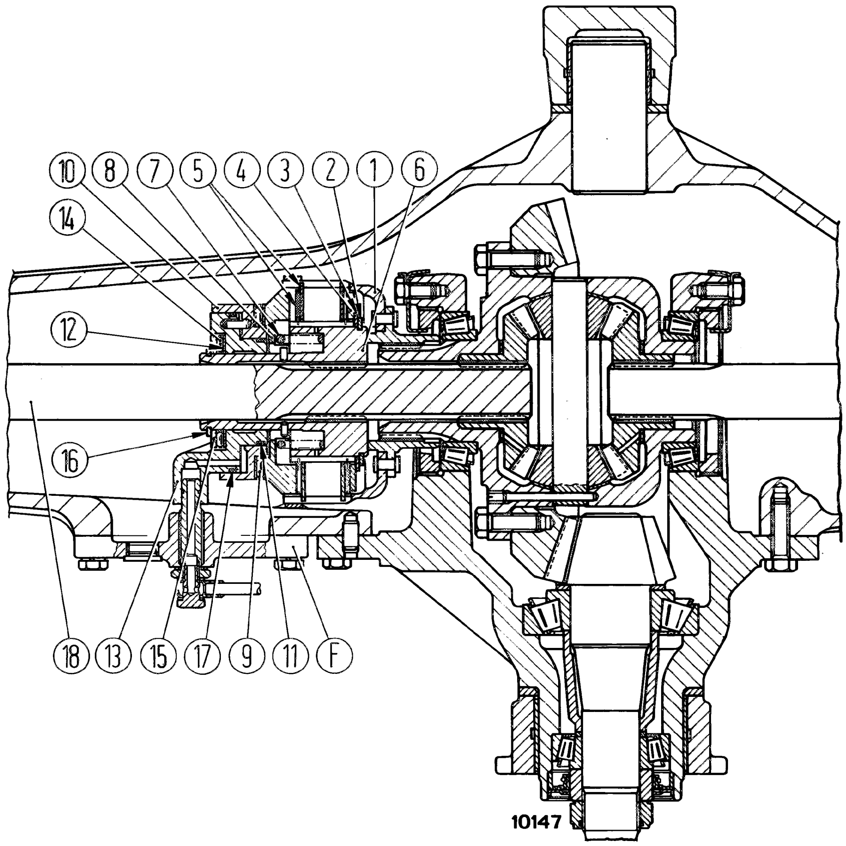


Removing (installing) clutch drive and driven plate retaining ring (2).



Section through front axle hydraulic differential lock clutch.

Note: For references to differential and bevel drive assembly see page 3, Section 402.

F. Side cover - 1. Housing - 2/16. Retaining rings - 3. Washer - 4. Thrust plate - 5. Clutch drive and driven plates - 6. Hub - 7. Plate return spring - 8. Pressure plate - 9/14. Thrust bearings - 10. Piston - 11/17. O-rings - 12/15. Washers - 13. Oil delivery cylinder - 18. LH axle shaft.

Install clutch on tool, tighten nut (D) overcoming spring resistence and remove retaining ring (16).

Slacken tool nut (D) and retrieve:

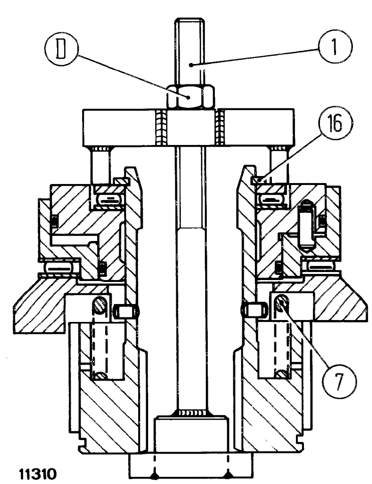
— thrust bearing (14) and washers (12 and 15);

— oil delivery cylinder (13) with associated O-rings (11 and 17) and piston (10);

— thrust bearing (9) with associated washers;

— pressure plate (8) and spring (7).

Separate piston (10) from oil delivery cylinder (13). Clean cylinder using compressed air and check O-rings (11 and 17).



Disassembling (assembling) clutch plate return spring (7).

D. Nut - 1. Tool to be constructed - 16. Retaining ring.

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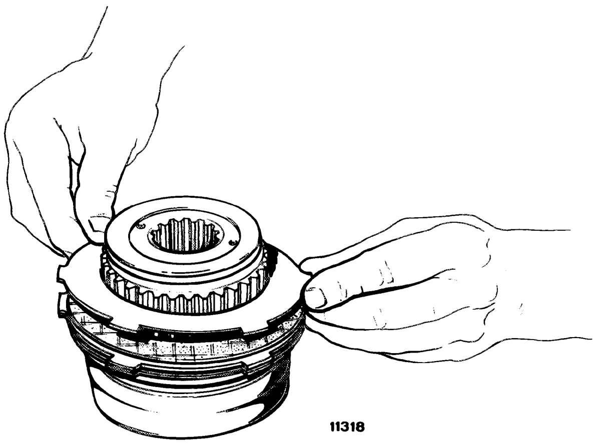
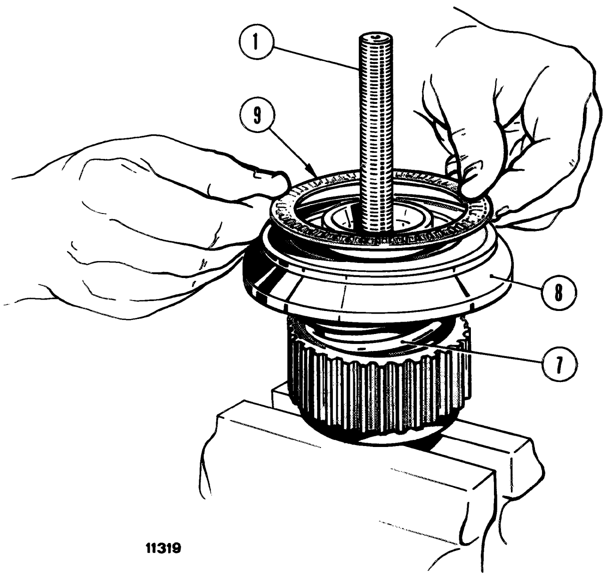


Disassembling (assembling) clutch plates.



Disassembling (assembling) thrust bearings (9).

1. Tool to be constructed - 7. Clutch plate return spring - 8. Pressure plate.

Check clutch components, especially drive and driven plates for wear.

Assemble clutch following instructions for disassembly in the reverse order and ensuring that spline of pressure plate (8, page 11) is aligned with hub (6) centraliser.

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DRIVE SHAFTS

Removal

To remove the drive shafts proceed as follows:

— take off the shaft guard;

— move retaining rings (31 and 40, page 3) out of the way and withdraw front drive shaft (33) sliding drive sleeve (35) toward the rear;

— take off drive sleeve (35) from the centre bearings (36) and remove rear shaft (38) from the front.

Carefully examine the splines of both shafts and sleeves and check the ball type centre bearing (36) for inefficiency.

Installation

Install the shafts and adjust as follows:

— align the two drive shafts (33 and 38, page 3) in drive sleeve (35);

— bring front drive sleeve (30) in contact with retaining ring (31), assess the amount of clearance (L) using a suitable feeler gauge and install a shim (S_4) to obtain 1.2 to 1.7 mm (.05 to .07 in.) sleeve clearance (L).

AXLE DRIVE

Removal and disassembly

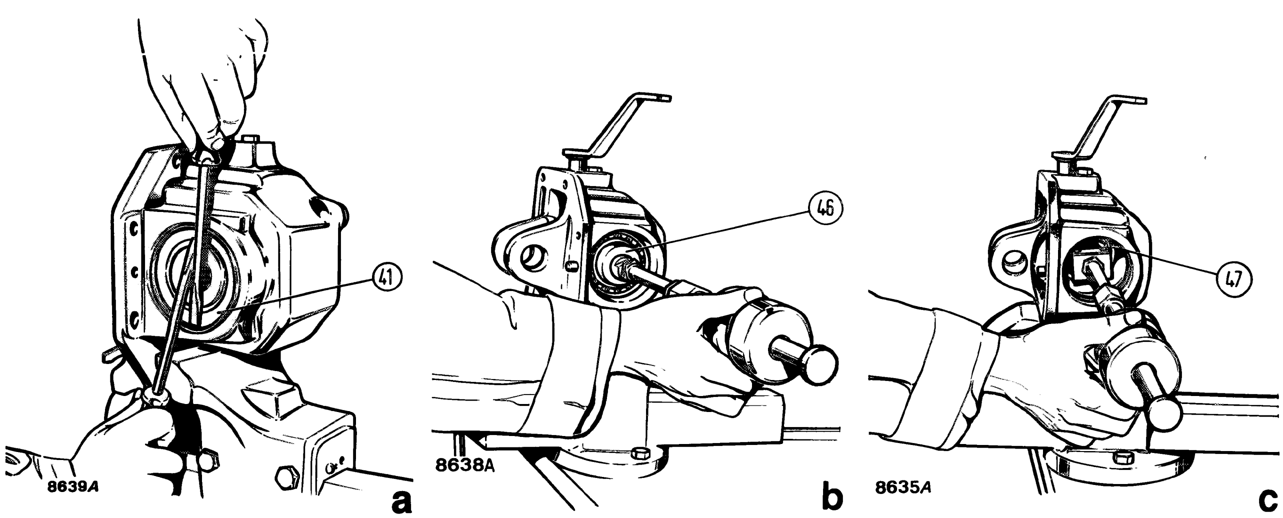
To remove axle drive assembly from tractor, take off front and rear drive shafts as directed above, drain rear transmission oil, disconnect vertical link from outer lever, take off screws (C_{12}) and withdraw axle drive clear.

To disassemble on bench proceed as follows:

— withdraw roll pin (48) using a suitable driver;

— remove intermediate shaft (49) and gear (51) with attached needle roller bearing (50) and thrust washers;

— from the outside of axle drive housing, remove dust excluder (41) as shown in (a), seal (42) circlip (43) and, using an internal universal puller, driven shaft (46) as shown in (b) with attached ball bearing (44), oil catcher and retaining ring;



Removing axle drive housing using universal slide hammer puller.

a. Removing dust excluder (41) - b. Removing driven shaft (46) - c. Removing roller bearing outer race (47).

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— remove driven gear (45) from housing, back off plug (56) and withdraw spring (55), plunger (54) and inner lever (53) after removing associated roll pin;

— if necessary, remove straight roller bearing outer race (47) from housing using an internal universal puller as shown in (c).

Check seal (42) and replace if inefficient. Check the bearings, especially the needle roller bearing.

Assembly

Assemble reversing the disassembly sequence and referring to the figure on page 3.

Preferably replace dust excluder (41) taking care to avoid distortion on assembly.

When installing axle drive housing, tighten screws to the torque specified on page 4, Section 40; check front and rear drive shaft adjustment as directed in the appropriate section.

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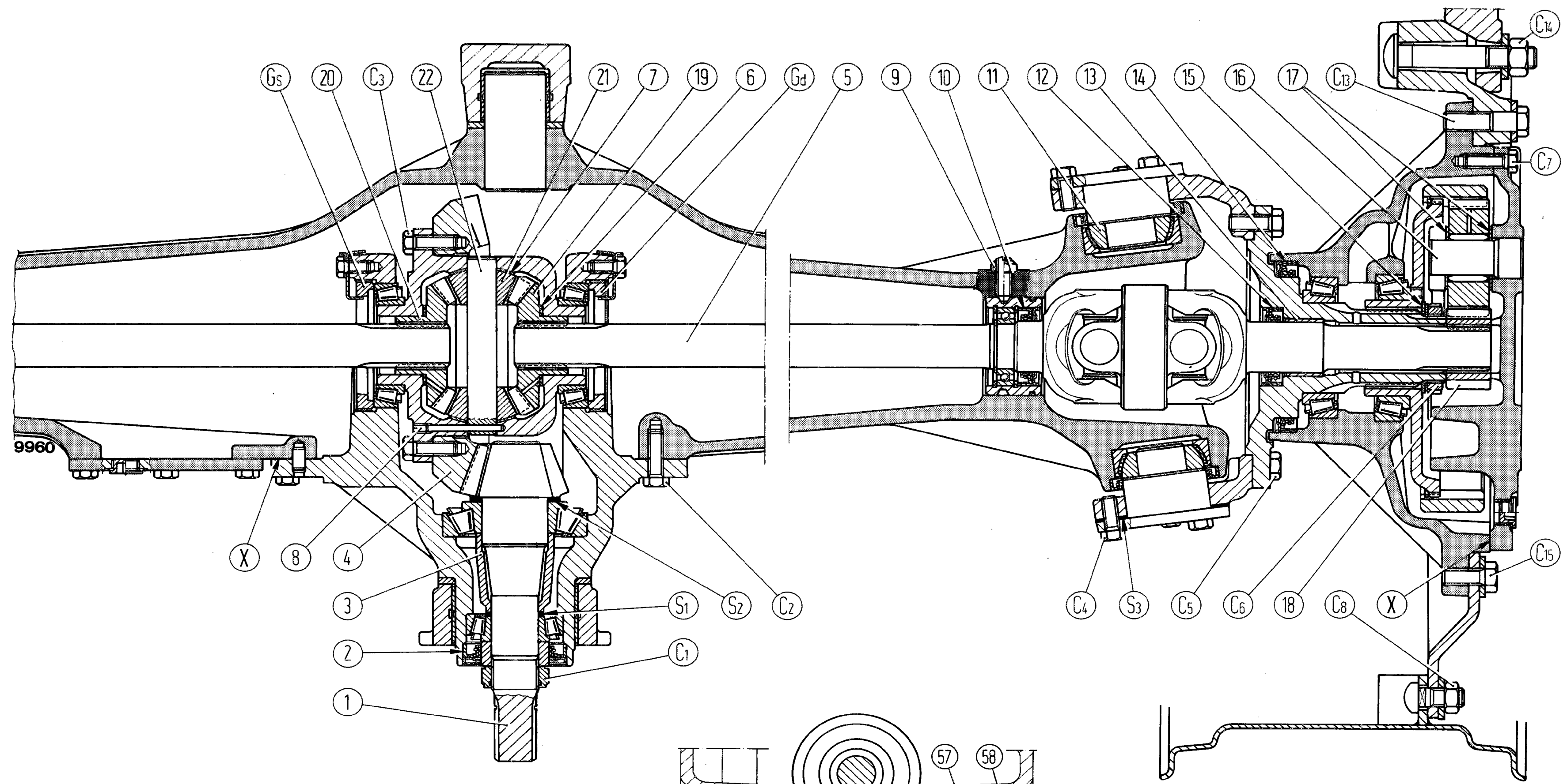
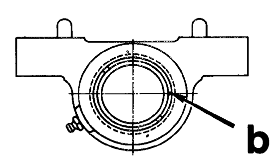
Longitudinal section through front axle, drive and shafts, 1180 DT - 1380 DT - 1580 DT - 1880 DT.

Note: On assembly thoroughly clean mating surfaces **X** and apply one of the jointing compounds listed on page 7, section A.

a. Section through axle drive control - b. Correct position of axle pivot front support bushing (split arrowed) - c. Correct position of axle pivot rear support bushing - C_1. Bevel pinion bearing lock ring - C_2. Bevel drive support capscrew - C_3. Ring gear capscrew - C_4. King pin capscrew - C_5. Steering knuckle capscrew - C_6. Wheel bearing lock ring - C_7. Final drive capscrew - C_8. Wheel nut - C_9. Differential cap capscrews - C_{10}. Front axle support capscrew - C_{11}. Center bearing capscrew - C_{12}. Axle drive capscrew - C_{13}. Cast disc capscrew - C_{14}. RAIL clamp nut - C_{15}. Pressed disc capscrew - G_d/G_s. RH and LH differential bearing lock rings - H = 1 mm (.04 in). Front bushing stand-in. L = 1.2 to 1.7 mm (.047 to .067 in) sleeve end float - S_1. Bevel pinion bearing shim - S_2. Bevel pinion position shim - S_3. King pin bearing shim - S_4. Sleeve position shim - 1. Bevel pinion - 2. Seal - 3. Bevel pinion bearing spacer - 4. Ring gear - 5. Axle shaft with universal joint - 6. Side gear thrust washer - 7. Differential pinion thrust washer - 8. Differential pinion shaft capscrew - 9. Bearing carrier capscrew - 10. Seal - 11. King pin bearing - 12. Seal - 13. Axle shaft bushing - 14. Seal - 15. Thrust washer - 16. Planet shaft - 17. Planet thrust washers - 18. Sun gear - 19/20. Side gears - 21. Differential pinions - 22. Shaft - 23. Axle pivot front support - 24. Front bushing - 25. Front thrust whasher - 26. Rear thrust washer - 27. Rear bushing - 28. Axle pivot rear support - 29, 31, 34, 37, 40 and 59. Retaining rings - 30. Front drive sleeve - 32/39. Drive shaft guards - 33. Front drive shaft - 35. Splined sleeve - 36. Center bearing - 38. Rear drive shaft - 41. Dust excluder - 42. Seal - 43. Retaining ring - 44. Ball bearing - 45. Driven gear - 46. Splined driven shaft - 47. Straight roller bearing - 48. Roll pin - 49. Intermediate shaft - 50. Needle roller bearing - 51. Intermediate gear - 52. Drive gear on bevel pinion - 53. Inner relay lever - 54. Detent - 55. Detent spring - 56. Plug - 57. O-ring - 58. Axle drive outer lever.





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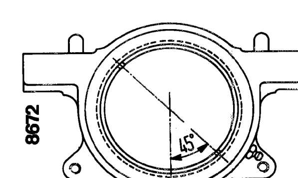

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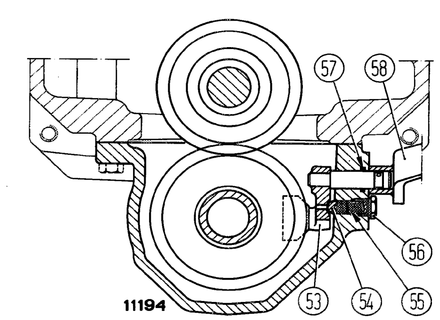

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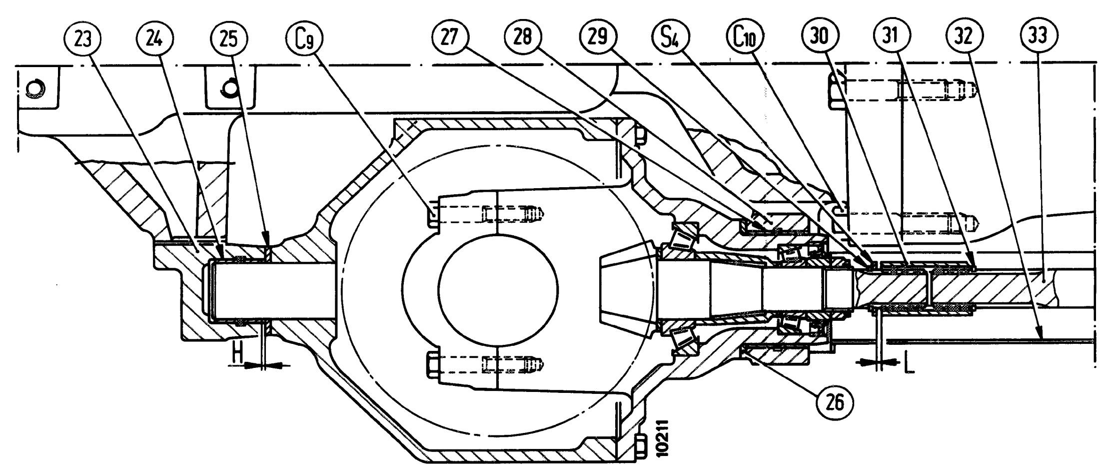

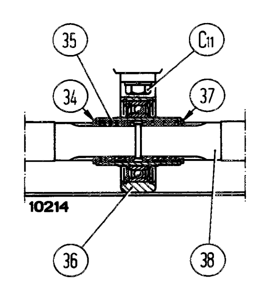

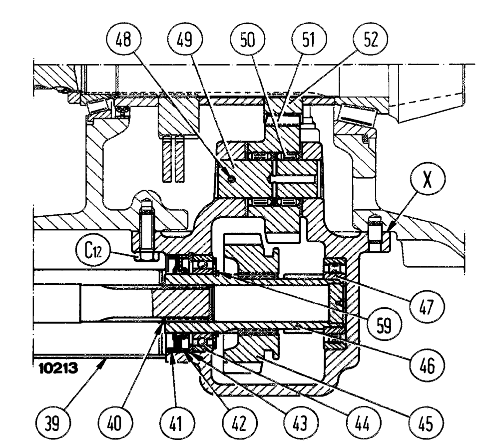

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LIFT

Type	position control, draught control and combined draught/position control
Control	separate levers plus rear-mounted lever for position control from ground
Sensitivity adjustment	control valve mounted knob, control located behind operator's seat
Single acting cylinder:	
— bore × stroke	115 × 159 mm (4.52 × 6.25 in)
— displacement	1651 cm^3 (100.74 in^3)
Remote control valve relief valve setting	170 bar (173 kg/cm^2) (2,465.68 psi)
Relief valve crack-off pressure	165 bar min (168 kg/cm^2 min) (2393.16 psi max)
Cylinder safety valve setting	225 to 235 (230 to 240 kg/cm^2) (3263 to 3408.4 psi)
Design lift capacity	28067 Nm (2862 kgm) (1) (20.701 ft.lb)
Lift piston dia.	114.940 to 114.960 mm (4.525 to 4.526 in)
Lift cylinder bore dia.	115.036 to 115.071 mm (4.528 to 4.53 in)
Piston working clearance in bore	.076 to .131 mm (.003 to .005 in)
Cross shaft journal dia.:	
— RH	64.970 to 65.000 mm (2.557 to 2.559 in)
— LH	74.970 to 75.000 mm (2.951 to 2.952 in)
Bushing fitted ID in lift body:	
— RH	65.100 to 65.170 (2) mm (2.562 to 2.565 in)
— LH	75.100 to 75.170 (2) mm (2.956 to 2.959 in)
Cross shaft working clearance in bushings	.100 to .200 mm (.004 to .008 in)
Right bushing interference fit in housing	.046 to .102 mm (.002 to .004 in)
Left bushing interference fit in housing	.046 to .102 mm (.002 to .004 in)
Cross shaft end float with lift arms in position	.1 to .5 mm (.004 to .019 in)

(1) Applicable to 1180 and 1380. For models 1580 and 1880 add auxiliary cylinder capacity.
(2) Not reamed.

(follows)

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LIFT

(continued)

Draught control lever pin dia. (20, page 8, section 501):	
— RH	18.837 to 18.870 mm (.741 to .742 in)
— LH	13.982 to 14.000 mm (.550 to .551 in)
Pin bore dia. in lift body:	
— RH	18.920 to 18.950 mm (.744 to .746 in)
— LH	14.050 to 14.077 mm (.553 to .554 in)
Pin clearance in housing:	
— RH	.050 to .113 mm (.002 to .004 in)
— LH	.050 to .095 mm (.002 to .0037 in)
Draught link fork pin dia (14, page 5)	11.957 to 12.000 mm (.470 to .472 in)
Bushing (13 and 15) fitted ID	12.016 to 12.059 mm (.473 to .474 in)
Pin clearance in bushing	.016 to .102 mm (.0006 to .0040 in)
Bushing interference fit in lever	.05 to .10 mm (.002 to .004 in)
Position shaft dia.	29.967 to 30.000 mm (1.179 to 1.181 in)
Bushing fitted ID	30.020 to 30.072 (1) mm (1.181 to 1.183 in)
Shaft clearance in housing	.020 to .105 mm (.0008 to .004 in)
Bushing interference fit	.034 to .098 mm (.0013 to .0038 in)
Draught shaft diameter (8)	15.957 to 16.000 mm (.628 to .629 in)
Bushing fitted ID	16.016 to 16.059 (1) mm (.630 to .632 in)
Shaft clearance in body	.016 to .102 mm (.0006 to .0040 in)
Bushing interference fit	.007 to .061 mm (.0003 to .0024 in)
Valve body clearance in seats	.015 to .025 (2) mm (.0006 to .0010 in)
Pilot valve clearance in seat	.008 to .012 (2) mm (.0003 to .0005 in)
Unload valve clearance in seat	.008 to .012 (2) mm (.0003 to .0005 in)
Pilot valve (3, page 7, section 501) and unload valve (4) spring length:	
— free	50.5 mm (1.98 in)
— under 41 to 45 N (4.18 to 4.62 kg) (9.2 to 10.2 lb)	29 mm (1.14 in)

(1) Not reamed.
(2) Matched and ground-in together on assembly.

(follows)

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LIFT

(continued)

Control valve spring length (2):	
— free	81,5 mm (3.21 in)
— under 46 to 51 N (4.65 to 5.15 kg) (10.2 to 11.3 lb)	38 mm (1.50 in)
Lift response control valve (5) spring length:	
— free	38 mm (1.50 in)
— under 17 to 18 N (1.74 to 1.92 kg) (3.8 to 4.2 lb)	20 mm (.79 in)
Spring loaded link inner spring length (12, page 8, section 501):	
— free	107 mm (4.21 in)
— under 338 to 378 N (34.5 to 38.5 kg) (76 to 85 lb)	56 mm (2.20 in)
Spring loaded link outer spring length:	
— free	112 mm (4.41 in)
— under 647 to 716 N (66 to 73 kg) (145 to 161 lb)	56 mm (2.20 in)

LIFT PUMP

Filters	
Type	two, full flow, side by side, paper cartridge
Location	suction side, on RH side of oil sump
Pump	
Type	gear, drawing from rear transmission
Location:	
— 1180-1380	behind timing cover
— 1580-1880	in front of timing cover
Make	TUROLLA (PLESSEY licence)
Model:	
— 1180	TF/A 217S
— 1380-1580-1880	TF/A 220S

(follows)

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HYDRAULIC LIFT UNIT: Specification and data

LIFT PUMP

(continued)

Drive	valve timing gear driven
Rotation (from drive end)	anti-clockwise
Drive ratio:	
— 1180-1380	1:1.166
— 1580-1880	1:1.300
Maximum rated speed (engine at governed rpm rate):	
— 1180	2975 rpm
— 1380	2800 rpm
— 1580-1880	2860 rpm
Maximum rated output:	
— 1180	50.6 l/min (11.13 galls/min)
— 1380	54.6 l/min (12.01 galls/min)
— 1580-1880	55.8 l/min (12.27 galls/min)
Output at 1450 rpm and 153 bar (156 kg/cm^2) (2495 psi) on test machine:	
— New or reconditioned:	
— 1180	22.9 l/min (5.04 gall/min)
— 1380-1580 and 1880	26.4 l/min (5.81 galls/min)
— Used	
— 1180	16 l/min (3.52 galls/min)
— 1380-1580 and 1880	18.4 l/min (4.05 galls/min)
Test oil temperature	55 to 65°C (131 to 149°F)
Test oil grade	SAE 20
Pump gear journal dia.	17.410 to 17.420 mm (.685 to .686 in)
Seat ID in bearings	17.444 to 17.505 mm (.687 to .689 in)
Journal clearance in seats	.024 to .095 mm (.001 to .037 in)
Max. wear clearance	.110 mm (.004 in)
Gear clearance in pump body	.048 to .080 mm (002 to .003 in)
Max. pump body wear on suction side	.08 mm (.003 in)
Gear flank width TF/A 217S	27.999 to 28.001 mm (1.1023 to 1.1024 in)
Gear flank width TF/A 220S	31.999 to 32.001 mm (1.2599 to 1.2600 in)
Bearing width TF/A 217S	19.990 to 20.000 mm (.7870 to .7874 in)
Bearing width TF/A 220S	21.990 to 22.000 mm (.8657 to .8661 in)
Bearing housing width in pump body TF/A 217S	68.070 to 68.080 mm (2.6799 to 2.6803 in)
Bearing housing width in pump body TF/A 220S	76.070 to 76.080 mm (2.9949 to 2.9953 in)
Gear and bearing end float (applicable to new and reconditioned pump)	.069 to .101 mm (.0027 to .0040 in)

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IMPLEMENT ATTACHMENT

Type	standard three point
Category	two or three ([1])
Draught control	through lower links and sensing bar
Max. lift capacity at lower link joints from horizontal:	
— 1180-1380	3334 daN (3400 kg) (7260 lb)
— 1580-1880 ([2])	4609 daN (4700 kg) (10340 lb)
Max. lift capacity, centre of gravity 610 mm (24 in) from lower link joints from horizontal (top link in top hole position on support):	
— 1180-1380	2844 daN (2900 kg) (6380 lb)
— 1580-1880 ([2])	3923 daN (4000 kg) (8800 lb)
Lift travel:	
— 1180	535 mm (21 in)
— 1380	535 mm (21 in)
— 1580	450 mm (18 in)
— 1880	450 mm (18 in)
Max. lift capacity from horizontal (top link in top hole position on support):	
— 1180 (centre of gravity 1530 mm, 60 in from lower link joints)	2157 daN (2200 kg) ([3]) (4840 lb)
	2844 daN (2900 kg) ([4]) (6380 lb)
Lift travel	630 mm (25 in)
— 1380 (centre of gravity 1690 mm, 66.5 in from lower link joints)	2059 daN (2100 kg) ([3]) (4620 lb)
	2746 daN (2800 kg) ([4]) (6160 lb)
Lift travel	655 mm (26 in)
— 1580 (centre of gravity 1850 mm, 73 in from lower link joints	2648 daN (2700 kg) (5940 lb)
Lift travel	565 mm (22 in)
— 1880 (centre of gravity 2050 mm, 81 in from lower link joints)	2550 daN (2600 kg) (5720 lb)
Lift travel	595 mm (23.5 in)

(follows)

([1]) Optional.
([2]) Also for 1180-1380 with optional auxiliary cylinder.
([3]) Standard version without auxiliary cylinder.
([4]) Optional version equipped with auxiliary cylinder.

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IMPLEMENT ATTACHMENT *(continued)*

Max. lower link end travel:	
— lift rods fully in	660 mm (26 in)
— lift rods fully out	725 mm (28.5 in)
Sensing bar end float	1.9 to 4.5 mm (.075 to .177 in)

AUXILIARY CYLINDER
STANDARD ON 1580-1880 - OPTIONAL ON 1180-1380

Type	single acting (one)
Location	hinged to LH lift arm and hydraulically connected in parallel with lift cylinder
Control	through lift levers
Bore x stroke	75 × 140 mm (2.95 × 5.51 in)
Total displacement	619 cm^3 (37.8 in^3)
Design lift capacity (to be added to normal lift capacity)	10523 Nm (1073 kgm) (7.761 ft.lbs)
Piston diameter	74.960 to 75.000 mm (2.951 to 2.952 in)
Cylinder head ID	75.030 to 75.060 mm (2.953 to 2.955 in)
Piston clearance in cylinder head	.030 to .100 mm (.001 to .004 in)
Lower cylinder pivot diameter	29.916 to 30.000 mm (1.178 to 1.181 in)
Pivot housing bore diameter	30.110 to 30.240 mm (1.185 to 1.190 in)
Pivot clearance in housing	.110 to .324 mm (.004 to .013 in)
Upper pivot diameter	27.979 to 28.000 mm (1.101 to 1.102 in)
Pivot housing bore diameter in piston	28.065 to 28.149 mm (1.104 to 1.108 in)
Pivot clearance in housing	.065 to .170 mm (.002 to .006 in)

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REMOTE CONTROL VALVES

Filter	two filters in parallel, paper cartridge (common to hydraulic lift circuit)
Pump	gear (common to hydraulic lift circuit)
Remote control valves	
Make	BOSCH
Location	in-line (3 max) secured under RH side of platform
Control	hand lever
Relief valve setting	170 bar (173 kg/cm^2) (2466 psi)
Type:	
— single and double-acting, convertible	0.521.601.179
— single and double-acting, convertible, with automatic release	0.521.601.178
— double-acting, with float control and automatic release	0.521.601.177
Trailer brake control valve	
Make	BOSCH
Location	secured to rear transmission housing
Valve control	tractor brake pedals
Trailer brake control	hydraulic lift oil
Type	0.538.008.312

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TORQUE DATA

DESCRIPTION	Thread	Torque		
		Nm	kgm	ft.lb
Lift - section 501				
Capscrew, lift to rear transmission housing (C_1, page 4)	M 12×1.25	98	10	72
Capscrew, control valve top cover	M 8×1.25	25	2.6	19
Capscrew, guard and control support	M 8×1.25	25	2.6	19
Capscrew, auxiliary cylinder lower pin	M 10×1.25	59	6	43
Capscrews, lift arm to shaft (C_2, page 2)	M 16×1.5	221	22.5	163
Safety valve, cylinder	M 20×1.5	34	3.5	25
Capscrew, inner lift arm	M 16×1.5	152	15.5	112
Auxiliary cylinder - section 501				
Lockring, piston (C_1, page 6)	M 30×1.5	711	72.5	524
Cylinder head (C_2)	M100×2	2059	210	1519
Hydraulic pump - section 502				
Capscrews and locknuts, pump (8, page 1)	M 6×1	8	.8	6
Capscrews, pump covers (12)	—	34	3.5	25
3-point linkage and towing attachment - section 503				
Capscrews, sensing bar support	M 18×1.5	294	30	217
Capscrew, draught control return lever support	M 8×1.25	25	2.6	19
Capscrew, top link support	M 18×1.5	348	35.5	257

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TROUBLE SHOOTING

Fault	Cause	Remedy
1. Lift fails to operate.	**a.** Governor (2, page 7, section 501) stuck open	Remove foreign particles and inspect filter.
	b. Inefficient pump.	Disassemble and inspect pump.
	c. Incorrect installation of push rod and tube on spring-loaded link (12, page 8, section 501).	Disassemble and assemble correctly.
	d. Spacer (6, page 8, section 501, out of contact with rollers).	Disassemble and restore contact.
2. Erratic lift movement during raise.	**a.** Clogged oil filter.	Inspect filter and replace cartridge as necessary.
	b. Ingress of air in inlet line.	Check for faulty connections and seals.
3. Lift fails to hold the load in raised position. Continuous pitching movement with the engine running; upon stopping engine the load is lowered.	**a.** Incorrect spool sensitivity.	Check sensitivity adjustment.
	b. Unload valve stuck open. Faulty seals.	Disassemble. Check for leakage, clean and replace damaged parts - Inspect filter.
	c. Inlet valve leakage.	Disassemble, inspect and clean.
	d. Leakage past lift piston gland or lift cylinder seal.	Replace seals.
	e. Safety valve leakage or incorrect setting.	Replace.
4. Relief valve cracks off with lift arms in fully raised position.	Lift arm travel out of adjustment.	Adjust setting.
5. Insufficient or inadequate lifting power.	**a.** Incorrect relief valve setting.	Adjust setting.
	b. Incorrect safety valve setting.	Replace.
	c. Poor pump performance (usually accompanied by increased raise time).	Check pump performance. Overhaul or replace as necessary.
6. Lift arms fail to lower.	Unload valve stuck.	Inspect and replace as necessary.
7. Erratic lift arm movement during lower.	Control valve return springs installed back to front.	Disassemble and install correctly.
8. Lift arms fail to lower to end of travel.	Incorrect adjustment of maximum lift arm travel.	Adjust setting.

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TRAILER BRAKE CONTROL VALVE TROUBLE SHOOTING

Fault	Cause	Remedy
Valve operation erratic (more than two pulses per second).	Faulty check valve seals (3, page 11, section 504).	Disassemble and clean check valve.
Valve fails to operate	Restriction (9, page 10, section 504) obstructed.	Disassemble and clean flow regulator (1).

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DESCRIPTION

The lift senses the forces acting on the lower links through a sensing bar permitting the following functions:

— position control;
— float;
— draught control;
— combined draught and position control.

Each of these should be selected in relation to the type of work in hand, type of implement used and ground consistency.

Position control (a)

Position control means that the implement may be brought to, and held in, any desired position, both below or above ground, in relation to the position to which control lever (P) is moved.

During position control operation, draught control lever (F) should be fully back on the quadrant.

Float (b)

In the float position the lift arms are free and the implement may follow the ground contour.

To achieve float, keep both control levers (F and P) fully forward on quadrant.

Raise and lower the implement through position control lever (P) only.

Draught control (c)

During draught control, the lift keeps the tractive effort required of the tractor steady by slightly altering the working depth of the implement. This occurs quite automatically.

Average working depth, and therefore the draught, is adjusted solely by moving lever (F), holding position control lever (P) fully forward on the quadrant.

Raise and lower the implement through draught control lever (P) only. When working, adjust the lift sensitivity lever to maximum sensitivity, at the same time preventing the implement from jolting.

Combined draught and position control (d)

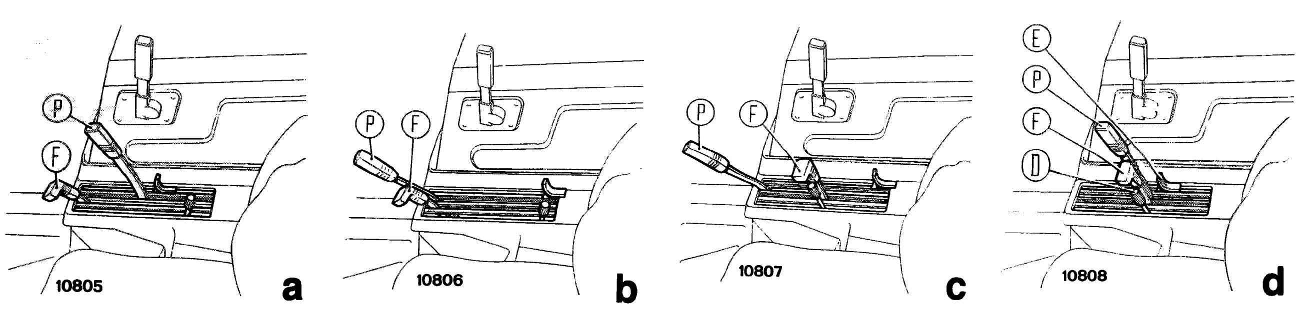
When working with position control on ground of uneven consistency, the combined draught and position control function is desirable to prevent the implement from digging-in.

Proceed as follows:

— set the desired depth of work through draught control lever (F), holding position control lever (P) fully forward on the quadrant;

— move position control lever (P) gradually backward until the lift arms tend to raise;

— lock lever stop (E) to return lever (P) to same position at the start of each pass.



Lift control lever positions.

a. Position control - b. Float - c. Draught control - d. Draught and position control - D. Lever (F) positioner - E. Lever stop (P) - F. Draught control lever - P. Position control lever.

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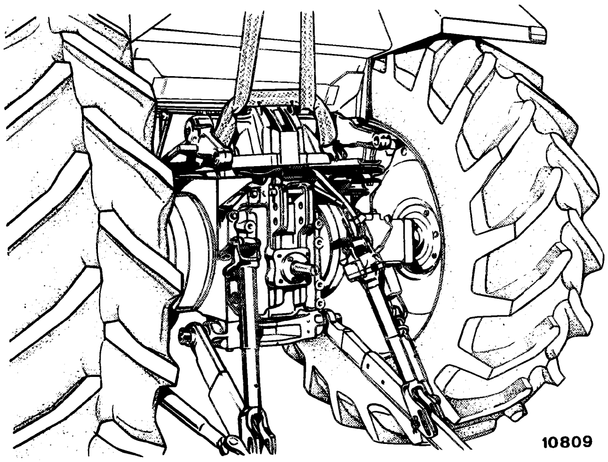


Removing (replacing) lift.

The lift works in draught control but prevents implement from digging-in in lower consistency ground when unsuitable soil might be brought to the surface

Raise and lower lift through position control lever (P, page 1).

Hold draught control lever (F) still to maintain constant working depth.

REMOVAL

To remove the lift unit from the tractor proceed as follows:

— disconnect lift arms from the three point linkage;

— remove remote control valve coupling bulkhead plate from lift body;

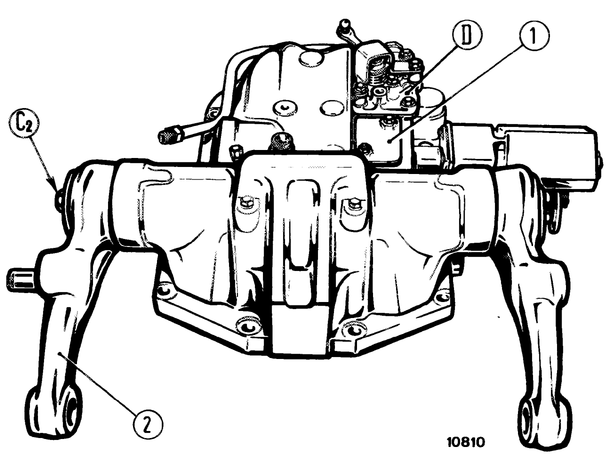
— disconnect lift and sensitivity control linkage;

— disconnect remote control valve oil lines from lift body;

— remove vent pipe between lift top cover and parking brake quadrant support (late model lifts);

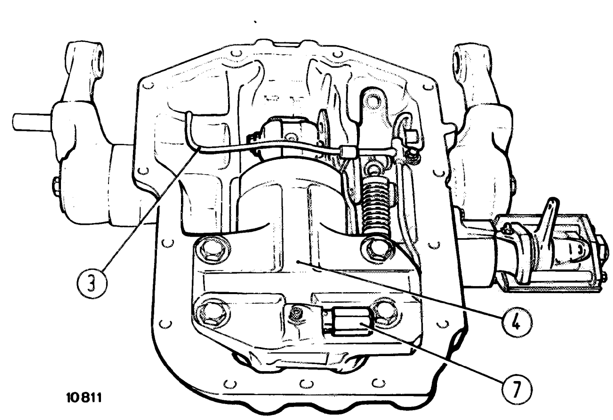
— remove auxiliary cylinder;

— withdraw lift screws and lift the unit clear from the rear using block and tackle as shown. Take care that draught link does not foul the lift linkage.



Top view of lift.

C_2. Lift arm capscrews - D. Valve block - 1. Adjuster screw cover - 2. Lift arms.



Bottom view of lift.

3. Early model lubrication line to lift shaft bushings and piston-cylinder - 4. Cylinder - 7. Cylinder safety valve.

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DISASSEMBLY

Place lift assembly on the bench and disassemble noting the following points:

— back off capscrews and remove control valve assembly (D, page 2) and lift adjustment screw cover (1);

— remove quadrant complete with levers and springs;

— back off two capscrews (C_2) and remove lift arms (2, page 2);

— remove lubricant line (3) (early type lifts) retrieving the control valve lube fitting and associated spring;

— back off four capscrews and remove cylinder (4) with piston and cylinder safety valve (7). Retrieve ball, spring and inlet valve retaining spacer;

— withdraw piston from cylinder introducing compressed air into oil delivery port;

— remove capscrews (9, page 4) and crank retaining dowel (10). Install protector **292768** on right seal (5, page 4) and remove cross shaft from body by striking R.H. end;

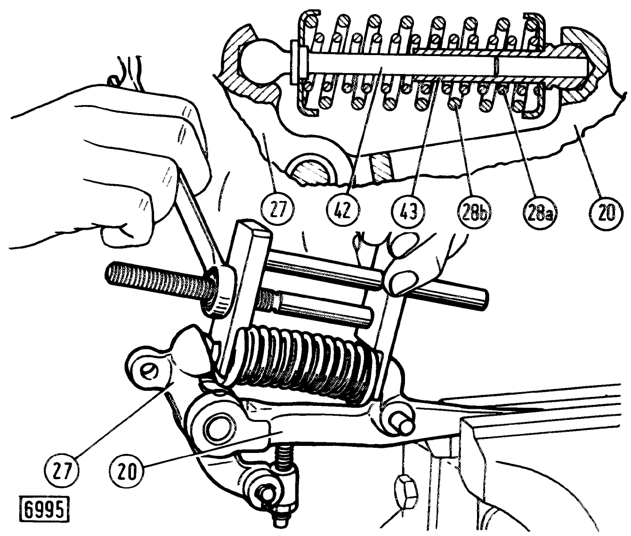
— remove internal linkage from lift body and compress spring-loaded link (28a, 28b) springs with tool **291485** to remove control valve lever (20) from crank (27).

Disassemble control valve by removing:

— roll pin (69, page 7), retrieving control lever (E), spring (71) and plate (70);

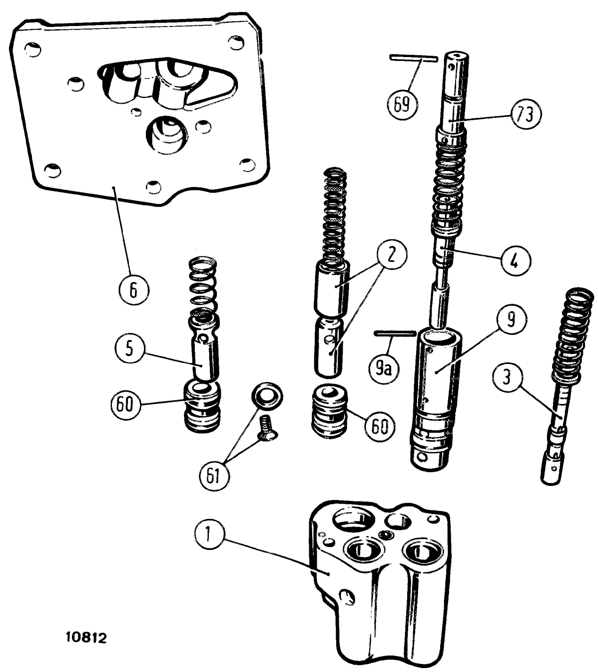
— two cover retaining capscrews separating cover from valve body and retrieving springs and inner valves;

— delivery (60) connection capscrew retrieving the connections.



Removing spring-loaded link springs using tool 291485.

20. Control valve lever - 27. Lever crank - 28a/28b. Spring-loaded link springs - 42. Push rod - 43. Tube.



Disassembling the control valve.

1. Body - 2. Governor valve - 3. Pilot valve - 4. Unload valve - 5. Draught response control - 6. Control valve cover - 9. Unload valve seat - 9a. Pin - 60. Delivery connection - 61. Capscrew and washer - 69. Roll pin - 73. Response adjustment pin.

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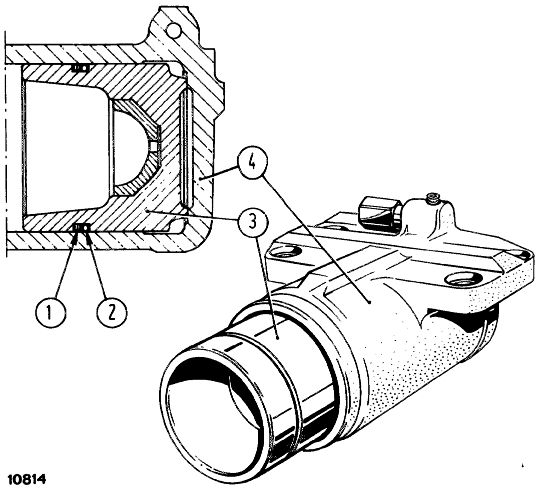


Cylinder assembly.

1. Backing ring - 2. Seal - 3. Piston - 4. Cylinder.

INSPECTION

Refer to the data given on the table of pages 1, 2 and 3, section 50:

— check the seals for inefficiency and replace as necessary;

— check valves for wear.

Note that replacement pilot and governor valves are, supplied together with valve body to which they are matched in production, whereas unload valve is supplied together with its own body;

— check the pressure setting of relief valve incorporated in remote control valves and cylinder safety valve as directed on page 14.

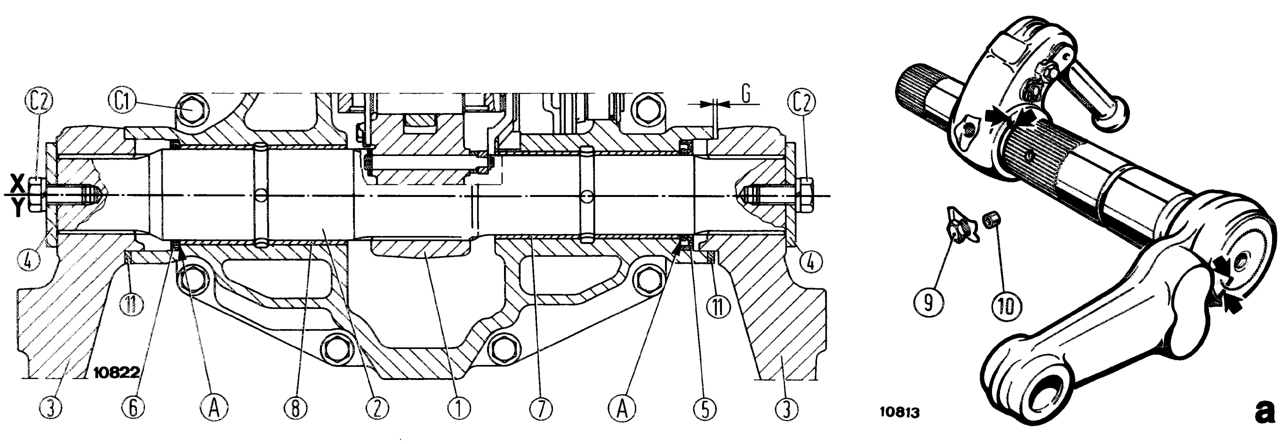
ASSEMBLY

Reverse the disassembling procedure noting the following points:

— if bush replacement is necessary, press the replacement bushings into the lift body from outside ensuring that bushings lie flush with face (A). These bushings do not require reaming after fitting;

— couple crank (1) and lift arms (3) to cross shaft (2) ensuring that the reference marks are in register as shown;

— remove LH seal (6) and, if replacement is necessary, also RH seal (5);



Section through lift cross shaft.

a. Reference mark location for correct assembly - A. Face to be flush with bush - C_1. Lift capscrew - C_2. Thrust plate retaining screws - (4) G = .1 to .5 mm (.004 to .020 in) Cross shaft end float - X. Early type - Y. Late type - 1. Crank - 2. Cross shaft - 3. Lift arms - 4. Thrust plates - 5. Right seal - 6. Left seal - 7. Right bushing - 8. Left bushing - 9. Crank capscrew - 10. Dowel - 11. Thrust washer (late type).

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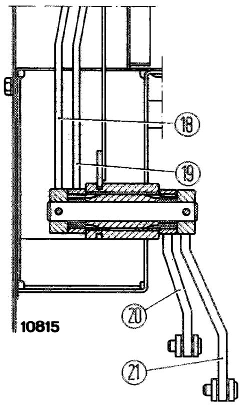
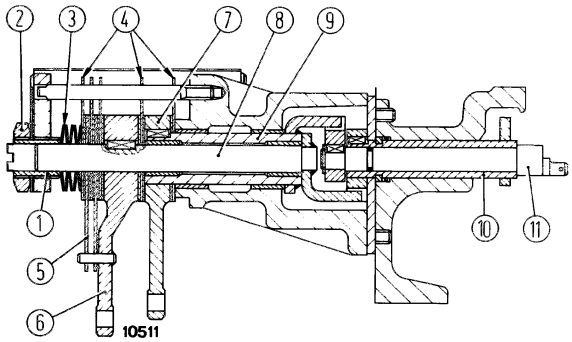
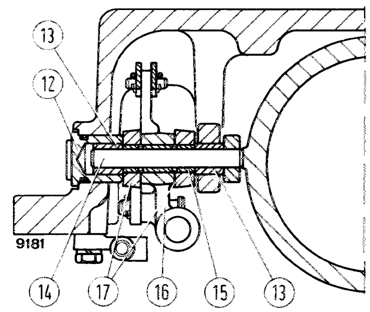




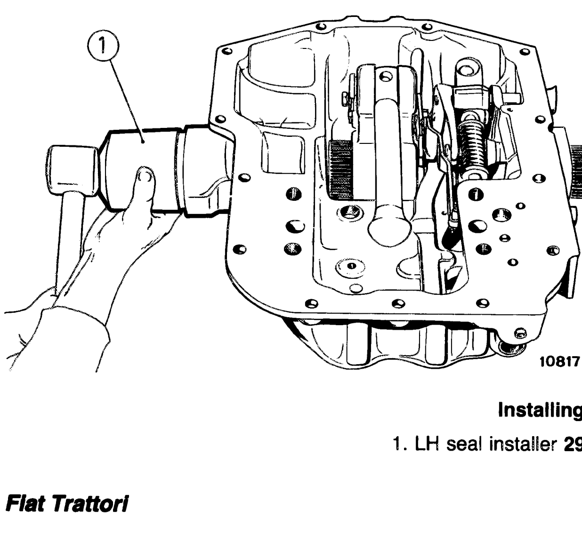


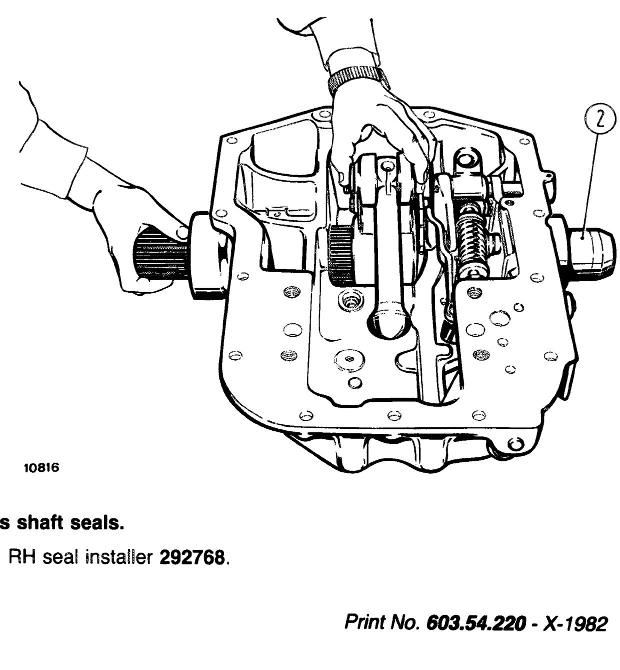
Sections through lift linkage and controls.

1. Outer lever load adjustment screw - 2. Locknut - 3. Belleville springs - 4. Clutch plates - 5. Draft control lever washers - 6. Outer draught relay lever - 7. Outer position relay lever - 8. Draught lever outer shaft - 9. Position lever outer shaft - 10. Draught lever inner shaft - 11. Position lever pivot - 12. Sleeve - 13. Position relay lever bushings - 14. Position relay lever pivot - 15. Lever (16 and 17) coupling bushing - 16. Control valve lever crank - 17. Draught control lever - 18. Outer position control lever - 19. Outer draught control lever - 20. Draught relay lever - 21. Position relay lever.

Note: When installing seals on late model lifts make a spacer (14, page 6, to be used with drivers **292769/1** or **292770**): Material Aq45; thickness 5 ± .1 mm (.12 in ± .004 in); ID, 91.5 (3.6 in); O.D, 102 mm (4.02 in) for use with drivers not equipped with spacers. Late type drivers are provided with spacer).

— install cross shaft (2) and position LH seal using driver **292770** (1), complete with spacer (late type lift) and RH seal using protector **292768** (2) and driver **292769/1** complete with spacer (late type lift);





Installing lift cross shaft seals.

1. LH seal installer **292770** - 2. RH seal installer **292768**.

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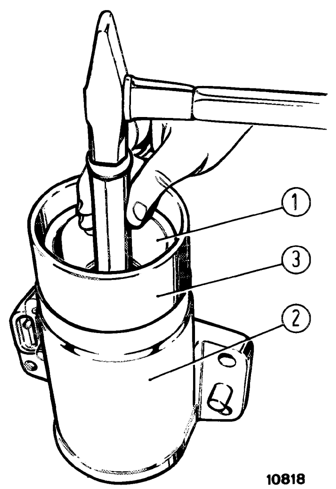
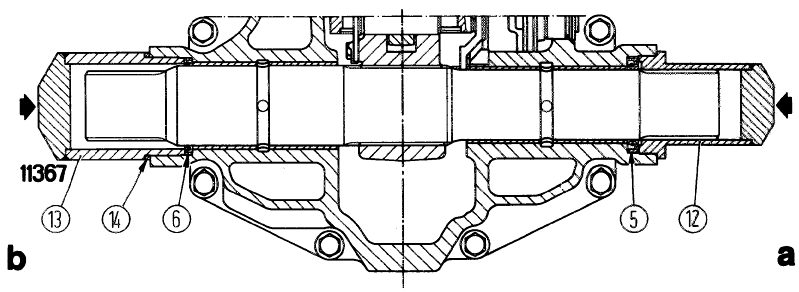


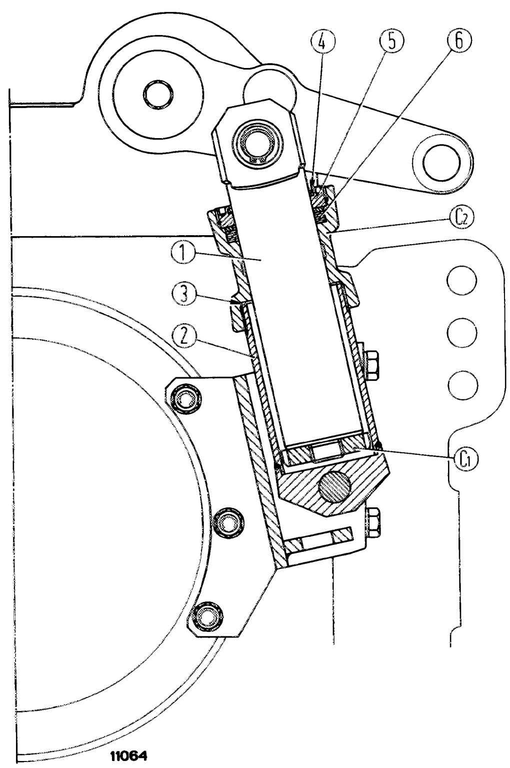
Installing piston (1) in cylinder (2).

3. Guide ring **293813.**



Installing lift cross shaft seals (5 and 6).

a. Early type lift body (without thrust washers) - b. Late type lift body (with thrust washers) - 12. Driver **292769/1** - 13. Driver **292770** - 14. Spacer to be constructed (for use with driver **292769/1** or **292770**; late type lift) (only for drivers not equipped with spacer. Late type drivers are provided with spacers).



Section through auxiliary cylinder.

C_1. Piston lock ring - C_2. Cylinder head - 1. Piston - 2. Cylinder - 3. Copper washer - 4. Dust excluder - 5. Excluder lock ring - 6. Piston gland.

Note: If RH seal (5, page 4) is not to be replaced, install protector **292768** (2, page 5), remove LH seal (6, page 4) and install cross shaft from left side of lift. Install seal (6).

- after installation check that lift cross shaft end float is .1 to .5 mm, .004 to .020 in (G, page 4);
- position piston inside cylinder using guide ring **293813** (3) to prevent seal damage;
- assemble control linkage and control valve as shown in appropriate diagrams;

Note: When tightening capscrews securing cover to control valve body, check that sensitivity adjustment lever (E, page 7) moves freely. If not, tap cover gently until freedom from binding is obtained.

- thoroughly clean and degrease mating surfaces or apply a specified jointing compound (see page 7, section A).

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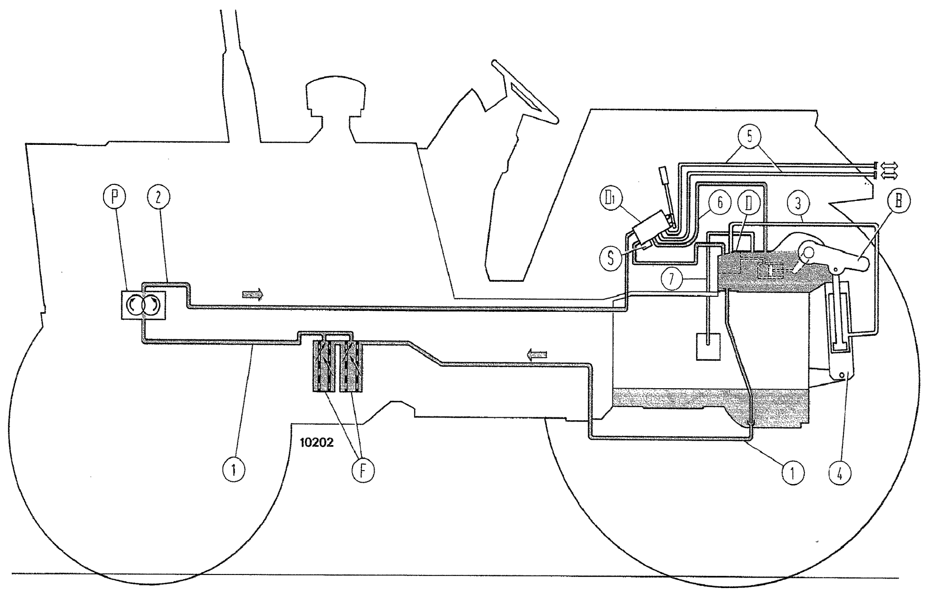
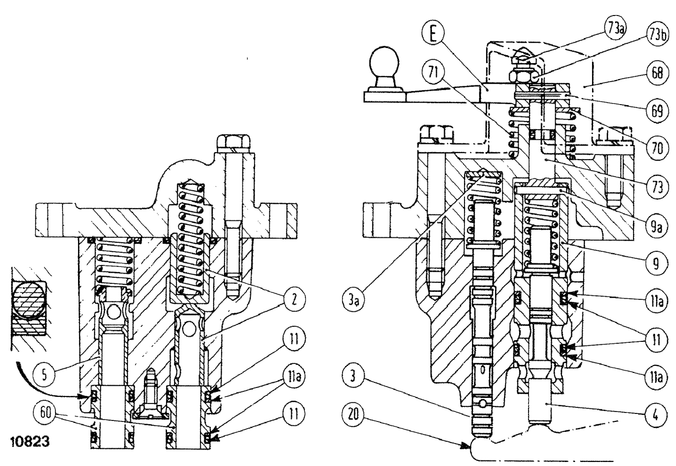


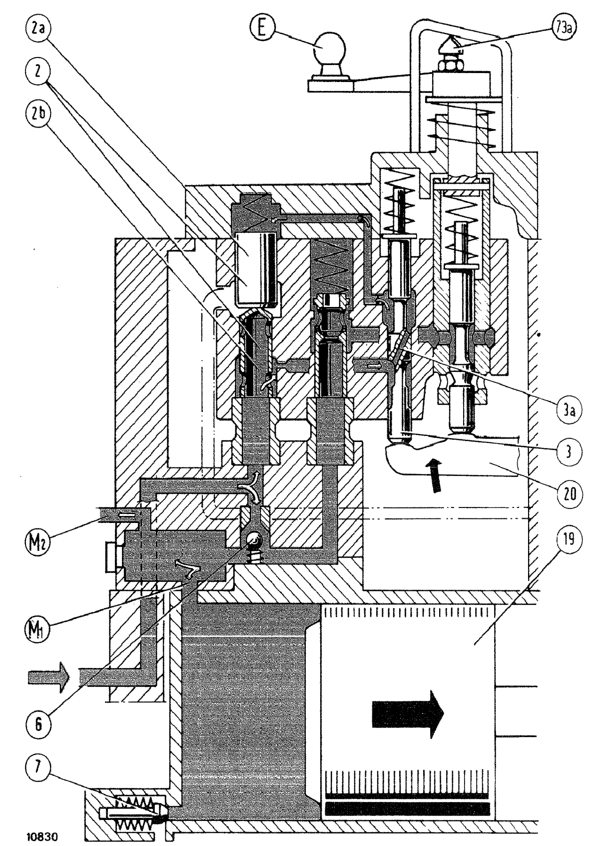
Hydraulic lift system diagram.

B. Lift arm - D. Control valve - D_1. Single acting - double acting convertible remote control valves - F. Filters (2, side by side) - P. Pump - S. Relief valve (incorporated in remote control valves) - 1. Suction line from rear transmission housing - 2. Delivery line to remote control valve - 3. Delivery line to auxiliary cylinder - 4. Auxiliary cylinder (optional on 1180 and 1380 and standard on 1580 and 1880) - 5. Oil delivery line - 6. Drain to lift body - 7. Vent pipe.



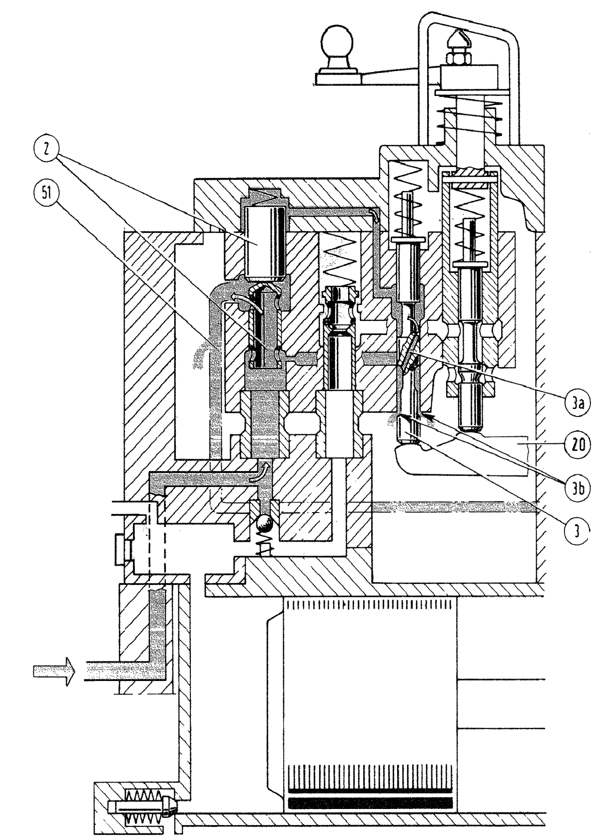
Section through lift control valve.

E. Sensitivity lever (actuated through knob located behind lift control levers - 2. Governor valve - 3. Pilot valve - 3a. Washer - 4. Unload valve - 5. Lift response control valve - 9. Unload valve seat - 9a. Pin - 11. O-ring - 11a. Anti-extrusion ring - 20. Control valve lever - 60. Delivery connections - 68. Bracket - 69. Roll pin - 70. Plate - 71. Spring - 73. Sensitivity adjustment pin - 73a/73b. Sensitivity adjustment screw and associated locknut.



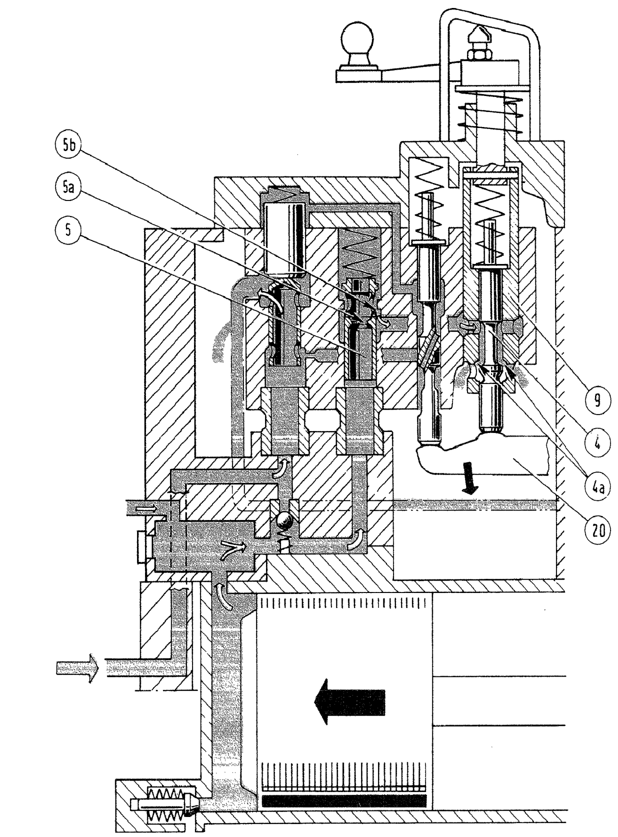
S. Arms up.

Raising of lever (20) and subsequent upward displacement of pilot valve (3) allow oil from the pump to act upon the governor piston (2a) through port (3a); since the area of piston (2a) is larger than that of plunger 2b, piston force is sufficient to move the plunger downward, thereby closing the drain ports. Oil under pressure opens valve (6) and acts on piston (through M_1) and auxiliary cylinder (if fitted) through M_2 to raise the arms.



N. Neutral (arms at rest).

Position taken up by lever (20) causes pilot valve (3) to lower which in turn causes governor upper chamber to drain through port (3a) and ports (3b). Thus, oil from pump acts on governor plunger. Governor valve (2) lifts and drain ports open diverting oil flow to tank (rear transmission housing).



A. Arms down.

Downward displacement of lever (20) and, subsequently, unload valve (4), allows piston to force cylinder oil to drain through lift response control valve restrictions (5a) and (5b) and ports (4a) which are opened by unload valve. The pressure drop caused by fixed restriction 5 (a) reduces the effective area of variable restriction 5 (b) as oil flow tends to increase and vice versa. Thus arm lower rate remains virtually constant regardless of implement weight.

High pressure oil

Inlet, delivery or drain oil

Trapped oil

HYDRAULIC LIFT CONTROL VALVE OPERATION.

Note: Rotation of lever (E), integral with unload valve (9) seat, causes endwise displacement of unload valve through effect of screw (73a) sliding on angle bracket. Thus unload valve (4) operation is advanced or retarded to control implement lower relative to pilot valve (3) operation controlling arm raise, there by regulating lift response.

E. Oraft sensitivity lever - 2. Twin body governor valve - 2a/2b. Governor valve piston and plunger - 3. Pilot valve - 3a. Pilot valve port - 4. Unload valve - 4a. Drain ports - 5. Lift response control valve - 5a/5b. Restrictions - 6. Inlet valve - 7. Cylinder safety valve - 9. Unload valve seat - 19. Lift arm piston - 20. Control valve inner lever. - 51. Bushing, cross shaft and cylinder (late type) lubricant line - 73a. Sensitivity adjustment screw.

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OPERATION

X. Position control.

Backward displacement of lever (P) brings about endwise displacement of spacer (6) between rollers (7) and (10) through the cam or inner end of pin (5). As roller (7) is initially at rest because it is connected to rocker (8), spacer (6) pushes roller (10) upward causing crank (11) and lever (4) to rotate in the direction indicated by the solid arrows, thereby placing control valve in delivery (S, page 7). The arms raise until rocker (8), actuated by roller (9) rotates in the direction of the open arrow, causes roller (7) to move downward, disengages roller (10) and allows downward rotation of lever (4) through spring action of valves (1 and 2).
The control valve returns to neutral and the arms stop. Maximum lift arm height is checked, independently of lever (P), through adjustment screw (14) which returns control valve to neutral before the piston reaches the mechanical stop by coming into contact with pin (15), on lever (4).
A reverse sequence is obtained when lever (P) is moved forward to lower the implement.

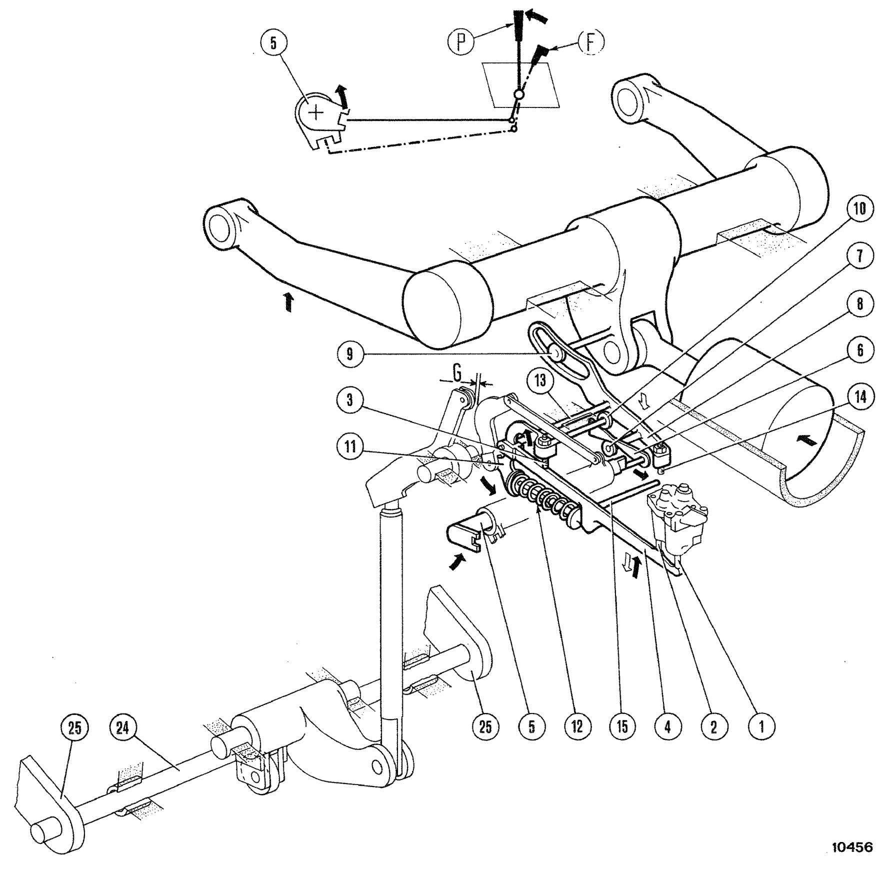
Float.

Full forward displacement of position control lever (P) and draught control lever (F) results in:

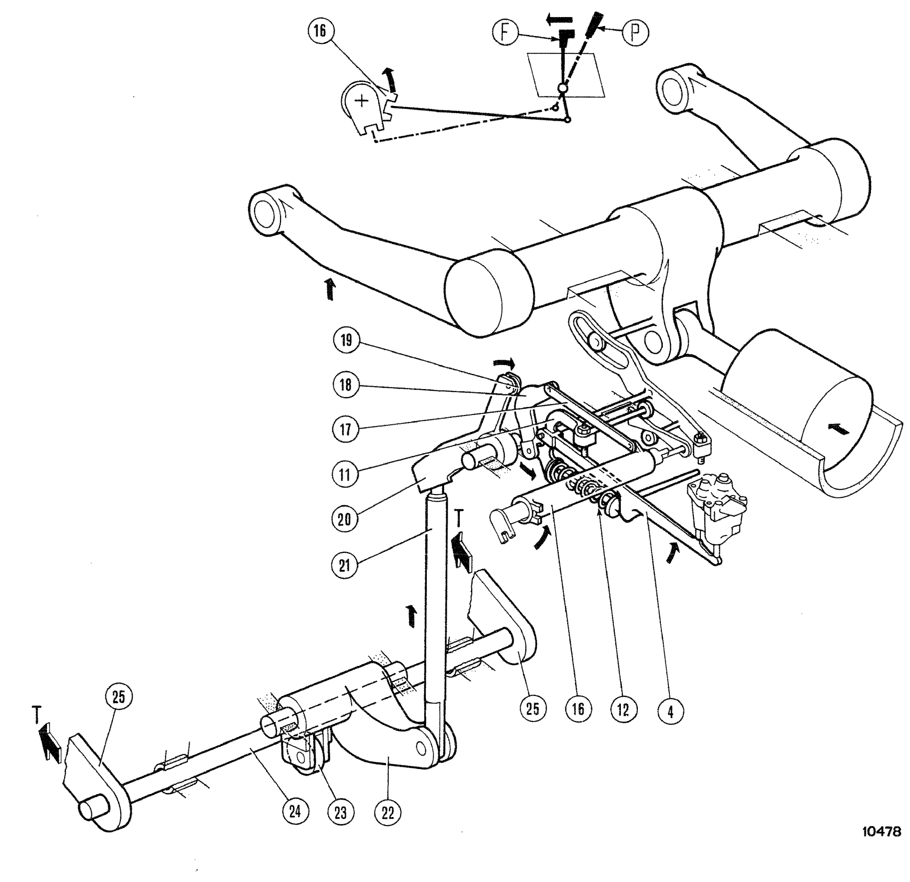
- clearance (G) between roller (19) and lever (18) to prevent draught linkage from being activated in this phase;
- movement of pin (5), spacer (6), crank (11) and lever (4) in the opposite direction to that indicated by the solid arrows, thus maintaining control valve in lower position (A, page 7) which allows arms to swing free and implement to rest on ground as the arms cannot complete their downward stroke.

Y. Draught control.

After adjusting lever (F) on quadrant to achieve desired working depth, suppose that draft (T) of implement on lower links tends to increases.



X. Implement raising in position control.
(Move draught control lever (F) fully forward. The thin line section of linkage is activated but does not influence draught control.



Y. Implement raising in draught control.
(Move position control lever (P) fully forward. The thin line section of linkage is activated but does not affect position control.

LIFT CONTROL LINKAGE SCHEMATICS.

Note: Arrows refer to lift arm raising movements. When lowering, movements are in opposite direction.

F. Draught control lever - G. Roller clearance - P. Position control lever - T. Draft on arms during tractor motion - 1/2 Pilot valve and unload valves (spring loaded against lever 4) - 3. Start of lift adjustment screw - 4. Control valve lever - 5. Pin, connected to position control lever (P) through tie rod - 6. Spacer - 7. Steady roller (integral with rocker) - 8. Rocker - 9. Actuating roller - 10. Position control roller - 11. Control valve lever crank - 12. Spring-loaded link - 13. Hinge pin - 14. Maximum lift adjustment screw - 15. Maximum lift stop pin - 16. Hollow shaft - 17. Connecting link - 18. Draught lever (hinged to crank at bottom) - 19. Draught roller - 20. Draught rocking lever - 21. Draught link - 22. Draught relay lever - 23. Draught relay lever roller - 24. Sensing bar - 25. Lower links.

Any such increase causes sensing bar (24) to flex and, bearing on roller (23) to turn lever (22) which actuates lever (20), roller (19) and lever (18) in the direction indicated by the solid arrows. Lever (18), hinged at the bottom to crank (11) and connected at the top to shaft (16) through connecting link (17) (the shaft being restrained by lever F), causes crank (11) to turn and lever (4) to move up thereby placing control valve in delivery (S, page 7). The arms raise until consequent reduction in draught (T) reduces the load on sensing bar (24) and causes lever (22) to turn in the opposite direction allowing springs in valves (1 and 2) to recall lever (4) downward. Control valve returns to neutral and the arms stop. After overcoming the obstacle, the further decrease in draught (T) reduces load on sensing bar (24) and lever (4) moves, further downward. Control valve is placed in exaust (A, page 7) allowing lift arms to lower until initial working conditions are restored. If control lever (F) is moved further back on the quadrant draught reduction hollow shaft (16) causes lever (18) to react against roller (19) through connecting link (17) and causes lever (4) to turn upward thereby placing control valve in delivery. The arms raise until consequent reduction in draught (T) causes roller (19) to retreat and control valve is placed in neutral.
Forward displacement of lever (F) (draught increase) causes a reversal of the above sequence.

Draught and position control.

With backward movement of draught control lever (F) and full forward displacement of position control lever (P), the working depth is adjusted as described under draught control. The subsequent backward movement of lever (P) causes spacer (6), crank (11) and lever (4) to move in the direction indicated by the solid arrows in diagram X and places control valve in delivery resulting in the lift arms raising slightly.
This condition does not prevent the lift from working in draught control when draught increases owing to working in a patch of hard ground. Thus, mixed draught and position control is a means of containing working depth reduction during draught control.

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LIFT ADJUSTMENT

This adjustment is to be carried out with the lift unit in position on the tractor whenever lift operating malfunction is suspected.

1. Sensitivity relay link adjustment

Align response control knob (S) with + sign and check that lever (E) is in maximum sensitivity position (adjusting screw 73a, page 7, facing toward upper part of bracket 68).

If not, slacken locknut (1) and back off or tighten fork (2) until, with knob (S) aligned with + sign, lever (E) is in maximum sensitivity position.

Tighten locknut (1).

2. Control valve sensitivity adjustment

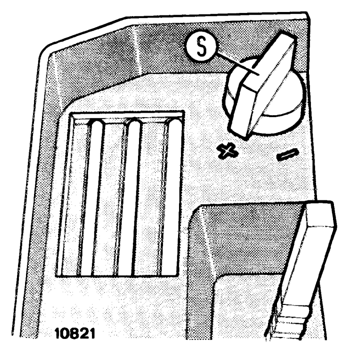
Test conditions:

— place a 200 kg (440 lb) weight on the ends of the lower links;

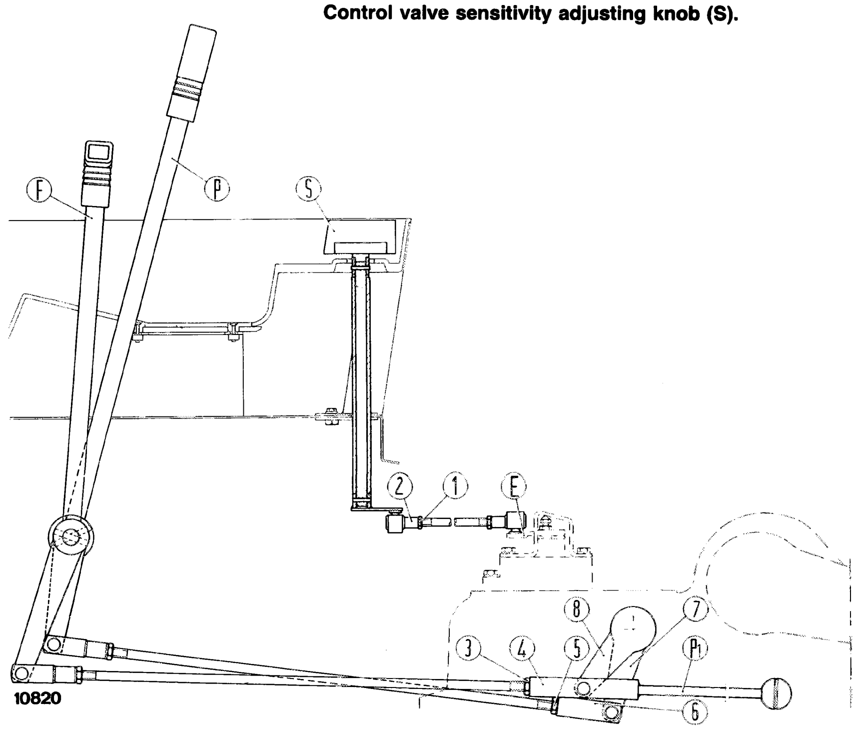
— raise oil temperature to 50° - 60°C;

— run the engine at 1200 to 1500 rpm;

— move draught control lever (F, page 10) fully forward on the quadrant;



Control valve sensitivity adjusting knob (S).



Section through lift control levers and linkage.

E. Control lever - F. Draught control lever - P. Position control lever - P_1. Position control lever (operated from ground) - S. Sensitivity adjusting knob - 1/2. Sensitivity link adjusting fork and locknut - 3/4. Position link adjusting fork and locknut - 5/6. Draught link adjusting fork and locknut - 7. Outer draught relay lever - 8. Outer position relay lever.

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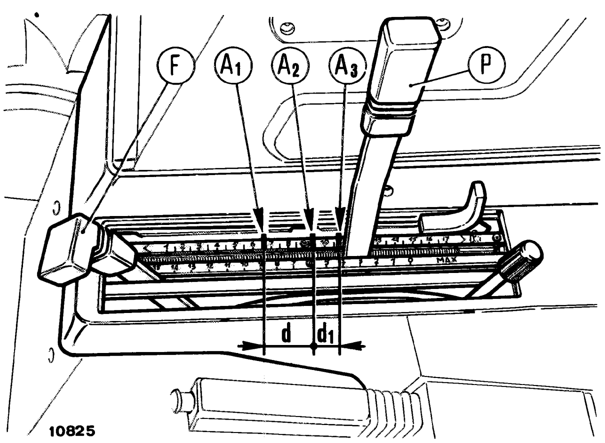


Adjusting control valve sensitivity.
A_1, A_2, A_3, d, d_1. See text - F. Draught control lever - P. Position control lever.

— align control knob (S, page 9) to + sign (maximum sensitivity condition).

Subsequently, proceed as follows:

— move position control lever (P) through at least five raise strokes;

— starting from full-back position (arms fully raised) move lever (P) to halfway position on quadrant in one stroke and wait until arms come to rest;

— apply a reference mark (A_1) on the quadrant in line with the lever;

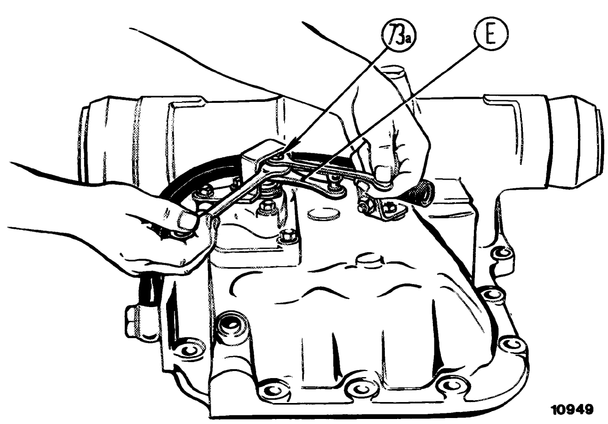
— move lever backward in small increments until arms start to raise;

— apply a second reference mark in this position (A_2) and check that distance (d) between marks is 16 to 18 mm (.63 to .70 in); if distance (d) is greater, slacken nut (73b, page 7) and screw in screw (73a), if it is smaller, back off the screw;

— starting from position (A_2), move lever (P) backward again until arms start to raise;

— apply a third reference mark (A_3) and check that distance (d_1) is at least 4 mm (.16 in) smaller than distance (d). If not, reduce sensitivity by backing off screw (73a, page 7) to obtain specified distance.

The subsequent increase in distance (d) will not affect lift performance.



Adjusting control valve sensitivity.
E. Control lever - 73a. Adjusting screw.

3. Start of lift adjustment in position control

Carry out this adjustment under test conditions as in para. 2 proceeding as follows:

— align control knob (S, pag. 9) to + sign (maximum sensitivity position);

— move draught control lever (F, page 11) forward on quadrant at start of travel;

— separate fork (4, page 9) from outer position control lever (8);

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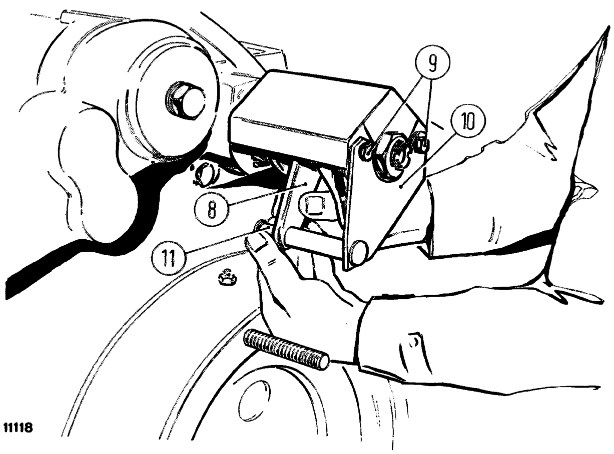
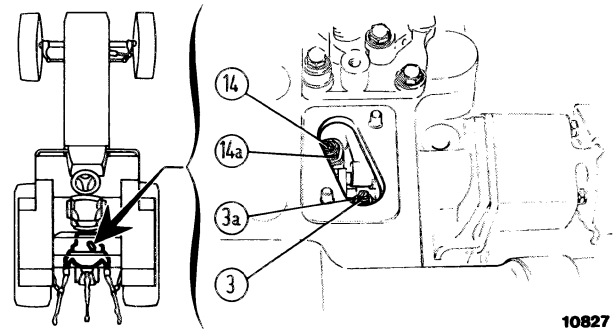


Installing start of raise adjusting device 293833 (10) in position control.

8. Outer position control lever - 9. Capscrews - 11. Pin.



Lift adjusting screws.

3. Start of raise adjusting screws - 3a. Locknut - 14. Maximum height adjusting screw - 14a. Locknut.

— slacken screws (9), install device **293833** (10) as shown. Connect outer position control lever (8) to the device through pin (11) on fork (4, page 9).

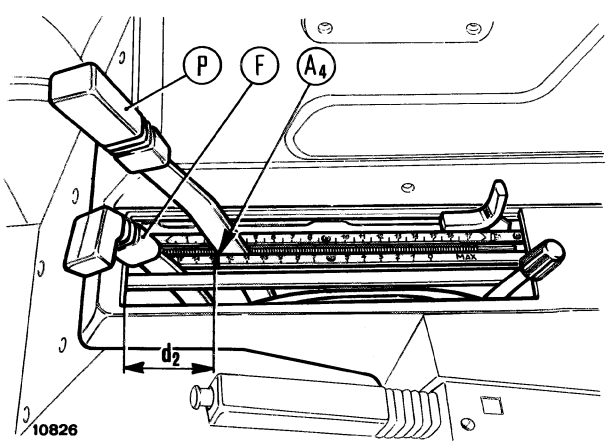
In these conditions, with lever (8) at an angle of 32° ± 30′ to the vertical, arms should start to raise.

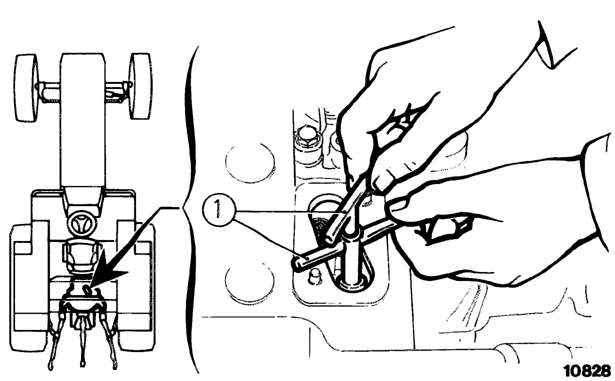
To achieve this, proceed as follows:

— remove upper lift body cover and if arms are raised with lever (8) so positioned, slacken inner nut (3a) with wrench **293716** (1) and back off screw (3) until arms lower;

— with arms fully lowered, screw in screw (3) until arms start to raise;

— tighten nut (3a) and remove device **293833** (10) taking care not to move outer position control lever (8);





Adjusting start of raise in position control.

A_4. See text - d_2. = 65 to 70 mm (2.56 to 2.75 in) distance from start of slot on quadrant to position control lever - F. Draught control lever - P. Position control lever - 1. Wrench **293716.**

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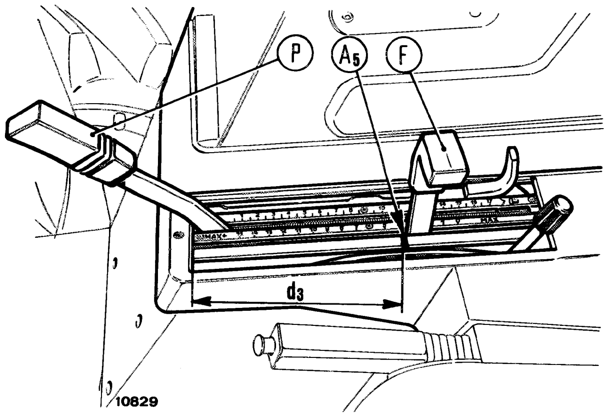


Adjusting start of raise in draught control.

A_5. See text - d_3. = 195 to 200 mm (7.68 to 7.87 in) distance from start of slot on quadrant to draught control lever - F. Draught control lever - P. Position control lever.

— apply a reference mark (A_4, page 11) on quadrant at 65 to 70 mm (2.56 to 2.75 in) from start of slot and align lever (P) to mark;

— connect tie rod, adjusting length through fork (4, page 9) and then tighten locknut (3);

— carry out several raise strokes checking that start of raise always occurs when position control lever (P) is aligned to reference mark (A_4) previously applied.

4. Start of raise adjustment in draught control

Test conditions:

— no additional weight on lower links;

— system oil temperature 50° to 60°C;

— engine at 1200 to 1500 rpm;

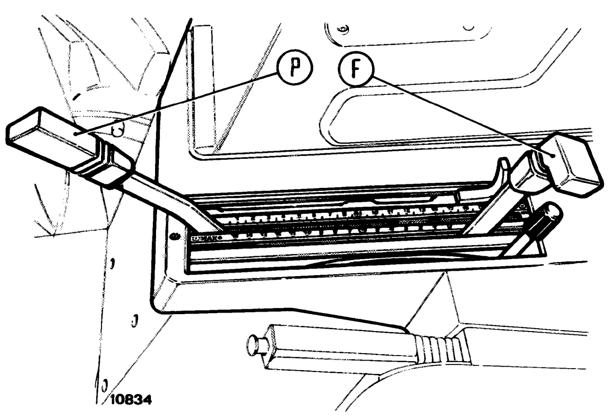
— sensitivity control knob (S, page 9) aligned with + sign (maximum sensitivity condition).

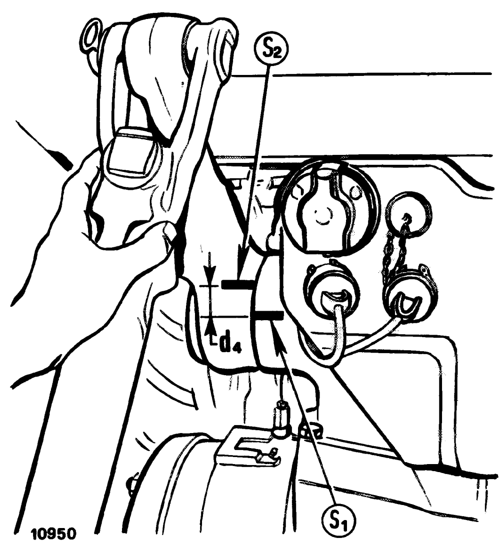
Subsequently, proceed as follows:

— carry out several raise strokes;

— move draught control lever (F) and position control lever (P) forward at start of stroke on quadrant;

— move draught control lever (F) gradually backward until arms raise;





Adjusting maximum lift arm travel.

d_4. = 2 to 2.5 mm (.078 to .098 in) distance from marks S_1 to S_2 (residual arm travel) - F. Draught control lever - P. Position control lever - S_1. Reference mark on lift body - S_2. Reference mark on lift arm.

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— apply a reference mark (A_5, page 12) on quadrant in alignment with lever;

— check that distance (d_3) from start of slot and reference mark (A_5) is 195 to 200 mm (7.68 to 7.87 in). If not, slacken locknut (5, page 9) and, if the distance (d_3) is greater, screw in fork (6, page 9); if smaller, back off fork.

5. Maximum lift arm travel adjustment

Carry out this adjustment under the same test conditions as described in para 4, proceeding as follows:

— align control knob (S, page 9) to + sign (maximum sensitivity condition);

— move draught control lever (F, page 12) and position control lever (P) forward at start of stroke on quadrant;

— fully raise lift arms by moving draught control lever (F) fully back on quadrant;

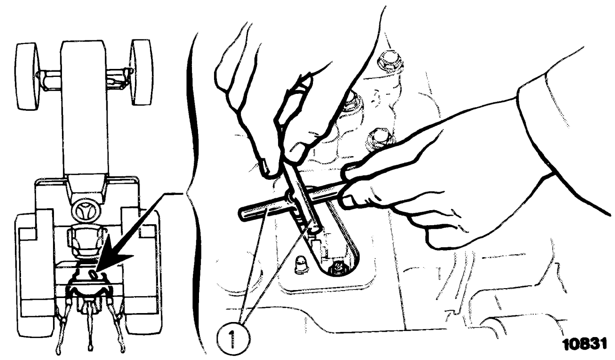
— apply two corresponding reference marks on the lift body (S_1) and lift arm (S_2);

— raise arms by hand up to mechanical stop and check that distance (d_4) between reference marks (S_1 and S_2) is 2 to 2.5 mm (.079 to .098 in); If not, remove lift body top cover, slacken inner nut (14a, page 11) with wrench **293716** (1) and screw in screw (14, page 11) to increase the distance or back off to reduce.

6. Control lever actuating force adjustment

Proceed as follows:

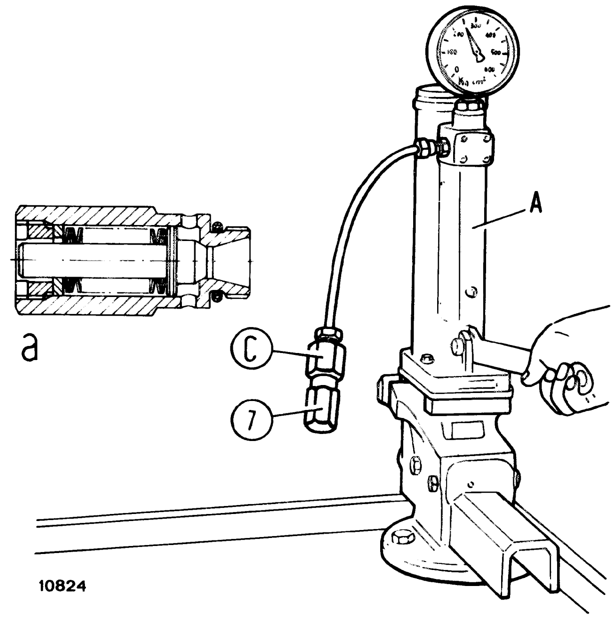
— apply a dynamometer to lower end of draught control lever (7, page 9) and check that the force needed to pull lever toward rear of tractor is 16 to 19 daN (16.3 to 19.4 kg - 35.9 to 42.8 lb);



Adjusting maximum lift arm travel.
1. Wrench **293716**.

— if not, slacken nut (2, page 5) and screw in screw (1) to increase force or back off reduce;

— tighten locknut (2), actuate lever repeatedly to settle the linkage and recheck force on dynamometer.



Apparatus for checking cylinder safety valve setting on bench.
a. Section through cylinder safety valve - A. Hand pump **290284** - C. Valve connection **290828** - 7. Cylinder safety valve.

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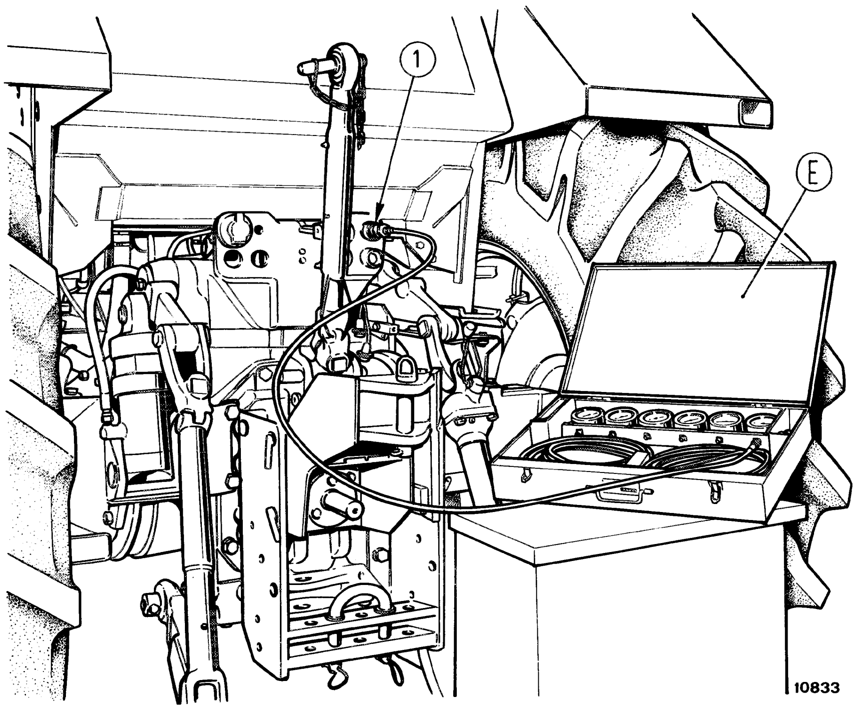

Checking relief valve setting on tractor.

E. Tool kit **293300** - 1. Connection **293449**.

VALVE CHECKS

Relief valve and cylinder safety valve setting

Relief valve (V, pages 1 and 3, section 504, incorporated in remote control valves) setting may be checked either on bench (see page 6, section 504) or on tractor. Cylinder safety valve setting (7, page 2) may be checked on bench only.
The on-bench cylinder safety valve test is carried out using hand pump **290284** (A, page 13) equipped with valve holder connection **290828** (C).
Valve should crack off at 225 to 235 bar (230 to 240 kg/cm^2 - 3,263 to 3,408 psi).

Note: If the setting is found to be incorrect it is preferable to renew the valve. However, if necessary, it may be adjusted through the threaded plugs after unlocking the peened areas.

When testing the relief valve on the tractor proceed as follows:

— run the engine to bring oil temperature to 50° to 60°C;

— install connection **293449** (1) in a quick-disconnect female half coupling and connect to pressure gauge, scale 0 to 250 kg/cm^2 (0 to 3556 psi) provided with tool kit **293300** (E);

— move lever cf control valve of the appropriate half coupling until relief valve cracks off;

— with engine running at 1100 rpm, 1180 model, 1000 rpm, 1380 model, and 950 rpm, 1580 and 1880 models, pressure gauge should indicate 170 to 175 bar (173 to 178 kg/cm^2 - 2465 to 2721 psi). To adjust, remove cover (20, page 3, section 504), slacken locknut (19) and turn adjusting screw (V_1) as necessary.

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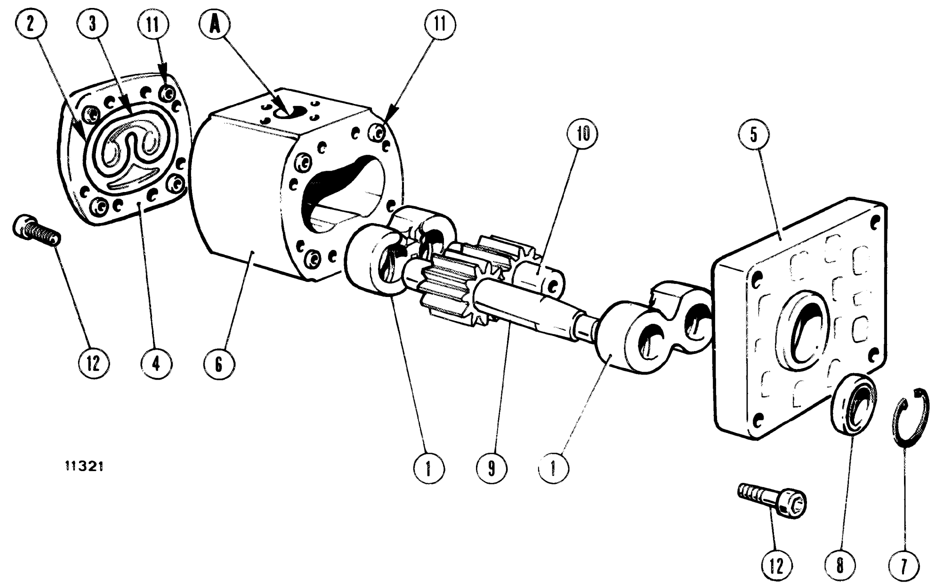


Hydraulic pump components.

A. Suction port - 1. Bearings - 2. Cover O-rings - 3. Cover O-rings and anti-extrusion rings - 4/5 Covers - 6. Pump body - 7. Retaining ring - 8. Seal - 9. Drive gear shaft - 10. Driven gear shaft - 11. Dowels - 12. Cover capscrews.

LIFT PUMP

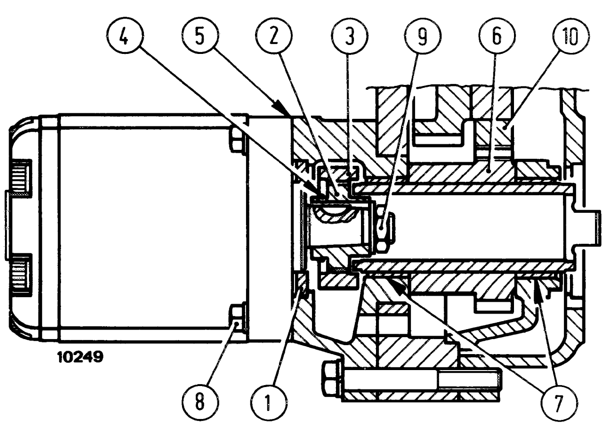
The lift pump is driven from the engine valve timing gear through a front dog-tooth clutch.

To gain access to the drive gear remove the engine valve timing cover.

Gear lubrication and end float take-up are secured through the action of the oil itself circulating within the pump.

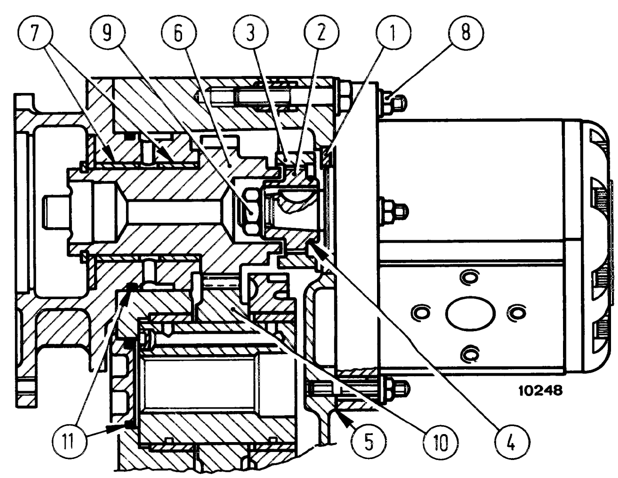
Overhaul

To disassemble the pump refer to the figure above.



Section through lift pump drive (1180 and 1380).

1. Centraliser - 2. Drive sleeve - 3. Drive ring - 4. Retaining ring - 5. Gasket - 6. Pump driven gear - 7. Bushings - 8. Pump capscrews - 9. Sleeve nut - 10. Lift and steering pump drive gear.



Section through lift pump drive (1580 and 1880).

1. Centraliser - 2. Drive sleeve - 3. Drive ring - 4. Retaining ring - 5. Gasket - 6. Pump driven gear - 7. Bushings - 8. Pump retaining nuts - 9. Sleeve nut - 10. Lift and steering pump drive gear - 11. O-ring.

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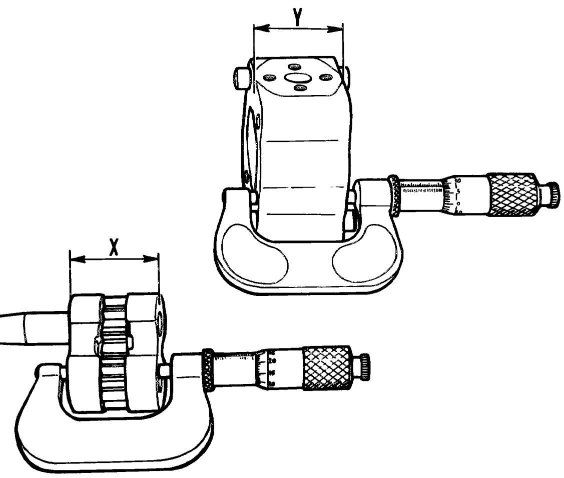
HYDRAULIC LIFT UNIT: Lift pump



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Checking gear end clearance in pump body.

Note: Dimension **X** to be smaller than dimension **Y** .069 to .101 mm (.003 to .004 in)

Mark the position of internal parts in order to restore them to their original position on assembly.

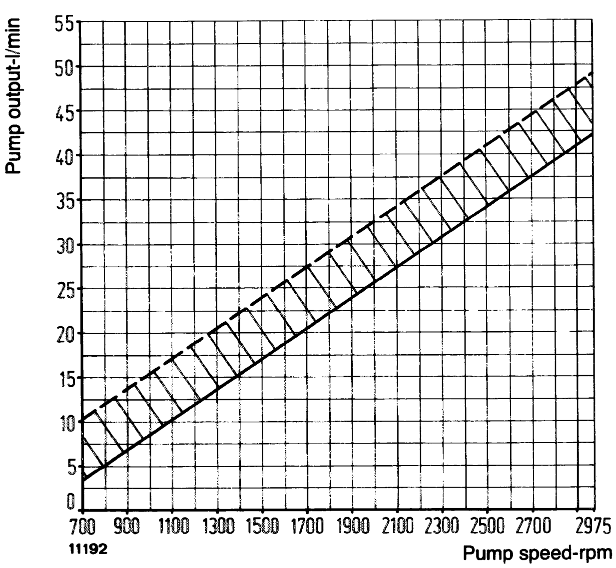
Check gear shaft and bearings for wear comparing the readings to the data given in the table on page 4, section 50.

Check gear side face flatness and squareness relative to the bearings, smearing the surfaces in question with carbon black. Small defects may be remedied using wet zero-grade emery cloth.

Check gear end clearance in the pump body with the bearings in position. The correct end float is .069 to .101 mm (.003 to .004 in). Any pump body face dressing with a view to restoring the specified end clearance should be carried out using wet 0-grade emery cloth, removing as little material as possible.

Liberally lubricate all pump parts using the same grade of hydraulic lift oil, then assemble referring to the illustration on page 1 and noting the following points:

- ensure that the reference marks applied on disassembly are in register;
- position plastic anti-extrusion ring inside the centre O-ring (3, page 1);
- gradually tighten the cover nuts and bolts to the pump body to the specified torque.



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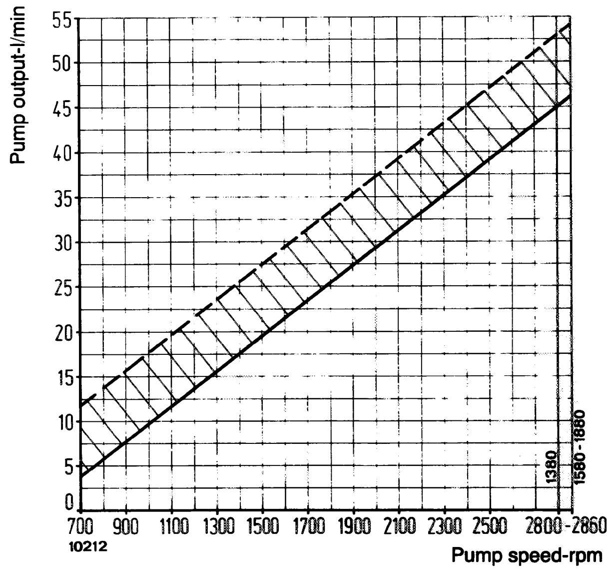
TF/A 217 S



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TF/A 220 S

Lift pump speed-output chart.

TF/A 217 S, pump installed on 1180 - TF/A 220 S, pump installed on 1380, 1580 and 1880.

Test pressure 153 bar (156 kg/cm^2 - 2219 psi) - Oil temperature 55° to 65°C

Pump drive ratio: $\left\{\begin{array}{l}\text{1.166 to 1, 1180 and 1380}\\ \text{1.300 to 1, 1580 and 1880}\end{array}\right.$

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When installing the pump, fill both suction pipe and pump body with **oliofiat TUTELA MULTI F** to facilitate priming and avoid seizure during initial running.

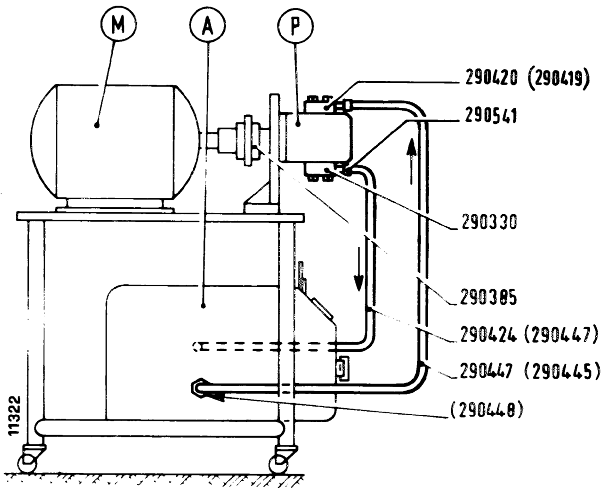
Output test

Couple the pump to the drive motor and connect to output test machine using the equipment shown.

Use **oliofiat IDRAULICAR AP51** (SAE 20) supplied with test machine, or other approved equivalent, and carry out the output test at the specified temperature and pressure settings.

Compare the output figures obtained with the values in the chart (page 2), noting the following:

- output ratings of new or reconditioned pumps should be fairly close to the dotted line;
- output ratings of used pumps are acceptable if included in the shaded area of the chart.



11322

Lift pump output tester set-up.

Note: Bracketed numbers refer to output tester **291231.**

A. Output tester **292574** small (or **291231**, large) - M. Motor **291235** or **292150** - P. Pump under test (TF/A 217 S, 1180, or TF/A 220 S, 1380, 1580 and 1880).

If the pump rating is very near to, or lower than, the continuous line, the pump in question should be overhauled or replaced.

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THREE POINT LINKAGE

The implement attachment is a three-point linkage with adjustable lift rods and top link, and check arms or blocks for lower link lateral control.

The telescoping lower links, pivotted to the sensing bar, are equipped with spacers to change pivot position and allow variations in draft sensitivity (see note on page 2).

Right-hand lifting rod

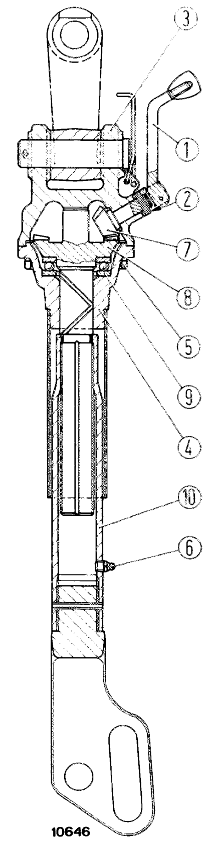
To remove the right-hand lifting rod proceed as follows:

— remove screws (5) followed by cover (4) with attached driven gear (8);

— back off lower end (10) and remove driven gear and thrust bearing (9);

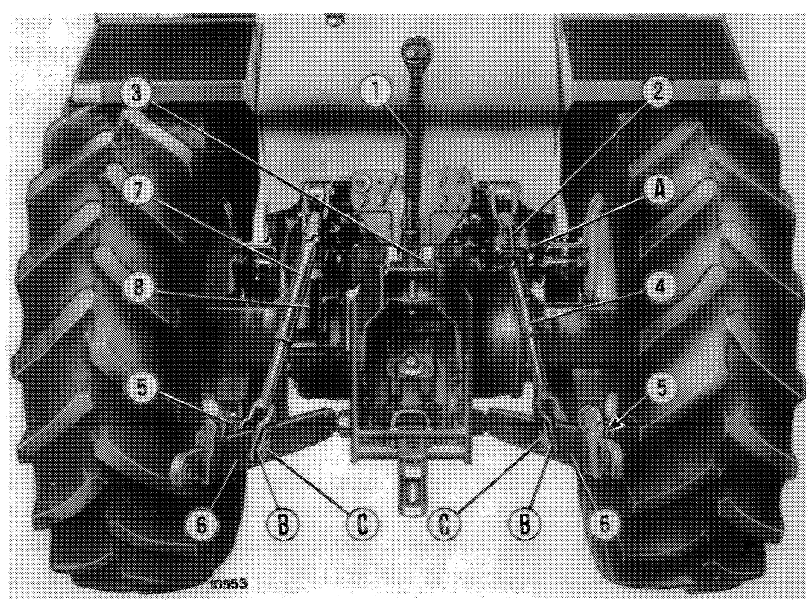
— take off pin (2) and remove handle (1) and drive gear.

On assembly, pack the top and bottom recesses with **grassofiat TUTELA G9** or other approved grease.



Section through R.H. lift rod.

1. Levelling box handle - 2. Roll pin - 3. Top end - 4. Cover - 5. Cover capscrews - 6. Lubricator - 7. Drive gear - 8. Driven gear - 9. Thrust bearing - 10. Lower end.



Lift and implement attachment.

A. Lift control lever from ground - B. Lift rod elongated holes - C. Lift rod mounting holes - 1. Adjustable top link - 2. Levelling box handle and spring - 3. Top link pivot - 4. Right hand lift rod - 5. Check arms - 6. Telescoping lower links - 7. Left hand lift rod - 8. Auxiliary lift cylinder (optional on 1180 and 1380, standard on 1580 and 1880).

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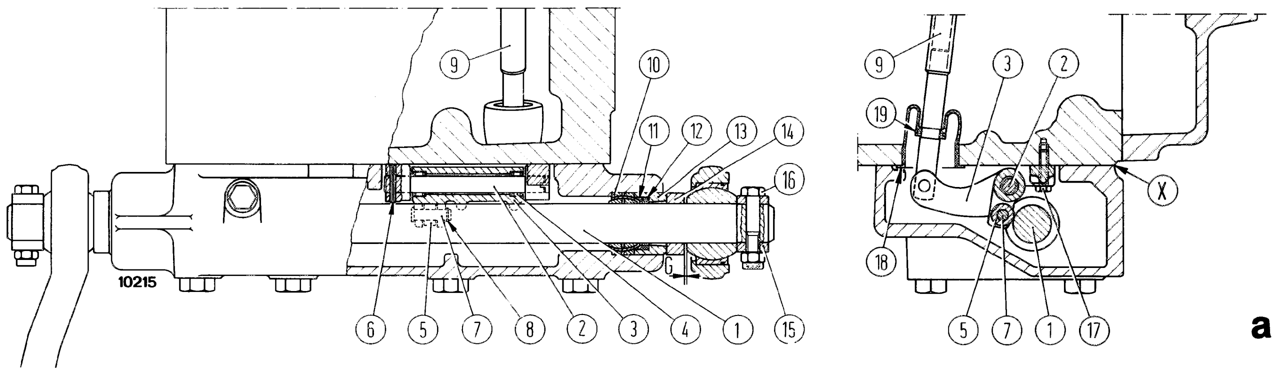

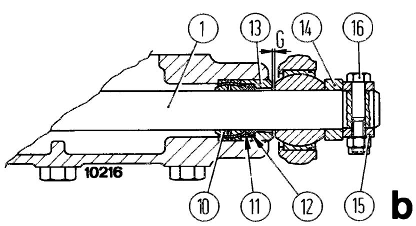

Section through draught control device.

a. Spacer (14) location for standard applications - b. Spacer (14) location for heavy-duty applications - G. 1.9 to 4.5 mm (.075 to 0.177 in) sensing bar end play - 1. Sensing bar - 2. Draught relay lever pivot - 3. Draught relay lever - 4. Needle roller bearing - 5. Draught relay lever roller - 6. Roll pin - 7. Pivot - 8. Retaining ring - 9. Draught relay link - 10. Sensing bar bushing - 11. Thrust ring - 12. Seal - 13. Inner spacer - 14. Outer spacer - 15. Thrust bushing - 16. Arm retaining screw - 17. Capscrews securing lever (3) to transmission housing - 18. Seal - 19. Spring.

Note: Clean and thoroughly degrease mating surfaces **X** on assembly and apply one of the jointing compounds listed on page 7, section A.

DRAUGHT CONTROL DEVICE

To remove the draught sensing bar, which constitutes the means for monitoring and controlling draught on three-point links, proceed as follows:

— remove the lift rods and lower links;

— remove the retaining screws and sensing bar support assembly taking care not to spill the oil within;

Note: To remove draught relay link (9) drain oil from rear transmission housing, back off four capscrews (17) securing relay lever (3) to the transmission housing and take off relay link from below, taking care not to damage seal (18) and retrieving spring (19).

— operating on a suitable work bench, take off sensing bar (1) and, using a slide hammer puller, withdraw bushings (10) and inner spacers (13)

— remove roll pin (6) and withdraw pivot (2) retrieving needle roller bearings (4).

On assembly, pack draught control support recess with lubricant of the type and in the amount indicated on page 24, section 00, and check that sensing bar end float G is 1.9 to 4.5 mm (.075 to .177 in).

Note: To obtain increased lift sensitivity when working with light implements in draught or combined draught and position control, assemble spacer (14) on inside of lower links as shown in fig. **a**.
For heavy duty applications with draught control lever in full lower position if working depth is insufficient assemble spacer (14) on outside of lower links as shown in fig. **b**.

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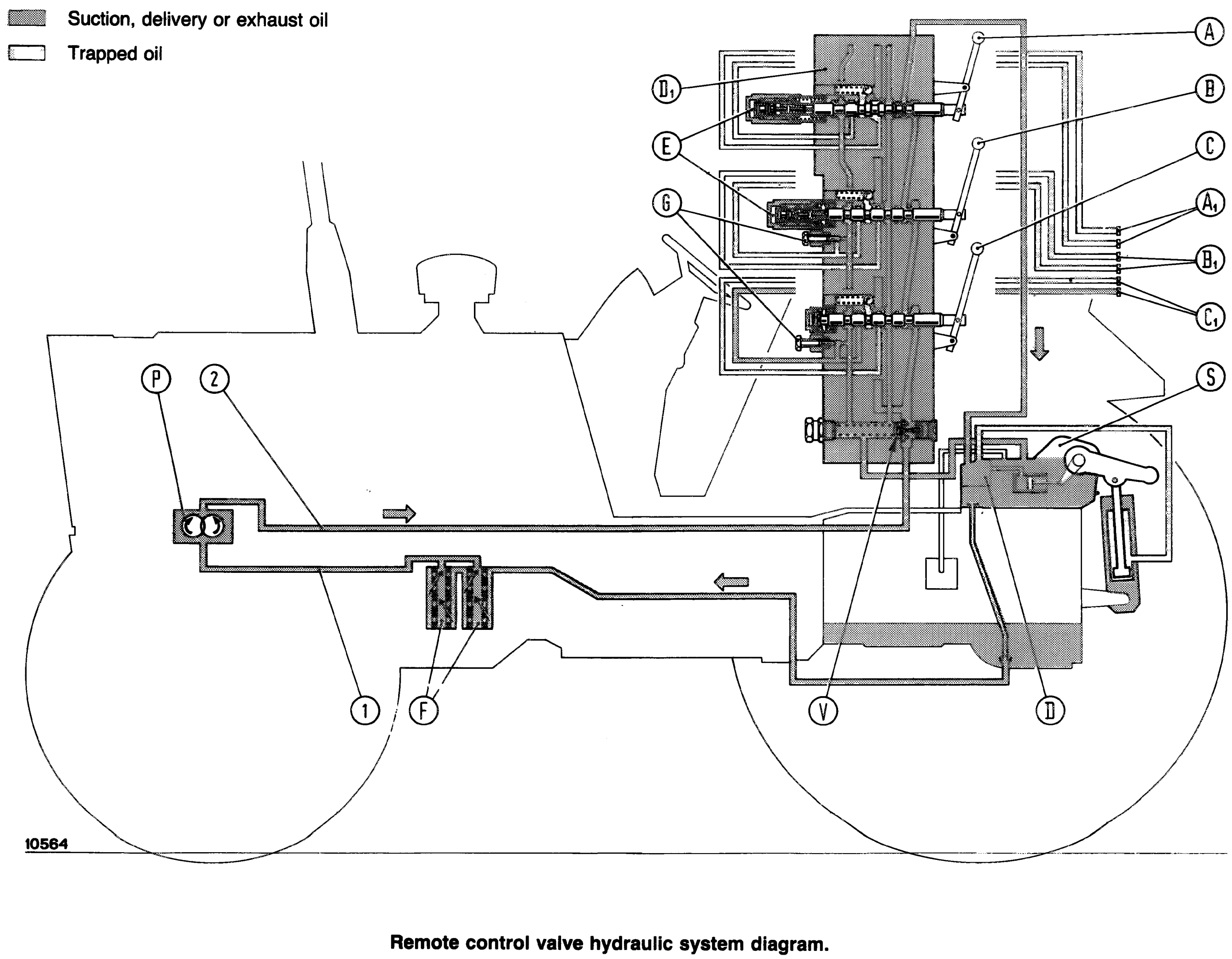
DESCRIPTION AND OPERATION

The spool-type remote control valves are suitable for single and double-acting cylinder applications. The tractor performs float function and an optional hydraulic trailer brake remote control valve is also available (see pages 9, 10 and 11).

Valves may be banked up to three together (one single-double acting convertible type provided as standard equipment) and secured to the right of tractor platform at bottom.

Operation is through lift pump and oil (rear transmission lubricating oil) though separately controlled by hand levers (A, B and C). Valves may be supplied in the following types: single and double acting convertible, single and double acting convertible with automatic release, double acting with float.



Remote control valve hydraulic system diagram.

A. Double-acting, float, automatic release valve lever - B. Single and double-acting convertible, automatic release valve lever (shown in double-acting application) - C. Single and double-acting convertible valve lever (shown in single acting application) - A_1, B_1, C_1. Single-acting cylinder, double-acting cylinder or float half couplings - D. Hydraulic lift control valve - E. Automatic release mechanism - F. Oil filters (two, in parallel) on pump suction side (common to lift) - G. Single-double acting conversion screw - P. Hydraulic pump - S. Lift body - V. Relief valve - 1. Suction pipe from rear transmission housing - 2. Delivery line to control valves.

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HYDRAULIC LIFT UNIT: Remote control valves

For double-acting cylinder control, screw G should be fully in; for single-acting cylinder control screw should be backed off by three turns.

Remote control valve hydraulic circuit has priority over lift circuit.

Simultaneous operation of a remote control valve and the lift is only possible with control valve in float position.

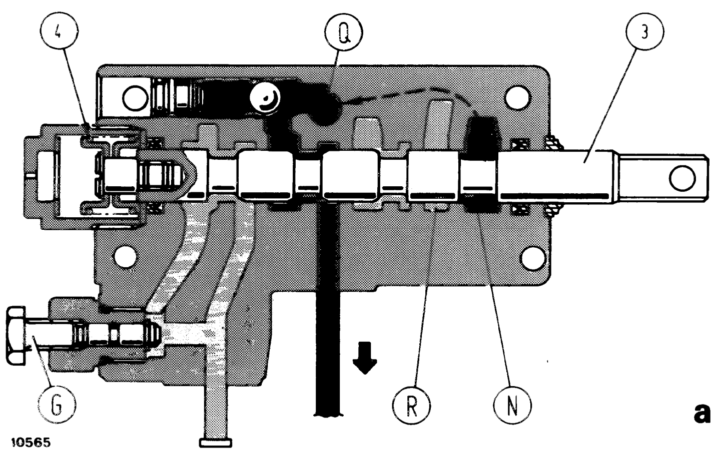
Relief valve (setting 170 bar - 173 kg/cm^3 - 2465 psi) is located in the remote control valve mounting plate; it also limits pressure in the lift hydraulic circuit.

The figure on page 1 shows oil circulation through the three remote control valves, with associated control levers in neutral position so that oil from pump is directed through the remote control valves as arrowed and flows to lift control valve.

High pressure oil

Suction, delivery or exhaust oil

Trapped oil



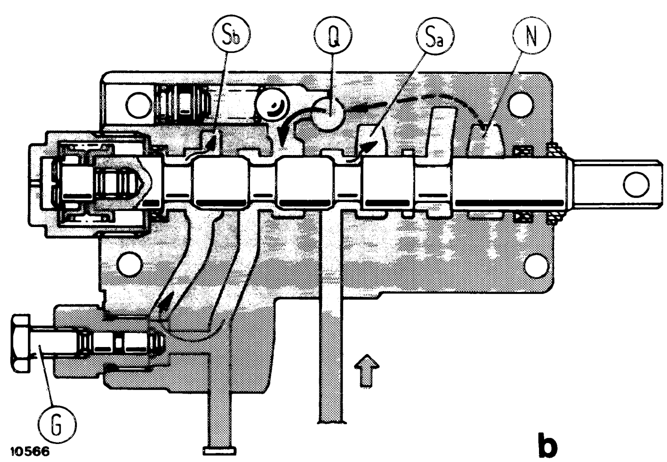
a

Single-acting cylinder and remote control valve operation schematics.

Note - For single-acting cylinder application screw (G) should be screwed fully in and then backed off through three turns.

a. RAISING - When lever (C, page 1) is pulled back, spool (3) establishes communication between ports (N) and (Q) through hole in the control valve mounting plate (see fig. h, page 3) and between delivery line and single-acting cylinder, 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. Upon release, the lever springs back to neutral and the entire pump output is directed to the lift control through port (R).



b

b. LOWERING - For implement lowering, push control lever (C, page 1) forward and hold until the operation is completed. In this case, oil in cylinder is placed in exhaust through port (Sa) and the entire pump output is directed to exhaust through aperture controlled by screw (G) and through port (Sb).

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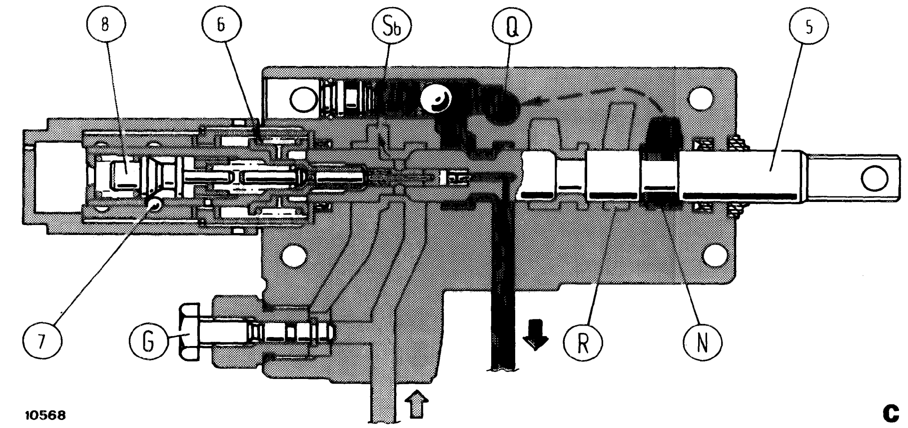
Automatic release, double-acting cylinder and control valve operation schematics.

Note - For double-acting cylinder application screw (G) should be fully in.

c. RAISING - When lever (B, page 1) is pulled back, spool (5) is held by ball (7) retained in place by pin (8) to establish communication between ports (N) and (Q) through hole in control valve mounting plate (fig. h), between exhaust port (Sb) and upper cylinder chamber and between delivery line and lower cylinder chamber preventing oil delivery to lift control valve.

To discontinue raising before the end of cylinder piston travel, manually release lever (B, page 1) which springs back to neutral recalled by spring (6), the entire pump output being directed to lift control valve through port (R).



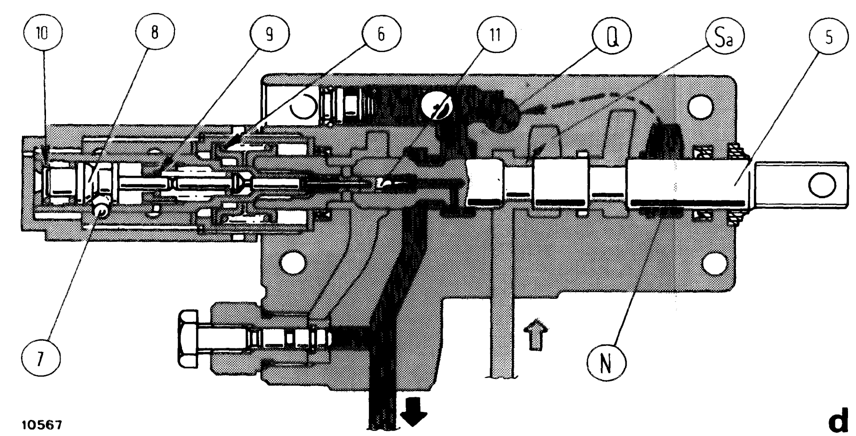
c

d. LOWERING AND AUTOMATIC RELEASE - For implement lowering, push control lever (B, page 1) forward.

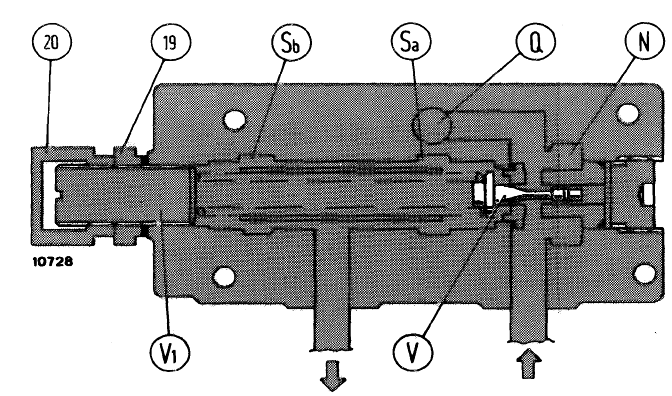
Spool (5) takes up position shown in fig. d where it is held by ball (7) retained in place by pin (8), and establishes communication between ports (N) and (Q) through hole in control valve mounting plate (fig. h), between drain port (Sa) and lower cylinder chamber and between delivery line and upper chamber.

At the end of piston travel, oil pressure in delivery line increases and acts against pin (11) which overcomes spring (9 and 10) resistance and moves to the left.

Ball (7), now freed from pin (8) pressure lifts off its seat and allows spring (6) to return valve spool (5) to neutral.



d



h

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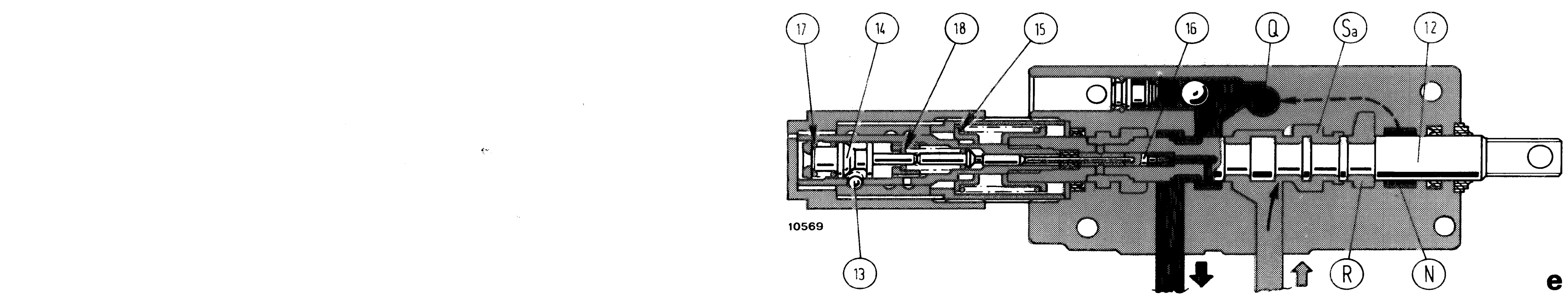
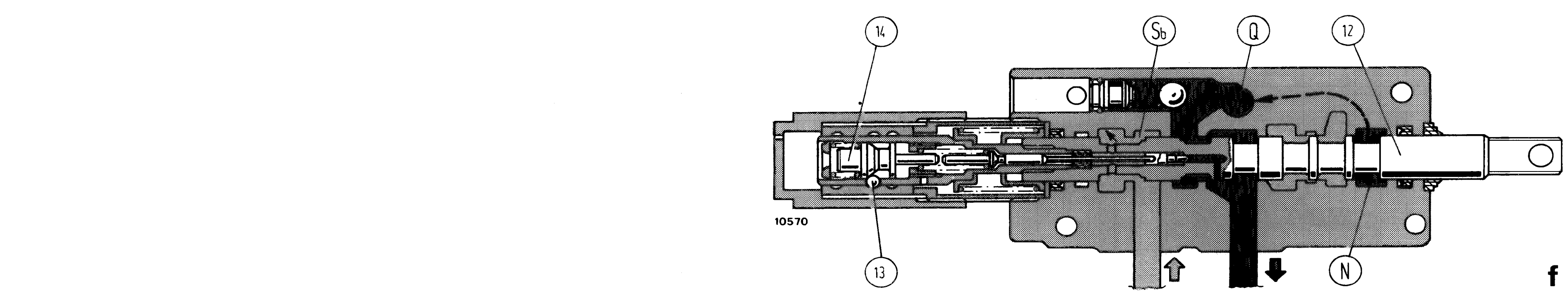
■ High pressure oil

▒ Suction, delivery or exhaust oil

□ Trapped oil



e



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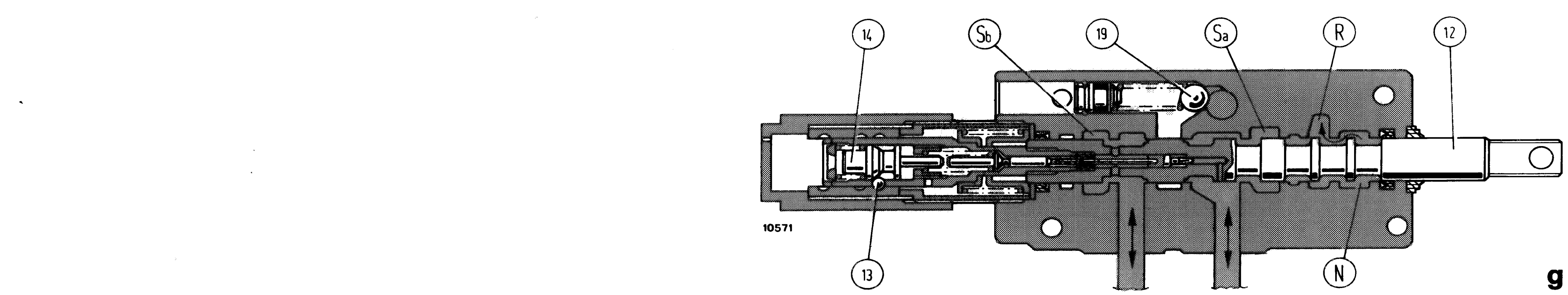


g

Double-acting cylinder, float, automatic release and remote control valve operation schematics.

e. RAISING - When lever (A, page 1) is pulled back, spool (12) is held by ball (13) retained in place by pin (14) and establishes communication between ports (N) and (Q) through hole in control valve mounting plate (fig. h, page 3), between exhaust port (Sa) and upper cylinder chamber and between delivery line and lower chamber, preventing oil delivery to lift control valve.

At the end of cylinder piston travel, oil pressure in delivery line increases and acts on pin (16) which overcomes spring (17 and 18) resistance and moves to the left. Ball (13), freed from pin (14) pressure, lifts off its seat and allows spring (15) to return valve spool (12) to neutral and thus to direct entire pump output to lift control valve through port (R).

To discontinue raising before end of travel, release lever (A, page 1) which springs back to neutral position recalled by spring (15).

f. LOWERING - For implement lowering, push control lever (A, page 1) forward. Spool (12) takes up position shown in fig. f where it is held by ball (13) retained in place by pin (14), and establishes communication between ports (N) and (Q) through hole in control valve mounting plate (fig. h, page 3), between drain port (Sb) and lower cylinder chamber, and between delivery line and upper chamber.

g. FLOAT - For implement float operation, push lever (A, page 1) fully forward.

Spool (12) takes up position shown in fig. g where it is held by ball (13) retained in place by pin (14), and establishes contact between ports (N) and (R), directing entire pump output to lift control valve, and between two drain ports (Sb and Sa) and lower and upper cylinder chambers respectively.

Thus, implement may follow the ground contour as lift arms are free. Lift may be operated in float control.

REMOTE CONTROL VALVES

Disassemble remote control valves referring to the sectional views below and noting the following points:

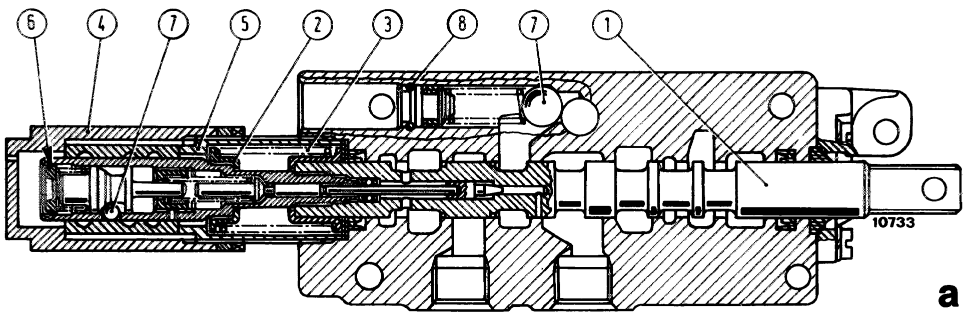
— remove the spool from each valve body after removing caps (4) and sleeves (5);

— complete spool disassembly by removing ring (6) and components of automatic release device, retrieving ball (10);

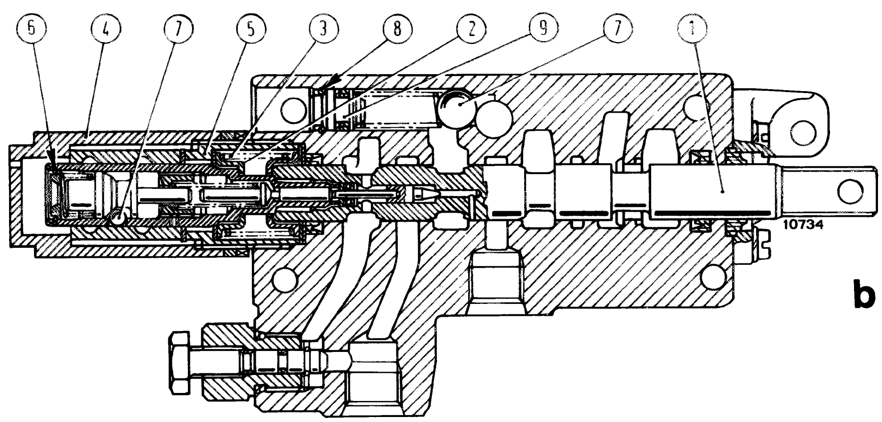
— remove retaining ring (8), plug (9) and check valve (7);

— remove threaded plug (see fig. h, page 3) and relief valve located on control valve mounting plate.

Assemble valves by reversing the disassembly sequence. Subsequently, carry out hydraulic tests as directed hereunder.



a



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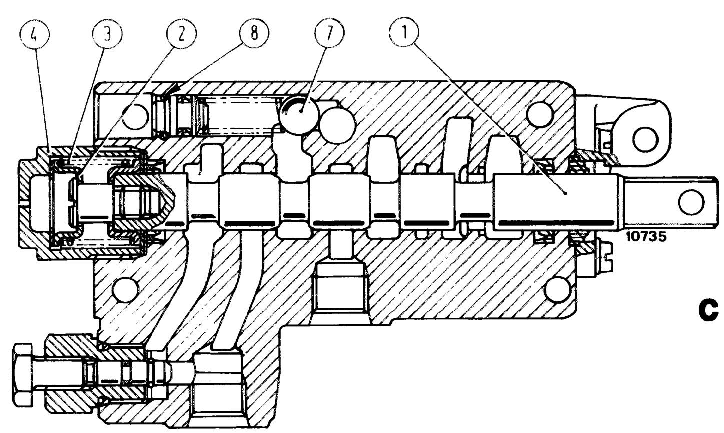

c

Section through remote control valves for double-acting cylinder (b, c) and float (a) control.

1. Spool - 2. Cup - 3. Spool spring - 4. Cap - 5. Threaded sleeve - 6. Retaining ring - 7. Check valve - 8. Retaining ring - 9. Plug - 10. Automatic release ball.

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On tractor relief valve adjustment (V, pages 1 and 3).

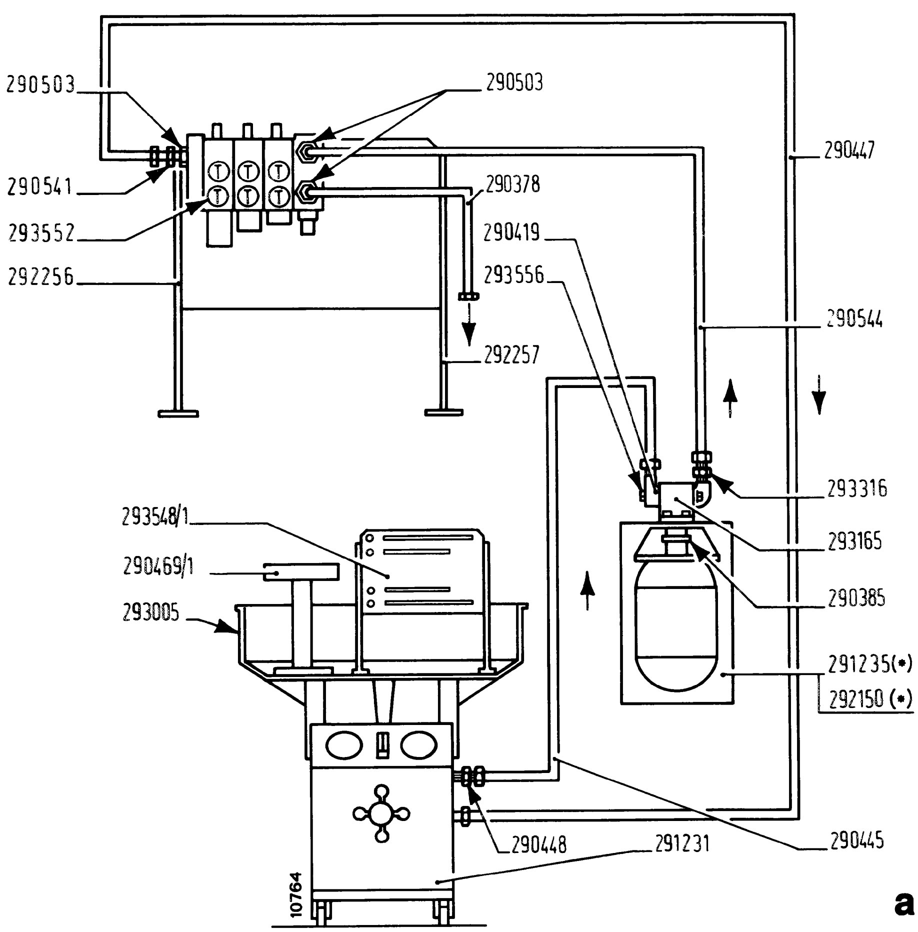
See page 14, section 501.

On-bench relief valve adjustment (V, pages 1 and 3).

Install remote control valve assembly under test and test equipment as directed in diagram (a) noting that oil return piping **290447** from control valve must be connected to the valve using connection **290503**.

Establish proper connection as indicated in the diagram, and test as follows: activate hydraulic pump, gradually increase pressure acting on control handle of tester **291231** and check on pressure gauge that relief pressure crack-off occurs at 170 bar (173 kg/cm^2) (2465 psi).
To increase or decrease the valve setting, screw in or back off adjuster screw (V_1, page 3) as necessary.

Note : If tester is filled with **oliofiat IDRAULICAR AP51** fluid (SAE 20W), the above test and those that follow must be carried out at 60°C approx. 12.5 l/min (22 Imp. pints/min) output, obtainable by running tester motor at higher speed (1445 rpm).



Relief valve tester installation diagram.

(*) 11 kW motor **292150**, shown as alternative to 8 kW motor **291235**.

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Spool return test (b)

Install remote control valve assembly under test and test equipment as indicated in diagram (b), noting the following points:

— oil delivery ports to cylinder must be connected to fitting with ball **293549** through associated lines **290424** and swivel adapters **293553**.

Establish proper connections as indicated in the diagram and test as follows:

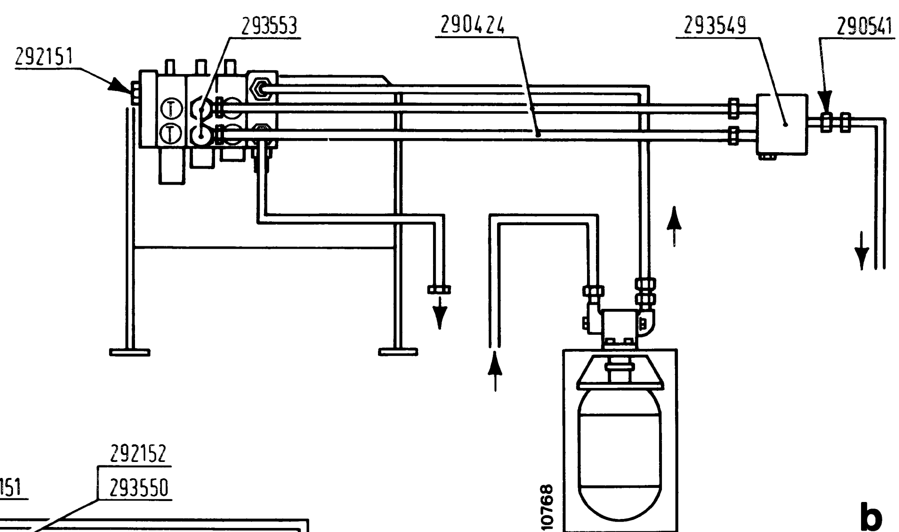
— activate hydraulic pump, actuate spool hand lever (in both directions) discontinuing oil flow from delivery connection to lift by means of plug **292151**;

— gradually increase pressure through the control handle of output tester **291231** and check on the test pressure gauge that the setting is 150 bar (153 kg/cm^2 - 2,175 psi);

— in these conditions the spool under test should slide freely and return to neutral without binding as soon as the control lever is released;

Note : For control valves with automatic release, actuate spool hand lever (in both directions) and lock in control position.
Gradually increase pressure as directed above and check that spool is released and returns to neutral without binding at below 170 bar (173 kg/cm^3 - 2465 psi).

— test the other spools after establishing the necessary connections.



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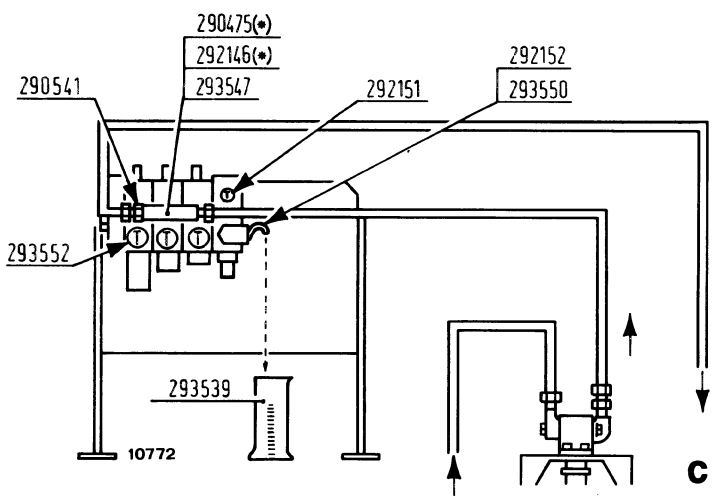

c

(*) **290475** = Early type three-way adapter - **292146** = Late type three-way adapter.

Test equipment installation diagram for:

— remote control valve (b) spool return;
— remote control valve (c) spool leakage.

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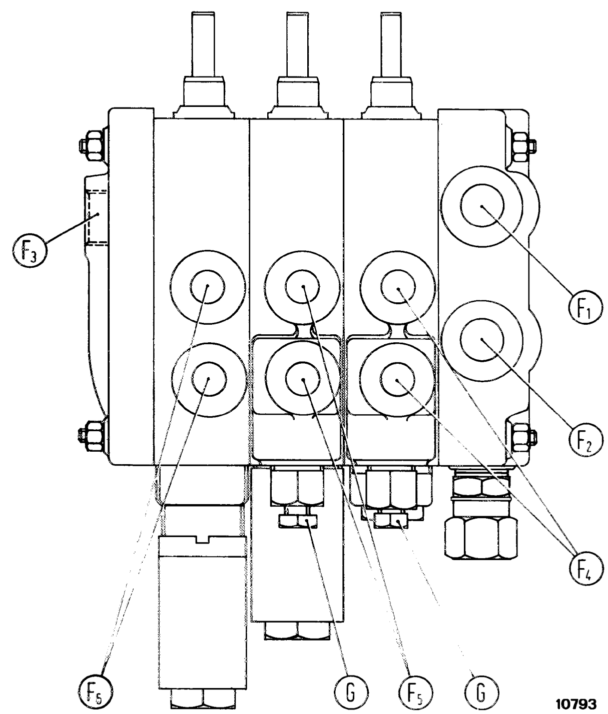
Remote control valve leakage test (c, page 7).

Install remote control valve assembly under test and test equipment as indicated in diagram (c, page 7), noting that three-way connection **290475** or **292146)** is to be fitted to the control valves using adapters **293547**.

After establishing proper connections as indicated in the diagram, test as follows:

— heat oil in output tester **291231** to 80°C, activate hydraulic pump, gradually increase pressure through output tester control handle and check that pressure reaches 150 bar (153 kg/cm^2 - 2175 psi) on pressure gauge;

— collect leakage oil flowing from connection **293550** in glass **293539** for exactly one minute and check the contents; leakage oil should not exceed 15 cc/min (.91 cu in/minute) on a new control valve, or 60 cc/minute (3.66 cu in/minute) on a used valve.



Remote control valve line connection diagram.

F_1. Connection for oil inlet line from pump - F_2. Connection for fitting for oil exhaust to lift - F_3. Connection for oil line to lift control valve - F_4. Connections for oil line to double-acting cylinder - F_5. Connections for oil line to double-acting cylinder (automatic release control valve) - F_6. Connections for oil line to double-acting cylinder (float) - G. Single and double-acting conversion screw.

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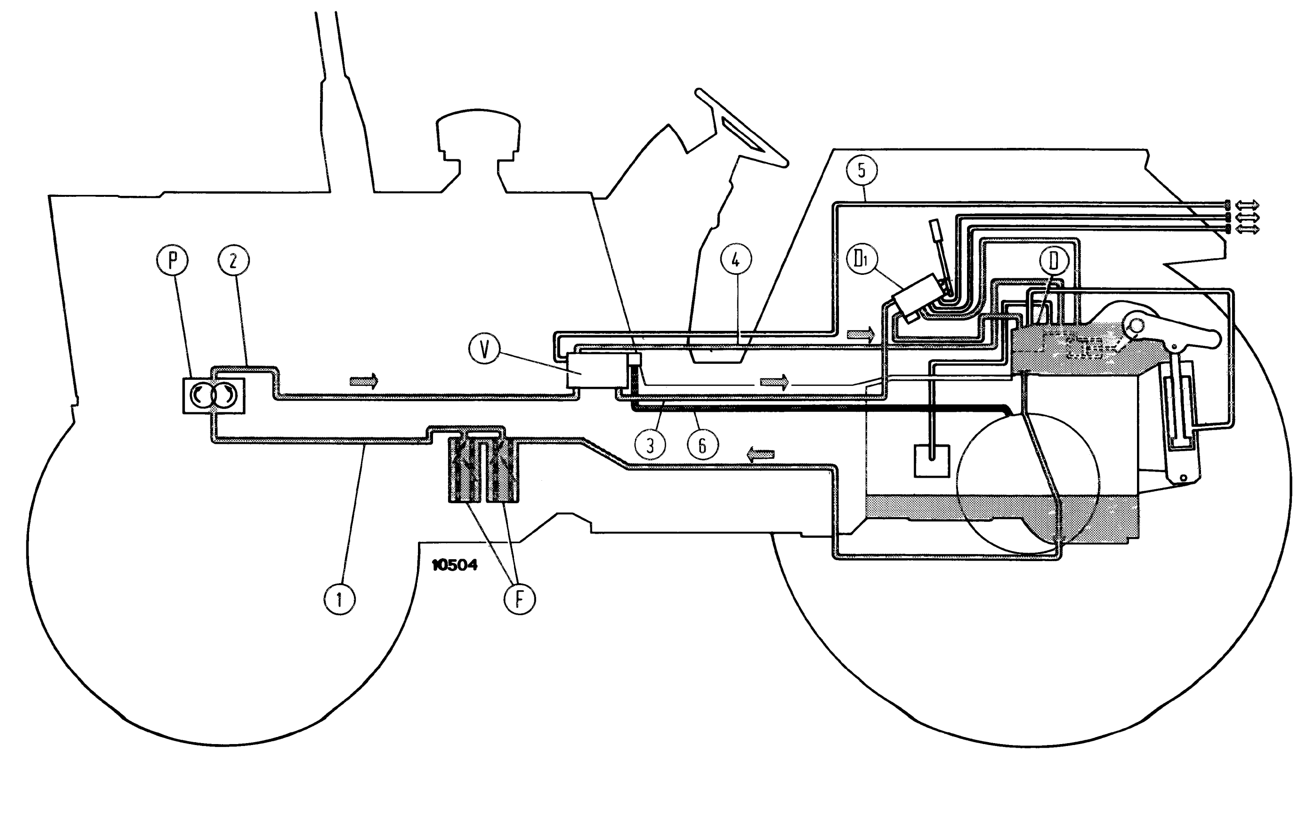
TRAILER BRAKE REMOTE CONTROL VALVE

The optional trailer brake remote control valve is attached to the rear transmission housing through a bracket. It is controlled by hydrostatic brake circuit oil pressure obtained by depressing appropriate brake pedals to bring about trailer braking through lift hydraulic circuit.

Suction, delivery and exhaust oil

Trapped oil

Brake circuit oil (tractor at rest)



Trailer brake remote control valve hydraulic system diagram.

D. Lift control valve - D_1. Remote control valve - F. Filters (2 in parallel) - P. Hydraulic pump (common to hydraulic lift) - V. Trailer brake remote control valve - 1. Suction pipe from rear transmission housing - 2. Delivery line to trailer brake control valve - 3. Delivery line to remote control valve - 4. Drain pipe to lift body - 5. Delivery line to trailer brake - 6. Line connecting trailer brake control valve with tractor brake circuit.

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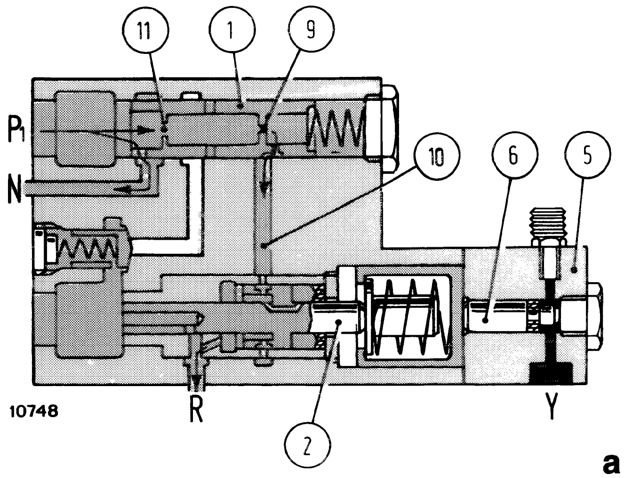


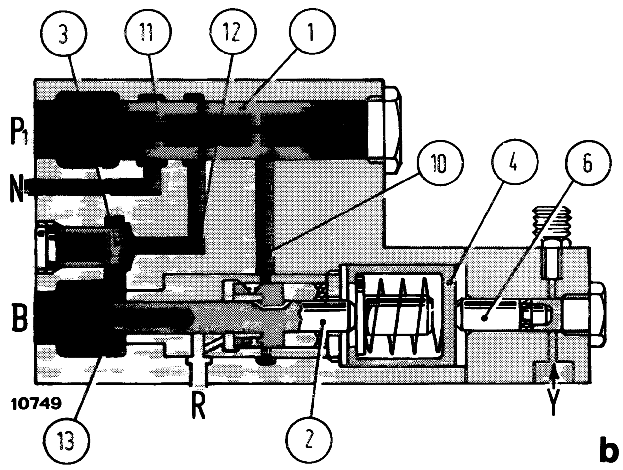
Trailer brakes released.

N. To remote control valves - P_1. From lift hydraulic pump - R. To hydraulic lift drain - Y. From tractor brakes.

a. TRAILER BRAKES RELEASED - When tractor brakes are at rest, hydrostatic circuit connected to control valve through union (Y) is not under pressure and pilot valve piston (6) and piston (2) take up the positions shown in fig. **a**.

Oil from hydraulic pump (P, page 9) directed to fitting (P_1) through diaphragm (11) and restriction (9) undergoes a pressure drop to move flow control valve (1) to the right.

Most of the oil flows through connection (N) to the remote control valves. The remaining output is drained into the hydraulic lift through line (10), piston (2) and connection (R).



Brake application.

B. To trailer brake - N. To remote control valves - P_1. From lift hydraulic pump - R. To hydraulic lift drain - Y. From tractor brakes.

b. BRAKE APPLICATION - On tractor brake pedal application, hydrostatic circuit oil in union (Y) undergoes an increase in pressure and causes leftward movement of piston (6), pressure limiter (4) and piston (2) which discontinues communication between oil drain fitting (R) and both trailer brake connection (B) and port (10).

Oil inside flow control valve (1) maintains a constant pressure and under spring bad moves to the left to take up position shown in fig. **b**.

Part of hydraulic pump output in connection (P_1) flows to the remote control valves through connection (N) while remaining output reaches trailer braking device through diaphragm (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 tractor brake circuit hydrostatic oil on piston (6).

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c. BRAKING - Continued brake pedal application causes an increase in oil pressure at trailer brake connection (B) which acting on effective area (13) of piston (2) moves the latter to the right overcoming the opposition of pressure limiter springs (8).

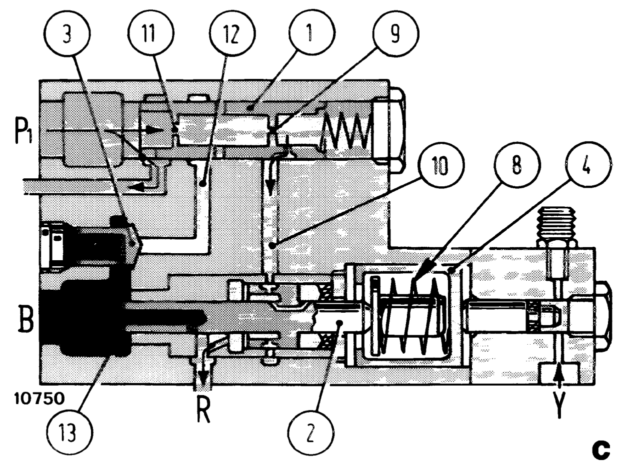
When trailer brake circuit oil pressure is equal to spring (8) pressure, piston (2) stabilises as shown in fig. **c** and establishes communication between oil from pump and lift drain through connection (P_1), diaphragm (11), restriction (9), port (10) and connection (R).

Diaphragm (11) and restriction (9) cause a pressure drop in flow control valve (1) which moves rightward to close port (12) and, consequently, check valve (3).

Further depression of tractor brake pedals causes a leftward movement of piston (6, page 10), pressure limiter (4) and piston (2) with a consequent increase in trailer brake circuit oil pressure as the sequence described in para **b**, "BRAKE APPLICATION" is repeated.

If, for external reasons, trailer brake circuit pressure increases, piston (2) rapidly establishes communication between trailer brake connection (B) and oil drain connection to lift (R) thus holding brake circuit oil pressure in correct balance with pressure limiter springs (8).

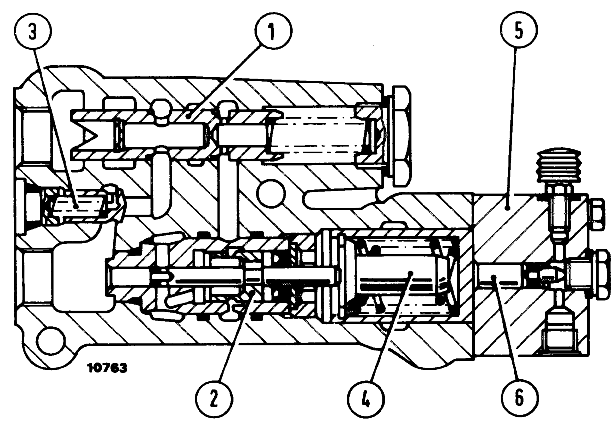
Upon releasing tractor brake pedals pressure at fitting (Y) subsides and the system returns to the conditions shown in fig. **a** page 10.



c

Brakes applied.

B. To trailer brake - P_1. From lift circuit hydraulic pump - R. To hydraulic lift drain - Y. From tractor brakes.



Section through trailer brake remote control valve.

1. Flow control valve - 2. Piston - 3. Check valve - 4. Pressure limiter - 5. Pilot valve body - 6. Pilot valve piston.

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CHARGING SYSTEM

Alternator	
Type	MARELLI Three-Phase Self-Rectifying AA 125-14V-55A
Rated voltage	14 Volts
Rotation (seen from Pulley Side)	Clockwise
Cut-in speed at 12 V and 25°C	≤1050 rpm
Output at 14 V and 7000 rpm across battery after warm-up (°)	≥55A
Rated output (°)	~60A
Rotor winding resistance	3.0 to 3.2 Ohm
On machine alternator speed (at engine governed speed): 1180	4845 rpm
1380	4560 rpm
1580	4840 rpm
1880	4840 rpm
drive ratio: 1180 and 1380	1 to 1.9
1580 and 1880	1 to 2.2
Voltage regulator	
Type	Integral Transistor RTT 114 A
Alternator test speed	6000 rpm
Voltage setting	13.65 to 1.4

(°) Applicable to fully bedded-in brushes.

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MARELLI STARTER

Type	MARELLI MT 68LB
Voltage rating	12 V
Rated output	3.5 kW
Rotation (seen from pinion end)	clockwise
Starter drive ratio: 1180 and 1380	9/127
Starter drive ratio: 1580 and 1880	9/130
N° of poles	4
Field winding	series
Control	lever and freewheel
Operation	through solenoid
Bench test data	
Running torque at 20°C:	
— Current	700 A max.
— Torque	19 Nm min: (1.9 kgm) (13.75 ft.lb.)
— Speed	1700 rpm
— Voltage	9.1 V
Lock torque at 20°C:	
— Current	1550 A max.
— Voltage	5.7 V
— Torque	52 Nm min. (5.3 kgm) (38.3 ft.lb.)
— Overall internal resistance	.0037 Ohm
Light running torque at 20°C:	
— Current	80 A max.
— Voltage	11.6 V min.
— Speed	7000 rpm min.
Mechanical data	
Brush spring pressure (new brushes) bar (kg/cm^2)	1.28 to 1.52 bar (18.56 to 22 p.s.i.)
MICA Undercut depth	1 mm max. (.040 in)
Clutch slip torque (pinion rotating torque)	.6 to .8 Nm (.06 to .08 kgm) (.4 to .6 ft.lb.)

(follows)

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MARELLI STARTER

(continued)

Commutator dia.	45.000 to 45.840 mm (1.7716 to 1.8047 in.)
— Maximum wear limit	43.840 mm (1.7259 in.)
— Maximum ovality	.1 mm (.0039 in.)
— Armature end float	.1 to .4 mm (.004 to .016 in.)
Solenoid	
Winding resistance at 20°C (hold-in winding	.23 ± .01 Ohm
Winding resistance at 20°C (pull-in winding	.78 ± .04 Ohm
Current consumption at 12 V	70 A max.
Activation Voltage	7 V max.
Moving contact travel	2.2 to 3.5 Nm (.086 to .137 in.)
Plunger stroke	14.3 mm (.562 in.)
End of stroke plunger load at 12 V	40 kg min (88 lb.)
Installation data	
Pole shoe I.D.	75.830 to 76.000 mm (2.9854 to 2.9921 in.)
Armature O.D.	74.900 to 74.950 mm (2.9488 to 2.9508 in.)
Drive end bushing I.D.	12.475 to 12.502 mm (.4911 to .4922 in.)
Pinion journal O.D.	12.425 to 12.440 mm (.4892 to .4900 in.)
Pinion clearance in bushing	.035 to .077 mm (.0014 to .0030 in.)
Intermediate bushing I.D.	20.200 to 20.264 mm (.7953 to .7978 in.)
Shaft journal dia.	19.967 to 20.000 mm (.7861 to .7874 in.)
Shaft clearance in bushing	.200 to .297 mm (.0080 to .0116 in.)
Commutator end bushing I.D.	14.000 to 14.027 mm (.5512 to .5522 in.)
Shaft journal dia.	13.984 to 13.957 mm (.5505 to .549 in.)
Shaft clearance in bushing	.016 to .070 mm (.0006 to .0027 in.)
Lubrication data	
Starter drive helical groove (during overhaul)	**grassofiat TUTELA MR 3**
Commutator end thrust washer	**grassofiat TUTELA MR 3**

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BOSCH STARTER

Type	JD→12 V A001.806.499
Voltage rating	12 V
Rated output	2.95 kW
Rotation (seen from pinion end)	clockwise
Starter drive ratio:	
— 1180 and 1380	9/127
— 1580 and 1880	9/130
N° of poles	4
Field winding	compound
Control	lever and freewheel
Operation	through solenoid
Bench test data	
Running torque at 20°C:	
— Current	1250 A max.
— Torque	4.6 kgm min (33.25 ft.lb.)
— Voltage	6V
Light running torque at 20°C:	
— Current	120 A max.
— Voltage	12 V
— Speed	7000 rpm min.
Mechanical data	
Brush spring pressure (new brushes)	3.2 kg (7 lb.)
Armature end play	.05 to .4 mm (.002 to .016 in)
Commutator dia.	44.84 to 45 mm (1.7653 to 1.7716 in.)
Maximum wear limit	42.5 mm (1.67 in.)
Maximum ovality	.03 mm (.0012 in.)
Maximum lamination ovality	.1 mm (.004 in)

(follows)

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BOSCH STARTER

(continued)

Solenoid	
Resistance at 20°C (hold-in winding)	1.05 Ohm
Resistance at 20°C (pull-in winding)	.25 Ohm
Current consumption at 12 V (hold-in winding)	12 A
Current consumption at 12 V (pull-in winding	48 A
Activation voltage	8 V max.
Plunger stroke	~12.5 mm (.49 in.)
Installation data	
Pole shoe I.D.	75.850 to 75.980 mm (2.9862 to 2.9913 in.)
Armature O.D.	74.926 to 75.000 mm (2.9498 to 2.9527 in.)
Armature bushing fitted I.D.:	
— Pinion	12.475 to 12.502 mm (.4911 to .4922 in.)
— Intermediate	19.020 to 19.053 mm (.7488 to .7501 in.)
— Commutator	14.000 to 14.018 mm (.5511 to .5518 in.)
Armature shaft journal:	
— Pinion	12.425 to 12.440 mm (.4891 to .4897 in.)
— Intermediate	18.887 to 18.910 mm (.7435 to .7444 in.)
— Commutator	13.932 to 13.950 mm (.5485 to .5492 in.)
Armature shaft clearance in bushing:	
— Pinion	.035 to .077 mm (.0014 to .0030 in.)
— Intermediate	.110 to .176 mm (.0043 to .0069 in.)
— Commutator	.050 to .086 mm (.0019 to .0034 in.)
Pinion bushing fitted I.D.	14.245 to 14.272 mm (.5608 to .5570 in.)
Armature shaft journal dia. over pinion bushing	14.123 to 14.150 mm (.5560 to .5570 in.)
Armature shaft clearance in pinion bushing	.095 to .149 mm (.0037 to .0058 in.)
Lubrication data	
Starter drive helical groove (during overhaul)	**grassofiat TUTELA MR 3**

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BATTERY

Type: 1180-1380	MARELLI 6 A TM 25-A SCAINI 64072
Type: 1580-1880	MARELLI 6 A TP 33
Rated voltage	12 V
Nominal capacity (at 20 hour rate):	
— MARELLI 6 A TM 25-A	132 AL
— MARELLI 6 A TP 33	176 AL
— SCAINI 64072	140 AL
Size (length × width × depth):	
— MARELLI 6 A TM 25-A, SCAINI 64072	508 × 174 × 205 mm (20 × 6 7/8 × 8 in.)
— MARELLI 6 A TP 33	510 × 250 × 225 mm (20 1/8 × 9 7/8 × 8 7/8)

FUSES

Six 8 A, two 16 A and two 25 A located in fuse box

Fuse	PROTECTED CIRCUITS	Amps
1	Thermostarter or start pilot-Hydraulic differential lock.	16
2	Main beam and warning light.	8
3	Dipped beam.	8
4	LH side light - RH rear light - Floodlight and integral switch - Gauge light.	8
5	RH side light - LH rear light - Parking light indicator - Cigar lighter light.	8
6	Tractor and trailer stop lights - Tractor and trailer direction light and indicators - Fuel gauge - Low oil pressure switch and warning light - Battery charge indicator - Cigar lighter.	8
7	Parking brake warning light and switch - Low brake oil level warning light - Horn.	8
8	Cab.	8
9	Cab.	25
10	Spare.	8
11	Hazard warning lights and flasher - single pole power point.	16
12	Spare.	25

Unprotected circuits: generating and starting system.

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LIGHTING SIGNALS - ACCESSORIES

Headlamps: asymmetric main and dipped beam, 40/45 W, double filament, white or yellow.

Two front lights:
- side, 5 W, white lens;
- direction 21 W, white or yellow.

Two tail lights:
- rear; 5 W, red lens (RH light also used as number plate lights);
- direction, 21 W, orange lens;
- stop, 21 W; red lens.

Reflex reflectors.

Floodlight, integral switch, 35 W; white.

Warning lights; 3 W:
- alternator (red);
- low oil pressure (red);
- air cleaner (red);
- parking brake (red);
- low brake oil level (red);
- side lights (green);
- main beam (blue);
- tractor direction indicator (green);
- first trailer direction indicator (green);
- second trailer direction indicator (green);

Thermostarter.

Cigar lighter.

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STARTER SWITCH

CO BO Type, 4-position, 50 A.	
Positions	Circuits completed
Position 0 30	Hazard warning lights - Single pole power point (*).
Position 1 30-15/54 57-58/57	Lighting switch - Fuel gauge - Water temp. gauge - Alternator W/L - Air cleaner W/L - Low oil pressure W/L - Direction lights and W/L - Oil pressure switch - Parking brake W/L - Cigar lighter - Low brake oil lever W/L.
Position 2 30-15/54-50 57-58/57	Lighting switch - Fuel gauge - Water temp. gauge - Alternator W/L - Air cleaner W/L - Low oil pressure W/L - Direction lights and W/L - Oil pressure switch - Parking brake W/L - Cigar lighter - Low brake oil level W/L - Starter.
Position 3 30-57	RH side and LH rear lights - LH side and RH rear lights - Side light W/L - Multiple gauge light - Floodlight.

(*) Key removable.

LIGHTING SWITCH (integral horn push)

CO BO Type, 4-position.	
Positions	Circuits completed (°)
Position 0 30 49-49a	Horn.
Position 1 30-57/58 49-49a	RH side and LH rear lights - LH side and RH rear lights - Side light W/L - Multiple gauge light - Horn - Floodlight.
Position 2 30-57/58-56b 49-49a	RH side and LH rear lights - LH side and RH rear lights - Side light W/L - Multiple gauge light - Horn - Floodlight - Dipped beam.
Position 3 30-57/58-56a 49-49a	RH side and LH rear lights - LH side and RH rear lights - Side light W/L - Multiple gauge light - Horn - Floodlight - Main beam.

TRACTOR AND TRAILER TURN SIGNAL SWITCH

CO BO Type, 3-position.	
Positions	Circuits completed (°)
Position 0 (centre) 54	Off.
Position 1 (right) 54 1	Right hand turn (tractor and trailers).
Position 2 (left) 54 2	Left hand turn (tractor and trailers).

(°) Lighting and direction switches inoperative with starter switch off.

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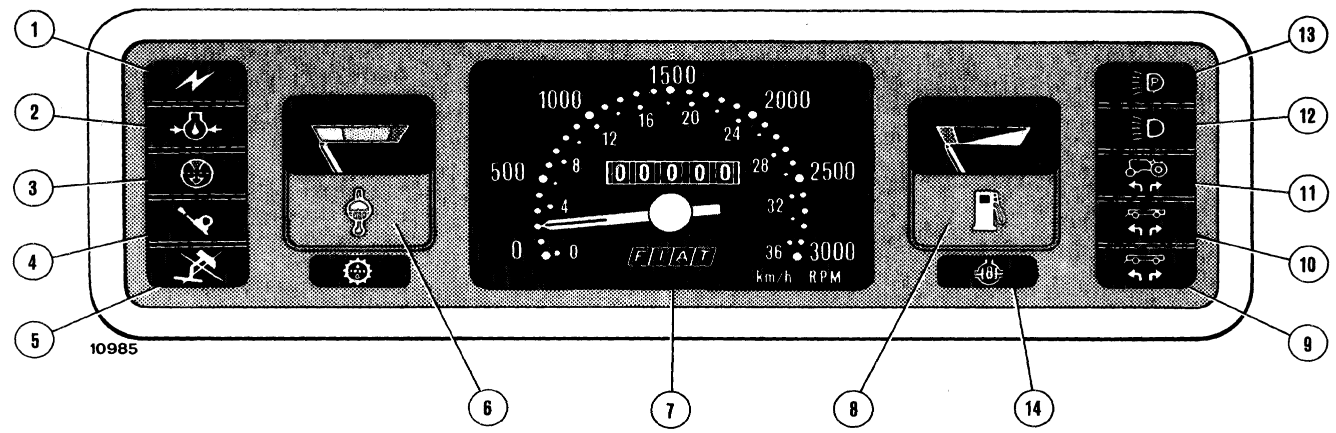
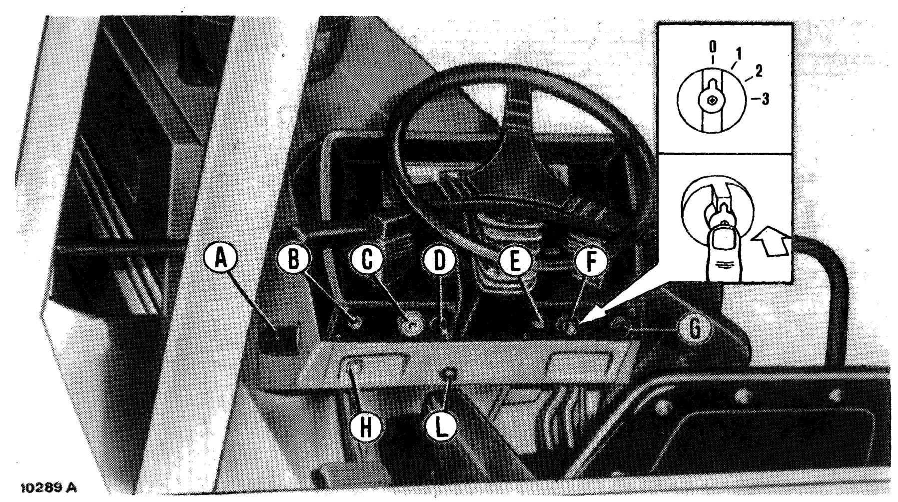
CONTROLS AND INSTRUMENTS



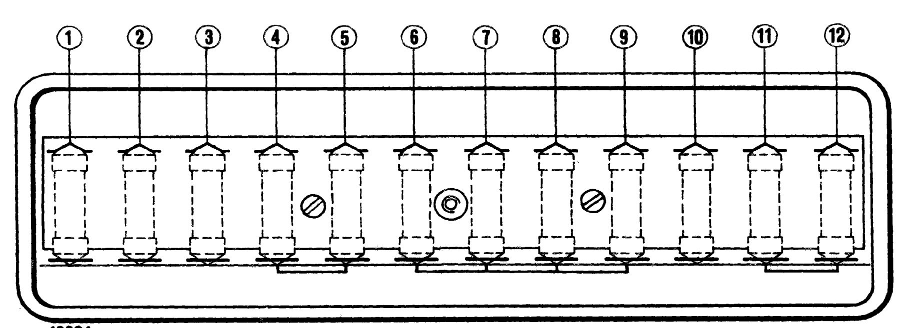
Instrument panel.

1. Alternator warning light (red) - 2. Low engine oil pressure warning light (red) - 3. Air cleaner warning light (red) - 4. Parking brake flashing warning light (red) - 5. Low brake oil pressure warning lights (red) - 6. Water temperature gauge - 7. Tractor meter - 8. Fuel gauge (main and reserve tanks) - 9. Second trailer direction warning light (green) - 10. First trailer direction warning light (green) - 11. Tractor direction warning light (green) - 12. Main beam warning light (blue) - 13. Side light warning light (green) - 14. Hydraulic differential lock warning light (green).



Control board.

A. Fuse unit - B. Single pole power point - C. Hazard warning light switch with integral indicator - D. Direction indicator switch - E. Fuel gauge control - F. Lighting switch and horn push - G. Starter switch - H. Cigar lighter - L. Thermostarter or start-pilot push.



Fuse unit.

(For reference see page 6).

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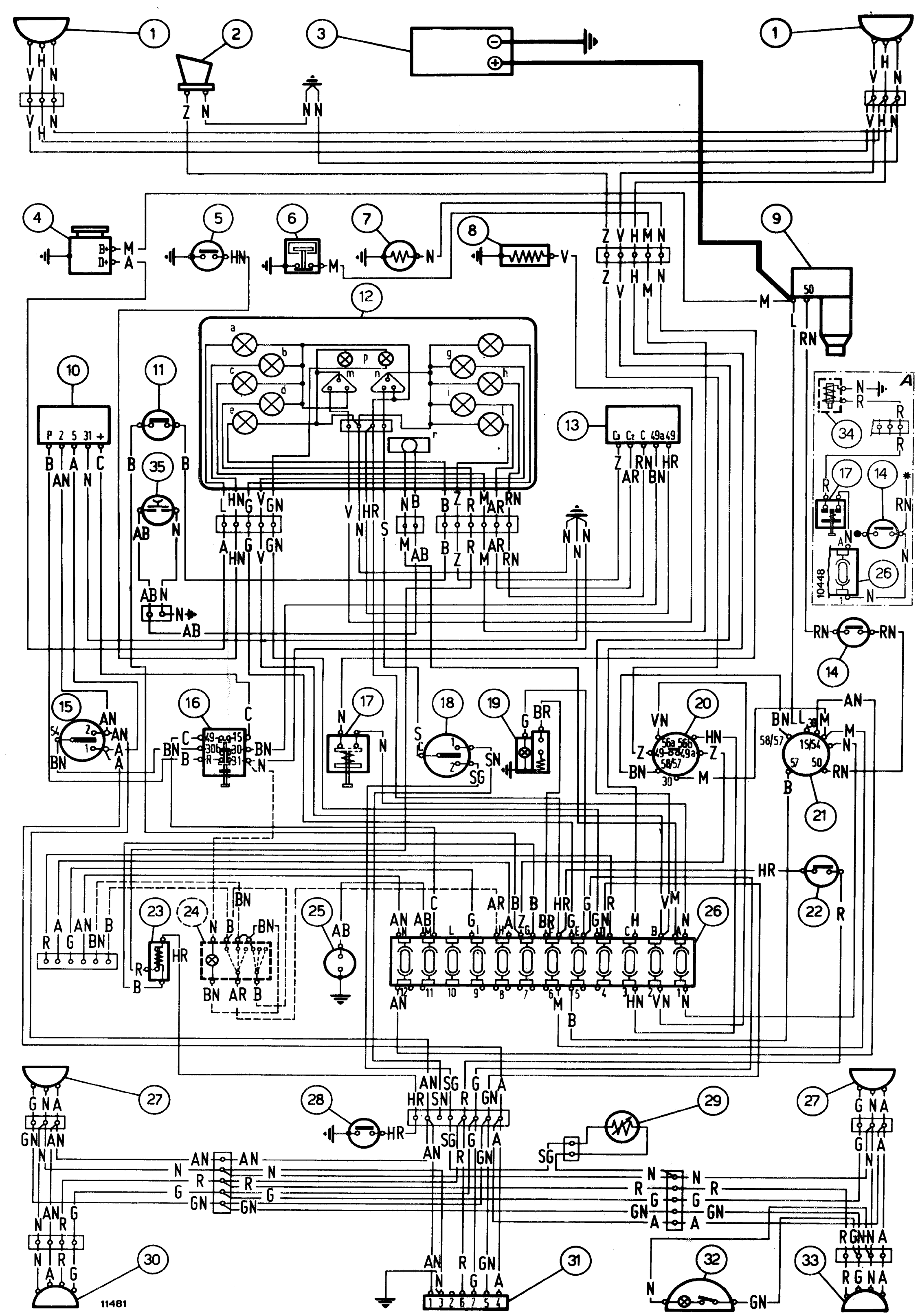

WIRING DIAGRAM

NOTE - *Detail **A** shows the start-pilot device which can be installed as an alternative to the thermostarter.*

- ● To starter connection 50.
- ✱ To starter switch connection 50.

1. Headlamps (dipped and main beam).
2. Horn.
3. Battery.
4. Alternator.
5. Low oil pressure warning switch.
6. Air cleaner warning switch.
7. Thermostarter.
8. Water temperature gauge sending unit.
9. Starter.
10. Hazard warning flasher.
11. Low brake oil level sending unit.
12. Multiple gauge (16 function):
- *a.* alternator warning light;
- *b.* low oil pressure warning light;
- *c.* air cleaner warning light;
- *d.* parking brake warning light;
- *e.* low brake oil level warning light;
- *f.* side light warning light;
- *g.* main beam warning light;
- *h.* tractor direction warning light;
- *i.* first trailer direction warning light;
- *l.* second trailer direction warning light;
- *m.* water temperature gauge;
- *n.* fuel gauge;
- *p.* gauge light;
- *q.* hydraulic differential lock warning light.

13. Tractor first trailer/second trailer direction flasher.
14. Start inhibitor switch.
15. Direction indicator switch.
16. Hazard warning switch and indicator.
17. Thermostarter or start-pilot control button.
18. Fuel gauge sending unit switch.
19. Cigar lighter.
20. Lighting switch and horn push.
21. Starter switch.
22. Stop light switch.
23. Parking brake warning flasher.
24. Cab auxiliary headlight switch (optional).
25. Single pole power point.
26. Fuse unit.
27. Side/direction lights.
28. Parking brake warning light sending unit.
29. Fuel gauge control.
30. Rear/direction/stop/number plate lights.
31. Seven pole power point.
32. Floodlight and switch.
33. Rear/direction/stop lights.
34. Start-pilot (optional; as an alternative to thermostarter).
35. Hydraulic differential lock pressure switch.

CABLE COLOUR CODE

A = Light blue	**B** = White	**C** = Orange
G = Yellow	**H** = Grey	**L** = Dark blue
M = Brown	**N** = Black	**R** = Red
S = Pink	**V** = Green	**Z** = Mauve

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10 - ENGINE

100 - Removal and installation - Performance data.

290740/1	Hook, lift.
293002/2	Bracket, universal (use with revolving stand **290090**).
291309	Tester, cylinder compression.
292631 **293499**	Dummy injector and bracket (1180 and 1380).
292635 **293499**	Dummy injector and bracket (1580 and 1880).

101 - Engine block - Cylinder head.

A394102 (291816)	Spindle, cylinder bore.
A394107 (291818)	Cutter.
A394133 (291820)	Bushing.
A394134 (291822)	Taper.
293349	Remover, cylinder liner (1180 and 1380).
291501	Inserter, cylinder liner (1180 and 1380).
A360712/3 (292162)	Spacers (4 off), cylinder liner (1580 and 1880).
290956	Spacers (3 off), cylinder liner (1580 and 1880).
A390363 (293269)	Reamer, camshaft bush (1180 and 1380).
A360383 (292103)	Remover/replacer, camshaft bush (1180 and 1380).
A390368 (292163)	Reamer, camshaft bush (1580 and 1880).
A360380 (292164)	Remover/replacer, camshaft bush (1580 and 1880).
290947	Remover/replacer, tappet (1580 and 1880).
A360409/1 (291046/1)	Remover, valve guide.
291177	Reamer, valve guide (1180 and 1380).
290944	Reamer, valve guide (1580 and 1880).
292913	Lathe, universal, valve seat.
291883 (A350108)	Wrench, rocker (all models).
290886	Wrench, rocker (1180 and 1380).
A342137 (293784)	Puller, injector sleeve.
293742/1	Kit, injector seat dressing.
293386/1	Roller burnisher, injector sleeve.
A360445 (293821)	Compressor, cylinder liner standout (1580 and 1880).
A360283 (291779)	Installer, exhaust valve guide (use with **291046/1**, 1580 and 1880).
A360409/3 (291780)	Installer, intake and exhaust valve guide (1180 and 1380) or intake valve guide (1580 and 1880) (use with **291046/1**).

103 - Crank gear.

291504	Puller, crankshaft pulley hub (1180 and 1380).

104 - Fuel system.

293814	Steady, GARRETT turbocharger wheel (1380).
293671	Kit, nozzle cleaner.
290898	Support, injector (WEBER-OMAP).
293760	Support, injector (BOSCH-CAV-OMAP).
293761	Wrenches, injector.
293786	Wrench, injection pump delivery connections.

ATTENTION

Some of the tools listed are common to the various injection pump types; when ordering, check common tools carefully to avoid ordering the same tool twice.

BOSCH distributor injection pump (1180)

A365055 (290847)	Wrench, pump drive coupling.
A342140 (292172)	Puller, splined hub.
290752	Plate, support, pump (use with support **290239**).
292133	Coupling, bench test.
292147	Adapter, pump test.
290765	Piping, delivery (test A, 6 × 2 × 850 mm).
293401	Kit, distributor injection pump tester.
290780	Kit, remover, O-ring.
290766	Remover/replacer, transfer pump rotor.
292197	Dial gauge (1/100 mm - 30 mm - dia. 60 mm).

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292554	Protector, cam ring.
292548	Installer, cam ring.
292555/1	Remover/replacer, pump shaft (use with **293378** and **293392**).
290774	Gauge, prestroke (use with **292197**).
290778	Spacer, distributor piston spring preload.
292551	Extension, M14.5 × 2 (use with **290774**).
292553	Remover, relief valve retaining ring.
292556	Wrench, shuttle and metering valve.
292557/1	Compressor, relief valve.
292558	Centralizer, hydraulic head.
293378	Remover/replacer, pump shaft (use with **292555/1** and **293392**).
293387	Spacer, automatic advance (use with **292817/1**).
293392	Remover/replacer, pump shaft (use with **292555/1** and **293378**).
292139	Installer, O-ring.
292817/1	Tester, advance device and supply pressure.

C.A.V. distributor injection pump (1180)

290752	Plate, support, pump (use with support **290239**).
290756	Test drive coupling.
292131	Test splined drive coupling.
A365147 (292137)	Wrench, back-up, pump drive coupling.
A342138 (292173)	Puller, splined hub.
292147	Adapter, pump test.
290765	Piping, delivery (test A, 6 × 2 × 850 mm).
293401	Kit, diagnostic, distributor pump.
290741	Guide, throttle lever shaft.
290742	Guide, shutoff and throttle lever shaft O-ring.
A365077 (290743/1)	Tester, advance.
290744	Remover/replacer, transfer pump rotor (use with torque wrench).
290745	Installer, O-ring, start retard.
290746	Installer, O-ring, advance device plug.
290747	Wrench, back-up, distributing rotor flange.
290748	Plug, pump leakage test.
290749	Fitting, transfer pump delivery pressure.
290750	Fitting, fuel leak back.
290751	Fitting, fuel supply line.
290753	Fitting, pump air pressure test.
290754	Wrench, delivery adjusting screw.
290755	Fitting with relief valve, roller stroke.
290757	Phaser, graduated.
290758	Remover/replacer, cam ring pin.
290759	Installer, governor control shaft.
290764	Fitting, exhaust, bench test.
290760	Fitting, advance device.

FIAT in-line injection pump (1380 and 1580)

290312/1	Plate, pump support (use with **290239**).
A365033 (290979)	Wrench, back-up, pump drive coupling (1380).
A342139 (292175)	Puller, splined hub (1380).
A365147 (292137)	Wrench, back-up, pump drive coupling (1580).
A342138 (292173)	Puller, pump splined hub (1580).
292131	Coupling, splined, bench test (dia. 39 mm, 1580).
292133	Coupling, bench test (dia. 17 mm).
292132	Coupling, splined, bench test (dia. 33 mm, 1380).
292148	Adapter, pump test.
293661	Piping, delivery (test A, 6 × 2 × 600 mm).
291195	Kit, fittings with pressure gauge, injector and pump element.
292197	Dial gauge (1/100 mm - stroke 30 mm - dia. 60 mm).
A365022 (290903)	Installer, pump tappet.
A365019 (290901)	Fork, tappet (6 off).
292424/1	Screwdriver (pump body plug).
291190/1	Puller, pump valve.
365020 (290895)	Installer, pump plunger.
A390339 (290902)	Reamer, control rod bush.
A394029 (290900)	Cutter, pump barrel seat.
292139	Installer, O-ring.
A365023 (290904/1)	Adjuster, delivery adjustment bush.

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293217	Cover, plug, bench test.
293673	Kit, tappet lift check (use with **292197**).
A352106 (290896)	Wrench, tappet.
290984	Adjuster, control rod (use with **290985**).
290985	Extension, control rod (use with **290984**).
291188	Gauge, control rod.
291468	Wrench, double, control rod stroke.
290981/2	Wrench, governor weight nut.
290977	Puller, governor weight hub.
A352107 (292730)	Wrench, governor weight lock ring.
293809	Tester, aneroid (1380)

BOSCH in-line injection pump (1880)

290312/1	Plate, pump support (use with **290239**).
A365147 (292137)	Wrench, back-up, pump drive coupling (dia. 39 mm).
A342138 (292173)	Puller, pump splined hub.
290756	Coupling, bench test (dia. 20 mm).
292131	Coupling, splined, bench test (dia. 39 mm).
292148	Adapter, pump test.
293661	Piping, delivery (test A, 6 × 2 × 600 mm).
292198	Dial gauge, without return spring (1/100 mm - stroke 30 mm).
292197	Dial gauge, (1/100 mm - stroke 30 mm - dia. 60 mm).
292424/1	Screwdriver, pump body plug.
292180	Puller, side cover.
292181	Retainer, tappet (3 off).
292182	Plate, pump element.
292183	Installer, O-ring.
292184	Guide, drive shaft.
292185	Installer, pump shaft and bearing.
292188	Separator, inlet chamber leakage test (3 off).
292189	Installer, pump shaft roller bearing.
292191	Shims, test (2 off).
292192	Installer, tappet.
292193	Installer, side covers.
293217	Cover, plug, pump tester.
292194	Gauge, pump tappet lift (use with **292197**).
292196	Gauge, control rod stroke (use with **292198**).
292141	Adjuster, angle, throttle lever.
290981/2	Wrench, nut, governor weight.
290977	Puller, governor weight hub.
A352107 (292730)	Wrench, lock ring, governor weight.
292143	Gauge, governor control sleeve position.
293809	Tester, aneroid.
292315	Installer, pump element spacer ring.

106 - Cooling system.

291182/1	Puller, water pump impeller (1180 and 1380).
A40026 (292155)	Puller, water pump impeller (1580 and 1880).

20 - DRIVE TRAIN

201 - Clutch

291291/2	Kit, clutch overhaul (early).
293650	Kit, universal, clutch overhaul (late).
293801	Centralizer/adjuster, clutch on tractor.
293763	Wrench, release lever adjusting screw, P.T.O. clutch (1180).
293802	Adjuster, LUK 12″/12″ clutch on tractor (1180 - use with **293801**).
291814	Adjuster, FERODO 12″/12″ clutch, on tractor (1180 - use with **298301**).
292176	Tester, clutch release levers (1180 - use with **293650**).

202 - Transmission and splitter.

291517	Hook, transmission.
293803	Adjuster, drive/driven shaft taper roller bearing.
293510	Adjuster, universal, drive/driven taper roller bearing.
290832	Remover, driven shaft.
293805	Remover, drive shaft.
293806/1	Wrench, drive shaft nut.
293343/1	Wrench, driven shaft nut (early).
293806/1	Wrench, driven shaft nut (late).
293807	Wrench, back-up, drive shaft.
293808	Wrench, back-up, driven shaft.
292888	Guides, engine.

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293512 Wrench, torque, drive/driven shaft taper roller bearing.

204 - Bevel drive and differential.

291517 Hook, rear transmission.

293400/1 Gauge, bevel pinion position.

293510 Adjuster, universal, bevel pinion shaft bearing.

293803 Adjuster, special-purpose, bevel pinion shaft bearing.

293800 Handle (use with **293810** or **293810/1**).

293810 Installer/positioner, bevel pinion shaft seal (pinion removed - use with **293800**).

293810/1 Installer/positioner, bevel pinion shaft seal (pinion removed or in position - use with **293800**).

293806/1 Wrench, bevel pinion shaft nut tightering and rotating torque check.

293817 Remover, bevel pinion rear bearing inner race.

291477 Installer, differential lock actuating fork spring.

291525 Pins, differential support assembly.

293300 Kit, universal, pressure gauge (use with fitting **291328** for differential hydraulic lock relief valve test).

293512 Wrench, torque, pinion/ring gear taper roller bearing rotating torque.

291728 Installer, differential/hydraulic lock retaining ring.

205 - Brakes.

Hydraulic pump bench test.

291235 Motor, pump, including:

290385 - drive coupling.

291231 Tester, output, large, including:

290448 - adapter;

290445 - pipe;

290417 - connection;

290434 - inlet connection screw (2 off);

292588 - hydraulic pump, Plessey A18 X;

290330 - connection;

290358 - delivery connection screw (2 off);

290544 - delivery pipe (2 off);

293532 - connection (2 off);

293531 - plate, flow control valve;

293533 - flow control valve, ATOS-QV 10/3;

290424 - delivery pipe;

293534 - 3-way connection;

293535 - leak connection;

290488/2 - support;

293005 - tank;

291318 - connection for kit **293300**;

293300 - kit, universal, pressure gauge;

293539 - graduated glass;

293560 - support, master cylinder;

206 - Final drives

293811 Hook, final drive.

293781 Support, final drive.

292179 Installer, rear wheel (with ballast plates).

207 - Power take-off

293818 Tester, P.T.O. hydraulic clutch relief valve.

293300 Kit, universal, pressure gauge.

293812 Pins, P.T.O.

30 - FRONT AXLE - STEERING

301 - Axle.

292927 Puller, slide hammer, plus adapter (M12 × 1.25).

290793 Axle pivot.

293521 Wrench, kingpin lock nut.

302 - Hydrostatic steering.

293388 Installer, O-ring.

293389 Installer, rotary valve return spring.

293390 Retainer, rotor.

293300 Kit, universal, pressure gauge, on tractor overpressure test (use with fittings **291236** and **293799**, 1180 and 1380, or fittings **291323** and **293799**, 1580 and 1880).

Power steering hydraulic test.

291231 Tester, pump output.

293005 Tank.

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291235 or **292150**	Motor, electric (6-10 hp). Motor, electric (9-15 hp).
290385	Coupling.
293165	Pump, hydraulic.
293723	Support.
292256 **292257**	Bracket, support.
292724	Capscrew (2 off).
293192/1	Wrench.
290445	Pipe, suction.
290448 **290540**	Adapter, suction pipe.
293316	Adapter, (2 off), suction and delivery pipe.
290544	Pipe, delivery.
290475	Connector, 3-way.
290541	Adapter, return pipe.
290447	Pipe, return.
293315	Plug (2 off).
293721	Connection, drain.
292775	Pipe, plastic, oil drain.

40 - FRONT WHEEL DRIVE

401 - For one front axle.

292116	Hook, ballast support.
291517	Hook, front differential.
293743	Support, bevel pinion carrier.
293524/1	Wrench, lock ring, bevel pinion bearing and rotating torque.
293400/1	Gauge, bevel pinion positioning (use with **293804** or **293510**).
293510	Adjuster, universal, bevel pinion bearing.
293804	Adjuster, special-purpose, bevel pinion bearing.
293798	Wrench, lock ring, differential bearing.
293797	Wrench, lock ring, wheel bearing.
293601	Screw, forcing, hub bearing brace.
292220/3	Tester, king pin bearing rotating torque.
292927	Puller, slide hammer, plus adapter, king pin.
292888	Pins, final drive cover.
293812	Pins, front wheel.
292161	Puller, axle pivot bearing outer race.

293512	Wrench, torque, pinion/ring gear taper roller bearing rotating torque.

50 - HYDRAULIC LIFT

501 - Lift.

290284	Pump, hand, bulb test.
293300	Kit, universal, pressure gauge and fittings, hydraulic circuit pressure test (use with fitting **293449**).
293813	Installer, lift piston with seal.
292768 **292769/2**	Protector and installer, lift arm cross shaft right seal.
292770/1	Driver, lift arm cross shaft left seal.
290828	Fitting, cylinder safety valve tester.
293716	Wrench, start of lift and maximum lift.
291485	Remover/replacer, lift spring-loaded link spring.
293833	Adjuster, position control outer lever.
291862	Wrench, lift cylinder safety valve lock ring.

502 - Hydraulic pump TF/A 217 S (1180), TF/A 220 S (1380, 1580 and 1880) and HY/ZFS 11/11 R169 (power steering, section 302).

291756	Flange, power steering hydraulic pump assembly.
293300	Kit, universal, pressure gauge.
291231	Tester, output, large, including:
290448	- adapter, suction;
290445	- pipe, suction;
290419	- connection, suction;
293553	- connection, delivery (steering pump);
290541	- adapter, delivery;
290447	- pipe, delivery.
291235 or **292150**	Motor, electric, pump (6-10 hp). Motor, electric, pump (9-15 hp) including:
290385	- coupling, drive.
292574	Tester, output, small, including:
290447	- pipe, suction;
290420	- connection, suction;
293553	- connection, delivery (steering pump);
290330	- connection, delivery (TF/A 217 S and TF/A 220 S);
290424	- pipe, delivery.

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504 - Remote control valves.

291231	Tester, output, large, including:
291235 or **292150**	- motor, electric (6-10 hp); - motor, electric (9-15 hp);
293005	- tank;
293165(*)	- pump, hydraulic;
290385(*)	- coupling;
293548/1(*)	- support, valve;
292256(*)	- bracket;
292257(*)	- bracket;
290469/1(*)	- support;
293539(*)	- graduated glass;
290448	- adapter;
290445	- pipe;
290419	- connection, suction;
293556(*)	- screw;
293316(*)	- adapter;
290544(*)	- pipe;
290503(*)	- adapter;
290378(*)	- pipe, drain;
290541(*)	- adapter;
290447	- pipe, return;
293552(*)	- plug;
292151(*)	- plug;
293553(*)	- connection;
290424(*)	- pipe;
293549(*)	- connection, ball;
292146(*) or **290475(*)**	- fitting, 3-way;
293547(*)	- adapter;
292152(*)	- adapter;
293550(*)	- connection, leak.
292574	Tester, output, small, including:
290447	- pipe, suction;
290420	- connection, suction;
291237	- tank.

FIAT CAB

292109	Pair of hooks, FIAT cab and platform lifting (with **293769**).
293774	Installer, FIAT cab door hinge outer seal.
293512	Torque wrench (0 to 1.2 kgm), FIAT cab rear window.
293822	Vacuum and loading station for air conditioning system.
293825	Oil tin vacuum and loading station.
293827	Wrench, charger taps.
293823	Detector, acoustic, gas leaks.
293831	Cleaner - adjuster, evaporator and condenser fins.
293826	Athermic tape, air conditioning system expansion valve.
291785	Centralizer, magneto on charger (AM).
291896	Centralizer, magneto on charger (PM).
A.47951 (291784)	Puller, charger controlling electromagnetic pulley.
A.77504 (291788)	Centralizer, charger shaft seal and flange.
A.95368 (291789)	Tester rod, charger oil level.

(*) Equipment common to large output tester **291231** and to small output tester **292574**.

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